

COLORADO DESERT VEGETATION MAPPING PROJECT FINAL REPORT 2023-2026



Luis E. Barrios, Scott Heacox, Melanie J. Davis, Danelle A. Baronía and Lynn C. Sweet
University of California, Riverside, Center for Conservation Biology, Palm Desert, CA

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Contact:

University of California, Riverside
Center for Conservation Biology (CCB)
75-080 Frank Sinatra Drive
Palm Desert, CA 92211
lynn.sweet@ucr.edu

California Department of Fish and Wildlife
Vegetation Classification and Mapping Program
PO Box 944209
Sacramento, CA 94244
vegcamp@wildlife.ca.gov

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VegCAMP and UCR CCB Field Team Training – UCR CCB 2025
Desert Ironwood and Brittlebush in Winterhaven – UCR CCB 2024
Sand Dunes in the Algodones Wilderness – UCR CCB 2024
Restoration Pond with Cattails in Imperial Valley – UCR CCB 2025

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ABSTRACT

This report summarizes the results from the University of California, Riverside Center for Conservation Biology (UCR CCB), Colorado Desert vegetation community mapping project in support of the California Department of Fish and Wildlife (CDFW) Vegetation and Classification and Mapping Program (VegCAMP). As part of the Survey of California Vegetation (SCV), one of VegCAMP's goals is to produce a fine-scale vegetation map across the entire state of California. Vegetation, defined as the patterns of plant species that occur together (communities) over the landscape, is one of the best biological indicators of wildlife habitat quality and ecosystem function. It synthesizes much of what ecologists and conservation biologists require to understand the terrestrial landscape. Fine-scale vegetation maps are used by CDFW, other state and federal agencies, non-governmental agencies, and the public for conservation planning and many other purposes.

The vegetation communities identified by this map and the mapping rules and attributes follow the standards defined by the Survey of California Vegetation (SCV, VegCAMP 2025), which are set forth by VegCAMP. The SCV starts with collection of plant community data in the field that are then analyzed to develop a classification of vegetation types. The vegetation classification is then used to create fine-scale digital vegetation maps. This project used true-color and color infrared imagery from the 2022 National Agricultural Imagery Program (NAIP) as the basis for heads-up (manual delineation and photointerpretation) mapping of the project area.

The map presented herein covers large portions of four areas of the Colorado Desert: the Coachella Valley (310,090 mapped acres), Algodones/Imperial Dunes (197,594 acres), Winterhaven area (52,088 acres), and the Salton Sea and Imperial Valley to the Mexico-United States border (680,574 acres). With the exception of the Algodones/Imperial Dunes, which are primarily composed of the Algodones Wilderness to the north and Imperial Dunes Off-Highway Vehicle Recreation Area to the south, the majority of this map covers large urban areas (the Coachella Valley cities, Brawley, and El Centro) mixed with agriculture (the southeastern section of the Coachella Valley, most of Imperial Valley, and the Winterhaven area).

Keywords: vegetation, vegetation type mapping, desert, aeolian sand dunes, photointerpretation, Colorado Desert, Coachella Valley, Imperial Valley, Algodones Dunes, tribal lands

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INTRODUCTION

PROJECT BACKGROUND

This report summarizes the results of the University of California, Riverside Center for Conservation Biology (UCR CCB) mapping of vegetation communities across Colorado Desert in support of the California Department of Fish and Wildlife (CDFW) Vegetation and Classification and Mapping Program (VegCAMP) goal to produce a fine-scale vegetation map across the entire state of California, in accordance with the Survey of California Vegetation Mapping Standards (SCV). The vegetation communities identified by this map follow the state and national classification defined by National Vegetation Classification System (NVCS), and the project as a whole follows the SCV. The SCV provides a framework for producing vegetation data, including survey protocols, field keys and descriptions of each vegetation type, mapping standards, and methods for assessing accuracy. Taxonomic nomenclature in this report follows the most current vegetation classification found in the Manual of California Vegetation (MCV), and in some cases, these include plant species names that are not current with the Jepson Manual (Jepson Flora Project (eds.), 2025); for example, we use *Prosopis glandulosa* Torr. var. *torreyana* (L.D. Benson) M.C. Johnst. instead of the most current name, *Neltuma odorata* (Torr. & Frém.) C.E. Hughes & G.P. Lewis when referring to the native honey mesquite type.

The vegetation classification used for the project was developed by CDFW and the California Native Plant Society (CNPS) vegetation program and was refined through the work provided by the Desert Renewable Energy Conservation Plan (DRECP) vegetation mapping project conducted by Aerial Information Systems (AIS) for CDFW and the California Energy Commission (hereafter referred to as “the DRECP”, see Menke et al. 2013, 2016; VegCAMP 2013; Reyes et al. 2020, 2021, 2023). The DRECP mapping project, which consisted of several phases, mapped large areas of the Mojave and Colorado Deserts, and thus has considerable overlap with the vegetation types found in this project. However, UCR CCB identified four previously undescribed or poorly described vegetation types within the mapping area and collected field surveys for these types to support a more comprehensive classification for the Colorado Desert.

Fieldwork and mapping for this project took place from 2023 to 2025. We divided this project area into two delivery areas, or “modules”. Module 1 included the Coachella Valley, Algodones Dunes, and Winterhaven (primarily Fort Yuma Quechan tribal lands) areas, a total of approximately 559,772 acres. Module 2 consisted of the Imperial Valley and most of the Salton Sea for a total of approximately 680,574 acres. Each module began with “reconnaissance” surveys to ensure adequate field information for mappers to interpret aerial imagery. Next, mappers completed mapping (delineation and attributions) for assigned portions of the project area, conducting additional reconnaissance as needed, which were then joined together into a single map and submitted to CDFW for accuracy assessment (AA) sample allocation. Finally, field teams completed a set of accuracy assessment surveys utilizing CDFW’s standard

protocol to test the accuracy of the map. Module 1 mapping and reconnaissance took place from April 2023 to January 2024 and Module 1 AA surveys took place from February 2024 to July 2024. Module 2 mapping and reconnaissance took place from October 2024 to February 2025, and AA surveys from February 2025 to June 2025 (Tables 2 and 14).

Mappers used ArcGIS Pro (ESRI, [esri.com](https://www.esri.com), version 3.6.2) to heads-up digitize (manual photo interpretation) assigned portions of the mapping area and used 2022 NAIP true-color and color infrared (CIR) imagery with a 60-centimeter resolution as the basis for defining the extent of vegetation types. They also utilized other imagery resources, including HxGN 15-centimeter CIR imagery and Google Earth, especially “street view”, to help identify vegetation types, but did not reference these during the delineation of lines for polygon creation in order to maintain a single, uniform photo-imagery basis for mapping.

MAPPING AREA

The study area is located within the Sonoran Basin and Range USDA Ecoregion (Griffith et al., 2016). Climatically, these areas fall within the Colorado Desert section of the Sonoran Desert, the areas west of the Colorado River, which generally lack regular summer rainfall and where temperatures are hotter than the rest of the Sonoran Desert. Several of the maps created for the surrounding area were completed under the auspices of the Coachella Valley Multiple Species Habitat Conservation Plan (CVMSHCP) and Natural Communities Conservation Plan (NCCP) for the Coachella Valley Conservation Commission; Riverside County areas within this map fall within the Plan area. The adjacent maps created for the CVMSHCP cover specifically-designated Conservation Areas, which are primarily natural areas. This mapping area abuts ecotonal boundaries with the Mojave Desert to the north and the Southern California Coast in the northwestern-most end of the mapping area (Griffith et al., 2016). Within the two delivery areas, as above, we discuss the regions of the mapping area as a whole in terms of four informal subareas: Coachella Valley, Algodones Dunes, Winterhaven, and the Salton Sea/Imperial Valley (Figure 1). The first three of these subareas constituted the first delivery area, Module 1, while the latter comprised the second delivery area, Module 2.

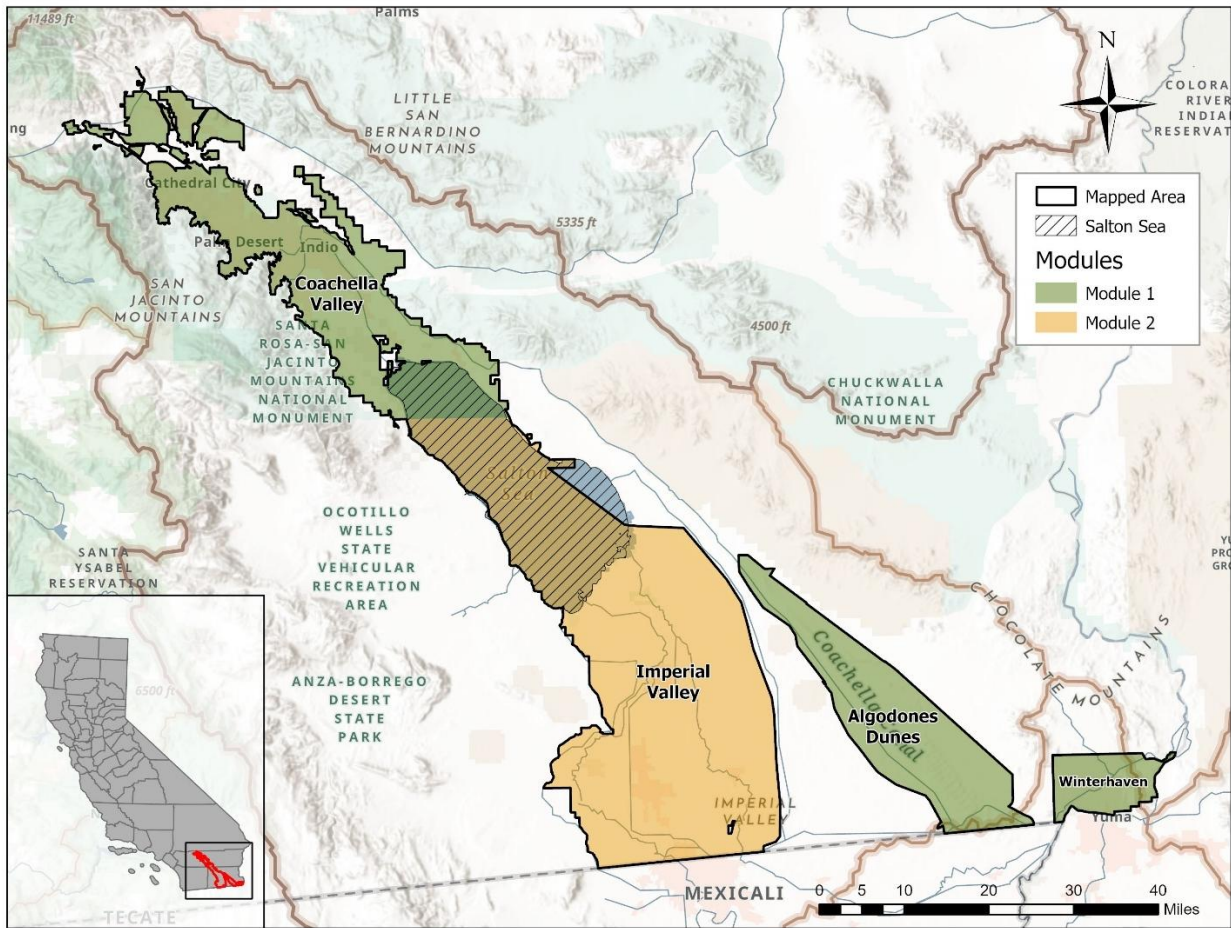


Figure 1: Map of the Colorado Desert showing the mapping area and divisions of Module 1 and 2. Green represents Module 1 including the Coachella Valley, Algodones Dunes, and Winterhaven subareas. Yellow represents Module 2, which encompassed the Salton Sea/Imperial Valley subarea.

Coachella Valley Subarea

The Coachella Valley subarea encompasses the entirety of the previously unmapped sections of the Coachella Valley floor. One of the vegetation maps created for the CVMSHCP, the Coachella Valley Floor map (CDFW BIOS ds2898; Sweet et al., 2019) mapped most of the conserved/undeveloped land immediately adjacent to this map, at the lower elevations of the Coachella Valley. The work presented in this report completes the mapping of the Coachella Valley floor, encompassing primarily the highly developed network of residential communities, industrial areas, agricultural areas and remaining natural areas that fall outside of CVMSHCP Conservation Areas. Mapping areas bordering this subarea to the north include Sand to Snow Habitat Conservation Area map (CDFW BIOS ds2936; Sweet et al., 2017a), the Joshua Tree National Park map (CDFW BIOS ds730; La Doux et al., 2013), the Desert Tortoise and Linkage Area

map (CDFW BIOS ds2927; Sweet et al., 2017b), the Dos Palmas Conservation Area map (CDFW BIOS ds2926; Sweet et al., 2019), and the Mecca-Hills and Orocopia Mountains Conservation Area map (CDFW BIOS ds2692; Sweet et al., 2015) and forthcoming Mecca-Hills and Orocopia Mountains Conservation Area map reattribution (Davis et al., 2026). The south margin of this subarea is bordered by the Peninsular Bighorn Sheep Habitat vegetation map (CDFW BIOS ds2660; Menke and Johnson, 2016), and the southeastern edge of the subarea, along the north shore of the Salton Sea, abuts the Coachella Valley Stormwater Channel and Delta Conservation Area Vegetation Map (CDFW BIOS ds2913; Sweet et al., 2017c).

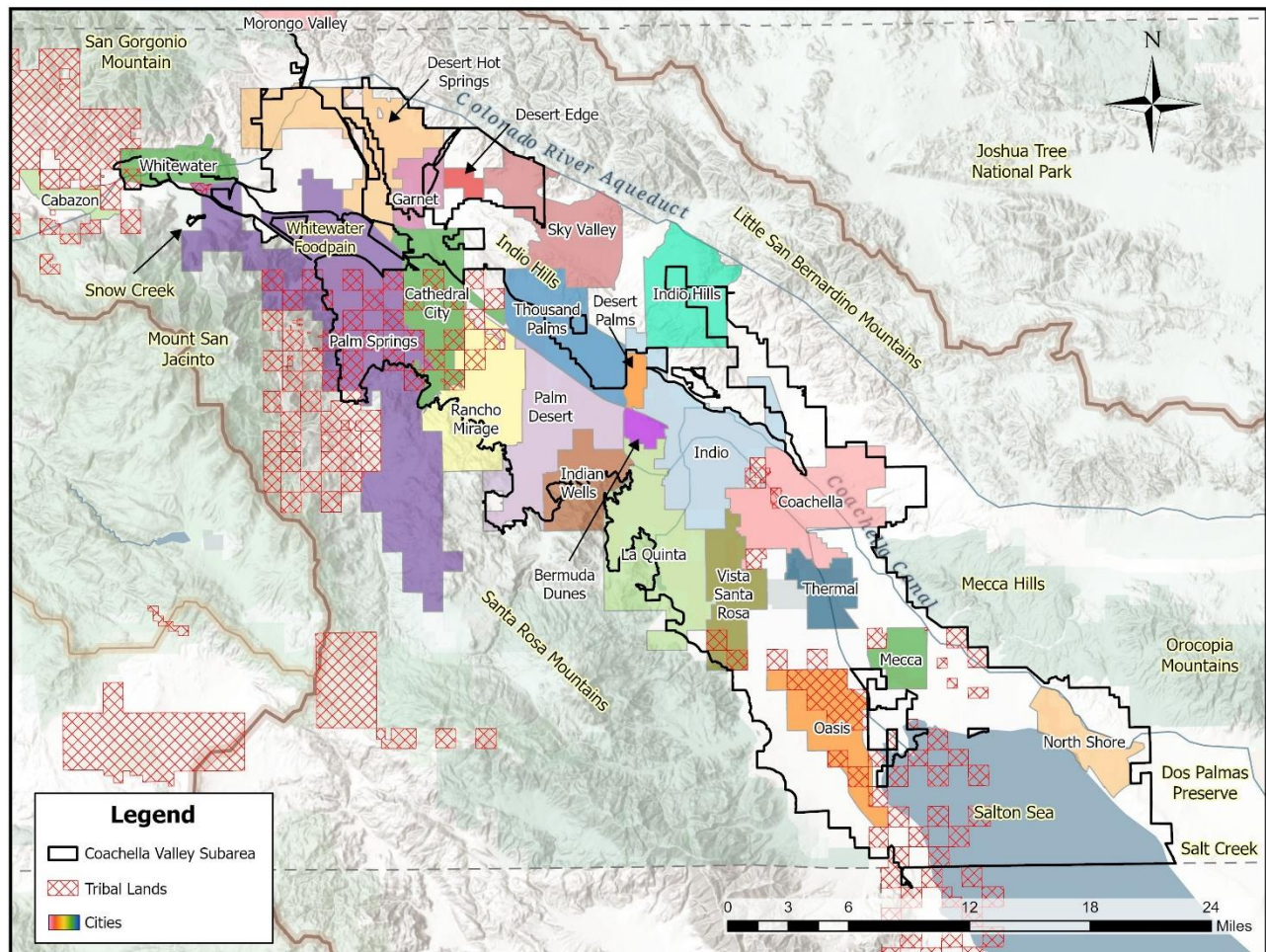


Figure 2: Map of the Coachella Valley Subarea (within Module 1) showing the boundaries of cities, tribal lands, and major geographic features.

In the Coachella Valley subarea, 14,604.78 acres are within the sovereign nation of the Agua Caliente Band of Cahuilla Indians. This tribal reservation is checkerboarded throughout the greater Palm Springs area in the northwestern portion of the mapping area. 24,376.51 acres were within the Torres Martinez Desert Cahuilla Indians sovereign tribal lands on the northwestern side of the Salton Sea and in Thermal, California (Figure 2).

Geographically, this mapping subarea begins in the west at the small community of Whitewater within the San Gorgonio Pass, at approximately 430 meters elevation, which is the primary travel corridor between the Coachella Valley and the greater Los Angeles area. To the north lies San Gorgonio Mountain, part of the San Bernardino Mountains and the Transverse Ranges, which is the tallest mountain in Southern California at 3506 meters elevation. To the south of the pass are the San Jacinto Mountains of the Peninsular Ranges, with a maximum height of 3302 meters. Along the north margin of the valley runs the Little San Bernardino Mountains, mostly contained within Joshua Tree National Park. Bordering this range to the southeast lies the Mecca Hills and Orocopia Mountains. To the south of the Orocopia Mountains is the Dos Palmas Preserve. This subarea terminates in the south along the Riverside-Imperial County line which cuts east-west through the north end of the Salton Sea. This southern, terrestrial margin of the mapping area, along the receding shoreline of the Salton Sea, lies well below sea level, currently at approximately -70 meters.

The San Gorgonio Pass creates a transition area from the lower elevation, drier Colorado Desert (a subdivision of the Sonoran Desert) to the east and the higher elevation, wetter South Coast floristic province to the west. Continuing southeast down the valley, elevation on average decreases, and creosote bush (*Larrea tridentata*) is frequently the dominant shrub, with varying densities of brittlebush (*Encelia farinosa*) and burro bush (*Ambrosia dumosa*) throughout. Occasional dry washes provide habitat for desert riparian species including desert willow (*Chilopsis linearis*), honey mesquite (*Prosopis glandulosa* var. *torreyana*), blue palo verde (*Parkinsonia florida*), cheesebush (*Ambrosia salsola*), and sweetbush (*Bebbia juncea*). Herbaceous species in the Coachella Valley are typically seasonal, reaching peak density in the spring following the winter rainy season, with additional, but less frequent, pulses of late summer/autumn annual germination following monsoon storms. Most herbs visible on the imagery used for this mapping project were dead remnants of invasive weed species, especially Sahara mustard (*Brassica tournefortii*) and Mediterranean grass (*Schismus* spp.), which thrive in the Coachella Valley with the aid of increased soil nitrogen resulting from air pollution carried from the Los Angeles area through the San Gorgonio Pass (Brooks, 2003).

The Coachella Valley subarea falls within the traditional homelands of the Cahuilla people, whose imprint of traditional land stewardship no doubt influenced the patterns of vegetation we see today, in particular types in the general area such as honey mesquite and desert agave (*Agave deserti*); however, this mapping area falls within a majority of the Coachella Valley subarea that has been anthropogenically altered in the post-European settlement period and contains only remnants of these types now. The northern portion of the valley, extending as far south as the city of Coachella, is primarily residential and industrial, with a heavy emphasis on seasonal resorts and golf country clubs. South of the city of Coachella, land use shifts to primarily agricultural, with a mix of annual row crops and orchards, especially date palms. Within this agricultural matrix, exist remnant undeveloped parcels containing plants adapted to

alkaline, lakebed clay soils characteristic of the sub-sea level Salton Sink. Saltbush (*Atriplex lentiformis*, *A. canescens*, and *A. polycarpa*), iodine bush (*Allenrolfea occidentalis*), bush seepweed (*Suaeda nigra*), and arrow weed (*Pluchea sericea*) can form dense shrub stands. A relatively high water table and/or access to agricultural runoff promotes stands of honey mesquite, ruderal California fan palm (*Washingtonia filifera*), nonnative date palm (*Phoenix dactylifera*), and highly invasive tamarisk/saltcedar (*Tamarix* spp.) that form impenetrable thickets. Occasional artificially created ponds or irrigation channels promote growth of herbaceous aquatic plants including cattail (*Typha domingensis*) and common reed (*Phragmites australis*).

Algodones Dunes Subarea

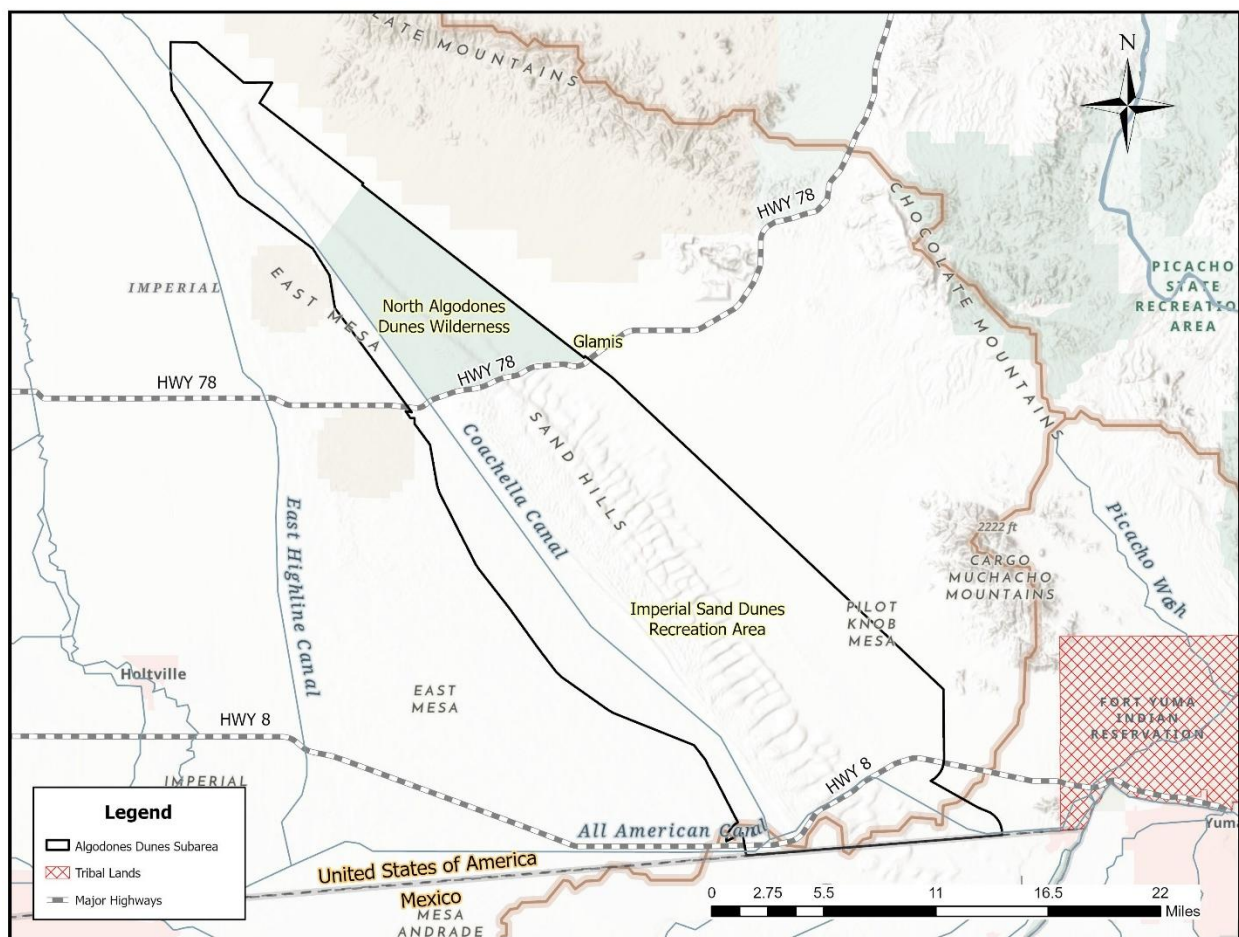


Figure 3: Map of the Algodones Dunes Subarea showing tribal lands, the U.S.-Mexico international boundary, and major geographic features.

The 170,419-acre Algodones Dunes subarea encompasses the Algodones Dunes, also known as the Imperial Dunes, a sprawling erg (large wind-blown sand dune system) to the southwest of the Salton Sea in Imperial County (Figure 3). The Desert Renewable Energy Conservation Plan vegetation map surrounds the entirety of this subarea. The

Algodones dunes were created by wind-transported sands from the ancient Lake Cahuilla sediments (Muhs et al., 1995). The dune system runs approximately northwest-southeast, starting in the north about 20 kilometers east of the town of Calipatria and terminating about 4 kilometers south of the U.S.-Mexico border, just west of the Mexican town of Los Algodones. This subarea is crossed by two east-west highways: Interstate 8 in the south and Highway 78 in the center. North of Highway 78 lies the approximately 26,000-acre North Algodones Dunes BLM Wilderness. South of this highway and extending to the U.S.-Mexico border is the Imperial Sand Dunes Recreation Area, which is an extremely popular OHV recreation destination. This subarea is primarily uninhabited except for OHV enthusiasts who are allowed to camp long-term throughout the Recreation Area but often congregate in large numbers in the designated camping areas and the small settlement of Glamis on the eastern edge of the Recreation Area.

The main dune system, which occupies the centerline of the subarea, is relatively sparsely vegetated due to the harsh conditions caused by wind-driven aeolian sand. However, within the dunes, Colorado Desert buckwheat (*Eriogonum deserticola*), long leafed ephedra (*Ephedra trifurca*), and creosote bush (*Larrea tridentata*) sometimes occur at mappable coverage. Within the Imperial Sand Dunes Recreation Area, vegetation cover is lower because of intense seasonal OHV activity. West of the main dune system in the region of East Mesa is a flat expanse of creosote bush scrub, sometimes with additional shrubs at mappable densities, such as burro bush and dye bush (*Psoralea argemonea*).

The east side of the dune system meets the lower reaches of the vast rock/gravel alluvium deposited from the Chocolate Mountains to the north and Cargo Muchacho Mountains to the south. At the dune-alluvium interface are large stands of dense honey mesquite and blue palo verde/ironwood woodlands, presumably fed by floodwaters originating to the east and terminating against the dunes. Many of these woodland stands also sustain extremely dense, nearly continuous carpets of annual plants, especially Coulter's mallow (*Sphaeralcea coulteri*). Continuing east beyond these woodlands is a mix of silt flats dominated by various herbaceous species, and flat expanses of sandy/silty creosote bush scrubland. Beyond this, the landscape transitions into desert pavement characterized by low shrub and tree cover and indicator species such as devil's spine flower (*Chorizanthe rigida*) and desert sunflower (*Geraea canescens*). As is common in many desert habitat types, the presence of herbaceous cover depends on seasonal precipitation and can vary widely year by year. This expanse of pavement on the eastern margin of the subarea also has networks of dry washes throughout that often have stands of blue palo verde and desert ironwood (*Olneya tesota*).

Winterhaven Subarea

The 52,089-acre Winterhaven subarea encompasses the Fort Yuma Quechan Indian Reservation (41,221.27 acres), a sovereign tribal nation, adjacent to the California-Arizona and U.S.-Mexico border. The subarea is roughly divided in two by the All-American Canal which runs from the southwest corner of the subarea to the northeast corner (Figure 4). South of this canal is primarily agriculture with sparse residential parcels throughout. North of the canal is primarily open desert habitat with an extensive network of OHV trails. The Colorado River roughly borders the subarea on the south and east margins. A very small portion of this area on the southern boundary shares approximately one mile of the border with Mexico. The surrounding areas (excluding Arizona and Mexico) were mapped as part of the DRECP vegetation map.

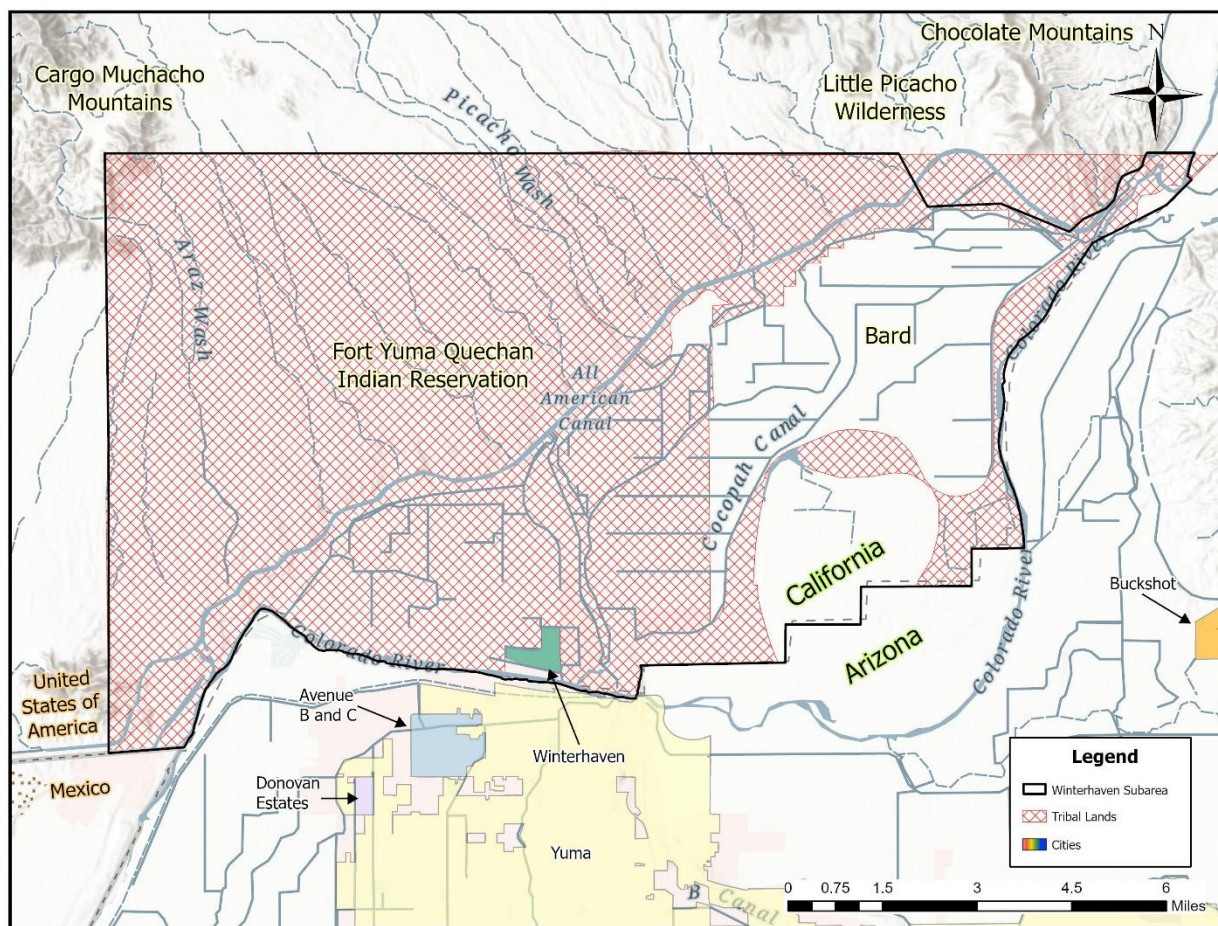


Figure 4: Map of the Winterhaven Subarea showing cities, tribal lands, the California boundary with Arizona and Mexico, and major geographic features.

From the Cargo Muchacho Mountains and the southeasternmost extent of Little Picacho Wilderness, within the southern tip of the Chocolate Mountains, extends a complex network of desert washes flowing south toward the All-American Canal. Where these washes meet the canal exists sparsely vegetated, highly eroded badlands cut by multiple wide washes. The badlands contain sparse creosote bush scrub and

occasionally give way to pavement conditions at their crests. The washes contain a mix of blue palo verde and desert ironwood trees with sparse cover of smaller shrubs including cheese bush, sweet bush, creosote bush, and dye bush. Continuing north from the canal, where *Chorizanthe rigida* – *Geraea canescens* Desert Pavement Alliance becomes the dominant vegetation type.

South of the canal is composed of primarily agricultural land. Patches of undeveloped parcels may contain a mix of halophytic shrubs such as arrowweed and tamarisk. The north bank of the Colorado River within the Quechan Reservation was undergoing restoration in some areas. Restoration efforts have focused on tamarisk removal in favor of native shrubs, especially arrowweed, and several trees including honey mesquite and cottonwood (*Populus fremontii*). The honey mesquite here are primarily irrigated transplants.

Salton Sea/Imperial Valley Subarea

This 990,664-acre subarea covers much of the Salton Sea and its banks, plus the developed areas of the Imperial Valley south to the U.S.-Mexico border (Figure 5). This subarea is almost entirely below sea level, with the lowest elevation at approximately - 70 meters (surface of Salton Sea) to around 12 meters near the international border. The Imperial Valley and the Salton Sea exist within a large endorheic basin that periodically floods when the Colorado River alters its course to outflow into this area. This entire subarea was at one time submerged as early as 900 years ago under the ancient Lake Cahuilla, as evidenced by the visible ancient travertine shorelines on the surrounding mountainsides and the silty lakebed sediment characteristic of the soil in this area. The east and west borders of this subarea meet the DRECP mapping area and the north-most margins connect with the Coachella Valley mapping subarea from this project.

Some areas along the banks of the Salton Sea overlap with the DRECP mapping area due to the need for remapping because of the rapid change in vegetation this area experiences. This subarea also encompasses the small Heber Dunes State Vehicular Recreation Area, south of the town of Holtville, as part of the State Vehicle Recreation Areas vegetation map (CDFW BIOS ds3194; Patten et al., 2022).

About one-third of this subarea is water (Salton Sea). The west and east shores of the Salton Sea are usually sparsely vegetated with scattered halophytic shrubs such as big saltbush (*Atriplex lentiformis*), iodine bush, and bush seepweed, which are well adapted to the alkaline lakebed sediments that characterize this region. The southern rim of the Salton Sea contains several important wetland habitats that provide critical refuge for migratory birds. The US Fish and Wildlife Service and California Department of Fish and Wildlife actively manage most of these habitats in the Sonny Bono National Wildlife Refuge and Imperial Wildlife Areas, respectively. These areas feature extensive restoration efforts including ponds surrounded by dense riparian vegetation composed of cattail, reeds, honey mesquite, screwbean mesquite (*Prosopis pubescens*), California fan palms, arrowweed, iodine bush, big saltbush, and bush seepweed. Tamarisk are

also prevalent invaders of this area, producing large, impenetrable thickets. Non-aquatic herb cover is sparse, except for some swaths of native salt grass (*Distichlis spicata*), invasive Bermuda grass (*Cynodon dactylon*), and small patches of alkali heliotrope (*Heliotropium curassavicum*).

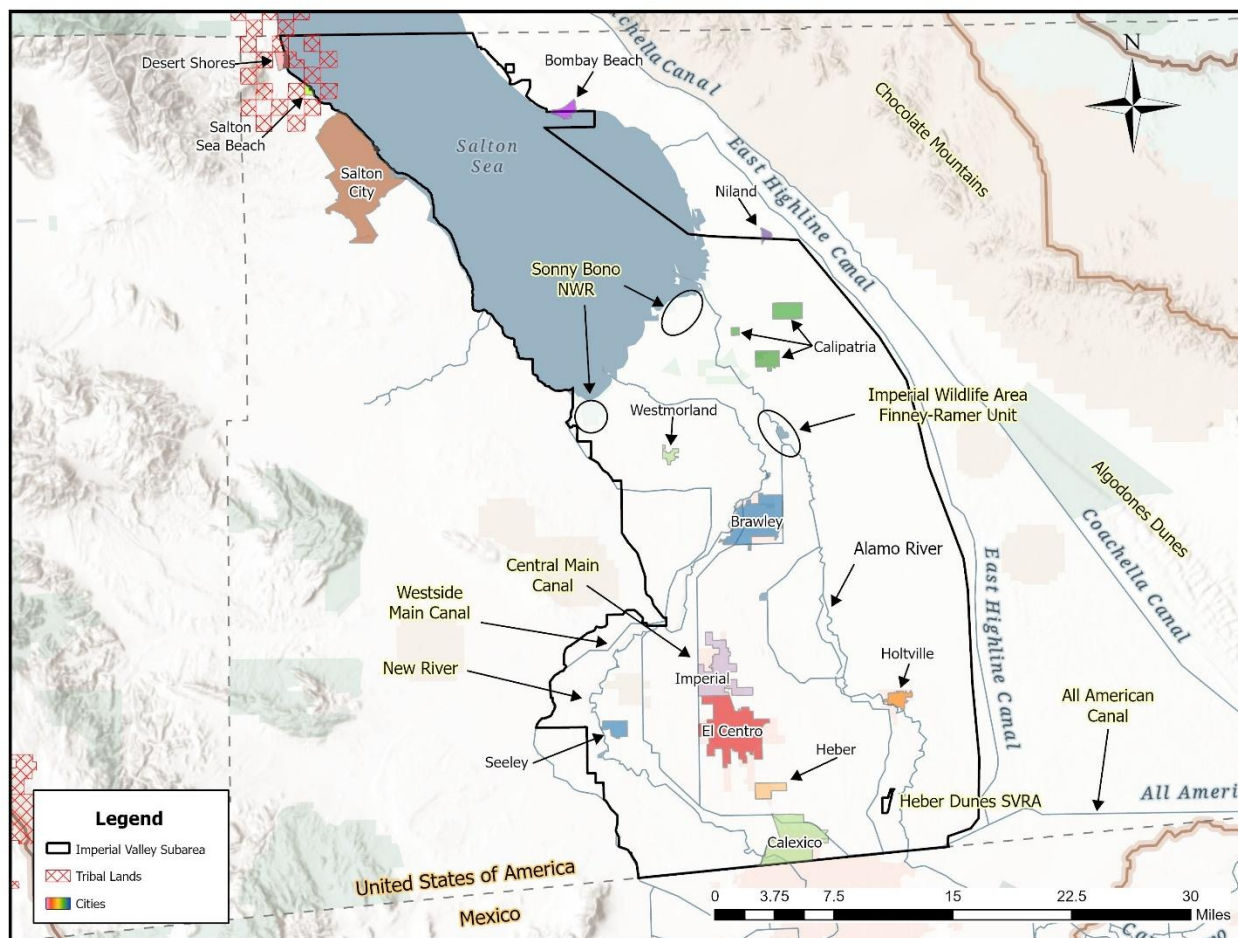


Figure 5: Map of the Salton/Sea Imperial Valley Subarea showing cities, tribal lands, the U.S.-Mexico international boundary, and major geographic features.

Geology around the south rim of the Salton Sea is complex. Most soil is representative of the typical lakebed sediment found throughout the rest of the mapping subarea, however there are several volcanoes (Obsidian Butte, Rock Hill, Red Hill, and Mullet Island), where the soil supports small upland stands of desert holly (*Atriplex hymenelytra*) and creosote bush (*Larrea tridentata*).

Agriculture makes up much of the Imperial Valley subarea. Two rivers, the New River to the west and the Alamo River to the east, span the length of the valley, and primarily serve to transport agricultural runoff to the Salton Sea. Despite the remarkable pollution of these rivers associated with agricultural runoff, they still support narrow strands of vegetation along their banks, similar in species composition to the riparian areas along the south shore of the Salton Sea. Along the Alamo River, just south of the town of Calipatria, exist the Finney and Ramer Lake Units of the Imperial Wildlife Area,

providing larger areas of these riparian vegetation types. At the time of this project, Ramer Lake was drained and undergoing maintenance following a dam breach, and as such was off-limits to our field teams. Strips of non-anthropogenic vegetation also occupy portions of the network of earthen canals and channels innervate the fields. Along these channel banks, grow a variety of native and nonnative herbs, arrowweed, and tamarisk.

METHODS

OVERVIEW

The framework for this mapping effort follows the Survey of California Vegetation Mapping Standards (SCV) and was modeled after work done by the Aerial Information Systems, Inc (AIS) for the DRECP mapping project. The mapping effort began with the compilation of a preliminary mapping classification provided by CDFW and based on existing mapping and floristic classifications for the Colorado Desert Region. The mapping classification was augmented as needed based on regional and novel types. The overall mapping region was divided into two delivery areas, or Modules (See Project Background; Figure 1).

To kick-off the project and ensure mapping methods were calibrated with the current mapping standards, UCR CCB staff trained in the field with CDFW VegCAMP staff, and surveyed and mapped 10% of Module 1. The three mappers divided this 10% evenly between them and then submitted the results to CDFW for review and scoring. After CDFW completed the review and approved methods, the mapping team proceeded with standard fine-scale vegetation mapping of Module 1 and 2.

Photo interpretation was conducted by three mappers: Luis Barrios, Melanie Davis, and Scott Heacox. For each module, they internally divided the area into three sections to be completed by each mapper, then conducted field “reconnaissance” surveys, also referred to as “recons”. These reconnaissance surveys were quick, informal surveys primarily designed to acquaint field teams with the area and provide mappers with a set of field-verified vegetation type signatures. Mappers then completed their assigned portions of the map through heads-up digitization following SCV standards, mapping rules described by AIS in the DRECP, and previously agreed upon attributes between CDFW and UCR CCB. Throughout the mapping process mappers conducted additional reconnaissance as needed.

The assigned mapping areas were then joined together into a single map for that Module and submitted to CDFW for accuracy assessment (AA) sample allocation. The field team then completed a set of accuracy assessment surveys; a comprehensive field survey protocol designed to assess the accuracy of the submitted map. Module 1 mapping and reconnaissance took place from April 2023 to January 2024 and Module 1 AA surveys took place from February 2024 to July 2024. Module 2 mapping and reconnaissance took place from October 2024 to February 2025, and AA surveys from February 2025 to June 2025 (Tables 2 and 14).

Additionally, vegetation types that were not well-defined in the classification were surveyed throughout all seasons of field work. Field teams conducted vegetation surveys following the CDFW-CNPS Protocol for the Combined Vegetation Rapid Assessment and Relevé protocol (Table 1, Appendix D). These supplemental data were submitted to CDFW VegCAMP to support future analysis and induction of novel vegetation types into the state-wide classification.

FIELD SAMPLING

Rapid Assessment, Relevé, and Reconnaissance

Field data collection for improving the classification (Rapid Assessment and Relevé protocol) and to support the mapping (Reconnaissance) occurred in locations that were accessible and either permission from the landowner/manager was granted or vegetation was visible from the roadside. Mappers flagged unique photo signatures visible on aerial imagery and targeted these locations in the field. Mappers also flagged locations prior to field excursions based on biotic factors such as associated vegetation, locations of rare taxa, and vegetation cover; abiotic factors such as hydrology, geology, and topography, including slope and aspect; and factors associated with anthropogenic land use such as abandoned agriculture fields, restoration, and development. Field teams, led by mappers, also opportunistically collected reconnaissance data in the field where land access was granted and where vegetation type changes or cover value changes were evident. In some rare cases, reconnaissance targeted areas were not surveyed when viewing private property from the roadside posed a safety challenge for the field team. Similarly, while performing work as guests on tribal lands, teams deferred to the tribal cultural monitors around culturally sensitive resources.

The map classification used in the data collection was the same used throughout this mapping project; see the Map Classification section for details on the source and development of the classification. Supplemental additions to the classification were discussed with the team at CDFW VegCAMP and addressed on a case-by-case basis. Four Mapping Units were added to the mapping classification and targeted in the field for the purpose of capturing un-represented mappable vegetation stands: *Eriogonum deserticola* Mapping Unit, *Psoralea emoryi* Mapping Unit, *Psoralea schottii* Mapping Unit, and Desert Forb Provisional Mapping Unit (Table 1). The data collected and polygons mapped for these types will inform refinement of the state-wide classification represented in the MCV.

In the case of working within the Agua Caliente Band of Cahuilla Indians Reservation and Fort Yuma Quechan Indian Reservation (within Module 1) and Torres-Martinez Indian Reservation (Module 2), we worked closely with Tribal Council and members of the Cultural Committees, Conservation Departments, Historic Preservation Offices, Tribal Planning Departments, and Environmental Protection Offices for the respective tribes. On all surveys where we deviated from roadsides within the Reservation it was required that tribal members or cultural monitors accompany us, as part of the land access agreements we negotiated with the respective tribal councils. The cultural committee tribal members advised us on sensitive cultural resources that would be valuable to capture in the mapping process (such as plants of significant cultural value, as well as specific uses of the land), as well as sensitive areas that we did not have permission to represent in our field photos or in field notes (such as sacred sites, artifacts, geoglyphs, and petroglyphs).

Collaborative data collection on tribal lands requires a sensitivity that differs from working with other landowners and managers. Cultural customs should be respected and issues surrounding data and land sovereignty should be considered, and in all cases, sincere communication of intent and approach is primary. We recommend that future efforts that plan to conduct any data collection involving tribal lands endeavor to make it a collaborative effort with the tribal entities, as well as allocate additional resources to contract cultural monitors. In most cases, the tribal councils granted us permission to access their lands under the agreement that we would work with cultural monitors, who had to be present during the field data collection. Customs differ among nations and we were advised by the Native American Land Conservancy to demonstrate appropriate respect and gratitude through such actions as: presenting gifts, sharing meals, being transparent with our research, and providing opportunities for training in mapping methods. During this project we have adhered to this advice and kept the lines of communication and data-sharing open with our tribal partners. We have presented the results from tribal lands first to the cultural committees to guarantee that we are representing tribal resources in a responsible manner.

Data Collection

Field teams used four different standard survey types developed by CDFW and CNPS to develop information for mapping: reconnaissance (primarily), rapid assessments and relevés (rarely); and following the mapping effort, accuracy assessments (Figure 6; see Appendix D for protocols and methods). Reconnaissance surveys served as a vital tool for mappers throughout the mapping stage. These surveys allowed the mappers to relate imagery and photo signatures to concrete field data and not only allowed mappers to map the location of the survey, but to apply it to matching photo signatures throughout the region. Having the mappers also lead the field team increased efficiency and allowed mappers to make informal and quick notes about changes across the landscape of their mapping area. After the completion of the map, we implemented accuracy assessment (AA) procedures and quality control of the map in collaboration with CDFW. See the Accuracy Assessment section in Methods.

We created an Esri Field Maps form that was used to collect on the ground field data in a digital format. Field teams utilized the Field Maps application on Samsung Galaxy Tab Active4 Pro tablets with the devices' built-in GPS to capture location information obtaining an accuracy of 1 to 5 meters. The Field Maps form was pre-configured to align with CDFWs standard vegetation survey forms to ensure consistency and compliance with SCV standards.

Field teams entered data directly into Field Maps in real time, using pre-downloaded offline areas (i.e. georeferenced maps containing imagery and various spatial layers, including the 2022 NAIP imagery) and digital forms with pick-lists using controlled vocabularies to reduce data entry errors. Data were synced regularly to a centralized ArcGIS Online environment, allowing for review and coordination between field teams and project leads throughout the survey period.

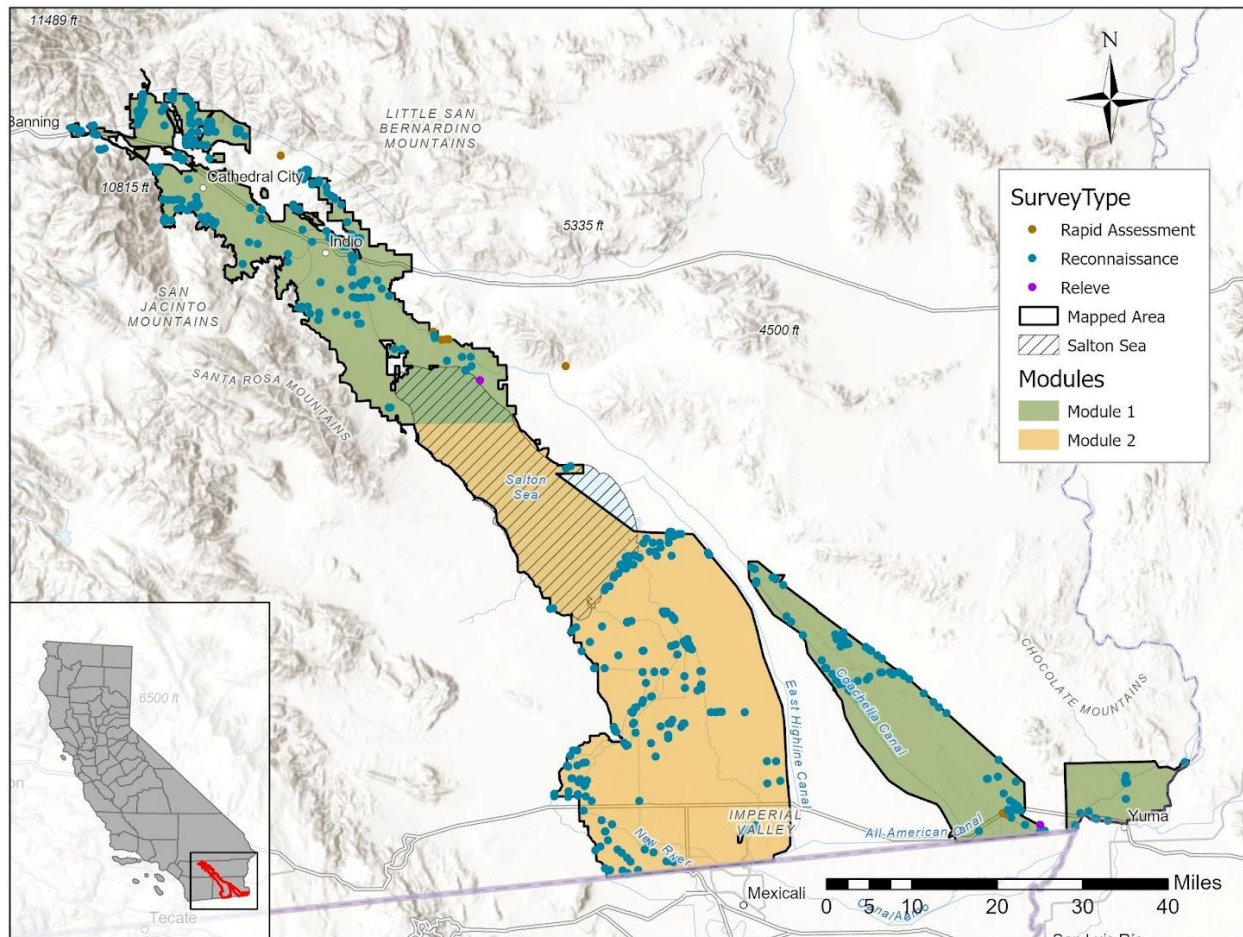


Figure 6: Map of the Colorado Desert showing the mapping area and locations of reconnaissance, rapid assessment, and relevé field survey locations. Locations of the 546 surveys included in the final vegetation classification data analysis for the Colorado Desert vegetation mapping project. Blue points represent the 534 reconnaissance surveys, brown points represent the 10 rapid assessment surveys, and purple points represent the 2 relevé surveys.

Field teams hand wrote comments and plant species lists in the field on pre-printed physical forms and within field notebooks. Field teams attached photographs of the physical field forms to the corresponding digital survey point in the Field Maps application. Data not recorded in the digital field form were subsequently digitized in the office using an editable web application created in ArcGIS Online.

Only a handful of scenarios required collection of rapid assessment (RA's) and relevé surveys, and over the course of this project a total of 10 RA's and 2 relevés were conducted. Because there was an established classification for the mapping project, it was not necessary to sample vegetation types at this level. However, there were several types that were not represented in the Manual of California Vegetation (MCV) or were underrepresented in previous sampling or mapping efforts (Table 1). In these instances, we completed RA's or relevés to support the classification of new vegetation types.

Table 1: Summary of Rapid Assessment and relevé surveys by field assessed Map Class.

Map Unit	Survey Type	Reason	Total Surveys
<i>Psorothamnus arborescens</i> Association	Rapid Assessment	Possibly a new Association under <i>Psorothamnus fremontii</i> - <i>Psorothamnus polydenius</i> Shrubland Alliance	2
<i>Eriogonum deserticola</i> Mapping Unit	Rapid Assessment	Underrepresented provisional type	2
<i>Psorothamnus schottii</i> Mapping Unit	Rapid Assessment	Underrepresented provisional type	6
Californian Ruderal Grassland, Meadow and Scrub Group	Relevé	Underrepresented type within desert region, later defined as Desert Forb Provisional Mapping Unit	2

Field staff used the Jepson eFlora for identification of plants, and incorporated USDA NRCS PLANTS codes into standard databases (USDA NRCS, 2015; Jepson Flora Project (eds.), 2025). Where identification to minimum rank taxa was not possible in the field, the field team collected voucher specimens at the survey locations, which were identified in the lab and either discarded or accessioned into the UC Riverside herbarium. Imperial County is particularly underrepresented in regional floristic databases and herbaria and so the field team made voucher collections throughout Imperial County where phenology and timing were allowed. Field teams collected all specimens under the appropriate collection permits or landowners' permission, and all vouchers have been deposited at the UCR Herbarium and coded as 'Deposited' in the survey database.

Digital Data Entry Methods and Field Survey Database Description

Both the data collection process and the overall project workflow included quality control procedures. To minimize errors and ensure completeness, digital Field Maps forms were configured with required and auto-calculated fields to prevent submission of lacking essential information or incorrectly entered information.

During fieldwork, field team leaders verified that data was being properly recorded by checking if all necessary information was collected for each survey. The use of required and auto-calculated fields greatly reduced the likelihood of missing or incomplete data.

In addition, the vegetation team held weekly meetings to discuss and resolve questions related to signature and species identification, data consistency, and vegetation classification. After syncing the recorded data to ArcGIS Online, the project team performed manual reviews to check for inconsistencies or formatting issues. Species names and vegetation types were verified against the MCV and the CNPS database. Final data cleaning included standardization and correction of any identified issues prior to submission.

MAPPING

The following section describes the mapping classification that was used and developed for this mapping project, field reconnaissance to support mapping, mapping rules and criteria, and mapping processes implemented that ensured internal consistency and compliance with SCV mapping standards. It describes in detail the criteria for polygon attribution, and special case scenarios where this map differs from the DRECP.

Description of Mapping Geodatabase and Quality Control Methods

Vegetation mapping data were compiled within an Esri File Geodatabase. The primary dataset consists of polygon features representing final vegetation Alliances and land use Map Units. Each polygon includes unique identifiers and standardized geometry fields.

Vegetation structure and composition were attributed using standardized fields describing dominant life forms and cover classes (conifer, hardwood, Joshua tree, total tree, shrub, and herbaceous cover). Disturbance and modification attributes included anthropogenic alteration, development, roadedness, exotic species presence, and hydromodification. Photo interpreters used specific modifiers to record target invasive plants (*Tamarix* species) or important native species (*Prosopis* spp., *Washingtonia filifera*, *Olneya tesota*, and *Parkinsonia florida*) where applicable. Attribute values were informed using a combination of photo interpretation, field-based surveys, and supplemental reference data, and photo interpreters documented applicable reference sources in the MethodID field.

Certain Map Units require pre-determined attribute values. For example, every polygon mapped to an invasive Alliance, such as the *Tamarix* spp. Semi-natural Alliance, automatically receive an Exotics modifier level of “High”. This also applies to many anthropogenic/miscellaneous Map Units, such as the Built-Up Urban Map Unit, where photo interpreters do not estimate plant cover classes, roadedness, or hydrologic alteration, and thus mark these attributes as “Not Applicable/Not Assigned”. These

attributes are described in detail in the Mapping Attributes subsection of the Mapping Criteria section. To ensure consistent attribution across these special Map Units, a “consistency table” for internal use by photo interpreters, which defined expected attribute values for certain vegetation and land use Map Units, was developed and used during photo interpretation and quality control.

Quality control was conducted iteratively and included spatial, attribute, and cross-field validation. Spatial quality control addressed polygon overlaps, gaps, geometry errors, boundary alignment, and minimum mapping unit compliance. Attribute quality control verified consistency between Map Units, vegetation cover fields, and disturbance indicators, while cross-field validation used the consistency table to identify and resolve conflicting attribute combinations.

Final validation confirmed that all polygons were assigned valid Map Units and attributes were applied consistently and in accordance with project classification rules. The finalized geodatabase meets CDFW and DRECP vegetation mapping standards and supports accuracy assessment, analysis, and regulatory review.

Map Classification

The mapping classification used for this project was based on the SCV and United States National Vegetation Classification (USNVC) as defined in the Online Manual of California Vegetation (MCV; CNPS, 2026); a hierarchical classification system. The mapping classification was limited to the types present within the mapping area and to those types that are mappable as defined by SCV standards and interpretable from available spatial layers. The mapping classification contains Provisional Mapping Units and Miscellaneous Classes, which are mappable areas that are not included in the floristic vegetation classification due to the lack of a defining vegetation present. These mapping units include areas of sparse vegetation defined by geologic or topographic features, such as rocky outcrops and mud hills, and are also meant to describe areas that are highly built-up or anthropogenically altered, such as agricultural operations and urban development.

The map classification used in the course of this effort was adapted from the mapping classification used by AIS in the DRECP Vegetation Mapping project, which was provided by CDFW and further developed in the course of the 2013 and 2021 maps (Menke et al., 2013 and Reyes et al., 2021). This classification was initially developed from the following previous mapping and classification projects in the Colorado/Sonoran and Mojave Deserts:

- Vegetation Mapping of Anza-Borrego Desert State Park and Environs (Keeler-Wolf et al., 1998)
- Mojave Desert Ecosystem Program’s Vegetation Database (Thomas et al., 2004)
- Vegetation of Joshua Tree National Park (La Doux et al., 2013)

- Vegetation Classification and Mapping at Lake Mead National Recreation Area, Mojave National Preserve and Death Valley National Park (Evans et al., 2020).

In the field we used the hierarchical field and mapping key developed for the DRECP based off the Lake Mead National Recreation Area, Death Valley National Park, Mojave National Preserve, and Castle Mountains National Monument (Evans et al., 2020; Appendix C), provided by CDFW VegCAMP. We brought any potential classification changes or refinement to VegCAMP for revision and discussion, resulting in additional rapid assessment and relev  surveys within the mapping area, as described in the Field Sampling Methods section on Data collection. VegCAMP addressed additions to the classification on a case-by-case basis. Mappable vegetation was assigned at the Alliance level where possible.

Mapping Reconnaissance

Reconnaissance surveys as described in the Field Sampling Methods section on Data Collection served as a vital tool to support photo interpretation performed by mappers throughout the mapping stage. For Module 1, field teams conducted a total of 319 reconnaissance surveys, which took place from April 24, 2023, to January 8, 2024, over the course of 16 trips totaling 28 days. In Module 2 field teams conducted a total of 215 reconnaissance surveys, from October 3, 2024, to February 14, 2025, over the course of 14 trips totaling 23 days (Table 2).

Table 2: Summary of completed field reconnaissance trips per Module with date range and total field trips and field days.

Module	Dates of Recon Points	No. trips	No. days	Total Recons
Module 1	04/24/2023 - 01/08/2024	16	28	319
Module 2	10/03/2024 - 02/14/2025	14	23	215
N/A	Grand Total	N/A	N/A	534

As described in the Field Sampling Methods section on Sample Allocation, mappers and field teams conducted field sampling in the form of reconnaissance surveys based on land access permissions and access feasibility, unique photo signatures, and targeted locations with both unique and representative biotic and abiotic factors for the region, including vegetation type, rare taxa habitat, geology, topography, aspect, and anthropogenic effects. At reconnaissance points the field team took digital color photos in the four cardinal directions. The field team captured the photos through the Esri Field

Maps data collection application and attached the photos to the GPS point on the collection feature layer. The team identified the mapping unit or keyed out the vegetation Alliance at the survey location, recorded adjacent Alliances, vegetation cover, and data on dominant vegetation and plant species, along with any site notes pertinent to mapping. In Module 1 and Module 2, field teams collected a total of 319 and 215 reconnaissance points, respectively (Figure 6).

Mapping Methods and Criteria

Rules used for mapping followed those set forth by the SCV and were also used for the DRECP vegetation mapping projects and the Mojave and Sonoran Desert mapping project. The mapping rules dictate how vegetation stands are delineated, such as the minimum mapping unit (MMU) and minimum mapping width (MMW). The mapping rules are described in depth in “Vegetation Minimum Mapping Unit Size Considerations” section. These rules apply to all Map Units including Alliances, Associations, Mapping Units, and Miscellaneous Classes. Mapping Units describe natural features outside of floristic classification, such as sparsely vegetated areas (wash bottoms, desert pavement, mud hills, etc.), as well as assemblages of plants that regularly occur together and thus have ecological value in mapping but would otherwise be individually unmappable due to sub-MMU stand sizes or difficulty differentiating when mixed, such as the *Bolboschoenus maritimus* - *Schoenoplectus americanus* Mapping Unit. Miscellaneous Classes describe built-up or anthropogenically altered features, such as urban areas, agricultural fields, and aqueducts, and are further described in the Miscellaneous Classes section.

After discussion with VegCAMP, it was decided to implement adjustments to the mapping protocols used by the DRECP project, most notably reducing the minimum mapping unit for riparian types from 1 acre as used by the DRECP to 0.5 acres used in this project. Other MMU and MMW rules are detailed in the Vegetation Minimum Mapping Unit Size Considerations section and in Table 3.

Mapping Materials

The vegetation mapping effort was conducted using a variety of computers, including a Lenovo Legion 7, HP Victus, and Dell XPS 15 7590. Computer workstations equipped with dual monitors enabled mappers to use secondary monitors to view ancillary imagery sources and ground photographs while map delineation was performed on the primary monitor. All mapping was completed using Esri ArcGIS Pro software. The final vegetation map was delivered in an ArcGIS Pro 3.6.2 file geodatabase format.

The primary digital imagery base for the mapping project was 2022 National Agriculture Imagery Program (NAIP) with a spatial resolution of 60 centimeters. Both true-color and color-infrared (CIR) imagery was used to evaluate similarities and differences among vegetation Map Units.

Mappers used heads-up digitization (manual photo interpretation) to produce a georeferenced geodatabase delineating polygons of defined vegetation types, wall-to-wall across the project area (See Mapping Methods and Criteria section). To aid with photo interpretation of the vegetation, the 2022 Hexagon color-infrared digital imagery with a spatial resolution of 15 centimeters provided by CDFW was used as supplemental imagery.

Mappers also consulted publicly available imagery sources, including Google Earth and Google Maps. Where available, street-level imagery from these platforms was used to support interpretation. In some cases, mappers reviewed historical imagery accessed through Google Earth to assess long-term vegetation trends and phenological variation.

A variety of ancillary datasets were used throughout the vegetation mapping process to support interpretation and improve mapping confidence. These included species occurrence records from iNaturalist, CalFlora, and the Consortium of California Herbaria (CCH2), as well as data from surveys conducted by the CCB in previous efforts. Although these supplemental sources and ancillary datasets informed interpretation and provided mappers with ecological context and assisted in verifying vegetation patterns, polygon delineations and line work were based exclusively on the 2022 NAIP base imagery.

Additional reference layers and adjacent vegetation maps (BIOS datasets, identified by a “ds” number listed in citation; CDFW BIOS, 2026) were provided by CDFW, with the exception of Mecca Hills and Orocopia Mountains which was created by UCR CCB and is currently under review for inclusion in BIOS (Davis et al., 2026). Ancillary layers used to assist mappers are as follows:

- Anza-Borrego Desert State Park (ds165, Keeler-Wolf et al., 1998)
- Coachella Valley Floor (ds2898, Sweet et al., 2019)
- Coachella Valley Stormwater Channel and Delta Conservation Area (ds2913, Sweet et al., 2017)
- Desert Tortoise and Linkage, Coachella Valley MSHCP (ds2927, Sweet et al., 2017)
- Dos Palmas, Coachella Valley (ds2926, Sweet et al., 2019)
- Joshua Tree National Park - 2012 (ds735, La Doux et al., 2013)
- Mecca Hills and Orocopia Mountains Conservation Area (Davis et al., 2026)
- Peninsular Bighorn Sheep Habitat Vegetation Map (ds2660, Menke and Johnson, 2016)
- Sand to Snow Habitat Conservation Area (ds2936, Sweet et al., 2017)
- Mojave Desert for DRECP - Final (ds735), multiple projects as follows:
 - Menke et al., 2013

- VegCAMP, 2013
- Menke et al., 2016
- Reyes et al., 2020
- Reyes et al., 2021
- Reyes et al., 2023
- Heber Dunes State Vehicle Recreation Area (ds3194, Patten et al., 2022)
- Chocolate Mountain Naval Aerial Gunnery Range (ds3124, Malusa and Sanders, 2023)

Roads layers (provided by CDFW)

- CalTrans Functional Classification Road layer (available at <https://lab.data.ca.gov/dataset/public-road-functional-classification>)
- BLM Ground Transportation Linear Feature (GTLF) layer (available at https://gis.blm.gov/arcgis/rest/services/transportation/BLM_Natl_GTLF/MapServer/0)
- CA State Parks recreational routes (available at https://www.parks.ca.gov/?page_id=29682)
- USFWS Roads (available at <https://gis-fws.opendata.arcgis.com/>)

Ownership layers

- CPAD (downloaded from <https://data.cnra.ca.gov/dataset/california-protected-areas-database>)
- Parcel ownership layer (provided by CDFW)
- BLM wilderness layer (referenced via BLM National Data Viewer)

Mapping Process

All photo interpretation and mapping were completed by staff from UCR CCB who had ecological knowledge of the mapping area, which was further supported by field reconnaissance conducted before and during the mapping process. Module 1 and Module 2 were mapped separately. Module 1 was completed in January 2024 and Module 2 was completed in January 2025. Each module was divided into three areas of approximately equal size, which the mappers assigned amongst themselves. Mappers loaded their assigned mapping area into individual ArcGIS Pro sessions, along with the 2022 NAIP imagery and additional ancillary layers (see Mapping Materials section). Mappers used manual heads-up digitization to delineate polygons within a georeferenced feature layer overlaid on the NAIP imagery. They referenced NAIP imagery, ancillary data, SCV Mapping Standards, vegetation type field keys, and

available field survey data, and delineated polygons based on vegetation type/miscellaneous class transitions, as well as changes in tree, shrub, and/or herbaceous cover class categories (see the Percent Cover description in the Mapping Attributes section for cover value breaks). Mappers delineated polygons at a map scale from 1:1000 to 1:2000, with a streaming tolerance of 10 meters; streaming was used rarely.

For each polygon, mappers then assigned values for the following attributes: Map Unit, six different Percent Cover types, Exotics, Roadedness Disturbance, Development Disturbance, Anthropogenically Altered Disturbance, Altered Hydrologic Regime Modifier, *Olneya tesota* – *Parkinsonia florida* (OLTE_PAFL) Presence Modifier, Land Use, Method ID, Tamarix Modifier, Mesquite Modifier, and Fan Palm Modifier. Each attribute field had custom domains coded for each of the possible values. This mitigated the risk for data entry errors during the polygon attribution process. The domains correspond to alphanumeric codes, which allow for hierarchical grouping. Explanations of each modifier can be found in the Mapping Attributes section of Methods. See Appendix A for Map Unit descriptions and Appendix B for the final map classification.

To ensure consistency, the three mappers met regularly to review appropriate application of complex mapping rules, to “calibrate” to one another on plant cover estimation and make decisions on tricky Map Unit calls. Any outstanding issues were brought to VegCAMP for further discussion and resolution.

When the mappers completed all sections of a module, the sections were combined into a single geodatabase, edge-matched, and quality checked for issues such as geometry errors, blank attributes, and any additional inconsistencies that were not addressed during regular meetings. Each Module was submitted to the team at VegCAMP after completion.

Vegetation Minimum Mapping Unit Size Considerations

The minimum allowable mappable size of a polygon is called the minimum mapping unit (MMU), which varies depending on the type of Map Unit assigned to the polygon (Table 3). The MMU rules used were adopted from those used for the DRECP vegetation mapping project, with the main exception of a reduced MMU for riparian vegetation types used in this project (1-acre MMU in DRECP versus 0.5-acre MMU in this project). Mappers considered minimum mapping unit sizes early in the polygon delineation process, with polygon sizes noted on-the-fly with the help of an automatically updating field in the mapping attribute table that calculated the area of a polygon once it was drawn. Mappers only created sub-MMU in a small number of scenarios, such as with polygons that continue outside of the mapping area as part of a larger stand that would otherwise meet the MMU, or when a stand of vegetation passes under a large bridge (see the explanation for dual coding in the Land Use Modifier section of Mapping Attributes for more information).

Table 3: Minimum mapping units (MMU) and corresponding minimum mapping widths (MMW) by mapping unit type used in this project.

Mapped Feature	MMU	MMW
Riparian vegetation; wetlands; certain wash types	0.5 acres	22 meters
Water: perennial streams, rivers, and lakes/ponds, dammed ephemeral ponds, major aqueducts	1 acre	32 meters
Land use: agriculture, built-up, water impoundment features	2.5 acres	50 meters
<i>Atriplex polycarpa</i> and <i>Ambrosia salsola</i> in washes	5 acres	71 meters
Upland vegetation	10 acres	101 meters
Vacant areas within settlements agriculture and water within urban windows	10 acres	101 meters
Flood control basins (smaller ones are mapped as built-up land use)	10 acres	101 meters
Urban windows	1 sq mile	805 meters

Minimum mapping width (MMW) refers to the shortest allowable mappable width of a given polygon. In general, the allowable mappable MMW for each Map Unit is one-half the length of the side of a square that meets the MMU for that Map Unit. For example, a perfectly square 10-acre MMU for a typical upland desert vegetation stand is approximately 201 meters per side (10 acres or 40468 square meters), so the resulting MMW for upland desert vegetation is one-half 201 meters, or 100.5 meters (rounded to 101 meters). Table 3 provides the minimum mapping widths for all mapping categories. An exception to the MMW rule was made in the case of vegetation stands lining the small, narrow agricultural drainages abundant in the Imperial Valley. For these stands, MMW was reduced to 15 meters to capture these important anthropogenically-shaped strips of vegetation, which was a slight reduction from the typical MMW of 22 meters mappers used for riparian vegetation stands that were not adjacent to canals or manmade drainages. Mappers also implemented this 15-meter MMW exception for vegetation lining edges of large canals, especially the All American Canal in the Winterhaven subarea. Minimum width was generally considered as an average over the entire polygon; parts of the polygon may be narrower than the MMW to preserve continuity of a stand.

Mapping standards such as MMU sizes are followed to create a coherent, comparable, and ecologically useful vegetation map at resolutions realistic for a small team of mappers to achieve over such large areas. Naturally, mappers frequently identified vegetation stands that fell below the corresponding MMU. In these cases, the mappers “lumped” these small stands in with larger bordering stands that have the most ecological similarities such as of the same dominant lifeform. For example, a sub-MMU stand of rubber rabbitbrush (*Ericameria nauseosa*), a wash/riparian shrub, would be lumped into an adjacent above-MMU stand of desert lavender (*Hyptis emoryi*), another wash/riparian shrub, before it was lumped in with an adjacent stand of desert willow, a wash/riparian tree, or a stand of *Larrea tridentata*, an upland shrub. When lumping vegetation stands, mappers always prioritized combining similar riparian vegetation types first, regardless of life form, before combining riparian with upland vegetation types.

Miscellaneous Classes

The mapping classification used for this project includes some Map Units that are anthropogenic and non-floristic, including various built-up/urban features, agriculture, man-made water storage or diversion structures, and large areas of intentionally planted ornamental trees. A complete list of these features and accompanying descriptions can be found in Appendix A. These features are often easy to delineate due to complete or near-complete removal of natural vegetation within the feature, however there are also many instances where anthropogenic structures and landscape alterations interface and blend with surrounding natural stands of vegetation. In the latter case, when the mapper must decide on the most appropriate Map Unit (a Map Class that reflects either the natural vegetation or the anthropogenic feature), priority was typically given to the natural vegetation type.

However, the geodatabase used in this project features a “Land Use” modifier where the mapper can still record important anthropogenic influences such as agriculture, urban use, and restoration. The use of this modifier leads to what the DRECP vegetation mapping project termed “dual-coding” classes, where a polygon with a vegetation Map Unit can also have a Land Use modifier that reflects anthropogenic uses. See Land Use Modifier (subsection Urban (1000)) in the Mapping Attributes section for details about how mappers applied dual-coding.

Mapping Attributes

The following additional mapping attribute fields were assessed for all polygons, except where otherwise described. See the following sections for in depth descriptions of the mapping attributes.

Percent Cover

“Percent cover” refers to the density of plants across a defined area as estimated from satellite imagery used for mapping during this project. For each polygon, mappers estimated the total percent cover for each lifeform class (herb, shrub, and tree) and cover specifically for hardwood and conifer trees. Cover estimates were recorded in the geodatabase as one of the categories listed below. Our mapping geodatabase also includes a field for *Yucca brevifolia* (western Joshua tree) cover class; however, field teams did not encounter any Joshua trees within this mapping area.

Mappers only estimated percent coverage for plants that were visible on the overhead NAIP imagery used for this project; they did not attempt to estimate coverage of understory plants obscured by tree canopies. Since this mapping area was entirely within the Colorado Desert where plant cover was naturally sparse and trees were relatively rare, it was not common to encounter vegetation stands with a significant component of obscured understory vegetation. However, some dense *Prosopis glandulosa* and *Olneya tesota* - *Parkinsonia florida* woodlands with a significant herbaceous understory along the eastern margins of the Algodones Dunes were encountered.

Herbaceous cover in the Colorado Desert is extremely variable due to the unpredictable nature of precipitation events. On average, most precipitation is seasonal and primarily concentrated in the cooler months. However, summer monsoon storms can also contribute significantly to annual precipitation. While winter precipitation is generally more regular, all precipitation in the Colorado Desert is fairly unpredictable and years-long droughts are not uncommon. As such, herbaceous cover, which relies on seasonal precipitation, is unpredictable and any imagery dataset represents only one of many possible conditions ranging from complete absence of herbaceous cover during dry seasons or drought, to nearly unbroken cover of annual herbs following particularly wet seasons. For the purposes of mapping, mappers always deferred to the conditions represented in the 2022 NAIP imagery which mappers used as their primary imagery dataset. Importantly, mappers are usually able to differentiate between long-dead (more than one seasons past) herbaceous cover and recently-dead cover due to the color of the vegetation (gray colors in CIR indicate long-dead material, and straw-colors indicate recently-dead). For this project, recently-dead herbaceous vegetation was considered part of the total vegetation cover but long-dead vegetation was excluded from any lifeform cover category.

Estimating percent cover is a subjective process; to maintain as much consistency as possible between mappers, mappers and members of field teams regularly referenced the percent cover diagrams provided online by CNPS (https://www.cnps.org/wp-content/uploads/2024/11/CNPS-CDFW-RA-Releve_Protocol_Code-Key_Descriptions_Cover-Soil-Key_ADA-20240416.pdf), checked estimates against survey data whenever possible, and periodically worked as a group to estimate percent

covers to help “calibrate” and reduce estimate variance between mappers. Below is a breakdown of the cover classes used in this project:

Cover classes used for conifer, hardwood, total tree, and shrub cover attributes:

0: None or Not Observable.

1: >0-1%

2: >1-5%

3: >5-15%

4: >15-25%

5: >25-50%

6: >50-75%

7: >75-100%

9: Not applicable/Not assigned

Cover classes used for herbaceous cover attribute:

0: None or Not Observable.

1: >0-2%

2: >2-15%

3: >15-40%

4: >40

9: Not applicable/Not assigned

Yucca brevifolia cover classes used to estimate cover of *Yucca brevifolia* in each polygon (note: not encountered in this mapping project):

0: None or Not Observable

1: >0-1%

2: >1-5%

3: >5

9: Not applicable/Not assigned

Exotics

Mappers assessed cover of exotic plant species for every vegetation polygon, including for some polygons of miscellaneous classes such as agriculture. Intensity of exotics was categorized using SCV standards, shown in Table 4. It is important to note that mappers considered recently-dead herbaceous exotics as part of the total exotics cover. The most abundant exotic herbaceous species within the mapping area, Sahara mustard (*Brassica tournefortii*) and Mediterranean grass (*Schismus spp.*), are significant components of large parts of the Colorado Desert and are typically easily identifiable when recently-dead. When recently-dead, these species present on NAIP imagery (both true color and CIR) as a light straw color, and mappers verified their abundance using a combination of ground-truthing surveys as well as local knowledge.

Table 4: Explanation of Exotics Map Classes, adapted from DRECP 2021.

Code	Category	Discussion
0	None visible	Sparse herbaceous vegetation with a minimal to low relative cover of exotic species; based on field data, no evidence of exotics in sampling, no evidence of exotics on imagery and based on modeling, assumed not present or not regular in the stand.
1	Patches of exotics visible, but cover not significant (relative cover to total <33%)	Sparse to moderate cover of herbaceous vegetation with a low to moderately high relative cover of exotic species. Patches of exotics are visible, but cover is not significant.
2	Exotics (particularly herbaceous) significant and cover may exceed dominant vegetation strata (relative cover Between 33% and 66%)	Exotics, particularly herbaceous ones, are significant and cover may exceed the dominant vegetation strata.
3	Stand characterized by exotics (vegetation type is "exotic") (relative cover >66%)	This is reserved primarily for Alliance-level calls which are defined by exotics; stands are characterized by exotic vegetation (as defined by the Map Unit).
9	Not applicable/Not assigned	Exotics are not applicable when the Map Unit is 9210, 9220, 9300, 9310, 9800, 9801, 9803, 9804, 9805.

Roadedness Disturbance

“Roadedness” refers to the amount of a polygon that was bisected by roads intended for vehicles. Mappers considered both paved and unpaved roads to contribute to Roadedness, however they must be well-worn and regularly travelled routes, either in the past or present, and not just a single set of tracks left from one or two vehicles. Mappers determined roadedness by estimating the amount of habitat within the polygon that was left intact and not intersected by a road, as demonstrated in Table 5.

Table 5: Explanation of Roadedness Disturbance Map Classes

Code	Category	Explanation	Example
0	None	No roads detected within polygon	N/A
1	Low	At least 2/3 of the polygon are left intact	See Figure 7a
2	Moderate	Between 2/3 and 1/3 of the polygon are left intact	See Figure 7b
3	High	Less than 1/3 of the polygon is left intact	See Figure 7c
9	Not Applicable	Roadedness not estimated for 9200, 9210, 9220, 9300, 9310, 9800, 9801, 9803, 9804, 9805	N/A

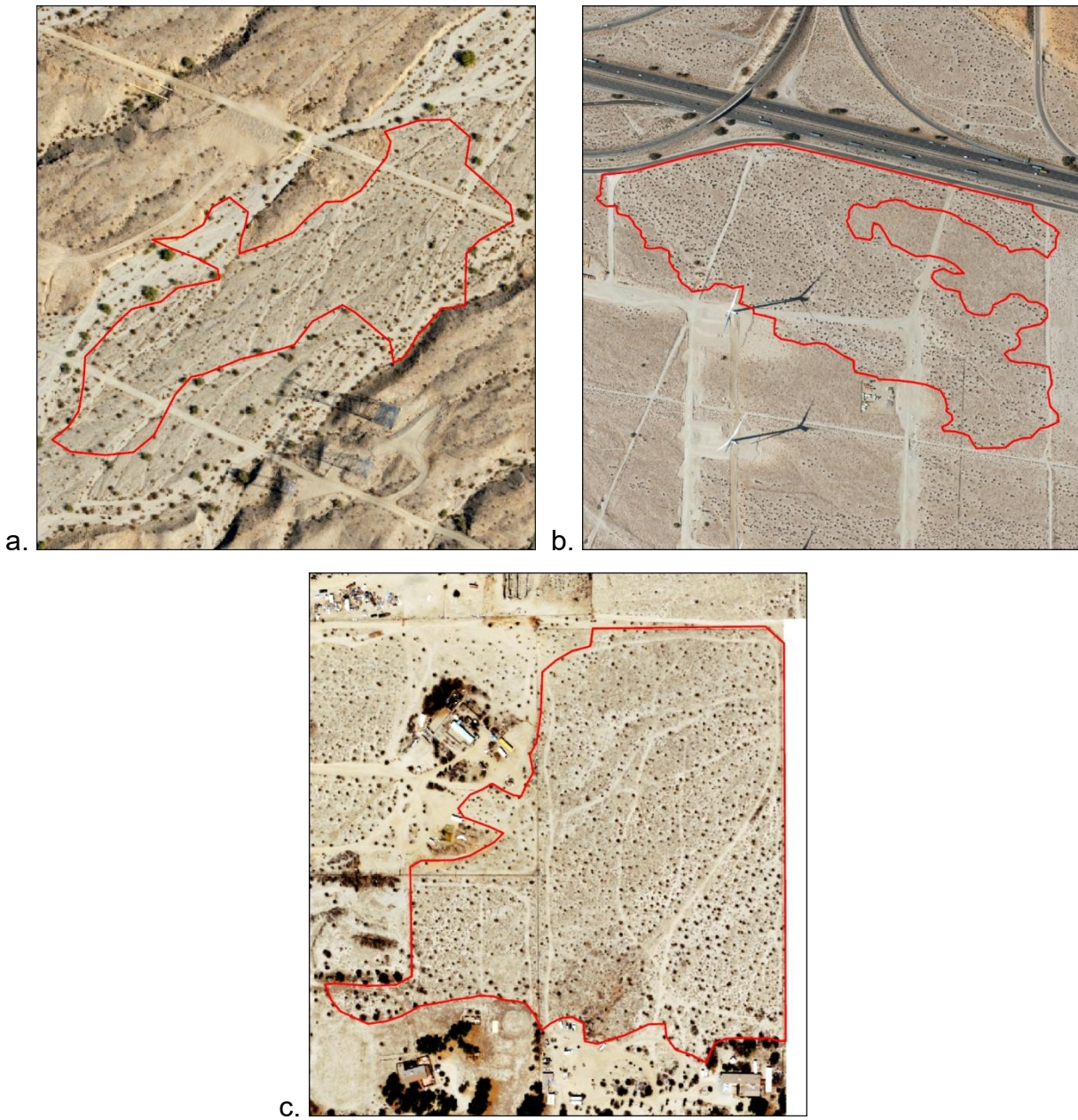


Figure 7: Examples of a vegetation stands with different levels of roadedness. a. Low roadedness. b. Moderate roadedness. c. High roadedness.

Development Disturbance

Mappers attributed values to Development Disturbance to characterize the amount of manmade building that has affected a polygon. These disturbances are usually some kind of structure, such as a house or industrial buildings (both occupied and abandoned/decayed), pylons for electrical transmission, utility hardware, and parking lots. Development Disturbance also includes non-permanent additions to the landscape, such as trailers, abandoned vehicles, large dump sites or discarded objects (big enough to see from imagery), and makeshift encampments. The level of Development Disturbance for each polygon was determined based on the percentage of the polygon occupied by these structures, as described in Table 6.

Table 6: Explanation of Development Disturbance Map Classes

Code	Category	Explanation
0	None visible	No evidence of structures or dumping within the polygon
1	Low	<2% of polygon occupied by structures or dumping
2	Moderate	Between 2% to 5% of polygon occupied by structures or dumping
3	High	Over 5% of polygon occupied by structures or dumping
9	Not Applicable/Not Assigned	Development Disturbance is not estimated for Map Units 9200, 9210, 9220, 9801

Anthropogenically Altered Disturbance (AnthroAlt)

Mappers assigned a value for Anthropogenically Altered Disturbance based on the amount of human disturbance present in a polygon that was not covered by the Development Disturbance attribute (i.e. disturbance unrelated to structures or dumping sites; Table 7). This type of disturbance generally involved a noticeable removal of natural vegetation (grading for construction, residential parcels, mining, weed control, etc.) or signs of removal in the past (old till lines still present, most apparent on land previously used for agriculture). Areas displaying Anthropogenically Altered Disturbance were often, but not always, delineated by features such as fencing or roads.

Table 7: Explanation of Anthropogenically Altered Disturbance Map Classes

Code	Category	Explanation
0	None visible	No evidence of past or present Anthropogenically Altered Disturbance
1	Low	Less than 33% of polygon is affected
2	Moderate	Between 33% and 66% of polygon is affected
3	High	Over 66% of polygon is affected
9	Not applicable/Not assigned	Not assigned for Map Unit 9801

Altered Hydrologic Regime Modifier (HydroMod)

Altered Hydrologic Regime modifier indicates when a cover class or vegetation type difference was delineated as a result of an impediment or redirection of an upslope water source. Mappers did not commonly use this modifier within this mapping area, but applied it for instance when flood control berms funneling that dispersed sheet flow over a wide area into a narrow channel, leading to an increase in riparian or desert woodland vegetation on the downstream side of the funnel's "spout" which would not normally be present without this funneling effect, as seen in the example in Table 8. This modifier was only applied for polygons that experienced effects of water diversion on the downslope side of the impediment.

Table 8: Explanation of Altered Hydrologic Regime Map Classes

Code	Category	Explanation
0	Not affected	No water flow impediment exists which results in a cover class or vegetation type break between polygons
1	Affected	An impediment exists upslope of the polygon which affects the natural flow of water, resulting in a change in cover class or vegetation type of the polygon. See Figure 8 for an example.
9	Not applicable/Not assigned	Not assigned for Map Units 9300, 9310, 9800, 9801, 9803, 9804, 9805

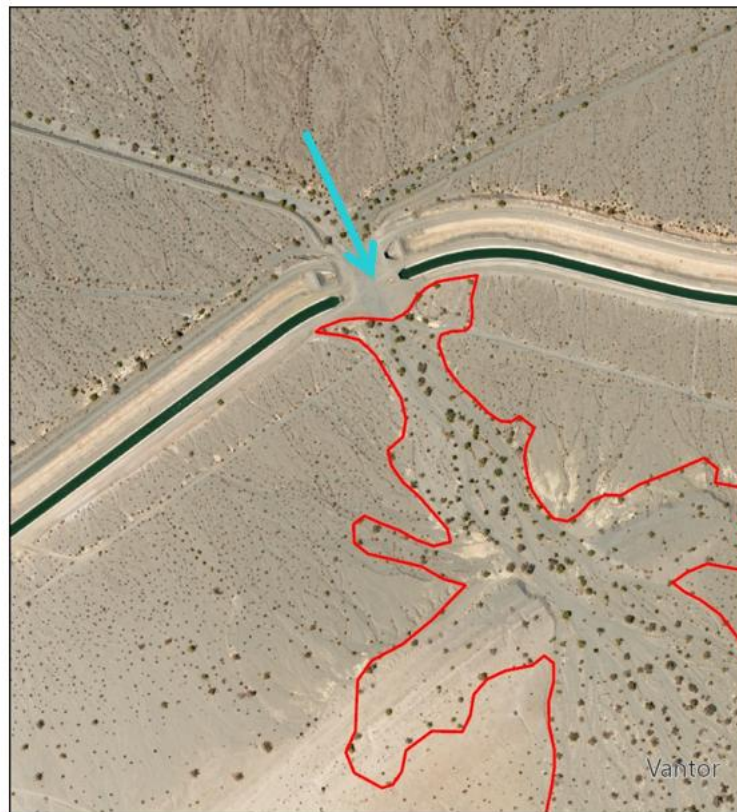


Figure 8: Example of a stand of vegetation that is hydrologically altered. The blue arrow indicates the direction of surface water flow, which has been altered by the construction of earthen berms that funnel sheet flow through a narrow corridor, resulting in the establishment of a *Parkinsonia florida* and *Olneya tesota* woodland in a wash that would otherwise not exist without this upstream anthropogenic alteration.

Ironwood – Blue Palo Verde Presence Modifier (OLTE_PAFL)

Mappers used the Ironwood – Blue Palo Verde Presence modifier to indicate polygons that contain at least trace amounts of either blue palo verde (*Parkinsonia florida*), desert ironwood (*Olneya tesota*), or both, consistently spread across the polygon (Table 9). This modifier helps to describe polygons that are not mapped as the *Parkinsonia florida* - *Olneya tesota* Alliance yet still contain one or both of these ecologically important species spread characteristically across the landscape, such as many instances of desert pavement, relatively sparsely vegetated washes, or broad alluvial fans reaching down from mountains including the Little San Bernardino Mountains, Orocopia Mountains, and Chocolate Mountains. By default, mappers also assigned polygons mapped as *Parkinsonia florida* - *Olneya tesota* Alliance a 1 (present).

Table 9: Explanation of Ironwood – Blue Palo Verde Presence Modifier Map Classes

Code	Category	Explanation
0	Not present	No <i>Parkinsonia florida</i> or <i>Olneya tesota</i> are present within the polygon, or, if present, they are not consistently spread across the polygon.
1	Present	Either <i>Parkinsonia florida</i> , <i>Olneya tesota</i> , or both are present in at least trace amounts and consistently spread across the polygon.

Tamarix spp. Presence Modifier (TamarixMod)

Mappers used the *Tamarix* spp. Presence modifier to indicate the presence of a species of the nonnative/invasive genus *Tamarix* (tamarisk) in a polygon (Table 10). This included both shrubby species (e.g. *Tamarix ramosissima* or *T. chinensis*) and a tree species (*Tamarix aphylla*). Shrubby tamarisk species are highly invasive and extremely common throughout much of this mapping area and the rest of the Colorado Desert, growing rapidly across landscapes with access to natural water (e.g. some washes, playas, creeks, rivers) or anthropogenic water sources (e.g. agricultural drainage ditches, canals, floodwater basins). The tree species Athel tamarisk (*Tamarix aphylla*) is commonly planted as both a landscaping tree in yards, parks, and along residential roads, as well as used as a barrier to protect features such as railroads and agricultural plots from drifting sand. In spite of its prevalence, *T. aphylla* is not known to easily spread without human intervention and is considered far less invasive than shrubby *Tamarix* species.

Table 10: Explanation of *Tamarix* spp. Presence Modifier Map Classes

Code	Category	Explanation
0	Target plant not evident	No <i>Tamarix</i> is apparent within the polygon
1	Target plant evident	At least one <i>Tamarix</i> plant is evident within the polygon

Mesquite Presence Modifier (MesquiteMod)

Honey mesquite (*Prosopis glandulosa*) and screwbean mesquite (*Prosopis pubescens*) are native trees with important cultural and ecological value throughout the Colorado Desert. Within this mapping area, these trees are associated with mesic areas such as springs, seeps, creeks, riversides, washes, and areas with a high water table such as near certain faultlines and throughout the Salton Sink. Due to overextraction of groundwater, wild mesquite trees are in decline throughout much of the Coachella Valley. This modifier was used to indicate when a native mesquite is present within a polygon (Table 11).

Table 11: Explanation of Mesquite Presence Modifier Map Classes

Code	Category	Explanation
0	Target plant not evident	No native mesquite is apparent within the polygon
1	Target plant evident	At least one native mesquite plant is evident within the polygon

California Fan Palm Presence Modifier (FanPalmMod)

California fan palms (*Washingtonia filifera*) are native to the Colorado Desert and found in riparian areas throughout the mapping area. Similar to mesquite, California fan palms have important cultural and ecological impacts. Natural stands are found in small groves or oases along springs and seeps, often along fault lines where water pools near or at the surface. Ruderal/semi-natural California fan palm trees are also abundant near the Salton Sea, where there is access to ample shallow ground water and agricultural runoff. Mappers used this modifier to indicate the presence of at least one California fan palm tree within a polygon (Table 12). Other nonnative palm species, such as the Mexican fan palm (*Washingtonia robusta*) and the date palm (*Phoenix dactylifera*), were not considered when applying this modifier.

Table 12: Explanation of California Fan Palm Presence Modifier Map Classes

Code	Category	Explanation
0	Target plant not evident	No California fan palm trees are apparent within the polygon
1	Target plant evident	At least one California fan palm tree is evident within the polygon

Land Use Modifier

The LandUse modifier identifies secondary anthropogenic attributes of a polygon that may otherwise be lost if only a vegetation type or miscellaneous Map Unit was attributed. Mappers adopted this Land Use code system from the DRECP, who took it from the Southern California Land Use Consortium/ Southern California Association of Government's Land Use Classification (Johnson and Reyes 1990), which was based on Anderson, et al. (1972). A table containing all Land Use codes and their designations, plus descriptions of each Land Use code, are described below, along with their typical application (Table 13).

Table 13: Land Use Codes and Designations

Code	Explanation
0000	Not Assigned/Not Assessed
1000	Urban
1436	Water Transfer (major canals, aqueducts, and agricultural channels)
1850	Wildlife Preserved & Sanctuaries
2000	Agriculture (includes nurseries)
2100	Non-woody Row & Field Crops
2200	Orchards & Vineyards
2300	Improved Pasturelands (Irrigated)
3500	Vacant Land - Restoration
9800	Undifferentiated Water
9810	Water Impoundment Feature

Not Assigned/Not Assessed (0000)

This code applies to polygons that do not have a noteworthy underlying secondary anthropogenic use. Most polygons of natural vegetation type are assigned this code.

Urban (1000)

This code was applied to polygons that are intensely built-up with structures (residential, industrial, utility, etc.), freeways, railroads, major highways, and associated parking lots,

surface streets, and access roads. This code was applied to all polygons with Map Units of Built-Up & Urban Disturbance (9300) and Urban Windows (9310).

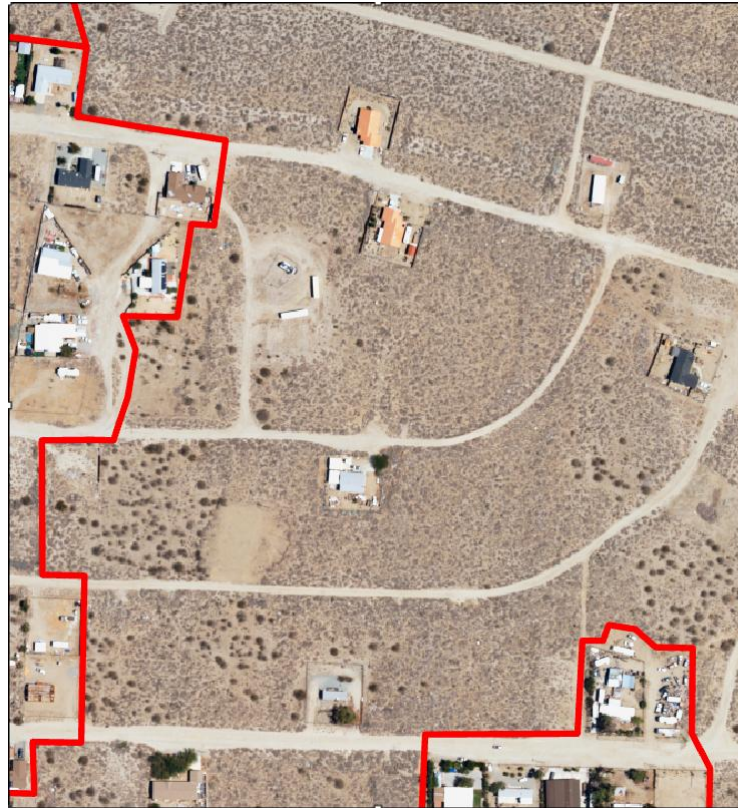


Figure 9: Example of a dual-coded polygon in the western Coachella Valley. This polygon in the community of Whitewater in the Coachella Valley subarea has an extensive land use footprint throughout, but it was still predominantly native vegetation (*Encelia farinosa* with scattered, sub-MMU *Larrea tridentata*). In this case, mappers coded the polygon as *Encelia farinosa* Shrubland Alliance (4114) with a Land Use of Urban (1000).

Mappers also used the Urban (1000) Land Use code for “dual coding” vegetation polygons that have moderate levels of built-up disturbance. For example, unincorporated communities in the north of the Coachella Valley, such as Sky Valley and Desert Edge, contain residential areas of relatively sparse structures spread across an otherwise intact desert landscape. The urban footprint of this neighborhood was greater than 2.5 acres, but there was extensive natural vegetation interspersed throughout. Mappers utilized the same rules for dual-coding implemented for the DRECP project: if a polygon had at least 10% cover of intact natural vegetation/landscape, mappers coded the polygon to the natural vegetation type and applied a Land Use modifier to represent the anthropogenic component. For the unincorporated community example given above, where the man-made structures and disturbances did not meet the MMU to map individually as Urban/Built-Up disturbance

and were distributed throughout otherwise intact vegetation (usually with *Larrea tridentata* as a primary component), mappers assigned these areas to *Larrea tridentata* Alliance (or related Alliance) with a Land Use of “Urban”. See Figure 9 for an example of a dual-coded polygon in the western Coachella Valley.

Another type of dual coding involves the scenario in which a stand of vegetation passes beneath a bridge that is large enough to be coded as Built-up & Urban Disturbance (9300). In this case, mappers delineated a small polygon that follows the stand of vegetation beneath the bridge. This polygon is bounded by the width of the stand of vegetation in one direction and the width of the bridge in the other direction. These polygons are dual-coded with a Map Unit reflecting the vegetation type beneath the bridge and a Land Use code of Urban (1000). These polygons are delineated even if sub-MMU.

Water Transfer (major canals, aqueducts, and agricultural channels) (1436)

Mappers used this code to identify polygons that describe major domestic and agricultural water conveyance channels, such as the Coachella Canal and the All-American Canal. Additionally, some of the smaller agricultural drainages and channels throughout the Coachella and Imperial Valley subareas, if they meet an appropriate size, receive this code (see the Map Unit Description for Agriculture (9200)). All polygons designated a Map Unit of Major Canals and Aqueducts (9804) and polygons of Agriculture (9200) that denote agricultural channels receive this code.

Wildlife Preserves & Sanctuaries (1850)

This code was applied to actively managed areas, either public or private, that serve as wildlife preserves or refuges. This includes the extensive network of artificially constructed wetland habitat along the south side of the Salton Sea that are either privately owned (usually for the purposes of hunting) or are a part of the US Fish and Wildlife Service Sonny Bono National Wildlife Refuge. Another wildlife area exists at the Imperial Wildlife Area, along the Alamo River in the Imperial Valley subarea, which is managed by the California Department of Fish and Wildlife. Mappers used a land ownership layer to determine the boundaries of these wildlife refuges, and all polygons that at least partially crossed into these refuges were given the 1850 Land Use code. See the Map Unit Description for Arid West Interior Freshwater Marsh & Wet Meadow Macrogroup (3400) for more information about how mappers delineated these managed wetland habitats.

Agriculture (Includes Nurseries) (2000)

Mappers used this general code to refer to agricultural practices outside of annual field crops, orchards, or vineyards, which have dedicated Land Use codes (Non-woody Row

and Field Crops (2100) and Orchards & Vineyards (2200)). Areas that received an Agriculture (2000) code included dairies, plant nurseries, and indoor or greenhouse facilities where we could not determine the type of plant product. All polygons with a Map Unit of Agriculture (9200) received this code.

Non-woody Row & Field Crops (2100)

Mappers used this code for plots of land dedicated to growing annual field crops. Fields that did not currently have crops were also given this code if they had been planted in the last five years. Mappers used Google Earth to view imagery from past years to inform this decision. The Map Unit Non-Woody Row and Field Agriculture (9220) always received this code.

Orchards & Vineyards (2200)

Mappers used this code for agricultural operations growing trees or grapes. This includes date palm plantations. Inactive/abandoned orchards still received this code unless all trees had been removed. All polygons mapped as Woody Agriculture (orchards, vineyards) (9210) were given this Land Use code.

Improved Pastureland (Irrigated) (2300)

This Land Use code applies to fields that are irrigated and maintained for the purpose of livestock grazing. This does not include small corrals or livestock pens associated with residential properties, which would be considered part of a Built-Up & Urban Disturbance (9300) with a Land Use code of Urban (1000). Mappers gave the Improved Pastureland (Irrigated) (2300) code to all polygons mapped as Irrigated Pastures (9230)

Vacant Land - Restoration (3500)

This code was applied to areas where managed restoration was taking place. Within the mapping area, this applied to a section of Indian reservation land directly adjacent to the Colorado River which was undergoing replanting of *Populus fremontii* and *Prosopis glandulosa* by the Fort Yuma Quechan Tribe. New restoration areas that have been planted but have not yet reached >2% vegetation cover were mapped as Restoration (9400) and given this Land Use code, however mappers did not encounter this scenario within this mapping area. If a restoration area has >2% vegetation cover, such as these *Populus fremontii* and *Prosopis glandulosa* restoration areas, mappers assigned them to their appropriate vegetation type and gave them this Land Use code.

Undifferentiated Water (9800)

This code was applied to natural or artificial bodies of water, such as ponds, lakes, and rivers. This did not include bodies of water that are associated with utility or industrial practices, such as sewage treatment, aquaculture, or agriculture (when impoundment feature is dry), which were treated as a Water Impoundment Feature (9805) and given a Land Use code of Water Impoundment Feature (9810). Examples of bodies of water that mappers gave a Land Use code of Undifferentiated Water (9800) include artificially managed lakes and ponds used for recreation, ponds within golf courses, and the Salton Sea, which mappers assigned to Water (9800), as well as rivers and creeks, such as the Colorado River, which mappers assigned to Perennial Stream Channel (Open Water) (9801).

Water Impoundment Feature (9810)

Mappers used this code for polygons mapped as Water Impoundment Feature (9805), which include manmade, usually bermed or concrete-lined holding ponds for industrial or utility purposes such as agriculture, sewage treatment, and aquaculture. Agricultural water impoundment ponds were only mapped as Water Impoundment Feature (9810) if dry, otherwise they were mapped as Water (9800) with a Land Use code of Undifferentiated Water (9800).

ACCURACY ASSESSMENT

Sample Allocation Methods

Accuracy assessment begins with the allocation of mapped polygons selected to be visited in the field. The allocations were designed to ensure that a representation of most, if not all, of the mapped vegetation types were assessed. For this project, CDFW completed the allocation for testing map accuracy for each of the two modules. CDFW selected polygons from the vegetation mapping geodatabases using a stratified random sampling method, in which polygons from the vegetation map were selected for field validation that were distributed across the mapped units so that both rare and common types were represented. To determine the polygons to be assessed, the mapped polygons were subset into polygons that could be included in the allocation and polygons that should be excluded from the allocation. CDFW excluded polygons that had previous rapid assessment, relev  , or reconnaissance samples within them, as well as polygons that were small slivers and large polygons in which it would not be possible for the surveyors to see 20%. Because some of the large polygons also had low polygon counts for those types and were in dunes used by OHVs, a few were manually selected and the sampling team was told they could sample more than once within the polygon as long as the samples were > 1000 m apart. This gave the sampling team freedom to select sites where they could ensure safety. Sampling was limited to polygons occurring on public lands within the California Protected Areas Database

(CPAD, GreenInfo Network, 2022 <https://calands.org/>), private or Tribal lands where the contractors had been given permission to sample, or adjacent to roadsides where the land use was private but had public right of ways. Additionally, the polygon subset only included polygons within either 500 m or 750 m from roads using steep slopes and canals as barriers to ensure that polygons could be reasonably accessed. Finally, for each module, stratified random selections of the polygon subset were performed to ensure no two polygons that were within 1,000 meters of each other were selected. Though to ensure that polygons of rarer types were included, a few polygons that violated that rule were manually included. The final AA allocation contained 851 polygons.

Field Sampling and Data Entry

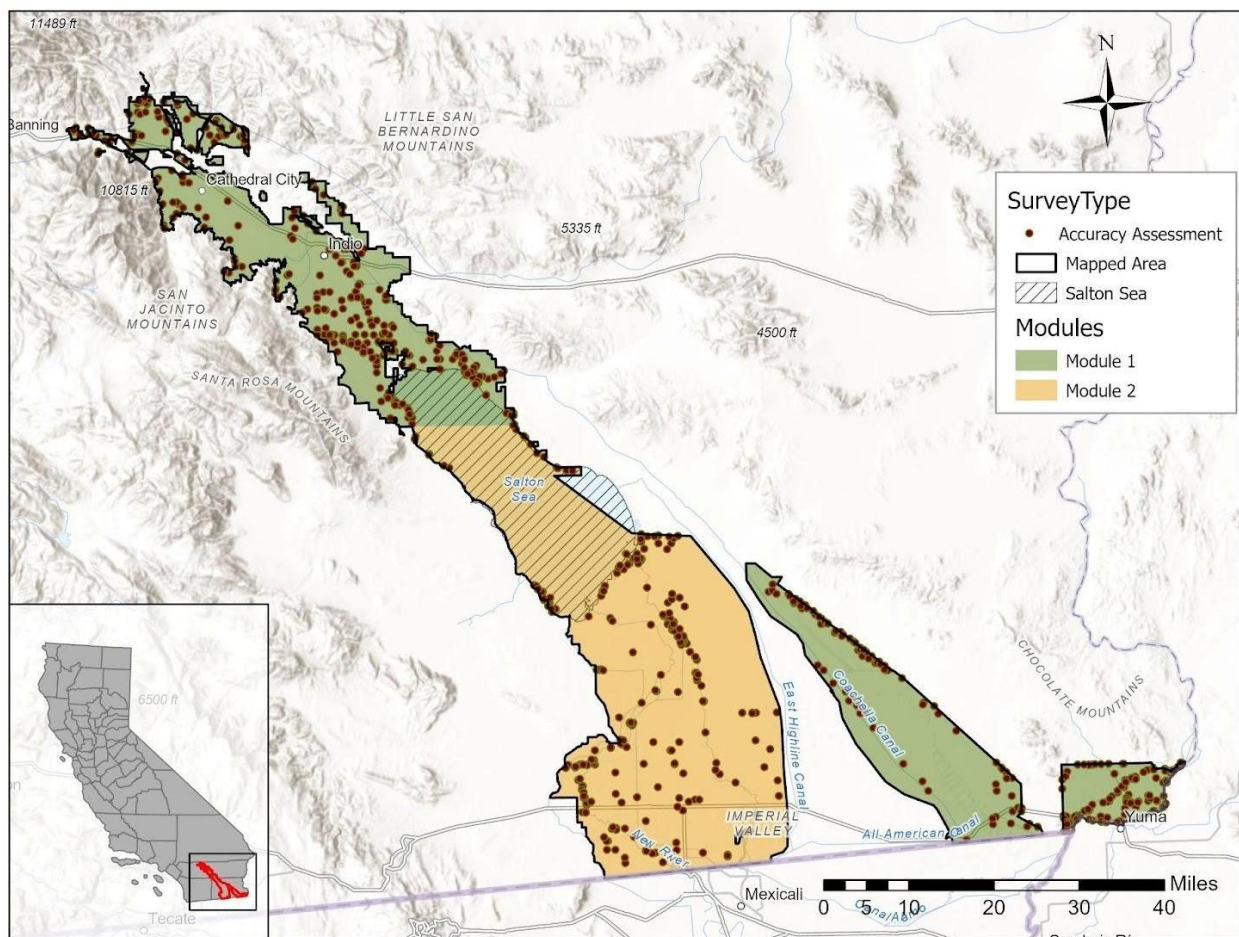


Figure 10: Map of the Colorado Desert showing the mapping area and locations for Accurate Assessment (AA) Survey. Locations of the 822 AA surveys included in the final vegetation classification data analysis for the Colorado Desert vegetation mapping project.

Accuracy assessment field sampling to validate the vegetation map took place after the completion of each Module. Field assessment teams conducted surveys for Module 1 from February 2024 to July 2024 in 19 trips over the course of 45 days for a total of 553 surveys, and Module 2 from February 2025 to June 2025 in 13 trips over the course of 24 days for a total of 269 surveys (Figure 10, Table 14).

Accuracy assessment field teams that included staff who worked as mappers on this project were assigned to assess different regions of the map where they were not the mapper, and field teams did not have access to the mapping data for that area. Mappers generally mapped contiguous portions of the area, making it easy to allocate field assignments and surveys to mappers only outside of regions that they mapped. In keeping with AA protocol, in the field, assessors used the field key with descriptions and a tablet with only the allocated polygons with no appended mapping data and 2022 NAIP imagery. Assessors determined the mapping unit or Alliance of the polygon on the ground using the field key adapted and developed for the DRECP (see Appendix C for full key).

Table 14: Summary of completed accuracy assessment (AA) Surveys per Module with date range and total field trips and field days.

Module	Dates of AA Points	No. trips	No. days	Total AA Surveys
Module 1	02/06/2024 - 07/02/2024	19	45	553
Module 2	02/11/2025 - 06/12/2025	13	24	269
	Grand Total	32	69	822

Using the field key and descriptions provided by CDFW, UC Riverside field assessors visited allocated polygons to determine the vegetation type without knowledge of the polygon attribution. Field assessors recorded data from AA surveys as described in the Field Sampling Methods: Data Collection section. At polygons allocated for accuracy assessment, the field team determined a location to perform the AA survey where it was possible to have a view of at least 20% of the allocated polygon, the minimum required area for the polygon to be scored for accuracy. Where the assessors were unable to view the polygon due to obstructed view or restricted land access, they rejected the polygon without performing an accuracy assessment survey. Field assessors also rejected polygons if the 2022 NAIP imagery differed too greatly from the vegetation type on the ground. Examples of this include areas that had been denuded through scraping or flooding since the imagery was flown, or areas where the vegetation type changed at

the Alliance level due to successional species. All AA survey locations were established in areas where field assessors were permitted access by landowners or managers, or along roadsides where permits were not obtained for accessing the land. In some rare cases, AAs were not performed when viewing private property from the roadside posed a personal or physical safety challenge for the field team. Similarly, while performing work as guests on tribal lands, teams deferred to the tribal cultural monitors to assess constraints around culturally-sensitive resources, although no survey points were specifically rejected due to this mutual cooperation.

For each AA survey, the location of the survey was digitally marked using a GPS device (Samsung Galaxy), and on the ground digital color photos at cardinal directions from the point were taken at the AA GPS location. In some cases, additional photos were also taken if the cardinal photos did not sufficiently capture the stand. The field assessors took photos through the Esri Field Maps data collection application and attached the photos to the point on the collection feature layer, in the same manner as had been used for reconnaissance surveys. If the field assessors established the survey outside of the allocated polygon lines, they took data on the distance and bearing to the polygon, in addition to the standard AA survey data (see Appendix D for complete explanation of field protocols).

The field staff provided a primary vegetation type call and a list of dominant plant species, along with percent cover estimates by species and by vegetation strata. If a polygon contained more than one mappable vegetation type and/or had linework problems, notes were provided for how the polygon should be divided, and a separate survey was taken for each type meeting the minimum Map Unit size to inform the map correction. See Appendix D for accuracy assessment protocol and survey form.

AA field data was entered into a standardized database developed by CDFW and CNPS. CDFW ecologists scored the accuracy of the vegetation geodatabase based on a fuzzy logic method used for the Survey of California Vegetation (VegCAMP, 2022). CDFW staff reviewed each AA survey and removed from consideration any surveys that had problems associated with land access permissions, vegetation or plant species identification, visibility, or significant changes in land use or vegetation since the date of the imagery on which the map was based. If the field teams could not identify the vegetation type based on the field key or incorrectly identified the type, CDFW staff assigned the final type based on the species covers recorded in the AA survey data, any additional notes taken by the field teams, and field photos.

Scoring and Determining Accuracy

A fuzzy logic method was used to score each AA survey, rather than simply denoting whether a sample was correct or incorrect (Congalton and Green, 2009; Gopal and Woodcock, 1994; Hagen, 2003). Each field-verified polygon was scored according to a set of decision rules (Table 15), with a total of 5 possible points for each. Scores were summed for each vegetation type, then divided by the total possible score and

multiplied by 100 for a percent accuracy. Additionally, a total overall accuracy was calculated by counting the valid AA surveys, which include correct (score of 5, or 100%), acceptable (score of 3 or 4, or 60% or 80% accurate), or failed (score of 0, 1, or 2) then dividing that count by the total number of AA surveys scored across all vegetation types.

Table 15: Accuracy assessment (AA) Scoring Rules and Points

Code	Reason for Score	Score
A	PI completely correct.	5
B	The PI chose the correct Group OR the next level up in the hierarchy.	4
C	Threshold/transition between PI (Producers') call and Final (Field assessed) call. This was used when cover values of the dominant or indicator species were close to the values that would key to the PI's type.	4
D	Correct at Macrogroup level OR next level up in hierarchy.	3
E	Based on close ecological similarity. Ecological similarity addresses assessed and mapped calls that contained vegetation with overlapping diagnostic species but were not technically closely related in the NVCS hierarchy. This was common in stands that contain a mix of species of late and early seral vegetation types and also common in zones of overlap between ecoregions.	3
F	Correct at Division level (OR next level up in hierarchy).	2
G	Some floristic/hydrologic similarity. This addresses cases in which the mapped and the assessed vegetation type had different diagnostic species, but bear some similarity in ecological traits based on predicted and actual setting such as hydrologic regime, overall climate, or successional state.	2
H	Correct only at Lifeform, without any floristic similarity.	1
I	No similarity above Formation and incorrect life form.	0
J	Survey removed because there was a significant change in the polygon (e.g., the stand was burned, developed, or cleared since the date of the base imagery).	no score

Code	Reason for Score	Score
K	Survey removed because inadequate portion (<20%) of the polygon was viewed by the field assessment.	no score
L	Survey removed because field/PI data are incomplete, inadequate or confusing (e.g., cover values were not provided for key species in the stand).	no score
M	Supplementary record not scored (for multiple point assessments within a polygon where the AA call was the same).	no score

AA scores were calculated by vegetation type and results were summarized in the form of a contingency table, so that specific and systematic errors could be addressed by the mappers. Two forms of accuracy (User's and Producer's) can be estimated from the data (Story and Congalton, 1986). User's accuracy provides an estimate of commission error, or how well spatial mapping data represents what is actually found on the ground; i.e., when the user goes to a location mapped as a certain class, the resulting probability that it is in fact that class is provided (with a percent accuracy). Producer's accuracy, on the other hand, measures omission error, or the probability that vegetation of a given class in the field is mapped as that class. Producer's accuracy may inform the mappers how well a mapping class can be detected by the mappers (Story and Congalton, 1986; Lea and Curtis, 2010). Both user's and producer's accuracy were calculated and reported.

Once a Delivery Area (Module) had been scored, the accuracy assessment results were sent to UCR mappers for review by senior mappers. In some cases, the photo interpreter flagged a specific AA survey finding for follow-up discussion and review with CDFW ecologist staff, resulting in either CDFW retaining their original AA call, modifying the AA call, or eliminating the AA point out of the analysis. Once AA review was completed, any types not achieving 80% accuracy were further evaluated in consultation between CDFW ecologists and mapping staff. The mappers then revised the polygons based on the AA results. Therefore, the final map accuracy was improved over the version represented in the score.

RESULTS

This section presents our results for vegetation type mapping, surveys to support the final map and current vegetation classification, and accuracy assessment. In the Floristics section we report on including total number of species encountered in this project, vegetation types supporting rare taxa, and voucher and noteworthy collections. In the Sample Collection section, we include a summary of the types of survey data collected within all used Map Units. In the Mapping section here, we report summary statistics for the total number and average size of polygons, list the number of mapped polygons per Map Unit, highlight uncommon vegetation types, and describe Map Units. Map Unit descriptions include a description of the type, mapping considerations, photo-signature examples, and descriptions of commonly confused types, and are attached in Appendix A. In the Accuracy Assessment section we report on the total number of AA surveys that were performed per Mapping Unit mapped, and summary statistics, including a contingency table (Appendix E), results showing users' and producer's accuracy by vegetation type, and a discussion of types that did not reach 80% accuracy.

SAMPLING

Floristics

The Colorado Desert is notoriously under-represented in Herbaria and California floristics, particularly the portions of Imperial County that fall within this mapping area. We recorded a total of 280 plant taxa throughout the entirety of this project: 257 in Module 1 and 105 in Module 2 (82 were observed in both Modules). Nine are species with a California Rare Plant Rank from the California Native Plant Society (see: <https://rareplants.cnps.org/>) and are listed as rare by the State of California (CNDDDB, 2026) (Table 16). Throughout both Modules, we documented 50 taxa that are non-native and 22 of which are considered invasive by the California Invasive Plant Council (CNPS RPG, 2026).

Field teams opportunistically collected voucher specimens throughout the project in under-represented areas, where local phenology was amenable to collecting, and where we were granted collection permits. Field teams collected a total of 284 voucher specimens, representing 150 taxa throughout the mapping area. Voucher specimens were deposited at the UCR Herbarium.

Throughout the field data collection for both reconnaissance and accuracy assessment, field teams made several noteworthy observations. Firstly, they documented *Ocosiphon pilulifer* (stinknet) in eastern Imperial County, where it had not been recorded in this region since 2005. *Ocosiphon pilulifer* is a highly invasive weed with a California Invasive Plant Council (Cal-IPC) rating of High (Cal-IPC, 2026). They also documented *Lactuca serriola* for the first time in Imperial Valley. Previously, this species had only been documented in the northeastern portion of the Imperial Valley near the Colorado

River, approximately 120 kilometers away. *Lactuca serriola* is rated as Moderate for invasibility by Cal-IPC, where it generally occurs on roadsides in agricultural areas. Other significant findings include documenting under-represented introduced tree species in Imperial County, including tree of heaven (*Ailanthus altissima*), river red gum (*Eucalyptus camaldulensis*), southern blue gum (*Eucalyptus globulus*), Peruvian pepper tree (*Schinus molle*), and Mexican fan palm (*Washingtonia robusta*), all of which field teams observed as ornamental and escaped individuals, and none of which are represented in California herbaria for the county (CCH2 2026). Data for both species point records as well as specimen collections were provided to CDFW for inclusion, as relevant, in the California Natural Diversity Database (CNDDDB, 2026).

Table 16: Summary of Rare taxa documented throughout all survey types. ‘*’ indicates that the taxon was collected. ‘†’ indicates that the taxon is listed by CDFW as rare, threatened, or endangered. Listed rare species were collected under permit No. 2081(a)-24-130-V (permitted to Melanie Davis) and reported to CDFW and CNDDDB.

Rare Taxon Name	CNPS Rarity Rank	Associated Units (No. Surveys)	Note
<i>Astragalus crotalariae</i>	4.3	Desert Forb Provisional Mapping Unit (1) <i>Encelia farinosa</i> Alliance (1)	Northeastern side of the Salton Sea; Module 1
<i>Astragalus insularis</i> var. <i>harwoodii</i> *	2B.2	<i>Larrea tridentata</i> Alliance <i>Larrea tridentata</i> – <i>Ambrosia dumosa</i> Alliance	Algodones Dunes; Module 1
<i>Astragalus lentiginosus</i> var. <i>coachellae</i> †	1B.2	<i>Ambrosia salsola</i> – <i>Bebbia juncea</i> Alliance (1) Anthropogenic Areas of Little or No Vegetation (1)	Federally endangered. Central-western Coachella Valley; Module 1
<i>Croton wigginsii</i> *†	2B.2	<i>Ephedra californica</i> – <i>Ephedra trifurca</i> Alliance (2) <i>Eriogonum deserticola</i> Mapping Unit (2) <i>Psoralethamnus emoryi</i> Mapping Unit	Algodones Dunes; Module 1

Rare Taxon Name	CNPS Rarity Rank	Associated Units (No. Surveys)	Note
		Anthropogenic Areas of Little or No Vegetation	
<i>Helianthus niveus</i> ssp. <i>tephrodes</i> *†	1B.2	<i>Eriogonum deserticola</i> Mapping Unit (1) North American Warm Semi-Desert Dune & Sand Flats Group (1) <i>Dicoria canescens</i> – <i>Abronia villosa</i> – <i>Panicum urvilleanum</i> Alliance	Algodones Dunes; Module 1
<i>Johnstonella costata</i> *	4.3	<i>Ephedra californica</i> – <i>Ephedra trifurca</i> Alliance	Algodones Dunes; Module 1
<i>Juncus acutus</i> ssp. <i>leopoldii</i>	4.2	<i>Allenrolfea occidentalis</i> Alliance (1) <i>Typha (angustifolia, domingensis, latifolia)</i> Alliance (1)	Salton Sea wetlands on western shore of the Salton Sea; Module 1 and 2
<i>Linanthus maculatus</i> ssp. <i>maculatus</i>	1B.2	<i>Chilopsis linearis</i> – <i>Psoralea spinosa</i> Alliance (1)	Northwestern Coachella Valley at Mission Creek; Module 1
<i>Palafoxia arida</i> var. <i>gigantea</i>	1B.3	Desert Forb Provisional Mapping Unit (1) <i>Larrea tridentata</i> Alliance (1) <i>Parkinsonia florida</i> – <i>Olneya tesota</i> Alliance (1)	Algodones Dunes; Module 1
<i>Panicum hirticaule</i> ssp. <i>hirticaule</i>	2B.1	<i>Larrea tridentata</i> Alliance (2) <i>Parkinsonia florida</i> – <i>Olneya tesota</i> Alliance (1) <i>Prosopis glandulosa</i> – <i>Prosopis velutina</i> –	Northeastern edge of Algodones Dunes; Module 1

Rare Taxon Name	CNPS Rarity Rank	Associated Units (No. Surveys)	Note
		<i>Prosopis pubescens</i> Alliance (1)	
<i>Pholisma sonora</i> *	1B.2	<i>Ephedra californica</i> – <i>Ephedra trifurca</i> Alliance	Algodones Dunes; Module 1
<i>Proboscidea althaeifolia</i>	4.3	<i>Larrea tridentata</i> – <i>Ambrosia dumosa</i> Alliance (1)	Northern edge of Winterhaven mapping area; Module 1

Vegetation Surveys

Field teams surveyed a total of 50 Map Units throughout the reconnaissance period within both Modules, 36 of which were identified to the Alliance level, five to the group level, and 3 were designated as Mapping Units (provisional vegetation types; Table 17). Field teams surveyed 4 Map Units that fall into Miscellaneous Classes that are related to anthropogenic land use. Mappers delineated a total of 61 Map Units; the discrepancy of 10 Map Units can be attributed to further refinement of the classification and other Miscellaneous Classes that field teams did not collect data for, such as Irrigated Pastures, Major Canals and Aqueducts (Open Water), and Water Impoundment Features. Field teams conducted a total of 10 rapid assessments and 2 relevés throughout the entire mapping area to support additional classification of Colorado Desert vegetation types. Field teams conducted a total of 534 reconnaissance surveys to provide on-the-ground data in support of mapping: 319 surveys in Module 1 and 215 surveys in Module 2 (Table 17).

Table 17: Vegetation classification by Map Unit for the Colorado Desert, summarized by survey type. RA = Rapid Assessment, Rec = Reconnaissance, and Rel = Relevé. "Total" refers to the total number of surveys conducted.

Map Unit Code	Map Unit Name	Hierarchy Level	No. RA	No. Rec	No. Rel	Total	Notes
9200	Agriculture	Map Unit	0	2	0	2	
3721	<i>Allenrolfea occidentalis</i> Alliance	Alliance	0	29	0	29	
4111	<i>Ambrosia dumosa</i> Alliance	Alliance	0	5	0	5	
7211	<i>Ambrosia salsola</i> – <i>Bebbia juncea</i> Alliance	Alliance	0	28	0	28	
9320	Anthropogenic Areas of Little or No Vegetation	Map Unit	0	4	0	4	
3410	Arid West Interior Freshwater Marsh Group	Group	0	3	0	3	
5111	<i>Atriplex canescens</i> Alliance	Alliance	0	12	0	12	
6111	<i>Atriplex hymenelytra</i> Alliance	Alliance	0	3	0	3	
3722	<i>Atriplex lentiformis</i> Alliance	Alliance	0	31	0	31	
4113	<i>Atriplex polycarpa</i> Alliance	Alliance	0	18	0	18	
1423	<i>Baccharis emoryi</i> – <i>Baccharis sergiloides</i> Alliance	Alliance	0	1	0	1	

Map Unit Code	Map Unit Name	Hierarchy Level	No. RA	No. Rec	No. Rel	Total	Notes
3717	<i>Bolboschoenus maritimus</i> Alliance	Alliance	0	1	0	1	
9300	Built-up & Urban Disturbance	Map Unit	0	2	0	2	
2310	Californian Annual Grassland & Forb Meadow Group	Group	0	1	0	1	
7222	<i>Chilopsis linearis</i> – <i>Psorothamnus spinosus</i> Alliance	Alliance	0	6	0	6	
6117	<i>Chorizanthe rigida</i> – <i>Geraea canescens</i> Desert Pavement Alliance	Alliance	0	4	0	4	
4124	<i>Cylindropuntia bigelovii</i> Alliance	Alliance	0	1	0	1	
3716	<i>Cynodon dactylon</i> – <i>Crypsis</i> spp. – <i>Paspalum</i> spp. Alliance	Alliance	0	3	0	3	
6121	<i>Dicoria canescens</i> – <i>Abronia villosa</i> – <i>Panicum urvilleanum</i> Alliance	Alliance	0	3	0	3	
3726	<i>Distichlis spicata</i> – (<i>Juncus cooperi</i> – <i>Frankenia salina</i>) Interior Alliance	Alliance	0	3	0	3	

Map Unit Code	Map Unit Name	Hierarchy Level	No. RA	No. Rec	No. Rel	Total	Notes
4114	<i>Encelia farinosa</i> Alliance	Alliance	0	11	0	11	
4211	<i>Ephedra californica</i> – <i>Ephedra trifurca</i> Alliance	Alliance	0	7	0	7	
4213	<i>Ericameria paniculata</i> Alliance	Alliance	0	7	0	7	
6124	<i>Eriogonum deserticola</i> Mapping Unit	Mapping Unit	2	4	0	6	
9500	Exotic Trees	Map Unit	0	3	0	3	
4115	<i>Larrea tridentata</i> – <i>Ambrosia dumosa</i> Alliance	Alliance	0	43	0	43	
4118	<i>Larrea tridentata</i> – <i>Encelia farinosa</i> Alliance	Alliance	0	15	0	15	
4119	<i>Larrea tridentata</i> Alliance	Alliance	0	57	0	57	
4212	<i>Lepidospartum squamatum</i> Alliance	Alliance	0	3	0	3	
3450	North American Temperate Ruderal Aquatic Vegetation Macrogroup	Macrogroup	0	1	0	1	

Map Unit Code	Map Unit Name	Hierarchy Level	No. RA	No. Rec	No. Rel	Total	Notes
2330	Californian Ruderal Grassland, Meadow & Scrub Group	Group	0	0	2	2	
6120	North American Warm Semi-Desert Dune & Sand Flats Group	Group	0	4	0	4	
4227	<i>Parkinsonia florida</i> – <i>Olneya tesota</i> Alliance	Alliance	0	27	0	27	
1621	<i>Phoenix dactylifera</i> – <i>Washingtonia filifera</i> Alliance	Alliance	0	1	0	1	
1431	<i>Phragmites australis</i> – <i>Arundo donax</i> Semi-natural Alliance	Alliance	0	17	0	17	
3417	<i>Phragmites australis</i> ssp. <i>americanus</i> Association	Association	0	3	0	3	
4221	<i>Pluchea sericea</i> Alliance	Alliance	0	49	0	49	
1411	<i>Populus fremontii</i> – <i>Fraxinus velutina</i> – <i>Salix gooddingii</i> Alliance	Alliance	0	1	0	1	
4222	<i>Prosopis glandulosa</i> – <i>Prosopis velutina</i> – <i>Prosopis pubescens</i> Alliance	Alliance	0	13	0	13	
4232	<i>Psoralea arguta</i> Mapping Unit	Mapping Unit	0	3	0	3	

Map Unit Code	Map Unit Name	Hierarchy Level	No. RA	No. Rec	No. Rel	Total	Notes
4219	<i>Psorothamnus fremontii</i> – <i>Psorothamnus polydenius</i> Alliance	Alliance	2	5		7	
4231	<i>Psorothamnus schottii</i> Mapping Unit	Mapping Unit	6	1	0	7	
1416	<i>Salix gooddingii</i> – <i>Salix laevigata</i> Alliance	Alliance	0	3	0	3	
3412	<i>Schoenoplectus (acutus, californicus)</i> Alliance	Alliance	0	1	0	1	
4226	<i>Senegalia greggii</i> – <i>Hyptis emoryi</i> – <i>Justicia californica</i> Alliance	Alliance	0	1	0	1	
7411	<i>Suaeda moquinii</i> Alliance	Alliance	0	26	0	26	
1432	<i>Tamarix</i> spp. Semi-natural Alliance	Alliance	0	47	0	47	
3416	<i>Typha (angustifolia, domingensis, latifolia)</i> Alliance	Alliance	0	14	0	14	
	Unidentified Alliance		0	3	0	3	Not identified in the field, later determined using vegetation keys and consulting with CDFW.

Map Unit Code	Map Unit Name	Hierarchy Level	No. RA	No. Rec	No. Rel	Total	Notes
2340	Warm Desert Ruderal Grassland Group	Group	0	3	0	3	N/A
1415	<i>Washingtonia filifera</i> Alliance	Alliance	0	1	0	1	
		Grand Total	10	534	2	546	

MAPPING

Summary Statistics

Mappers delineated a total of 13,409 polygons across an area of 1,266,523.94 acres (512,544.06 hectares) using 61 Map Units (Table 18). Appendix A includes detailed descriptions of each Map Unit used in this project. The average polygon size in this map is 94.49 acres. Non-woody Row and Field Agriculture covered the most area, with a total of 440,122.39 acres and 558 polygons. Vegetation types with the most area were *Dicoria canescens* – *Abronia villosa* – *Panicum urvilleanum* Alliance and *Larrea tridentata* Alliance, with 91,816.45 acres and 87,766.87 acres respectively. The high cover of the *Dicoria canescens* – *Abronia villosa* – *Panicum urvilleanum* Alliance is attributed to the Algodones Dunes, where the vast majority of the central active dune system was mapped to this type. Map Units with the most mapped polygons include *Tamarix* spp. Semi-natural Alliance, Built-up & Urban Disturbance, *Allenrolfea occidentalis* Alliance, *Atriplex lentiformis* Alliance, and *Pluchea sericea* Alliance with 1953, 1392, 899, 889, and 841 polygons respectively. The least commonly mapped Map Units by total area with less than 0.01% of the total area include *Baccharis emoryi* – *Baccharis sergiloides* Alliance, *Bolboschoenus maritimus* - *Schoenoplectus americanus* Mapping Unit, *Washingtonia filifera* Alliance, *Salix gooddingii* – *Salix laevigata* Alliance, and *Lepidospartum squamatum* Alliance. Least common Map Units by total number of polygons at less than five are *Baccharis emoryi* – *Baccharis sergiloides* Alliance, *Salix gooddingii* – *Salix laevigata* Alliance, *Psoralea fremontii* – *Psoralea polydenius* Alliance, Western Ruderal Marsh, Wet Meadow & Shrubland Group, and *Psoralea emoryi* Mapping Unit.

Mappers assigned a total of 27 Sensitive Natural Communities (SNCs), as defined by CDFW VegCAMP (2025). SNCs covered a total of 313,015.05 acres of the mapping area, across a total of 6,119 mapped polygons. The average polygon size for these communities is 65.59 acres. *Allenrolfea occidentalis* Alliance, *Atriplex lentiformis* Alliance, *Pluchea sericea* Alliance, *Larrea tridentata* Alliance, and *Parkinsonia florida* –

Olneya tesota Alliance were the most abundant SNCs by number of polygons, all ranging from 899-481 polygons, respectively. By total area, *Dicoria canescens* – *Abronia villosa* – *Panicum urvilleanum* Alliance, *Larrea tridentata* Alliance, *Larrea tridentata* – *Ambrosia dumosa* Alliance, *Chorizanthe rigida* – *Geraea canescens* Desert Pavement Alliance, and *Parkinsonia florida* – *Olneya tesota* Alliance covered the most ground ranging from 1,816.45 to 16,256.88 acres respectively.

Table 18: Summary of the total mapped area for Map Units with the number of polygons, total hectares, total acres, percent of total area, and average size. ‘*’ Indicates that the Map Unit is ranked as a California Sensitive Natural Community, see Appendix A for Global and State ranks (VegCamp, 2025).

Map Unit Code	Map Unit Description	# of Polygons	Total Area (Hectares)	Total Area (Acres)	% of Total Area	Average Polygon Size (Acres)
9200	Agriculture	322	8,136.18	20,104.86	1.587%	62.44
3721	<i>Allenrolfea occidentalis</i> Alliance*	899	3,586.55	8,862.52	0.700%	9.86
4111	<i>Ambrosia dumosa</i> Alliance*	52	1,333.51	3,295.16	0.260%	63.37
7211	<i>Ambrosia salsola</i> – <i>Bebbia juncea</i> Alliance*	163	1,671.59	4,130.56	0.326%	25.34
9320	Anthropogenic Areas of Little or No Vegetation	650	6,499.36	16,060.21	1.268%	24.71
3400	Arid West Interior Freshwater Marsh & Wet Meadow Macrogroup	36	1,839.69	4,545.95	0.359%	126.28
5111	<i>Atriplex canescens</i> Alliance*	90	1,487.74	3,676.28	0.290%	40.85

Map Unit Code	Map Unit Description	# of Polygons	Total Area (Hectares)	Total Area (Acres)	% of Total Area	Average Polygon Size (Acres)
6111	<i>Atriplex hymenelytra</i> Alliance*	5	26.84	66.32	0.005%	13.26
3722	<i>Atriplex lentiformis</i> Alliance*	888	3,070.66	7,587.74	0.599%	8.54
4113	<i>Atriplex polycarpa</i> Alliance	74	990.48	2,447.51	0.193%	33.07
1423	<i>Baccharis emoryi</i> – <i>Baccharis sergiloides</i> Alliance*	2	2.61	6.46	0.001%	3.23
3715	<i>Bolboschoenus maritimus</i> - <i>Schoenoplectus americanus</i> Mapping Unit	5	2.91	7.20	0.001%	1.44
2331	<i>Brassica tournefortii</i> – <i>Malcolmia africana</i> Semi-natural Alliance	5	53.00	130.96	0.010%	26.19
2332	<i>Bromus rubens</i> – <i>Schismus (arabicus, barbatus)</i> Semi-natural Alliance	7	182.27	450.40	0.036%	64.34
9300	Built-up & Urban Disturbance	1392	23,583.88	58,276.80	4.601%	41.87
7222	<i>Chilopsis linearis</i> – <i>Psorothamnus spinosus</i> Alliance*	28	223.21	551.55	0.044%	19.70

Map Unit Code	Map Unit Description	# of Polygons	Total Area (Hectares)	Total Area (Acres)	% of Total Area	Average Polygon Size (Acres)
6117	<i>Chorizanthe rigida</i> – <i>Geraea canescens</i> Desert Pavement Alliance*	121	7,680.10	18,977.86	1.498%	156.84
3716	<i>Cynodon dactylon</i> – <i>Crypsis</i> spp. – <i>Paspalum</i> spp. Alliance	14	35.64	88.06	0.007%	6.29
6125	Desert Forb Provisional Mapping Unit	13	142.81	352.90	0.028%	27.15
6121	<i>Dicoria canescens</i> – <i>Abronia villosa</i> – <i>Panicum urvilleanum</i> Alliance*	114	37,156.95	91,816.45	7.249%	805.41
3726	<i>Distichlis spicata</i> – (<i>Juncus cooperi</i> – <i>Frankenia salina</i>) Interior Alliance*	75	115.46	285.32	0.023%	3.80
4114	<i>Encelia farinosa</i> Alliance*	86	1,548.51	3,826.43	0.302%	44.49
4211	<i>Ephedra californica</i> – <i>Ephedra trifurca</i> Alliance*	10	521.70	1,289.15	0.102%	128.92
4213	<i>Ericameria paniculata</i> Alliance*	20	127.01	313.85	0.025%	15.69

Map Unit Code	Map Unit Description	# of Polygons	Total Area (Hectares)	Total Area (Acres)	% of Total Area	Average Polygon Size (Acres)
6124	<i>Eriogonum deserticola</i> Mapping Unit	51	4,080.59	10,083.31	0.796%	197.71
9500	Exotic Trees	94	205.05	506.68	0.040%	5.39
9230	Irrigated Pastures	12	99.89	246.84	0.019%	20.57
4115	<i>Larrea tridentata</i> – <i>Ambrosia dumosa</i> Alliance*	329	15,975.75	39,476.79	3.117%	119.99
4118	<i>Larrea tridentata</i> – <i>Encelia farinosa</i> Alliance*	212	4,246.55	10,493.41	0.829%	49.50
4119	<i>Larrea tridentata</i> Alliance*	642	35,513.95	87,756.53	6.929%	136.69
4212	<i>Lepidospartum squamatum</i> Alliance*	7	14.54	35.92	0.003%	5.13
9804	Major Canals and Aqueducts (Open Water)	32	2,084.49	5,150.87	0.407%	160.96
6113	Mud Hills sparsely vegetated ephemeral herbs Mapping Unit	134	1,145.85	2,831.44	0.224%	21.13
9220	Non-woody Row and Field Agriculture	558	178,112.17	440,122.99	34.750%	788.75

Map Unit Code	Map Unit Description	# of Polygons	Total Area (Hectares)	Total Area (Acres)	% of Total Area	Average Polygon Size (Acres)
6110	North American Warm Semi-Desert Cliff, Scree & Pavement Sparse Vegetation Group	94	4,584.26	11,327.91	0.894%	120.51
6120	North American Warm Semi-Desert Dune & Sand Flats Group	28	875.55	2,163.53	0.171%	77.27
4227	<i>Parkinsonia florida</i> – <i>Olneya tesota</i> Alliance*	482	6,583.32	16,267.67	1.284%	33.75
9801	Perennial Stream Channel (Open Water)	48	375.13	926.95	0.073%	19.31
1621	<i>Phoenix dactylifera</i> – <i>Washingtonia filifera</i> Alliance	37	43.99	108.70	0.009%	2.94
1431	<i>Phragmites australis</i> – <i>Arundo donax</i> Semi-natural Alliance	406	573.71	1,417.65	0.11%	3.49
4221	<i>Pluchea sericea</i> Alliance*	839	2,113.87	5,223.46	0.412%	6.23
1411	<i>Populus fremontii</i> – <i>Fraxinus velutina</i> – <i>Salix gooddingii</i> Alliance*	25	60.97	150.65	0.012%	6.03

Map Unit Code	Map Unit Description	# of Polygons	Total Area (Hectares)	Total Area (Acres)	% of Total Area	Average Polygon Size (Acres)
4222	<i>Prosopis glandulosa</i> – <i>Prosopis velutina</i> – <i>Prosopis pubescens</i> Alliance*	325	621.62	1,536.06	0.121%	4.73
4232	<i>Psorothamnus emoryi</i> Mapping Unit	4	150.85	372.76	0.029%	93.19
4219	<i>Psorothamnus fremontii</i> – <i>Psorothamnus polydenius</i> Alliance*	3	47.45	117.26	0.009%	39.09
4231	<i>Psorothamnus schottii</i> Mapping Unit	43	1,007.12	2,488.63	0.196%	57.88
1416	<i>Salix gooddingii</i> – <i>Salix laevigata</i> Alliance*	2	5.90	14.58	0.001%	7.29
4226	<i>Senegalia greggii</i> – <i>Hyptis emoryi</i> – <i>Justicia californica</i> Alliance*	32	67.57	166.96	0.013%	5.22
6116	Sparsely vegetated playa (Ephemeral annuals) Mapping Unit	225	5,262.91	13,004.87	1.027%	57.80
9701	Sparsely Vegetated Recently Burned Areas	24	76.26	188.45	0.015%	7.85

Map Unit Code	Map Unit Description	# of Polygons	Total Area (Hectares)	Total Area (Acres)	% of Total Area	Average Polygon Size (Acres)
7411	<i>Suaeda moquinii</i> Alliance*	404	1,726.05	4,265.15	0.337%	10.56
1432	<i>Tamarix</i> spp. Semi-natural Alliance	1994	6,826.31	16,868.12	1.33%	8.46
3416	<i>Typha</i> (<i>angustifolia</i> , <i>domingensis</i> , <i>latifolia</i>) Alliance*	227	1,107.15	2,735.82	0.216%	12.05
6114	Unvegetated wash and river bottom Mapping Unit	16	203.16	502.02	0.040%	31.38
9310	Urban Window	11	43,935.47	108,566.48	8.572%	9,869.68
2340	Warm Desert Ruderal Grassland Group	19	344.86	852.16	0.067%	44.85
1415	<i>Washingtonia filifera</i> Alliance	7	3.18	7.86	0.001%	1.12
9800	Water	653	79,755.61	197,079.61	15.561%	301.81
9805	Water Impoundment Feature	44	1,233.68	3,048.49	0.241%	69.28
7110	Western Ruderal Marsh, Wet Meadow & Shrubland Group	4	68.34	168.87	0.013%	42.22

Map Unit Code	Map Unit Description	# of Polygons	Total Area (Hectares)	Total Area (Acres)	% of Total Area	Average Polygon Size (Acres)
9210	Woody Agriculture (orchards, vineyards)	271	13,394.33	33,097.98	2.613%	122.13
	Grand Total	13,409	512,546.11	1,266,523.94	100%	94.45

ACCURACY ASSESSMENT (AA)

Summary Statistics

Field teams conducted a total of 822 accuracy assessment surveys and 60 Map Unit types. The team at CDFW VegCAMP allocated a total of 851 polygons throughout both Module 1 and 2 for accuracy assessment (Table 19). Of these, field teams were able to access and assess 702 polygons. Some polygons were not assessed due to physical access limitations (e.g. rivers or cliffs that could not be safely passed) or the absence of land access permissions required for CCB field teams to enter certain areas. Within the 702 total surveyed polygons, field teams conducted 822 accuracy assessment surveys. Some polygons had greater than one survey where multiple vegetation types were included or linework needed to be adjusted. Of these surveys, 763 were used in the scoring process. Some accuracy assessment surveys were excluded from the final scoring due to substantial changes in vegetation since the base imagery was flown or because there was insufficient field information to support accurate scoring.

Table 19: Number of accuracy assessment (AA) surveys collected; number of polygons allocated by VegCAMP; and total number of polygons assessed by the CCB team.

Module	Dates of Survey Points	No. AA Surveys Collected	No. polygons Allocated	No. polygons Assessed
Module 1	02/06/2024 - 07/02/2024	553	587	492
Module 2	02/11/2025 - 06/12/2025	269	264	210
	Grand Total	822	851	702

A contingency table displaying assessed types by Users (field-assessed types) and Producers (mapper-interpreted types) for this AA effort is included in Appendix E. The contingency table is used to evaluate agreement between Producer-identified Map Units and the final User-assessed Map Units assigned following accuracy assessment. The table summarizes the number of polygons assigned from each final Map Unit and provides the basis for calculating classification accuracy.

Each column in the table represents a type assessed by field teams (Users) for each polygon, while each row represents the type mapped by the mappers (Producers). Numbers on the diagonal are correct calls by the mappers. The contingency table displays the numbers of assessed polygons by type and does not include fuzzy logic scores. Overall, the matrix indicates higher agreement for well-defined and structurally distinct vegetation types, with greater confusion among floristically and structurally similar desert scrub, sparsely vegetated, and ruderal grassland units. Some vegetation types with limited reference samples show increased classification uncertainty.

The AA field data were analyzed by CDFW-VegCAMP staff to verify accuracy of the vegetation maps. The resulting calculated percent accuracy for each area was greater than 80% overall. The overall fuzzy logic Accuracy Assessment User and Producer scores for the final vegetation map were both 83.6% (Table 20). A table with AA scores for each mapping unit within the Colorado Desert study area is provided in Table 20 below.

CDFW assessed individual Map Unit accuracy for any Map Unit with accuracy assessment sample size of five or greater. A full Map Unit level assessment of accuracy is not possible for all Map Units due to too low of a sample size for a subset of Map Units. There were 16 vegetation types that had five or more accuracy assessment samples and scored less than 80% accuracy. Below is a brief discussion of these types and why they might have failed to meet the minimum accuracy.

Table 20: Accuracy assessment Scores (fuzzy logic) for the Colorado Desert Mapping Area. Required overall minimum accuracy to meet SCV standards is 80%. Desired minimum accuracy for each map unit is also 80%. Scores for map units with fewer than five (5) assessed polygons, indicated in plain black text and also represented numerically as anything under 5 in the User and/or Producer Count columns, should not be used to determine individual map unit accuracy due to insufficient data to determine (though these do contribute to the overall score). Map units with five (5) or more assessed polygons are indicated in bold black text and also represented numerically as anything with more than 5 in the User and/or Producer Count columns. Map Units that have five (5) or more assessed polygons and do not meet 80% desired accuracy are indicated in bold and underlined text and also represented numerically as anything below 80% in the Producer Accuracy column.

Map Code	Map Unit	User's Accuracy (%)	User Count	Producer's Accuracy (%)	Producer Count
1411	Populus fremontii – Fraxinus velutina – Salix gooddingii Alliance	100.0	3	83.3	6
1415	Washingtonia filifera Alliance	100.0	4	85.7	7
1416	Salix gooddingii – Salix laevigata Alliance	80.0	1	0.0	0
1423	Baccharis emoryi – Baccharis sergiloides Alliance	0.0	0	60.0	1
1431	Phragmites australis – Arundo donax Semi-natural Alliance	82.6	39	95.2	25
1432	Tamarix spp. Semi-natural Alliance	75.6	41	87.1	31
1621	Phoenix dactylifera – Washingtonia filifera Semi-Natural Alliance	95.0	4	100.0	3
2310	Californian Annual Grassland & Forb Meadow Group	0.0	0	66.7	6
2331	Brassica tournefortii – Malcolmia africana Semi-natural Alliance	60.0	2	0.0	0
2332	Bromus rubens – Schismus (arabicus, barbatus) Semi-natural Alliance	60.0	1	0.0	0
2340	Warm Desert Ruderal Grassland Group	40.0	1	58.0	10

Map Code	Map Unit	User's Accuracy (%)	User Count	Producer's Accuracy (%)	Producer Count
3400	Arid West Interior Freshwater Marsh & Wet Meadow Macrogroup	100.0	5	80.0	8
3416	<u>Typha (angustifolia, domingensis, latifolia) Alliance</u>	82.9	14	<u>68.0</u>	30
3710	North American Desert Alkaline-Saline Marsh & Playa Group	0.0	0	40.0	1
3716	Cynodon dactylon – Cynopsis spp. – Paspalum spp. Alliance	40.0	4	70.0	2
3717	Bolboschoenus maritimus Alliance	0.0	0	60.0	1
3721	Allenrolfea occidentalis Alliance	89.8	47	93.2	41
3722	Atriplex lentiformis Alliance	81.7	35	86.5	37
3726	<u>Distichlis spicata – (Juncus cooperi – Frankenia salina) Interior Alliance</u>	86.7	6	<u>61.7</u>	12
4111	<u>Ambrosia dumosa Alliance</u>	70.0	6	<u>63.8</u>	16
4113	<u>Atriplex polycarpa Alliance</u>	73.0	23	<u>71.3</u>	23
4114	Encelia farinosa Alliance	87.6	21	94.7	15

Map Code	Map Unit	User's Accuracy (%)	User Count	Producer's Accuracy (%)	Producer Count
4115	Larrea tridentata – Ambrosia dumosa Alliance	90.0	14	80.7	27
4118	Larrea tridentata – Encelia farinosa Alliance	82.5	16	81.9	21
4119	Larrea tridentata Alliance	81.9	52	90.9	33
4211	Ephedra californica – Ephedra trifurca Alliance	60.0	4	73.3	3
4212	Lepidospartum squamatum Alliance	80.0	1	80.0	1
4213	Ericameria paniculata Alliance	80.0	1	66.7	3
4219	Psorothamnus fremontii – Psorothamnus polydenius Alliance	73.3	3	0.0	0
4221	Pluchea sericea Alliance	82.5	55	89.7	37
4222	Prosopis glandulosa – Prosopis velutina – Prosopis pubescens Alliance	93.5	34	88.8	41
4226	Senegalia greggii – Hyptis emoryi – Justicia californica Alliance	86.7	3	85.0	4
4227	Parkinsonia florida – Olneya tesota Alliance	88.1	32	94.4	25

Map Code	Map Unit	User's Accuracy (%)	User Count	Producer's Accuracy (%)	Producer Count
4231	<u>Psorothamnus schottii Mapping Unit</u>	85.0	4	<u>71.4</u>	7
4232	<u>Psorothamnus emoryi Mapping Unit</u>	40.0	5	<u>66.7</u>	3
5111	<u>Atriplex canescens Alliance</u>	77.1	21	<u>77.6</u>	25
6110	<u>North American Warm Semi-Desert Cliff, Scree & Pavement Sparse Vegetation Group</u>	100.0	5	<u>75.4</u>	13
6111	Atriplex hymenelytra Alliance	100.0	1	60.0	2
6113	<u>Mud Hills sparsely vegetated ephemeral herbs Mapping Unit</u>	94.7	15	<u>77.1</u>	21
6114	Unvegetated wash and river bottom Mapping Unit	95.0	4	76.7	6
6116	Sparsely vegetated playa (Ephemeral annuals) Mapping Unit	85.7	21	93.7	19
6117	Chorizanthe rigida – Geraea canescens Desert Pavement Alliance	86.7	30	89.6	25
6120	<u>North American Warm Semi-Desert Dune & Sand Flats Group</u>	76.7	12	<u>74.3</u>	14
6121	Dicoria canescens – Abronia villosa –	97.1	14	82.0	20

Map Code	Map Unit	User's Accuracy (%)	User Count	Producer's Accuracy (%)	Producer Count
	Panicum urvilleanum Alliance				
6124	Eriogonum deserticola Mapping Unit	90.0	6	80.0	8
6125	Desert Forb Provisional Mapping Unit	50.0	2	0.0	0
6126	Dicoria canescens Association	0.0	0	80.0	1
7110	Western Ruderal Marsh, Wet Meadow & Shrubland Group	64.0	5	100.0	1
7211	Ambrosia salsola – Bebbia juncea Alliance	85.0	28	83.8	26
7222	Chilopsis linearis – Psoralea argyrea Alliance	85.0	4	77.5	8
7411	Suaeda moquinii Alliance	83.0	46	83.1	45
9200	Agriculture	91.1	9	100.0	8
9210	Woody Agriculture (orchards, vineyards)	97.5	8	100.0	7
9300	Built-up & Urban Disturbance	82.0	10	0.0	0
9320	Anthropogenic Areas of Little or No Vegetation	80.0	34	90.0	22

Map Code	Map Unit	User's Accuracy (%)	User Count	Producer's Accuracy (%)	Producer Count
9500	Exotic Trees	88.6	7	93.3	12
	Overall Average Score: 83.6%				
	Total count of surveys included in overall Average Score: 763				

Note: Overall accuracy across all Map Units is **83.6%**, based on 763 surveys.

Description for Units not meeting Accuracy Criteria

Tamarix spp. Semi-natural Alliance: At 87.1%, the Producers' accuracy for this type exceeds the desired accuracy and the Users' accuracy was just under the desired accuracy at 75.6%. The error in mapping this type occurred most often when mappers failed to identify small stands of *Tamarix* within a larger riparian or wetland stand. Where noted during the accuracy assessment, mappers reviewed large wetland stands to determine if division was necessary to recognize *Tamarix* stands that met the minimum mapping unit rules.

Warm Desert Ruderal Grassland Group: Ten polygons of this type were assessed for accuracy though field staff saw this type only once while in the field. This means this type is difficult to map and is less common on the ground than it is recognized in the map. This outcome is not fully unexpected as it is well known that differentiating between native and non-native herbaceous types during mapping is very difficult. Often, this type was found to be another ruderal or disturbance type such as 'Anthropogenic Areas of Little or No Vegetation' or *Brassica tournefortii* – *Malcomia africana* Semi-natural Alliance (which falls under the broader group). Ground surveys are needed to refine the classification of these areas, and due to the unpredictable and ephemeral nature of herbaceous types in the Colorado Desert, post-mapping ground verification surveys may end up viewing a different type than what was present at the time of mapping.

***Typha (angustifolia, domingensis, latifolia)* Alliance:** *Typha* was most often mismapped as or found to be another tall wetland type such as the *Phragmites australis* – *Arundo donax* Semi-natural Alliance, *Tamarix* spp. Semi-natural Alliance, or *Pluchea sericea* Alliance. Differentiating herbaceous types using imagery alone can be difficult,

especially when stands are growing together. Mappers became more proficient with these types as the project advanced.

***Distichlis spicata* – (*Juncus cooperi* – *Frankenia salina*) Interior Alliance:** *Distichlis spicata* is a short, mat-forming grass found in salty or alkaline, moist settings. Though the setting is easily identifiable from aerial imagery, this Alliance specifically is difficult to differentiate from other types that occur in similar settings such as *Cynodon dactylon* – *Crypsis* spp. – *Paspalum* spp. Alliance and *Allenrolfea occidentalis* Alliance.

***Ambrosia dumosa* Alliance:** This type was most often over applied to types that fall within the same group and often have overlapping species composition and found in the same ecological settings such as *Encelia farinosa* Alliance, *Larrea tridentata* – *Ambrosia dumosa* Alliance, and *Larrea tridentata* Alliance. *Ambrosia dumosa* and *Encelia farinosa* look extremely similar in imagery, especially during periods of drought when plants are mostly dormant.

***Atriplex polycarpa* Alliance and *Atriplex canescens* Alliance:** These *Atriplex* Alliances can be found in similar ecological settings, are often difficult to differentiate in the field, and can easily be mismapped as the other.

***Psorothamnus emoryi* Mapping Unit:** This mapping unit was generally under sampled, but when it was seen in the field, it was found to have been mistakenly mapped as *Atriplex polycarpa* Alliance or *Dicoria canescens* – *Abronia villosa* – *Panicum urvilleanum* Alliance. *Psorothamnus emoryi* is a small, sparsely-leaved, grayish shrub that can be very difficult to identify on imagery, especially against the bright aeolian sand surfaces it sometimes occupies.

***Psorothamnus schottii* Association:** This mapping unit was generally under sampled and just barely meets desired accuracy. When assessed, this type was found to be erroneously applied to vegetation that is typically found in similar ecological settings such as in low-energy sandy washes or along sand dunes or decomposed granite. Types such as *Ambrosia salsola* – *Bebbia juncea* Alliance, *Ambrosia dumosa* Alliance, and *Larrea tridentata* Alliance were common targets of this misapplication. Many of the major stands of this type are found higher up on alluvial slopes just outside the mapping boundary of this project, so some of the mistakenly mapped stands likely represented areas of transition into other types that occupy these alluvial fans.

North American Warm Semi-Desert Cliff, Scree & Pavement Sparse Vegetation Group; Mud Hills sparsely vegetated ephemeral herbs Mapping Unit; North American Warm Semi-Desert Dune & Sand Flats Group; Unvegetated wash and river bottom Mapping Unit: Most of the time when these types were encountered in the field during accuracy assessment, they were mapped correctly leaving the majority of the errors for these ones being either errors of omission or mapping to an Alliance that nests under the determined appropriate final Map Unit. Often, mappers misidentified these sparsely vegetated types as one of the other or another sparsely vegetated type such as 'Anthropogenic Areas of Little or No Vegetation'. And while these types are similar in that they both are characterized by very low total vegetation

cover, the ecological drivers of these types are very different and are characterized by different indicator species. Confusion during surveys likely came from the presence of characteristic species such as *Chorizanthe rigida* and *Geraea canescens*, leading field teams to assign this desert pavement Alliance without fully taking into consideration the geology of the area. Also, signs of anthropogenic alteration are not always easily apparent on imagery but later recorded during surveys.

Western Ruderal Marsh, Wet Meadow & Shrubland Group: This type was generally under sampled and just barely did not meet desired accuracy. When assessed, this type was found to be erroneously misapplied to vegetation that are typically found in similar hydrologic settings such as Warm Desert Ruderal Grassland Group. From a mapper's perspective, some areas may superficially look like a mesic setting, while actual species composition, when verified by ground surveys, turned out to be more characteristic of upland habitat.

***Chilopsis linearis* – *Psoralea argophylla* Alliance:** This type was generally under sampled and just barely did not meet desired accuracy. When assessed, this type was found to be erroneously misapplied to vegetation that are typically found in similar hydrologic settings such as in washes, canyon bottoms, arroyos, and along floodplains. Misapplied to types such as *Senecioia greggii* – *Hyptis emoryi* – *Justicia californica* Alliance, *Ambrosia salsola* – *Bebbia juncea* Alliance, and *Parkinsonia florida* – *Olneya tesota* Alliance. The small number of this type within the mapping area made it difficult for mappers to get a good feel for the photosignature of this type.

Californian Annual Grassland & Forb Meadow Group: This type was generally under sampled, with Producer's Accuracy at - 66.7%. Often, this type was found to be misapplied to ruderal or disturbance types such as 'Anthropogenic Areas of Little or No Vegetation', *Phragmites australis* – *Arundo donax* Semi-natural Alliance or *Bromus rubens* – *Schismus (arabicus, barbatus)* Semi-natural Alliance. Identification of ephemeral desert herbaceous types can be difficult or impossible using aerial imagery alone, especially when the forbs are dead from the previous season during the time the imagery was taken.

Arid West Interior Freshwater Marsh & Wet Meadow Macrogroup: This type was generally under sampled and with a Producer's Accuracy of 80%, which just about meets minimum accuracy. This type was found to be misapplied to polygons that should have gone to the group level (Arid West Interior Freshwater Marsh Group), other mesic agricultural or disturbed settings. Some of these errors likely arose over confusion regarding the DRECP project's use of the Macrogroup only for specific restoration settings.

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APPENDIX A: MAP UNIT DESCRIPTIONS IDENTIFIED FOR THE COLORADO DESERT MAPPING PROJECT

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Explanation of Map Unit Descriptions

This appendix is a collection of descriptions for each Vegetation Type/Map Unit encountered in the Colorado Desert Vegetation Mapping Project. These descriptions serve as a quick explanation of important features useful for accurately mapping each Map Unit, including ground-level and aerial imagery photos, Alliance membership rules, written descriptions of photointerpretation signatures, locality maps and elevation graphs for this project, and important miscellaneous mapping considerations.

Descriptions are arranged in alphabetical order by the name of the Map Unit. Vegetation types are listed first, and Miscellaneous Classes (code 9000 and above) are grouped together at the end of the appendix.

An explanation of the layout of Map Unit description is as follows:

Header Info:

- Name of Map Unit and corresponding code
- Common name for Map Unit, when applicable
- Global (G#) and state (S#) rarity rank, when applicable
- Minimum Mapping Unit (MMU) size, in acres
- Minimum Mapping Width (MMW) distance, in meters
- Mandatory corresponding modifiers, when applicable
- Ground-level representative photo of stand, when available

SUMMARY: This section serves as a brief description of the Map Unit in question, including pertinent membership rules, noteworthy ecological considerations, and miscellaneous notes about how this Map Unit was applied to this mapping project.

PHOTOINTERPRETATION SIGNATURE: This section describes diagnostic features of each Map Unit as they appear on aerial imagery in both true color and color infrared (CIR). Typical information includes descriptions of colors, texture, shape, and distribution of plant species that mappers used to identify and assign vegetation types. Also included are side-by-side true color and CIR images of representative stands as mappers would have viewed them.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES: Many species of vegetation and even entire communities can look superficially similar when viewed only from aerial imagery. Presented here is a list of other Map Units that could be easily confused with the Map Unit in question and offer quick tips on how mappers differentiated between these similar looking types.

MAPPING CONSIDERATIONS: When relevant, this section is included for Map Units to describe miscellaneous notes on how mappers applied the Map Unit in question. This most commonly applies to Miscellaneous Map Units that represent anthropogenic

features which often have complicated sets of mapping rules. This section also explains special circumstances where mappers intentionally deviate from standard rules such as MMU and MMW.

PROJECT DISTRIBUTION: This section provides a brief overview of the distribution of each Map Unit across this project's mapping area. When relevant, ecological or geological context may also be included to help explain distributional patterns. Each Map Unit description also includes a map showing where each Map Unit occurred within the project mapping area, as well as a graph showing the elevation of mapped polygons. These elevation graphs represent the number of pixels of the respective Map Unit (y-axis, Elevation Value Count) found at a certain elevation (x-axis, Elevation (meters)) across the entire map, as determined by values extracted from a digital elevation model (DEM). For more information on the project area and its subareas, please refer to the Mapping Area section of this report.

Allenrolfea occidentalis Shrubland Alliance (3721)

***Allenrolfea occidentalis* Shrubland Alliance (3721)**

Iodine bush scrub Alliance

Rarity: G4S3.2

MMU: 0.5 acres

MMW: 22 meters

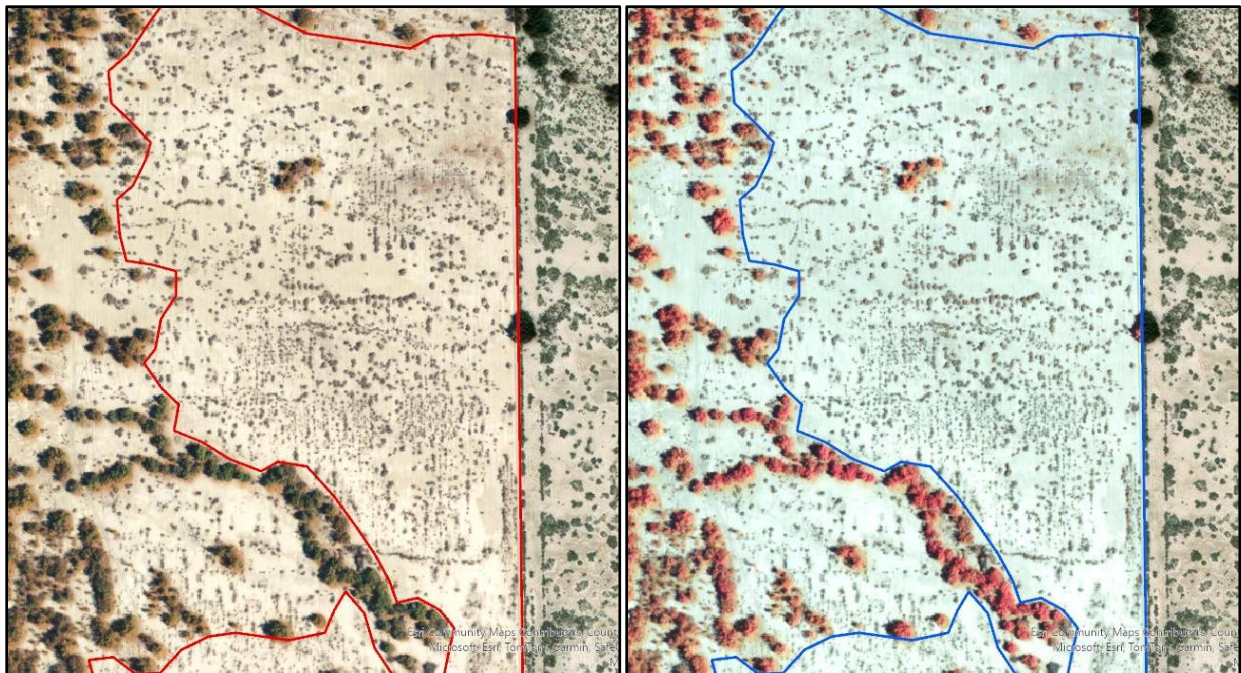


Allenrolfea occidentalis on a playa just south of Mullet Island, Imperial Valley subarea. Note the salt crust visible on the playa surface.

SUMMARY: *Allenrolfea occidentalis* shrublands are most often associated with playa sinks and other areas with extremely fine, alkaline silt substrate. This halophyte can tolerate salt conditions that most other species cannot, resulting in frequent instances where this is the only species present within the stand. It can cooccur with other halophytic shrubs, including *Suaeda moquinii*, *Atriplex lentiformis*, *Pluchea sericea*, and *Tamarix ramossissima*, and herbs such as *Heliotropium curassavicum* and *Distichlis spicata*. It is common for *A. occidentalis* stands to grow in dispersed, relatively low cover densities, as well as forming extremely dense, nearly impenetrable thickets. This shrub can effectively fill in tilled or graded landscapes, as seen in the aerial image below.

Allenrolfea occidentalis Shrubland Alliance (3721)

PHOTOINTERPRETATION SIGNATURE: This shrubland often occurs on harsh playas, with an otherwise barren landscape with bright white surface reflectance from the salt and/or shell/bone deposits, as is common on the shores of the Salton Sea. Playa substrate in this mapping area may also appear as mottled light gray/tan in areas with less surface salt and animal remains. Except in dense stands, mappers could generally distinguish individual plants, which ranged from small to large and often had a brown/dark green mottled color and an often irregular shape with ragged edges owing to the frequent patchiness of dead vs. live crown (see stand photo above). Rarely, in marshy areas near the shores of the Salton Sea, *A. occidentalis* mass germination events were observed which produce the appearance of a vibrant green grass-like mat. In general, *A. occidentalis* inhabiting marsh areas with permanently wet surface soil tended to lack the dead crown patches and appear as more solid bright green. Along the shores of the Salton Sea, it was common to see this shrub arranged in neat lines that track the recession of the water level over multiple years.

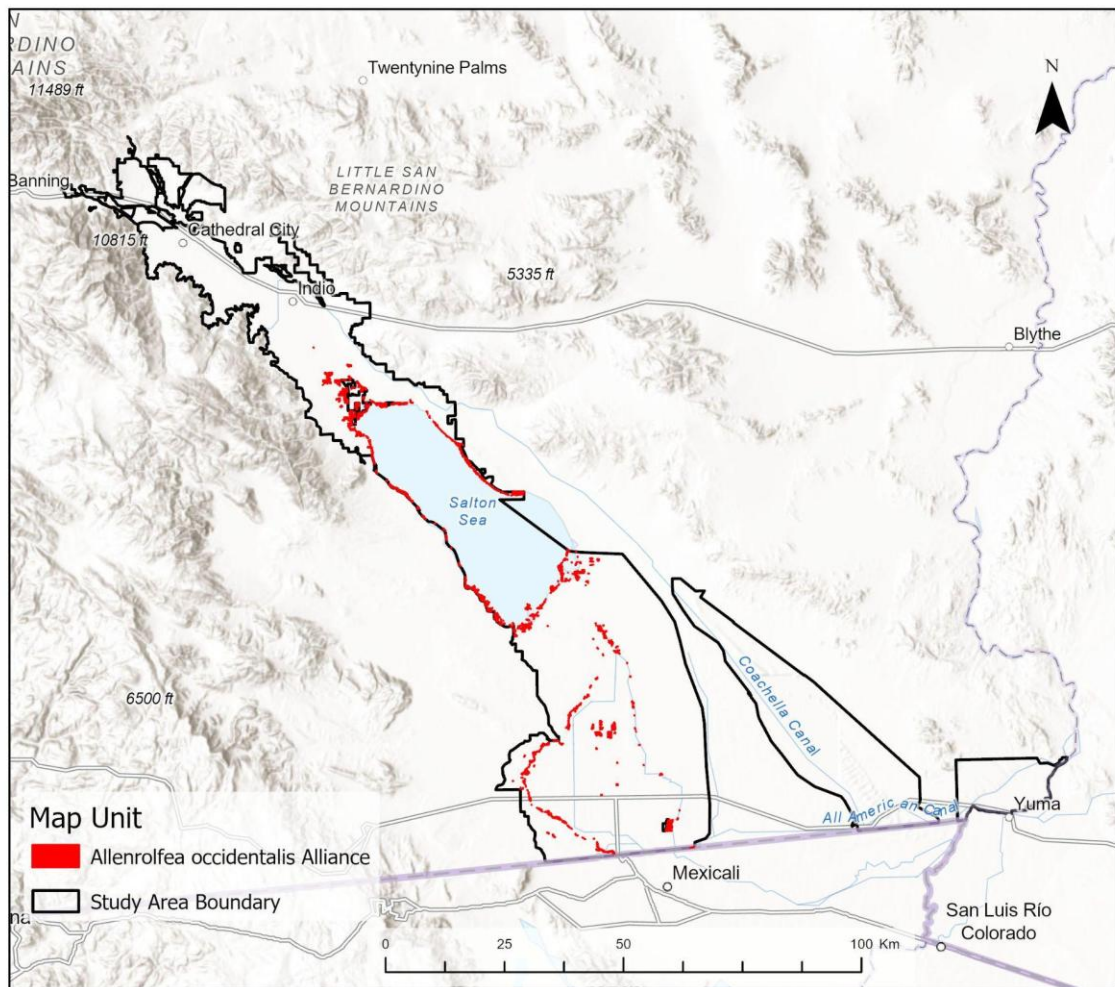


This example from the southern end of the Coachella Valley subarea shows the typical playa substrate type and brown-green in true color (left) and CIR (right). Note: the east margin of the image is outside the mapping area.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

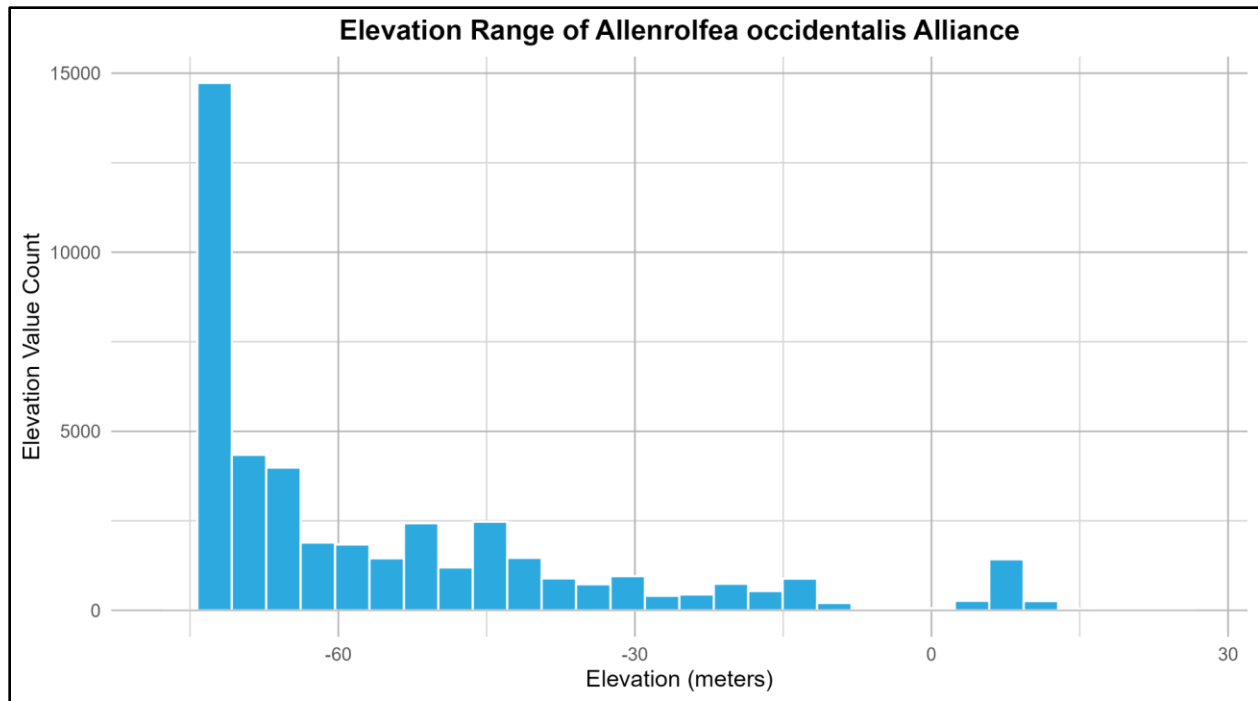
- *Suaeda moquinii* – *Isocoma acradenia* Shrubland Alliance (7411) – *Suaeda moquinii* is possibly the most difficult to distinguish from *Allenrolfea occidentalis*. Individual *S. moquinii* are often smaller in size. Additionally, *S. moquinii*, unless growing vigorously, often have sparse, very dark green (sometimes close to black) leaves present. Coupled with their very thin, wispy branches, they tend to have a “softer”, darker appearance in imagery. *Suaeda moquinii* are also often a darker red on CIR.
- *Atriplex lentiformis* Shrubland Alliance (3722) – *Atriplex lentiformis* can tolerate many of the same extreme halophytic conditions *Allenrolfea occidentalis* can, and as such they often co-occur. They can be easily separated by size difference (*Atriplex lentiformis* can reach much larger sizes), and color/crown patterning: *A. lentiformis* has a soft, pale green (light pink in CIR), uniform crown whereas *A. occidentalis* has an irregularly shaped, mottled dark green/brown (dark red in CIR) crown.
- *Atriplex canescens* Shrubland Alliance (5111) and *Atriplex polycarpa* Shrubland Alliance (4113) – this species can look strikingly similar to small *A. occidentalis*, especially in drought conditions where live leaves are sparse. However, *A. canescens* are typically much smaller and do not tolerate the same extreme alkaline conditions that *A. occidentalis* do. *Atriplex canescens* can also grow well in more xeric sandy soils, whereas *A. occidentalis* are restricted to lakebed silt substrates. So, one can usually differentiate between the two species by considering size and substrate geology. With CIR, *A. canescens* will appear pale pink, while *A. occidentalis* is deep red.
- *Pluchea sericea* Shrubland Alliance (4221) – this shrub often grows in clumps, sometimes forming dense thickets, whereas *A. occidentalis* usually grow individually, although it does occasionally form thickets. Color and texture vary slightly between species, with *P. sericea* having a softer texture and its thickets are usually mottled with patches of gray in both true color and CIR.

Allenrolfea occidentalis Shrubland Alliance (3721)



PROJECT DISTRIBUTION: *Allenrolfea occidentalis* shrubland Alliance is common throughout undeveloped areas of the Salton Trough with alkaline lakebed substrate (south end of the Coachella Valley subarea, excluding the eastern and western margins, and nearly all of the Imperial Valley/Salton Sea subarea). It is one of the few species that thrives directly on the shores of the Salton Sea. Areas with dense *Allenrolfea occidentalis* tend to be either inundated or have a very high water table. Mappers and field teams did not record any other instances of this Alliance in the Algodones Dunes or Winterhaven subareas.

Allenrolfea occidentalis Shrubland Alliance (3721)



Ambrosia dumosa Shrubland Alliance (4111)

***Ambrosia dumosa* Shrubland Alliance (4111)**

White bursage scrub

Rarity: G5S5

MMU: 10 acres

MMW: 101 meters



This example near Mecca, Coachella Valley subarea, shows *Ambrosia dumosa* (small, pale-green shrub) amongst low cover of other shrubs.

SUMMARY: Stands were mapped to the *Ambrosia dumosa* Alliance when *Ambrosia dumosa* exceeded 2% absolute cover and other shrub species were not dominant or are inconsistently spaced throughout the stand. *Ambrosia dumosa* is an extremely common shrub throughout the mapping area across open upland desert, alluvial fans, desert pavement, and aeolian sand fields. However, mappers rarely assigned polygons to *Ambrosia dumosa* due to its tendency to co-occur with *Larrea tridentata* which often maps to *Larrea tridentata* – *Ambrosia dumosa* Shrubland Alliance. Polygons mapped to *Ambrosia dumosa* Alliance usually still contained *Larrea tridentata* at <2% absolute cover and/or are unevenly distributed.

Ambrosia dumosa Shrubland Alliance (4111)

PHOTOINTERPRETATION SIGNATURE: This species experiences dormancy during drought and can appear nearly dead during such times, showing small, evenly scattered, grayish points on imagery. Close inspection can sometimes reveal a slight tinge of pale green (true color) or faint pale pink (CIR) on individuals with moderate photosynthetic growth. Stands often contain at least some *Larrea tridentata* or are surrounded by an Alliance with *Larrea tridentata* as either dominant or codominant. The upland desert landscapes where this species occurs often show bare sandy soil (high reflectance) or moderate to high nonnative annual cover (usually *Schismus* spp. and *Brassica tournefortii*).



Ambrosia dumosa appears as evenly distributed dots that are tiny, brown in true color (left) or gray to pale pink in CIR (right).

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Encelia farinosa* Shrubland Alliance (4114) – *Encelia farinosa* experiences a similar drought deciduous dormant state where it appears very similar to dormant *Ambrosia dumosa*. Both shrubs also have a similar pale gray-green photo signature when growing vigorously. Considerable overlap of species occurs throughout much of Desert Hot Springs, however *Encelia farinosa* tends to dominate the gentle slopes leading up to the Mission Creek and Whitewater

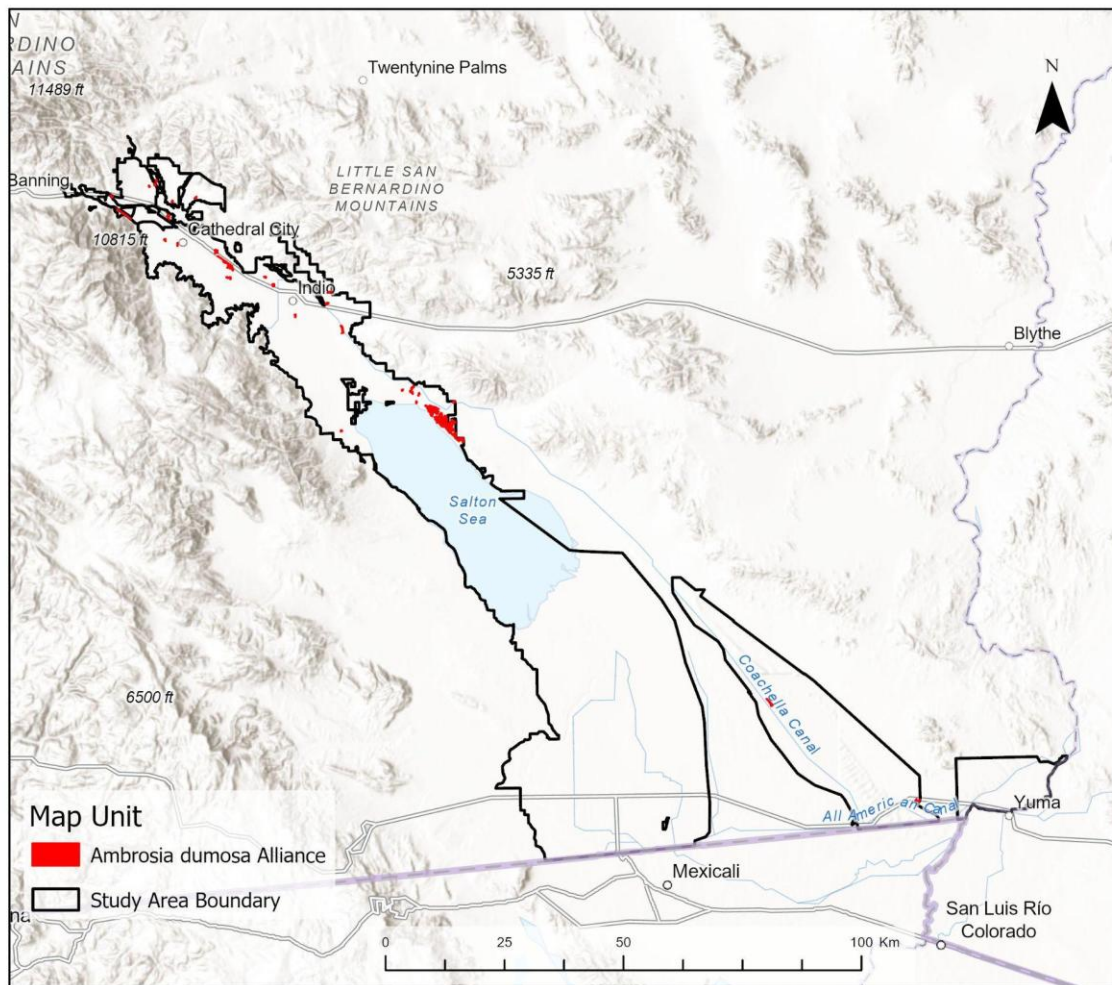
River areas of the western Coachella Valley, including areas north of the I-10 near Cabazon and the community of Whitewater. *Encelia farinosa* also favors the steep mountainsides to the north of Desert Hot Springs in the Little San

Ambrosia dumosa Shrubland Alliance (4111)

Bernardino Mountains, as well as the lower reaches of San Gorgonio Mountain. *Ambrosia dumosa* becomes much more common moving into the lower, hotter, drier reaches of the eastern Coachella Valley.

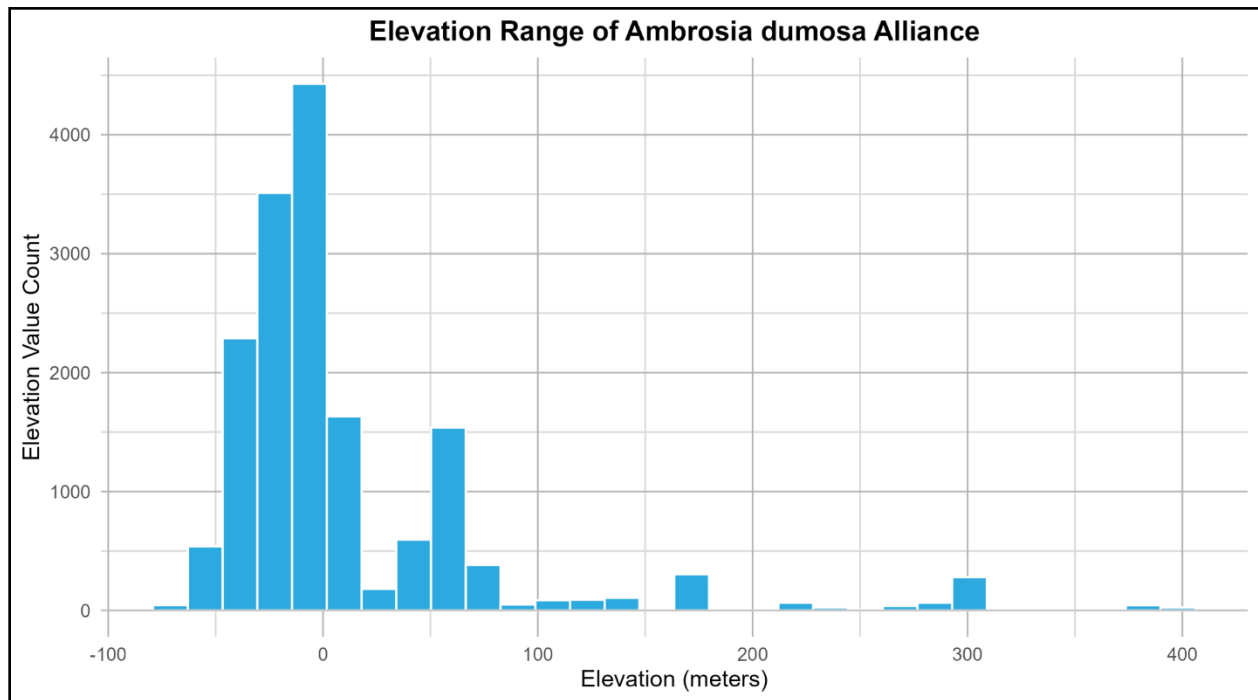
- *Atriplex polycarpa* Shrubland Alliance (4113) and *Atriplex canescens* (5111) – *Atriplex polycarpa* and *Atriplex canescens* are usually larger than *Ambrosia dumosa* and prefer highly saline soils and/or dry basins, however there are some areas, such as the saline mud hills around the northeast margins of the Salton Sea, where these species remain relatively small and sparsely spaced and are thus easily confused with *Ambrosia dumosa*. Field verification is usually necessary in these situations.
- *Atriplex hymenelytra* Shrubland Alliance (6111) – *Atriplex hymenelytra* is extremely difficult to differentiate from *Ambrosia dumosa* using imagery alone due to similar size and similar pale gray-green color, but knowledge of soil type can be useful; *Atriplex hymenelytra* is usually found in harsh upland landscapes with fine, silty, saline soils around the Salton Sea and natural oases where *Ambrosia dumosa* would not be as prevalent.
- *Ambrosia salsola* – *Bebbia juncea* Shrubland Alliance (7211) – The small shrubs associated with this Alliance have a similar size and often grow adjacent to or mixed with *Ambrosia dumosa*, however the color of *Ambrosia salsola* in true-color and CIR often shows a characteristic yellow-gold tinge to the shrubs. Large *Bebbia juncea* have a softer and rounder appearance than typical *Ambrosia dumosa*. *Ambrosia salsola* and *Bebbia juncea* are also more associated with dry washes or canyon bottoms, whereas *Ambrosia dumosa* favors upland landscapes.
- *Psoralea arguta* Mapping Unit – This shrub has a similar size, color, and growth habit to *Ambrosia dumosa*, and thus is extremely difficult to differentiate from imagery. Field verification is usually required.

Ambrosia dumosa Shrubland Alliance (4111)



PROJECT DISTRIBUTION: *Ambrosia dumosa* Alliance was found throughout much of the Coachella Valley, primarily in upland desert landscapes north of the I-10 and throughout the silty flats and mud hills to the northeast of the Salton Sea. There were also a small number of isolated patches of undeveloped desert within the Coachella Valley urban area with *Ambrosia dumosa*. Mappers assigned only two polygons of *Ambrosia dumosa* in the Algodones Dunes subarea, and none in Winterhaven or Imperial Valley.

Ambrosia dumosa Shrubland Alliance (4111)



Ambrosia salsola – *Bebbia juncea* Shrubland Alliance (7211)

***Ambrosia salsola* – *Bebbia juncea* Shrubland Alliance (7211)**

Cheesebush – sweetbush scrub

Rarity: G4S4

MMU: 10 or 5 acres (see Mapping Considerations section)

MMW: 101 or 71 meters (see Mapping Considerations section)

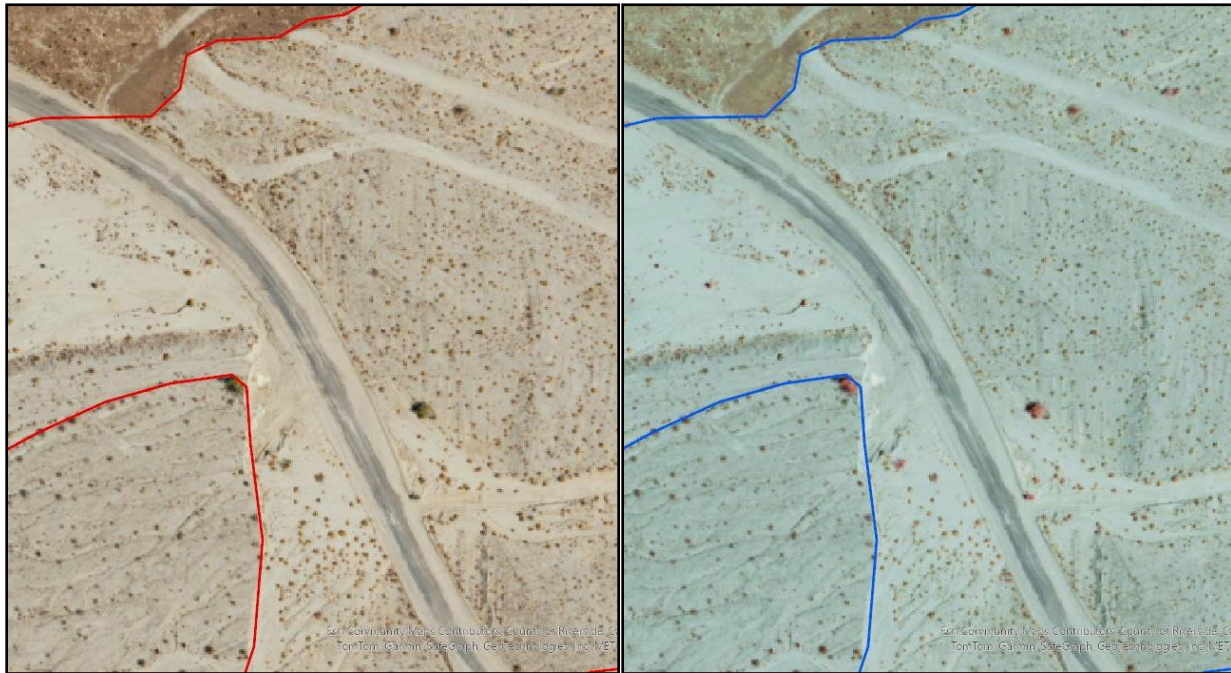


This stand of *Ambrosia salsola* and *Bebbia juncea* is within a low-energy gravel/sand wash in central Coachella Valley north of the I-10.

SUMMARY: This Alliance is characterized by dominant (>50%) relative cover of *Ambrosia salsola* and/or *Bebbia juncea* in the shrub layer. This Alliance is most commonly found throughout the network of washes feeding into the Coachella Valley from the surrounding hills and mountains. When delineated in washes, mappers used a 5-acre MMU as per the DRECP treatment of this Alliance. *Ambrosia salsola* is also commonly dominant in post-disturbance upland areas, such as housing developments that were graded but abandoned before construction began and graded flood control basins. Mappers delineated these upland and anthropogenically influenced stands at a 10-acre MMU as per the DRECP.

Ambrosia salsola – *Bebbia juncea* Shrubland Alliance (7211)

PHOTOINTERPRETATION SIGNATURE: The most apparent indicator of this Alliance is the golden-yellow color often associated with drought-stressed *Ambrosia salsola* which can be seen in both true-color and CIR imagery. Vigorously growing *Ambrosia salsola*, which was less commonly encountered at the time this map was created, appears as a distinct yellow-green (true color) and pale pink (CIR). *Bebbia juncea* appears as a darker green-brown (true color) or red-brown (CIR). Both shrubs have a round, soft, and full-crowned appearance and are either associated with clearly visible washes or, in the case of *Ambrosia salsola*, graded areas or dry flood control basins.



This stand of dominant *Ambrosia salsola* and trace *Bebbia juncea* covers a combination of washes and graded flood control embankments directly adjacent to a large landfill. The drought-stressed *Ambrosia salsola* show a distinct yellow-gold color.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

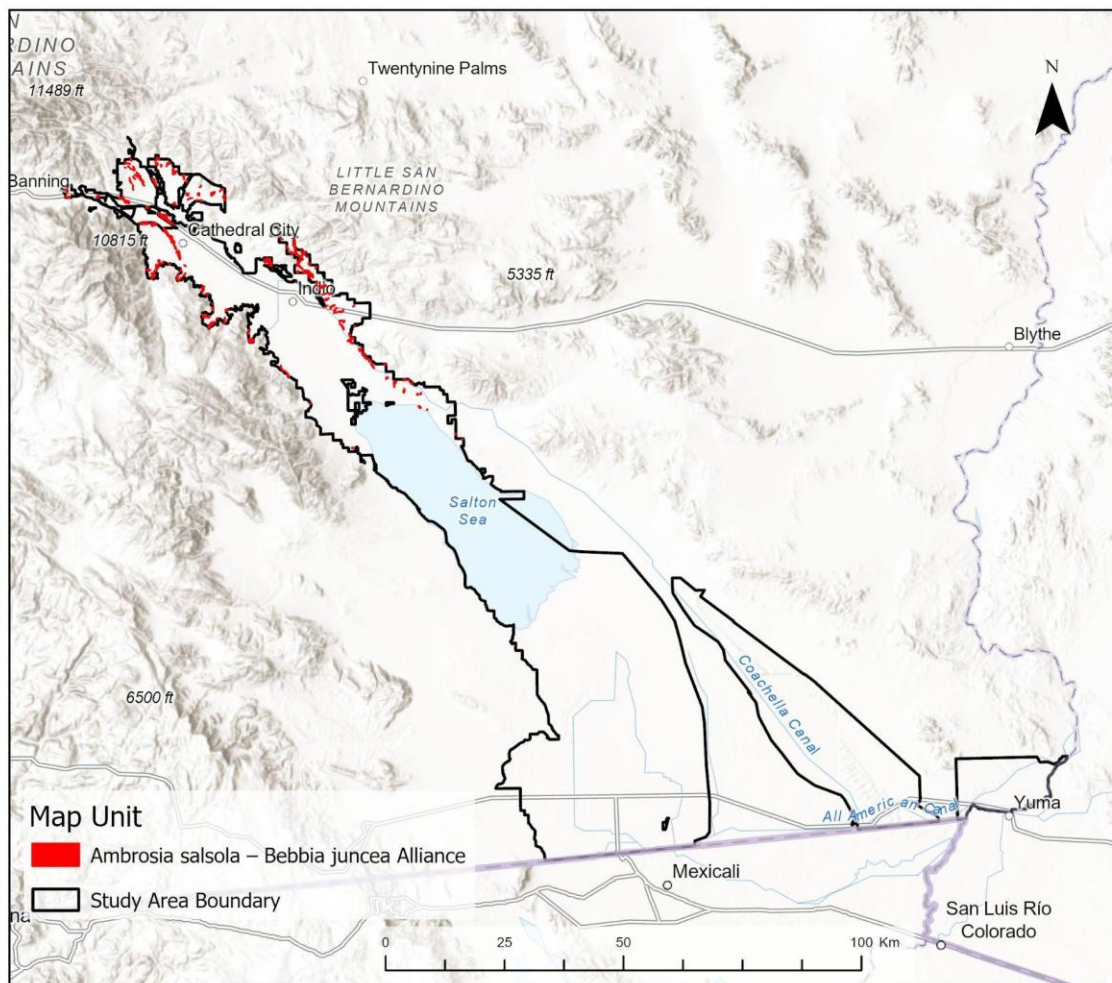
- *Psoralea schottii* Shrubland Mapping Unit (4231) – This shrub has a similar pale green-yellow appearance to *Ambrosia salsola* and the two species often grow together across the alluvial fans produced from the Little San Bernardino Mountains, Indio Hills, and Mecca Hills in the Coachella Valley. *Psoralea schottii* can be differentiated due to its larger size and tendency to grow in globular stands that are not restricted to wash bottoms.

Ambrosia salsola – *Bebbia juncea* Shrubland Alliance (7211)

- *Ericameria paniculata* Shrubland Alliance (4213) – These species share similar wash-bottom and small basin habitats, but *Ericameria paniculata* are often larger and darker green (not green-yellow).

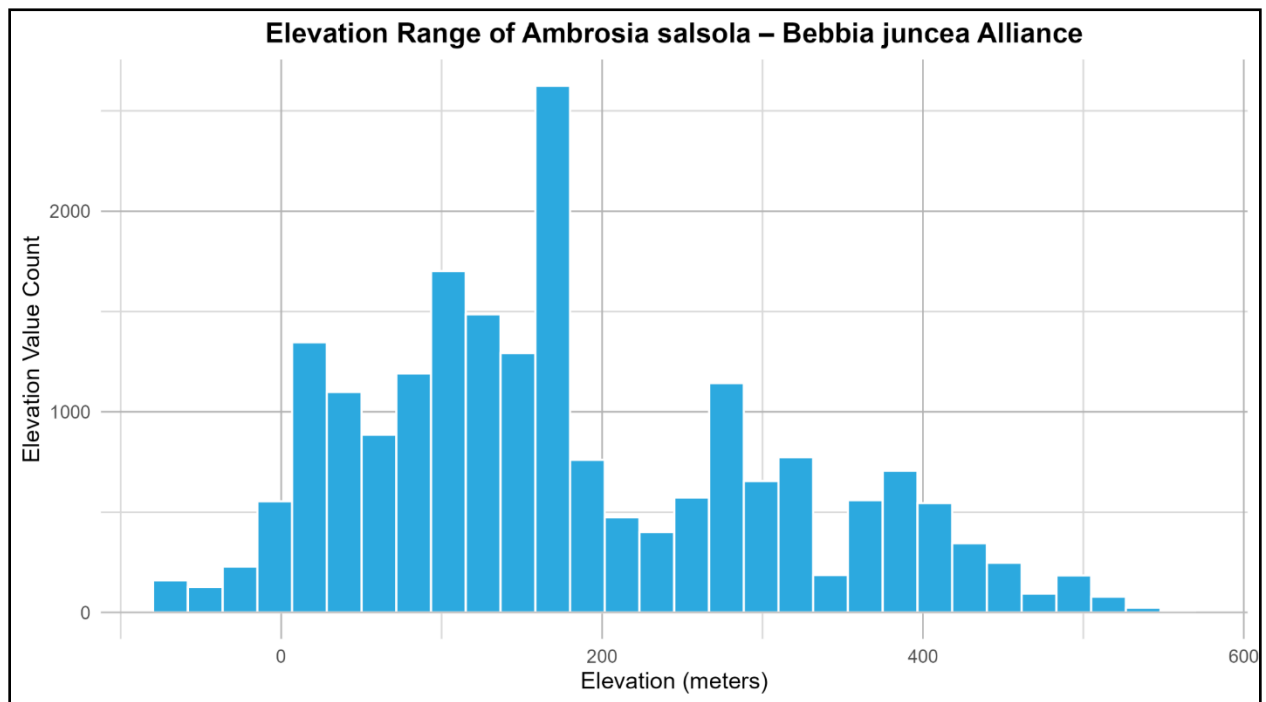
MAPPING CONSIDERATIONS:

- Because *Ambrosia salsola* can grow in both upland and wash habitats, mappers used two different MMU/MMW criteria depending on the habitat type of the mapped polygon. Polygons of this Alliance drawn primarily in upland habitat use the normal 10 acres MMU/101 meter MMW, and when primarily in wash 5 acre MMU/71 meter MMW. This is consistent with the DRECP mapping criteria for this Alliance.



Ambrosia salsola – *Bebbia juncea* Shrubland Alliance (7211)

PROJECT DISTRIBUTION: This Alliance was only mapped in the Coachella Valley mapping area, where it is relatively common outside of the main urban center. It is most often found throughout the series of entangled washes leading from the Little San Bernardino Mountains in the north, the Indio and Mecca Hills in the center of the Coachella Valley, and the Santa Rosa mountains to the south. It is also found across a range of anthropogenic landscapes, including long-abandoned agricultural fields, large swaths of graded land for failed housing developments, floodwater basins and diversion features, and the north end of the Whitewater River/Coachella Valley Storm Channel as the channel enters the urban area of Palm Springs.



Arid West Interior Freshwater Marsh & Wet Meadow Macrogroup (3400)

MMU: 0.5 acres

MMW: 22 meters



This photo was taken from the edge of a managed wetland habitat near the south shore of the Salton Sea.

SUMMARY: This Macrogroup was used specifically to identify manmade, managed wetland areas (inundated or dry) near the south side of the Salton Sea in the Imperial Valley subarea. These marshes are maintained by private or government entities for both restoration/conservation and hunting. This is concurrent with the decision by DRECP to map these areas to the Macrogroup level since the management actions in these wetland areas produce regularly changing herbaceous types and difficulty mapping to Alliance. Mappers applied this Macrogroup to portions of managed manmade wetland habitat containing either water, barren soil, or herbaceous cover; mappers assigned vegetation to Alliance for shrub and tree types within these areas.

Arid West Interior Freshwater Marsh & Wet Meadow Macrogroup (3400)

PHOTOINTERPRETATION SIGNATURE: These managed wetlands are typically obviously artificial due to the grid-like nature, linear sides bounded by access roads, and artificial islands. Depending on current management practices, they can be either dry and unvegetated or inundated with dense marshes of herbaceous vegetation including *Typha* sp., *Schoenoplectus* sp., and *Phragmites australis*.

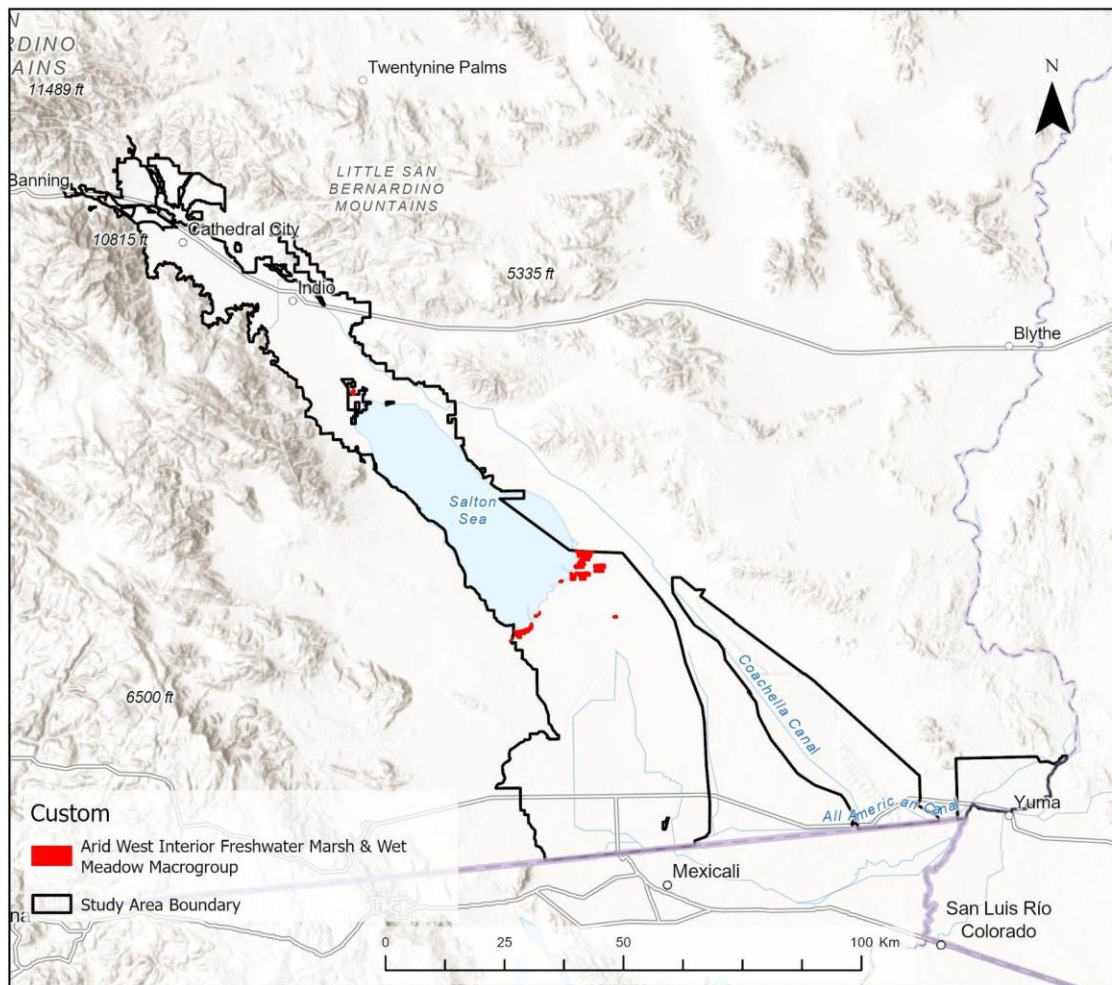


This portion of the US Fish and Wildlife Service Sonny Bono National Wildlife Refuge “Unit 1”, located on the south shore of the Salton Sea, demonstrates a variety of management practices possible within these manmade marshes.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

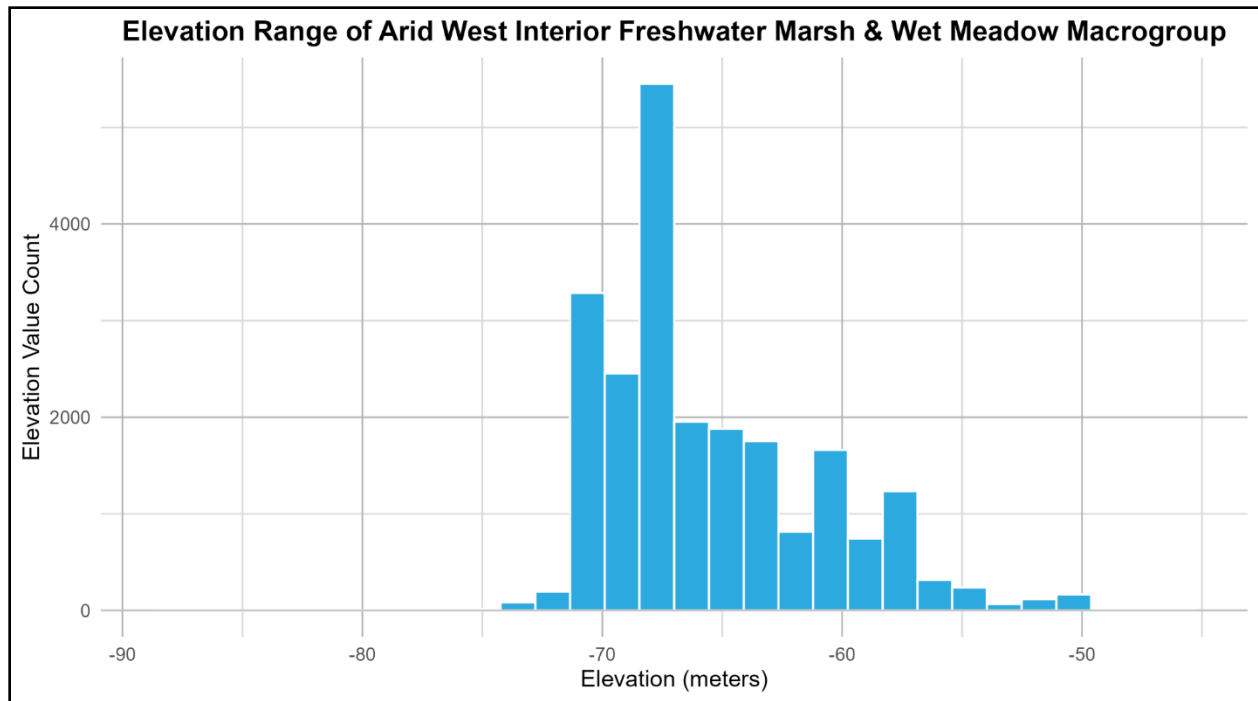
- Anthropogenic Areas of Little or No Vegetation (9320) – dry basins within these managed wetlands essentially appear as intentionally graded parcels. Ownership and purpose of land is essential for determining which Map Unit is appropriate.
- Non-Woody Row and Field Agriculture (9220) – The grid-like nature and abundance of dense herbaceous cover can lead to confusion between these two types, so knowledge of ownership and purpose of land is necessary for differentiating in certain cases. The presence of irregularly-oriented (at angles other than north-south and east-west) parcel divisions and artificial islands may help differentiate managed wetlands from agricultural plots.

Arid West Interior Freshwater Marsh & Wet Meadow Macrogroup (3400)



PROJECT DISTRIBUTION: All instances of this type were mapped along the south margin of the Salton Sea in the Imperial Valley subarea. These managed wetlands are a combination of government-owned parcels (US Fish and Wildlife Service - Sonny Bono National Wildlife Refuge and California Department of Fish and Wildlife - Imperial Wildlife Area) and privately-owned wetland managed for sport hunting.

Arid West Interior Freshwater Marsh & Wet Meadow Macrogroup (3400)



Atriplex canescens Shrubland Alliance (5111)

***Atriplex canescens* Shrubland Alliance (5111)**

Fourwing saltbush scrub

Rarity: G5S4

MMU: 10 acres

MMW: 101 meters

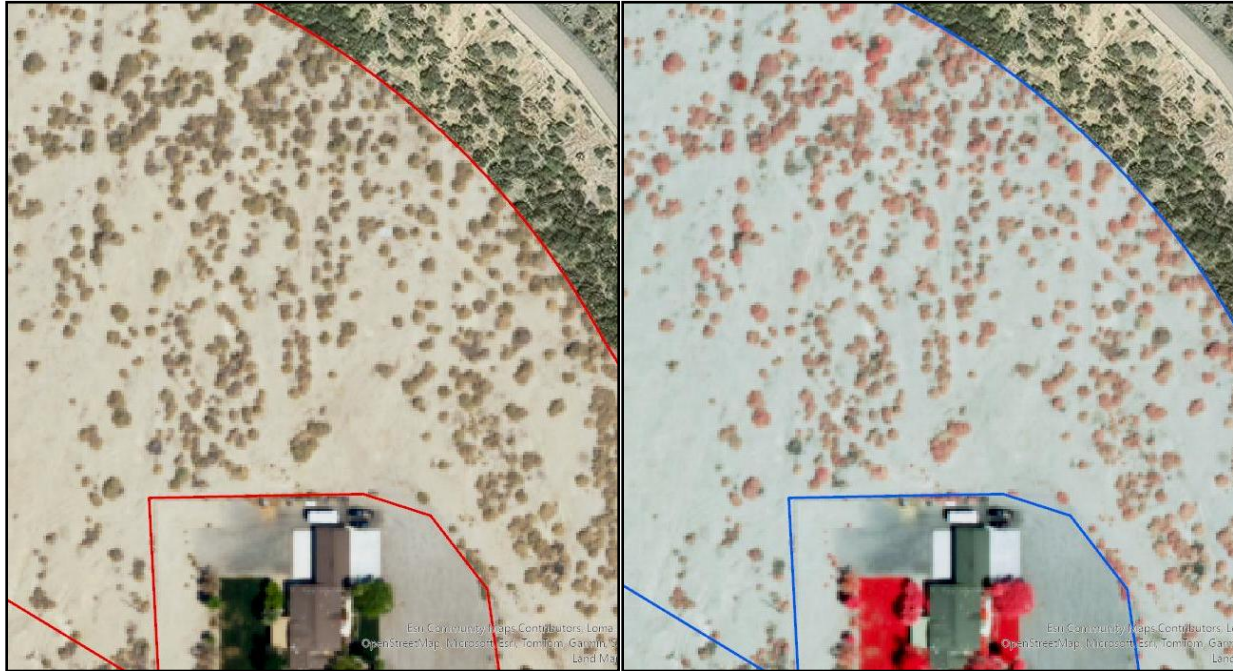


This particularly dense and vigorously growing stand of *Atriplex canescens* is located on the south embankment of the Coachella Canal in the city of Indio.

SUMMARY: This Alliance requires *Atriplex canescens* to reach >50% relative shrub cover, except when codominant with *Ephedra trifurca*, *Ephedra californica*, or *Allenrolfea occidentalis*, in which case it is mapped as the Alliance corresponding to the codominant species. This is a widespread species in sandy upland habitat, low-energy washes, and saline ancient lakebed slopes, although it rarely meets Alliance or MMU requirements in this mapping area unless it is associated with some form of anthropogenic landscape alteration such as abandoned farms, graded parcels in residential areas, and canal embankments. However, it is a major component of the sparse shrublands across the ancient lakebed silt/mud hills to the northeast of the Salton Sea. It commonly cooccurs with and possibly hybridizes with *Atriplex polycarpa*, sometimes complicating identification when the characteristic four-winged fruits are not present.

Atriplex canescens Shrubland Alliance (5111)

PHOTOINTERPRETATION SIGNATURE: This shrub tends to have some dead branches included with the crown, giving it a mottled dark gray-green and tan to straw-color appearance in true-color imagery. In CIR, the color is a pale red to pink color characteristic of *Atriplex* species. Individual shrubs are often erratically spaced or clumped together, and the crown shape is often irregular and ragged.



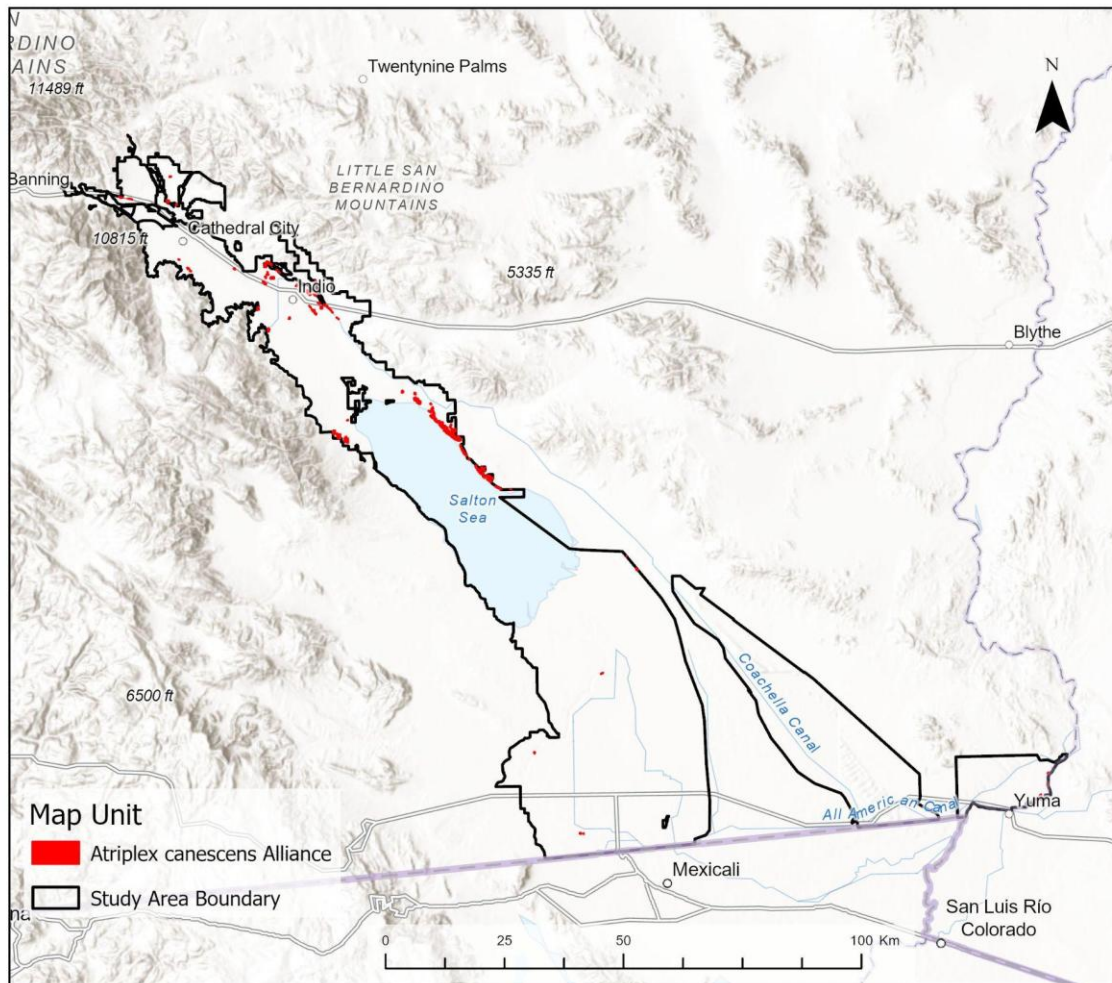
This relatively dense stand of *Atriplex canescens* shows the characteristic irregular spacing/clumping and pale red/pink color in CIR (right).

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Atriplex polycarpa* Shrubland Alliance (4113) – These species are not easily separated by imagery alone. Field verification is required.
- *Atriplex lentiformis* Shrubland Alliance (3722) – This species typically occurs in wetter areas, such as on the periphery of oases and seeps or, more commonly, lining agricultural canals and playas with a high water table in the low-elevation areas surrounding the Salton Sea. *Atriplex lentiformis* usually has larger and more circular and softer crowns than other *Atriplex* species.
- *Ambrosia dumosa* Shrubland Alliance (4111) – This species shares a similar imagery signature to *Atriplex canescens*, but within this mapping area, *Ambrosia dumosa* tends to favor different landscapes (sandy to rocky alluvial slopes and open desert). *Ambrosia dumosa* is also usually noticeably smaller than *Atriplex canescens*.

Atriplex canescens Shrubland Alliance (5111)

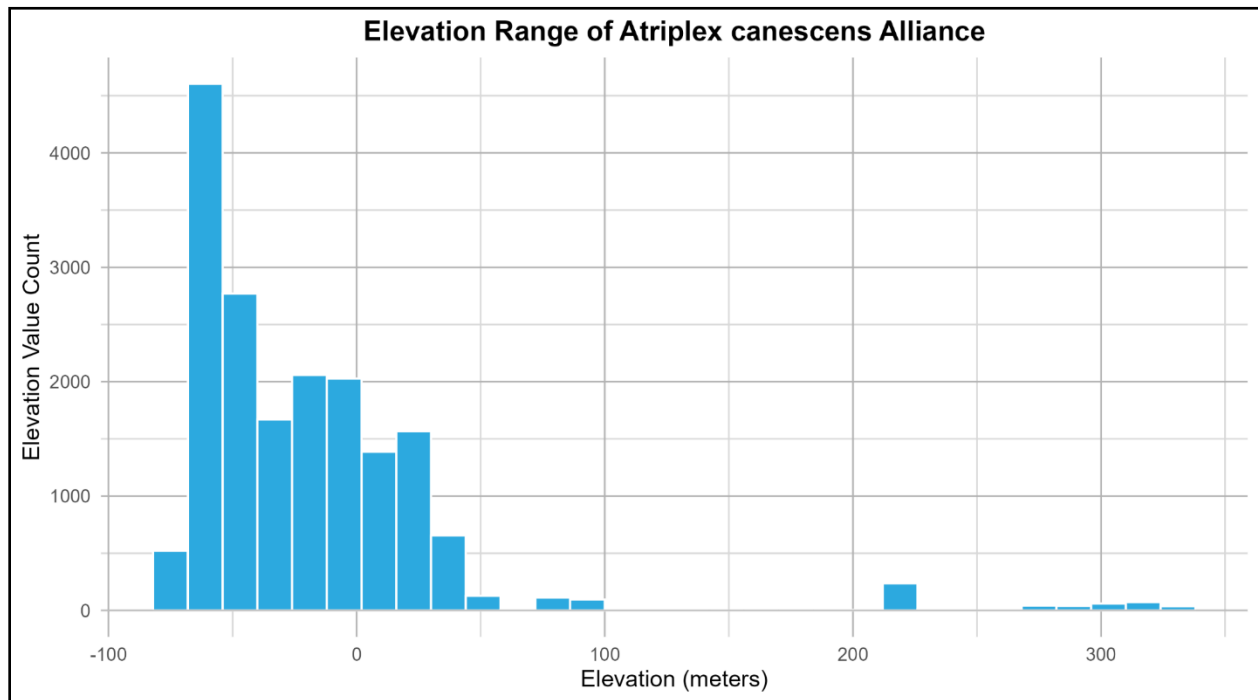
- *Pluchea sericea* Shrubland Alliance (4221) – The general shape and true-color of this species is similar to *Atriplex canescens*, however *Pluchea sericea* favors riparian or adjacent habitats, tends to form much denser clumps, and has a darker red CIR signature.



PROJECT DISTRIBUTION: *Atriplex canescens* Alliance was most commonly mapped in the Coachella Valley, where it is found throughout the valley floor, often in relation to some type of human alteration, such as abandoned agricultural fields, canal embankments, roadsides, graded lots, and dry floodwater basins. *Atriplex canescens* grows in more natural settings around the north end of the Salton Sea, where the soil is primarily alkaline ancient lakebed silt. Mappers identified large stands of *Atriplex canescens* Alliance throughout the ancient lakebed slopes northeast of the Salton Sea along

Atriplex canescens Shrubland Alliance (5111)

Highway 111, between the communities of North Shore and Bombay Beach. Mappers delineated a small number of *Atriplex canescens* stands in the east of the Winterhaven mapping area within undeveloped parcels in close proximity to the Colorado River, as well as a small number of stands along the New and Alamo River in the Imperial Valley mapping area.



Atriplex hymenelytra Shrubland Alliance (6111)

***Atriplex hymenelytra* Shrubland Alliance (6111)**

Desert holly scrub

Rarity: G5S4

MMU: 10 acres

MMW: 101 meters



Stand of relatively dense (about 4% absolute cover) *Atriplex hymenelytra* with sparse *Larrea tridentata* and *Prosopis glandulosa* on the north margin of Salt Creek, Coachella Valley subarea.

SUMMARY: *Atriplex hymenelytra* thrives in extremely harsh, alkaline substrates. It can be found occupying salty soils around natural seeps, as well as exposed unconsolidated gravel/cobble slopes with high natural disturbance, volcanic soils, and anthropogenically disturbed areas. The shrubs are small and unassuming, except during cooler months with adequate moisture when the toothed, holly-shaped leaves increase photosynthetic activity, appearing a brighter green, and conspicuous red fruit clusters appear. During drought and warmer seasons, remaining leaves turn pale gray. This is a sparsely vegetated Alliance, with *A. hymenelytra* absolute cover >1% with no other shrub reaching a higher cover.

Atriplex hymenelytra Shrubland Alliance (6111)

PHOTOINTERPRETATION SIGNATURE: *Atriplex hymenelytra* is a small, obscure shrub that can be difficult to locate on imagery, especially if the imagery is taken during drought conditions or warm months. The true color signatures are small, individual, medium brown points that easily blend in with the substrate. These shrubs are more prominent on CIR where they have a pale pink color, similar to other *Atriplex* shrub species.

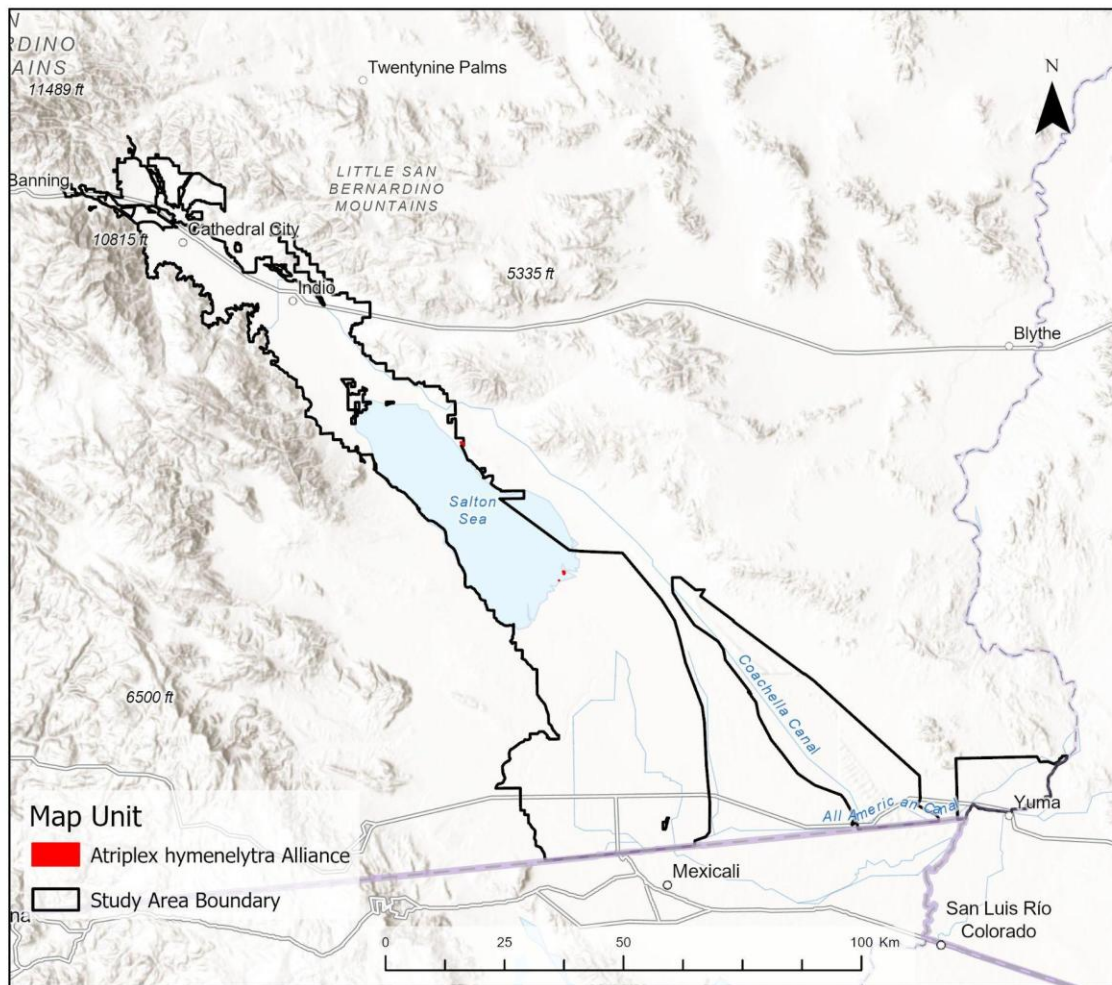


This characteristically difficult to see stand of *Atriplex hymenelytra* is near Salt Creek in the Coachella Valley subarea.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

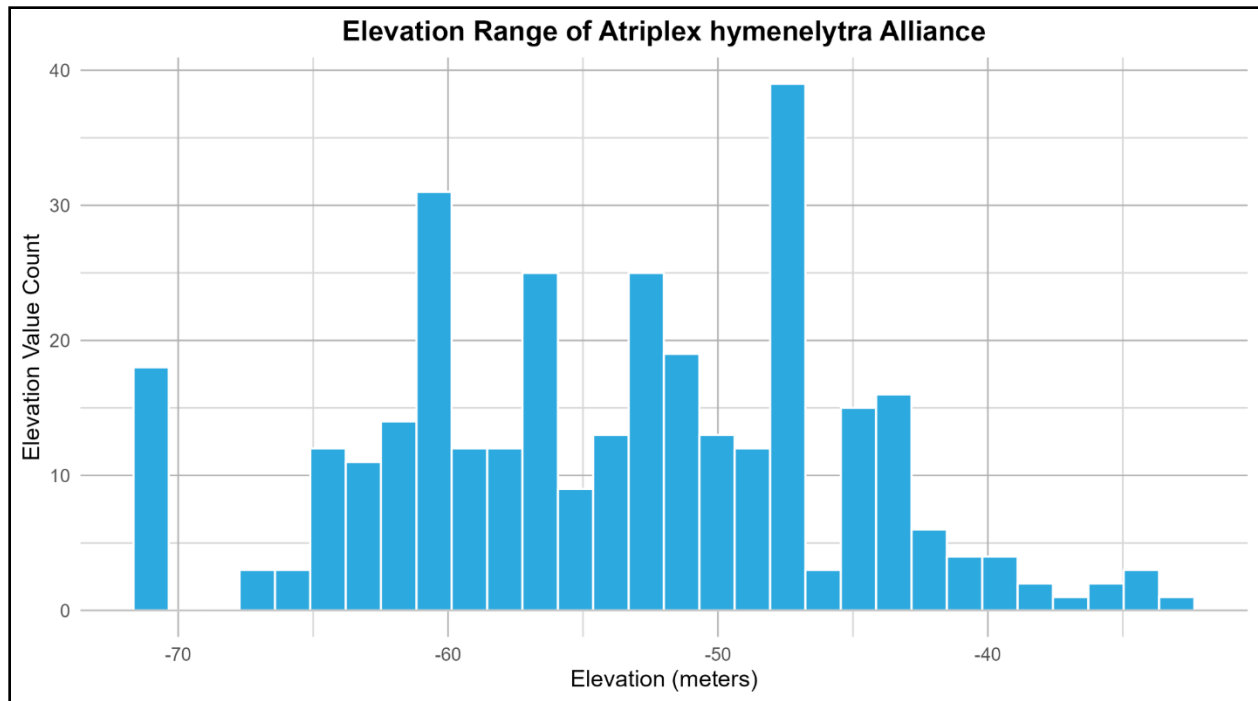
- *Ambrosia dumosa* Shrubland Alliance (4111) – This shrub is very difficult to separate from *A. hymenelytra* due to similar size, overlap in habitat choice, and appearance in true color imagery. However, the pale pink CIR coloration typical of *Atriplex* species may help separate the two.
- *Encelia farinosa* Shrubland Alliance (4118) – Similar to *Ambrosia dumosa*, *Encelia farinosa* can be extremely difficult to separate from *A. hymenelytra*. CIR coloration is likely the most reliable difference.

Atriplex hymenelytra Shrubland Alliance (6111)



PROJECT DISTRIBUTION: Mappable stands of *Atriplex hymenelytra* are rare within this mapping areas. Field teams recorded two stands within Module 1 at the extreme southeast corner of the Coachella Valley subarea, both along the margins of Salt Creek near Highway 111. In Module 2, two volcanoes on the south rim of the Salton Sea, Rock Hill and Mullet Island, also have stands of *A. hymenelytra*. These two geologic features offer an elevated mix of sedimentary and volcanic rock substrate, differing greatly from the fine silt lakebed sediment that dominates the rest of the Imperial Valley.

Atriplex hymenelytra Shrubland Alliance (6111)



Atriplex lentiformis Shrubland Alliance (3722)

***Atriplex lentiformis* Shrubland Alliance (3722)**

Quailbush scrub

Rarity: G4S4

MMU: 0.5 acres

MMW: 22 meters



This stand of *Atriplex lentiformis*, just outside the city of Calexico by the U.S.-Mexico border, shows an example of vigorously growing shrubs occupying an undeveloped parcel of salty lakebed sediment.

SUMMARY: Mappers assigned this Alliance when *Atriplex lentiformis* was dominant (>50%) in the shrub canopy. These fast-growing, large saltbush are common in riparian areas and playas within the Colorado Desert. *A. lentiformis* typically require access to more soil moisture than either *A. polycarpa* or *A. canescens*, thus they are found primarily in areas with a high water table, periodically flooded anthropogenic basins, or lining canals and rivers. They are often the first shrubs to regrow on graded parcels.

PHOTOINTERPRETATION SIGNATURE: *Atriplex* shrub species, including *A. lentiformis*, are most easily recognized by the soft pink/pale red color in CIR. *Atriplex lentiformis* can be further differentiated from these other *Atriplex* species by its larger size, -close proximity to water or areas where water collects (playas, floodwater basins), and tendency to form much denser thickets.



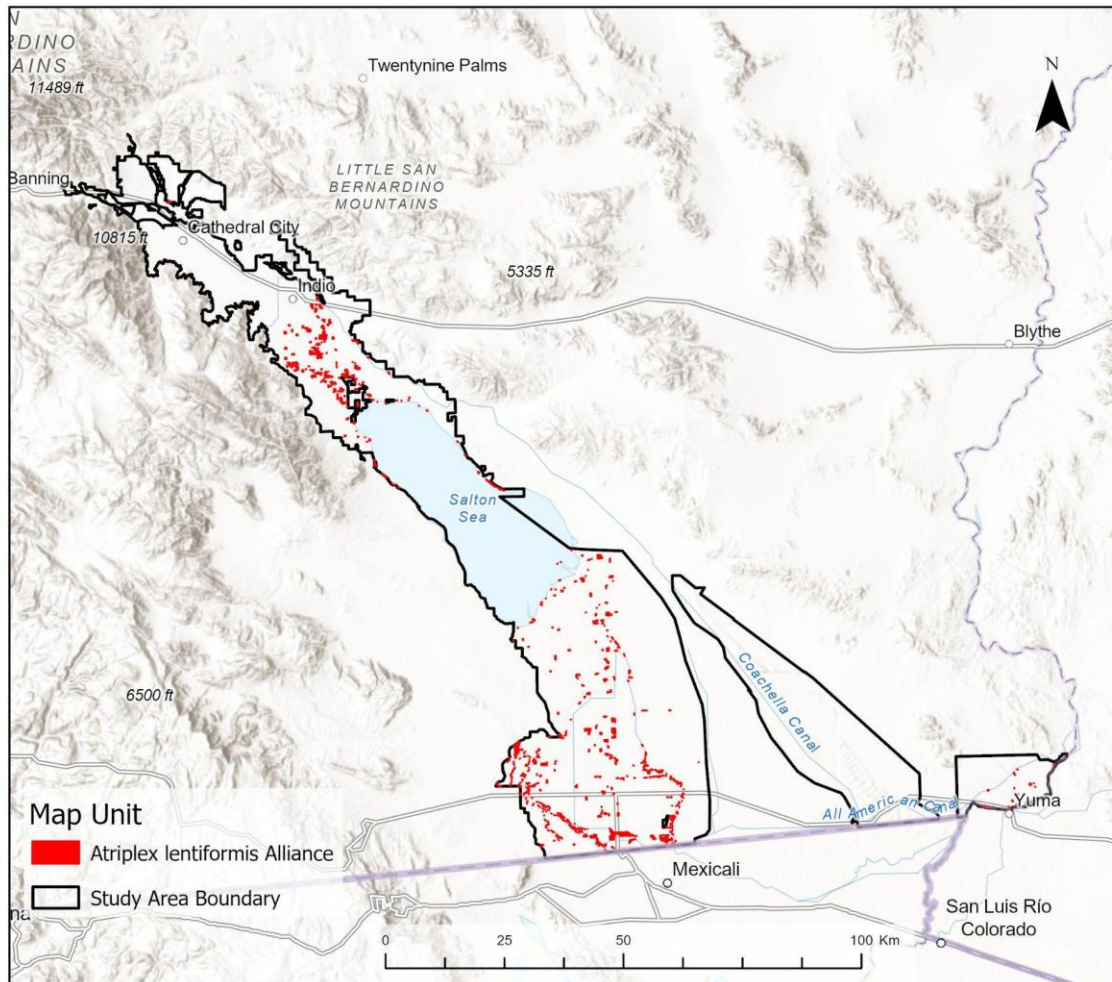
This stand of *Atriplex lentiformis* in the community of Thermal in the eastern Coachella Valley shows a mix of live and recently dead plants forming a dense thicket with *Tamarix* sp. (darker red) surrounding.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Atriplex polycarpa* and *Atriplex canescens* Shrubland Alliances (4113 and 5111)
 - Both of these *Atriplex* species share a similar appearance but can be differentiated from *A. lentiformis* by their smaller size and environmental context (*A. lentiformis* tends to be closer to water or on playas with a high water table). *Atriplex lentiformis* also tends to form dense thickets, while *A. polycarpa* and *A. canescens* individuals are often more scattered.
- *Pluchea sericea* Shrubland Alliance (4221) – *Pluchea sericea* and *Atriplex lentiformis* share considerable habitat overlap and often occur directly adjacent to or mixed within one another. Medium-sized *A. lentiformis* can look extremely similar to *Pluchea sericea* in true color, especially when the *A. lentiformis* are not vigorously growing and some of their crown is dead. However, CIR should be

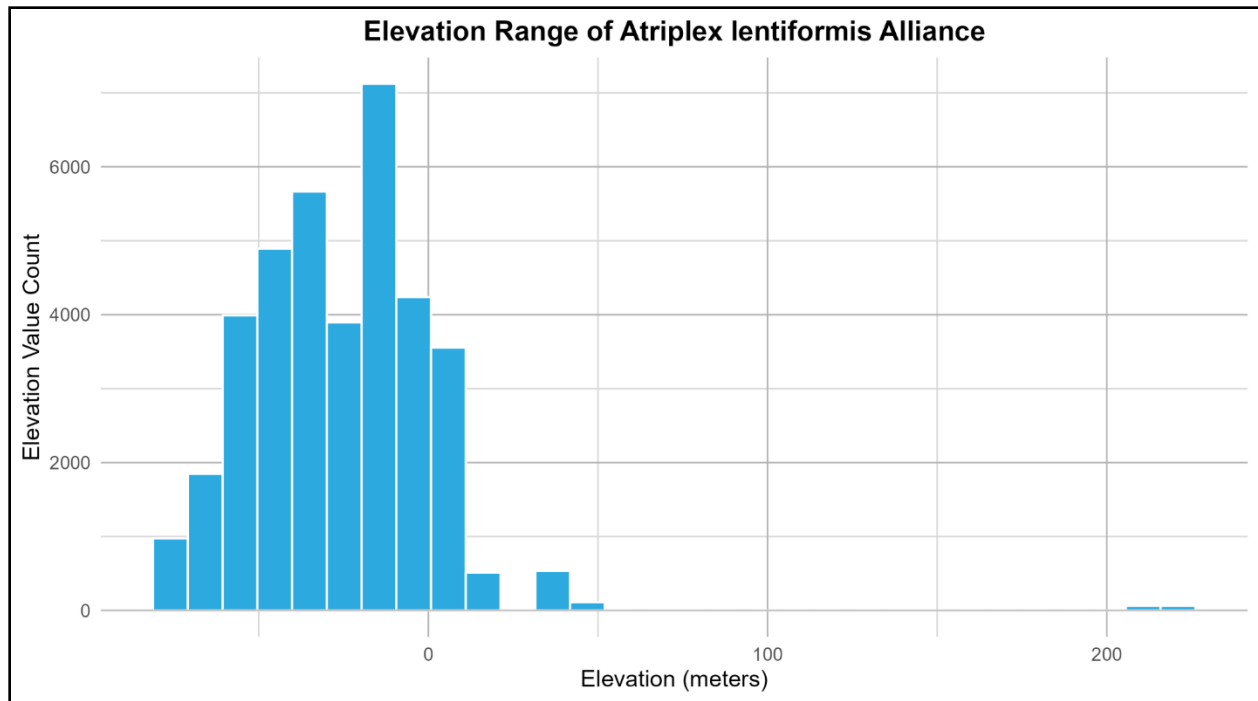
Atriplex lentiformis Shrubland Alliance (3722)

useful for differentiating the pale red/pink color of *A. lentiformis* from the deeper red color of *P. sericea*. When larger, *A. lentiformis* also have a much rounder/mound-like appearance.



PROJECT DISTRIBUTION: This Alliance is frequently encountered throughout most of the Imperial Valley subarea and southeastern Coachella Valley where the soil is composed of ancient lakebed sediments. Approximately starting northwest of Indio in the Coachella Valley, the soil changes from lakebed sediment to primarily aeolian and alluvial deposits where this species is not commonly found. This Alliance was mapped in the Winterhaven subarea usually in close proximity to water (canals or rivers) or on vacant land within the agricultural areas.

Atriplex lentiformis Shrubland Alliance (3722)



Atriplex polycarpa Shrubland Alliance (4113)

***Atriplex polycarpa* Shrubland Alliance (4113)**

Allscale scrub Alliance

Rarity: G4S4

MMU: 10 or 5 acres (see Mapping Considerations section)

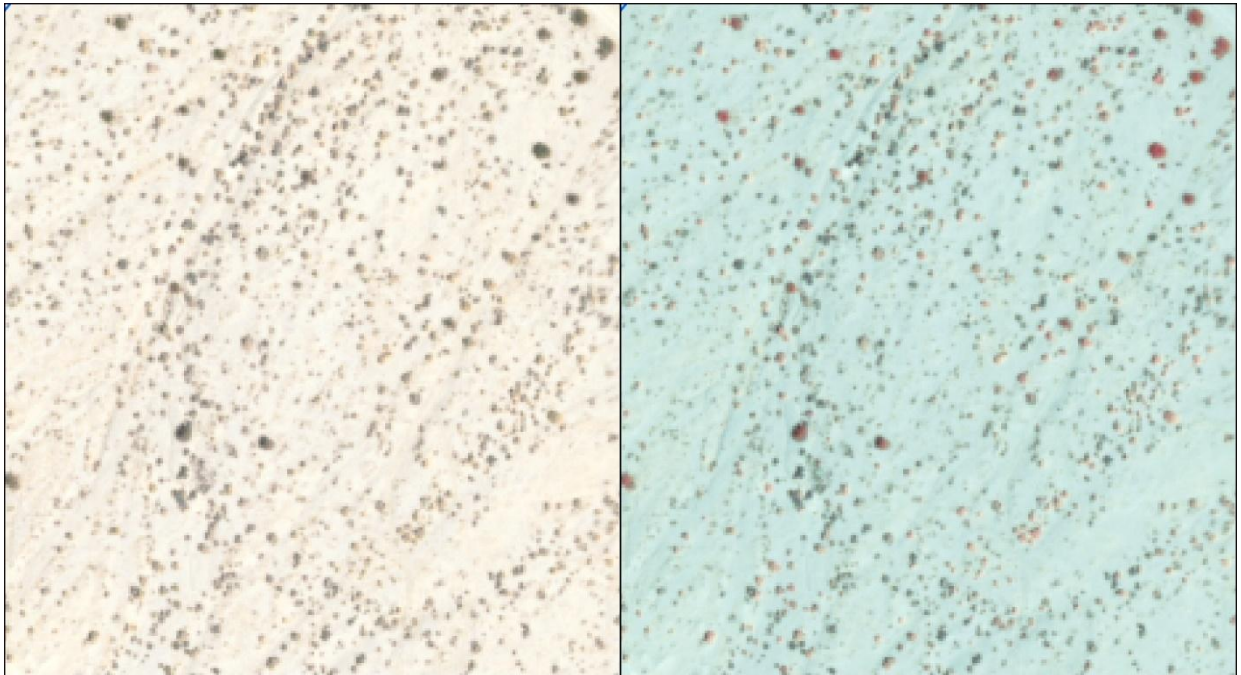
MMW: 101 or 71 meters (see Mapping Considerations section)



This photo shows an expansive stand of *Atriplex polycarpa*.

SUMMARY: *Atriplex polycarpa* is mapped when this species is >2% absolute cover and >50% relative cover in the shrub canopy. This species tends to favor sand or silt substrate and can tolerate higher soil alkalinity. In the Coachella Valley subarea, it often cooccurs with *A. canescens* at codominant cover, in which case it is mapped as *A. canescens*.

PHOTOINTERPRETATION SIGNATURE: Large, healthy *Atriplex polycarpa* will appear as a pale green-gray to pale orange (true color) or faint pink (CIR) with a rough texture and irregular shape. When small, stunted, or unhealthy, vegetation color can be difficult to see. The distribution of this species on a landscape can either be well spaced or, less commonly, bunched together.



This image shows relatively small, pale-colored *Atriplex polycarpa* spread across a flat landscape. Stand in image is part of a larger polygon with boundaries outside the image area.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Atriplex canescens* Shrubland Alliance (4113) – These species are not easily separated by imagery alone. Field verification is required.
- *Atriplex lentiformis* Shrubland Alliance (3722) – This species typically occurs in wetter areas, such as on the periphery of oases and seeps or, more commonly, lining agricultural canals and playas with a high water table in the low-elevation areas surrounding the Salton Sea. *Atriplex lentiformis* are also usually much larger than *Atriplex polycarpa* and have a more circular and softer crown.
- *Ambrosia dumosa* Shrubland Alliance (4111) – This species shares a similar imagery signature to *Atriplex polycarpa*, but within this mapping area, *Ambrosia dumosa* tends to favor different landscapes (sandy to rocky alluvial slopes and

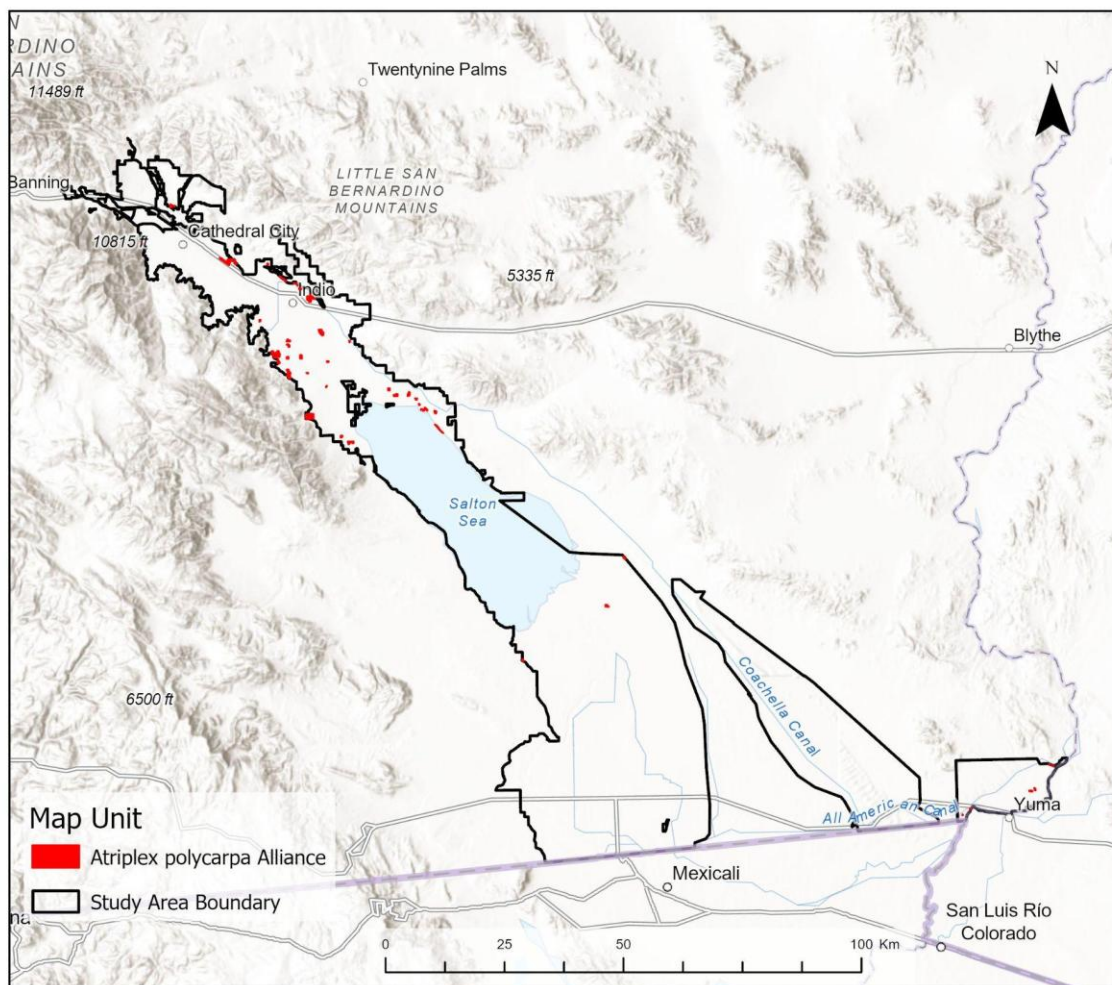
Atriplex polycarpa Shrubland Alliance (4113)

open desert). *Ambrosia dumosa* is also usually noticeably smaller than *Atriplex polycarpa*.

- *Pluchea sericea* Shrubland Alliance (4221) – The general shape and true-color of this species is similar to *Atriplex polycarpa*, however *Pluchea sericea* favors riparian or adjacent habitats, tends to form much denser clumps, and has a darker red CIR signature.

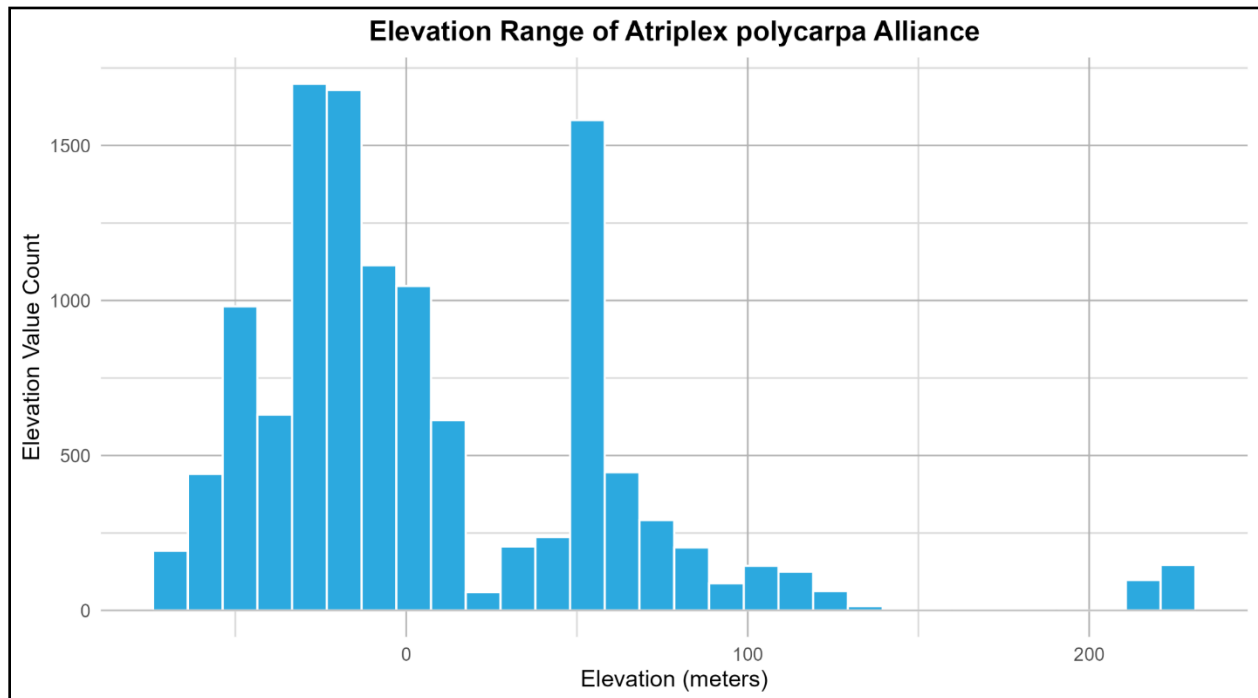
MAPPING CONSIDERATIONS:

- When stands occurred primarily in upland settings, mappers used a 10 acre MMU/101 meter MMW, and when stands occurred primarily in dry washes, mappers used a 5 acre MMU/71 meter MMW.



Atriplex polycarpa Shrubland Alliance (4113)

PROJECT DISTRIBUTION: This vegetation type is primarily found in areas with fine, alkaline soil, such as the eastern Coachella Valley and the southern half of the Winterhaven subarea. Despite the ideal soil conditions, mappers and field teams identified very few stands of this type in the Imperial Valley subarea, likely due to extensive development. Mappers did not identify this type in the Algodones Dunes subarea.



Baccharis emoryi – *Baccharis sergiloides* Shrubland Alliance (1423)

***Baccharis emoryi* – *Baccharis sergiloides* Shrubland Alliance (1423)**

Emory's and Broom baccharis scrub

Rarity: S3G4

MMU: 0.5 acres

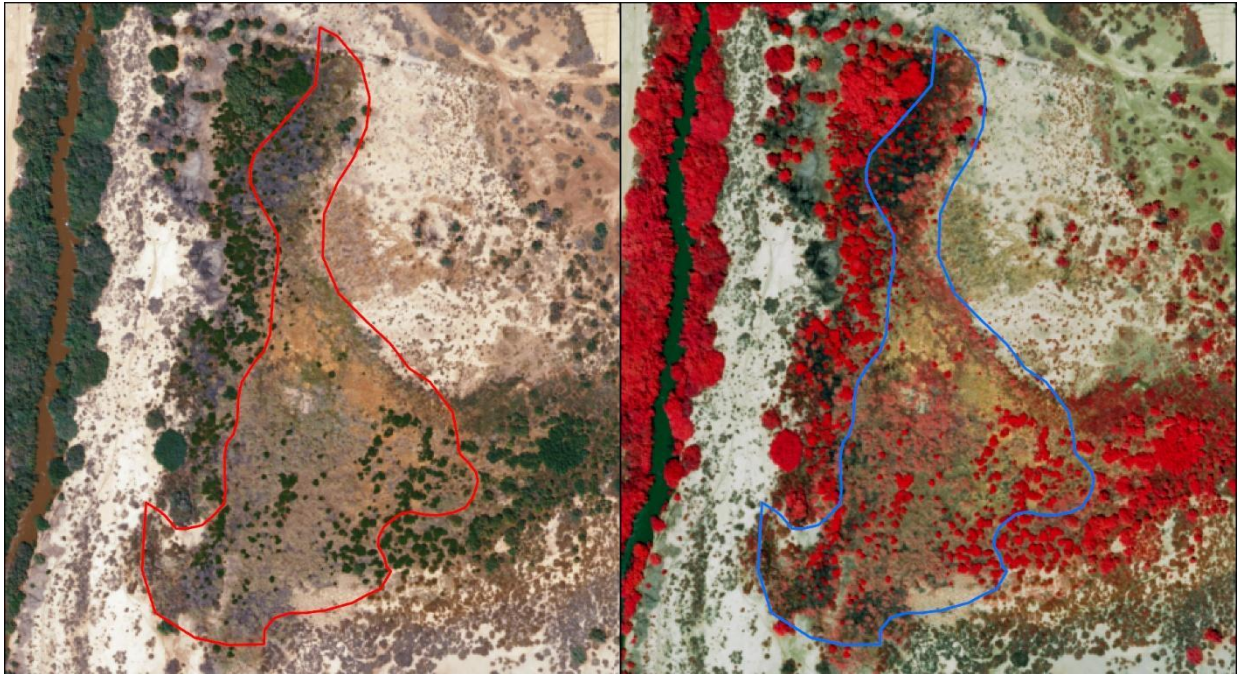
MMW: 22 meters



A thicket of *Baccharis* scrub is seen in the mid- and background with the fluffy, white clusters of seeds. The surrounding yellowish shrubs are *Tamarix* sp.

SUMMARY: This Alliance can occur as dense thickets to open shrubland and is associated with areas of high soil moisture. Either *Baccharis emoryi* or *B. sergiloides* must be dominant or co-dominant and reach >3% absolute cover. *Baccharis emoryi* must not be exceeded in cover by any other shrub species. This Alliance is associated with desert riparian areas including rocky drainages, creeks, springs, and rivers within the Colorado Desert, and was only mapped twice within this mapping area (once in Imperial Valley subarea and once in the Coachella Valley subarea).

PHOTOINTERPRETATION SIGNATURE: This shrub can grow in dense thickets or individually in areas with ample soil moisture, such as canyon bottoms, rocky drainages, and creeksides. In true color they appear as dull gray-green and dull red-pink in CIR. The texture appears soft and individual shrubs have a fairly amorphous crown shape.



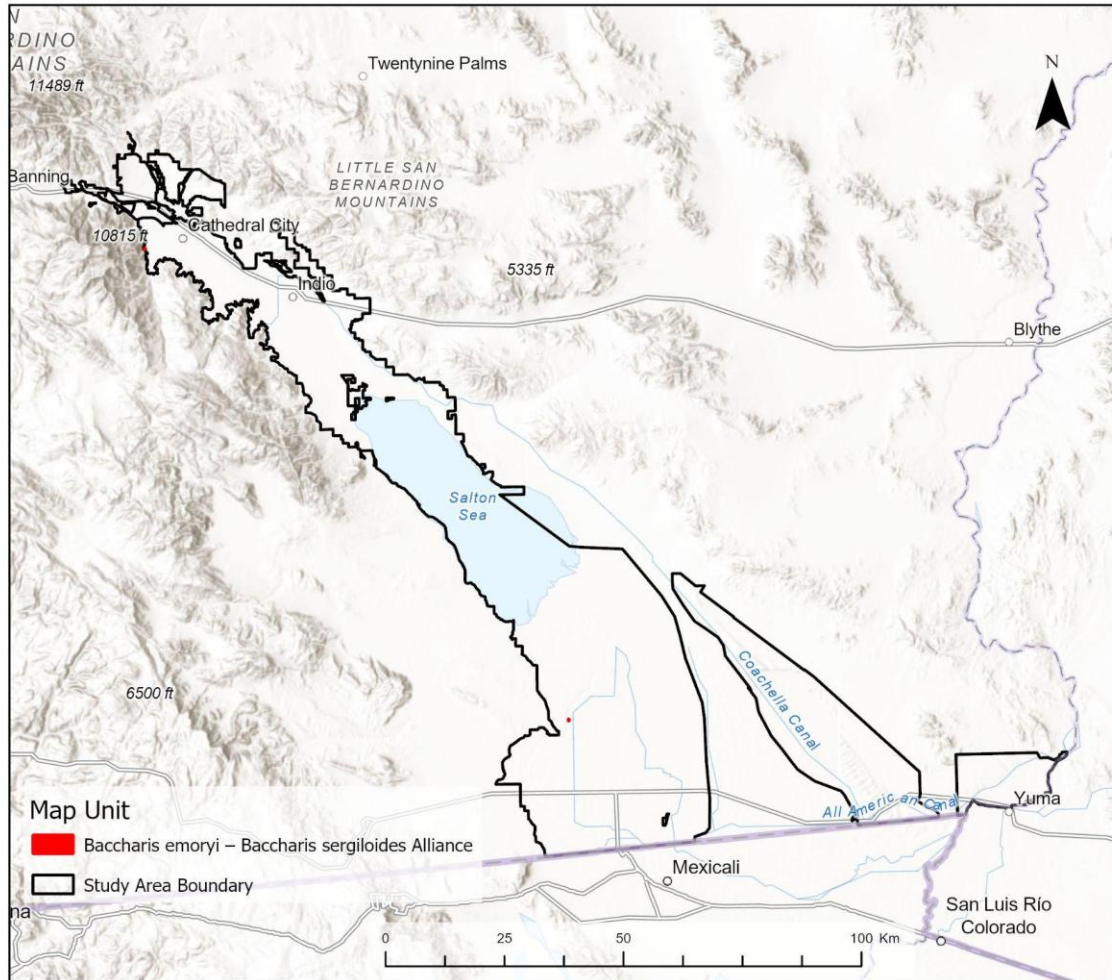
This dense stand of *Baccharis emoryi* – *Baccharis sergiloides* was mapped in the central Imperial Valley within a basin adjacent to the New River (left). The bright red shrubs are *Tamarix* sp.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Ericameria paniculata* Shrubland Alliance (4213) – the true color of *Ericameria paniculata* is similar to *Baccharis emoryi* – *Baccharis sergiloides*, however the CIR of *Ericameria paniculata* is a brighter pink-red, versus the dull pink-red of *Baccharis* species. Also, *Ericameria paniculata* is more often associated with sandy dry washes, roadside ditches, and other areas that may receive less predictable moisture, whereas *Baccharis* species are usually associated with proper riparian areas near seeps, creeks, and rivers.
- *Atriplex lentiformis* (3722), *A. polycarpa* (4113), and *A. canescens* (5111) Shrubland Alliances – These shrub types have a similar appearance on imagery, however *Baccharis* species has a more muted, slightly darker red color in CIR versus the paler pink with *Atriplex* species. *Atriplex polycarpa* and *A. canescens* are primarily upland species and rarely form thickets. *Atriplex lentiformis* grows much larger and has a more evenly round crown than *Baccharis* species.

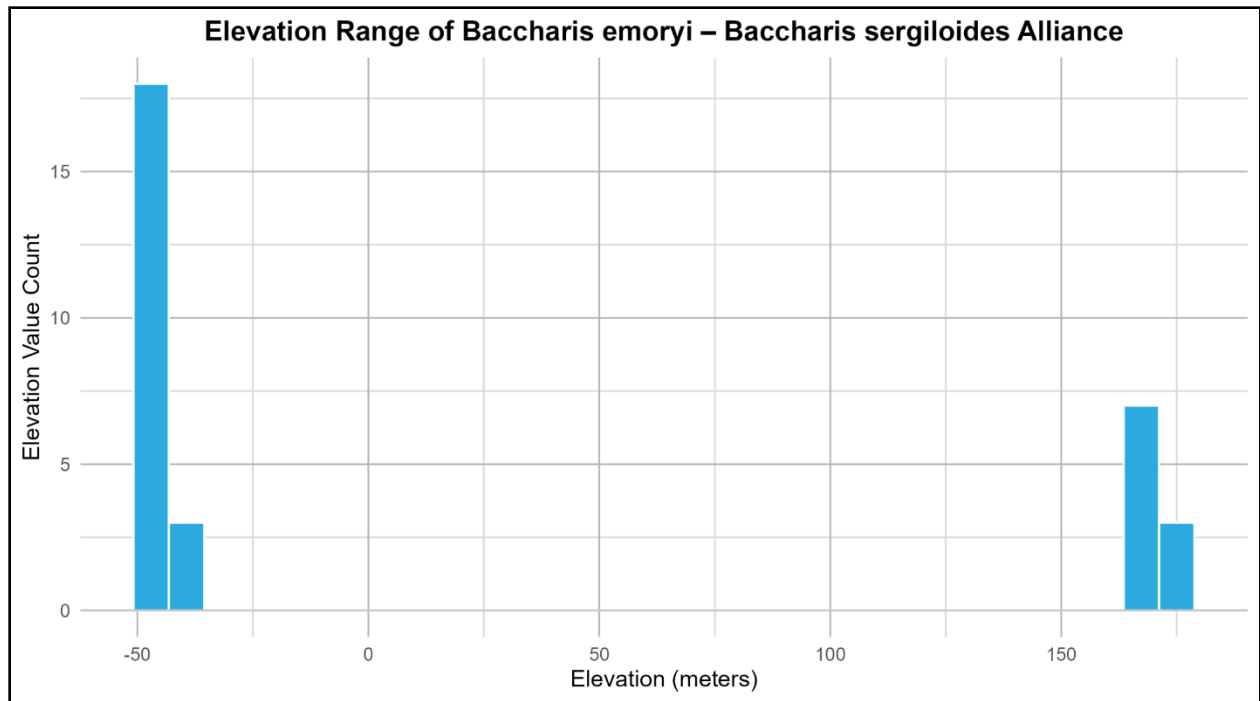
Baccharis emoryi – *Baccharis sergiloides* Shrubland Alliance (1423)

- *Pluchea sericea* Shrubland Alliance (4221) – This species can be differentiated by the brighter pink color in CIR as well as the larger size (shadows, when present, are more evident).



PROJECT DISTRIBUTION: Mappers assigned this Alliance in only two locations: once lining the rocky Tahquitz Creek in Palm Springs (Coachella Valley subarea) and once within a basin adjacent to the New River in the Imperial Valley subarea.

Baccharis emoryi – *Baccharis sergiloides* Shrubland Alliance (1423)



Bolboschoenus maritimus, Schoenoplectus americanus Mapping Unit (3715)

***Bolboschoenus maritimus, Schoenoplectus americanus* Mapping Unit (3715)**

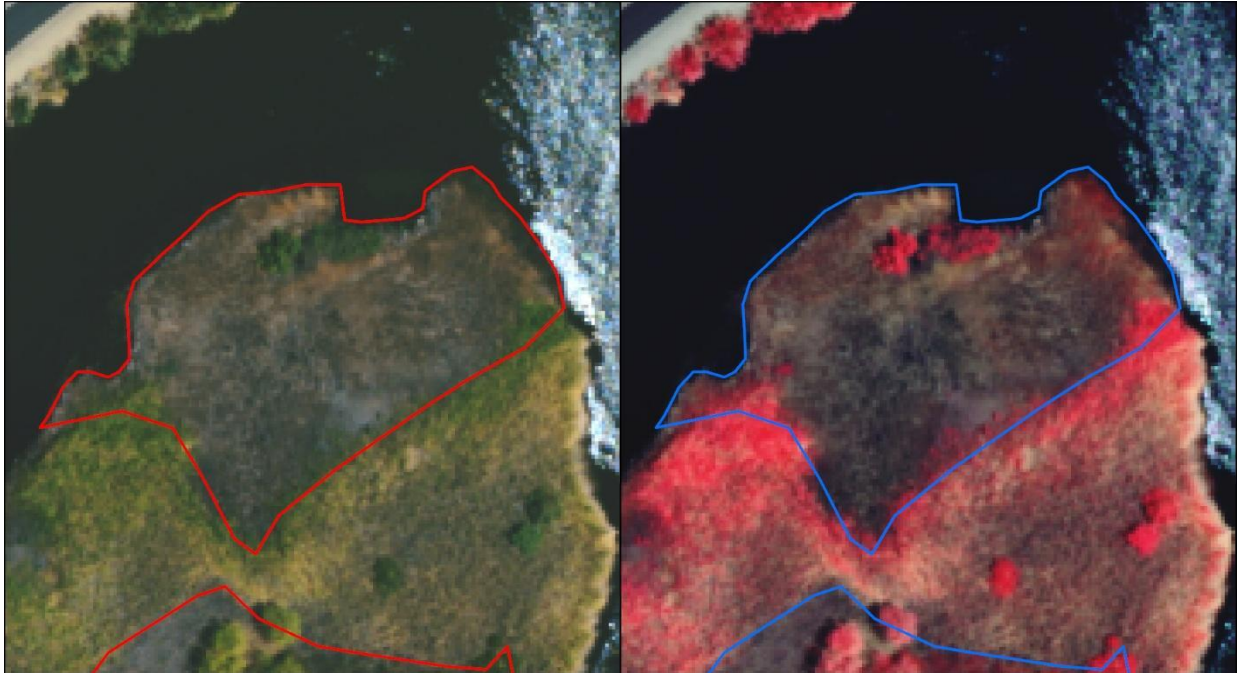
Salt marsh bulrush – American bulrush marshes

MMU: 0.5 acres

MMW: 22 meters

SUMMARY: Mappers assigned this mapping unit similar to the DRECP to denote stands of dense sedges/bulrush (*Bolboschoenus* spp. and *Schoenoplectus* spp) where exact species identification and composition is difficult to discern. Field teams were unable to access any of these polygons by foot to verify species, and mappers found identification of species from imagery to not be possible.

PHOTOINTERPRETATION SIGNATURE: Bulrush spread aggressively via underground rhizomes and form large colonies along the edges of water bodies. Vegetation can die back and resprout from the network of roots, so these dense stands often have signatures of both living and dead leaves throughout. Living vegetation appears as a dark green-brown in true color and a dark red in CIR. Dead vegetation ranges from gray to nearly black to a light straw color. The mix of live and dead vegetation produces a sort of “smudged” quality to the overall color of the stand.

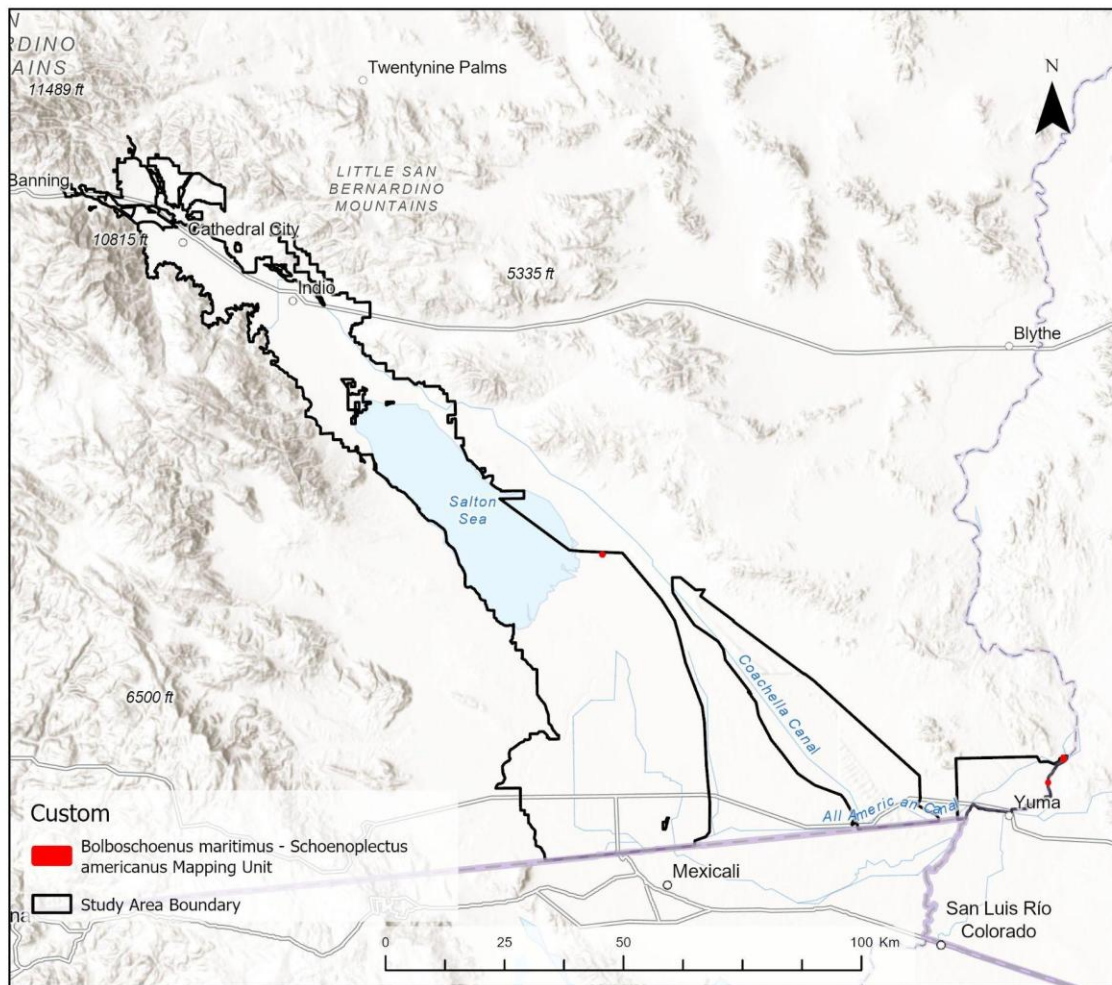


The *Bolboschoenus maritimus*, *Schoenoplectus americanus* Map Unit stands (center and bottom polygons) show a more drab, smudged color versus the *Phragmites australis* – *Arundo donax* Alliance stand in the center.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

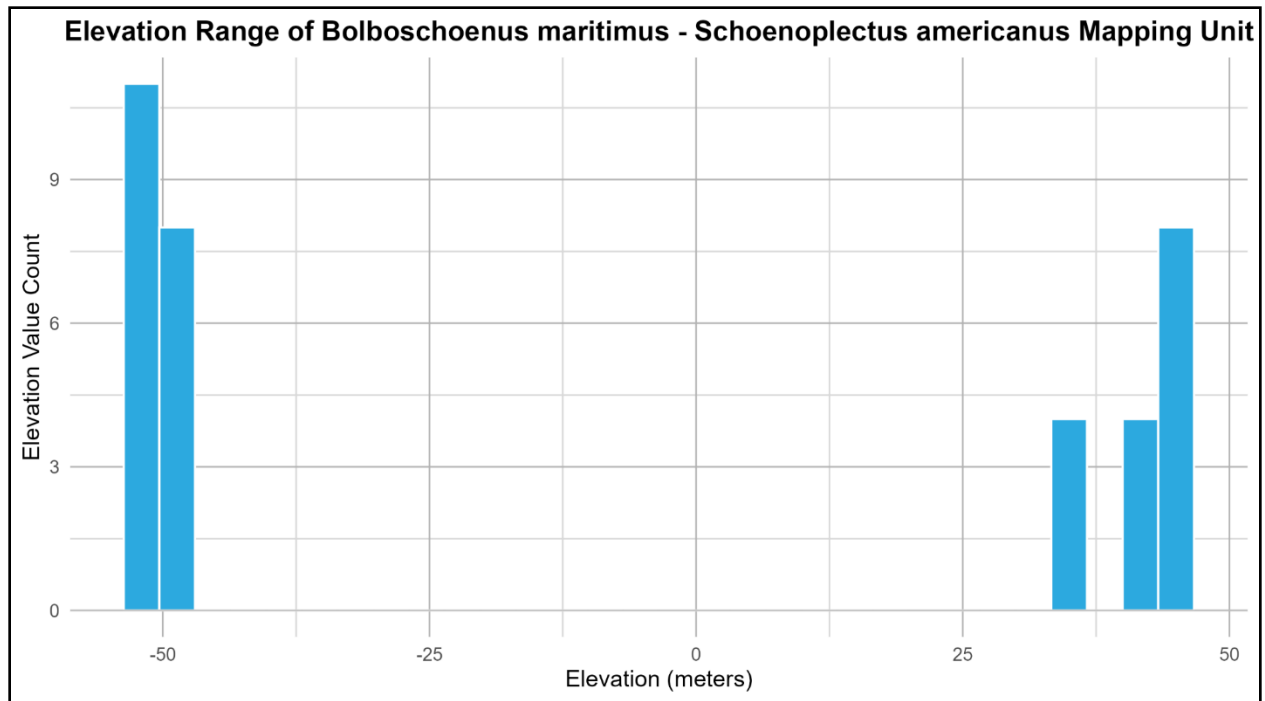
- *Typha* (*angustifolia*, *domingensis*, *latifolia*) Herbaceous Alliance (3416) – stands of *Typha* are a slightly lighter shade of green and tend to have less of an overall “smudged” appearance to the stand. Stands are also often significantly larger and mottled with straw-colored recently dead leaves. The natural matting of *Typha* leaves also produce a wave or mound pattern that is not present in bulrush stands.
- *Phragmites australis* – *Arundo donax* Semi-natural Alliance (1431) – *Phragmites australis* has a much more vibrant green-yellow color (true color) and a bright pink/red color (CIR). It also will line large canals for many miles, which mappers and field teams did not see with stands of bulrush.

Bolboschoenus maritimus, Schoenoplectus americanus Mapping Unit (3715)



PROJECT DISTRIBUTION: Mappers assigned this Unit once in the Imperial Valley subarea in the town of Niland and several times along the Colorado River in the Winterhaven subarea. Mappers did not assign this type in the Coachella Valley or Algodones Dunes subareas.

Bolboschoenus maritimus, Schoenoplectus americanus Mapping Unit (3715)



Brassica tournefortii – Malcolmia africana Semi-natural Stands (2331)

***Brassica tournefortii* – *Malcolmia africana* Semi-natural Stands (2331)**

Upland desert mustards semi-natural stands

Rarity GNRSNR

MMU: 10 acres

MMW: 101 meters



Sysimbrium irio (London rocket) is the dominant herb in this long-abandoned agricultural field near the community of Whitewater, California.

SUMMARY: This herbaceous type is mapped when shrub/tree cover is <2% and the herb layer is dominated by nonnative *Brassica tournefortii* (Sahara mustard), *Malcolmia africana* (African mustard), and/or *Sysimbrium irio* (London rocket). *Brassica tournefortii* is extremely common throughout the mapping area, especially in the Coachella Valley, but the vegetation community is rarely comprised in such a way that it is mapped as this Alliance, primarily due to the temporally variable nature of herbaceous communities in the Colorado Desert and the lack of confidence when trying to identify stands of long-dead herbs. Herbaceous stands that are thought to be regularly dominated by nonnative species, but where mappers could not confidently identify species, were mapped to North American Warm Desert Ruderal Grassland Group (G677).

PHOTOINTERPRETATION SIGNATURE: At the time the NAIP imagery was taken, most stands of annual herbs, including nonnative mustards, were mostly or completely dead. Dead stands of mustard appear as soft straw to light brown color. Live mustards appear as a soft-textured and relatively vibrant green color and bright light red in CIR. It is extremely difficult to separate mustard species, live or dead, from other desert annual herbs, so designating this type is coupled with a combination of field surveys and knowledge of local species distributions.



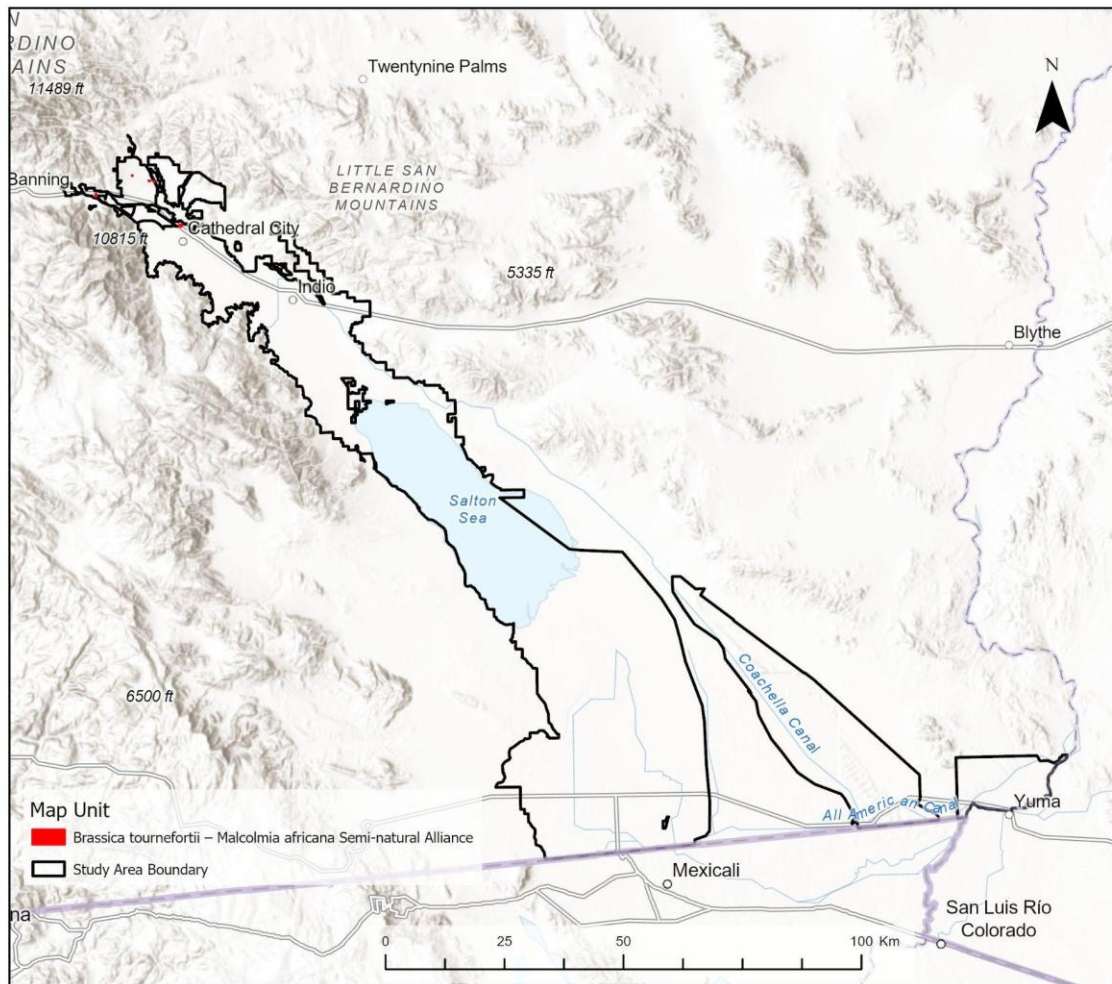
This long-abandoned agricultural field just south of the I-10 rest area in the community of Whitewater is now primarily dominated by nonnative desert mustards, especially *Sysimbrium irio*. Most of the herbs are dead (straw-colored), however the title photo of the same location shows an example of live, aggressively-growing *Sysimbrium irio*.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- Desert forbs provisional Mapping Unit – This is a provisional mapping unit UCR CCB created to better describe stands dominated by native annual herbs with shrub/tree cover <2%. Identifying annual herb species, whether live or dead, is extremely difficult from NAIP alone and must be supplemented with field survey information.
- *Psoralea emoryi* Mapping Unit – This small shrub is pale gray in appearance, thinly branched, and often lacks obvious leaves or flowers for much of the year, making it difficult to see on imagery. It also is quick to grow in disturbed areas where other shrubs have been removed and can blend into

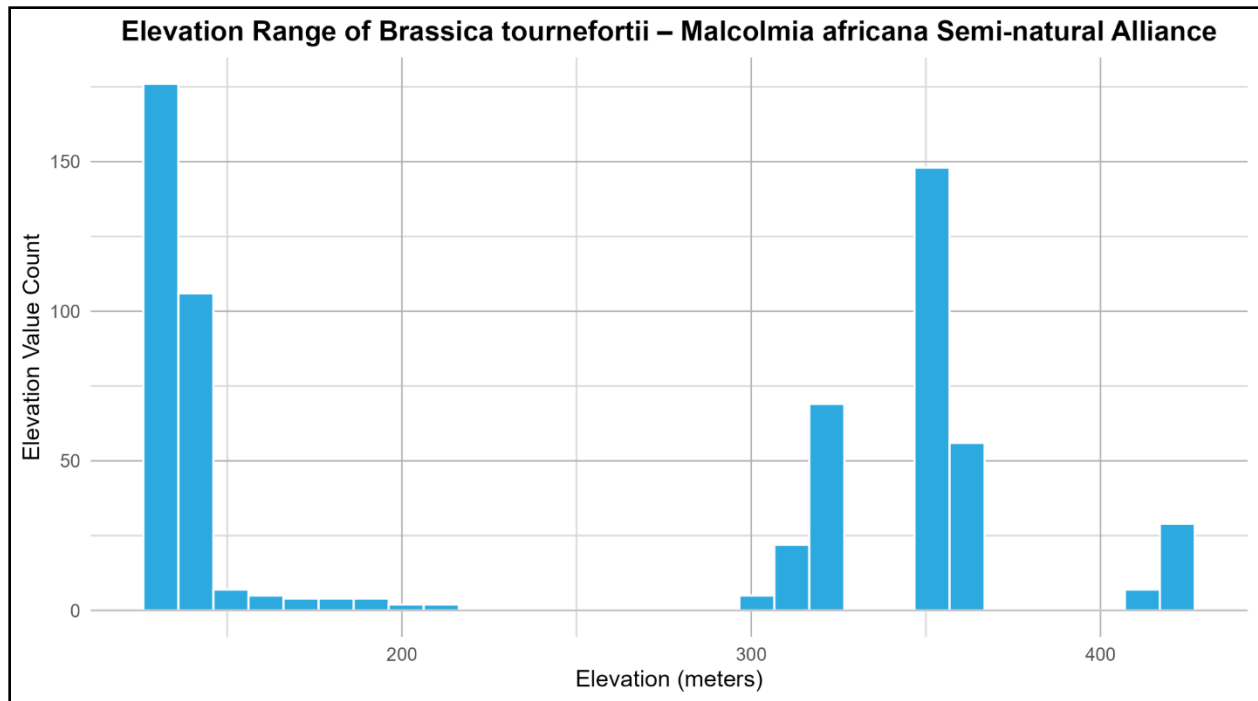
Brassica tournefortii – Malcolmia africana Semi-natural Stands (2331)

stands of desert mustard. Field observations are usually required to definitively identify the presence of *Psoralea argemone*.



PROJECT DISTRIBUTION: Although nonnative mustards, especially *Brassica tournefortii*, are present throughout most of the mapping area, they rarely occur in such a way that they are mapped to Alliance level (<2% shrubs/trees present). The small number of polygons mapped as this Alliance were in the western Coachella Valley, where *Sysimbrium irio* cooccurs with *Brassica tournefortii* in the westernmost parts of the mapping area, such as around the I-10 near Whitewater and Cabazon, and *Brassica tournefortii* is overwhelmingly dominant elsewhere. These stands usually occur in disturbed areas where shrubs have been removed.

Brassica tournefortii – Malcolmia africana Semi-natural Stands (2331)



Bromus rubens – *Schismus (arabicus, barbatus)* Semi-natural Alliance (2332)

***Bromus rubens* – *Schismus (arabicus, barbatus)* Semi-natural Alliance (2332)**

Red brome or Mediterranean grass grasslands

Rarity: GNASNA

MMU: 10 acres

MMW: 101 meters



This photo shows *Schismus* sp. dominating the patches of sand and gravel between the boulders in the Whitewater Floodplain.

SUMMARY: This grassland type is characterized by the invasive annual grasses *Bromus rubens* and/or *Schismus* sp. (*arabicus* or *barbatus*) dominating stands with no appreciable shrub or native herb component. This Alliance was only mapped in the western Coachella Valley, primarily on anthropogenically disturbed/recently graded parcels, however field teams encountered one large (372-acre) stand occupying the relatively undisturbed alluvial boulder fields of the Whitewater Floodplain (see image above). *Schismus* spp. is extremely common throughout the Colorado Desert, but mappers assigned it as an Alliance relatively rarely. *Bromus* species are most common in the wetter, cooler far-western Coachella Valley and in some sheltered canyons and wet throughout the rest of the Coachella Valley. These invasive species commonly cooccur with other nonnatives such as *Brassica tournefortii*, *Sisymbrium irio*, and

Bromus rubens – *Schismus* (*arabicus*, *barbatus*) Semi-natural Alliance (2332)

Erodium cicutarium, as well as native herbs such as *Malacothrix glabrata*, *Chylismia claviformis*, and *Chaenactis fremontii*.

PHOTOINTERPRETATION SIGNATURE: These grasses were most commonly dead during this mapping project. As such, the typical photosignature appears as a sort of orange to straw-colored “haze” across upland desert landscapes.

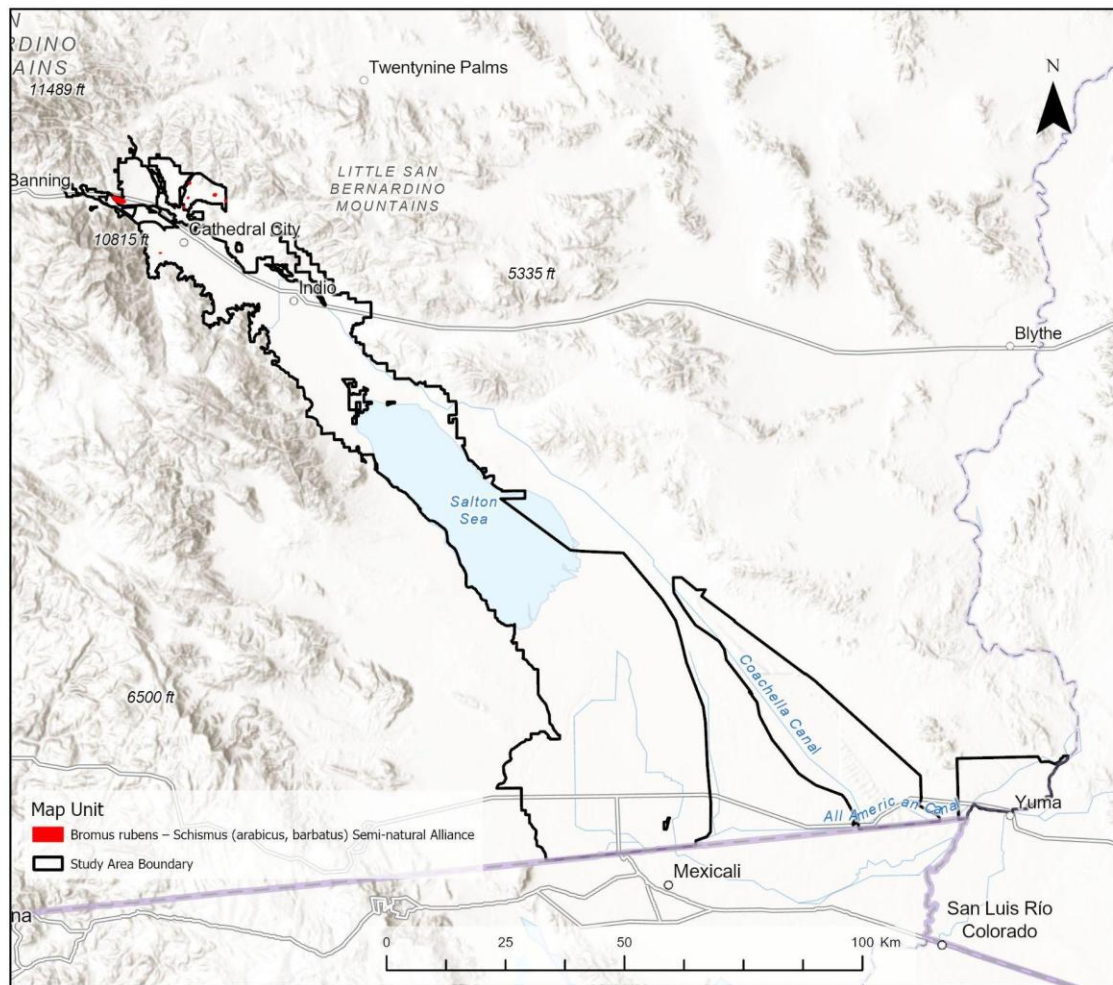


This *Schismus*-dominated herbaceous stand (upper portion of image) shows the typical orangish “haze” used to map this type.

TYPES WITH SIMILAR PHOTINTERPRETATION SIGNATURES:

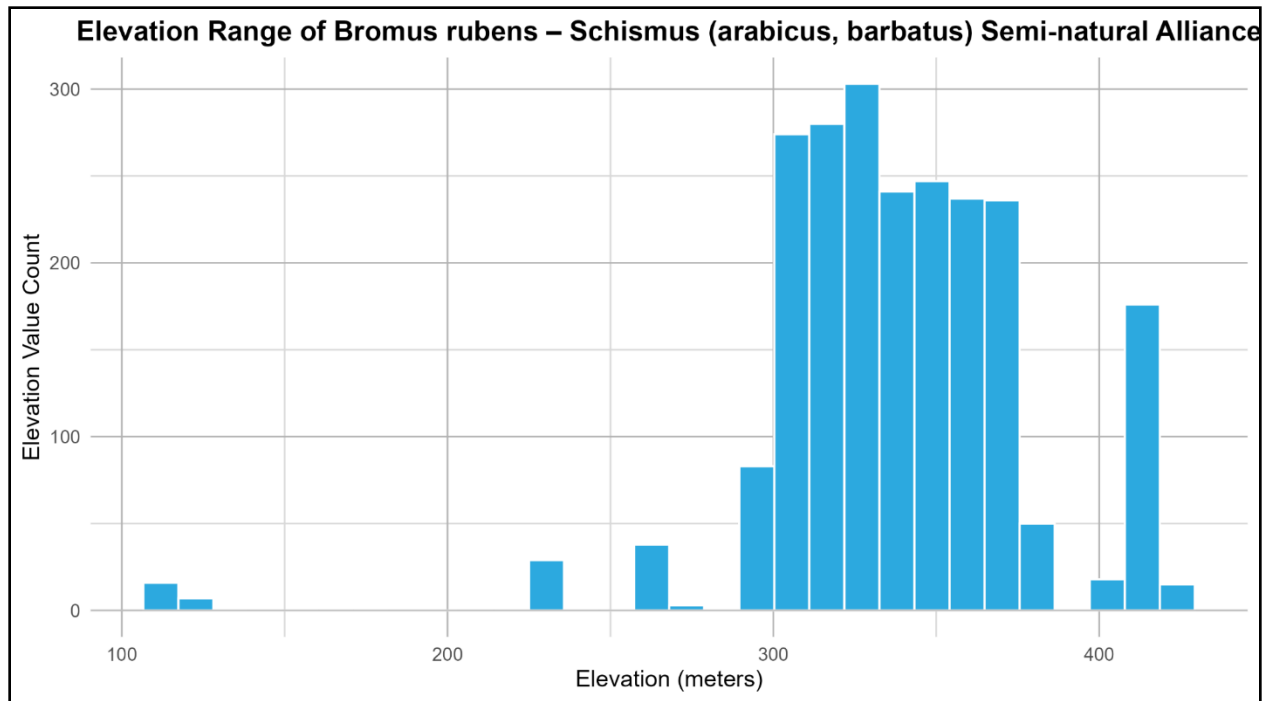
- *Brassica tournefortii* – *Malcolmia africana* Semi-natural Stands (2331) – Both of these Alliances were mapped primarily using recently-dead stands which have a very similar straw-like color. The size of individual *Brassica tournefortii* can vary widely depending on seasonal environmental factors, and large (approximately 2 feet wide) individuals likely would stand out on imagery. However, most of the *Brassica tournefortii* populations mapped were composed of small individuals that are difficult to differentiate from *Schismus* spp. using imagery alone.
- Desert Forbs Provisional Mapping Unit – Stands of herbs are difficult to differentiate using solely imagery, and ground proofing is required.

Bromus rubens – *Schismus (arabicus, barbatus)* Semi-natural Alliance (2332)



PROJECT DISTRIBUTION: This Alliance was only mapped in the western Coachella Valley. Most stands coincided with recently-graded properties, however one large 372-acre stand occurs within the boulder field of the upper Whitewater Floodplain in Palm Springs.

Bromus rubens – *Schismus (arabicus, barbatus)* Semi-natural Alliance (2332)



Chilopsis linearis – *Psorothamnus spinosus* Alliance (7222)

***Chilopsis linearis* – *Psorothamnus spinosus* Alliance (7222)**

Desert willow – smoketree wash woodland

Rarity: G4S3

MMU: 0.5 acres

MMW: 22 meters



This stand of *Chilopsis linearis* shows their typical winter-deciduous condition near Mission Creek in the Coachella Valley.

SUMMARY: This woodland Alliance is characterized by >2% absolute cover of *Chilopsis linearis* and/or *Psorothamnus spinosus*, which frequently grow together. Commonly associated shrubs include *Ambrosia salsola*, *Bebbia juncea*, *Ericameria paniculata*, *Lepidospartum squamatum*, and *Senegalia greggii*. This woodland Alliance occurs primarily in low-energy, intermittently-flooded sandy washes but is not associated with more strongly phreatophytic communities that include trees such as *Populus fremontii* and *Salix* species. In the far-western Coachella Valley, stands of *Chilopsis linearis* are frequently found along the rocky banks of seasonal or perennial streams and rivers such as Snow Creek, Mission Creek, and Whitewater River. *Psorothamnus spinosus* is a relatively strange tree in the sense that it rarely produces leaves and instead photosynthesizes through its pale blue-gray branches and twigs. Germination of *Psorothamnus spinosus* benefits greatly from seed scarification during infrequent large flood events, so it is possible for density of *Psorothamnus spinosus* to

Chilopsis linearis – Psorothamnus spinosus Alliance (7222)

rapidly increase within drainages that received violent flooding. Field teams observed this occur in the mouth of Box Canyon in the Mecca Hills after a massive flood that took place in September 2018.

PHOTOINTERPRETATION SIGNATURE: *Chilopsis linearis* appears as a medium dark-green (true color) and vibrant, bright red (CIR), subcircular small tree when leafed out. When dormant/defoliated, the tree is very hard to discern on imagery, but may appear as a gray, dead mass of branches. *Psorothamnus spinosus*, even when growing vigorously, has nearly no leaves and as such appears to have a tattered, rough texture with a blue-gray color (true color) or a muted, pale pink color (CIR). Young, healthy *Psorothamnus spinosus* appear to have a rounder, denser canopy and are a brighter red in CIR.

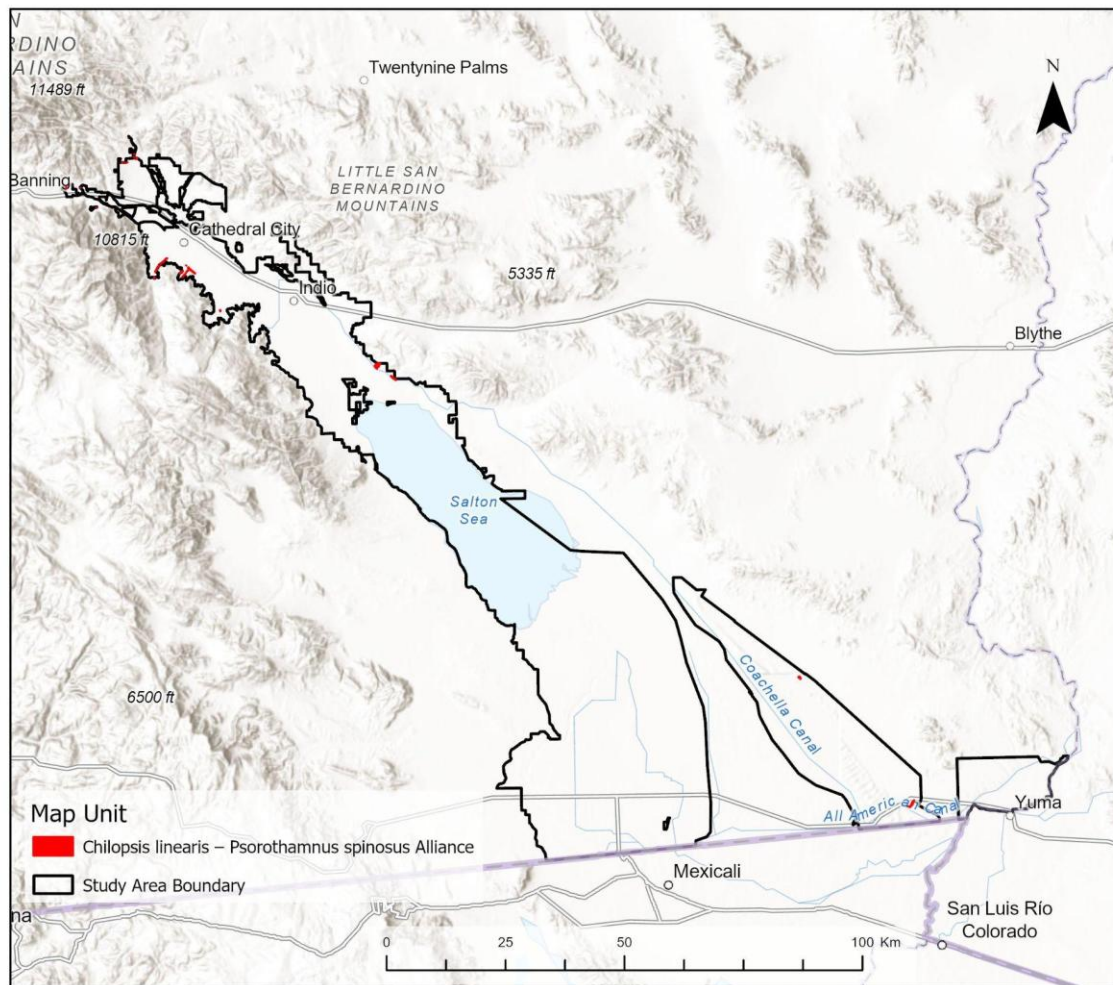


These photos of Palm Canyon Wash in Palm Springs show a mix of mature *Chilopsis linearis* (darker green/bright red) and *Psorothamnus spinosus* (blue-gray/muted pink).

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

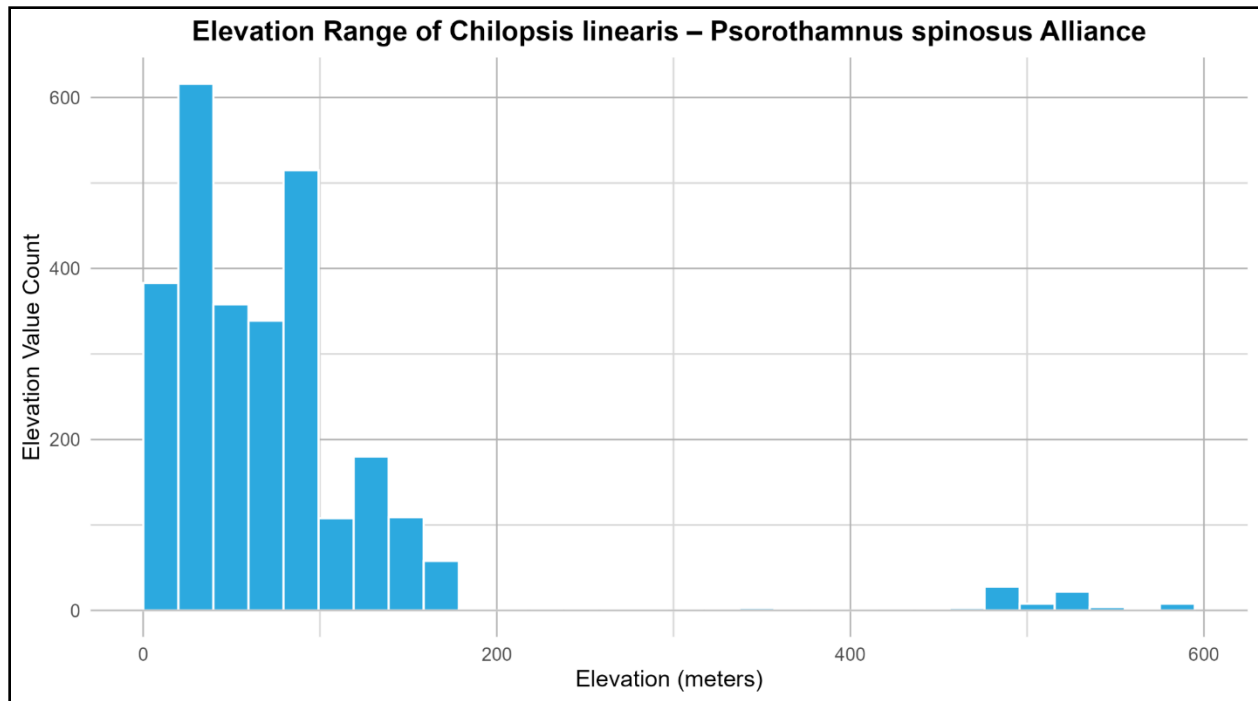
- *Tamarix* spp. Semi-natural Stands (1432) – Invasive, shrubby *Tamarix* species can occupy similar habitat, especially when close to urban areas. *Tamarix* species tend to have a darker, muted red color in CIR and form large thickets more easily than *Chilopsis linearis* or *Psorothamnus spinosus*.
- *Acacia greggii* – *Hyptis emoryi* Shrubland Alliance (4226) – These species are typically noticeably smaller, however in the far-western Coachella Valley, *Acacia greggii* can reach the size of small trees. Especially when defoliated, they can be very difficult to tell apart from *Chilopsis linearis*. However, across much of the mapping area, *Chilopsis linearis* and *Psorothamnus spinosus* tend to grow within lower reaches of washes and streams compared to *Acacia greggii*.
- *Parkinsonia florida* – *Olneya tesota* Woodland Alliance (4227) – *Parkinsonia florida* and *Olneya tesota* tend to tolerate lower-elevation, drier conditions than *Chilopsis linearis*. *Parkinsonia florida* can also occasionally expand beyond washes into adjacent upland areas and rocky hillsides. *Chilopsis linearis* was rarely mapped as a stand in the Algodones Dunes, where *Parkinsonia florida* was a much more common tree, even amongst large, active dunes away from washes. *Parkinsonia florida* and *Olneya tesota* appear as a paler, more muted red in CIR compared to *Chilopsis linearis*, and they usually have a larger, more complete crown than *Psorothamnus spinosus*.

Chilopsis linearis – Psorothamnus spinosus Alliance (7222)



PROJECT DISTRIBUTION: Mappers delineated stands of *Chilopsis linearis* within washes around the community of Whitewater in the far-western portion of the Coachella Valley, and along Mission Creek and nearby drainages. Field teams identified two stands of *Chilopsis linearis* within the Algodones Dunes subarea: one just west of Glamis and another bordering the north side of the All American Canal near the U.S.-Mexico border. Stands of mixed *Chilopsis linearis* and *Psorothamnus spinosus* occurred in anthropogenically channelized washes in Palm Springs, as well as at the mouth of Box Canyon outside of the town of Mecca in the eastern Coachella Valley.

Chilopsis linearis – Psorothamnus spinosus Alliance (7222)



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

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

Rigid spineflower – hairy desert sunflower Desert Pavement Sparsely Vegetated Alliance

Rarity: G4S4

MMU: 10 acres

MMW: 101 meters



This example shows old, dark desert pavement common throughout the north half of the Winterhaven subarea.

SUMMARY: This sparse vegetation type is diagnosed by both floral and geologic characteristics, especially the presence of *Chorizanthe rigida* (rigid spineflower), coupled with the predominantly flat or only very gently sloping desert pavement (close-packed gravel) substrate. As seen in the landscape photo above, this vegetation type can achieve relatively dense herb cover after adequate precipitation, but it is not uncommon for pavement to appear barren with a small number of long-lasting dead spineflower skeletons from past years. Other common herbs vary by region but may include hairy desert sunflower (*Geraea canescens*), desert plantain (*Plantago ovata*), clavate-fruited primrose (*Chylismia claviformis*), various members of Boraginaceae (e.g. *Johnstonella angustifolia*), and Mediterranean grass (*Schismus* spp.). Sparse shrub

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

cover (<2% absolute cover) may include *Larrea tridentata*, *Ambrosia dumosa*, and *Encelia farinosa*, reaching higher densities in narrow rivulets intersecting the pavement.

PHOTOINTERPRETATION SIGNATURE: Usually, the first apparent characteristic of Desert Pavement is the sparse shrub cover (<2%) and the twining rills with higher shrub and tree cover intersecting throughout. Herb cover is usually only barely or not at all apparent. Reflectance of the tight-packed gravel is gray to dark brown/reddish brown mottled with lighter-colored substrate, especially closer to the margins of the small rills. The flat, pavement-like nature of this landscape makes it popular for OHV activity, and resulting tracks are easily visible via aerial imagery and will persist for many decades.

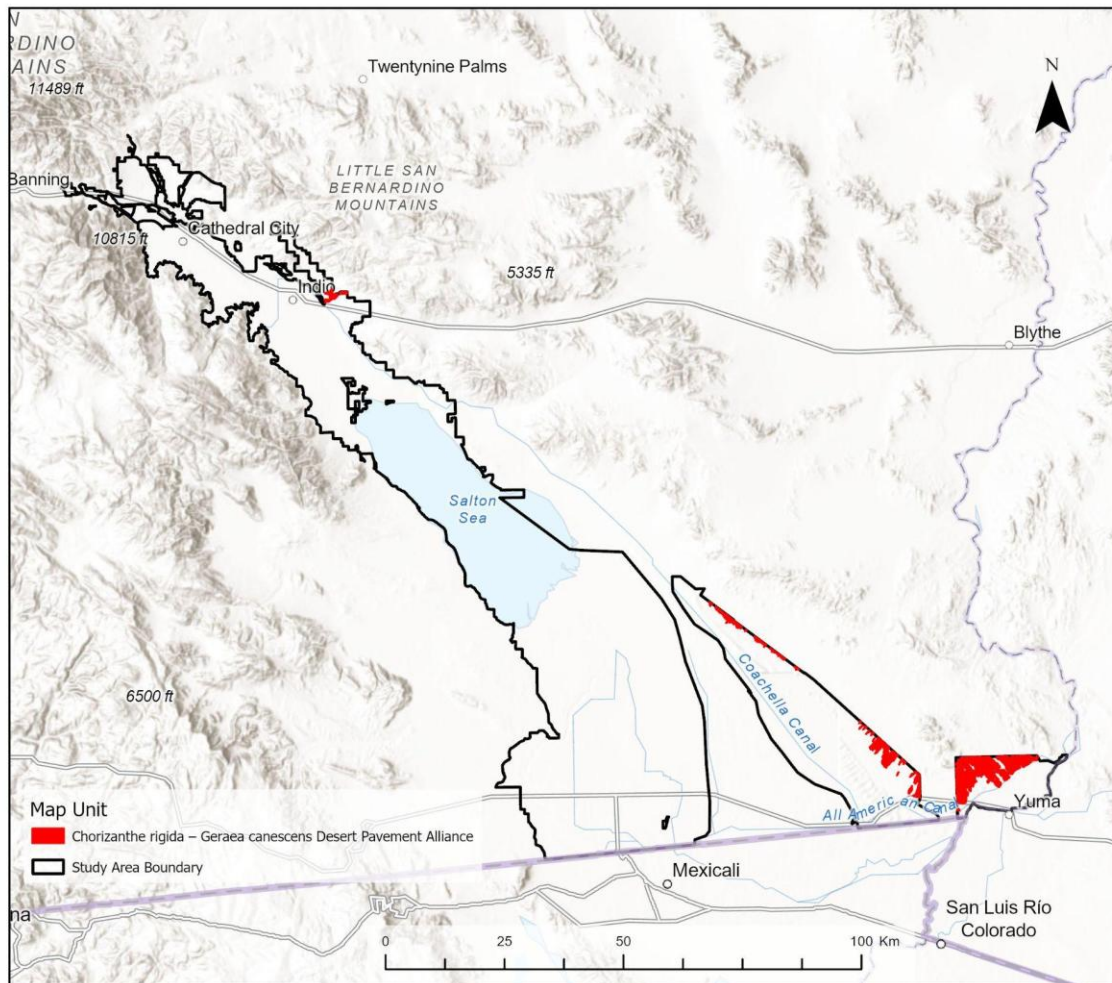


This pavement, also from the northern end of the Winterhaven mapping subarea, shows the expected tightly-packed, varnished gravel and sparse shrub cover.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

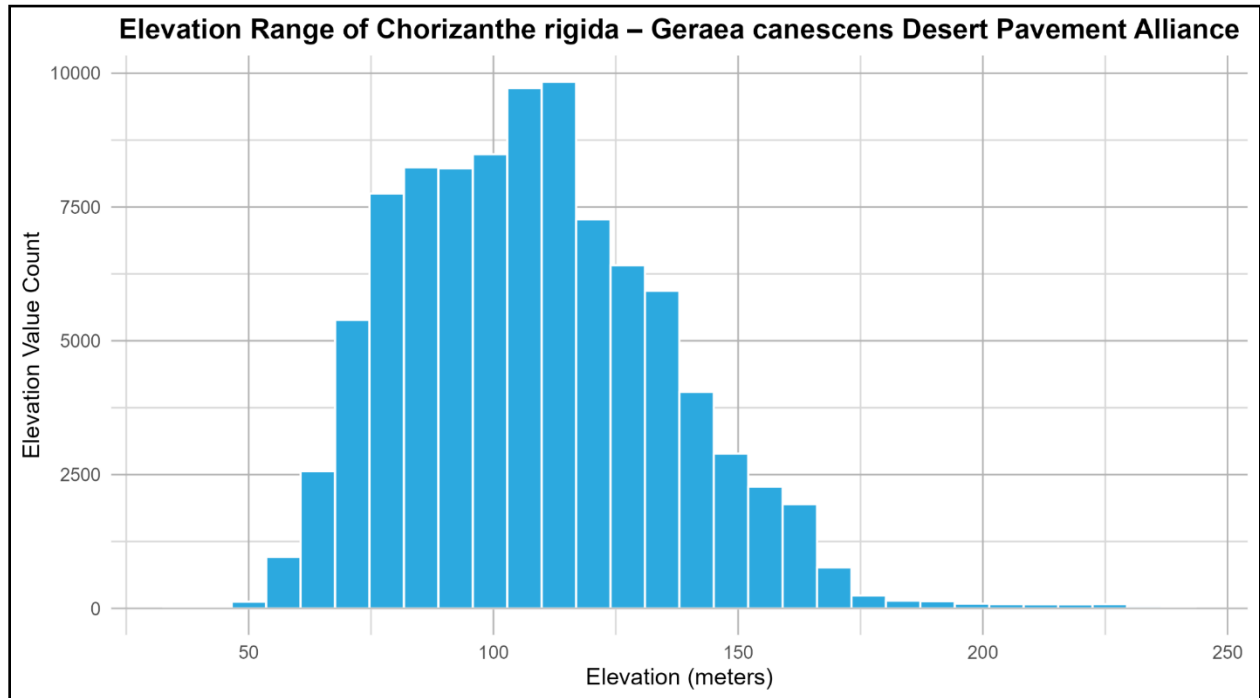
- Sparsely vegetated playa (Ephemeral annuals) Mapping Unit (6116) – Playas occur where water collects at the lowest elevation in a geographic area, whereas desert pavement is usually associated with the slopes/alluvial fan of mountains. As such, pavement will have erosional evidence of a slight slope (small rills and washes orienting downslope), while playas are more featureless. Shrubs, when present, tend to differ – playas more commonly support halophytic species such as *Suaeda moquinii*, *Allenrolfea occidentalis*, and *Atriplex* species, while desert pavement features sparse upland species typical of creosote scrub with desert wash species, such as *Parkinsonia florida*, *Olneya tesota*, *Bebbia juncea*, and *Ambrosia Salsola*, within the rills.
- *Larrea tridentata* – *Ambrosia dumosa* Shrubland Alliance (4115), *Larrea tridentata* – *Encelia farinosa* (4118), and *Larrea tridentata* (4119) Alliances – *Larrea tridentata* is often the most prevalent shrub on desert pavement, so differentiation usually relies on a combination of percent cover of shrubs and trees (*Larrea tridentata* types >2% absolute cover) and consistency of shrubs throughout the stand (desert pavement has primarily a density of shrubs restricted to small rills and are otherwise <2% absolute shrub and tree cover).
- Mud Hills sparsely vegetated ephemeral herbs Mapping Unit (6113) – Mud Hills can be extremely difficult to differentiate from desert pavement in areas where they transition together. However, generally, they can be separated by the differing topology (Mud Hills tend to have steeper slopes, greater relief, often with an obvious “ridge”, and desert pavement has overall low relief and obvious tracts of flat landscape) and erosional patterns (Mud Hills have a complex, dendritic network of highly eroded, smoothed-over gullies and rills originating from the hills’ ridges and terminating in larger washes, while desert pavement tends to have sharper erosional patterns more or less all oriented in the direction of the overall downslope). Substrate color can vary considerably for both vegetation types, but Mud Hills generally are lighter in color, owing to the presence of more fine silt/mud substrate among the less consolidated gravel. Higher rates of erosion in Mud Hills usually reduces the amount of darker desert varnish present on the gravel.

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



PROJECT DISTRIBUTION: *Chorizanthe rigida* – *Geraea canescens* Desert Pavement Sparsely Vegetated Alliance is abundant throughout the Mojave and Colorado Deserts. Pavement is found amongst the flat slopes beside desert hills and mountains. In this mapping area, desert pavement is most abundant in the Winterhaven subarea north of the All American Canal, where the desert is primarily undeveloped. The alluvial substrate here is fed by the Cargo Muchacho Mountains to the west and Chocolate Mountains to the east. Desert pavement is also common along the east margin of the Algodones Dunes subarea, on the lowest slopes of the Chocolate Mountains to the north and Cargo Muchacho Mountains to the south. A small amount of desert pavement is present in the Coachella Valley subarea north of Interstate 10 at the base of the Little San Bernardino Mountains at the mouth of Fargo Canyon.

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



Cynodon dactylon – *Crypsis* spp. – *Paspalum* spp. Herbaceous Semi-Natural Alliance (3716)

***Cynodon dactylon* – *Crypsis* spp. – *Paspalum* spp. Herbaceous Semi-Natural Alliance (3716)**

Bermudagrass – prickly grass – crowngrass turfs

Rarity: GNASNA

MMU: 0.5 acres

MMW: 22 meters



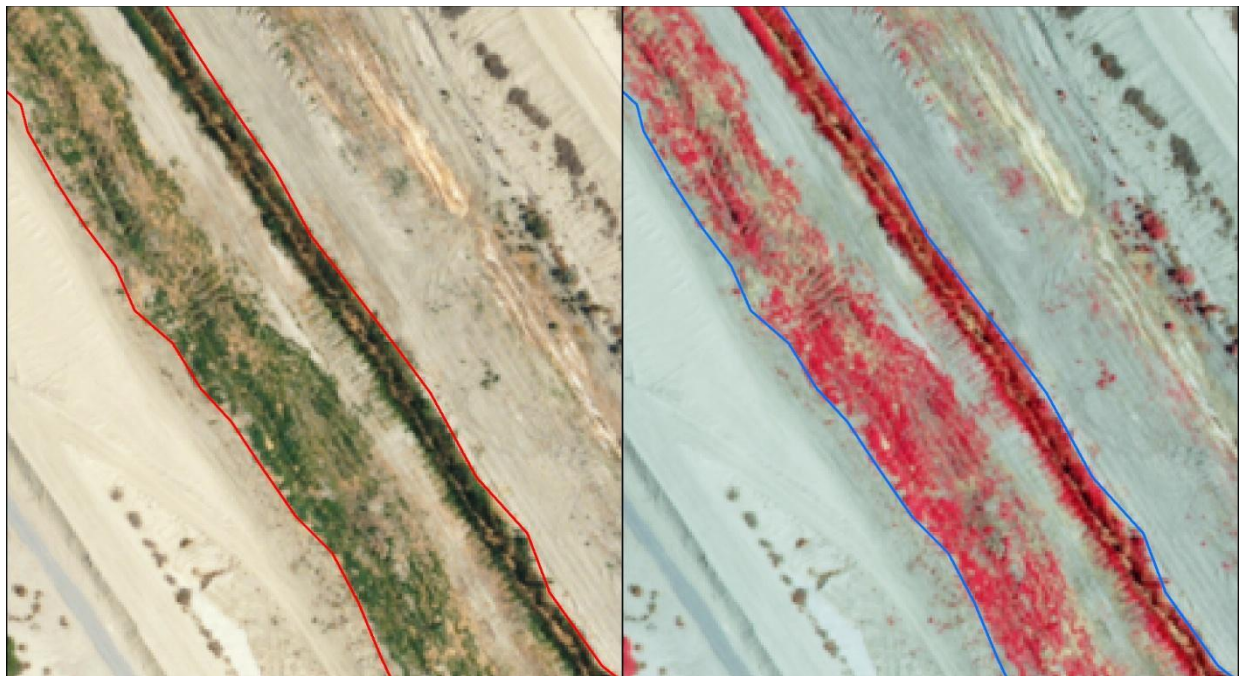
This photo of the bottom of the Whitewater Stormwater Channel in the Coachella Valley shows large clonal mats of *Cynodon dactylon* covering the soil surface.

SUMMARY: Mappers assigned this Alliance when *Cynodon dactylon* dominated the herbaceous layer and shrub and tree cover was less than 2%. Field teams found *Cynodon dactylon* frequently inhabiting roadside ditches, agriculture drainages, and floodwater channels throughout the Coachella and Imperial Valleys. This nonnative species of grass spread aggressively via stolons and rhizomes in areas of relatively high soil moisture, often fed by agricultural runoff. It regrows quickly from a dense network of roots after routine vegetation removal along agricultural channel berms, allowing it to outcompete other herbs and shrubs in these areas. It often grows adjacent to a semi-permanent water source and borders other riparian/marsh types including *Typha* species, *Phragmites australis*, and *Tamarix species*. The shoots and leaves of this species can die back while the roots remain alive for some time, ready to quickly regrow when conditions permit. As such, mappers delineated stands of this species

Cynodon dactylon – *Crypsis* spp. – *Paspalum* spp. Herbaceous Semi-Natural Alliance (3716)

even if the above-ground vegetation appeared to be recently dead (straw-like color), but did not assign this Alliance if the vegetation appeared long-dead (dark gray color).

PHOTOINTERPRETATION SIGNATURE: This herbaceous type appears as dense, irregularly arranged clumps of grass, usually found in anthropogenically disturbed areas containing a semi-permanent water source, such as flood control ditches and agricultural drainages. Stands of this species are usually a mixture of live and dead vegetation; live vegetation appears soft-textured and pale to medium green (true color) to bright red (CIR), while dead vegetation appears as a light straw color (true color and CIR).



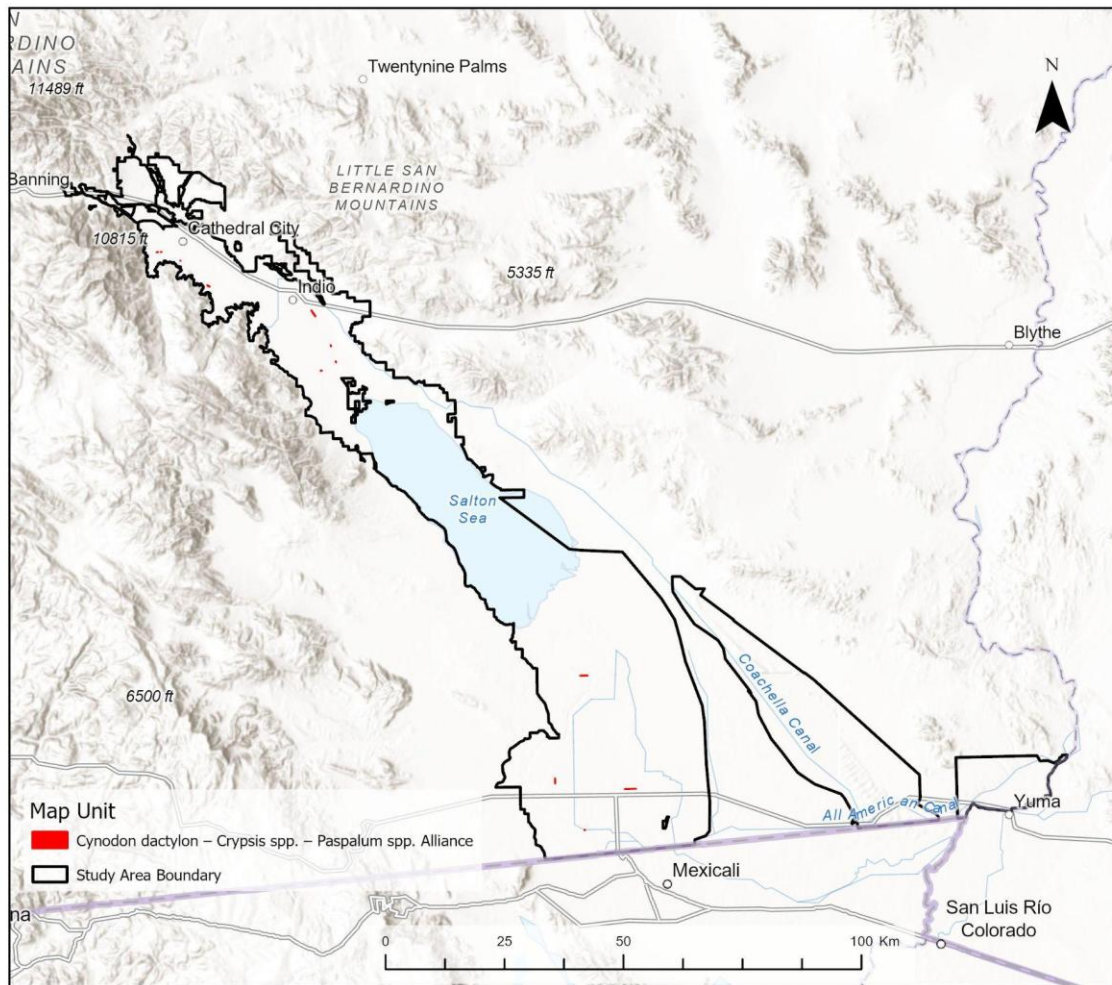
These photos show a section of a larger *Cynodon dactylon* polygon following the bottom of the Whitewater Stormwater Channel in the Coachella Valley. Note the mottling of live and dead vegetation and heavy anthropogenic disturbance.

Cynodon dactylon – *Crypsis* spp. – *Paspalum* spp. Herbaceous Semi-Natural Alliance (3716)

TYPES WITH SIMILAR PHOTINTERPRETATION SIGNATURES:

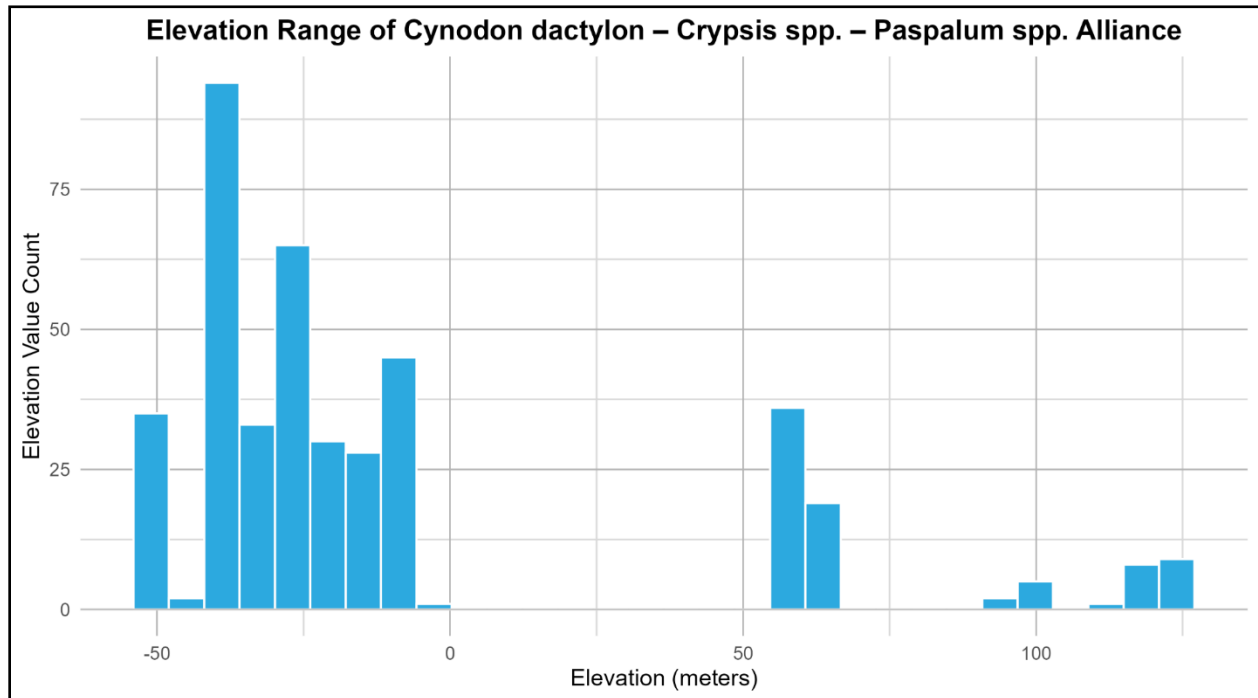
- *Distichlis spicata* Herbaceous Alliance (3726) – Both of these species form clumped mats that are a mix of live and dead vegetation, but *Distichlis spicata* occur more frequently in natural settings with higher soil alkalinity and the color of the vegetation on imagery is noticeably less vibrant.
- *Typha* (*angustifolia*, *domingensis*, *latifolia*) Herbaceous Alliance (3416) – These types both share the soft texture typical of herbaceous types, but the true color and CIR coloration differs between these types sufficiently to separate them in most cases. Stands of *Cynodon dactylon* normally show an obvious mottling of live and dead vegetation, whereas stands of *Typha* are usually more uniform in coloration. Also, *Typha* is a significantly taller herb which is usually apparent on imagery from the presence of shadows and a mound or wave-like texture across the stand. *Typha* grows within or directly adjacent to surface water, while *Cynodon dactylon* typically does not prefer inundation.
- *Brassica tournefortii* – *Malcolmia africana* Semi-natural Stands (2331) – Both of these herbaceous stands were mapped even when recently dead, and when dead they have a similar straw color. However, knowledge of soil type and geographic location (*Brassica tournefortii* is found primarily in upland sand and alluvial substrates, while *Cynodon dactylon* is found on fine lakebed substrate, usually in areas of high anthropogenic disturbance) can usually differentiate them. Also, *Brassica tournefortii* grow as individual plants, while *Cynodon dactylon* form rhizomatous mats often apparent from imagery.

Cynodon dactylon – *Crypsis* spp. – *Paspalum* spp. Herbaceous Semi-Natural Alliance
(3716)



PROJECT DISTRIBUTION: Mappers assigned this vegetation type near areas of surface water amongst high urban or agricultural development. Mappers delineated three stands within the Tahquitz Creek drainage in Palm Springs and the Palm Canyon drainage within Cathedral City and Rancho Mirage. Mappers delineated additional stands in the eastern Coachella Valley amongst floodwater and agricultural channels, as well as within several agricultural drainages throughout the Imperial Valley. Mappers and field teams did not identify this Alliance in the Algodones Dunes or Winterhaven subareas.

Cynodon dactylon – *Crypsis* spp. – *Paspalum* spp. Herbaceous Semi-Natural Alliance
(3716)



Desert Forb Provisional Mapping Unit (6125)

MMU: 10 acres

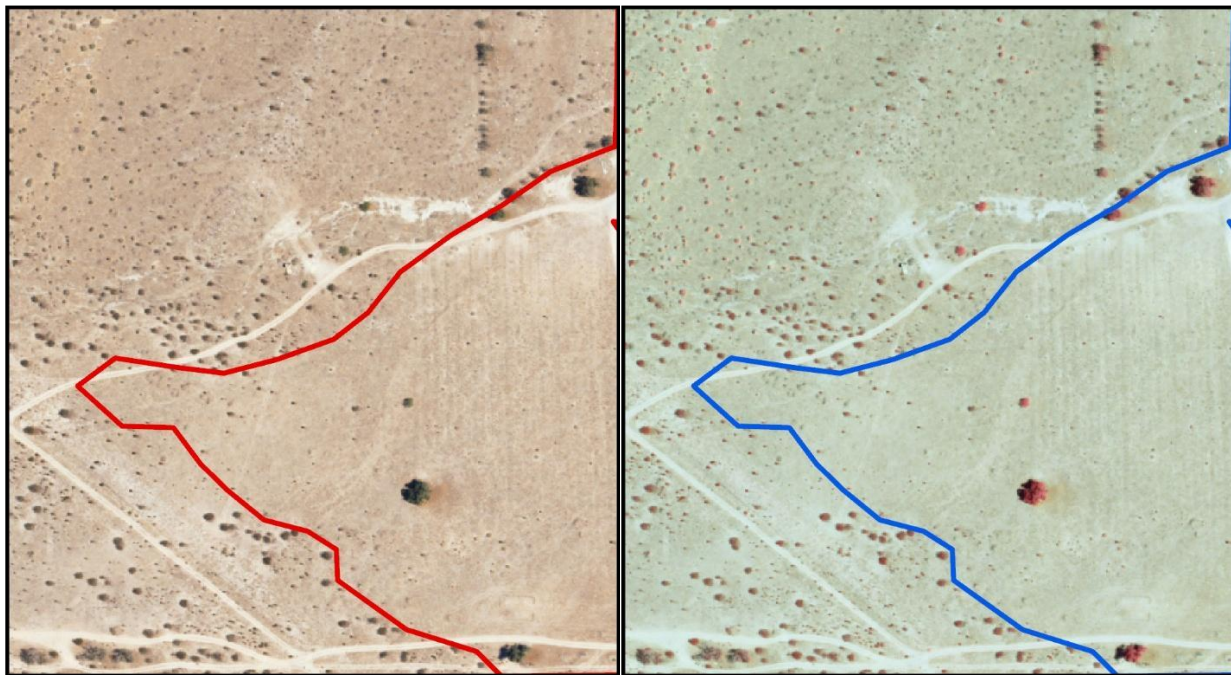
MMW: 101 meters



This anthropogenically cleared area below Whitewater Canyon, south of the I-10, is now covered with dense, predominantly native, annual forbs.

SUMMARY: This provisional mapping unit was utilized as a way to describe areas of low shrub and tree cover (<2% total) and with a dominant presence of native desert forbs that are not well described by other herbaceous types, such as *Chorizanthe rigida* – *Geraea canescens* Desert Pavement Sparsely Vegetated Alliance. These areas are often, but not always, associated with anthropogenic influence, especially clearing of land and alteration of hydrologic regime due to sheet flow diversion. In the Coachella Valley, as shown in the image above, common herbaceous species include desert dandelion (*Malacothrix glabrata*), combseed (*Pectocarya* spp.), and spurge (*Euphorbia* spp.). To the east of the Algodones Dunes, field teams encountered large areas of sparse shrub cover with a prominent native component of desert plantain (*Plantago ovata*), narrow-leaved johnstonella (*Johnstonella angustifolia*), and other native herbs. Exact species composition and relative covers may change from year to year, potentially shifting from dominant native forbs to dominant exotics, complicating efforts to accurately categorize this type. We recommend continuation of data collection to better understand this vegetation community.

PHOTOINTERPRETATION SIGNATURE: This provisional mapping unit is difficult to distinguish from herbaceous types with a dominant nonnative component. We have found that ground truthing is almost always necessary to identify a dominant native species composition. As with landscapes dominated by either live or recently-dead Sahara mustard (*Brassica tournefortii*) and/or Mediterranean grass (*Schismus* spp.), the ground appears to be covered by either a green or straw-colored haze. Desert Forb Provisional Mapping Units are often, but not always, found in areas with evidence of anthropogenic clearing, indicating that these herbaceous communities are sometimes the result of succession and may eventually be replaced by the original shrub community. As with most desert herbaceous vegetation types, presence of species is reliant upon unpredictable precipitation events, so percent cover varies between seasons and years.

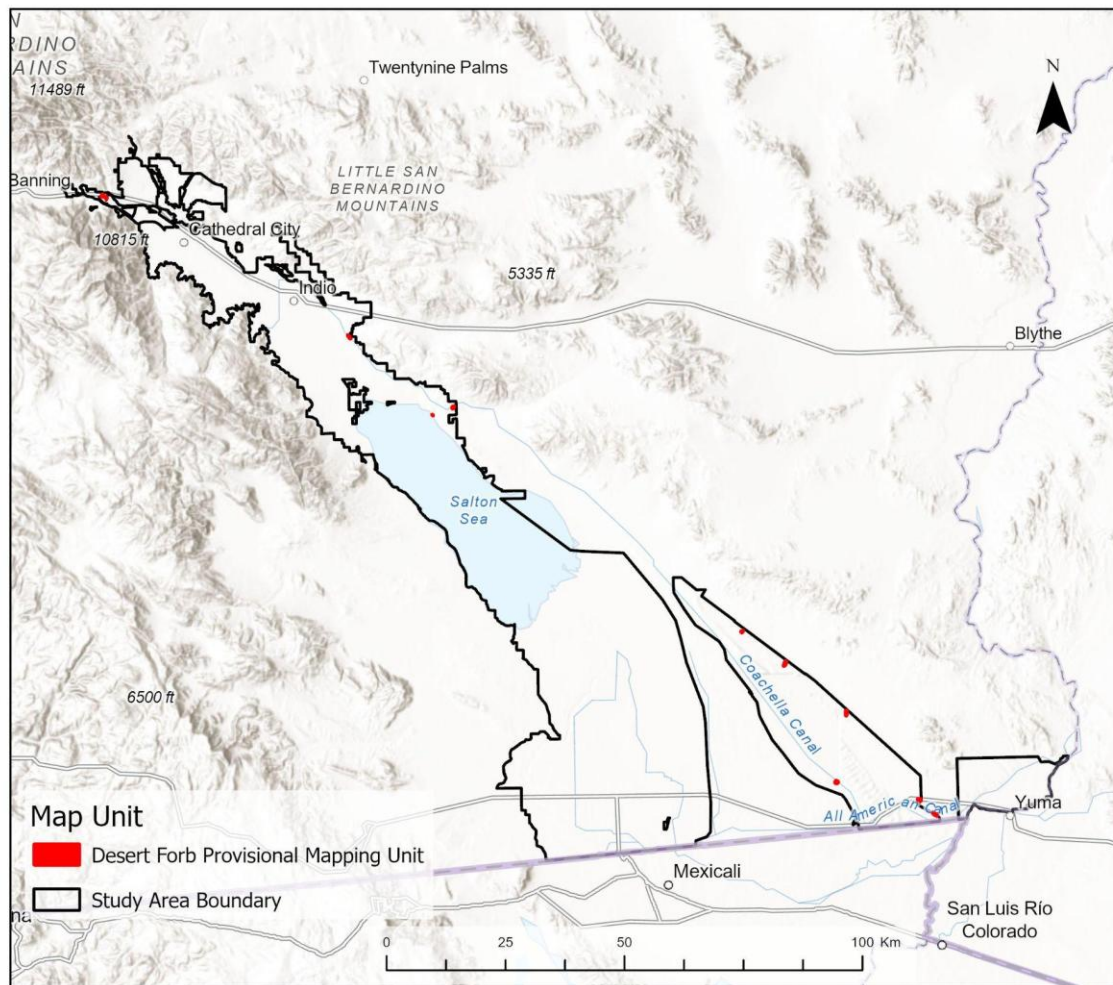


The field of annual plants and sparse shrub and tree cover shown within the polygon is composed primarily of native forbs at the time of surveying. There is clear evidence that shrubs have been cleared sometime in the past.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

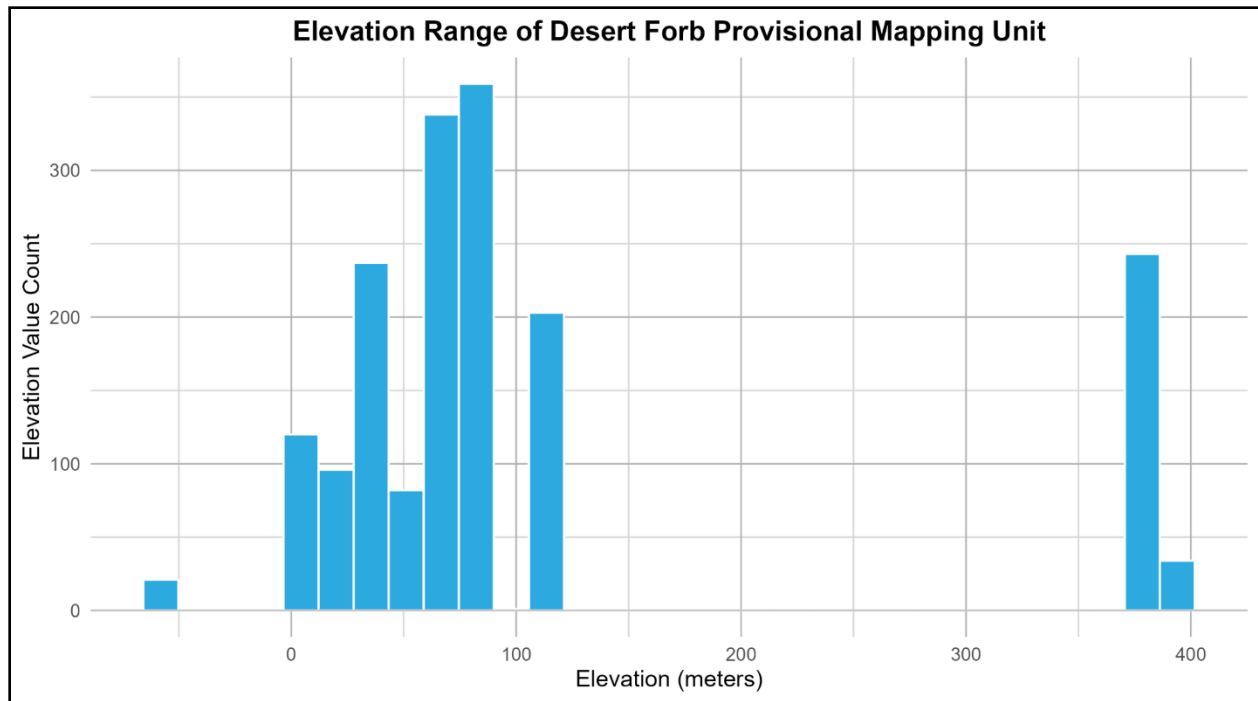
- Sparsely vegetated playa (Ephemeral annuals) Mapping Unit (6116) – The lack of significant shrub and tree cover in this Mapping Unit may lead to confusion with sparsely vegetated playas during years with minimal annual plant germination. In this case, geologic context can help separate the two.
- *Brassica tournefortii* – *Malcomia Africana* (Upland desert mustards) Semi-natural Stands (2331) – *Brassica tournefortii* is an extremely common exotic component of Colorado Desert landscapes. Photographic signatures are extremely difficult to tell apart, and ground-truthing is likely required to differentiate.
- *Bromus rubens* – *Schismus (arabicus, barbatus)* Semi-natural Stands (2332) – Similar to *Brassica tournefortii*, *Schismus* spp. are extremely abundant in the Colorado Desert and are difficult to differentiate from native herbaceous species using only imagery. Field surveys and local knowledge are required to differentiate.
- North American warm desert dunes and sand flats Group (6120) – The herbaceous species are difficult to differentiate, but geologic knowledge can separate the two (Desert Forb Provisional Mapping Units substrate will not be significantly aeolian).
- North American warm desert ruderal grassland Group (2340) – This Group is likely the easiest to confuse with the Desert Forb Provisional Mapping Unit due to overlap in geographic range and species composition. These are nearly impossible to tell apart via imagery, and surveys must be completed to determine the ratio of exotic versus native forbs.

Desert Forb Provisional Mapping Unit (6125)



PROJECT DISTRIBUTION: Field teams recorded this provisional mapping unit along the north side of the Coachella Valley subarea and primarily along the east side of the Algodones Dunes. In the Coachella Valley, it was consistently associated with either areas cleared of shrubby vegetation or in proximity to canal embankments or highway margins. In the Algodones Dunes subarea, this mapping unit was found amidst a matrix of active sand dunes, wash woodlands, and desert pavement. It was also found occasionally in close proximity to the I-8 freeway and the Coachella Canal.

Desert Forb Provisional Mapping Unit (6125)



Dicoria canescens – *Abronia villosa* – *Panicum urvilleanum* Alliance (6121)

***Dicoria canescens* – *Abronia villosa* – *Panicum urvilleanum* Alliance (6121)**

Mojave-Sonoran desert dunes

Rarity: G4S3.2

MMU: 10 acres

MMW: 101 meters

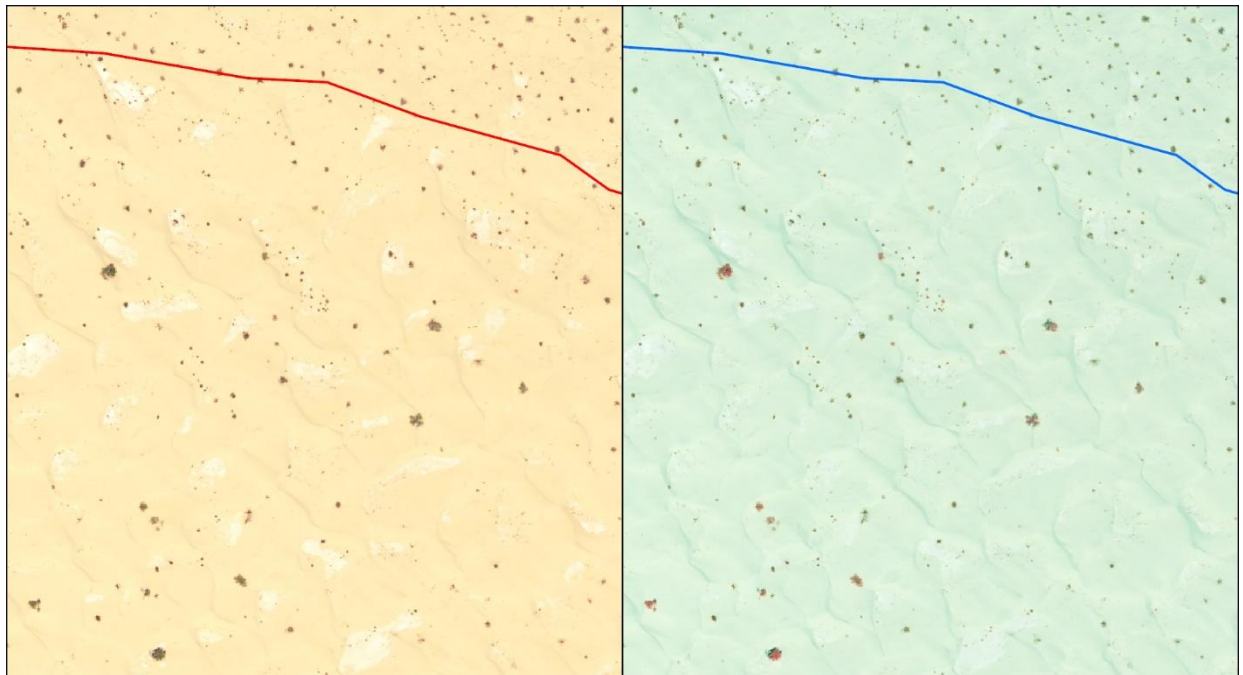


Sand dunes in the northern Algodones Dunes subarea, *Eriogonum deserticola* and annual herbs are sparse.

SUMMARY:

The *Dicoria canescens* – *Abronia villosa* – *Panicum urvilleanum* Alliance, while defined by herbaceous annual vegetation, is an Alliance that characterizes active and stabilized sand dunes and sand sheets in the Mojave and Colorado deserts of California. Soils are fine to moderately coarse sedimentary sand. Shrubs present in the canopy occur at <2% absolute cover and are generally dune related shrub species such as *Ephedra trifurca*, *Eriogonum deserticola*, and *Larrea tridentata*; *Psoralea argemone* and *Parkinsonia florida* can be present here as well. This Alliance was mapped on active sand dunes when no visible herbaceous layer was present due to variable precipitation, however when herbs were present *Dicoria canescens* and *Abronia villosa* generally co-occured with *Oenothera deltoides*, *Palafoxia arida*, and *Johnstonella angustifolia*.

PHOTOINTERPRETATION SIGNATURE: *Dicoria canescens* – *Abronia villosa* – *Panicum urvilleanum* Alliance photo signature generally shows little to no vegetation and is defined by active sand dunes. Active sand dunes and sand sheets are defined by the presence of piles or sheets of sand that are constantly shifting from wind. The wind creates evident patterns of wavy and crescent-like lines in the fine sand substrate. Sparse cover of vegetation may occur at the edges, within more stabilized areas of the dune systems, and shrubs may be scattered throughout the system at low cover. When psammophytic annual plants are present the sand sheets are peppered with a light pink texture, or greyish if the annuals are from a previous year.

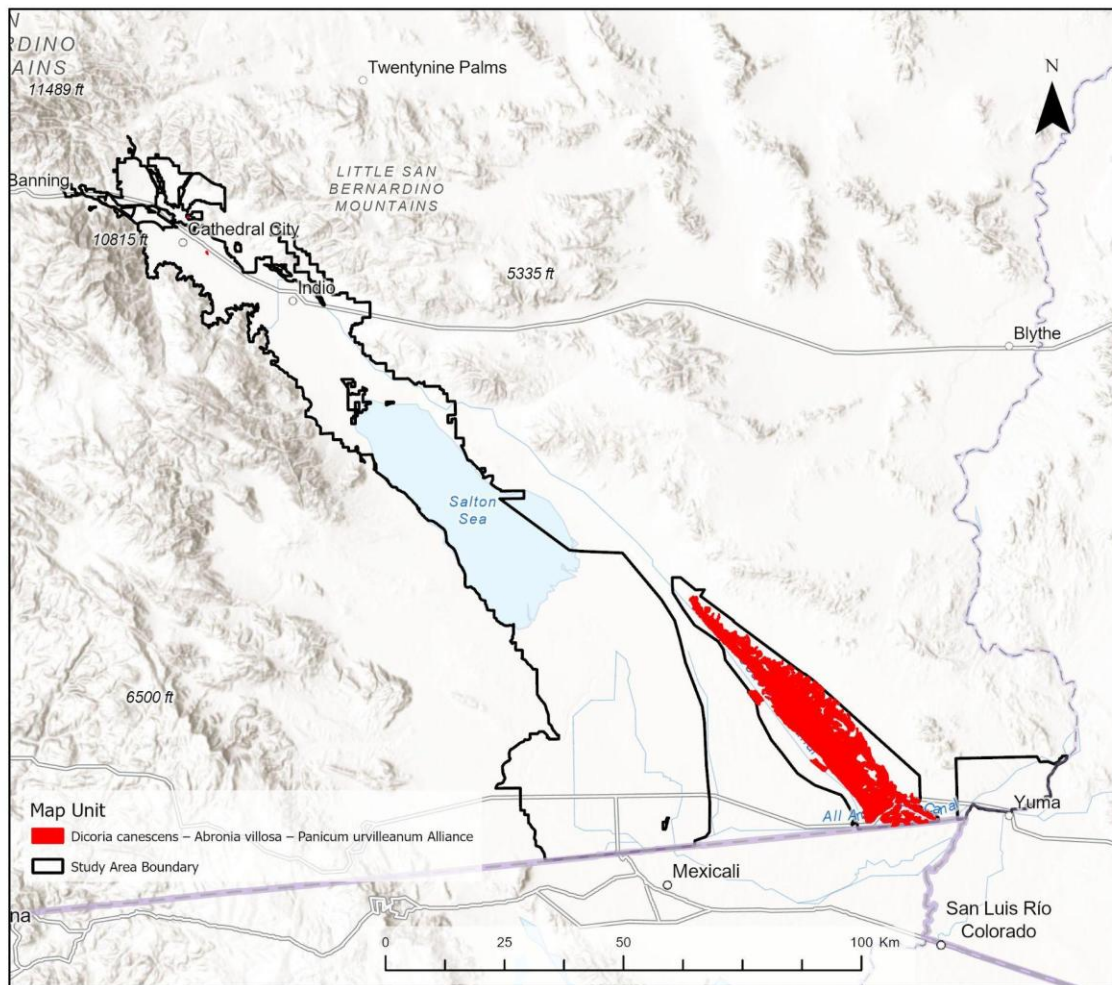


These photos demonstrate the sparse vegetation and active dune geology that help define this Alliance.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

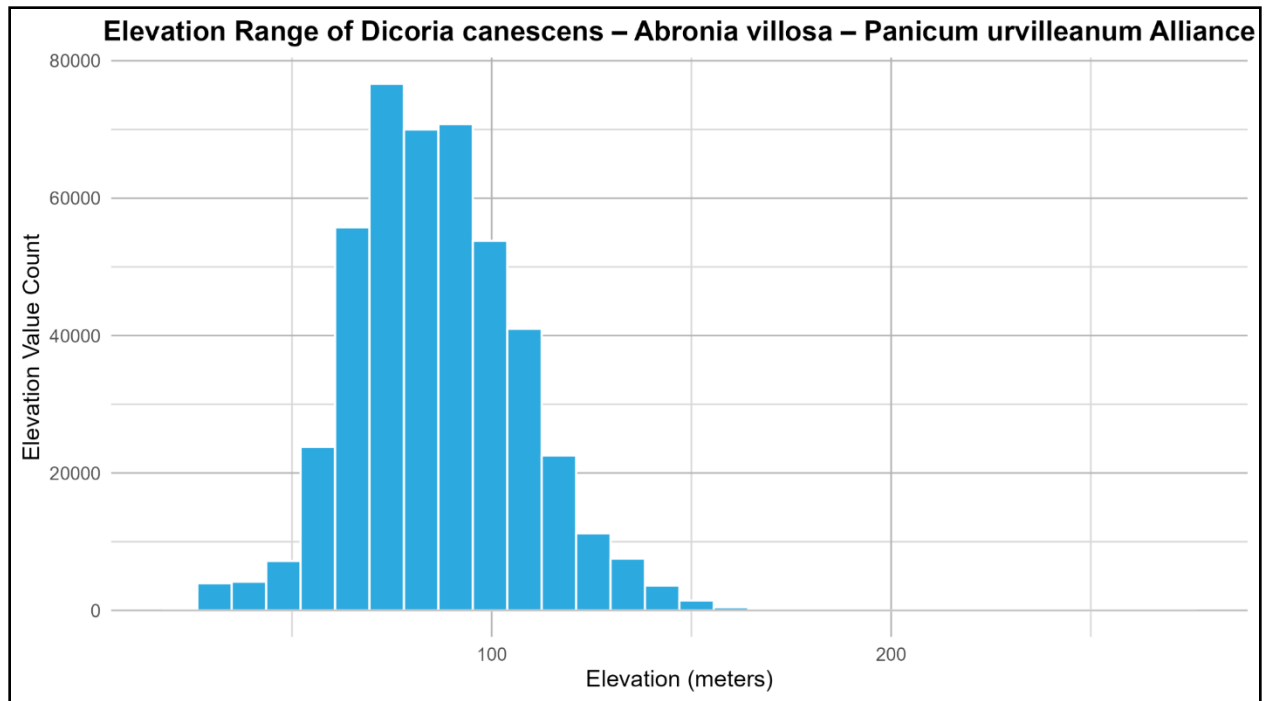
- *Eriogonum deserticola* Mapping Unit (6124) – *Eriogonum deserticola* can be difficult to pick out in imagery when it is not vegetated. Areas that reach the minimum absolute cover show more hummocks and texture around shrubs, especially in the leeward shelter of large dunes.
- *Ephedra californica* – *Ephedra trifurca* Shrubland Alliance (4211) – Stands of *Ephedra trifurca* occur on dune edges must meet >2% absolute cover. *E. trifurca* shrubs are evergreen and evident by their dense crowns with well-defined edges and often grow in rings. *E. trifurca* appears as dark green in imagery, and light to bright pink-orange on CIR.
- North American Warm Semi-Desert Dune & Sand Flats Group (6120) – this type was used where there was no apparent aeolian dune habitat and was distinguishable by the lack of visible relief in the sand or presence of psammophytic vegetation.
- *Larrea tridentata* Shrubland Alliance (4119) – these Alliances co-occur at margins of dunes and can look similar, *Larrea tridentata* must also reach >2% absolute cover and is darker in color.
- Anthropogenic Areas of Little or No Vegetation (9320) – sparsely vegetated sand sheets near urban areas in the Coachella Valley and in the Algodones could appear to be anthropogenically cleared. This type was used where there was evidence of clearing, such as tillage marks, or excessive OHV tracks that occur in the staging areas and campgrounds in the Algodones.
- *Psoralea argemone* Mapping Unit (4232) – *Psoralea argemone* occurs on the western edges of the active sand dunes in the Algodones. This species can be difficult to pick out from imagery as it is low-growing and light in color, making it blend in with the bright substrate. Where stands of *P. argemone* occur near sand dunes there is evidence of wind driven sand patterns that are often disrupted by faint pink shrubs are evident in CIR.

Dicoria canescens – Abronia villosa – Panicum urvilleanum Alliance (6121)



PROJECT DISTRIBUTION: Stands of *Dicoria canescens* – *Abronia villosa* – *Panicum urvilleanum* Alliance occur primarily in the Algodones Dunes subarea, with the exception of two polygons in the Coachella Valley subarea. These two stands were in central Coachella valley, one of which is associated with the Whitewater Floodplain, the other with the Indio Hills. This Alliance is common in the Coachella Valley, however much of the aeolian dunes that support this Alliance were mapped in a previous mapping effort (Sweet et al. 2019). In the Algodones Dunes, this Alliance covers the majority of the central dune system and is noticeably denser outside of the Wilderness boundaries, where OHV vehicle activity is common, resulting in a much lower density of shrubs.

Dicoria canescens – Abronia villosa – Panicum urvilleanum Alliance (6121)



Distichlis spicata – (*Juncus cooperi* – *Frakenia salina*) Interior Herbaceous Alliance (3726)

***Distichlis spicata* – (*Juncus cooperi* – *Frakenia salina*) Interior Herbaceous Alliance (3726)**

Saltgrass – Cooper's rush – Alkali heath Interior Herbaceous Alliance

Rarity: GNRS4

MMU: 0.5 acres

MMW: 22 meters



This particularly dense stand of *Distichlis spicata* shows the mostly-dead crown common with this species. *Tamarix* spp. is present in the background at high density.

SUMMARY: Mappers assigned *Distichlis spicata* Alliance when this species had >2% absolute cover and was a characteristic and/or dominant to co-dominant species, excluding shrubby *Tamarix* species which mappers only assigned to the *Tamarix* Alliance (1432) if *Tamarix* had >60% relative cover. This species occurred in highly saline soils, usually within the lakebed silt and clay soils of the Salton Sink. It usually coincided with standing water or permanently saturated soils associated with the shores of the Salton Sea, playas, rivers/creeks, agricultural drainage ditches, and flood basins. This species forms small clumps to dense mats via rhizomes and regularly dies back in response to seasonal heat or drought. Within this mapping area, it was often found lining the margins of dense stands of shrubby *Tamarix* species.

Distichlis spicata – (*Juncus cooperi* – *Frakenia salina*) Interior Herbaceous Alliance (3726)

PHOTOINTERPRETATION SIGNATURE: When the aboveground growth is mostly alive, this species shows as a muted, soft, pale dark green color, often with at least some patches of dead growth which shows as a yellow straw-like color. In CIR, the color ranges from a soft pink to a vibrant red. Abundant salt is usually seen on nearby patches of open soil. Dormant stands appear as a soft, fairly uniform straw color.



This stand of *Distichlis spicata* along the south shore of the Salton sea shows a relatively vigorously-growing, dense mat following the margins of dense *Tamarix*. The exposed white soil is an extremely salty lakebed playa.

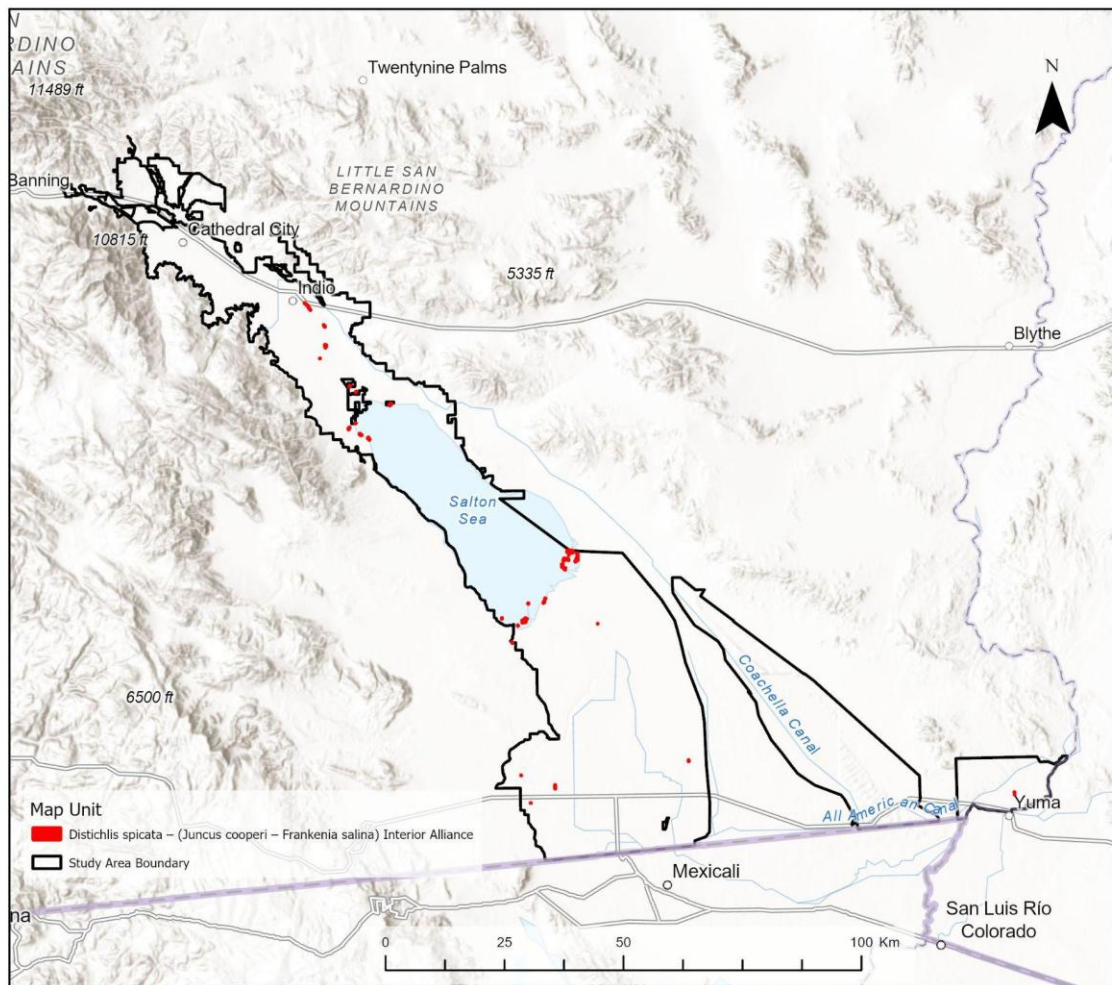
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Brassica tournefortii* – *Malcolmia africana* Semi-natural Stands (2331) – Both of these herbaceous stands were mapped even when recently dead, and when dead they have a similar straw color. However, knowledge of soil type and geographic location (*Brassica tournefortii* is found primarily in upland sand and alluvial substrates, while *Distichlis spicata* is found on fine, lakebed, alkaline substrate) can usually differentiate them. Also, *Brassica tournefortii* grow as individual plants, while *Distichlis spicata* form rhizomatous clumps often apparent from imagery.
- *Typha* (*angustifolia*, *domingensis*, *latifolia*) Herbaceous Alliance (3416) – These types both share the soft texture typical of herbaceous types and can both grow in similar habitat, but the true color and CIR coloration differs between these types sufficiently to separate them in most cases. Swaths of *Distichlis spicata*

Distichlis spicata – (*Juncus cooperi* – *Frankenia salina*) Interior Herbaceous Alliance (3726)

normally show an obvious mottling of colors from brown to various shades of green to straw color, whereas stands of *Typha* sp. are usually more uniform in coloration. Also, *Typha* is a significantly taller herb which is usually apparent on imagery from the presence of shadows and a mound or wave-like texture across the stand.

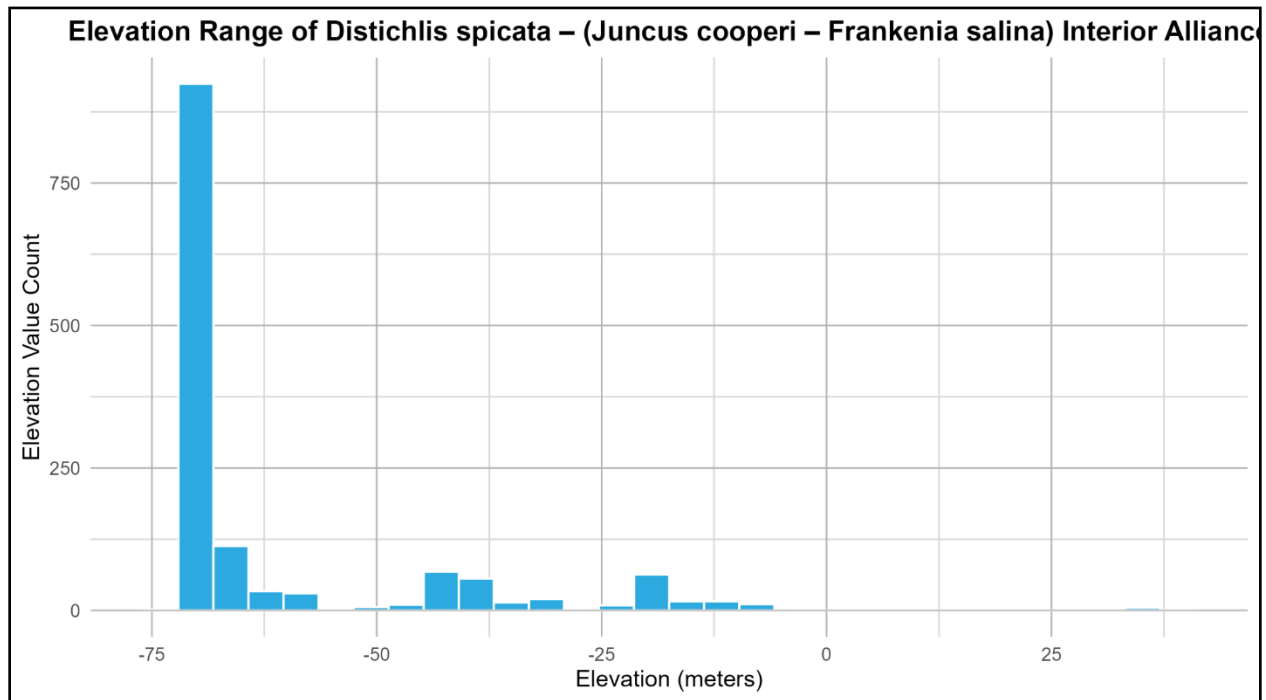
- *Cynodon dactylon* – *Crypsis* spp. – *Paspalum* spp. Herbaceous Alliance (3716) – Coloration of stands of *Cynodon dactylon* and *Distichlis spicata* both vary widely, however *Cynodon dactylon* typically presents a more bright, vibrant red color in CIR, whereas *Distichlis spicata* is a darker, muddier red.



PROJECT DISTRIBUTION: Mappers delineated this vegetation type in areas of silty, alkaline soil that receive higher than normal moisture, including in the Whitewater Storm Channel and agricultural areas of the Coachella Valley subarea, throughout the large riparian areas along the south shore of the Salton Sea, and within agricultural drainages

Distichlis spicata – (*Juncus cooperi* – *Frankenia salina*) Interior Herbaceous Alliance
(3726)

in the Winterhaven subarea. Mappers and field teams did not identify this Alliance in the Algodones Dunes subarea.



Encelia farinosa Shrubland Alliance (4114)

***Encelia farinosa* Shrubland Alliance (4114)**

Brittle bush scrub

Rarity: G5S4

MMU: 10 acres

MMW: 101 meters

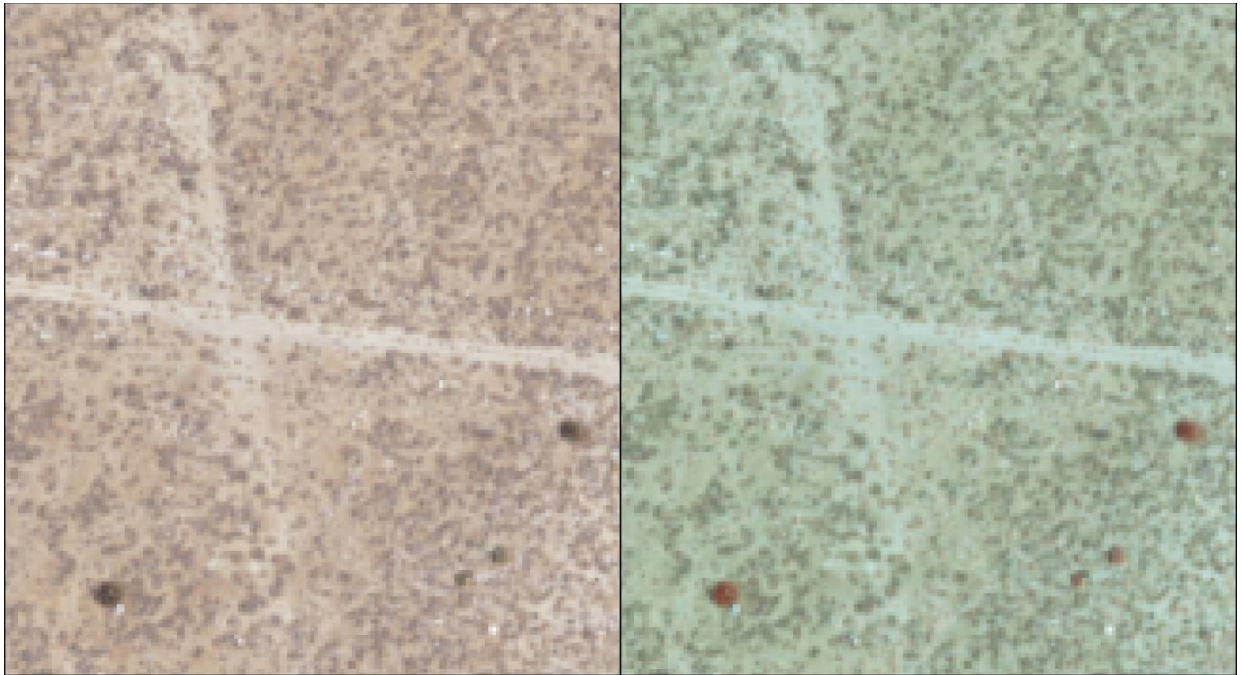


This gentle alluvial slope leading from Mission Creek in western Desert Hot Springs is strongly dominated by *Encelia farinosa*.

SUMMARY: *Encelia farinosa* is dominant with at least 2% absolute cover, with no other woody shrubs with equal or higher cover. Scattered *Larrea tridentata* may be present, but never codominant. *Ambrosia dumosa* is sometimes codominant. While *Encelia farinosa* is a widespread species found across much of the upland habitat within this mapping area, it is most often codominant or subdominant with *Larrea tridentata* in which case it is mapped to a different Alliance. Within this mapping area, this Alliance is most common on gently sloping rock/gravel bajadas below San Gorgonio Mountain in the western Coachella Valley, as well as steep, rocky slopes within the Santa Rosa and Little San Bernardino Mountains.

Encelia farinosa Shrubland Alliance (4114)

PHOTOINTERPRETATION SIGNATURE: *Encelia farinosa* are small, round, pale-green shrubs that are often difficult to see on imagery. Photosignature can also vary year-to-year or based on locality due to precipitation patterns, as this plant is drought deciduous and can appear leafless and dead for months at a time when conditions are poor. When flush with leaves, plants appear as a very pale green in true color and pale pink in CIR.

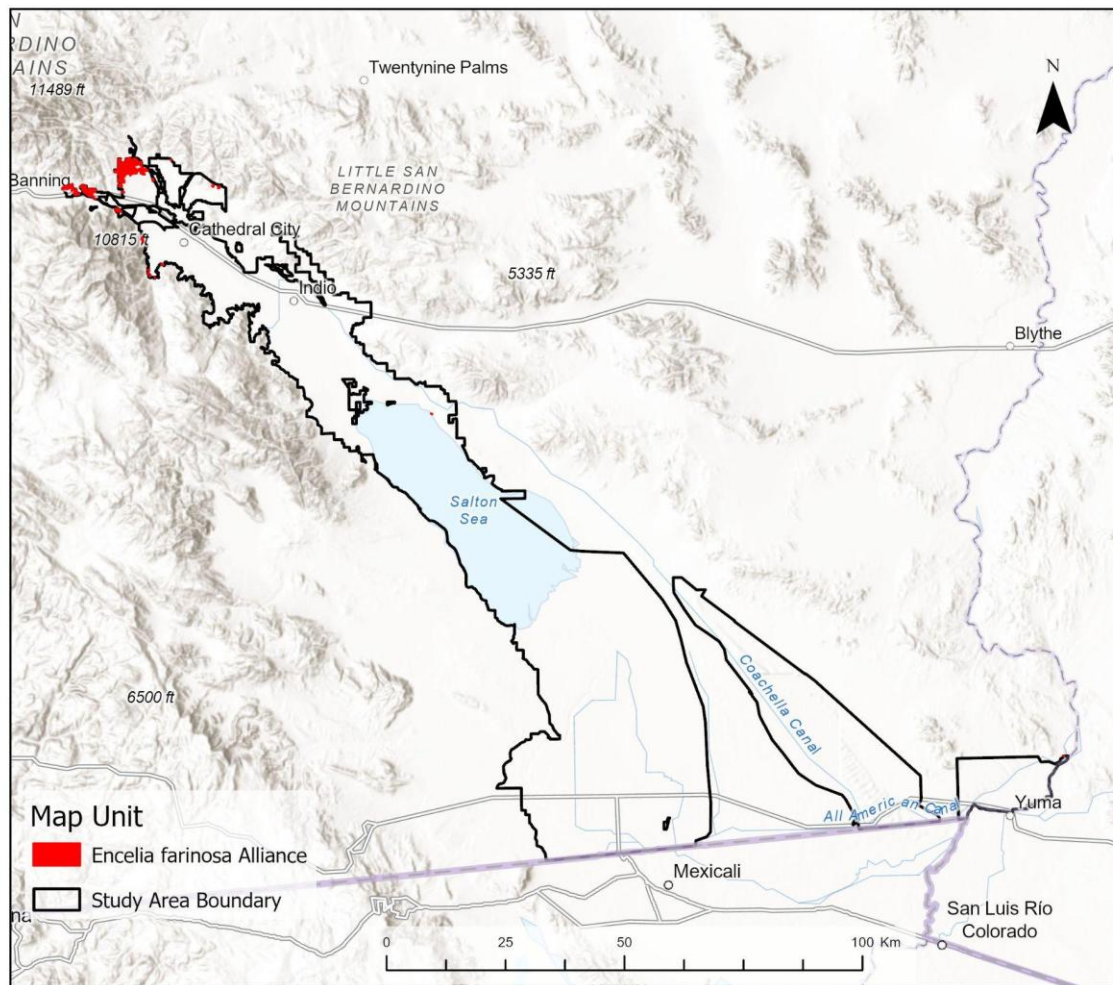


Encelia farinosa are often hard to discern on the landscape, as seen here in a dense stand in the community of Whitewater in the western Coachella Valley. The larger, darker shrubs are *Larrea tridentata*. The gray blotches are likely long-dead shrubs and forbs.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

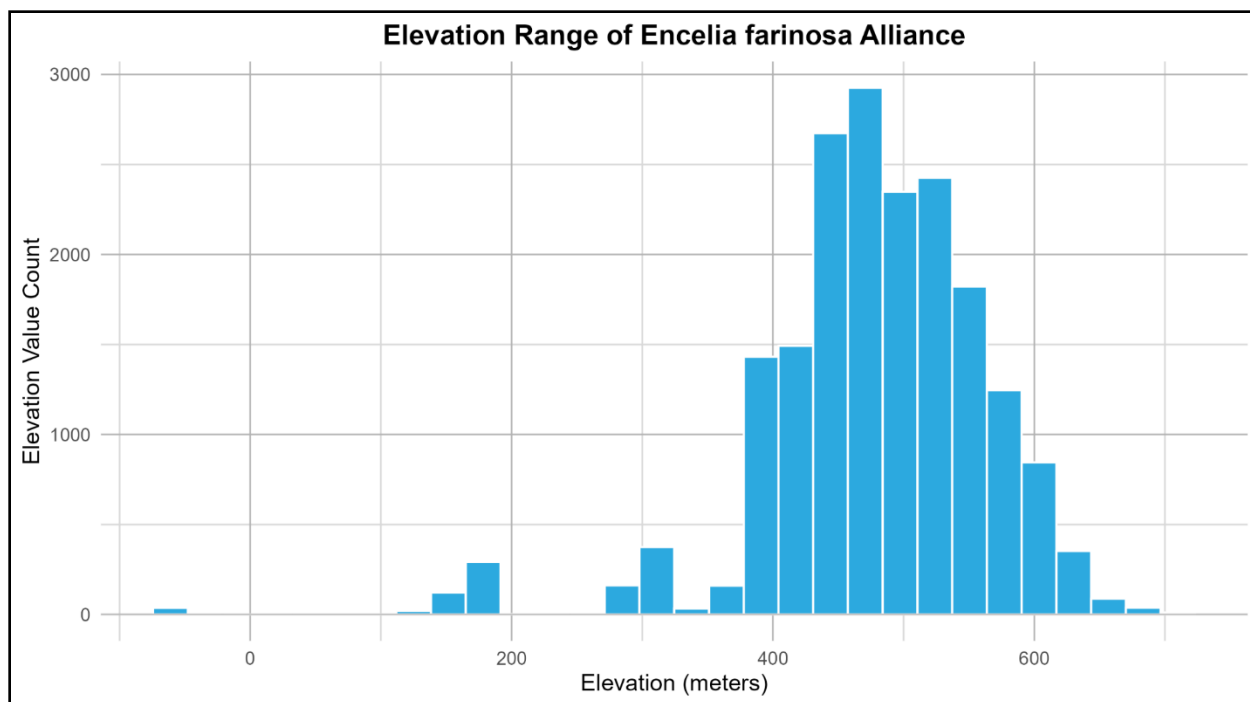
- *Ambrosia dumosa* Shrubland Alliance (4111) – both of these species are small, roughly round, and pale-green when leafed out. They also both occupy similar habitats (rocky to coarse sand bajadas and hillsides) and are similarly drought deciduous. The perfectly round shape of large, leafed-out *Encelia farinosa* is distinguishable from the more amorphous form of *Ambrosia dumosa*, but smaller plants and plants that are dormant likely require field verification to differentiate.
- *Ambrosia salsola* – *Bebbia juncea* Shrubland Alliance (7211) – *Ambrosia salsola* and *Bebbia juncea* have a round shape and size similar to *Encelia farinosa*, however the color of *Ambrosia salsola* (bright yellow-green to gold/straw color) and *Bebbia juncea* (darker, muted green) can be useful for separation. Also, these species tend to follow washes or bajada rivulets, whereas *Encelia farinosa* is found primarily in upland landscapes.

Encelia farinosa Shrubland Alliance (4114)



PROJECT DISTRIBUTION: *Encelia farinosa* Alliances are relatively uncommon across the mapping area, however they are quite dominant on the bajadas and hillsides in the far-western Coachella Valley near the community of Whitewater and along Highway 62 in western Desert Hot Springs. Mappers delineated scattered stands along the base of the Santa Rosa and Little San Bernardino Mountains in the Coachella Valley subarea, as well as one stand in the Winterhaven subarea along the rocky base of the Chocolate Mountains. Mappers did not delineate this Alliance in the Algodones Dunes or Imperial Valley subareas.

Encelia farinosa Shrubland Alliance (4114)



Ephedra californica – *Ephedra trifurca* Shrubland Alliance (4211)

***Ephedra californica* – *Ephedra trifurca* Shrubland Alliance (4211)**

California joint fir – longleaf joint-fir scrub Alliance

Rarity: G5S4

MMU: 10 or 5 acres (see Mapping Considerations section)

MMW: 101 or 71 meters (see Mapping Considerations section)



The midground shows large dark green *Ephedra trifurca* in the Algodones Dunes.

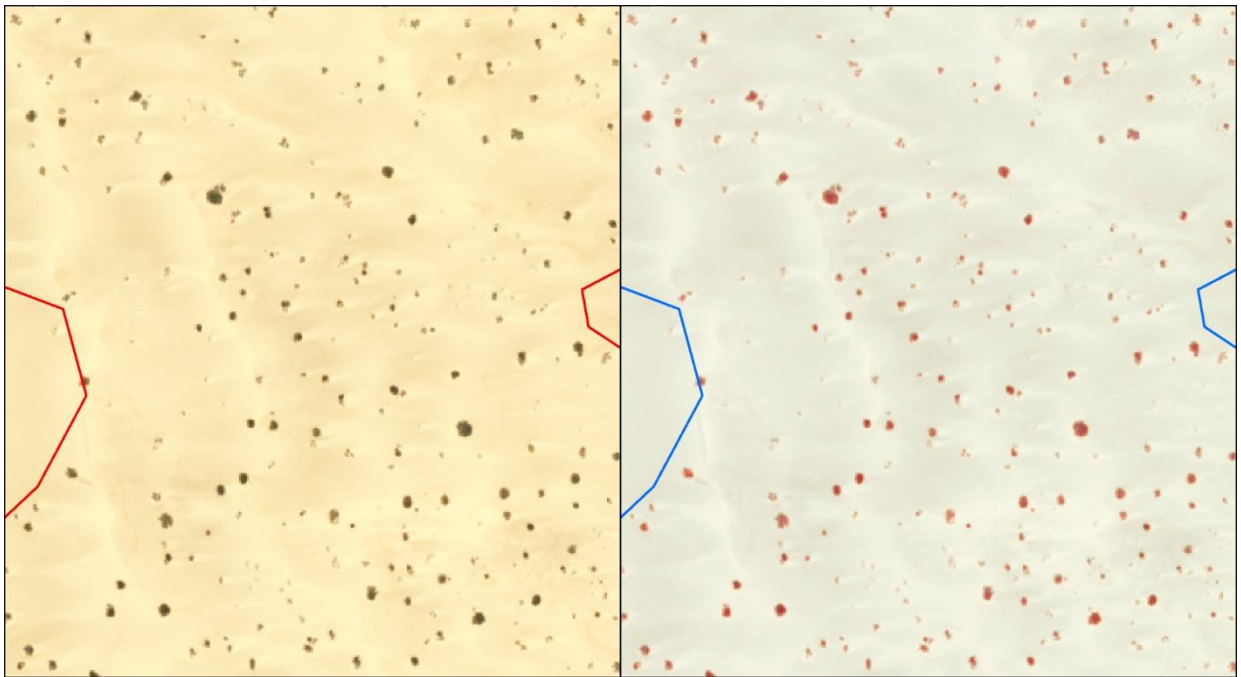
Ephedra californica – *Ephedra trifurca* Shrubland Alliance (4211)



Ephedra californica co-dominating with *Simmondsia chinensis* with herbaceous cover.

SUMMARY: *Ephedra californica* – *Ephedra trifurca* shrublands are associated with well drained and intermittently flooded areas within the Colorado desert. *Ephedra californica* is primarily found in broad washes, wash benches, arroyos, and alluvial fans with coarse-grain sands. Stands were mapped to this Alliance where *Ephedra* was dominant or co-dominant in the shrub canopy with at least 2% absolute cover. Here, *E. californica* occurs in dense shrubland stands, co-dominating with *Simmondsia chinensis* and *Ambrosia salsola*, a diversity of other shrubs at low cover, and moderate to high cover of herbaceous annuals. *Ephedra trifurca* is associated with open sand dunes, sand sheets, and fine-grained sedimentary substrates. Co-dominating species include *Larrea tridentata* and *Eriogonum deserticola* and co-occurring with *Croton wigginsii* and *Dicoria canescens*, with interannual variability of herbaceous annuals, varying from no cover to moderate cover.

PHOTOINTERPRETATION SIGNATURE: *Ephedra californica* associated shrublands occur in moderately dense stands, usually with a diversity of other shrub species. The rocky alluvial fan substrate can add texture to the photo-signature that falsely appears as smaller shrubs in the understory. *Ephedra trifurca* shrublands occur in open and low to moderately dense stands with few other shrubs in the understory. *Ephedra trifurca* creates hummocks within sand dunes; imagery generally shows these as triangular tracks on the leeward side of the prevailing wind. Both *Ephedra* species have a dense crown with well-defined but porous edges and grow in an evenly spaced clonal ring pattern. Shrubs are medium-large and appear dark green in imagery, and light to bright pink-orange on CIR.



These photos show a relatively dense stand of *Ephedra trifurca* on the aeolian sand fields of the Algodones Dunes.

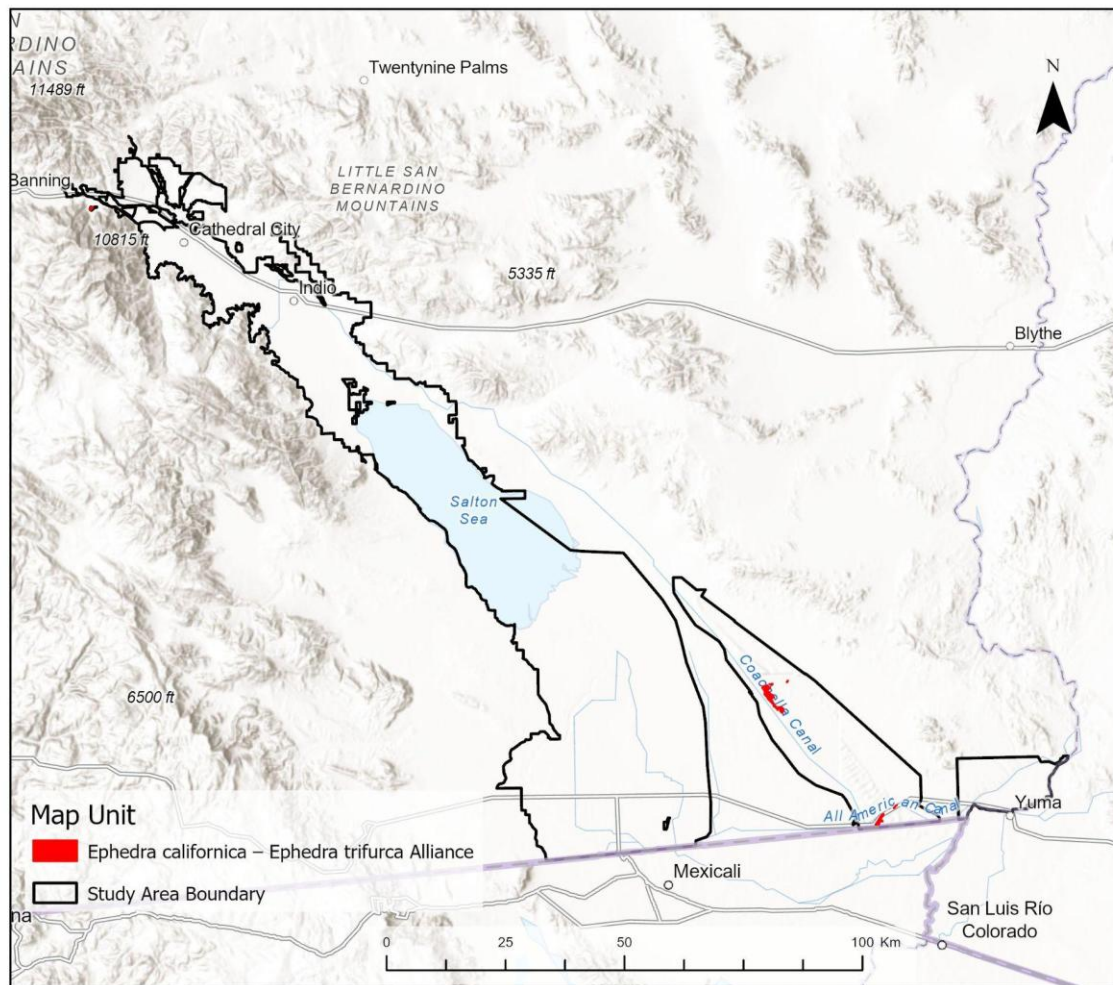
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Eriogonum deserticola* Mapping Unit (6124) – *Eriogonum deserticola* occupies similar areas in the Algodones, co-occurs with *Ephedra trifurca*, and has a similar photo-signature. *Eriogonum deserticola* is smaller with a less well-defined, dense canopy.
- *Larrea tridentata* Shrubland Alliance (4119) – co-occurs at margins of dunes and can look similar. *Larrea tridentata* is darker and the crown shape is more rounded.
- *Larrea tridentata* – *Ambrosia dumosa* Shrubland Alliance (4115) – Similarly to *Larrea tridentata* Alliance, 4115 occurs at dune edges, whereas *Ephedra trifurca* can tolerate more active dune systems.
- *Dicoria canescens* – *Abronia villosa* – *Panicum urvilleanum* Herbaceous Alliance (6121) – occurs adjacent in active dune systems. This Alliance is mainly differentiated from *Ephedra californica* – *Ephedra trifurca* Alliance by the sparse (<2%) shrub cover.
- *Senegalia greggii* – *Hyptis emoryi* – *Justicia californica* Shrubland Alliance (4226) – this Alliance occurs in the xeric washes below the benches where *Ephedra californica* stands occur. *Senegalia greggii* crowns are larger with more porosity.

MAPPING CONSIDERATIONS:

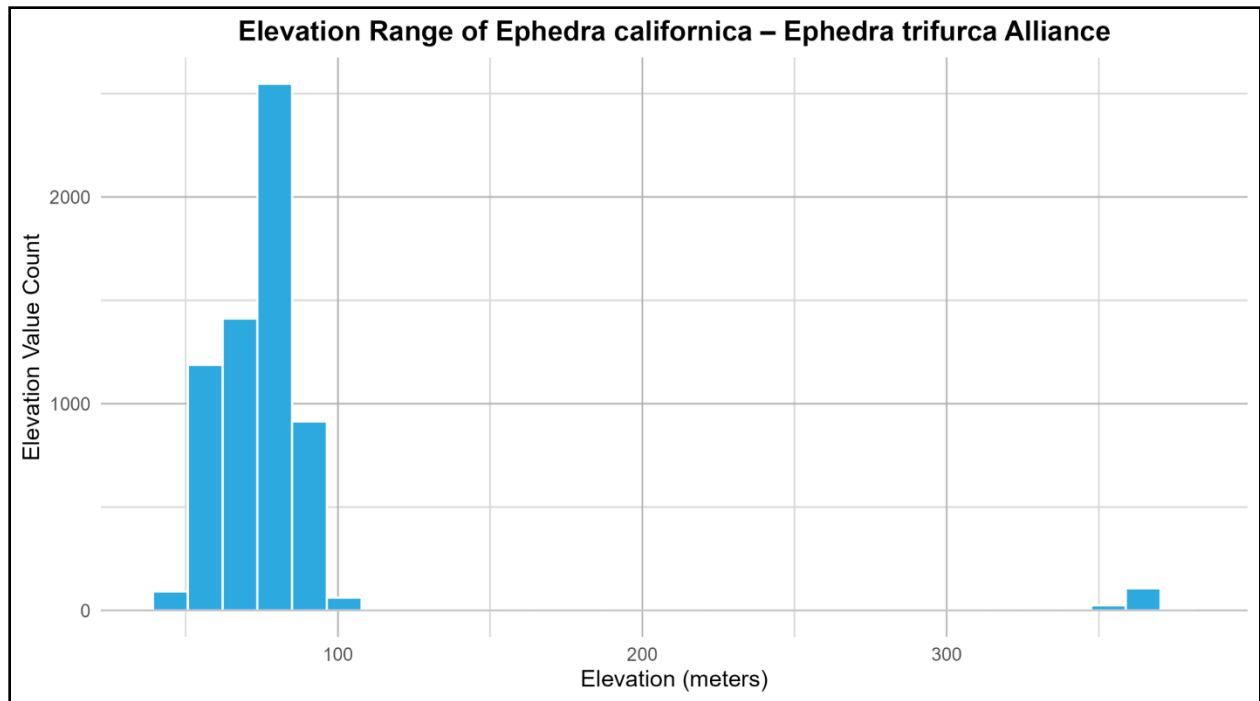
- *Ephedra californica* can be associated with washes or desert riparian areas as well as upland landscapes, so depending on the setting, mappers assigned this Alliance at a 5 acre MMU/71 meter MMW if the stand is primarily in a wash, or at a 10 acre MMU/101 meter MMW if it is primarily upland.

Ephedra californica – *Ephedra trifurca* Shrubland Alliance (4211)



PROJECT DISTRIBUTION: *Ephedra californica* – *Ephedra trifurca* shrublands were mapped in both the Coachella Valley sub area and the Algodones Dunes subarea. In the Coachella Valley, two stands were mapped as this Alliance in the far western section in Snow Creek. These stands were defined by the presence of *E. californica* and occurred in the large alluvial fan, bordering a xeric wash that experiences intermittent flooding from one of the major watersheds on the north side of Mount San Jacinto. Where this Alliance was mapped in the Algodones subarea, the defining species was *E. trifurca*. Stands were primarily mapped on the western side of the Algodones on stabilized sand sheets and rarely within the active dunes.

Ephedra californica – Ephedra trifurca Shrubland Alliance (4211)



Ericameria paniculata Alliance (4213)

***Ericameria paniculata* Alliance (4213)**

Black-stem rabbitbrush scrub

Rarity: G4S3

MMU: 0.5 acres

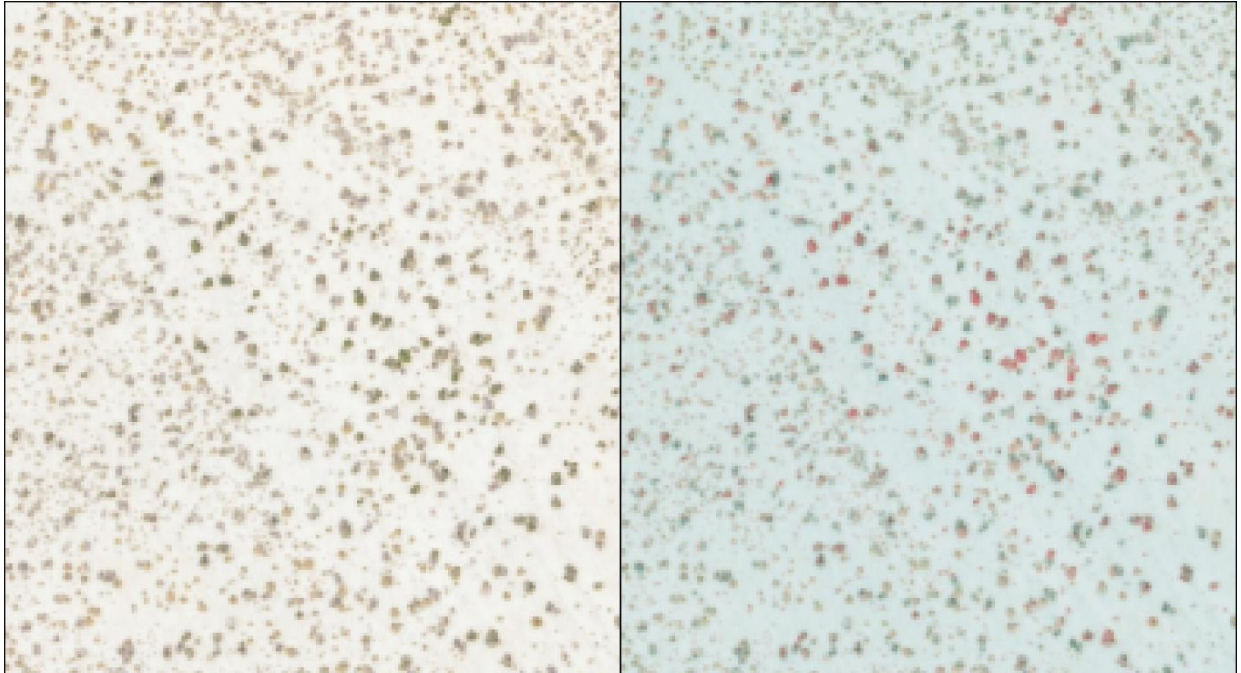
MMW: 22 meters



This stand of *Ericameria paniculata* (bright green shrub) was mapped in the Painted Hills community on the west side of Highway 62 in the Coachella Valley subarea.

SUMMARY: This evergreen, potent-smelling shrub is found in dry washes, roadside ditches, and flood control basins that receive higher soil moisture than surrounding upland areas. Mappers assigned this Alliance when *Ericameria paniculata* reached >5% absolute cover and was the dominant shrub species. Field teams found this Alliance only in the western Coachella Valley where this species cooccurs with other wash-associated shrubs such as *Bebbia juncea*, *Ambrosia salsola*, and *Lepidospartum squamatum*.

PHOTOINTERPRETATION SIGNATURE: This medium-sized evergreen shrub appears green-yellow in true color and bright light red in CIR. Individuals have an irregular crown shape with a soft texture and are usually well-spaced in washes or other areas that receive higher than average surface runoff, although a small number of individuals may sometimes appear to grow together.



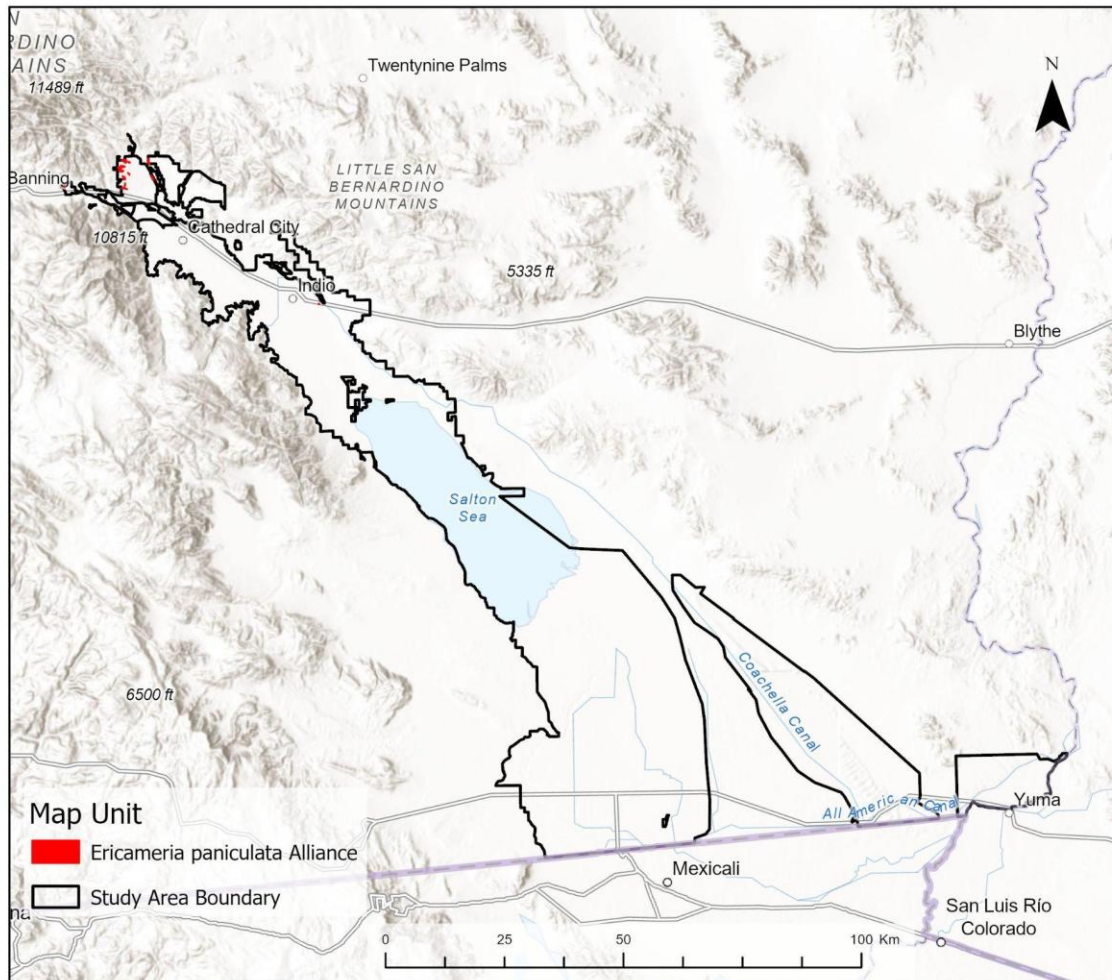
This relatively expansive stand of *Ericameria paniculata* covers a broad wash/alluvial fan in the Painted Hills community of the Coachella Valley. The stand in this picture is part of a larger polygon whose boundaries are not shown.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Ambrosia salsola* – *Bebbia juncea* Shrubland Alliance – These species all occur in similar dry wash habitat, but mappable stands of *Ericameria paniculata* are restricted to the western portion of the Coachella Valley, whereas *Ambrosia salsola* – *Bebbia juncea* is found over a wider area. The color of *Ericameria paniculata* appears brighter in both true color and CIR, and *Ambrosia dumosa* often has a distinct golden mottled appearance.
- *Psoralea schottii* Mapping Unit (4231) – This species has paler coloration and is not restricted to washes or similar habitat, although it is often densest in these areas. Additionally, *Psoralea schottii* stands were not mapped in the far-western Coachella Valley.
- *Lepidospartum squamatum* Shrubland Alliance (4212) – These shrubs occupy the same wash-bottom habitat types and often mix in the same stands, however, within this mapping area, *Lepidospartum squamatum* appears to favor natural,

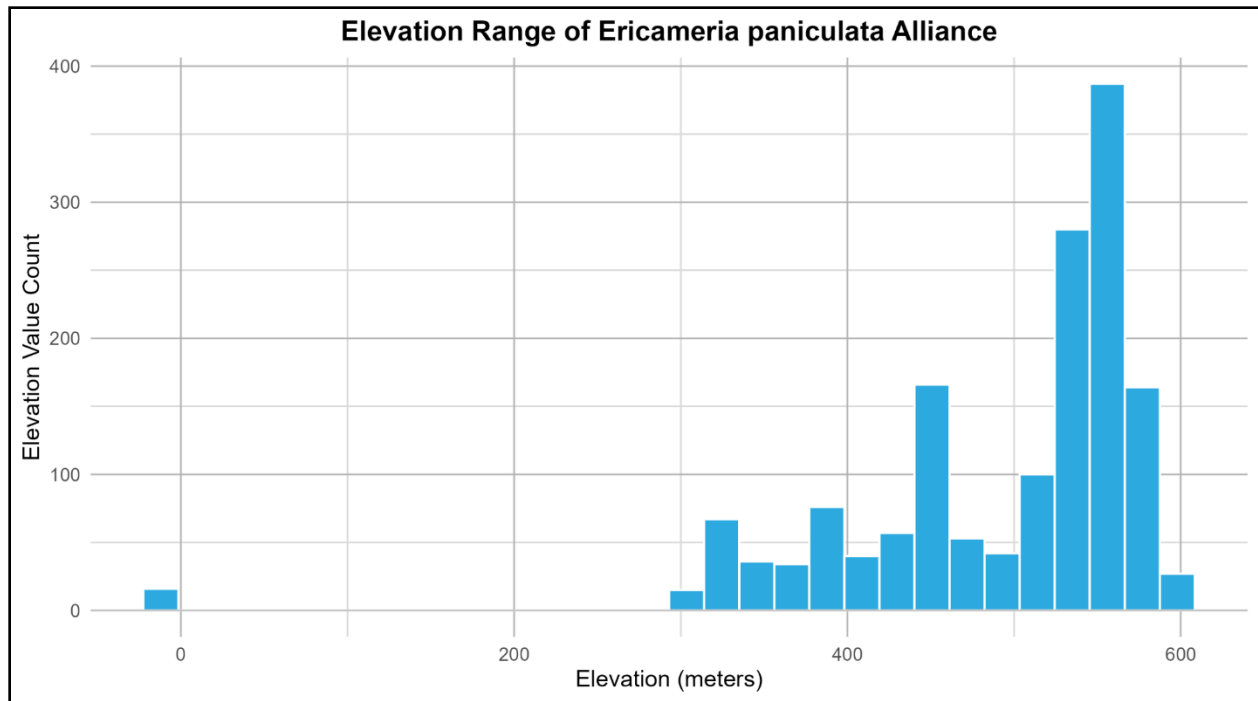
Ericameria paniculata Alliance (4213)

higher-energy washes in the higher-elevation, far-west portion of the Coachella Valley near the community of Whitewater, while *Ericameria paniculata* will also occupy anthropogenic features such as roadside ditches and floodwater basins. *Lepidospartum squamatum* may have a slightly deeper red color when viewed with CIR, however ground verification may be required.



PROJECT DISTRIBUTION: Mappers delineated this Alliance only in the western Coachella Valley between the western margin of the Desert Hot Springs urban area and the community of Painted Hills just west of Highway 62. Within this area, stands occupied natural washes and adjacent benches, roadside ditches, and a long-abandoned residential development.

Ericameria paniculata Alliance (4213)



Eriogonum deserticola Mapping Unit (6124)

***Eriogonum deserticola* Mapping Unit (6124)**

Colorado desert buckwheat Mapping Unit

MMU: 10 acres

MMW: 101 meters



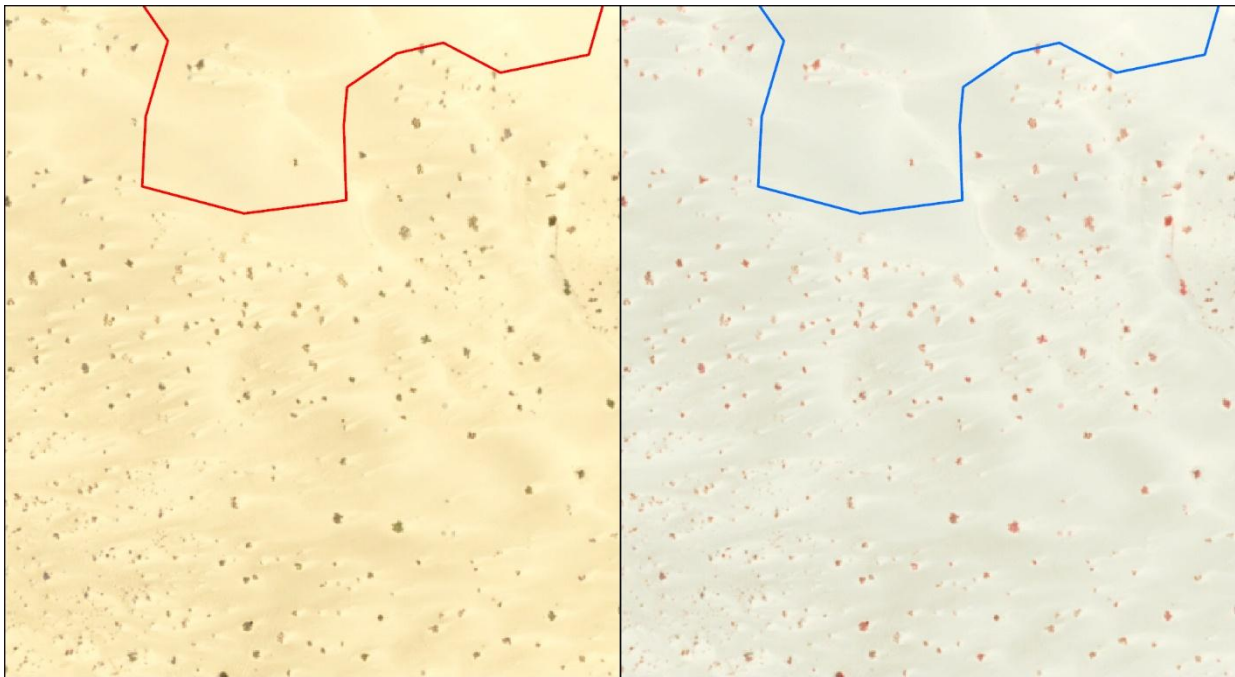
Eriogonum deserticola is the dominant shrub in this stand within the north-eastern Algodones Dunes.

SUMMARY: The *Eriogonum deserticola* Mapping Unit is defined by the presence of *Eriogonum deserticola* at greater than 2% absolute cover. This type has not formally been described in the Manual of California Vegetation as it is relatively restricted to the southeastern Imperial County dunes, particularly the Algodones. In previous mapping efforts, such as the DRECP, *Eriogonum deserticola* would have occurred in western Imperial County, however the species would not have been at a strong dominance that would have warranted a type description. In the Algodones Dunes, however, *Eriogonum deserticola* occurs as the dominant species in stands throughout the region and generally occupies the edges of the main active dunes, while not quite reaching the desert floor ecotone. *Eriogonum deserticola* co-occurs with *Larrea tridentata*, *Ephedra trifurca*, and the endemic Algodones Dunes sunflower (*Helianthus niveus* ssp. *tephrodes*) and is often adjacent to the active dune type *Dicoria canescens* – *Abronia villosa* – *Panicum urvilleanum* Alliance (6121). Psammophyte annuals such as *Dicoria canescens*, *Oenothera deltoides*, *Johnstonella angustifolia*, and *Abronia villosa* as well

Eriogonum deserticola Mapping Unit (6124)

as invasive species such as *Brassica tournefortii* and *Salsola tragus* occur in the herbaceous layer when precipitation is favorable. *Eriogonum deserticola* is the preferred host plant of the rare endemic root holoparasite; *Pholisma sonora*.

PHOTOINTERPRETATION SIGNATURE: *Eriogonum deserticola* is drought deciduous and can be difficult to pick out on the landscape as it can easily blend into the backdrop of the light dune sand, or the light pink of the CIR signature can be difficult to distinguish from psammophytic annual plants. True color imagery shows *Eriogonum deserticola* as brown to olive-green. *Eriogonum deserticola* has a sparse, porous crown, often taking a sprawling and inconsistent shape due to the extreme wind and shifting dune environment. Other shrubs that can tolerate the shifting dunes sands, such as *Ephedra trifurca* and *Larrea tridentata*, appear to be larger, individually more dense (less porous), and darker in color.



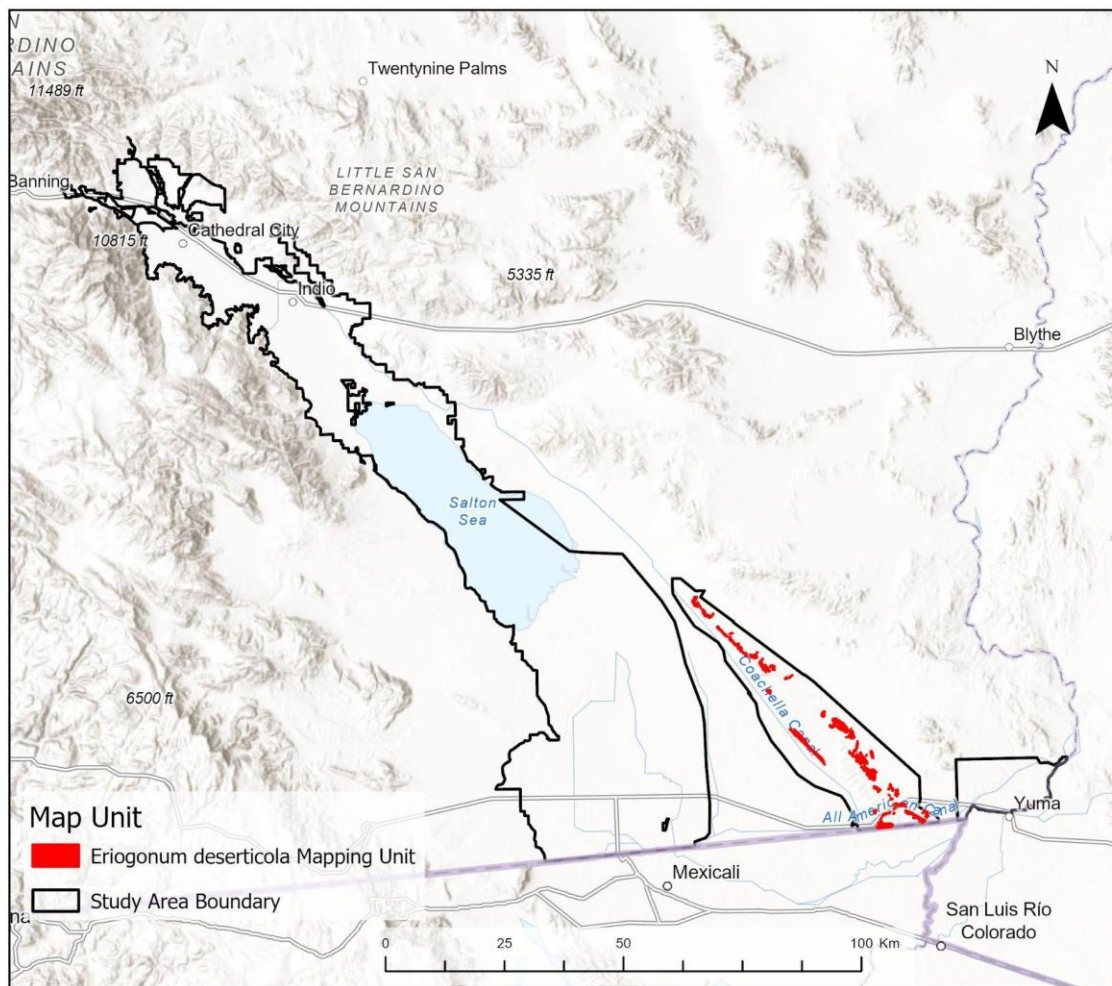
This stand of *Eriogonum deserticola* occurs on an aeolian field in the Algodones Dunes subarea.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Dicoria canescens* – *Abronia villosa* – *Panicum urvilleanum* Herbaceous Alliance (6121) – This Alliance occupies the more open and active dunes. *Eriogonum deserticola* might be present in small patches and scattered throughout this type, but it will overall be less than 2% absolute cover.

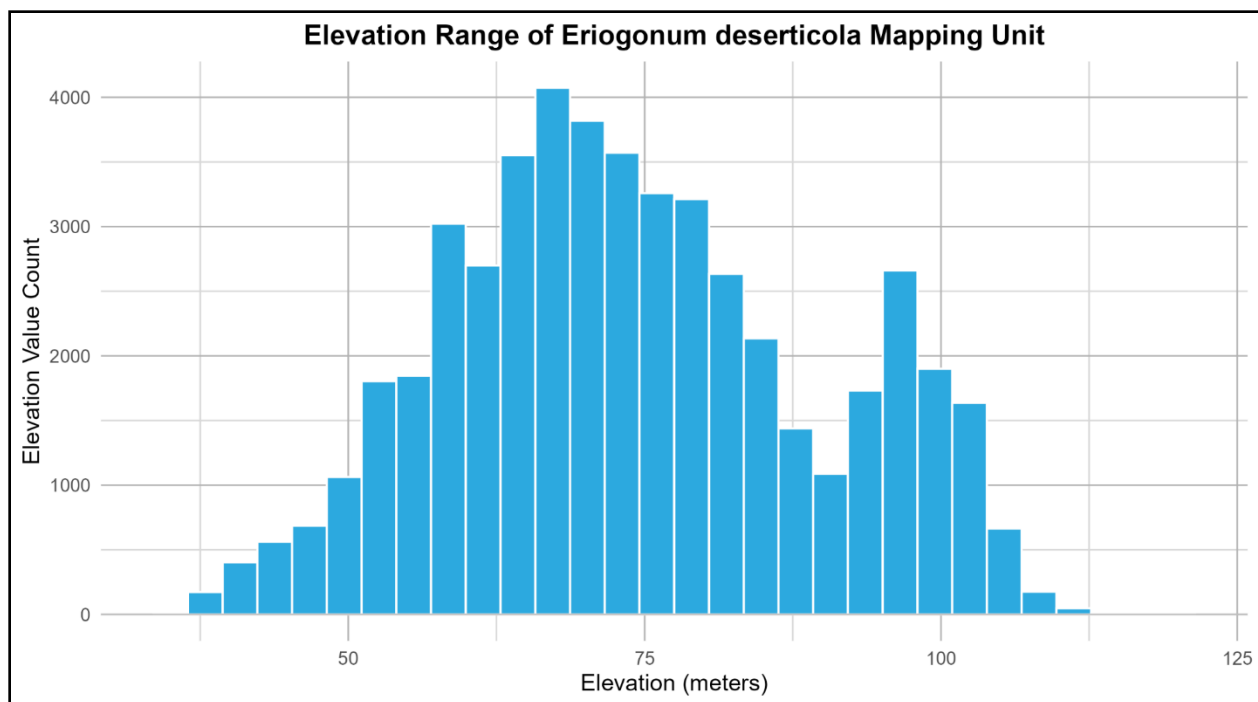
Eriogonum deserticola Mapping Unit (6124)

- *Ephedra californica* – *Ephedra trifurca* Shrubland Alliance (4211) – *Ephedra trifurca* has a darker photo-signature, individuals are more dense and spaced more evenly.
- *Larrea tridentata* Shrubland Alliance (4119) – co-occurs at margins of dunes and can look similar, *Larrea* is darker, with a more rounded crown shape.
- *Psoralea argemone* Mapping Unit (4232) – *Psoralea argemone* occurs on the western edges of the active sand dunes in the Algodones. This species can be difficult to pick out from imagery as it is low growing and light in cover, making it easily blend in with the bright substrate. However, it is lighter than *Eriogonum deserticola*.



PROJECT DISTRIBUTION: *Eriogonum deserticola* Mapping Unit stands occur only within the Algodones subarea and generally occur in the leeward side of large dunes and on the edges of the more active dune fields.

Eriogonum deserticola Mapping Unit (6124)



Larrea tridentata – Ambrosia dumosa Shrubland Alliance (4115)

***Larrea tridentata* – *Ambrosia dumosa* Shrubland Alliance (4115)**

Creosote bush – white bursage scrub

Rarity: S5G5

MMU: 10 acres

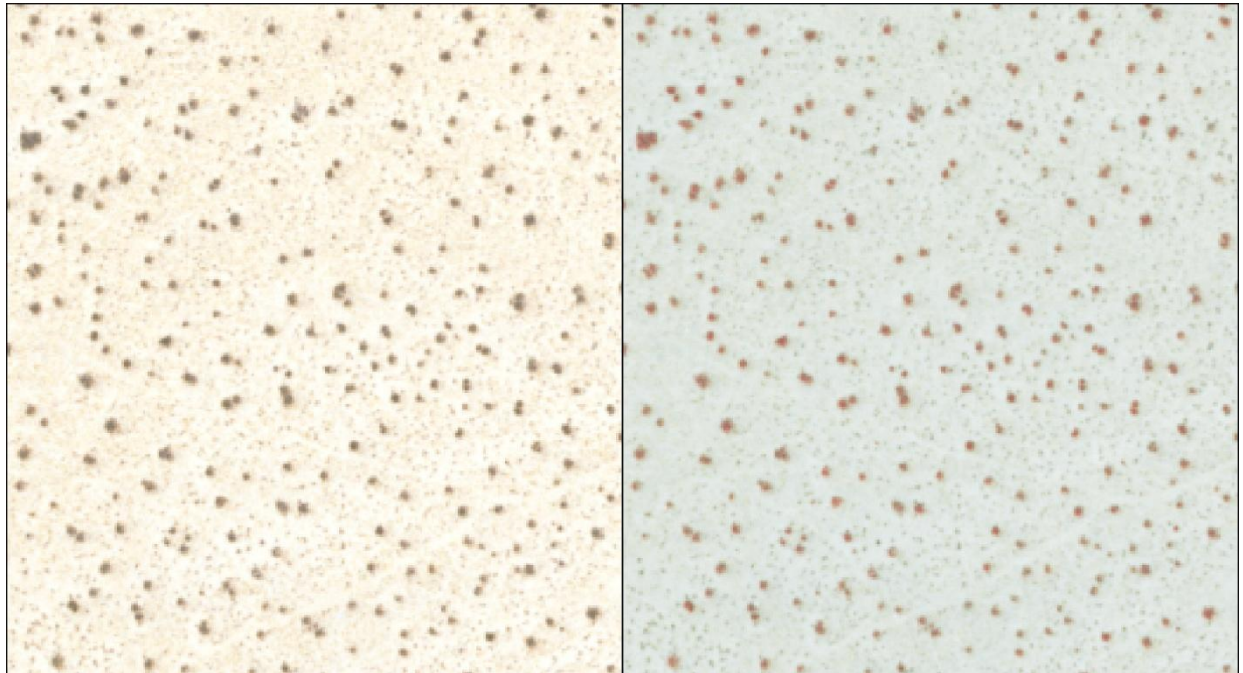
MMW: 101 meters



This photo shows a typical *Larrea tridentata* – *Ambrosia dumosa* shrubland in the Coachella Valley. The dead herb cover is primarily *Schismus* sp.

SUMMARY: This Alliance is widespread across much of the sandy, flat, upland landscapes across the Colorado Desert and is characterized by codominant *Larrea tridentata* and *Ambrosia dumosa* each at >1% absolute cover in the shrub canopy. *Ambrosia dumosa* can appear somewhat patchy throughout, however it must be more-or-less consistently spread across the stand. Unlike the larger, evergreen *Larrea tridentata*, *Ambrosia dumosa* are small and drought-deciduous and can appear nearly dead for much of the year, complicating identification using imagery. In the Coachella Valley, this Alliance often borders or blends with *Larrea tridentata* – *Encelia farinosa* Alliance. *Encelia farinosa* takes precedence when it is codominant with *Ambrosia dumosa*.

PHOTOINTERPRETATION SIGNATURE: *Larrea tridentata* appears scattered and widely spaced across the landscape, with a dark green to dark brown appearance in true color and a dark red-brown in CIR. *Ambrosia dumosa* are significantly smaller than *Larrea tridentata* and are openly spaced but can be relatively patchy in overall distribution across a landscape. Their appearance, even when vigorously growing, is little more than a small grayish dot with the slightest tinge of pale pink. When dormant from drought conditions, they appear gray. A faint orange haze across the soil surface is common and indicates abundant dead annuals, usually primarily invasives such as Sahara mustard (*Brassica tournefortii*) and Mediterranean grass (*Schismus* spp.).

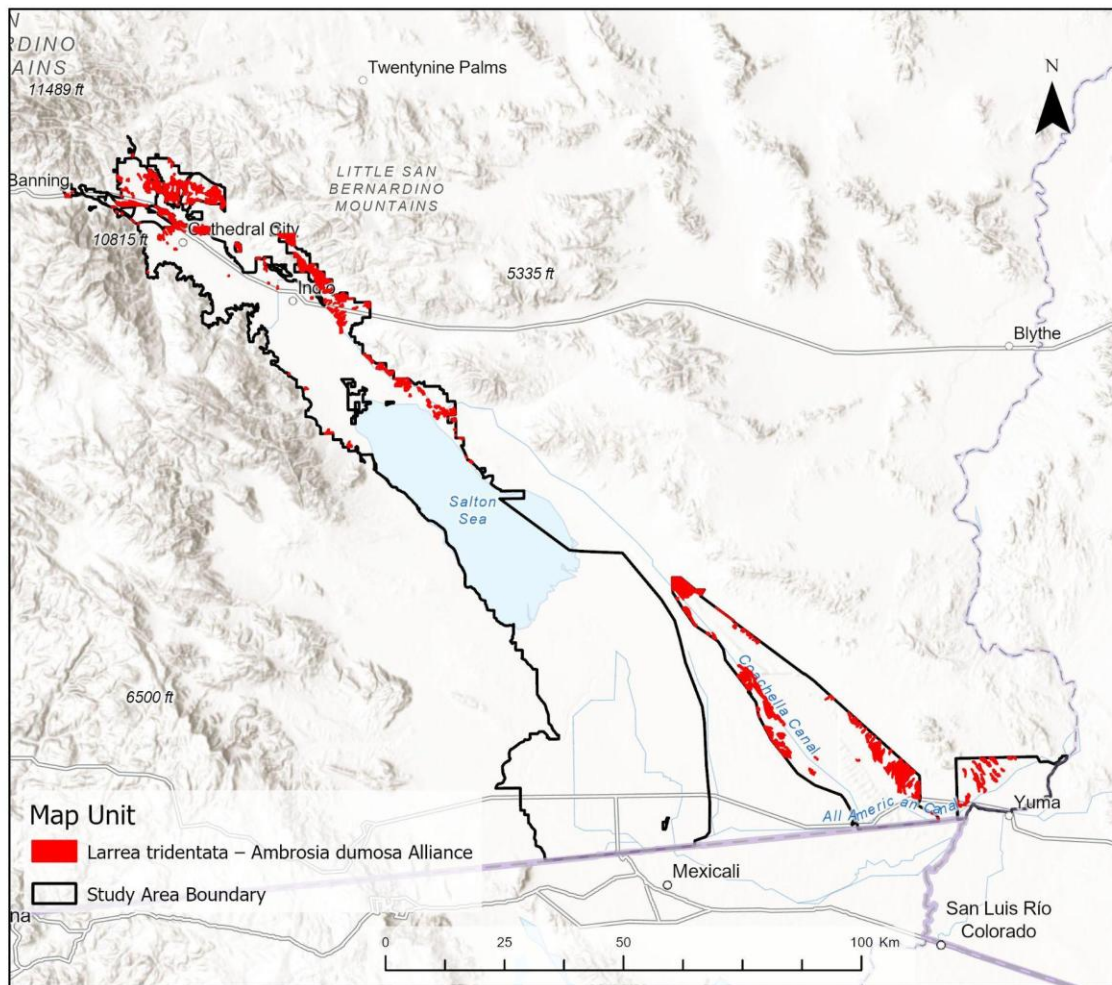


These images, taken from Desert Hot Springs in the Coachella Valley, show a relatively dense stand of *Larrea tridentata* – *Ambrosia dumosa* Alliance covering a large area on the flat, sandy valley floor. *Larrea tridentata* are the larger, darker shrubs, and *Ambrosia dumosa* are the abundant small, gray points. Note the orangish “haze” of dead annuals throughout.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

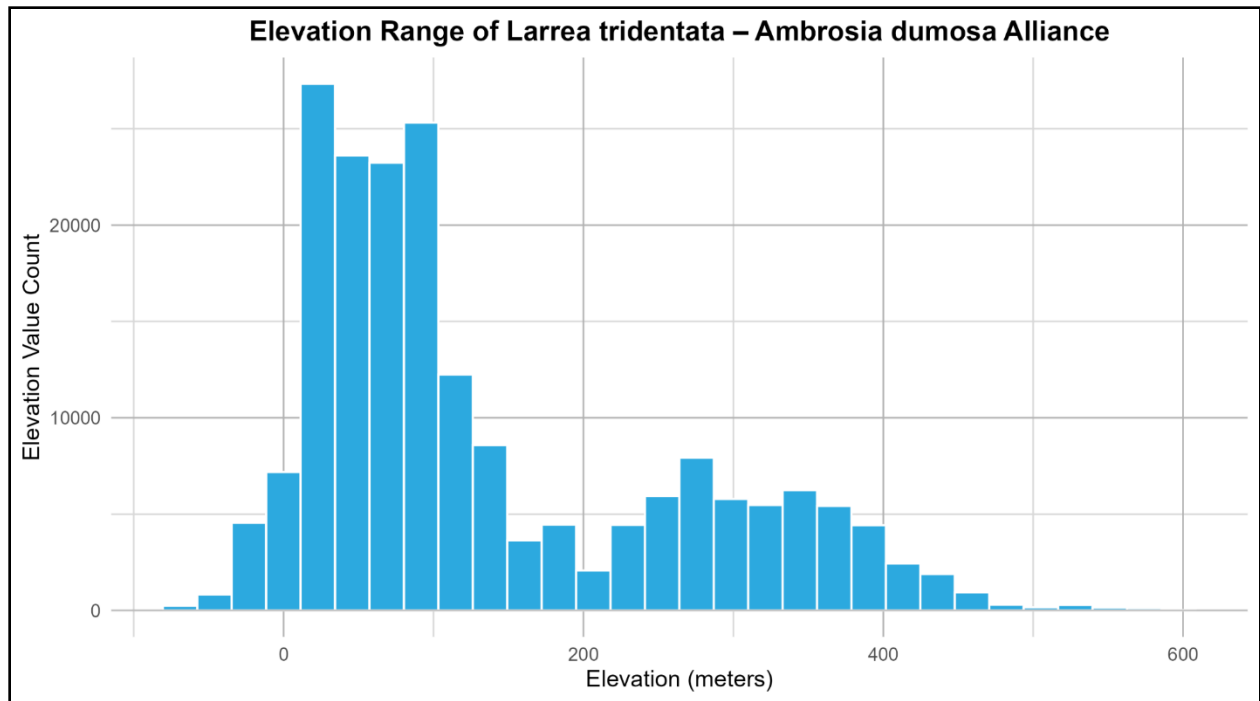
- *Larrea tridentata* – *Encelia farinosa* Shrubland Alliance (4118) – These Alliances can be extremely difficult to tell apart from imagery alone. Both *Ambrosia dumosa* and *Encelia farinosa* are drought-deciduous and appear as little more than gray points when dormant. These species also regularly overlap across the floor of the Coachella Valley, and field verification is often required to differentiate them. However, when growing vigorously, *Encelia farinosa* will have a noticeably round shape and slightly larger size than most *Ambrosia dumosa*.
- *Larrea tridentata* Shrubland Alliance (4119) – Large portions of the Coachella Valley floor have undergone type conversions over the last several decades, and evidence of die-off of small shrubs is common. Some areas may appear to be a *Larrea tridentata* dual Alliance with small or dormant *Encelia farinosa* or *Ambrosia dumosa*, but field inspection reveals that nearly all of the small shrub component is dead and appear similar to dormant shrubs on imagery. Without field verification, it is difficult to discern the species composition of small shrubs as well as the ratio of live dormant to dead.

Larrea tridentata – Ambrosia dumosa Shrubland Alliance (4115)



PROJECT DISTRIBUTION: This Alliance is widespread across the arid, sandy landscapes of the Coachella Valley floor, primarily north of the I-10 on the outskirts of Desert Hot Springs and throughout Sky Valley where development is considerably sparser, and as far west as the community of Whitewater. Multiple stands are present beyond the northeast shores of the Salton Sea, across the alluvial slopes of the Mecca Hills and Orocopia Mountains. Within the Algodones Dunes subarea, this Alliance is common on the flat, sandy landscapes surrounding the primary dune field. The Winterhaven subarea contains large stands interspersed throughout the otherwise predominantly desert pavement flatlands between the Cargo Muchacho Mountains and the All American Canal. This vegetation type is absent from the agriculture-dominated areas of the Winterhaven subarea south of the All American Canal and the entirety of the Imperial Valley subarea.

Larrea tridentata – Ambrosia dumosa Shrubland Alliance (4115)



Larrea tridentata – *Encelia farinosa* Shrubland Alliance (4118)

***Larrea tridentata* – *Encelia farinosa* Shrubland Alliance (4118)**

Creosote bush – brittle bush scrub Alliance

Rarity: G5S4

MMU: 10 acres

MMW: 101 meters



This stand of *Larrea tridentata* – *Encelia farinosa* is located on a broad, gently-sloping alluvial fan near the outflow of Mission Creek into the town of Desert Hot Springs in the Coachella Valley.

SUMMARY: This shrubland type is defined by a codominance of *Larrea tridentata* and *Encelia farinosa*, both at >1% absolute cover, and *Ambrosia dumosa* must be either absent or subdominant. Other shrubs present may include *Ephedra* spp., *Ambrosia dumosa*, *Psoralea emoryi*, *P. schottii*, *P. arborescens*, and *Cylindropuntia echinocarpa*. Within this mapping area, this Alliance commonly grows on the foothills of the mountains surrounding the Coachella Valley, as well as on the valley floor where it coincides with stands of *Larrea tridentata* and *Larrea tridentata* – *Ambrosia dumosa* Alliance.

Larrea tridentata – Encelia farinosa Shrubland Alliance (4118)

PHOTOINTERPRETATION SIGNATURE: *Larrea tridentata* appears as a medium-sized dark green (true color) to dark, muted red (CIR) with a well-spaced, scattered distribution. *Encelia farinosa* appears as a medium gray-green (leafed out) to gray (dormant) in true color and a pale pink (leafed out) to gray (dormant) in CIR. *Encelia farinosa* is very difficult to differentiate from *Ambrosia dumosa* unless the individuals are exceedingly large, in which case *Encelia farinosa* have a denser, rounder canopy.



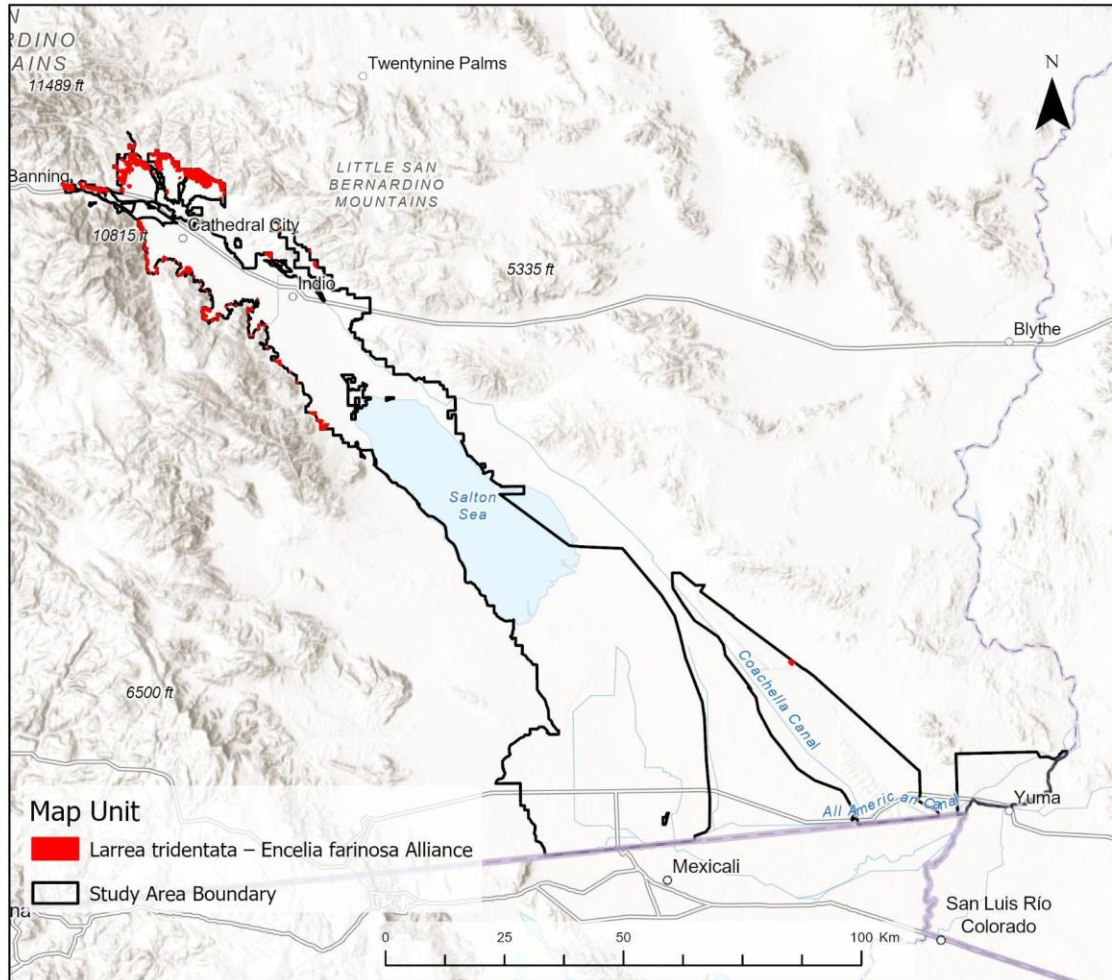
This stand of *Larrea tridentata* – *Encelia farinosa* is near the intersection of the I-10 freeway and Highway 62 in the Coachella Valley. The larger, dark green/red shrubs are *Larrea tridentata*, and the small grayish points are *Encelia farinosa*. The orange “haze” is a dense cover of nonnative herbs.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Larrea tridentata* – *Ambrosia dumosa* Shrubland Alliance (4115) – Very large and vigorously-growing *Encelia farinosa* can be differentiated from *Ambrosia dumosa* based on their dense, nearly perfectly round crown, however most individuals across this mapping area are less robust and field verification may be necessary, especially when plants are dormant. In general, *Encelia farinosa* tends to be more common on rocky hillslopes.
- *Larrea tridentata* Shrubland Alliance (4119) – Large portions of the Coachella Valley floor have undergone type conversions over the last several decades, and evidence of die-off of small shrubs is common. Some areas may appear to be a *Larrea tridentata* dual Alliance with small or dormant *Encelia farinosa* or *Ambrosia dumosa*, but field inspection reveals that nearly all of the small shrub

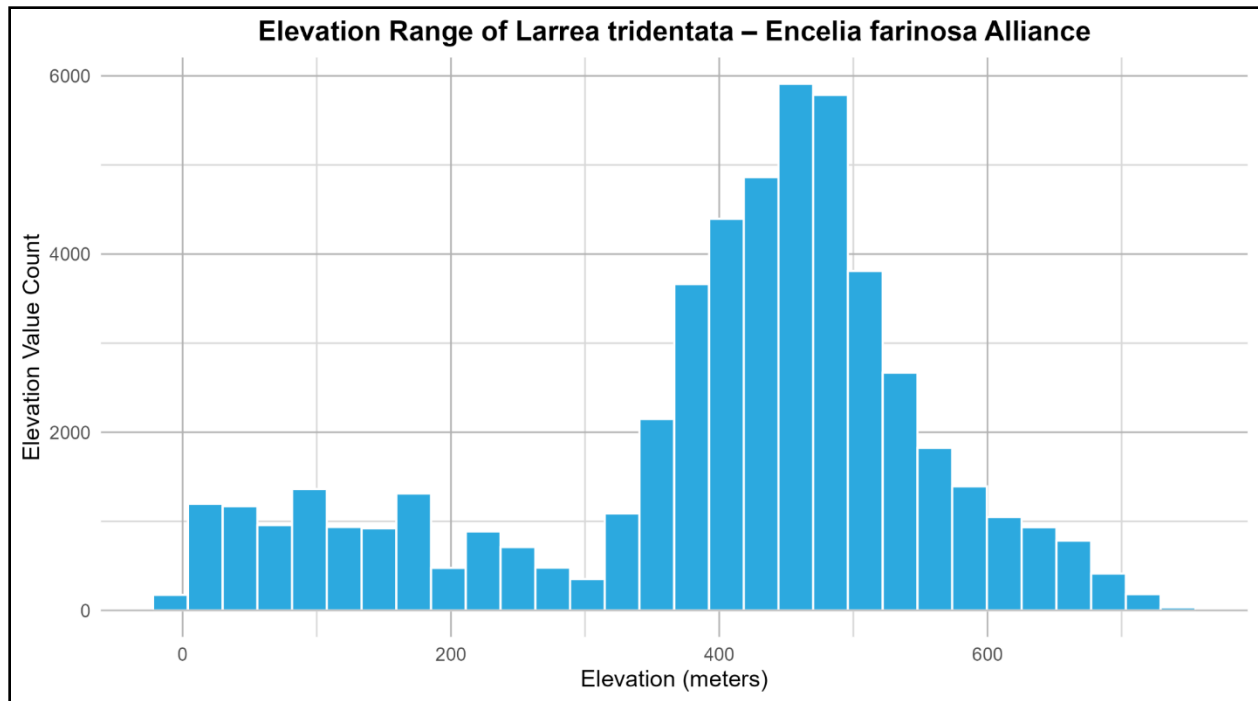
Larrea tridentata – Encelia farinosa Shrubland Alliance (4118)

component is dead and appear similar to dormant shrubs on imagery. Without field verification, it is difficult to discern the species composition of small shrubs as well as the ratio of live dormant to dead.



PROJECT DISTRIBUTION: This Alliance is common across the undeveloped portions of the Coachella Valley, especially on the foothills of the surrounding mountains and the Indio Hills that span the center of the valley. It is rarer on the lowest elevation parts of the valley floor, where it is typically replaced by *Larrea tridentata* or *Larrea tridentata* – *Ambrosia dumosa* Alliances. Mappers delineated only one stand of this Alliance in the Algodones Dunes subarea just northwest of Glamis on gravel alluvial sediment beneath the dunes. Mappers and field teams did not identify this Alliance in the Imperial Valley or Winterhaven subareas.

Larrea tridentata – Encelia farinosa Shrubland Alliance (4118)



Larrea tridentata Shrubland Alliance (4119)

***Larrea tridentata* Shrubland Alliance (4119)**

Creosote bush scrub

Rarity: G5S5

MMU: 10 acres

MMW: 101 meters

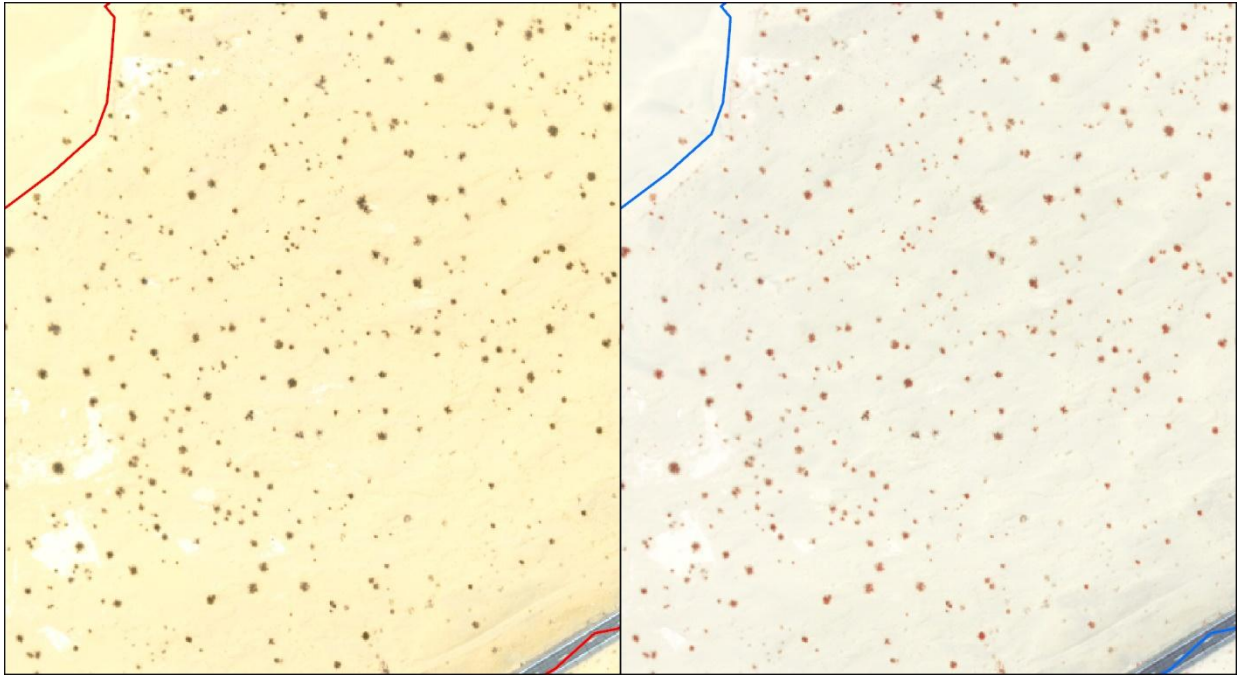


This photo was taken north of the wind farms of the western Coachella Valley and shows dense *Larrea tridentata* with a lack of other small shrub species.

SUMMARY: Mappers assigned this Alliance when *Larrea tridentata* is >2% absolute cover and dominant with both *Ambrosia dumosa* and *Encelia farinosa* absent or <1% absolute cover. This Alliance is extremely abundant across the Colorado Desert and is one of the few Alliances mapped within all four mapping subareas. Stands of *Larrea tridentata* can occur on hillsides, alluvial fans, sand fields, sand dunes, desert pavement, ancient lakebed silt and clay soil, and within undeveloped parcels inside massive urban areas. Especially in the western Coachella Valley, extremely dense nonnative herbaceous understories are common due to the increased nitrogen deposition brought by air pollution from the Los Angeles area.

Larrea tridentata Shrubland Alliance (4119)

PHOTOINTERPRETATION SIGNATURE: Stands of *Larrea tridentata* Alliance are often at least several dozen acres in size and are found all across the Colorado Desert. Shrubs appear as dark green to green-brown in true color and a muted, dark red in CIR. *Ambrosia dumosa* and *Encelia farinosa*, which usually appear as small, gray to gray-pink dots, should each be <1% absolute cover. In the western Coachella Valley, stands of *Larrea tridentata* are often accompanied by an orange “haze” of recently-dead nonnative herbs.

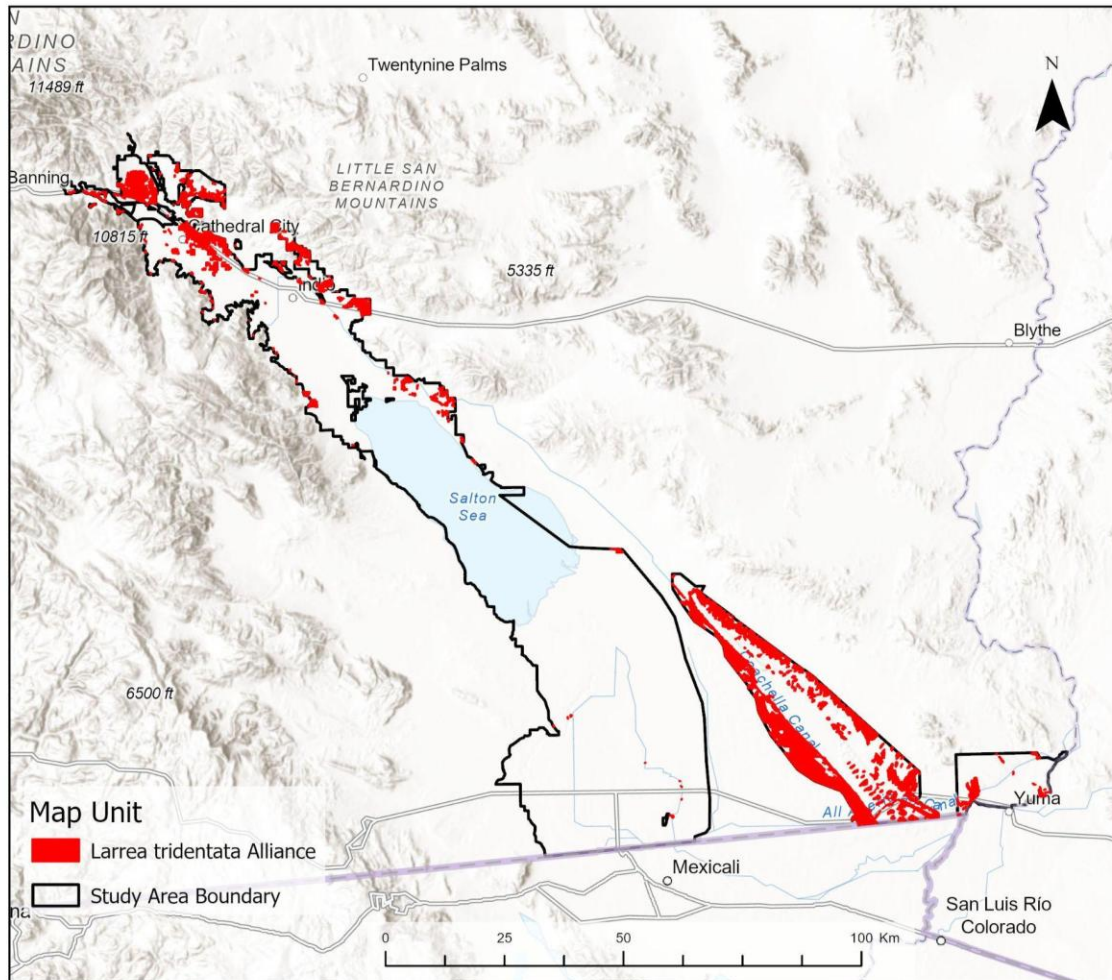


These images show dark green/red *Larrea tridentata* spread over a sandy landscape.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

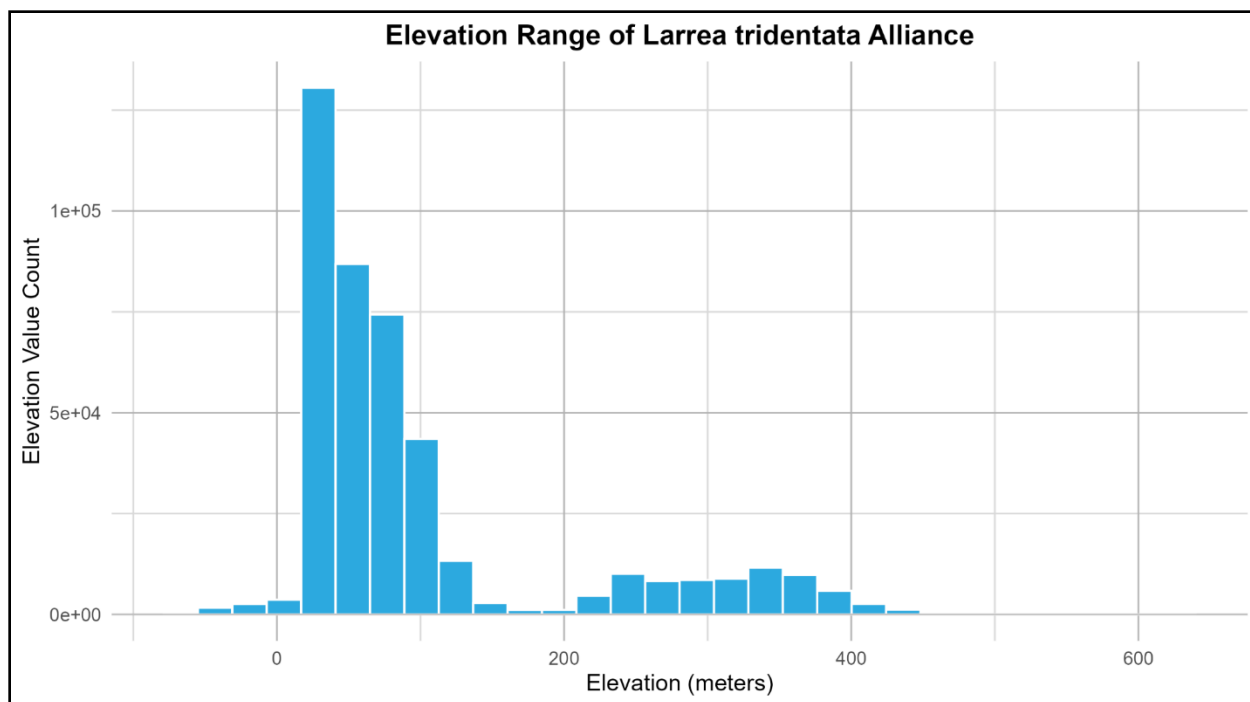
- *Larrea tridentata* – *Ambrosia dumosa* Shrubland Alliance (4115) and *Larrea tridentata* – *Encelia farinosa* (4118) Shrubland Alliances – the presence of small shrubs can be difficult to estimate, especially when dormant. In stands with numerous small gray shrubs, field verification may be required to determine the ratio of dormant live to dead.
- *Psoralea Schottii* Mapping Unit (4231) – This species tends to be restricted to alluvial fans and eroding slopes at the base of mountains such as the Little San Bernardino Mountains, Mecca Hills, and Indio Hills. Their size is similar to *Larrea tridentata*, but they appear lighter in color and are pale green-yellow in true color.

Larrea tridentata Shrubland Alliance (4119)



PROJECT DISTRIBUTION: Mappers assigned this Alliance in all mapping subareas, but it was most prevalent in the Coachella Valley and Algodones Dunes subareas. In the Coachella Valley, it is found primarily in undeveloped areas of the valley floor, but also in some large undeveloped parcels within the primary Urban Window. In the Algodones Dunes, mappers delineated this type primarily on the sand fields and desert pavement/alluvial fans surrounding the main dune system, although pockets of *Larrea tridentata* can be found occupying large natural swales or valleys amongst the large dunes. In the Imperial Valley subarea, mappers delineated 11 stands within undeveloped pieces of land along the New and Alamo Rivers. *Larrea tridentata* stands in the Winterhaven subarea are found primarily north of the All American Canal and on both sides of the canal near where it crosses the U.S.-Mexico border. A handful of additional stands can be found in the vicinity of Bard Lake.

Larrea tridentata Shrubland Alliance (4119)



Lepidospartum squamatum Shrubland Alliance (4212)

***Lepidospartum squamatum* Shrubland Alliance (4212)**

Scale broom scrub

Rarity: G3S3

MMU: 0.5 acres

MMW: 22 meters

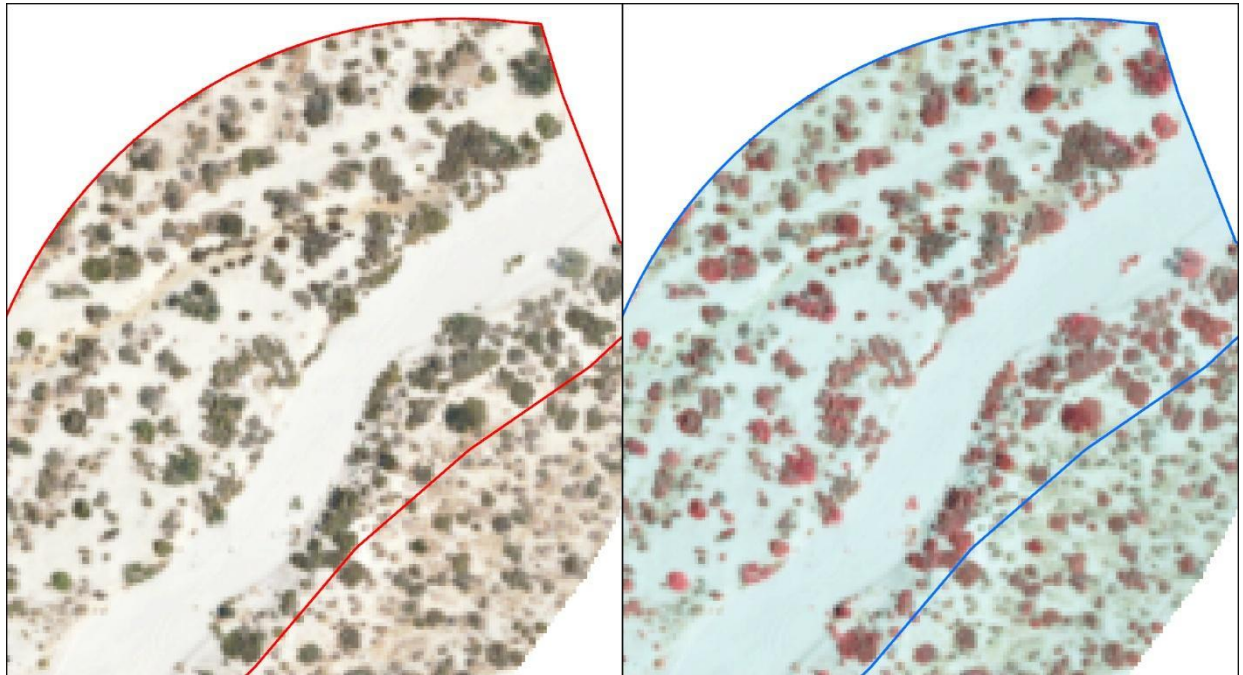


This photo was taken near Snow Creek in the western Coachella Valley and shows post-flower *Lepidospartum squamatum* (with yellow dried flowers and fluffy white seeds) lining a dry creek bed.

SUMMARY: *Lepidospartum squamatum* is a medium-sized shrub found along dry washes and intermittent creek beds in the Coachella Valley. This species is at least required to be characteristic in the stand (not necessarily dominant or codominant) in order for it to be mapped to this Alliance. Mappers delineated only a small number of these stands in the far-western Coachella Valley among broad, sandy washes near Snow Creek and in the San Gorgonio River, as well as in a basin near the community of Whitewater in a drainage leading south from the I-10 freeway. This shrub requires more frequent flooding conditions than the rest of this mapping area provides, although some scattered individuals may be present in particularly wet drainages throughout Palm Springs and Desert Hot Springs.

Lepidospartum squamatum Shrubland Alliance (4212)

PHOTOINTERPRETATION SIGNATURE: Healthy individuals have a dark green-yellow appearance in true color and a bright red in CIR. The crown shape is irregular and has a fairly rough texture. Stands are sometimes composed of well-spaced individuals or irregularly spaced clumps or small hummocks, generally within large, frequently active sandy drainages and adjacent banks.

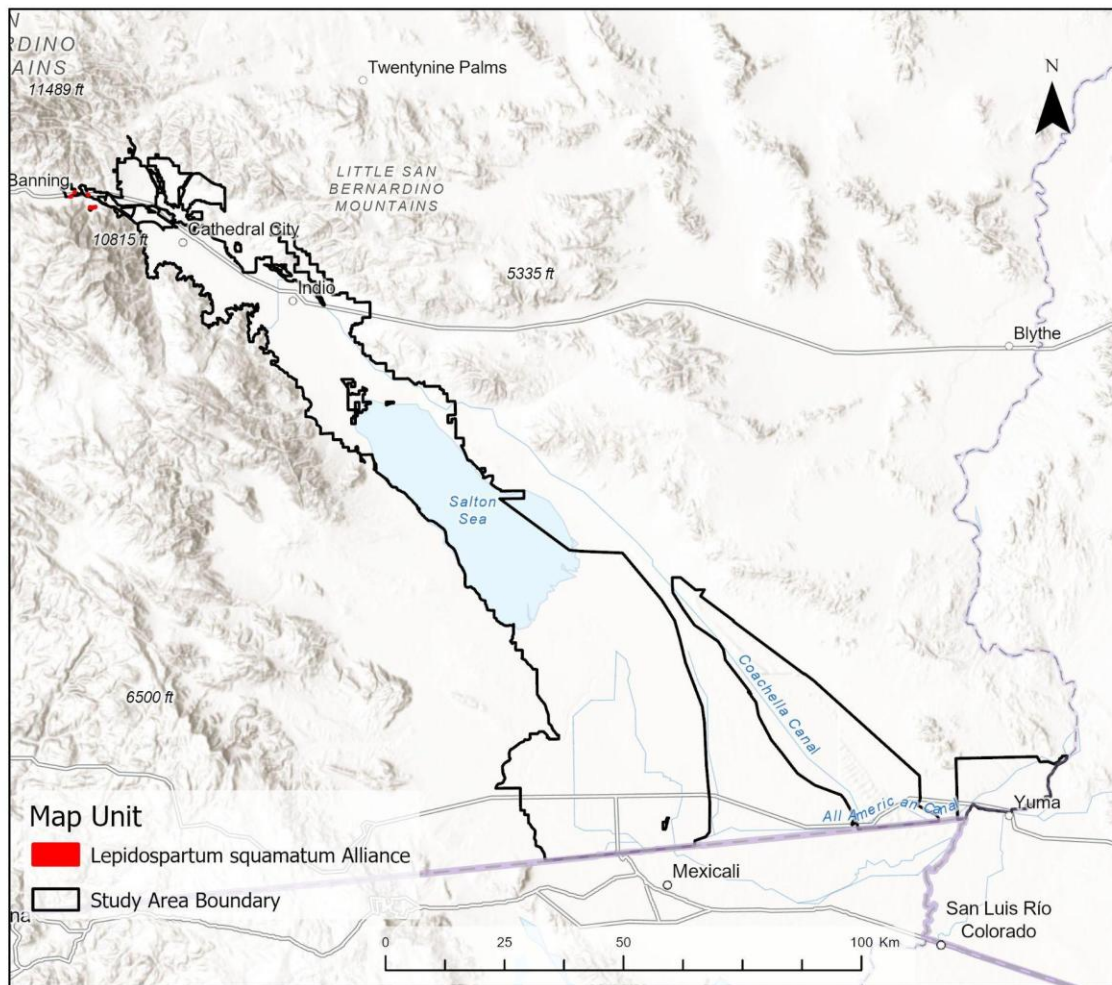


These images show a dense stand of *Lepidospartum squamatum* lining the west branch of Snow Creek, a seasonally-flowing drainage fed by floodwater and snow melt.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

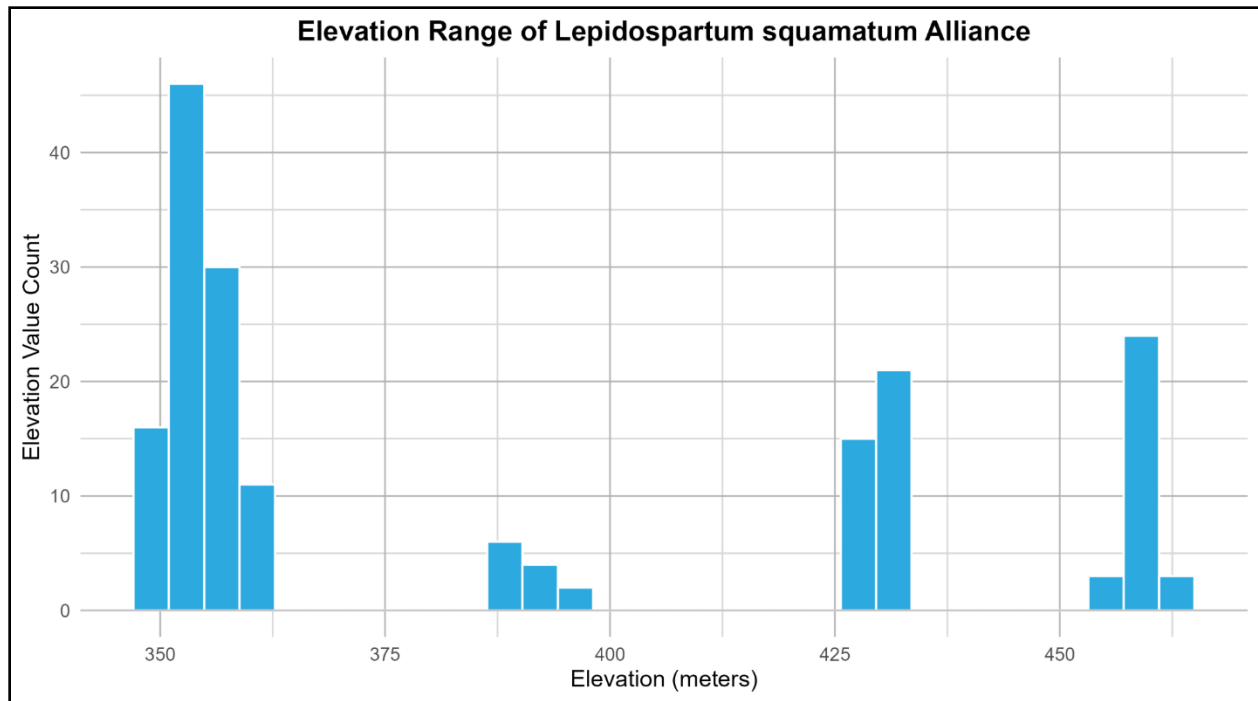
- *Ericameria paniculata* Shrubland Alliance (4213) – this species may sometimes have a brighter green to yellow-green color, but it is otherwise extremely similar in form, appearance, and habitat preference. It is likely less common in more active channels.
- *Ephedra californica* – *Ephedra trifurca* Shrubland Alliance (4211) – *Ephedra* species generally have a darker green/red color and a softer, more regular crown texture. *Ephedra californica* tends to occupy channel banks and upland areas and avoid channel bottoms, while *Ephedra trifurca* prefers aeolian sand habitats.
- *Ambrosia salsola* – *Bebbia juncea* Shrubland Alliance (7211) – these species tend to favor less active channels and both have a smaller size, paler color, and more round canopy shape.

Lepidospartum squamatum Shrubland Alliance (4212)



PROJECT DISTRIBUTION: Mappers delineated stands of *Lepidospartum squamatum* only in the far-western portion of the Coachella Valley subarea, approximately near the community of Whitewater. This area is the coolest and wettest part of the mapping area and contains multiple major drainages, such as Snow Creek, Cottonwood Canyon, and the San Gorgonio River, that are fed by snow melt and flooding from San Gorgonio and San Jacinto Mountains. *Lepidospartum squamatum* favors higher-activity channels such as these.

Lepidospartum squamatum Shrubland Alliance (4212)



Mud Hills sparsely vegetated ephemeral herbs Mapping Unit (6113)

Mud Hills sparsely vegetated ephemeral herbs Mapping Unit (6113)

MMU: 0.5 or 10 acres (see Mapping Considerations section)

MMW: 22 meters



Mud Hills are shown in the foreground and extending to the horizon, with sparse vegetation scattered throughout the mid-range and gullies. The stand of thick tamarisk in the right mid-ground is Salt Creek which drains into the Salton Sea.

SUMMARY: The Mud Hills mapping unit is a sparsely vegetated type with less than 2% absolute cover of shrubs and variable herbaceous annual cover. The substrate is composed of unconsolidated fine, sometimes alkaline sediments that have eroded into steep slopes and sometimes rugged topography. Mud hills such as these are often called “badlands”. Stands of vegetation including *Parkinsonia florida*, *Prosopis glandulosa*, *Larrea tridentata*, *Ambrosia salsola*, and *Pluchea sericea* can be found at a higher density within the gullies and washes, but these are generally too small to map and the cover is not consistent throughout the landform. Sparse shrub composition includes species like *Larrea tridentata*, *Atriplex polycarpa*, and *Atriplex hymenelytra*. In years with abundant winter rains, mud hills can experience high cover of annual plants, including *Chorizanthe rigida*, *Chaenactis fremontii*, *Gerrea canescens*, *Eriogonum thomasii*, *Johnstonella angustifolia*, *Oligomeris linifolia*, and *Plantago ovata*. Mud hill landscapes along the New and Alamo Rivers in the Imperial Valley subarea support low

Mud Hills sparsely vegetated ephemeral herbs Mapping Unit (6113)

cover of *Prosopis glandulosa*, *Tamarix* spp., *Atriplex canescens*, *Atriplex lentiformis*, and *Pluchea sericea*.

PHOTOINTERPRETATION SIGNATURE: The Mud Hills photo signature shows areas with very little vegetation. The coloration of the substrate is generally pale to bright tan, and in some areas there is reddish variegation from sediment deposits. The topography shows clear erosion drainage into ravines and gullies. These gullies are often deep, highly-branched, and smooth-curved.



This section of mud hills near the northeast side of the Salton Sea shows the characteristic deep, smooth-margined, highly-branched erosion patterns and general lack of vegetation.

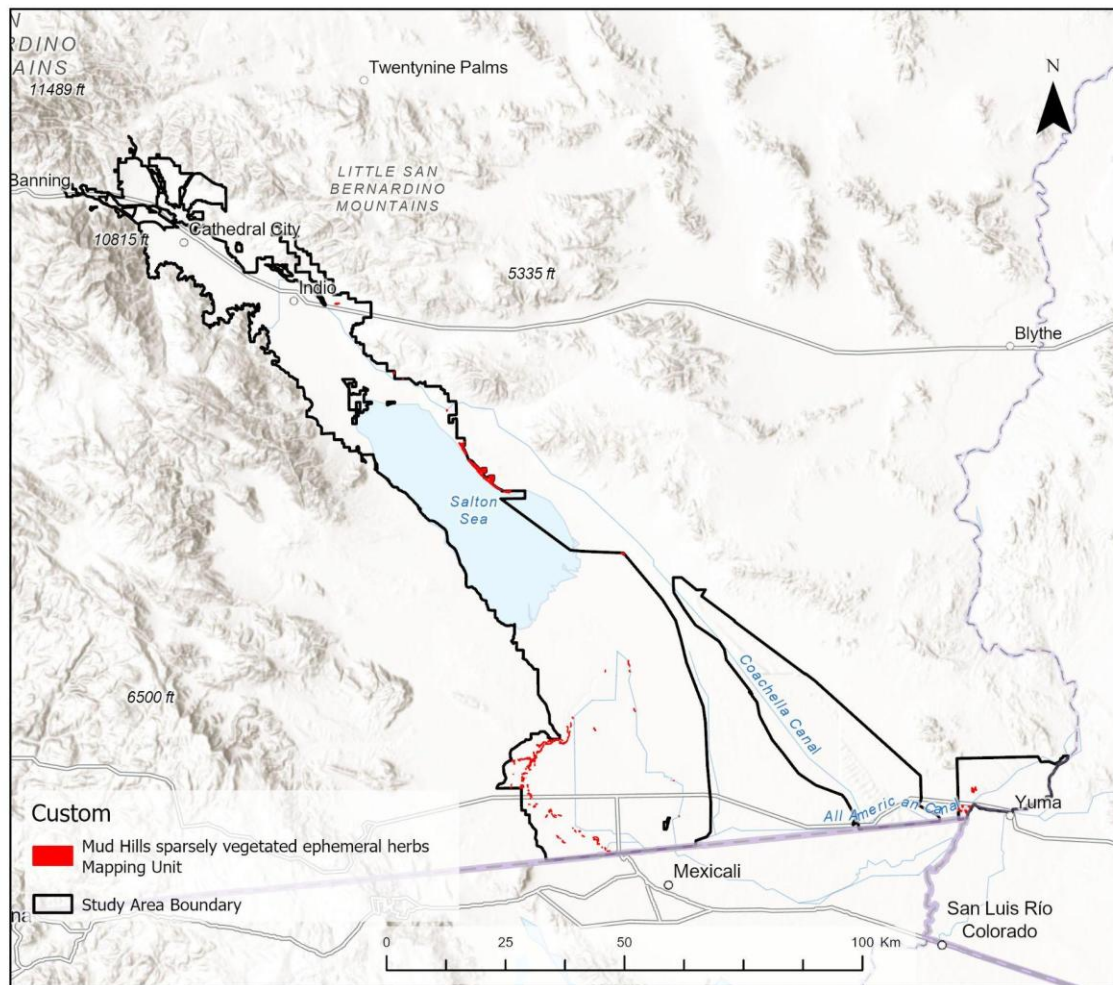
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Atriplex hymenelytra* Shrubland Alliance (6111) – *Atriplex hymenelytra* does occur on mud hills and where it is greater than 1% cover, with no other shrubs reaching higher cover, it should be mapped to this Alliance. This species is light in color and can often appear dead, making it blend into the substrate color.
- *Chorizanthe rigida* – *Geraea canescens* Desert Pavement Alliance (6117) – This Alliance is defined by the presence of desert pavement, which generally occurs on flat to gently sloping terrain with closely-packed gravel and cobble substrate that often has a characteristic gray to dark brown varnish. Erosional patterns throughout pavement landscapes are much shallower and less branched compared to mud hills. This type and the Mud Hills mapping unit generally share the same annual plant species, thus mapping decisions should be made based on geological characteristics.
- North American warm desert bedrock cliff and outcrop Group (6110) – This Group is used for sparsely vegetated mountainous areas that do not show the clear erosion of the unconsolidated sedimentary substrate of mud hills. This Group usually shows a harder-surface terrain with visible boulders and sharply-defined, relatively infrequently branching drainages and canyons.

MAPPING CONSIDERATIONS:

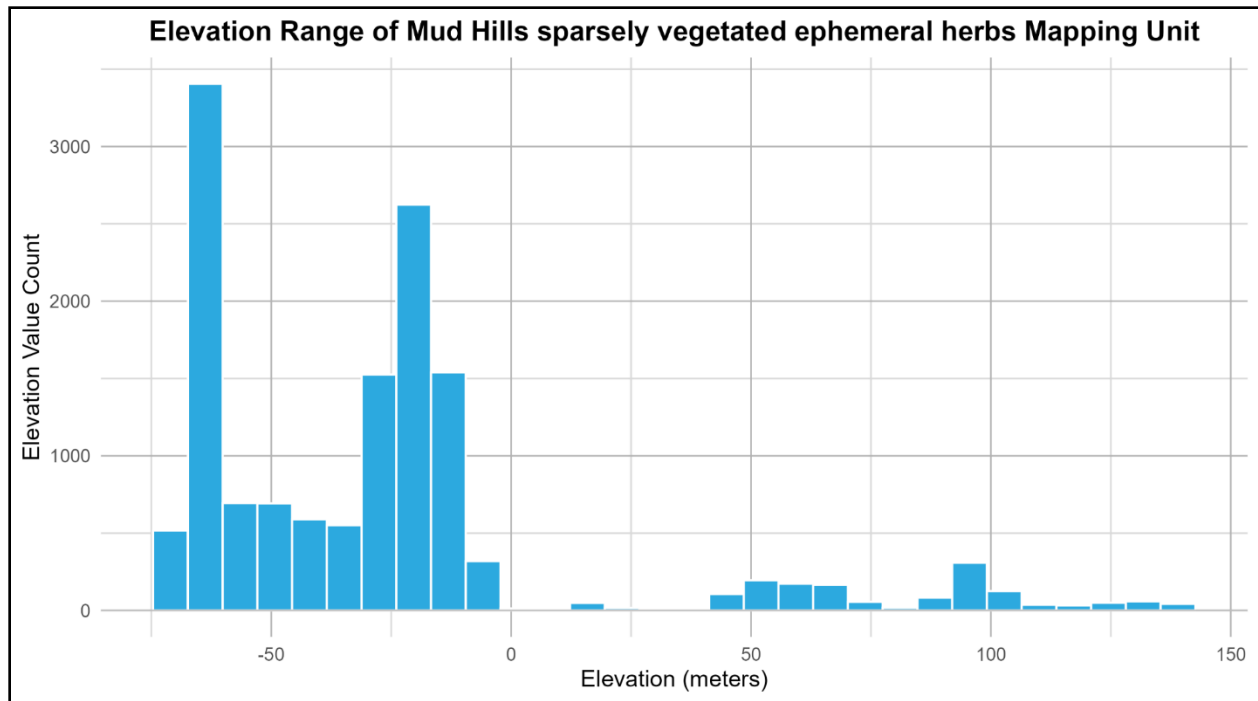
- The Mud Hills sparsely vegetated ephemeral herbs Mapping Unit is generally mapped at a minimum mapping unit of ten acres, where it occurs in upland desert regions. Mappers made an exception in the Imperial Valley subarea along the New River and Alamo River. In these regions the bluffs overlooking the rivers are composed of fine sediments and have eroded into rugged drainage gullies. These mud hills occur in smaller formations; thus mappers assigned them at a half-acre minimum mapping unit.

Mud Hills sparsely vegetated ephemeral herbs Mapping Unit (6113)



PROJECT DISTRIBUTION: Mud hills occur in the southwestern corner of the Winterhaven subarea near the All American Canal where the geology type shifts to unconsolidated sedimentary deposits and water runoff from adjacent mountains has eroded the substrate. This landform also occurs in the Imperial Valley subarea in smaller patches along the New River and Alamo River, and in the Coachella Valley subarea on the northern shore of the Salton Sea near the mouth of Salt Creek and adjacent bajadas below the Chocolate Mountains.

Mud Hills sparsely vegetated ephemeral herbs Mapping Unit (6113)



North American Warm Semi-Desert Cliff, Scree & Pavement Sparse Vegetation Group (6110)

North American Warm Semi-Desert Cliff, Scree & Pavement Sparse Vegetation Group (6110)

MMU: 10 acres

MMW: 101 meters



This rugged, sparsely-vegetated mountainside is part of the Cargo Muchaco Mountains in the northwestern corner of the Winterhaven mapping subarea. The gently-sloping landscape in the foreground is part of the *Chorizanthe rigida* – *Geraea canescens* Desert Pavement Alliance (6117), with North American Warm Semi-Desert Cliff, Scree & Pavement Sparse Vegetation Group (6110) in the background.

SUMMARY: Mappers assigned this Group to rugged, steep terrain, usually with visible boulders or unconsolidated scree, and <2% shrub cover. Erosion in this Group generally produces angularly-cut channels and canyons with relatively few branches. Annuals are usually sparse but may become quite dense following seasons of high precipitation. Common shrubs present in this Group are *Larrea tridentata* and *Encelia farinosa*. Shrubs may occasionally form relatively dense patches in washes or natural basins but are below MMU. Mappers utilized this Group primarily on steep mountain hillsides along the Little San Bernardino Mountains and Mecca Hills in the Coachella Valley and the Cargo Muchacho Mountains in the Winterhaven subarea. The rugged, hilly alluvial fan north of the All American Canal in the Winterhaven Subarea also contained large swaths of sparsely-vegetated steep slopes of unconsolidated rock and gravel mapped

North American Warm Semi-Desert Cliff, Scree & Pavement Sparse Vegetation Group (6110)

to this Group. See notes regarding differentiation between the very similar Mud Hills sparsely vegetated ephemeral herbs Mapping Unit (6113) and *Chorizanthe rigida* – *Geraea canescens* Desert Pavement Alliance (6117).

PHOTOINTERPRETATION SIGNATURE: This Group is characterized by relatively steep topography with a rugged, characteristically unconsolidated surface geology. Surface composition is a mix of large boulders, often discernable from imagery, to small rock and gravel scree, producing a gray to brown/orange reflectance depending on local geology. Shrub and tree cover is below 2% and herbaceous growth is highly variable season-to-season depending on precipitation patterns. This Group is usually associated with foothills of mountains or large hills.



These photos of the Cargo Muchacho Mountains in the Winterhaven subarea demonstrate the steep, rugged, sparsely vegetated hillsides that characterize this Group. Note the *Chorizanthe rigida* – *Geraea canescens* Desert Pavement Alliance (6117) along the right and bottom of the photos.

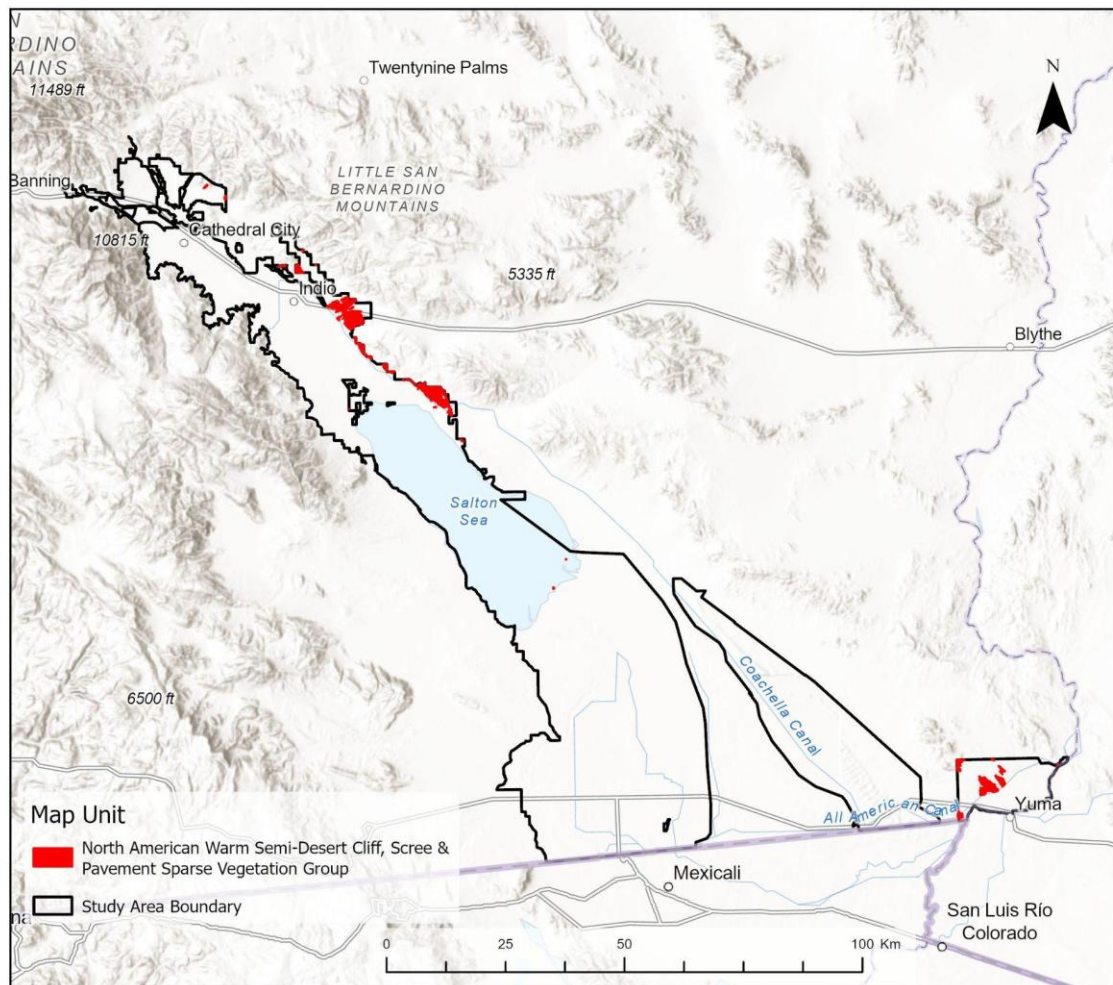
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- Mud Hills sparsely vegetated ephemeral herbs Mapping Unit (6113) – This Mapping Unit is easily confused due to the potential for similar steep topographic relief and sparse vegetation cover. Additionally, some areas of Mud Hills may grade into areas of sparsely-vegetated scree. In general, Mud Hills are composed of relatively fine-grain, cemented alluvial strata with distinct, highly eroded, highly-branched, often smooth-curved networks of canyons and

North American Warm Semi-Desert Cliff, Scree & Pavement Sparse Vegetation Group (6110)

drainages. Mappers generally identified Mud Hills by the smoother texture, general lack of visible boulders, and intricate, abundant, smooth-sided erosion channels.

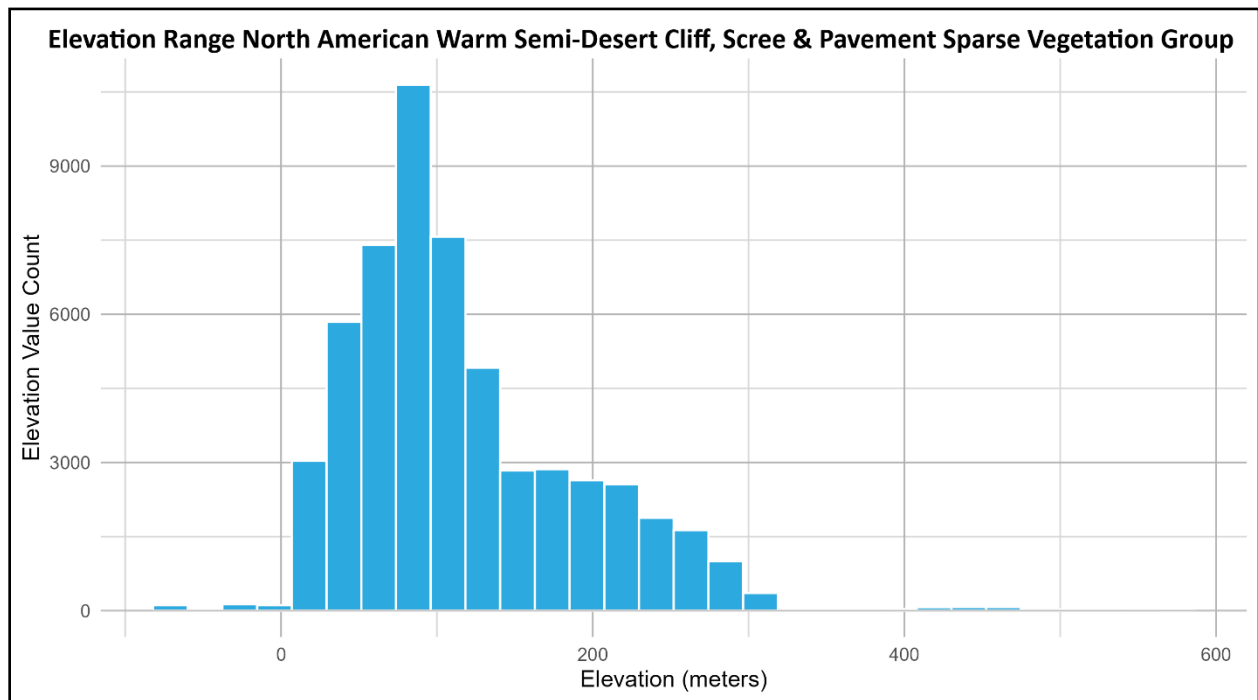
- *Chorizanthe rigida* – *Geraea canescens* Desert Pavement Alliance (6117) – This Alliance differs mostly by its primarily flat or gently sloping topographic relief. Sediments are composed of characteristic tightly-packed gravel and cobble, often with a dark gray/brown to rusty orange varnish visible from imagery. Erosion channels/rills are typically very shallow and steep slopes are rare but may exist on the margins of pavement polygons bordering larger washes.



PROJECT DISTRIBUTION: Mappers delineated this Group primarily on steep mountain hillsides along the Little San Bernardino Mountains and Mecca Hills in the Coachella Valley and the Cargo Muchacho Mountains in the Winterhaven subarea. The rugged, hilly alluvial fan north of the All American Canal in the Winterhaven Subarea also contained large swaths of sparsely-vegetated steep slopes of unconsolidated rock and

North American Warm Semi-Desert Cliff, Scree & Pavement Sparse Vegetation Group (6110)

gravel mapped to this Group. Mappers also assigned the Mullet Island and Obsidian Butte volcanoes on the south rim of the Salton Sea to this Group. Mappers did not identify this Group in the Algodones Dunes subarea.



North American Warm Semi-Desert Dune & Sand Flats Group (6120)

North American Warm Semi-Desert Dune & Sand Flats Group (6120)

MMU: 10 acres

MMW: 101 meters

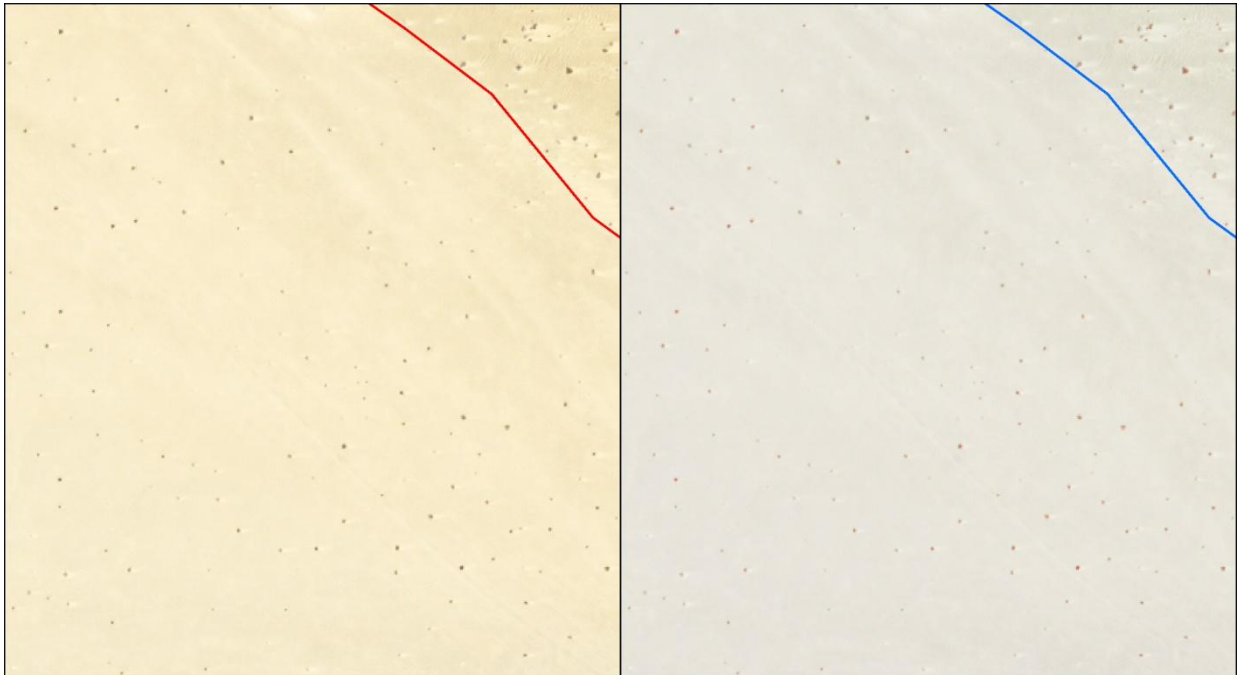


Sand flats in the eastern Algodones Dunes subarea with herbaceous annual plants, primarily *Johnstonella angustifolia*, *Larrea tridentata* stand on the horizon.

SUMMARY: This Group was used for sparsely vegetated or unvegetated open areas with sandy substrates, such as sand aprons and sand flats. Sand dunes where evidence of wind-blown sand was visible were mapped in the *Dicoria canescens* – *Abronia villosa* – *Panicum urvilleanum* Alliance. Stands were also assigned to the Group level where vegetation and ecological characteristics were inclusive to several types but sub-MMU. Substrates are wind-blown fine-grain sand. Shrub species such as *Larrea tridentata*, *Eriogonum deserticola*, and *Ephedra trifurca* may be found in these stands.

North American Warm Semi-Desert Dune & Sand Flats Group (6120)

PHOTOINTERPRETATION SIGNATURE: Sandy areas that were mapped to this Group level have the same white-tan tone as sand dunes, however are missing the characteristic rippled pattern that was used for determination for the *Dicoria canescens* – *Abronia villosa* – *Panicum urvilleanum* Alliance photo signature. Shrub canopy is inconsistent and low in cover. Some small patches of desert pavement are sometimes present.

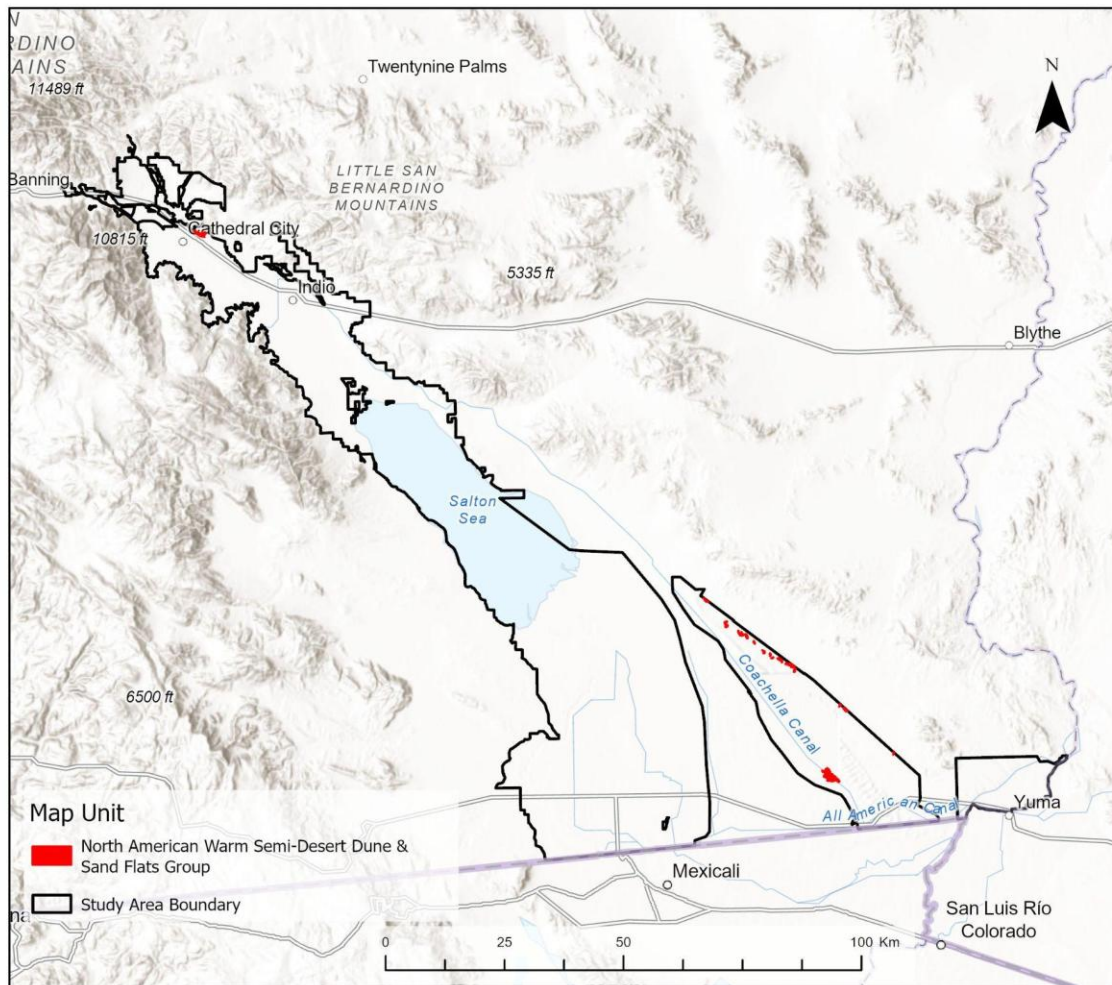


This sparsely-vegetated sand flat occurs along the Coachella Canal on the west side of the Algodones Dunes subarea.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

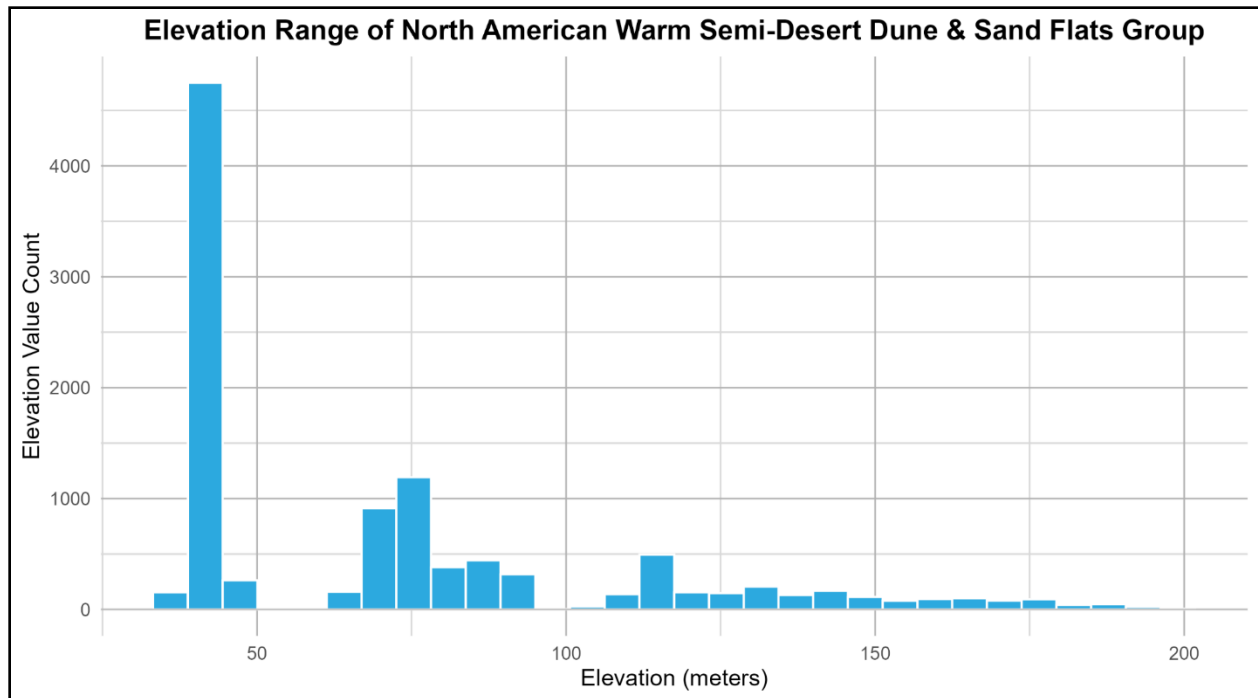
- *Dicoria canescens* – *Abronia villosa* – *Panicum urvilleanum* Herbaceous Alliance (6121) – This type was more commonly mapped throughout the Algodones Dunes and was defined by the presence of active sand dunes and herbaceous annuals.
- *Chorizanthe rigida* – *Geraea canescens* Desert Pavement Alliance (6117) – This type was determined by the presence of desert pavement (close-packed gravel) substrate, which had a darker in color signature
- Sparsely vegetated playa (Ephemeral annuals) Mapping Unit (6116) – Playas were found in low topographic points and are distinguishable by white mineral deposits.
- *Eriogonum deserticola* Mapping Unit (6124) – *Eriogonum deserticola* can be difficult to pick out in imagery when it is not vegetative. Areas that reach the minimum absolute cover show more hummocks and texture around shrubs, especially in the leeward shelter of large dunes.
- Anthropogenic Areas of Little or No Vegetation (9320) – sparsely vegetated sand sheets near urban areas in the Coachella Valley and in the Algodones could appear to be anthropogenically cleared. This Alliance was used where aeolian dune habitats were evident.
- *Psoralea argemone* Mapping Unit (4232) – *Psoralea argemone* occurs on the western edges of the active sand dunes in the Algodones. This species can be difficult to pick out from imagery as it is low growing and light in cover, making it easily blend in with the bright substrate. Here the wind driven sand patterns are often disrupted, and faint pink shrubs are evident in CIR.

North American Warm Semi-Desert Dune & Sand Flats Group (6120)



PROJECT DISTRIBUTION: This Group was primarily mapped on the eastern edges of the Algodones Dunes, where western originating winds drive sand onto desert pavement, creating sand sheets in sparsely vegetated areas. In the Coachella Valley subarea this Group was mapped once, where wind-blown fine-grain sand accumulates at the base of the Indio Hills and vegetation is sparse.

North American Warm Semi-Desert Dune & Sand Flats Group (6120)



Parkinsonia florida – Olneya tesota Alliance (4227)

***Parkinsonia florida* – *Olneya tesota* Alliance (4227)**

Blue palo verde – ironwood woodland Alliance

Rarity: G4S4.2

MMU: 0.5 acres

MMW: 22 meters

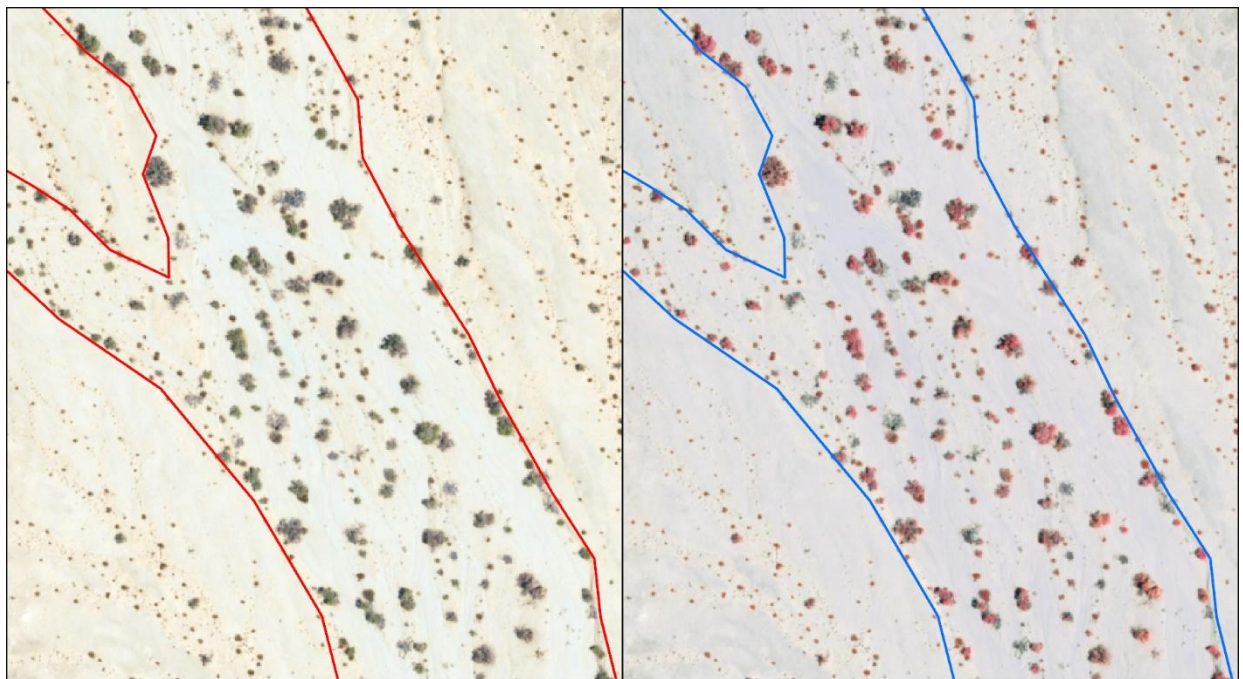


Midground shows large *Parkinsonia florida* scattered throughout a sandy wash with *Larrea tridentata* scattered throughout.

SUMMARY: The *Parkinsonia florida* – *Olneya tesota* Alliance is a type distinct to the Colorado Desert and is defined by the consistent cover of the trees *Parkinsonia florida* or *Olneya tesota*, or both, occurring at greater than 2% absolute cover. Typically, this type is found in xeric washes throughout bajadas and desert arroyo margins. Soils are fine sand to rocky, well-drained mixed alluvia. Stands also occur at the margins of active sand dunes in the Algodones Dunes subarea. Associated shrub species include *Larrea tridentata*, *Encelia farinosa*, *Ambrosia dumosa*, *Ambrosia salsola*, *Bebbia juncea*, and *Hilaria rigida*. Herbaceous annuals most commonly found within these microphyll woodlands include *Johnstonella angustifolia*, *Phacelia crenulata*, *Chaenactis* spp., *Plantago ovata*, *Schismus* spp., and *Brassica tournefortii*.

PHOTOINTERPRETATION SIGNATURE: *Parkinsonia florida* has a dense, vivid green canopy that appears bright red in CIR imagery. This species has fine, green branches and this comes across in the signature as somewhat diffused, making the edges of the trees roughly defined.

Olneya tesota has light colored bark and very dark, olive-colored leaves. This appears as a greyish green in the true-color imagery, and dark red-brown in CIR. Stands can range from sparse to relatively dense in cover, rarely exceeding 20% absolute cover. Individuals of both species vary in size and generally occupy wash margins or woodland “islands” in active washes.



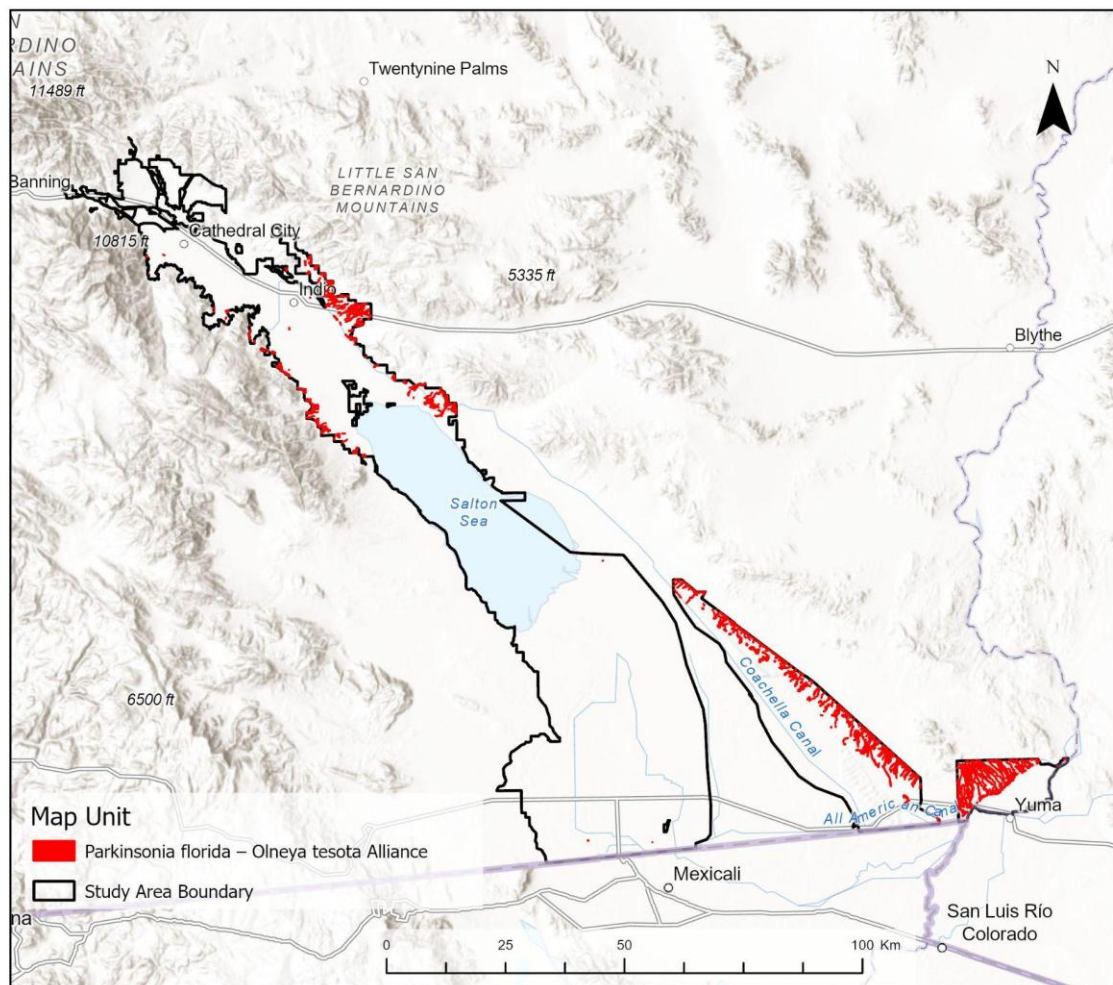
This *Parkinsonia florida* – *Olneya tesota* woodland wash is one of many twining through the desert pavement in the north half of the Winterhaven subarea.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Chilopsis linearis* – *Psoralea argophylla* Woodland Alliance (7222) – Crowns of *Chilopsis linearis* are large and linear or forming dense clusters of irregular shapes, and generally follow the direction of the wash. These two types did not overlap in the mapping area.
- *Larrea tridentata* Shrubland Alliance (4119) – In the Algodones Dunes, both *Larrea tridentata* and *Parkinsonia florida* occurred on the dune edges. The two species are distinguishable by the overall color and size, with *Larrea tridentata* being much darker green and smaller.

Parkinsonia florida – Olneya tesota Alliance (4227)

- *Larrea tridentata* – *Ambrosia dumosa* Alliance (4115) – This type occurs within the broad bajadas and throughout rivulets that support smaller and young *Parkinsonia florida* and *Olneya tesota*. This Alliance was determined by overall smaller and more dense distribution of shrubs on the landscape, with *L. tridentata* appearing darker green on imagery, and *A. dumosa* as low growing, small grayish dot.

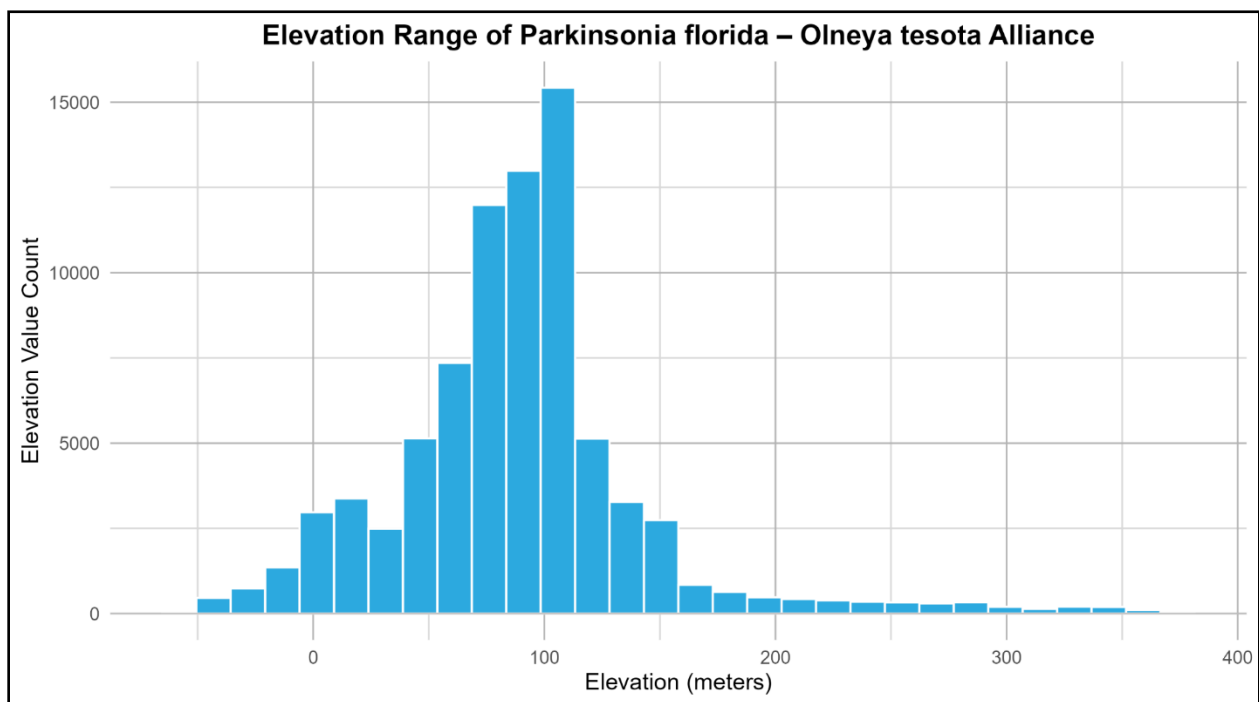


PROJECT DISTRIBUTION: *Parkinsonia florida* – *Olneya tesota* woodlands occur throughout the Coachella Valley, Algodones Dunes, and Winterhaven subareas where bajadas open into the valley floor or dunes. In the Coachella Valley subarea, this type is restricted to the margins of the mapping area, on the northeast side from the northern Salton Sea near the community of North Shore, to the community of Sky Valley north of Indio Hills, where the alluvial fans of the Little San Bernardino Mountains of Joshua Tree National Park flow southward. On the southern side of the Coachella Valley

Parkinsonia florida – Olneya tesota Alliance (4227)

subarea, this type primarily occurs at the foot of the Santa Rosa Mountains and is generally interrupted by urban development of the La Quinta and Thermal communities.

In the Algodones Dunes subarea, the *Parkinsonia florida* – *Olneya tesota* woodlands are restricted to the northeastern side of the mapping area, where the alluvial fans of the Chocolate Mountains flow into the dunes. In the Winterhaven subarea, these woodlands are found extensively in the northwestern half of this subarea, where the alluvial fans flow from the Cargo Muchacho Mountains and Picacho Peak. The xeric washes are interrupted by the All American Canal, which bisects the mapping area. Below this is primarily agriculture and some urban development.



Western Ruderal Marsh, Wet Meadow & Shrubland Group (7110)

MMU: 0.5 acres

MMW: 22 meters

Exotics = High



This photo shows dense *Pennisetum* sp., *Erigeron canadensis*, and a mix of other nonnative forbs within the Tahquitz Canyon drainage in Palm Springs.

SUMMARY: Mappers assigned this ruderal Group when riparian or riparian-adjacent nonnative herbs are dominant to codominant without characteristic species that meet Alliance-level requirements. Mappers delineated this Group only in a portion of the Tahquitz Canyon drainage running through the center of Palm Springs in the Coachella Valley mapping subarea which had a complex and regularly changing (due to flooding and maintenance) assortment of herbs such as *Pennisetum* sp., *Erigeron canadensis*, *Xanthium strumarium*, *Cynodon dactylon*, and *Ambrosia acanthicarpa*, as well as nonnative shrubs such as *Ricinus communis* and *Tamarix* species. Some native herbs, shrubs, and trees may be present but at very low cover.

PHOTOINTERPRETATION SIGNATURE: The portion of the Tahquitz Canyon drainage mapped as this Group appears as an obviously manmade drainage with a small creek running down the middle. This creek is intermittent and flows during flooding from large storm events and during adequate snow melt from San Jacinto Mountain. The vegetation signature is a mottling of various live and dead herbs with a soft texture and a pale green (true color) to pale pink (CIR) appearance when live. Various shrubs are scattered throughout but are not characteristic of the stand. Further up the drainage to the west, the vegetation becomes less dense and large boulders are visible.

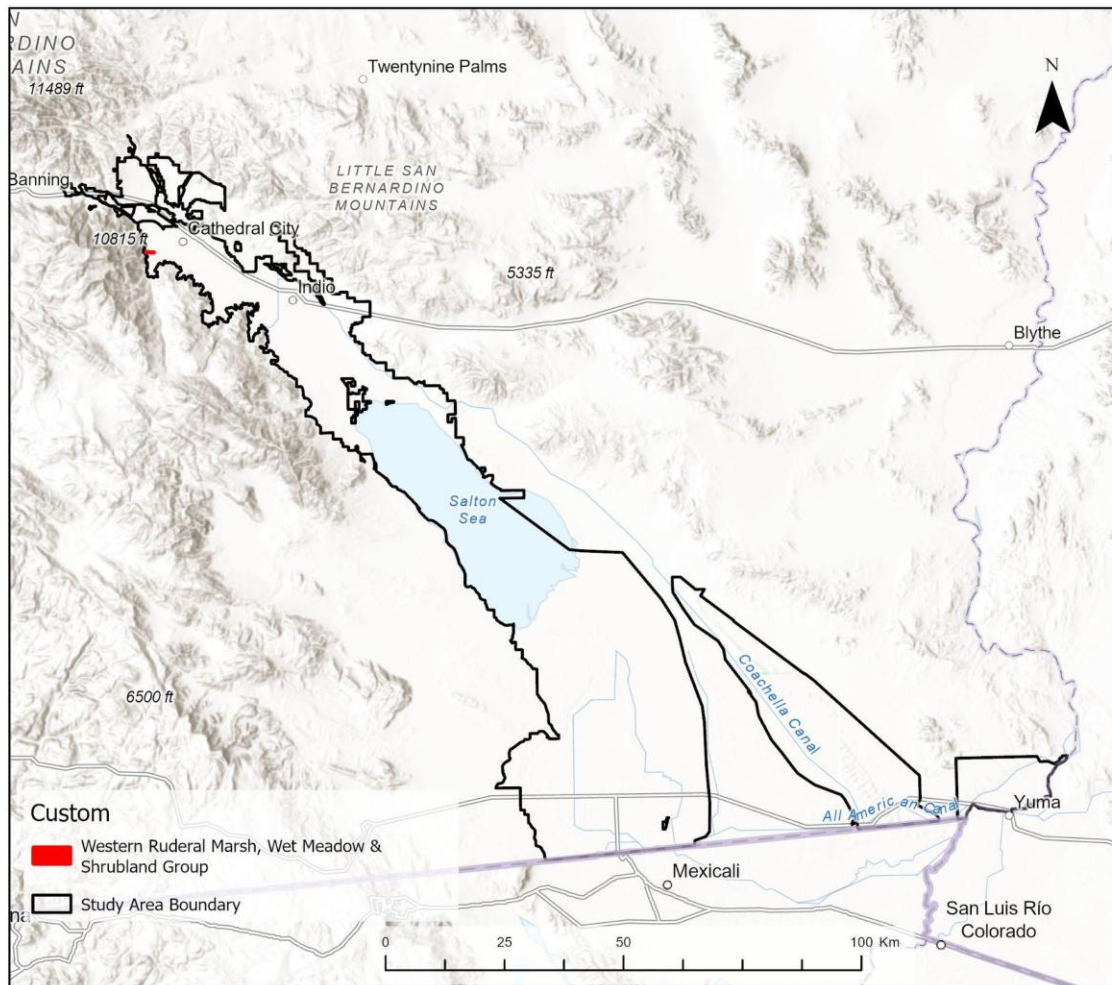


This section of the Tahquitz Canyon drainage in Palm Springs shows the dense, mostly nonnative herb cover lining the bottom of the channel.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

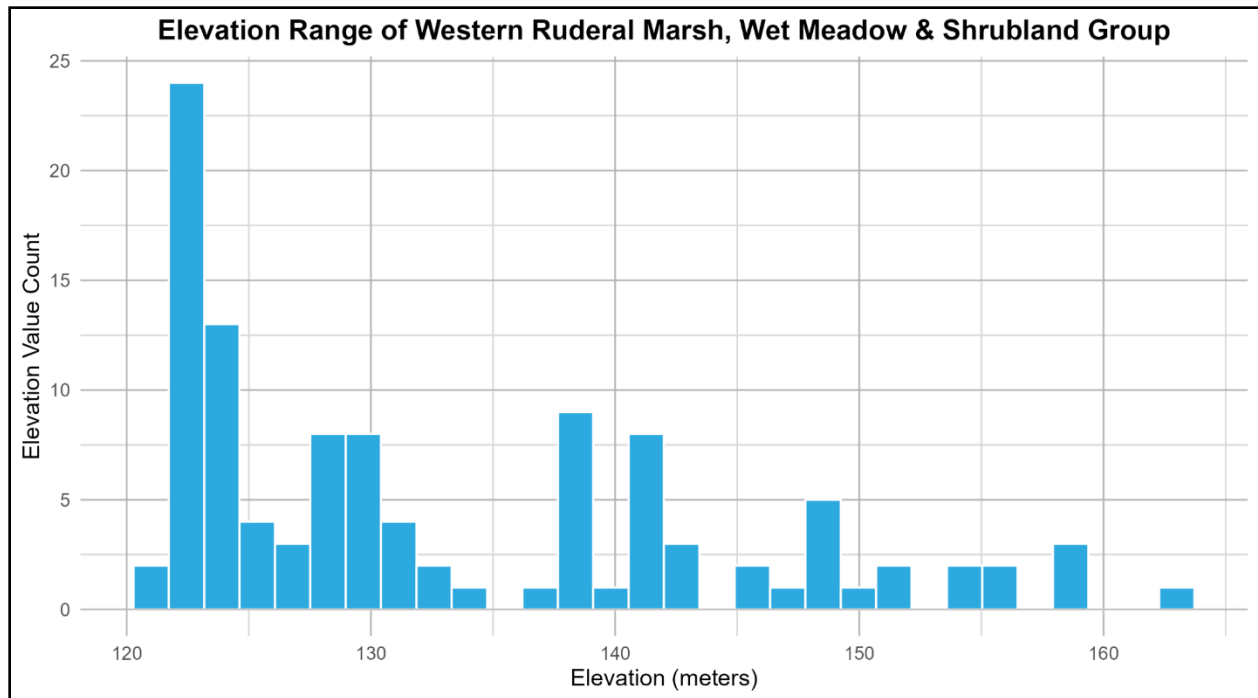
- *Cynodon dactylon* – *Crypsis* spp. – *Paspalum* spp. Semi-natural Alliance (3716) – *Cynodon dactylon* was a component of this stand, but clumps were intermittent and the total cover was subdominant. This grass spreads via rhizomes and stolons and so forms large clumps as opposed to individually identifiable plants as with *Pennisetum* species.
- *Distichlis spicata* – (*Juncus cooperi* – *Frankenia salina*) Interior Alliance (3726) – *Distichlis spicata* has a more muted color and tends to favor natural or semi-natural landscapes with alkaline soil.
- Warm Desert Ruderal Grassland Group (2340) – This Group is associated with upland landscapes and is composed of species that occur at thinner densities.

Western Ruderal Marsh, Wet Meadow & Shrubland Group (7110)



PROJECT DISTRIBUTION: Mappers assigned this Group across only two polygons within a portion of the Tahquitz Canyon drainage running through the center of Palm Springs in the Coachella Valley mapping subarea.

Western Ruderal Marsh, Wet Meadow & Shrubland Group (7110)



Phoenix dactylifera – Washingtonia filifera Alliance (1621)

***Phoenix dactylifera* – *Washingtonia filifera* Alliance (1621)**

Date palm – California fan palm groves

Rarity: GNASNA

MMU: 0.5 acres

MMW: 22 meters



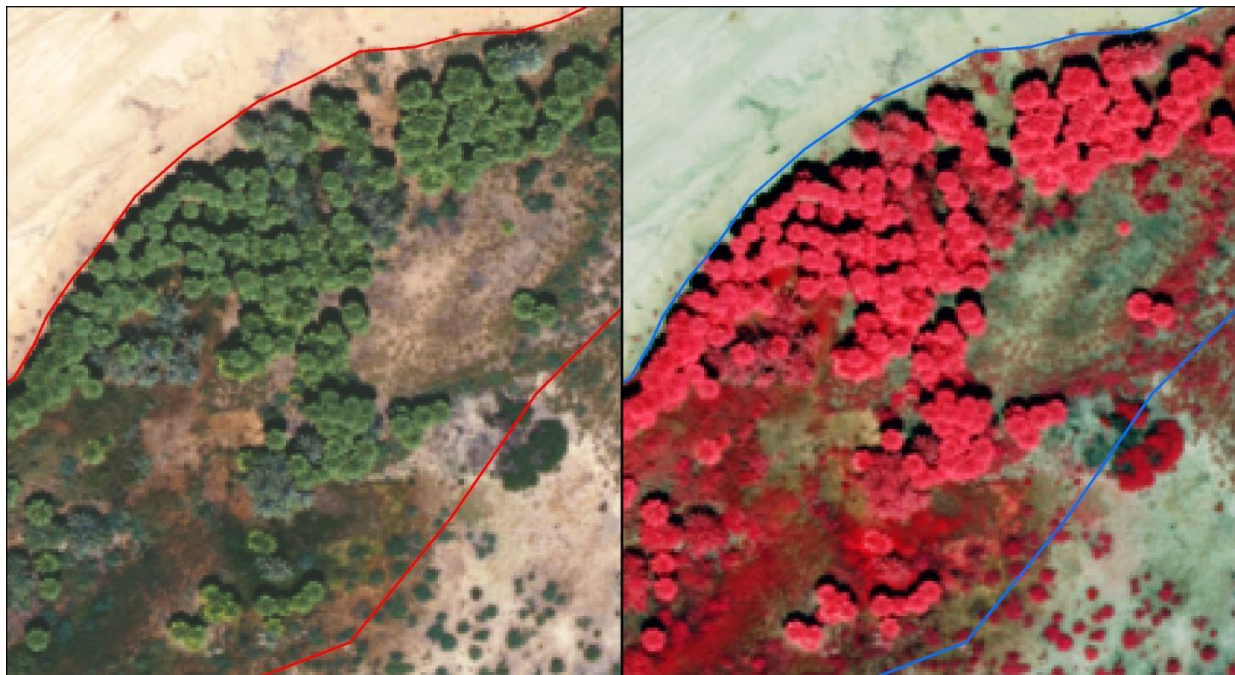
This grove of *Phoenix dactylifera* and *Washingtonia filifera* lined a large berm bordering the All American Canal in the Winterhaven subarea.

SUMMARY: Mappers used this Alliance specifically for *Washingtonia filifera* palm groves that are ruderal/human-influenced in some respect, as well as for palm groves where nonnative *Phoenix dactylifera*, *Phoenix canariensis*, and/or *Washingtonia robusta* are dominant. These groves must have one or more species of palm trees as dominant (>50%) in the tree layer. Palm seeds spread easily after a variety of bird and mammal species consume and transport them. Palms are also frequently planted by humans for ornamental purposes. This leads to numerous ruderal groves either intentionally planted or opportunistically spread to areas of artificially high soil moisture (agricultural ditches and canals, adjacent to aqueducts, excavated ponds, etc.). Mappers and field teams determined whether a grove was ruderal or not by imagining habitat conditions without human activities. In most cases, these areas would lose their high soil moisture and thus could not support self-sustaining groves of palms. This is in contrast to groves of native *Washingtonia filifera* that occur at natural seeps and springs usually resulting from underlying fault activity, or to groves along the Colorado River. These *Washingtonia filifera* groves that persist in the absence of human activity are treated in

Phoenix dactylifera – Washingtonia filifera Alliance (1621)

the *Washingtonia filifera* Woodland Alliance (1415). Other species associated with *Phoenix dactylifera* – *Washingtonia filifera* groves include typical Colorado Desert species such as *Pluchea sericea*, *Tamarix* spp., *Atriplex lentiformis*, *Salix* spp., *Prosopis glandulosa*, and *Phragmites australis*.

PHOTOINTERPRETATION SIGNATURE: *Washingtonia filifera* and *Washingtonia robusta* have essentially the same appearance from imagery – distinct, similarly-sized, neatly round crowns of green-yellow leaves with pale green highlights (true color) or bright red with pink highlights (CIR). *Phoenix dactylifera* sometimes have slightly larger, neatly round crowns with a rougher appearance, and appear as a dark blue-green to green-gray (true color) or a slightly paler red (CIR). Palms are usually tightly clustered in areas of noticeably higher soil moisture evidenced by dense understory vegetation relative to the surrounding landscape, although they can also sometimes appear more well-spaced and randomly scattered across a larger area with a high water table. *Washingtonia* species can grow extremely tall, and their shadows are often distinctly visible. For this ruderal Alliance, groves are closely associated with human activity (canals, water diversion berms, agriculture, residential properties, etc.).



This dense grove of *Washingtonia* sp. and *Phoenix dactylifera* follows the east berm of the West Mainside Canal in the Imperial Valley subarea.

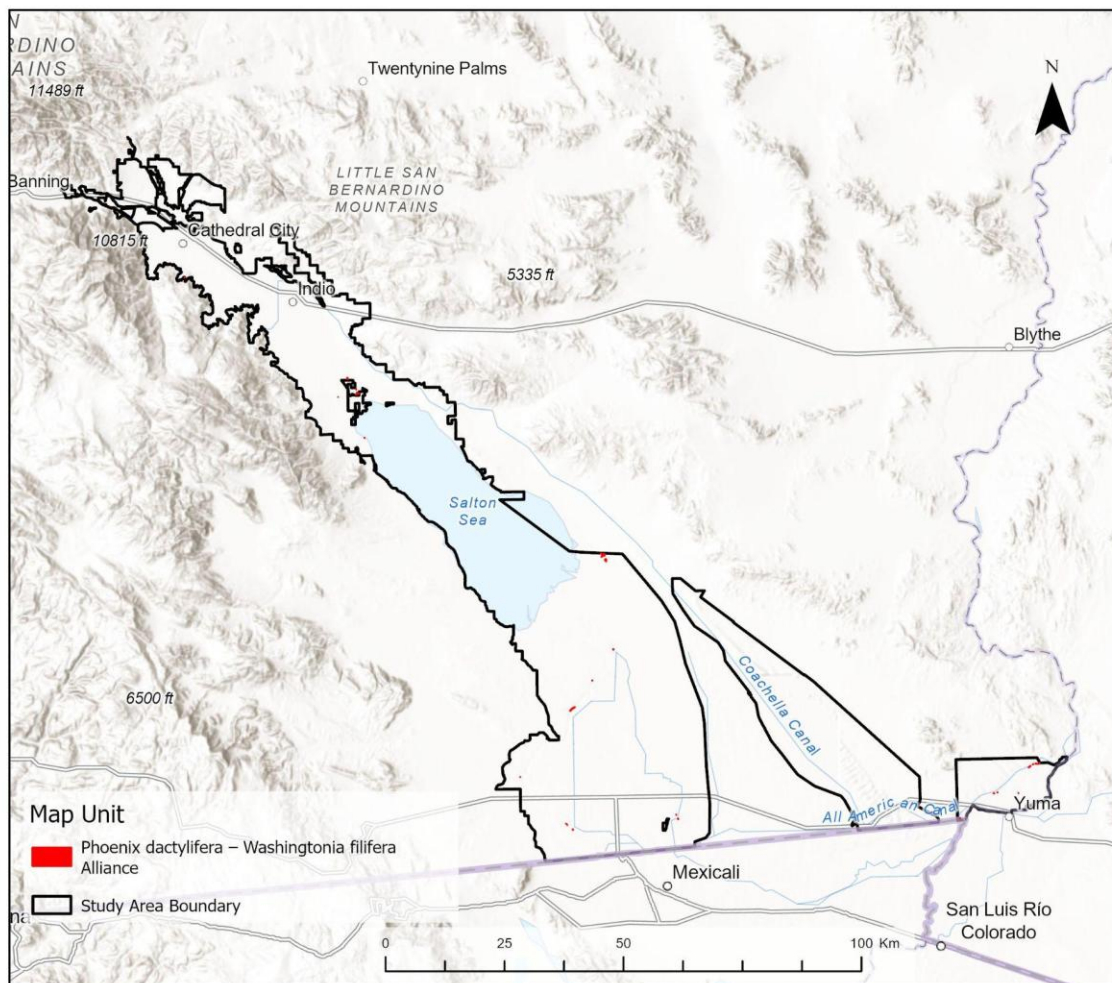
Phoenix dactylifera – Washingtonia filifera Alliance (1621)

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Washingtonia filifera* Woodland Alliance (1415) – Determining species of *Washingtonia* can be difficult/impossible using just aerial imagery, however *Phoenix dactylifera* has a distinct blue-green color and shorter stature that helps with identification. When significant cover of *Phoenix dactylifera* was not present, mappers used local knowledge of location of natural springs and geological features (prominent fault lines) to predict if a stand of *Washingtonia* sp. is ruderal or not.

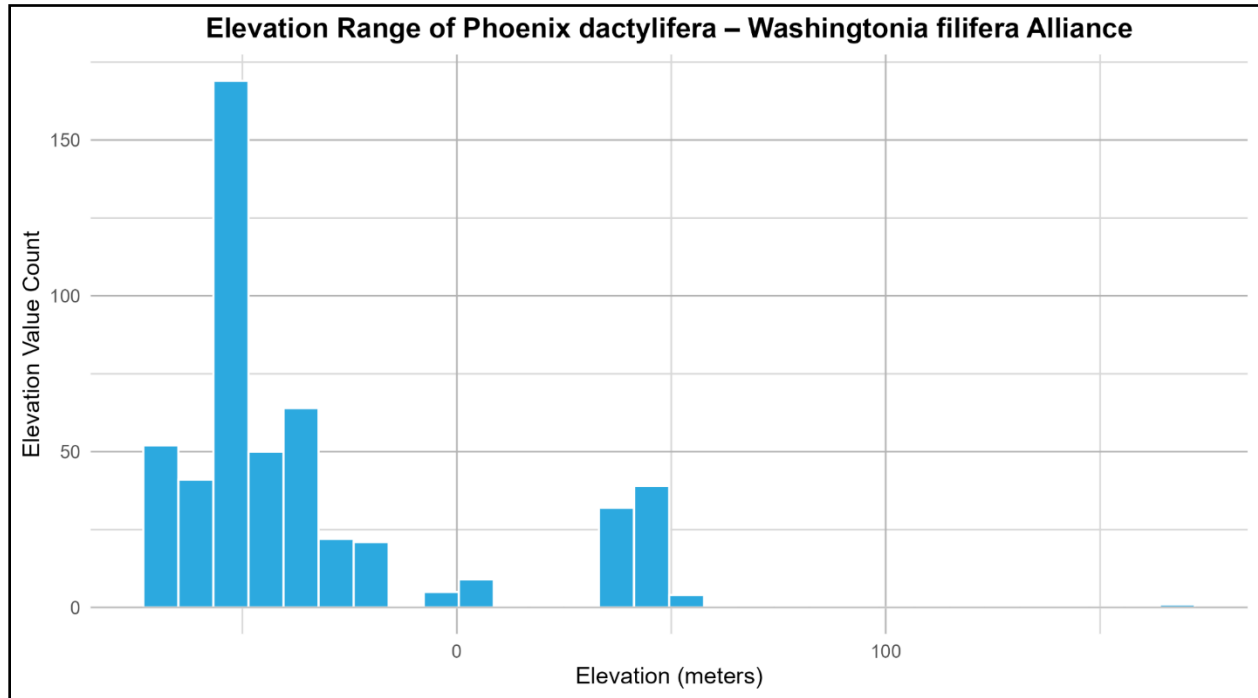
MAPPING CONSIDERATIONS:

- Mappers recorded percent cover of palm species in the Hardwood Cover attribute.



Phoenix dactylifera – Washingtonia filifera Alliance (1621)

PROJECT DISTRIBUTION: Mappers assigned this ruderal Alliance primarily in association with agricultural areas in the eastern Coachella Valley, Imperial Valley, and Winterhaven subareas.



***Phragmites australis* – *Arundo donax* Semi-natural Stands (1431)**

Common and giant reed marshes

Rarity: GNRSNR

MMU: 0.5 acres

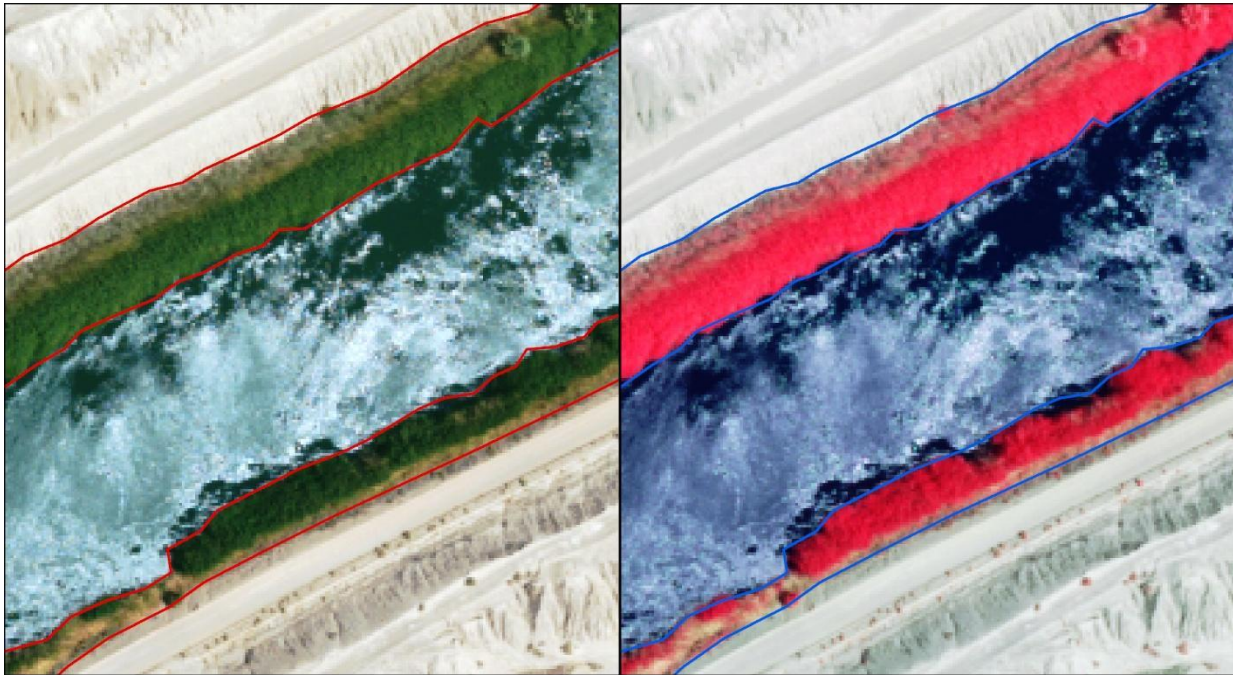
MMW: 22 meters



Dense *Phragmites australis* commonly lines waterways throughout the agricultural areas in this mapping area, as seen here along the All American Canal in the Winterhaven subarea.

SUMMARY: Both common reed (*Phragmites australis*) and giant reed (*Arundo donax*) are present along numerous agricultural waterways throughout the eastern Coachella Valley, Imperial Valley, and Winterhaven, where they form dense clonal thickets directly adjacent to open water. Field team surveys indicate that the semi-natural common reed is far more abundant than invasive giant reed within this mapping area. The two species can be easily confused and may hybridize, but height difference (giant reed is significantly taller) and differences in inflorescence (droopy in *P. australis* and erect in *A. donax*) are usually sufficient to differentiate these species at-a-glance. Within this mapping area, due to the anthropogenic conditions *P. australis* typically grows in, and also due to current unresolved questions regarding validity of taxonomy and morphological identification of *P. ssp. americanus*, mappers and field teams did not attempt to identify *P. australis* to subspecies and mapped all stands of *P. australis* to this ruderal Alliance, versus the *Phragmites australis* spp. *americanus* Provisional Association occasionally used in the DRECP mapping project.

PHOTOINTERPRETATION SIGNATURE: These reeds grow in large clonal clumps and only rarely include other plant species within the clumps. In true color imagery, these reeds appear as a vibrant green-yellow with a soft, smooth texture. In CIR, the color ranges from a bright pinkish-red to bright red. Recently-dead clumps appear golden-yellow on both true color and CIR imagery. To the best of our knowledge, it is difficult or impossible to differentiate giant reed from common reed using just satellite imagery. Stands usually occur in long, narrow strips directly on the edge of bodies of water, but may also form globular clumps deep within marshes.



The All American canal, shown here, is largely lined by dense *Phragmites australis* within the Winterhaven subarea.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

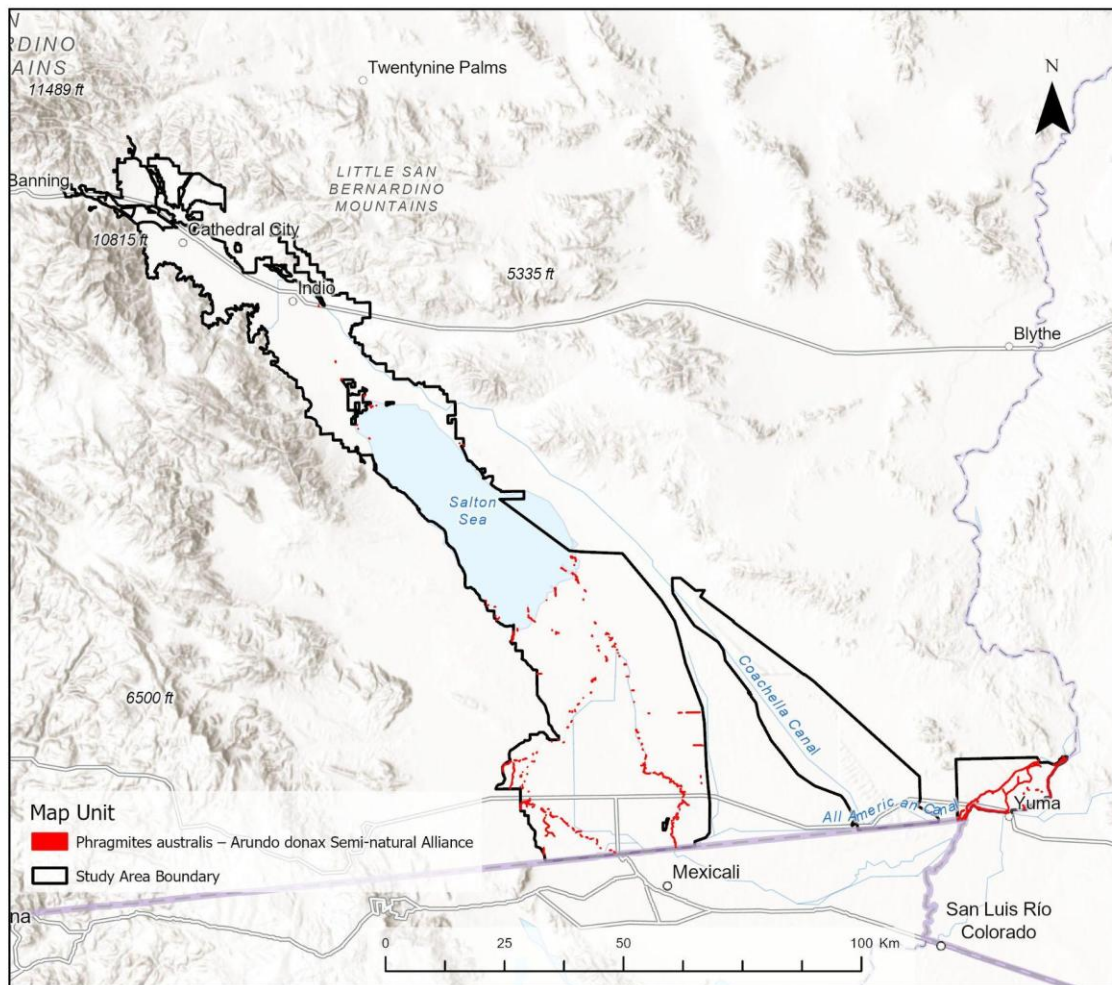
- *Typha* (*angustifolia*, *domingensis*, *latifolia*) Herbaceous Alliance (3416) – Cattails (*Typha* spp.) form clonal clumps similar to reeds and grow in similar habitats (perennially wet marshes and margins of water bodies). They also both have a similar soft, grass-like appearance when viewed using satellite imagery. However, *Typha* usually has a darker, less vibrant color (dark green in true color and deep red in CIR), and the lack of a rigid central stem causes *Typha* to occasionally droop and form a wave-like texture that is often visible via imagery, especially when recently-dead.
- *Pluchea sericea* Shrubland Alliance (4221) – *Pluchea sericea* sometimes forms dense thickets in similar wet habitats and thus may be confused with clumps of reeds. However, closer inspection reveals that *Pluchea sericea* stands, being

Phragmites australis – Arundo donax Semi-natural Stands (1431)

moderately sized shrubs, have a coarser texture and less vibrant coloration when viewed from satellite imagery. Additionally, bands of reeds, when present, usually form the first layer of vegetation closest to or in direct contact with open water, while *Pluchea sericea* grow farther inland (note, however, that the distance between these bands of vegetation is sometimes very narrow and difficult to resolve via imagery).

- *Bolboschoenus maritimus*, *Schoenoplectus americanus* Mapping Unit (3715) – these thin bulrush form a smooth, soft-textured mat in similar habitat to reeds. However, as they are much smaller and thinner, they tend to have even less apparent texture. When alive, their color is much deeper and almost a muddy, dark green in true color and a very deep red in CIR.

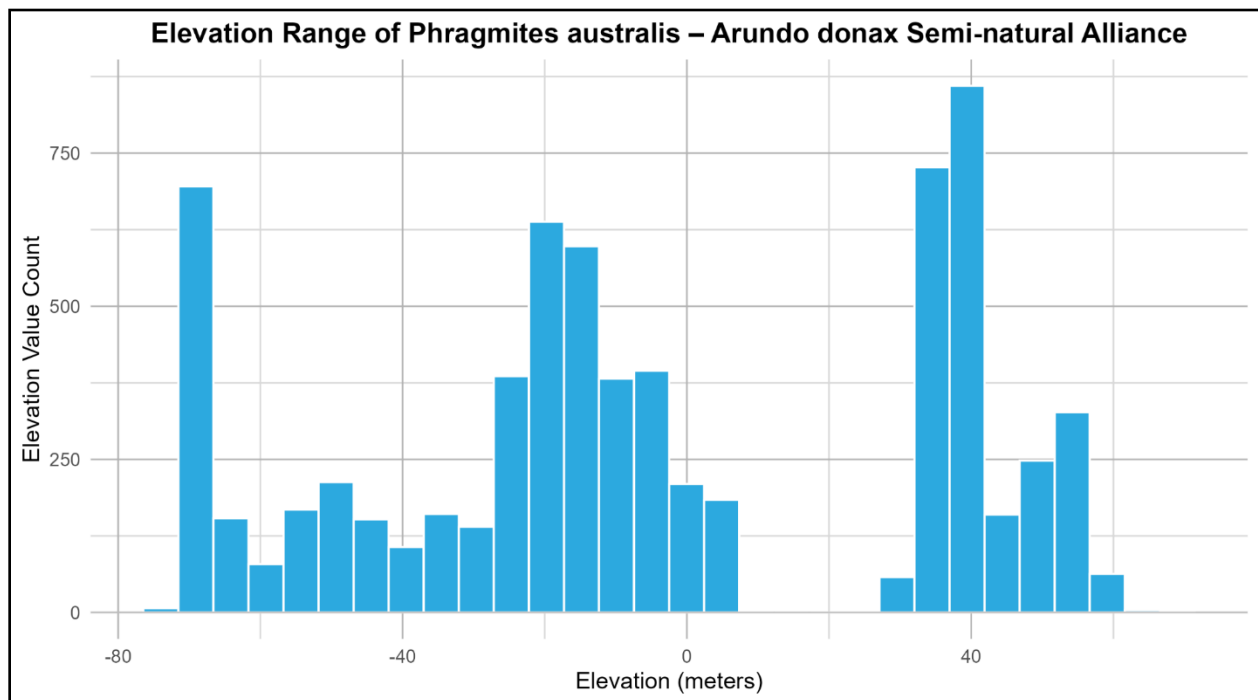
Phragmites australis – Arundo donax Semi-natural Stands (1431)



PROJECT DISTRIBUTION: *Phragmites australis* can be found lining most major waterways in the Winterhaven subarea, sometimes forming miles-long unbroken strands within the All American Canal, the Reservation Main Drain, and the Colorado River. Stands of common reed are also found within the large marshes around the north and south shores of the Salton Sea, and along the New and Alamo Rivers and associated canals/drainages in the Imperial Valley subarea. Mappable stands are restricted only to areas with permanently saturated soil or lining the banks of open bodies of water.

MAPPING CONSIDERATIONS:

- Within this mapping area, due to the anthropogenic conditions field teams typically find *P. australis* growing in, and also due to current unresolved questions regarding validity of taxonomy and morphological identification of *P. ssp. americanus*, field teams did not attempt to identify *P. australis* to subspecies and mappers assigned all stands of *P. australis* to this ruderal Alliance, versus the *Phragmites australis* spp. *americanus* Provisional Association occasionally used in the DRECP mapping project.



Pluchea sericea Alliance (4221)

***Pluchea sericea* Alliance (4221)**

Arrow weed thickets Alliance

Rarity: G4S3.3

MMU: 0.5 acres

MMW: 22 meters

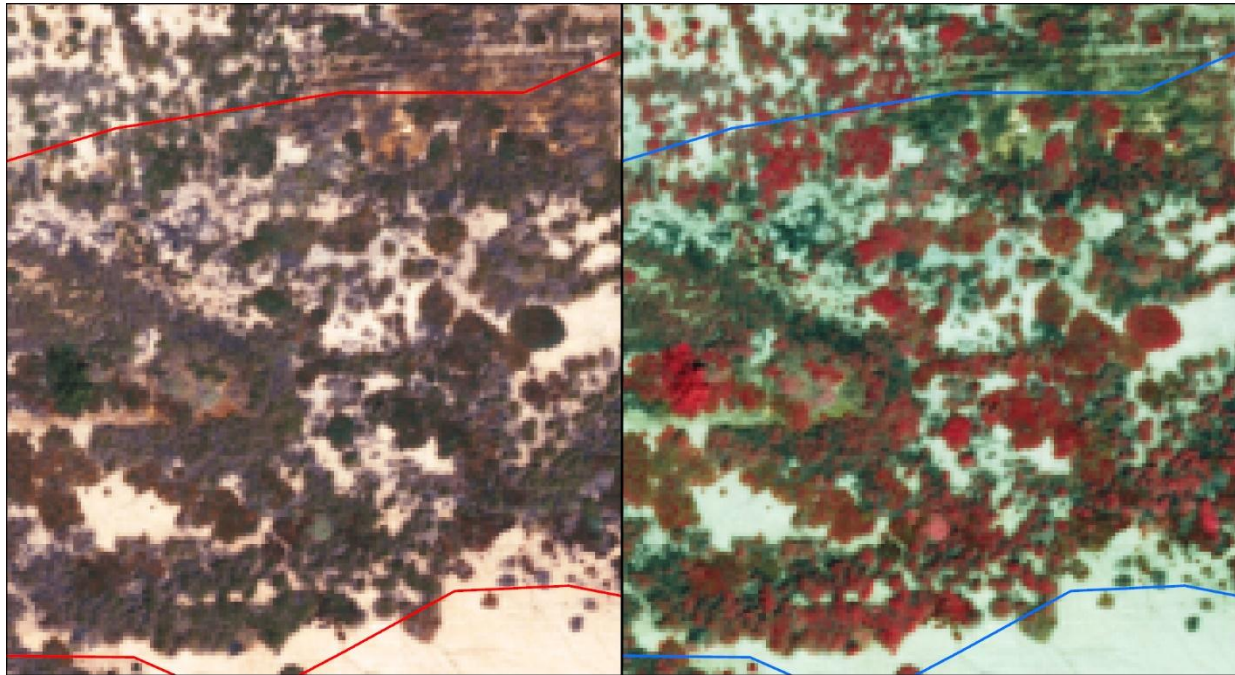


The foreground shows scattered *Pluchea sericea* on mud hill substrate, turning into a dense thicket in the midground along the New River.

SUMMARY: *Pluchea sericea* Alliance stands generally occur in dense thickets around seasonally flooded areas, irrigation ditches, river terraces, basins, and marshes. Stands are abundant within the mapping area at low elevations and were mapped where *Pluchea sericea* was dominant or co-dominant in the shrub canopy with at least 2% absolute cover. Soils are generally alkaline alluvial-derived sand or clay loams. Common co-occurring species include *Prosopis glandulosa*, shrubby *Tamarix* spp., *Atriplex lentiformis*, *Atriplex canescens*, *Allenrolfea occidentalis*, and *Suaeda nigra*.

Pluchea sericea Alliance (4221)

PHOTOINTERPRETATION SIGNATURE: *Pluchea sericea* cover can be sparse and well-spaced to very dense thickets. Dense stands appear as a homogenous thicket, with no other species co-dominating. In sparse stands or at the edges of thickets, individuals can be scattered to clumped. In aerial imagery dense thickets appear as a grey to light olive green tone. In CIR thickets appear light red to pink with grey.



These photos, from the southern part of the Imperial Valley mapping subarea, show dense *Pluchea sericea* (highest cover, clumped) with lower cover of *Atriplex lentiformis* and *Suaeda moquinii*.

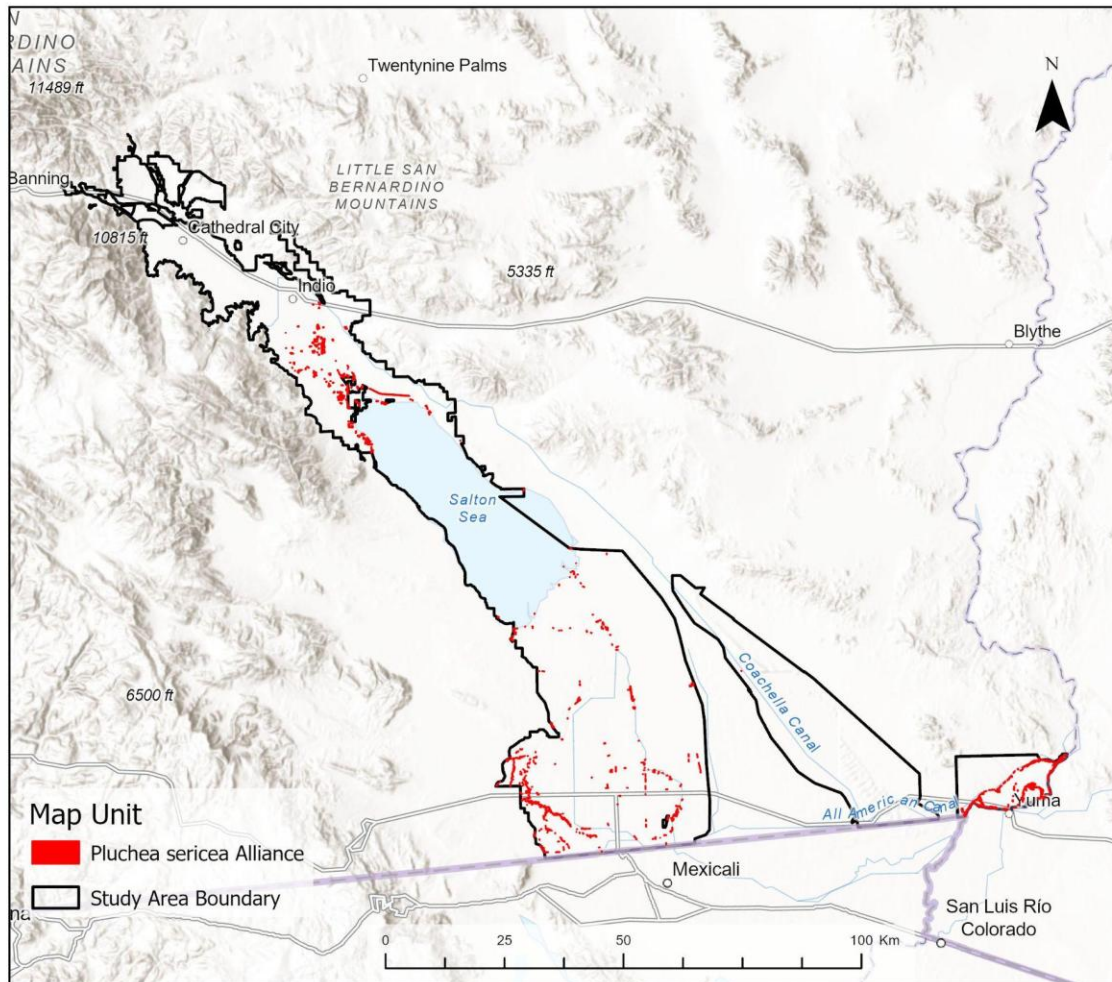
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Atriplex canescens* Shrubland Alliance (5111) – Stands of *Atriplex canescens* are found in upland and in arid regions within the mapping area, stands rarely dominate near river basins, and occur in less dense patches, rarely forming thickets. Coloration is similar, however *Atriplex canescens* appear to have more of a brown-green tone.
- *Atriplex lentiformis* Shrubland Alliance (3722) – *Atriplex lentiformis* has a similar color in both the true-color and CIR imagery, and it occurs in dense stands. *Atriplex lentiformis* individuals are large and distinct, even in a dense stand they have a globular form. Clumped *Pluchea sericea* individuals are difficult to tell apart in dense thickets. *Atriplex lentiformis* is also slightly lighter in color and prefers slightly drier sites.
- *Atriplex polycarpa* Shrubland Alliance (4113) – *Atriplex polycarpa* occurs with *Pluchea sericea*, however it rarely dominates in similar regions. Stands generally

Pluchea sericea Alliance (4221)

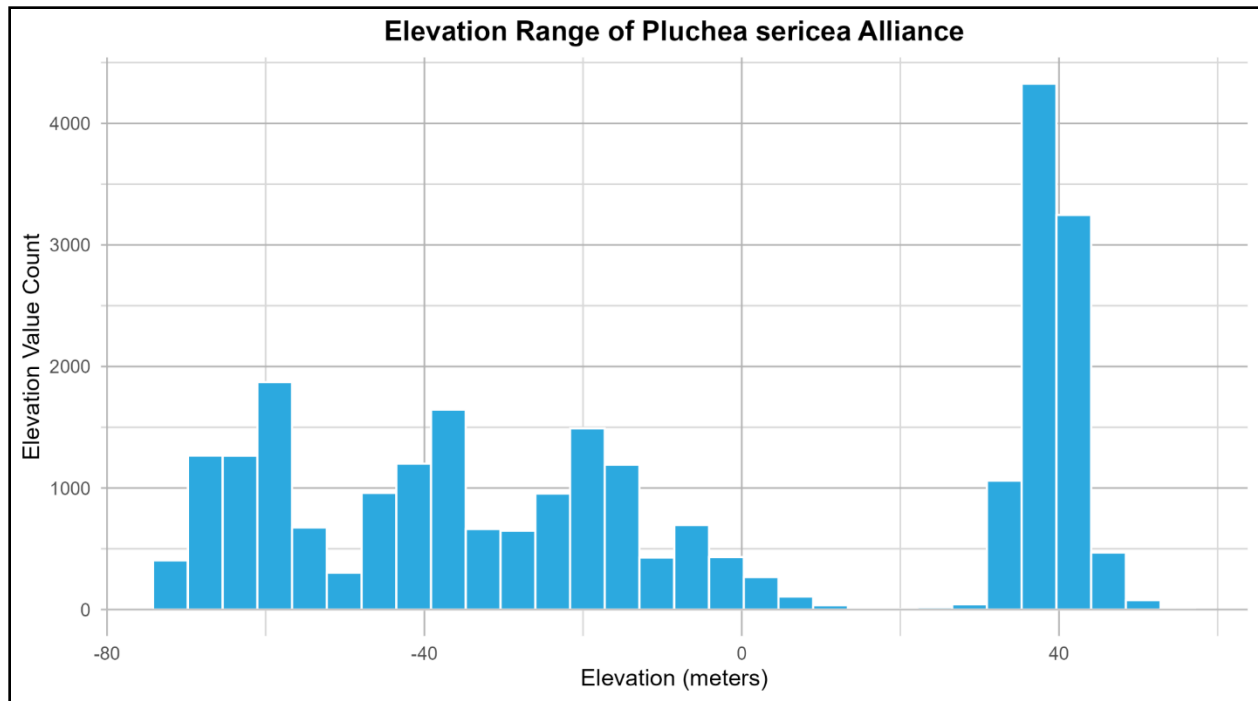
occur on the northwestern side of the Salton Sea in more well-drained soils. Stands share a similar signature to *Atriplex canescens*, however individuals tend to be smaller and darker in color.

- *Tamarix* spp. Semi-natural Stands (1432) – *Tamarix* spp. co-occur and can codominate with *Pluchea sericea* throughout its range. *Tamarix* is distinct in imagery; it is generally taller, brighter green, or red in CIR, and has a “feathery” appearance, which is not as smooth as the texture of *Pluchea sericea*.



PROJECT DISTRIBUTION: *Pluchea sericea* stands occur within the Coachella Valley, Imperial Valley and Winterhaven subareas. In the Coachella Valley it occurs at low elevations on the north side of the Salton Sea. Stands occur throughout the Imperial Valley, particularly along the New River and Alamo River, and throughout the southeastern portion of Winterhaven in the Colorado River basin.

Pluchea sericea Alliance (4221)



Populus fremontii – *Fraxinus velutina* – *Salix gooddingii* Alliance (1411)

***Populus fremontii* – *Fraxinus velutina* – *Salix gooddingii* Alliance (1411)**

Fremont cottonwood – Velvet ash – Black willow forest Alliance

Rarity: G4S3.2

MMU: 0.5 acres

MMW: 22 meters



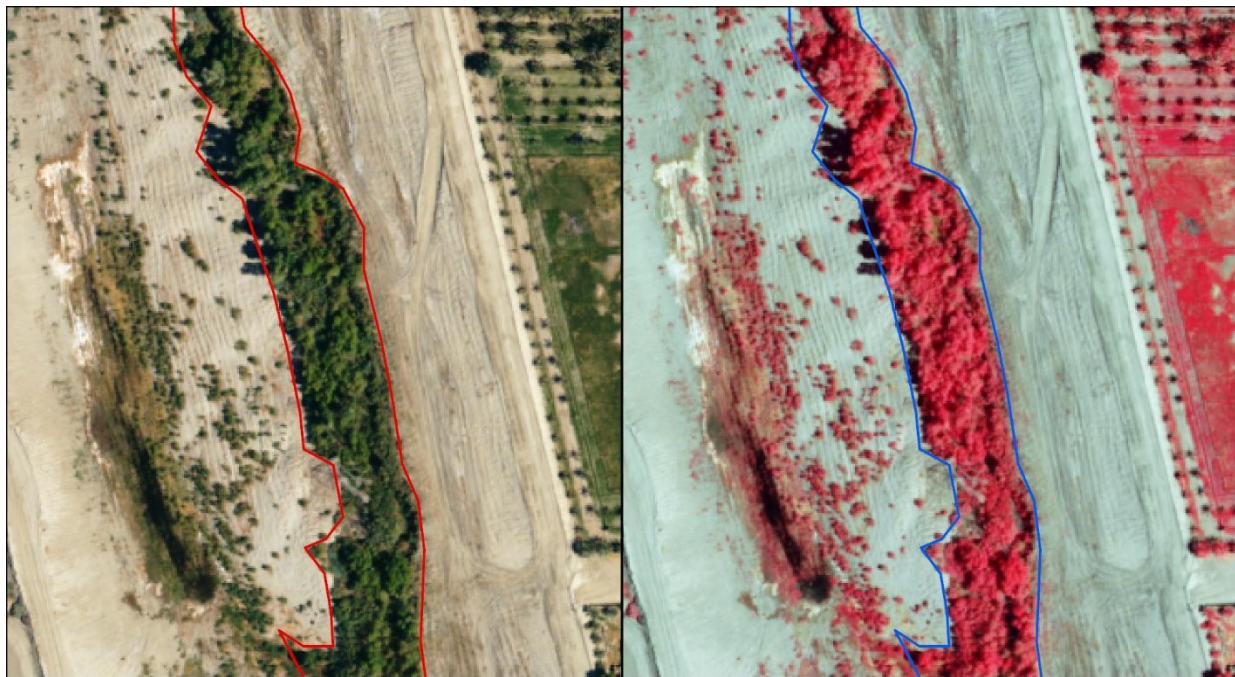
This cottonwood stand photographed at the Mojave Narrows Regional State Park along the Mojave River consists primarily of mature cottonwood trees with scattered *Salix* (willow) species. The straw-colored understory are large, invasive perennial *Lepidium latifolium* (perennial pepperweed) which field teams did not encounter within this mapping area.

SUMMARY: Mappers assigned this Alliance where *Populus fremontii* was present and dominant or codominate with *Salix gooddingii*, and achieved greater than 5% absolute cover, or 30% relative cover with *Salix gooddingii*. If *Populus fremontii* was not dominant and *Salix gooddingii* was greater than 50% relative cover in the tree canopy, the stand was mapped to the *Salix gooddingii* – *Salix laevigata* Alliance. This vegetation type was not common within this mapping area, but mappers and field teams occasionally found small, mappable patches of cottonwood and black willow along manmade storm channels and drainages, as well as along permanently wet patches of dense vegetation along the shores of the Salton Sea. Mappers and field teams more commonly found individual trees scattered within much denser riparian vegetation. Common understory

Populus fremontii – *Fraxinus velutina* – *Salix gooddingii* Alliance (1411)

species include *Tamarix* spp., *Atriplex lentiformis*, *Pluchea sericea*, and *Phragmites australis*.

PHOTOINTERPRETATION SIGNATURE: This riparian forest type occurs in areas of dense riparian vegetation. Large trees are often easily discernable due to the presence of shadows, as demonstrated in the images below. Smaller trees growing in dense groves may be difficult to separate from large shrubs such as *Tamarix ramosissima*, however *Populus fremontii* tend to be paler green (true color) or pink (CIR), and *Salix gooddingii* tend to be a more vibrant green to green-yellow (true color). Mature *Populus fremontii* also usually exhibit a more “fluffy” texture than other associated trees or tall shrubs. *Populus fremontii* are winter deciduous and appear wispy with light colored branches when leafless.



In the Coachella Valley, stands of *Populus fremontii* and *Salix gooddingii* are usually restricted to narrow strips lining the bottom of the Whitewater Storm Channel. Shadows and differences in color can be useful for identifying tall, mature trees.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

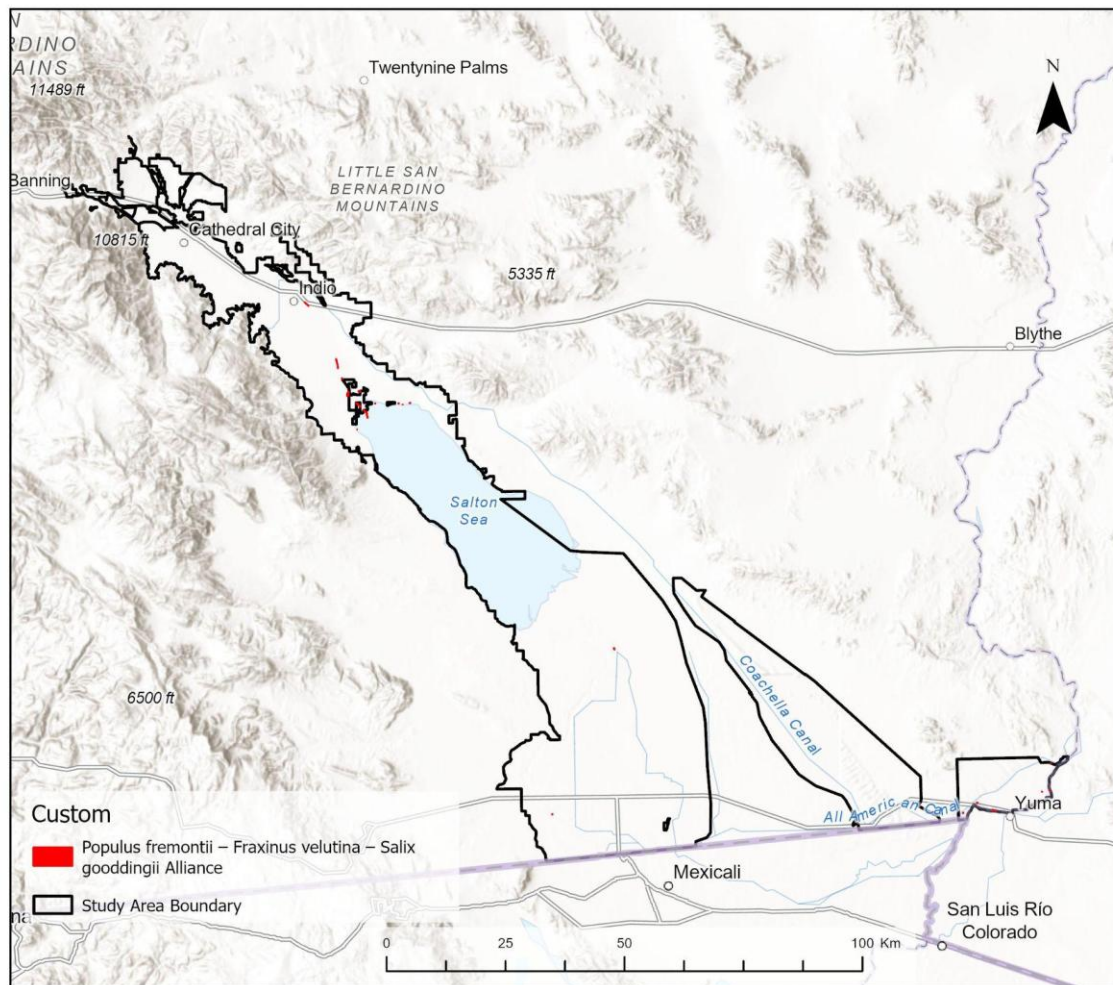
- *Tamarix* spp. Semi-natural Stands (1432) – *Tamarix* is very often a significant component in riparian areas in this mapping area, and as such is often found in close proximity or blending into the understory of large trees such as *Populus fremontii*. It can therefore be difficult to differentiate between trees and large *Tamarix*. However, *Tamarix* tend to have a deeper red color in CIR and often

Populus fremontii – Fraxinus velutina – Salix gooddingii Alliance (1411)

blend into a thicket of many individuals, whereas one can usually discern individual *Populus fremontii* trees due to their size. Shadows of tall trees also help separate them from shorter *Tamarix*.

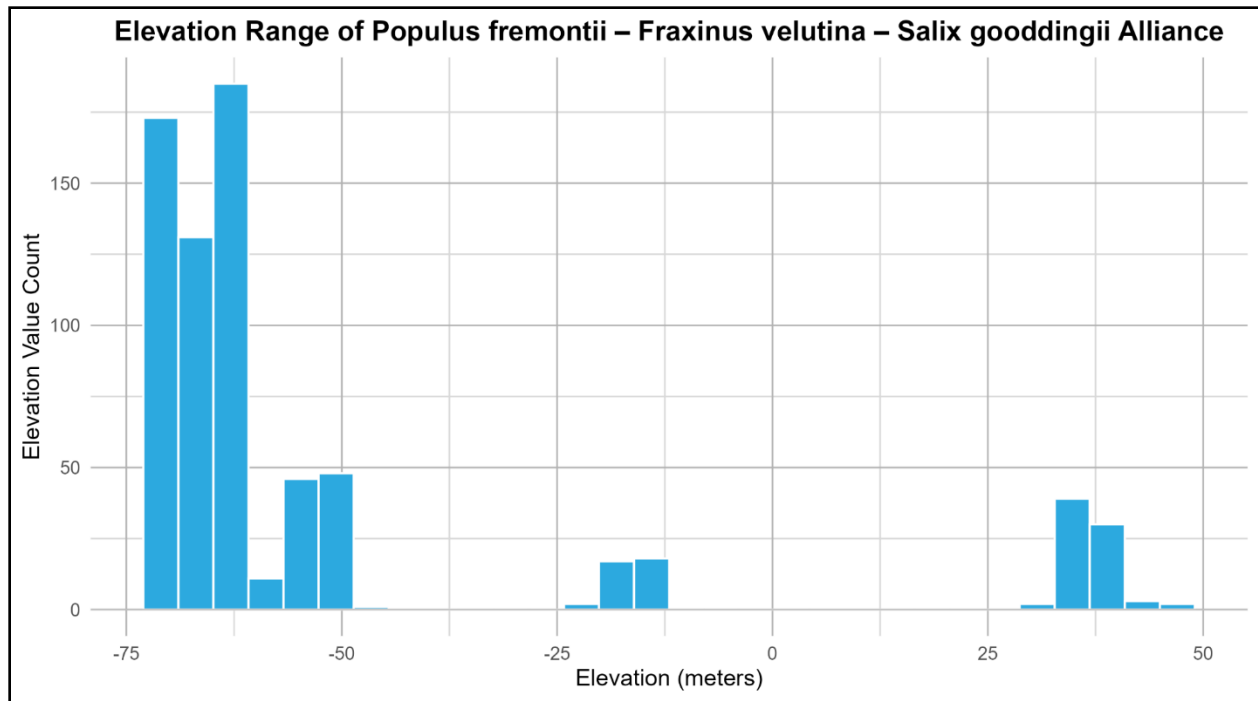
- Exotic Trees (9500) – Common exotic trees encountered in this mapping area include *Eucalyptus* species, athel tamarisk (*Tamarix aphylla*), and a variety of other large, drought-tolerant species. Location context is usually sufficient to rule out native *Populus fremontii* and *Salix* spp., as stands of native trees tend to only grow in particularly wet, unmanaged areas, such as around the shores of the Salton Sea and at the bottoms of large drainage channels. Exotic trees are usually found in association with residences or planted in rows along agricultural field margins, highways, or railroads.
- *Phoenix dactylifera* – *Washingtonia filifera* Semi-Natural Stands (1434) – *Washingtonia filifera* leaves have a similar color to *Populus fremontii*, however these trees can be easily separated by the small, round shape of palm tree crowns versus the much larger, irregular crown shape of *Populus fremontii* trees.
- *Salix laevigata* – *Salix gooddingii* Woodland Alliance (1416) – Stands that were mapped solely to the *Salix* Alliance lacked presence of *Populus fremontii* (or at less than 5% absolute cover). They are distinguishable by an overall softer appearance and lack of distinct individuals.

Populus fremontii – Fraxinus velutina – Salix gooddingii Alliance (1411)



PROJECT DISTRIBUTION: Stands of *Populus fremontii* were encountered at both natural and anthropogenic sources of standing water in the Coachella Valley within the Whitewater River stormwater channel and within the dense riparian stands along the north side of the Salton Sea. Field teams also identified two mappable stands of *P. fremontii* within artificial wetland habitat in the small communities of Oasis and Thermal, just north of the Salton Sea. In the Winterhaven mapping subarea, mappers delineated small stands of *P. fremontii* along or near to the All American Canal, as well as a restoration site of planted trees on the north bank of the Colorado River. Only one stand of *P. fremontii* was mapped in the Imperial Valley at the Imperial Wildlife Refuge, and no stands within the Algodones Dunes mapping subarea.

Populus fremontii – Fraxinus velutina – Salix gooddingii Alliance (1411)



Prosopis glandulosa – *Prosopis velutina* – *Prosopis pubescens* Woodland Alliance (4222)

***Prosopis glandulosa* – *Prosopis velutina* – *Prosopis pubescens*
Woodland Alliance (4222)**

Mesquite thickets Alliance

Rarity: G5S3

MMU: 0.5 acres

MMW: 22 meters

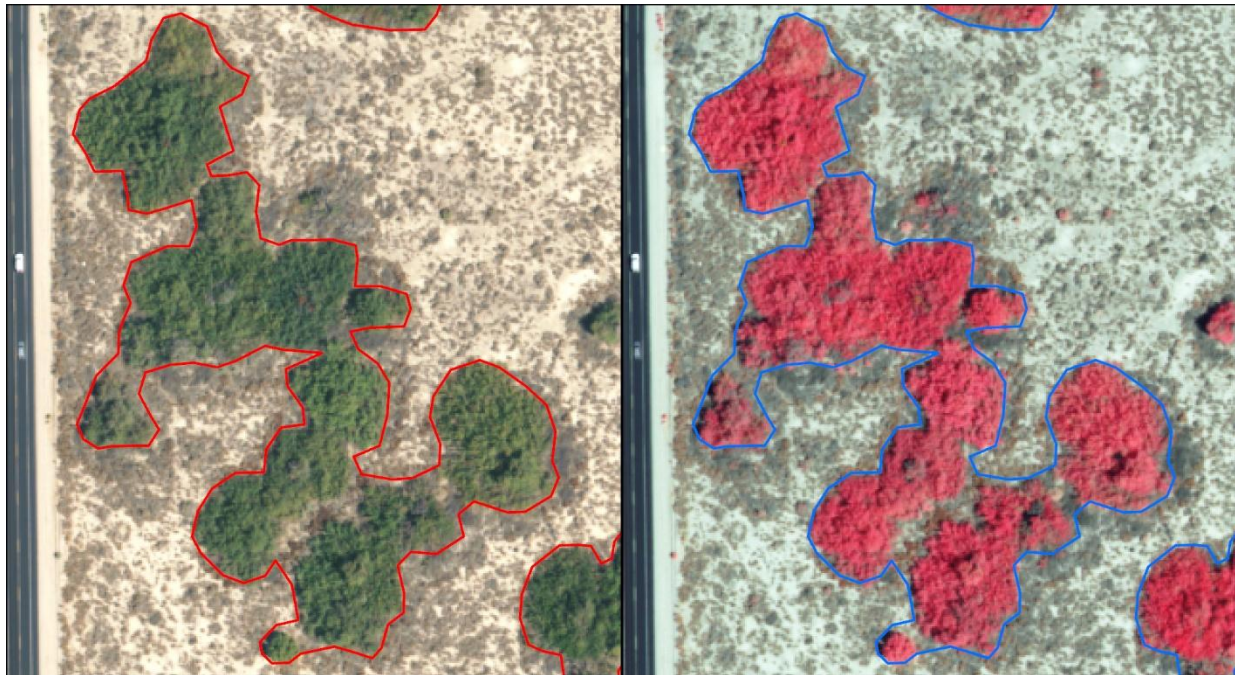


Photo of a large *Prosopis glandulosa* with mistletoe (*Phorodendron californica*). In the foreground there are dead annual herbs and *Suaeda moquinii*.

SUMMARY: In this region *Prosopis glandulosa* is the primary mesquite species, with occasional trace amounts of *Prosopis pubescens* within stands. *Prosopis glandulosa* comprises at least 2 percent absolute cover and does not codominate with other microphyll trees. Stands were mapped to the *Prosopis glandulosa* – *Prosopis velutina* – *Prosopis pubescens* Alliance where *Prosopis glandulosa* is consistently present but *Tamarisk* spp. could be present up to 60% relative cover. Stands generally occur on river terraces, stream banks, playa edges, gullies, floodplains, sand dune margins, and springs. *Phoradendron californica*, mesquite mistletoe, was found in almost all stands. Co-occurring shrubs in the understory or at stand edges include *Tamarisk* spp., *Allenrolfea occidentalis*, *Larrea tridentata*, *Atriplex canescens*, *Atriplex polycarpa*, *Pluchea sericea*, and *Suaeda moquinii*.

Prosopis glandulosa – *Prosopis velutina* – *Prosopis pubescens* Woodland Alliance (4222)

PHOTOINTERPRETATION SIGNATURE: Stands range in cover from sparse with scattered trees along a river terrace or undeveloped lots to dense thickets with close to 100% cover. Tree crowns are rounded with well-defined edges and varying height. Stands that are experiencing heavy die-off appear grey to brown. The photo signature for live stands appears medium, vibrant green in true-color and bright to bright red in CIR, with a bumpy texture.



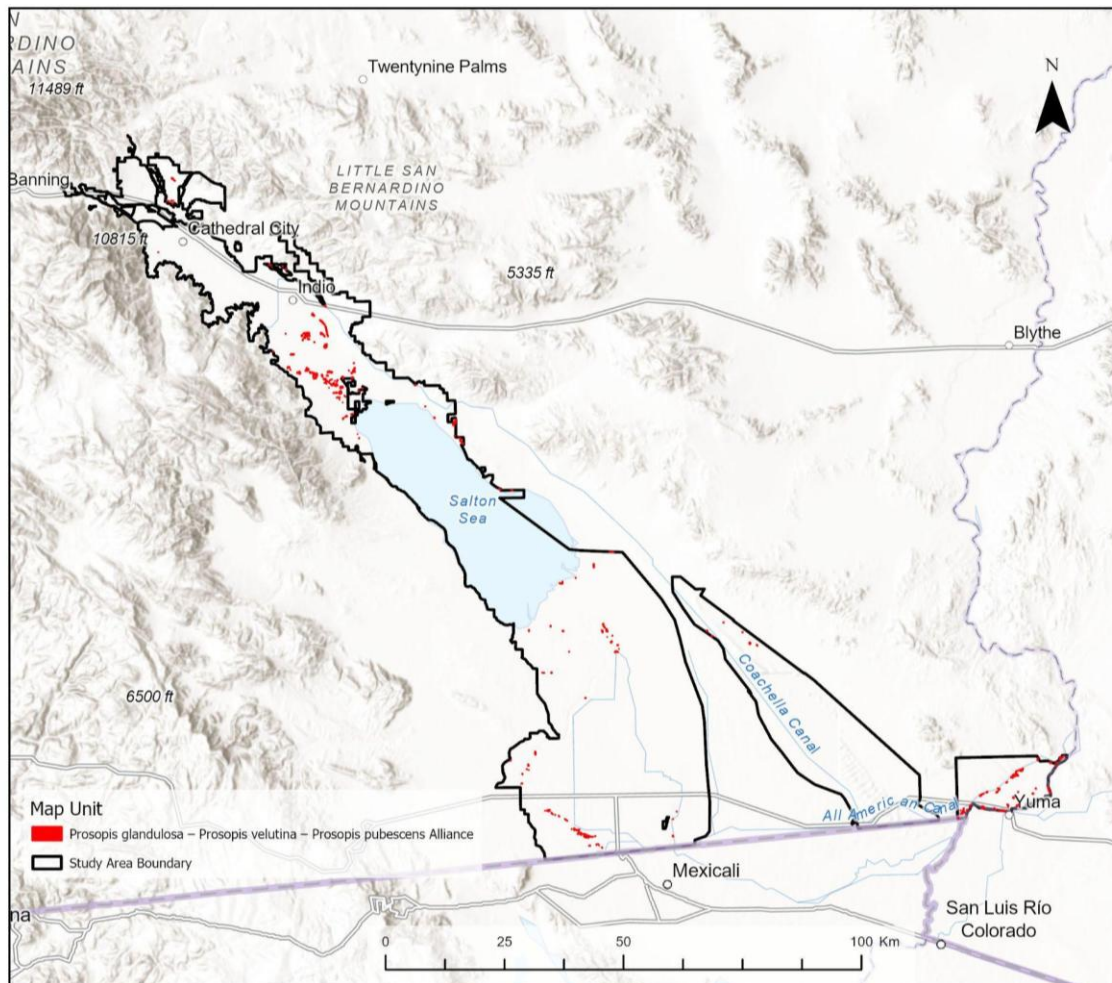
This dense, healthy honey mesquite thicket was found in the community of Thermal in the Coachella Valley mapping subarea.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Tamarix* spp. Semi-natural Alliance (1432) – Shrubs in the *Tamarix* Alliance have a less distinct crown with a more smooth appearance in the signature, the color difference is distinct, with *Tamarix* appearing as a slightly more muted red in CIR, and individuals are noticeably smaller.
- *Parkinsonia florida* – *Olneya tesota* Woodland Alliance (4227) – This tree Alliance occurs in upland settings within the bajadas of adjacent mountain foothills. Occasionally a *Parkinsonia florida* individual will occur near stands of *Prosopis*, especially in the Algodones Dunes subarea. Here, *Parkinsonia* is a much brighter green in imagery and has a less sprawling crown.
- Exotic Trees (9500) – Stands of exotic trees, including ornamental mesquite, occur throughout the Imperial Valley mapping area. Generally, these stands are

Prosopis glandulosa – Prosopis velutina – Prosopis pubescens Woodland Alliance (4222)

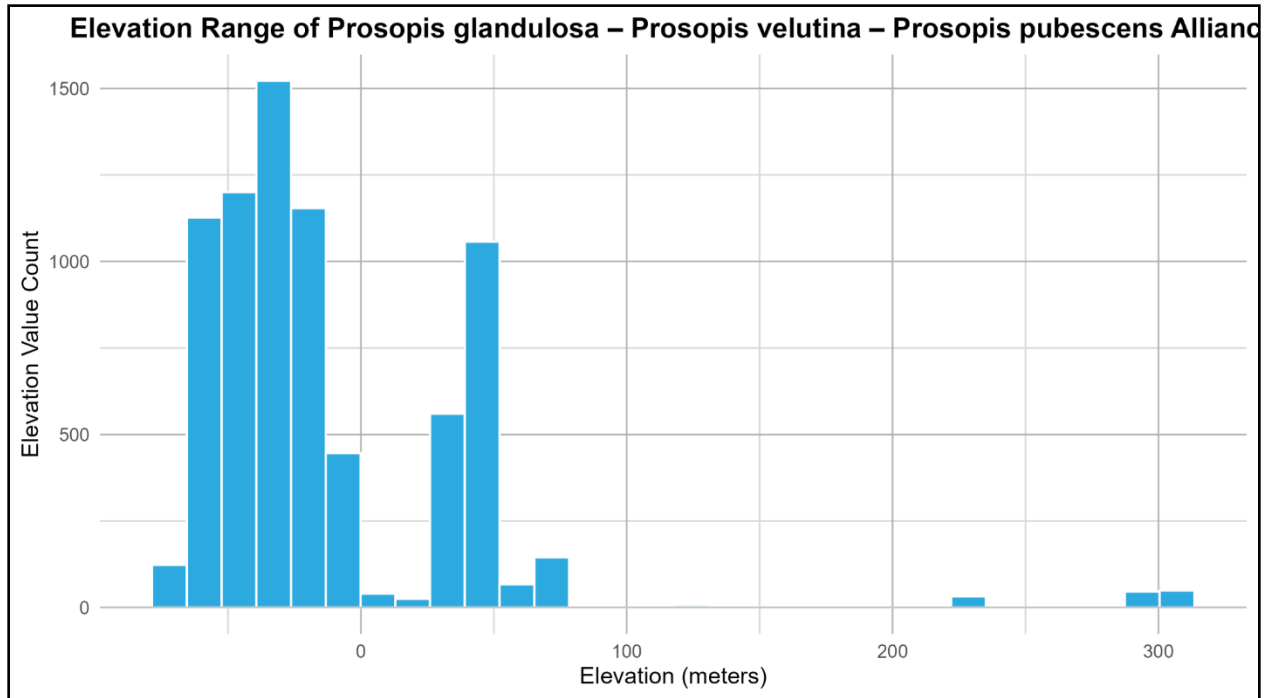
made up of many ornamental tree species, which are distinct in the imagery. For mixed exotic trees, color, texture, and height is variable, and generally associated with heavily developed areas. This mapping unit is also used for stands of *Tamarisk aphylla*, which is generally planted in rows to create wind breaks in the Coachella and Imperial Valleys. As with the *Tamarix* Alliance, there is an evident difference in the texture of *Tamarisk aphylla* versus *Prosopis*, as it appears overall taller and with more structure to the height, with a darker green color in imagery, dull red crown in CIR.



PROJECT DISTRIBUTION: *Prosopis* Alliance occurs throughout all three subareas. In the Coachella Valley it primarily occurs closer to the Salton sink within undeveloped areas of the community of Thermal at lower elevations, however there are stands in the western portion near Desert Hot Springs where it is associated with aeolian dune hummocks. In the Imperial Valley subarea, *Prosopis* stands are generally found on river terraces of the southern New River and throughout restoration areas of the Imperial Wildlife Area Finney-Ramer Management Unit along the Alamo River. In the Algodones

Prosopis glandulosa – Prosopis velutina – Prosopis pubescens Woodland Alliance
(4222)

Dunes, *Prosopis* is found on the northeastern edge along the dune margins and scattered on the western side where other riparian associated species occur. Within the Winterhaven subarea, *Prosopis* is scattered along the All American Canal, throughout restoration plots on tribal land, and adjacent to the Colorado River.



Psorothamnus fremontii – Psorothamnus polydenius Shrubland Alliance (4219)

***Psorothamnus fremontii* – *Psorothamnus polydenius* Shrubland Alliance (4219)**

Fremont's smokebush – Nevada smokebush scrub

Rarity: G4?S3

MMU: 10 acres

MMW: 101 meters

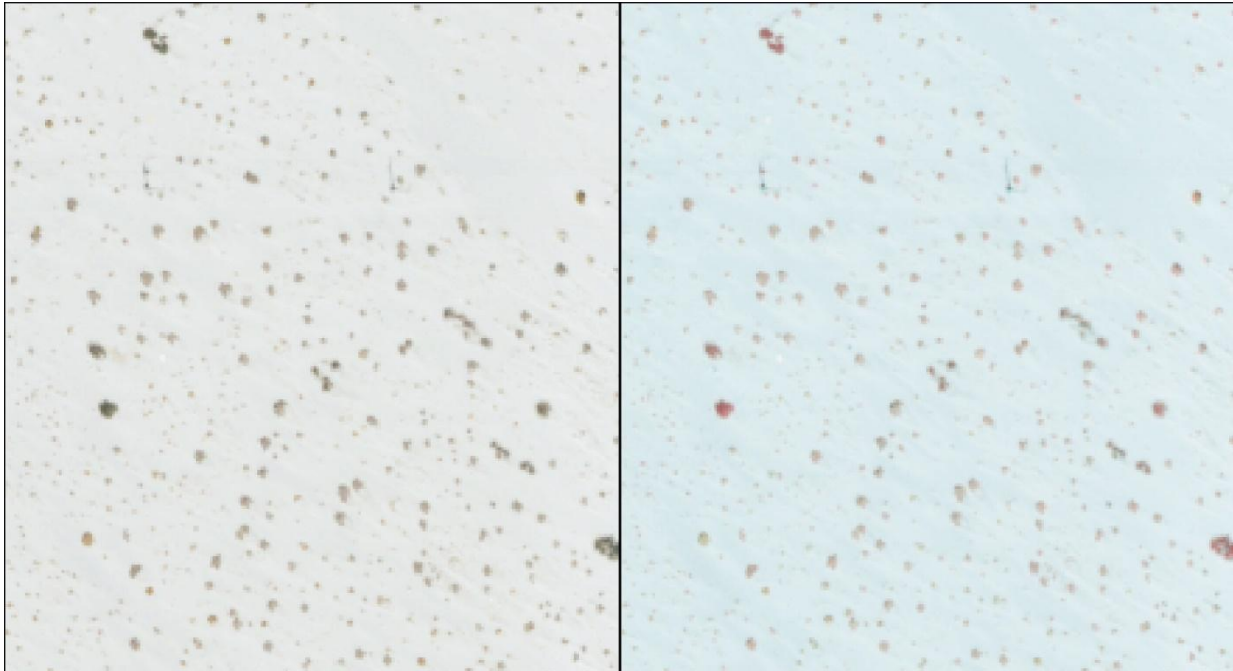


The midground shows *Psorothamnus arborescens* with dune hummocks and scattered *Ambrosia salsola*. Mount San Jacinto and wind turbines are in the background.

SUMMARY: The *Psorothamnus fremontii* – *Psorothamnus polydenius* Alliance was used to map stands of *Psorothamnus arborescens* in the Coachella Valley subarea. The southern extent of the range of *Psorothamnus arborescens* is the western portion of the Coachella Valley, where it occurs on the ephemeral sand dunes created by wind and periodic flooding events that drive sediment through the Whitewater Floodplain. *Psorothamnus arborescens* occurs in open stands with low to moderate cover with *Larrea tridentata*, *Psorothamnus emoryi*, *Ambrosia salsola*, *Ambrosia dumosa*, *Petalonyx thurberi*, and *Ephedra californica*.

Psorothamnus fremontii – *Psorothamnus polydenius* Shrubland Alliance (4219)

PHOTOINTERPRETATION SIGNATURE: *Psorothamnus arborescens* is a small to medium shrub with white stems and light green, hairy leaves that are drought deciduous. Wind-blown sand collects around the base of the shrubs, creating hummocks where it occurs on ephemeral sand fields. Individual plants are variable in size due to the harsh environment. In true color imagery they appear very light grey-sage green. In CIR they appear to be a light greyish-pink.

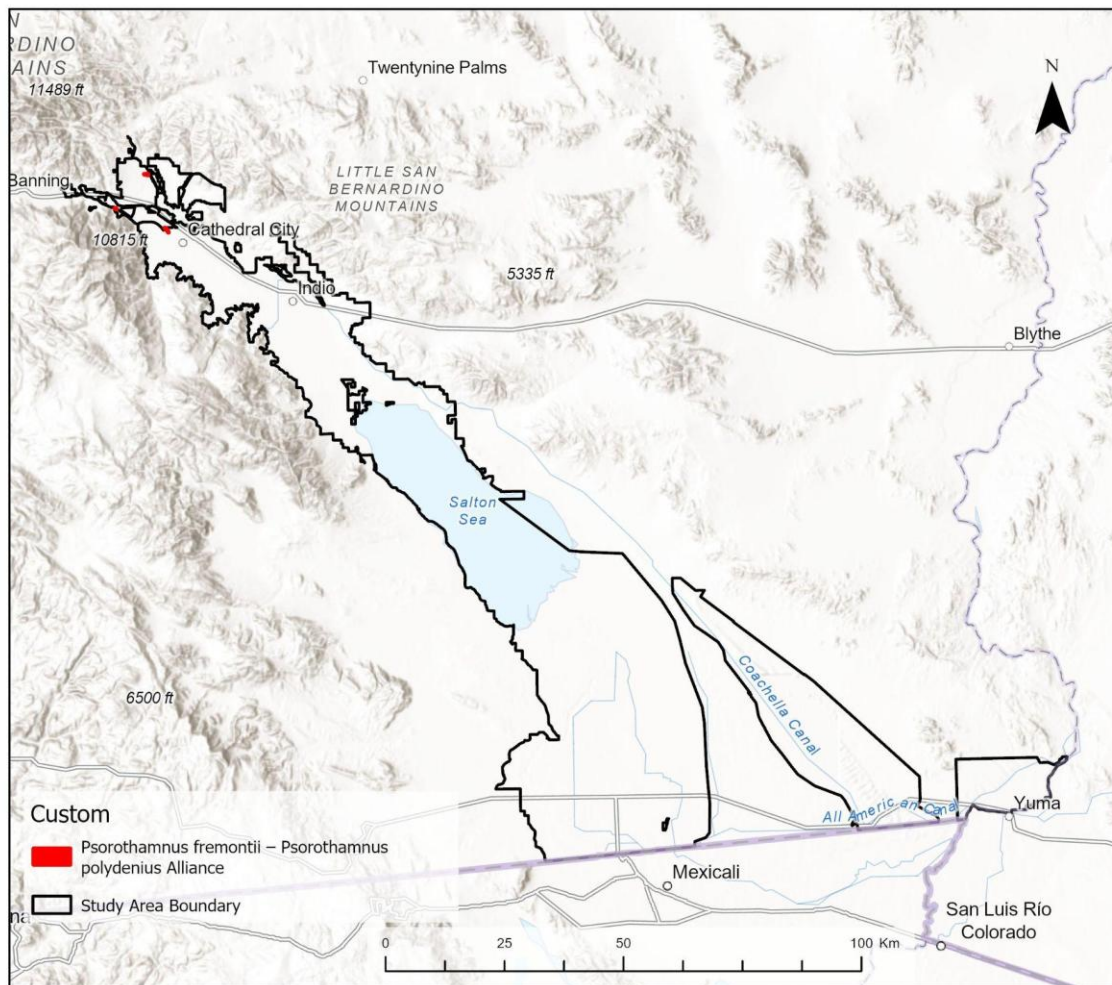


This photograph shows a stand of *Psorothamnus arborescens* within the Whitewater Floodplain, which primarily consists of aeolian sand fields.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

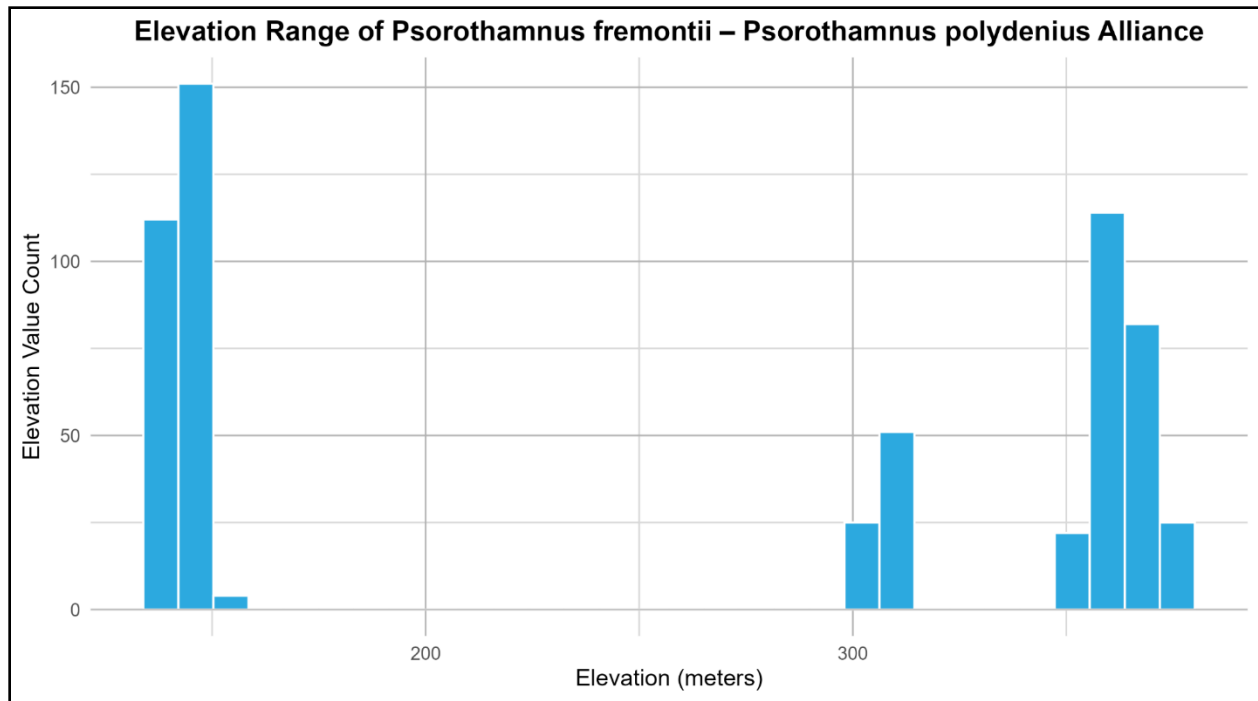
- *Larrea tridentata* Shrubland Alliance (4119) – *Larrea tridentata* is darker in color and with a generally larger stature.
- *Chilopsis linearis* – *Psorothamnus spinosus* Woodland Alliance (7222) – *Chilopsis linearis* are larger and individuals grow in roughly linear or densely clustered, irregular shapes, and generally occur within or along washes.
- *Psorothamnus emoryi* Mapping Unit (4232) – Both species are similar in color, however *Psorothamnus arborescens* is bigger in stature.

Psorothamnus fremontii – Psorothamnus polydenius Shrubland Alliance (4219)



PROJECT DISTRIBUTION: The *Psorothamnus fremontii* – *Psorothamnus polydenius* Alliance was only mapped twice in the western portion of the Coachella Valley subarea. The largest stands of *Psorothamnus arborescens* within the Coachella Valley occur within the Whitewater Floodplain and Snow Creek drainage which were mostly mapped during the Coachella Valley Floor (ds2898) mapping project.

Psorothamnus fremontii – Psorothamnus polydenius Shrubland Alliance (4219)



Psorothamnus schottii Mapping Unit (4231)

***Psorothamnus schottii* Mapping Unit (4231)**

Schott's indigo bush Mapping Unit

MMU: 10 acres

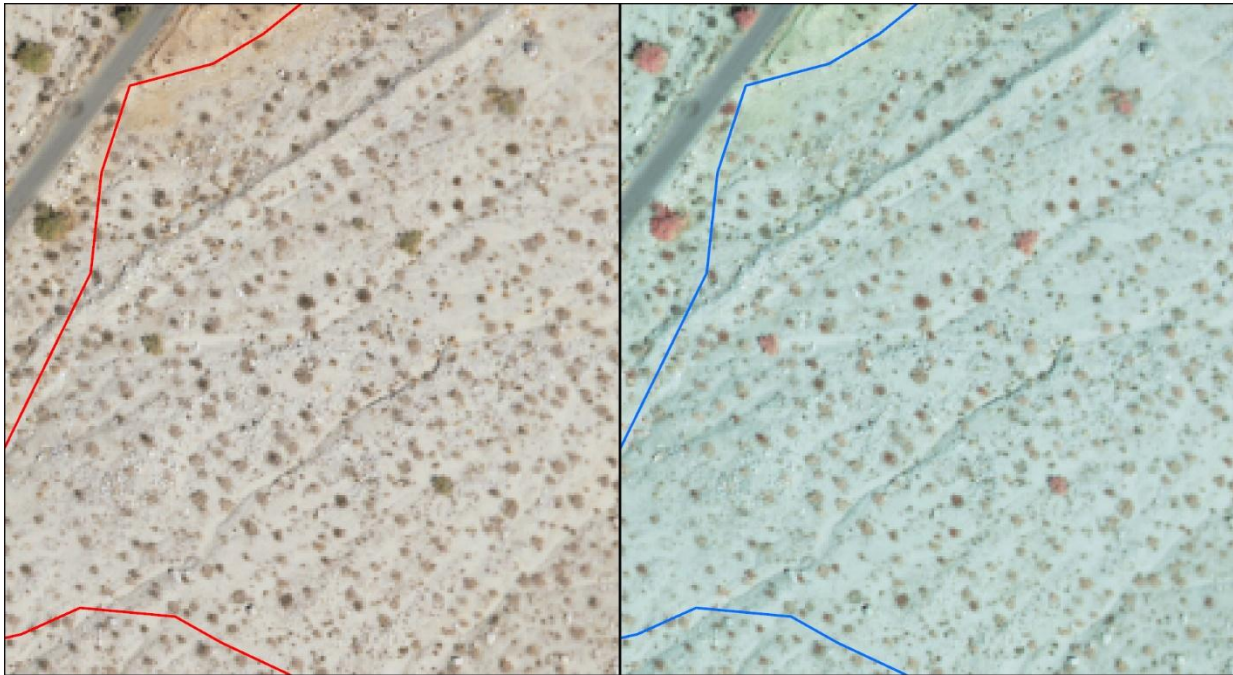
MMW: 101 meters



The foreground shows a stand of *Psorothamnus schottii* on a rocky alluvial substrate.

SUMMARY: Stands of *Psorothamnus schottii* occur on the midslope of alluvial fans and bajadas on rocky mixed alluvial substrate and do not share co-dominance with other shrub species. Shrub species that generally do occur at a subdominant cover include *Larrea tridentata*, *Ambrosia salsola*, and *Encelia farinosa*. There is generally some diversity of cacti species, such as *Ferocactus cylindraceus* and *Cylindropuntia* species. Human disturbance such as off-road vehicle use and clearing is usually low.

PHOTOINTERPRETATION SIGNATURE: *Psorothamnus schottii* is a medium sized shrub with white stems and bright green leaves that age to yellow. Dense stands occur in undisturbed bajadas, favoring benches. There is generally some diversity of smaller shrubs in the understory, occurring at low cover. Individuals appear grey to straw colored or with a subtle green-yellow in imagery, and light greyish-pink in CIR.

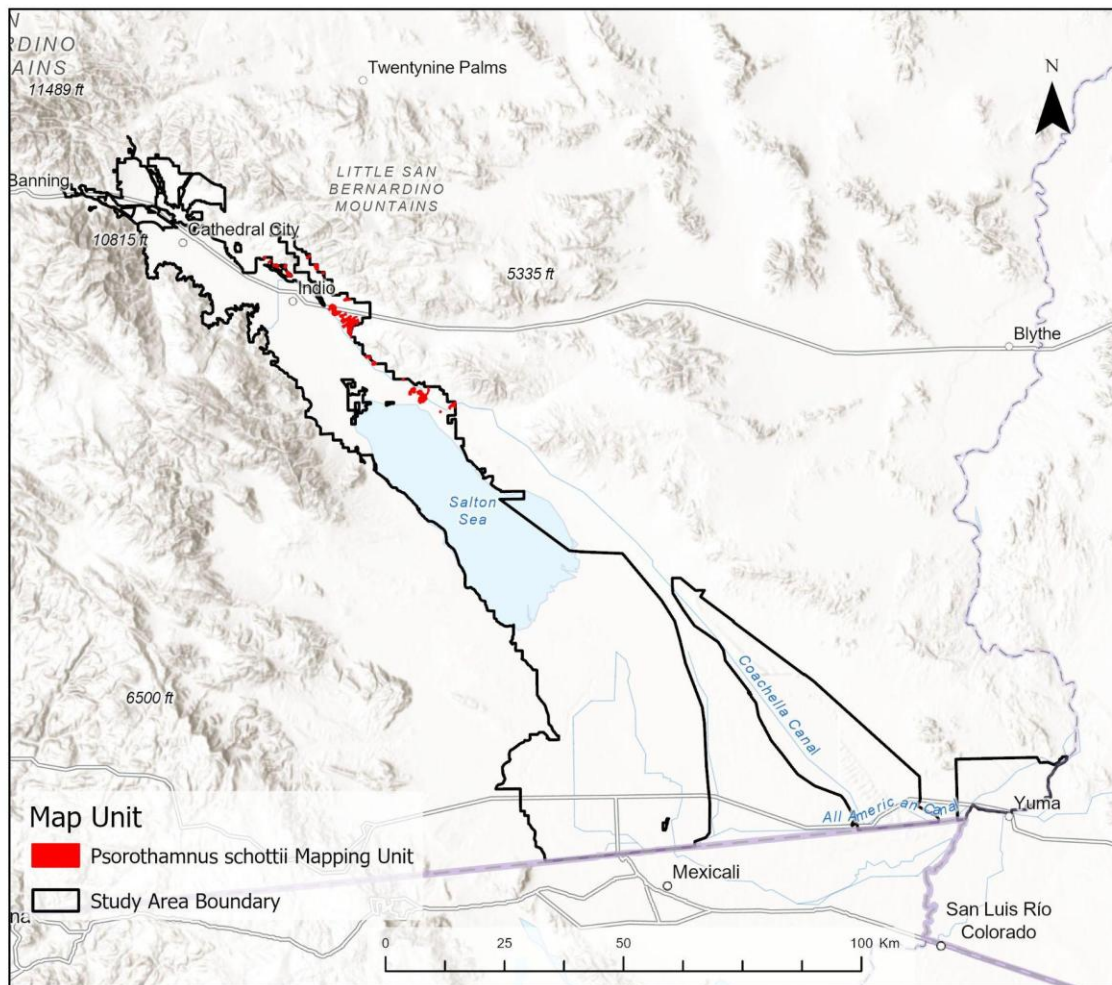


Field teams identified this stand of *Psorothamnus schottii* on the gravel/cobble alluvial fan below Berdoo Canyon in the Coachella Valley mapping subarea.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

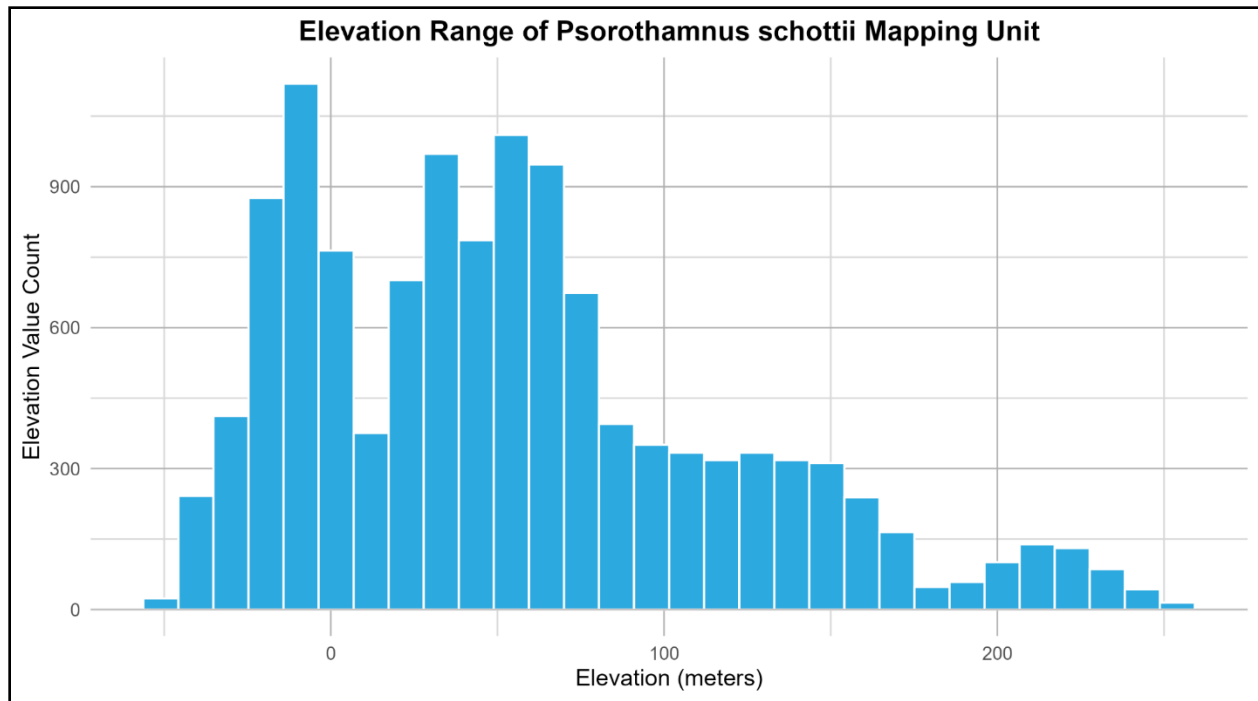
- *Larrea tridentata* – *Ambrosia dumosa* Shrubland Alliance (4115) – *Larrea tridentata* has a similar shape and size to *Psorothamnus schottii*, however it is a much darker green-brown (true color) or dark red-brown (CIR).
- *Ambrosia salsola* – *Bebbia juncea* Shrubland Alliance (7211) – This type is distinguishable by its habitat where it occurs in sandy washes and disturbed areas. *Ambrosia salsola* and *Bebbia juncea* are also usually noticeably smaller.

Psorothamnus schottii Mapping Unit (4231)



PROJECT DISTRIBUTION: *Psorothamnus schottii* Mapping Unit was mapped only on the northeastern side of the central Coachella Valley subarea. It was restricted to the bajadas and canyon mouths of the Mecca Hills, Orocopia Mountains, and Little San Bernardino Mountains.

Psorothamnus schottii Mapping Unit (4231)



Salix gooddingii – *Salix laevigata* Woodland Alliance (1416)

***Salix gooddingii* – *Salix laevigata* Woodland Alliance (1416)**

Black willow – Red willow riparian woodland and forest

Rarity: G4S3

MMU: 0.5 acres

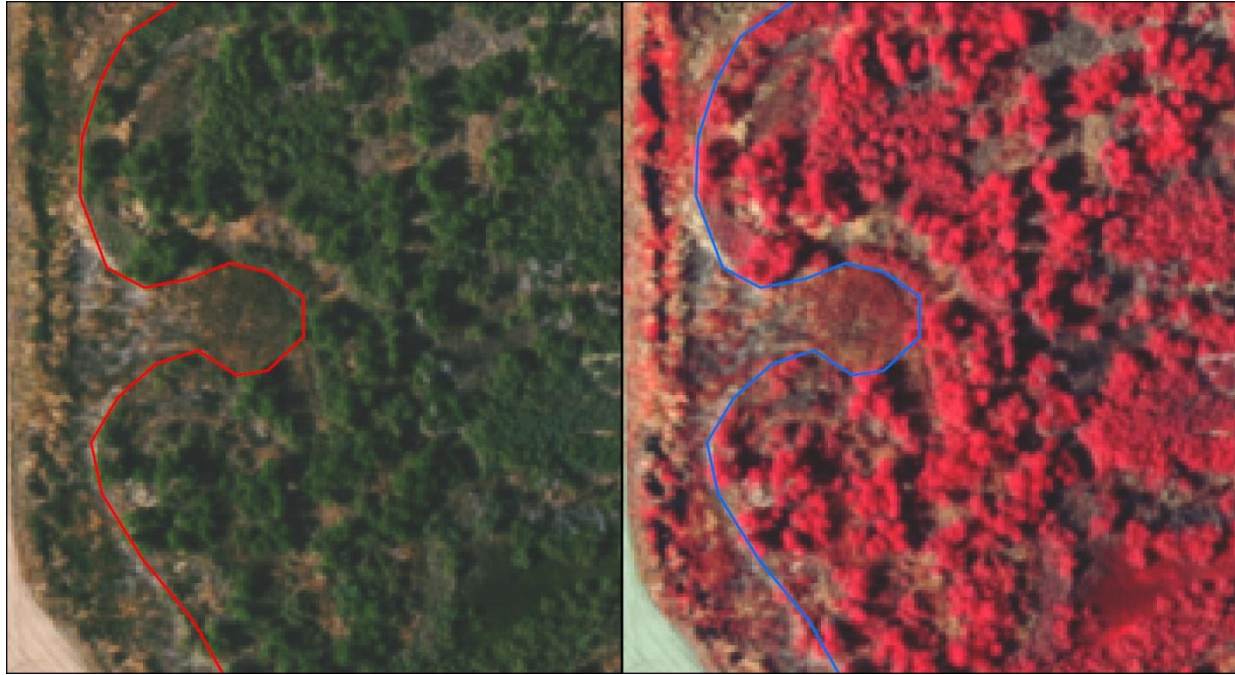
MMW: 22 meters



In the foreground is *Tamarix* spp., with *Salix gooddingii* and *Washingtonia filifera* in the midground.

SUMMARY: In this Alliance *Salix gooddingii* or *Salix laevigata* must dominate in the tree canopy with at least 50% relative cover, or 10% absolute cover, with other tree species, such as *Populus fremontii*, at no more than trace cover. Mappable stands occur rarely within the mapping area along large rivers or floodplains and in restoration areas. Co-occurring shrubs in the understory include *Tamarix* spp., and *Atriplex lentiformis* with *Washingtonia filifera* in the tree canopy.

PHOTOINTERPRETATION SIGNATURE: These stands occur only in riparian areas of the mapping area. Dense patches have multi-layered distinct crowns and tend to be a light to medium green color, appearing red to neon pink in CIR, with a smooth texture.



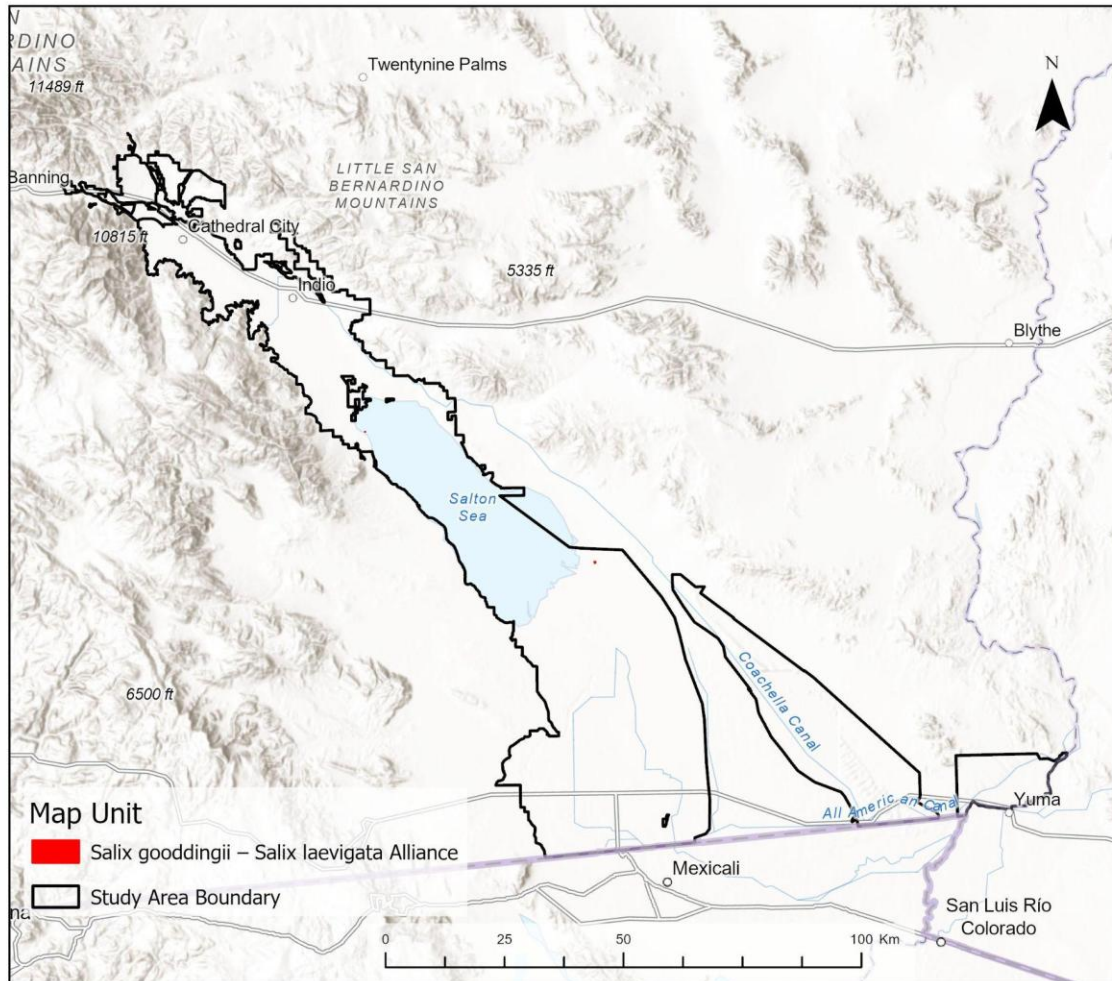
This stand of *Salix* spp. is located in a managed wetland area in the Imperial Valley subarea.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Tamarix* spp. Semi-natural Alliance (1432) – The *Tamarix* Alliance defines a shrub type and does not have the same relief as a multi-layered stand of trees. *Tamarix* spp. are also usually a darker green (true color) or darker red (CIR).
- *Parkinsonia florida* – *Olneya tesota* Woodland Alliance (4227) – This tree Alliance occurs more upland within the bajadas of adjacent mountain foothills. Occasionally a *Parkinsonia florida* individual will occur within these riparian areas, but will not form a consistent stand.
- Exotic Trees (9500) – These stands are made up of one or many ornamental tree species. This mapping unit is commonly used for stands of *Tamarix aphylla*, which is generally planted in rows to create wind breaks in the Coachella and Imperial Valleys. As with the *Tamarix* Alliance, there is an evident difference in the texture of *Tamarix aphylla* and *Salix* spp., where *Tamarix* stands lack a multi-layered canopy.

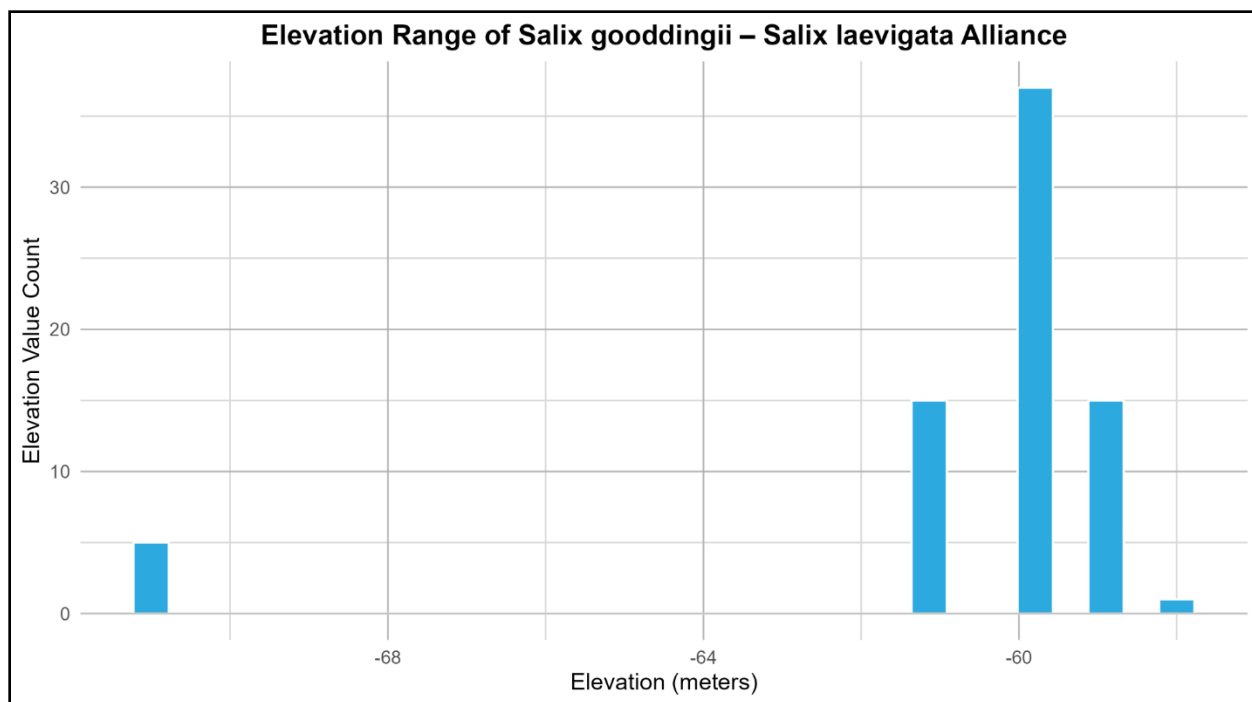
Salix gooddingii – Salix laevigata Woodland Alliance (1416)

- *Populus fremontii* – *Fraxinus velutina* – *Salix gooddingii* Woodland Alliance (1411) – Stands were mapped to this Alliance when *Populus fremontii* co-dominated. *Populus fremontii* tend to have more open, solitary crowns, and are a darker green.



PROJECT DISTRIBUTION: Mappers assigned two polygons to this Alliance: one on the northwestern shore of the Salton Sea in the Coachella Valley subarea, and one in the Imperial Valley subarea within the Sonny Bono National Wildlife refuge on the southeastern side of the Salton Sea.

Salix gooddingii – Salix laevigata Woodland Alliance (1416)



Senegalia greggii – Hyptis emoryi – Justicia californica Shrubland Alliance (4226)

Senegalia greggii – Hyptis emoryi – Justicia californica Shrubland Alliance (4226)

Catclaw acacia – desert lavender – chuparosa scrub Alliance

Rarity: G4S4

MMU: 0.5 acres

MMW: 22 meters



Photo of rocky wash with *Justicia californica* and *Hyptis emoryi* along with other desert shrubs in Palm Springs.

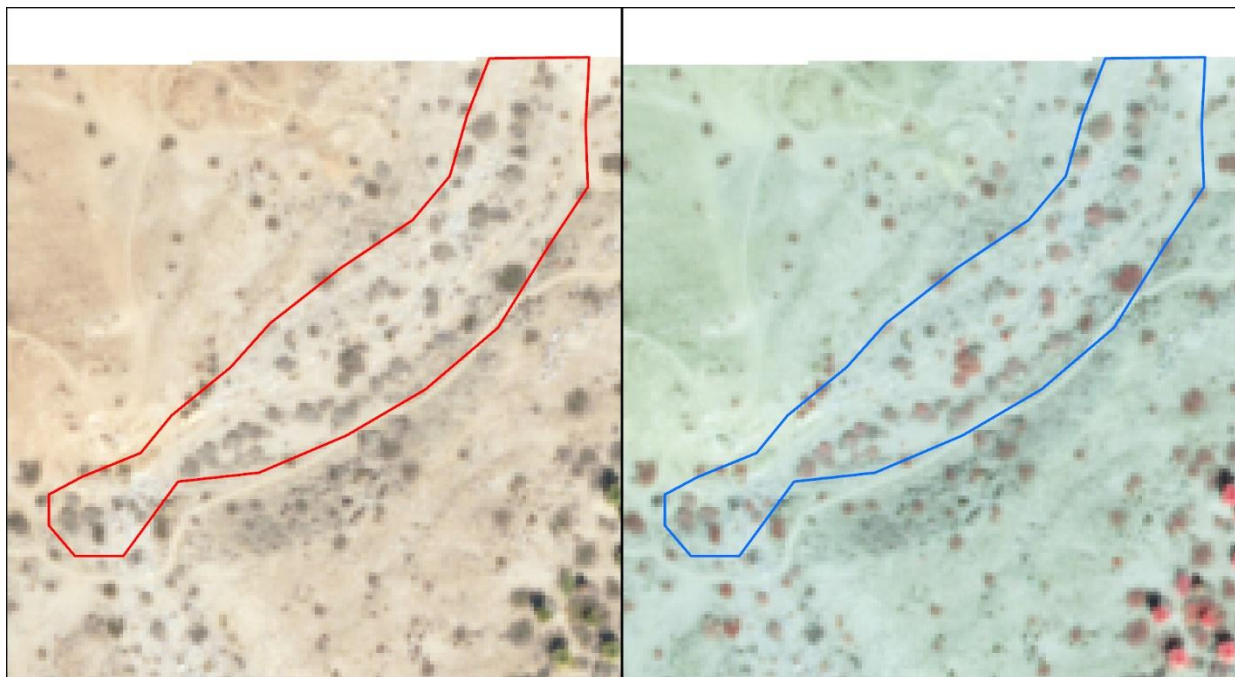
SUMMARY: Stands were mapped to this Alliance where *Senegalia greggii* was greater than 50% relative cover in the tall shrub canopy and at least 2% absolute cover, where *Hyptis emoryi* was greater than 2% absolute cover and 30% relative cover, and/or where *Justicia californica* was characteristically present and codominated with the previously described species. In instances where overall shrub cover was low, *Senegalia greggii* and *Hyptis emoryi* may have as low as 1% cover. This Alliance is most commonly found in arroyos and canyons with course-grained sand to rocky, well draining washes. Field teams found washes and canyon mouths in the foothills of the Santa Rosa mountains dominated by *Justicia californica* and *Hyptis emoryi* that were mapped to this type. Co-occurring species include *Larrea tridentata*, *Petalonyx thurberi*,

Senegalia greggii – Hyptis emoryi – Justicia californica Shrubland Alliance (4226)

Ambrosia salsola, *Bebbia juncea*, *Ambrosia dumosa*, *Psoralea schottii*, *Parkinsonia florida*, and *Psoralea spinosus*.

PHOTOINTERPRETATION SIGNATURE: *Senegalia greggii* is a tall, irregularly shaped shrub that follows the main channels of the washes and arroyos that it grows in. When found in upland communities it has a spherical canopy, however the edges are often diffused due to the long and thin branching patterns. Stands can be composed of moderate to sparse cover, crowns are generally dark grey with dark green tint and appear dull red in CIR.

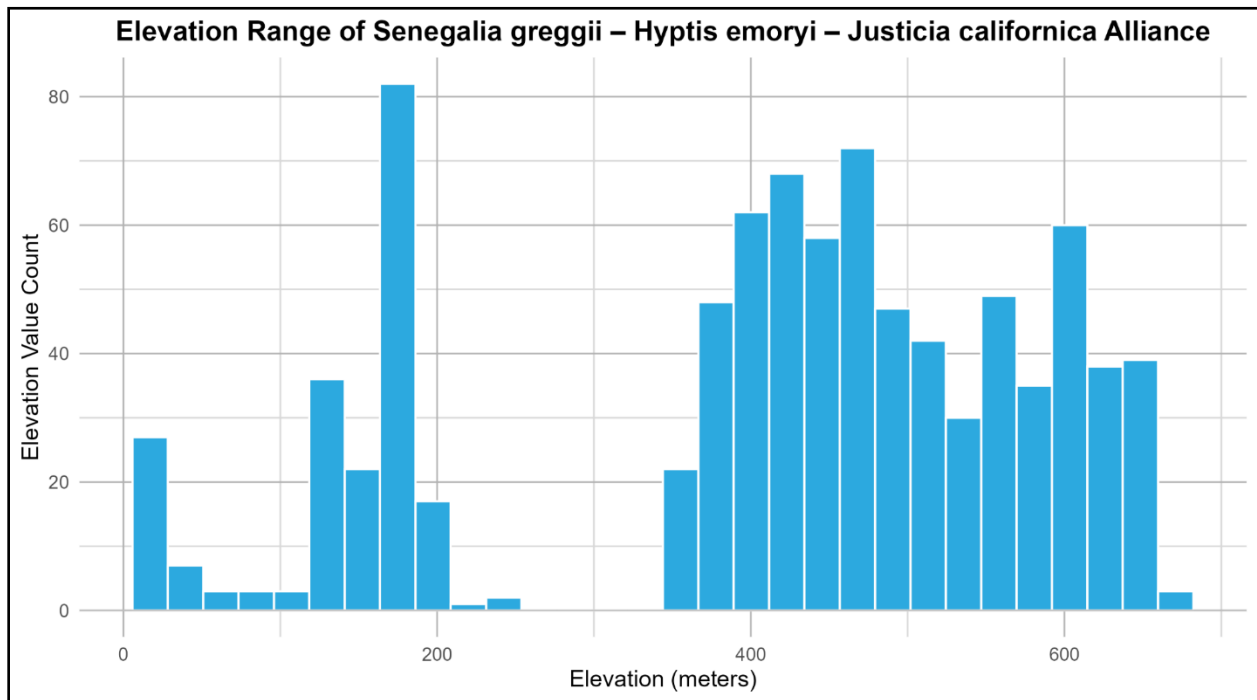
Hyptis emoryi and *Justicia californica* are light colored shrubs and are generally restricted to washes and wash margins. *Hyptis emoryi* has a somewhat regular shape, *Justicia* is lower growing and has an oblong shape. Both appear light grey in true-color imagery, and pale, dull purple-red in CIR.



This stand of *Justicia californica* and *Hyptis emoryi* occupied a wash in Palm Springs within the Coachella Valley subarea. The white area at the top of the images is outside the mapping boundary of this project.

Senegalia greggii – Hyptis emoryi – Justicia californica Shrubland Alliance (4226)

PROJECT DISTRIBUTION: This type is associated with mid elevation desert washes and was only mapped in the northwestern portion of the Coachella Valley subarea, particularly in canyon mouths of the Santa Rosa Mountains on the outskirts of Palm Springs and in Desert Hot Springs in the wash mouths of the Little San Bernardino Mountains.



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

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

MMU: 0.5 acres

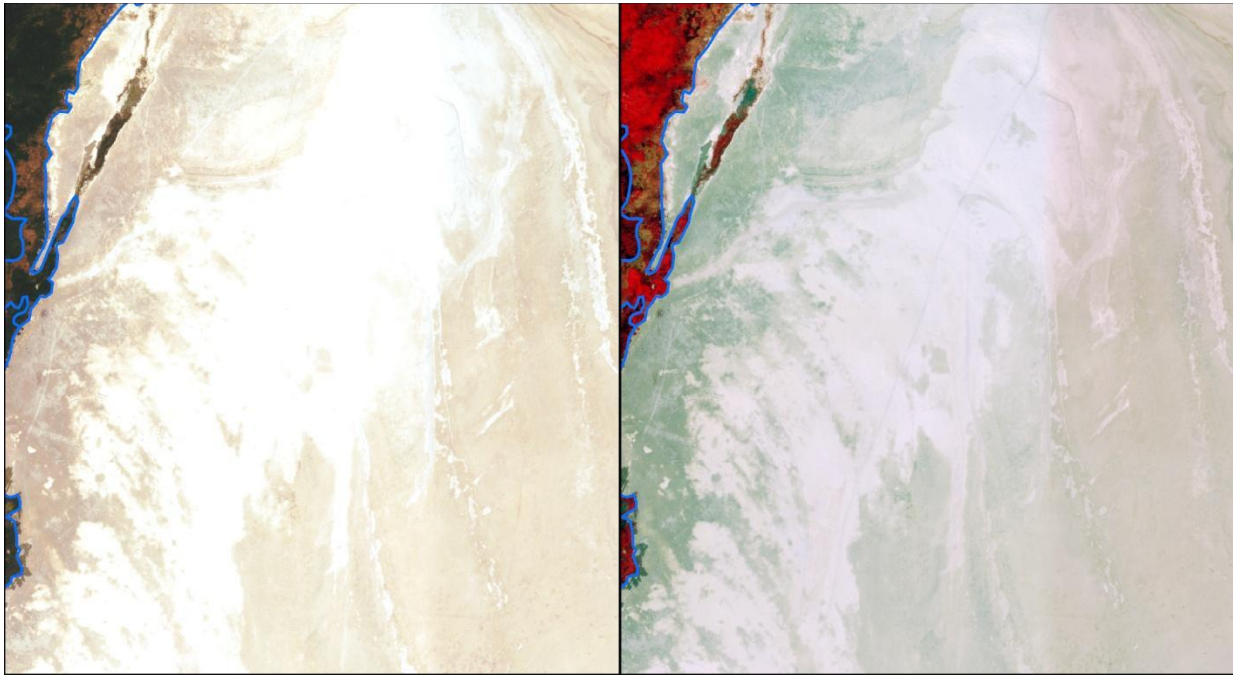
MMW: 22 acres



This swath of playa surrounded by shrubby *Tamarix* species is located near Obsidian Butte on the south shore of the Salton Sea.

SUMMARY: This sparsely vegetated Mapping Unit characterizes playas, also known as dry lake beds or endorheic basins, that are mostly or completely unvegetated but may have a low cover (<2%) of halophytic shrub and perennial herb species such as *Allenrolfea occidentalis*, *Atriplex lentiformis*, shrubby *Tamarix* species, and *Distichlis spicata*. Following adequate precipitation events, a sparse cover of annual herbs may be present, including species such as *Heliotropium curassavicum* and *Cryptantha* species. The substrate of these playas is a fine, silt and clay substrate and often has a thick salt crust formed from repeated evaporation of trapped surface water. These playas are found primarily along the receding shore of the Salton Sea and throughout the Imperial Valley mapping subarea. The Salton Sea and Imperial Valley, contained within the Salton Sink, is a natural endorheic basin and likely had massive areas of playa between flooding events.

PHOTOINTERPRETATION SIGNATURE: Playas are endorheic basins characterized by the sparse or completely absent vegetation cover and the nearly complete lack of topographic relief. Some playas have a thick salt crust, producing a bright white reflectance, while others are exposed lakebed silt, appearing pale tan to light orange-brown. Surfaces of large playas may show a cracked or mottled appearance or have parallel ditches constructed throughout to help reduce dust production.



This large stretch of playa is located on the southern shore of the Salton Sea.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- Anthropogenic Areas of Little or No Vegetation (9320) – These Mapping Units are differentiated primarily using the level of anthropogenic activity (scraping) evident across the surface. Some large playas were partially worked by heavy machinery, leaving large swaths of unbroken scraping and tire marks, while the rest was untouched. In these cases, the worked section of the playa was coded as Anthropogenic Areas of Little or No Vegetation (9320), and the untouched area as 6116. An exception was made for dust control ditches present across some shoreline playas on the south side of the Salton Sea, because the playa surface was not entirely disturbed.
- Mud Hills sparsely vegetated ephemeral herbs Mapping Unit (6113) – The primary distinction between these two Mapping Units is topographic relief. Mud Hills should have at least some well-defined erosion channels, bluff faces, or slopes, while playas should be entirely or almost entirely flat.

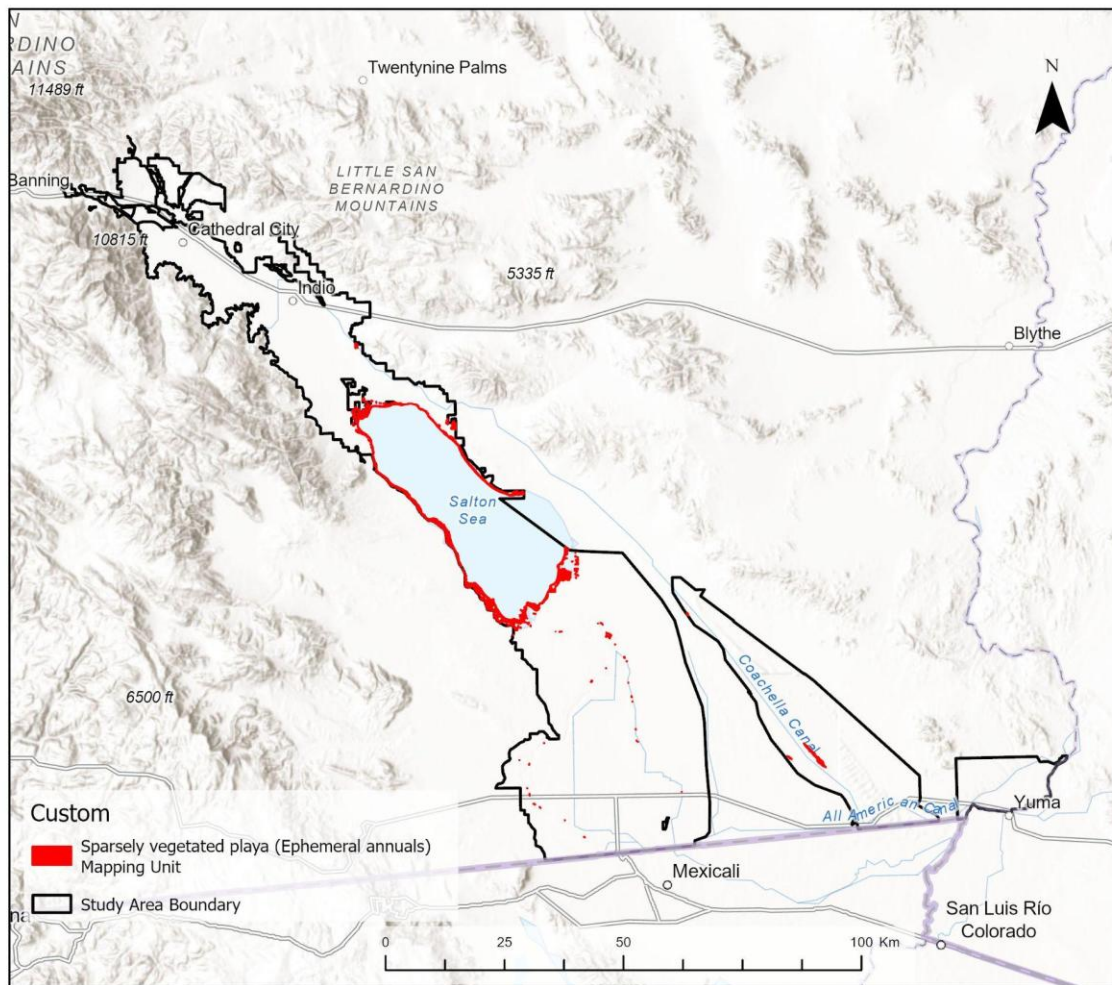
Sparsely vegetated playa (Ephemeral annuals) Mapping Unit (6116)

- *Chorizanthe rigida* – *Geraea canescens* Desert Pavement Alliance (6117) – Desert pavement almost always has some evidence of shallow rills or erosion channels throughout, which are often lighter color than the dark varnish present on the actual pavement. Playa surfaces lack this varnish and almost always appear much lighter in color.

MAPPING CONSIDERATIONS:

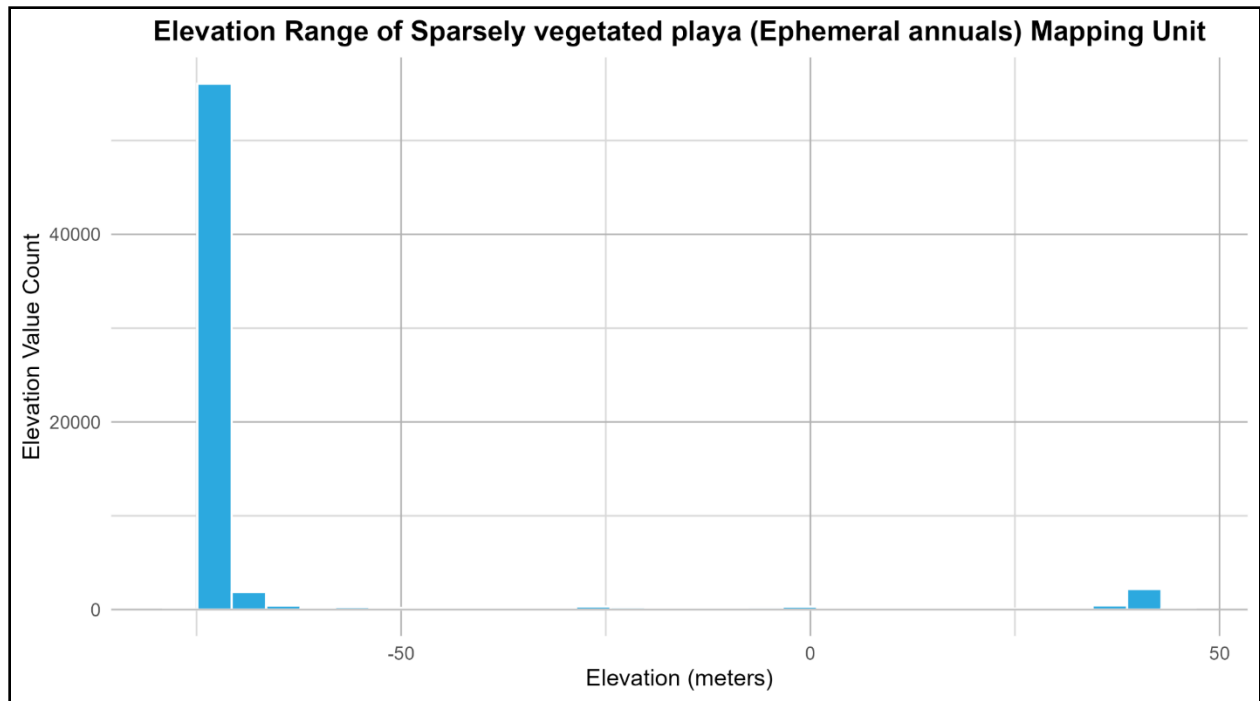
- Some large playas were partially worked by heavy machinery, leaving large swaths of unbroken scraping and tire marks, while the rest was untouched. In these cases, the worked section of the playa was coded as Anthropogenic Areas of Little or No Vegetation (9320), and the untouched area as 6116. An exception was made for dust control ditches present across some shoreline playas on the south side of the Salton Sea, because the playa surface was not entirely disturbed. Mappers classified these areas as 6116 with an appropriate intensity of the Anthropogenic Alteration modifier (usually High).

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



PROJECT DISTRIBUTION: These playas are found primarily along the receding shore of the Salton Sea and throughout the Imperial Valley mapping subarea. Within the Imperial Valley, playa polygons were typically small and associated with the banks of the New and Alamo Rivers. Mappers also delineated playas within the basin on the west side of the Algodones Dunes subarea, beneath the primary dune fields.

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



Sparsely Vegetated Recently Burned Areas (9701)

Sparsely Vegetated Recently Burned Areas (9701)

MMU: 2.5 acres

MMW: 71 meters

SUMMARY: This Mapping Unit describes recently-burned areas that have yet to recover more than 2% absolute cover of vegetation. Mappers used CIR to identify regrowth that is often otherwise difficult to discern within the ashes of the fire footprint. Within the mapping area of this project, burn areas are associated with riparian vegetation, often shrubby, invasive Tamarix species and/or ruderal palm groves. Mappers delineated recently burned areas along the New River in the Imperial Valley subarea, along the Yuma Main Canal in the Winterhaven subarea, and within a tamarisk thicket in the Coachella Valley subarea.

PHOTOINTERPRETATION SIGNATURE: Recently burned areas have a distinct black to gray appearance from the accumulation of ashes and burnt vegetation after the fire. Access roads/trails and embankments constructed during firefighting efforts are often seen. Some herbs or shrubs (especially Tamarix species) may begin to regrow, but must be below 2% absolute cover. Heat-killed but unburnt vegetation appears as a dark straw-color. These burn areas are in stark contrast to adjacent unburned stands of vegetation.

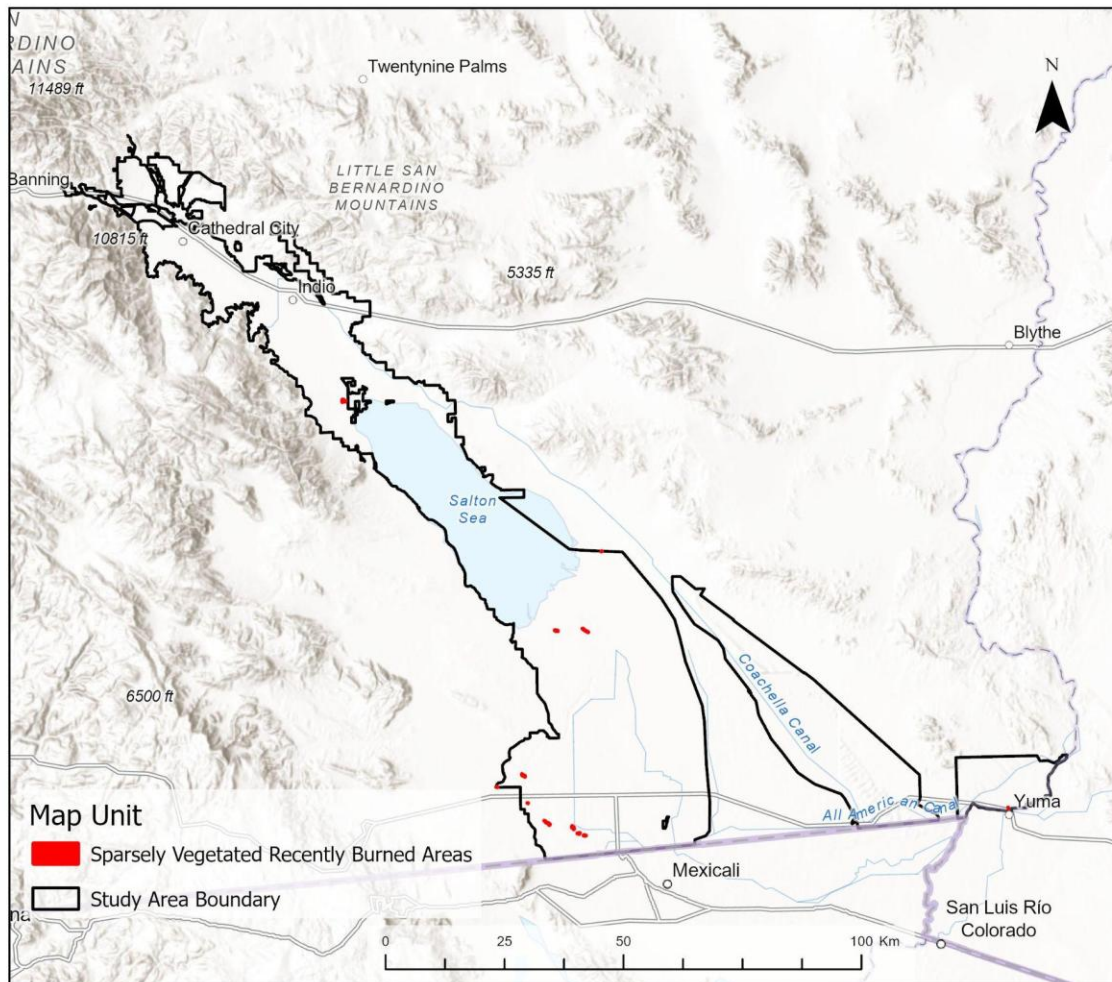


This burn area in the Coachella Valley demonstrates the characteristic black/gray coloration, ground disturbance from firefighting efforts, and heat-killed straw-colored vegetation.

Sparsely Vegetated Recently Burned Areas (9701)

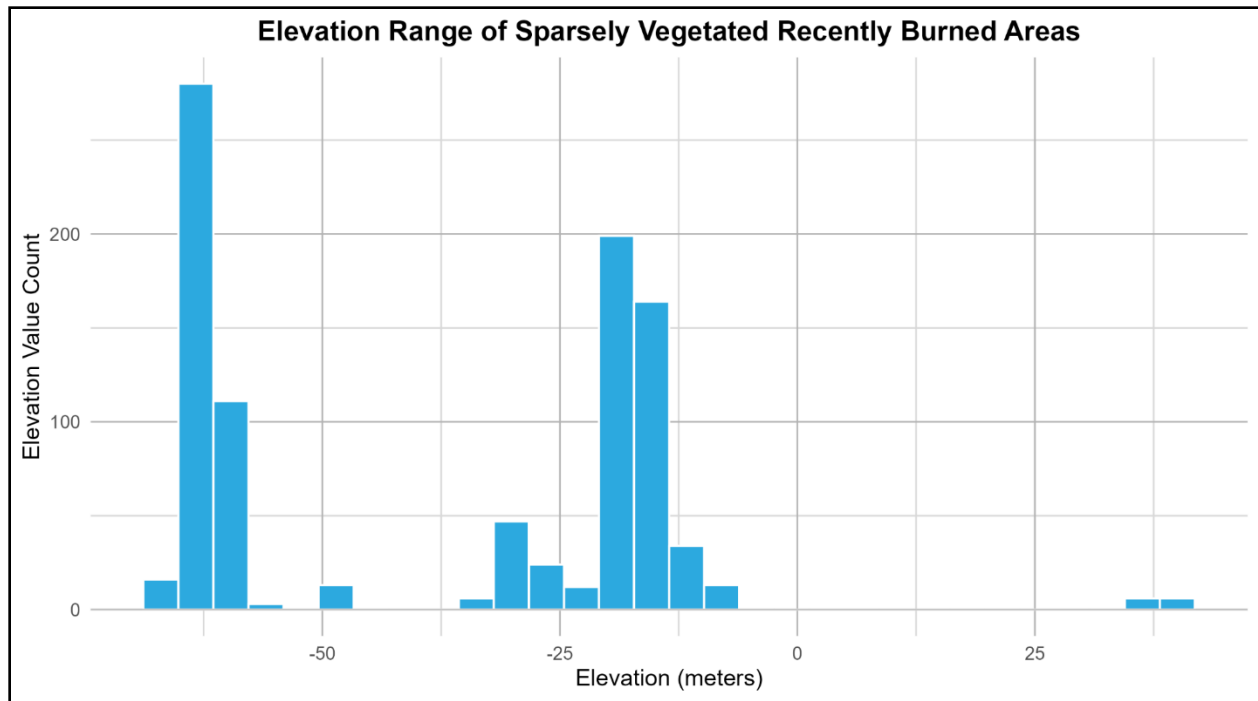
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- Anthropogenic Areas of Little or No Vegetation (9320) – Anthropogenic areas will have no black/gray cover of soot or visible remains of heat-killed or burnt vegetation.



PROJECT DISTRIBUTION: Recently burned areas occur along the New River in the Imperial Valley subarea, along the Yuma Main Canal in the Winterhaven subarea, and within a tamarisk thicket in the Coachella Valley subarea. Mappers did not identify any recently burned areas in the Algodones Dunes subarea.

Sparsely Vegetated Recently Burned Areas (9701)



Suaeda moquinii Shrubland Alliance (7411)

***Suaeda moquinii* Shrubland Alliance (7411)**

Bush seepweed scrub

Rarity: G4S3

MMU: 0.5 acres

MMW: 22 meters



Photo of stand of *Suaeda moquinii*.

SUMMARY: Stands of *Suaeda moquinii* (=nigra) Alliance stands were mapped where *Suaeda moquinii* dominated in the shrub layer with an absolute cover of 2 percent or more and did not co-dominate with other species. *Suaeda moquinii* stands occur in desert sinks on flat to slightly sloping valley bottoms, playas, low elevation river banks and terraces on mud hills, and disturbed, graded lots. Soils are fine-grained silt in texture and saline, often with visible salt deposits on the surface. Other shrub and tree species occurring within and on the edges of these stands include *Allenrolfea occidentalis*, *Atriplex canescens*, *Atriplex polycarpa*, *Pluchea sericea*, *Isocoma acredenica*, and *Tamarisk* spp..

Suaeda moquinii Shrubland Alliance (7411)

PHOTOINTERPRETATION SIGNATURE: Stands of *Suaeda moquinii* range in cover from sparse, scattered individuals, to dense homogenous thickets. Moderately dense stands often have an open quality to them due to crown porosity and lack of overlapping canopy. Highly dense stands create a coarse brown mat of shrubs. Individuals vary in size and stands will senesce in large groups, causing the photo-signature to be most commonly a dark grey and often have sparse, very dark green (sometimes close to black) leaves present. Coupled with their very thin, wispy branches, they tend to have a “softer”, darker appearance in imagery. In CIR, *Suaeda moquinii* appear to be a darker red to reddish-brown.



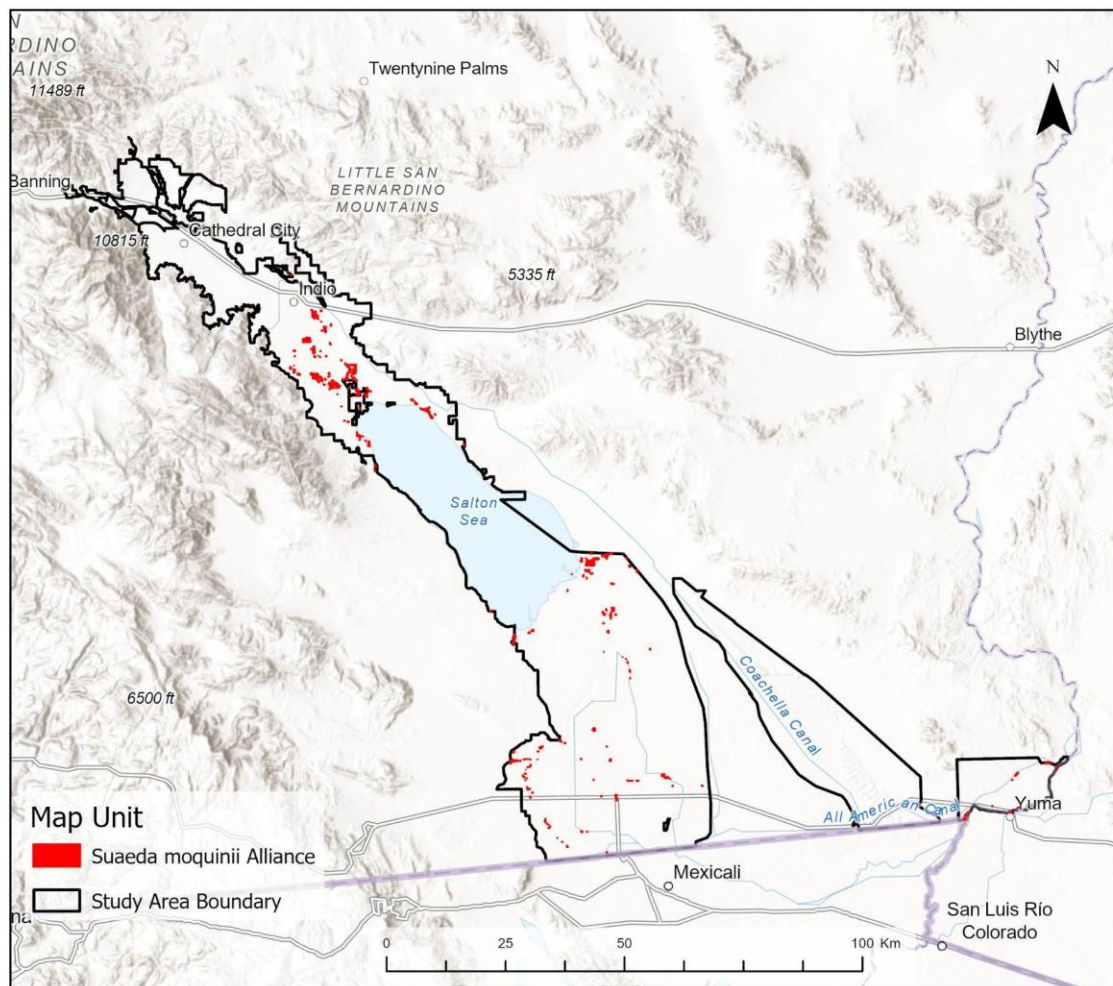
This roadside stand of *Suaeda moquinii* occurred in the community of Thermal within the Coachella Valley mapping subarea. The bright green/red vegetation is *Prosopis glandulosa*.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Allenrolfea occidentalis* Shrubland Alliance (3721) – *Allenrolfea occidentalis* stands are generally more isolated to harsher, more saline environments where very few other species manage to survive. *Allenrolfea occidentalis* is distinguishable from *Suaeda moquinii* where they co-dominate along the New River by a more verdant, although mottled tone attributed to evergreen succulent stems, and a more consistent canopy shape.

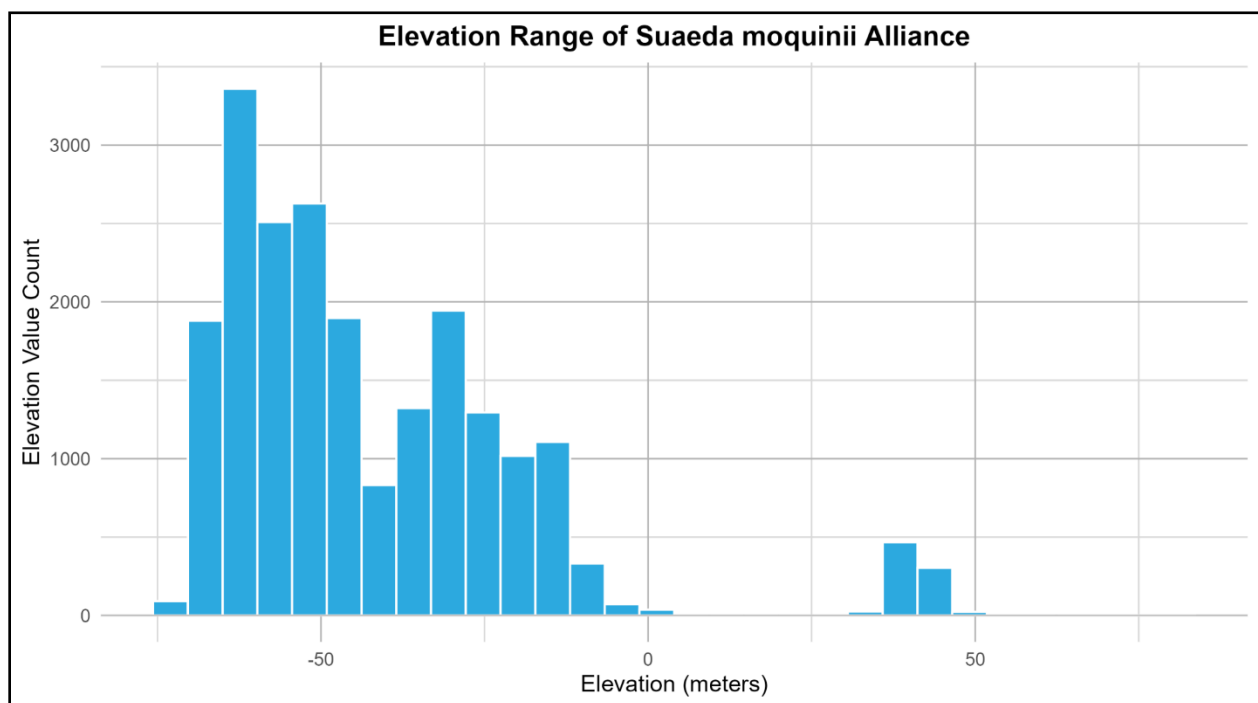
Suaeda moquinii Shrubland Alliance (7411)

- *Atriplex canescens* Shrubland Alliance (5111) – *Atriplex canescens* has a similar tolerance to highly alkaline soils, and co-occurring stands can be difficult to distinguish, however *Suaeda moquinii* appears darker, wispier, and with a less consistent canopy than *Atriplex canescens*.
- *Atriplex lentiformis* Shrubland Alliance (3722) – *Atriplex lentiformis* shares habitat preferences with *Suaeda moquinii*, however *Atriplex lentiformis* are much larger, lighter in color, and globe-shaped.
- *Atriplex polycarpa* Shrubland Alliance (4113) – As with *Atriplex canescens*, *Atriplex polycarpa* can be distinguished from *Suaeda moquinii* by the dark, wispy signature of *Suaeda moquinii*.



Suaeda moquinii Shrubland Alliance (7411)

PROJECT DISTRIBUTION: The *Suaeda moquinii* Alliance occurs throughout the Coachella Valley, Imperial Valley, and Winterhaven mapping subareas at low elevations. In the Coachella Valley stands are most common in the eastern portion, northwest of the Salton Sea. They are also dispersed throughout *Prosopis glandulosa* stands in undeveloped regions near the community of Thermal. Homogenous stands throughout Imperial Valley and Winterhaven subareas are less common as *Suaeda moquinii* often co-dominates with *Allenrolfea occidentalis*, which was mapped to the *Allenrolfea occidentalis* Alliance (3721); here stands were found in the northern portion of the valley on disturbed but undeveloped land, and on the river banks and terraces of the New River, Colorado River basin, and All American Canal.



Tamarix spp. Semi-natural Alliance (1432)

***Tamarix* spp. Semi-natural Alliance (1432)**

Tamarisk thickets

Rarity: GNASNA

MMU: 0.5 acres

MMW: 22 meters

Exotics: High



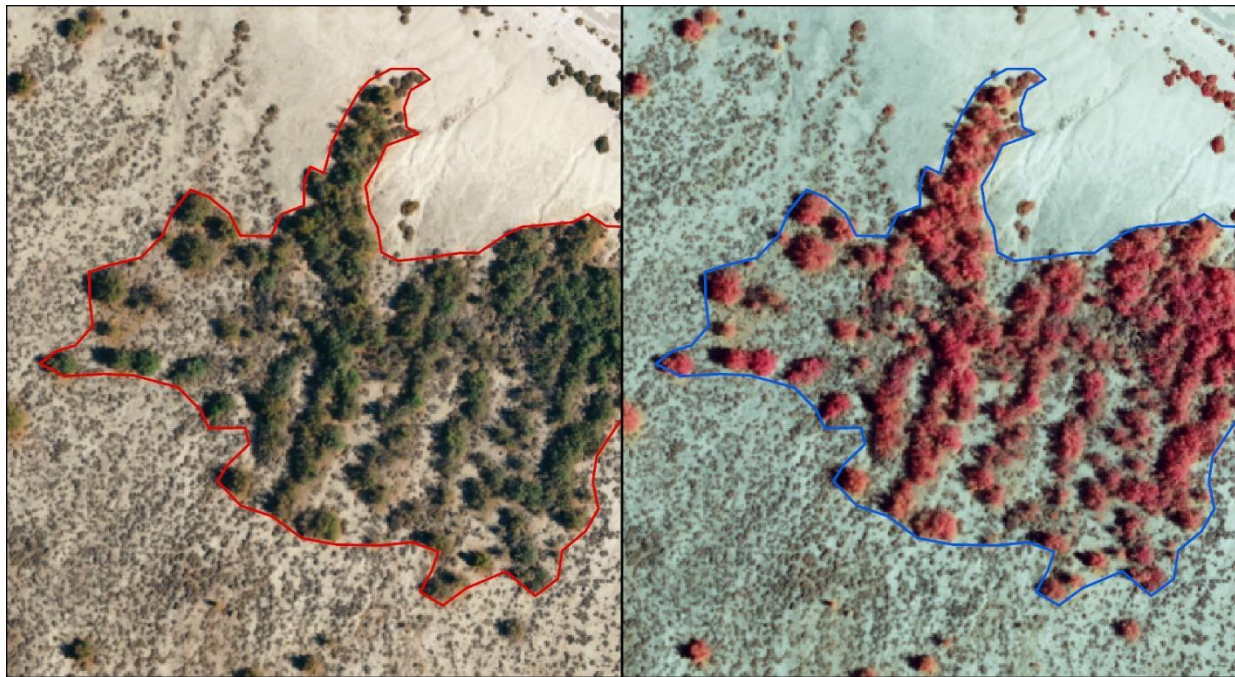
This tamarisk thicket within a marsh area on the south shore of the Salton Sea demonstrates their ability to dominate wet, alkaline landscapes. The mat of dead plants in the foreground are likely cattails (*Typha* sp.) remaining from when this area was inundated.

SUMMARY: Tall shrub tamarisk species (e.g. *Tamarix ramosissima* and *T. chinensis*) are highly invasive and common across many parts of the American Southwest where there is ample soil moisture, such as large washes, the shores of the Salton Sea, and in or lining agricultural channels. These shrubs can form impenetrable thickets, tolerate high soil alkalinity, displace native vegetation, and regrow rapidly if cut or burnt. This mapping unit does not include the less invasive *Tamarix aphylla*, which is a large tree and is mapped as part of the Exotic Trees mapping unit (9500). In order to be mapped as a tamarisk thicket, tamarisk must strongly dominate (exceed 60% relative cover) in the tall shrub or low tree layer. However, even when *Tamarix* is strongly dominant,

Tamarix spp. Semi-natural Alliance (1432)

stands are mapped to *Prosopis glandulosa* (honey mesquite) if this species is present throughout the stand.

PHOTOINTERPRETATION SIGNATURE: Tamarisk thickets can occur as both a stand of scattered plants (as seen in images below) or a dense, impenetrable mass of shrubs with no soil surface visible from above. Tamarisk always occur in areas which have access to abundant water, whether this is from agriculture or urban runoff or in natural or semi-natural areas such as the shores of the Salton Sea, playas, washes, or springs and seeps. Tamarisk appear as a dark, almost muddy green in true-color, and orangish mats of shed leaves can often be seen surrounding the shrubs. In CIR, plants appear as a dark red, often in muted tones where stands are suffering from lack of water and/or attacks from tamarisk beetles (*Diorhabda carinulata*). Healthy, vigorously-growing stands sometimes appear as a more vibrant dark red. The texture of mature shrubs is often apparent and relatively rough, except for the rare occasions where stands are composed of dense seedlings, which appear very soft and smooth, similar to a stand of dense forbs or grass.

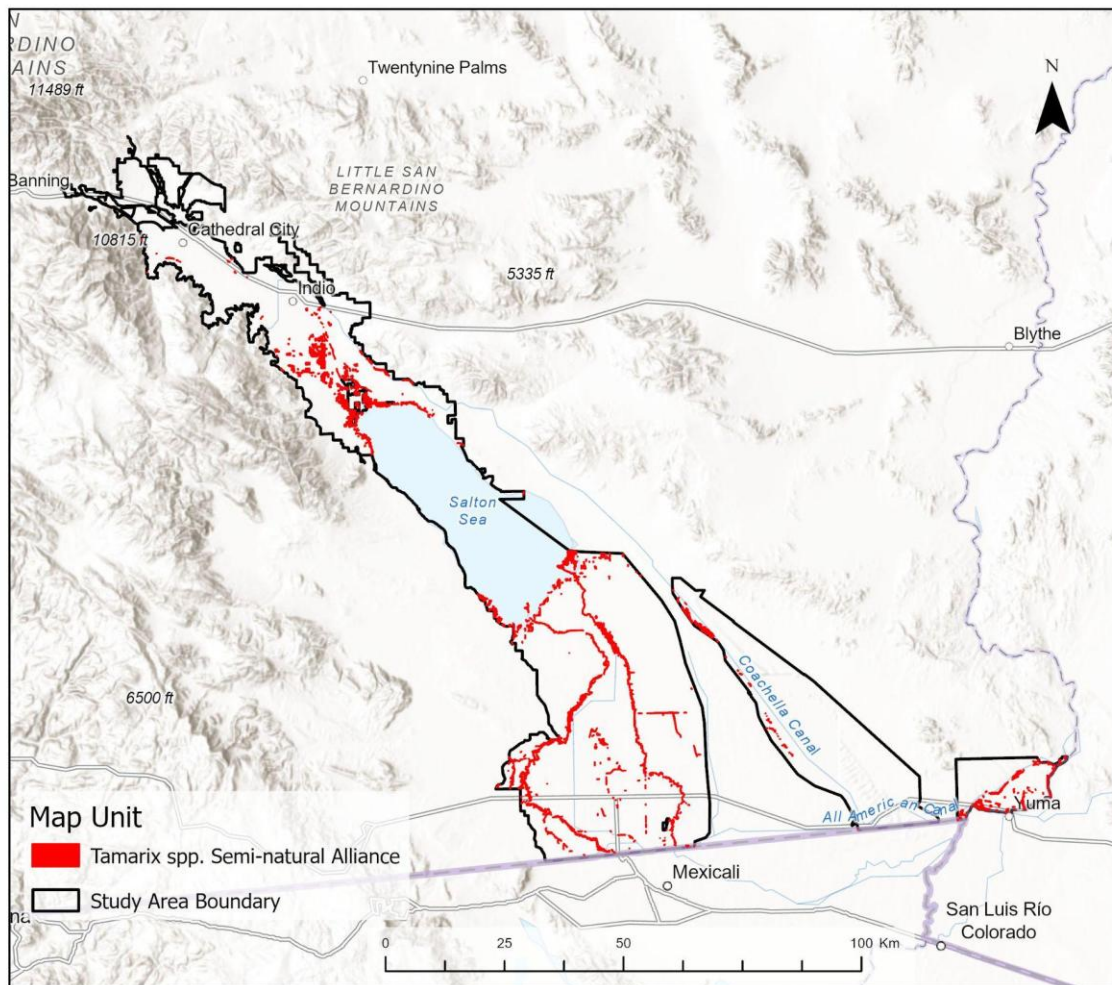


These images show a typical open-canopy stand of *Tamarix* spp. lining the northwestern shore of the Salton Sea. Color and texture is usually distinct enough to separate *Tamarix* spp. from similar riparian vegetation types.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

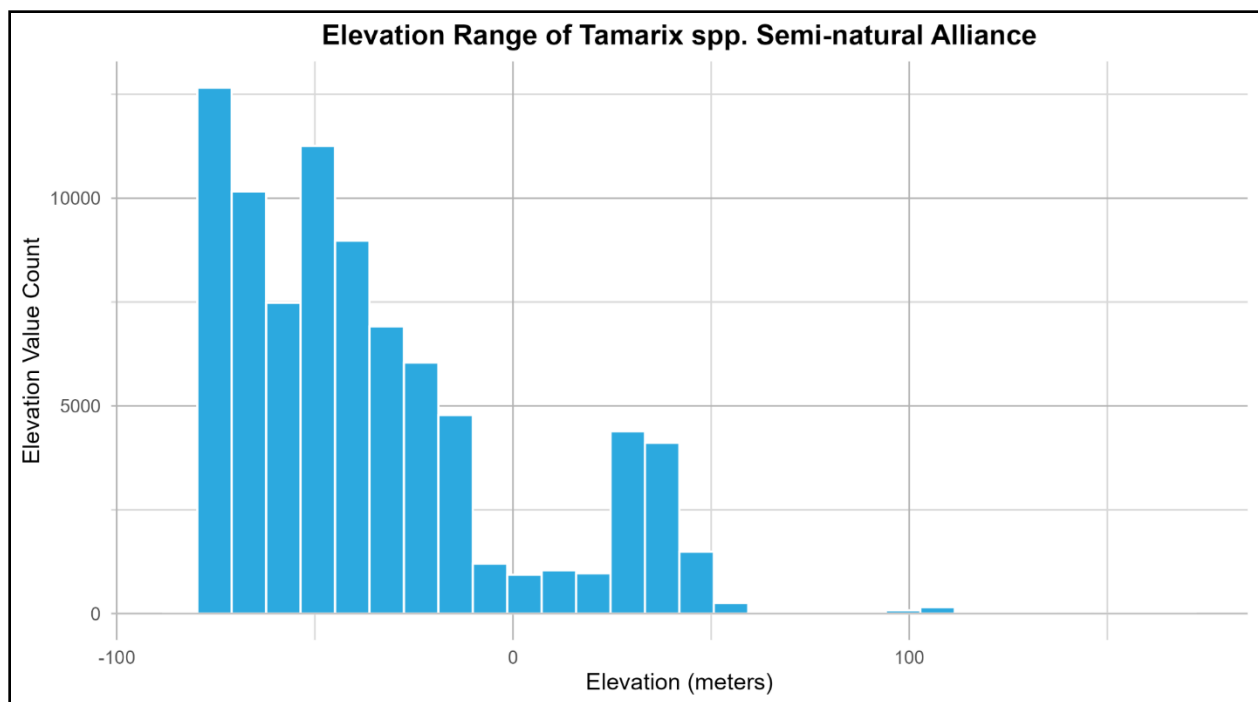
- *Pluchea sericea* Shrubland Alliance (4221) – *Pluchea sericea* and *Tamarix* spp. often grow in mixed stands or adjacent to one another, complicating identification. Further, vigorously-growing *Pluchea sericea* color is very similar to *Tamarix*. However, most mature stands of *P. sericea* have a more brown to pale green color, and individual *P. sericea* plants are usually distinctly smaller than *Tamarix*.
- *Prosopis glandulosa* – *Prosopis velutina* – *Prosopis pubescens* Woodland Alliance (4222) – It is not uncommon for *Prosopis* spp. to grow within dense stands of *Tamarix*. The colors of both *Prosopis* spp. and *Tamarix* spp. are similar in both true color and CIR. However, *Prosopis* spp. tend to be slightly darker green/red, and the canopy texture is smoother and softer. Mature *Prosopis glandulosa* can also to form massive circular or globular hummocks with smooth margins (possibly composed of just a single tree with an exposed crown spreading over a great distance) that are distinct from *Tamarix* thickets which tend to have irregular margins and are always comprised of many individual, relatively small shrubs.
- *Populus fremontii* – *Fraxinus velutina* – *Salix gooddingii* Woodland Alliance (1411) – *Tamarix* is very often a significant component in riparian areas in this mapping area, and as such is often found in close proximity or blending into the understory of large trees such as *Populus fremontii*. It can therefore be difficult to differentiate between trees and large *Tamarix*. However, *Tamarix* tend to have a deeper red color in CIR and they often blend into a thicket of many individuals, whereas one can usually discern individual *P. fremontii* trees due to their size. Shadows of tall trees also help separate them from shorter *Tamarix*.

Tamarix spp. Semi-natural Alliance (1432)



PROJECT DISTRIBUTION: This Alliance was mapped a significant number of times across all mapping subareas. This highly invasive shrub requires access to abundant water, which is readily available from canals and agricultural drainage ditches, rivers, and the high water table present in the Imperial Valley and eastern Coachella Valley. Large stands are common lining the north and south banks of the Salton Sea, the Alamo, New, and Colorado Rivers, and the Imperial Wildlife Area. Tamarisk thickets become much rarer in the western Coachella Valley due to a lower water table, and they are restricted to close proximity to canals within the Algodones Dunes subarea.

Tamarix spp. Semi-natural Alliance (1432)



Typha (*angustifolia*, *domingensis*, *latifolia*) Herbaceous Alliance (3416)

***Typha* (*angustifolia*, *domingensis*, *latifolia*) Herbaceous Alliance (3416)**

Cattail marshes

Rarity: G5S5

MMU: 0.5 acres

MMW: 22 meters

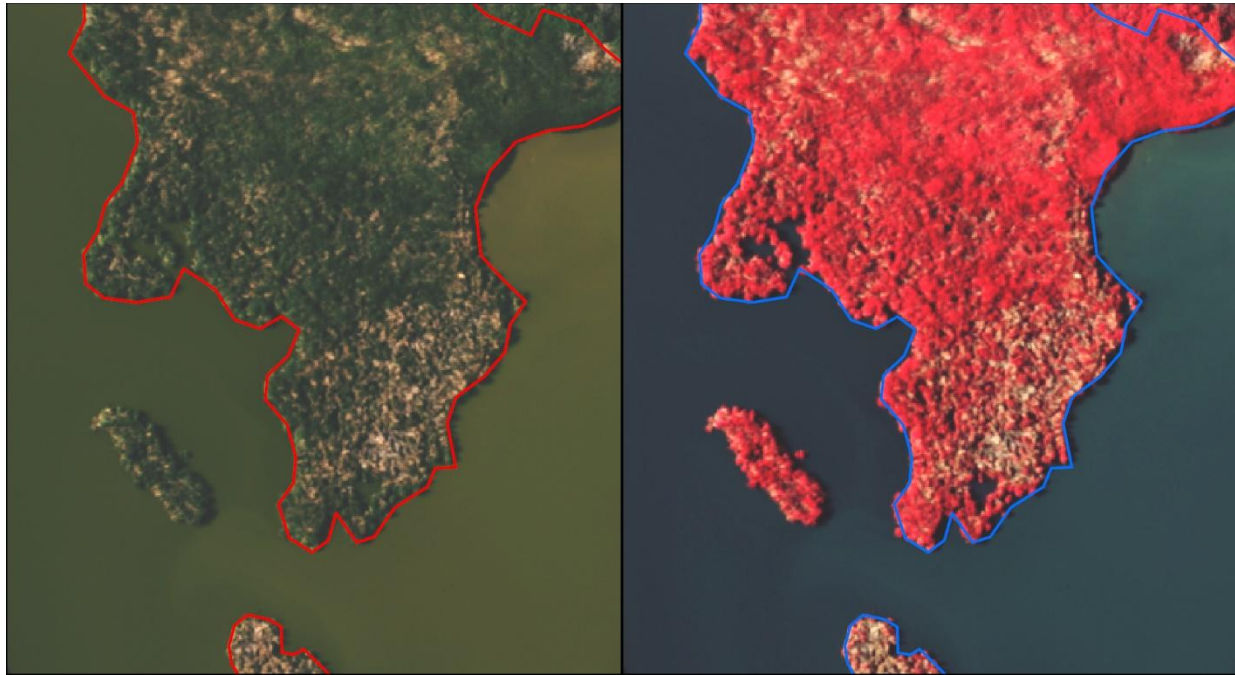


Typha sp. forms a dense stand along the edges of this artificial pond within the Sonny Bono National Wildlife Refuge in the Imperial Valley mapping subarea.

SUMMARY: Cattail marshes are characterized by presence of dominant (>50% relative cover) *Typha* species in the herbaceous layer. These marshes are typically found within standing water or saturated soil along rivers, seeps, or manmade ponds and wastewater channels. *Typha* form dense stands as they spread by rhizomes. The emerged foliage dies back in the winter or, presumably, as water availability changes, but the rhizomes remain alive as long as there is sufficient water present in the soil. As such, mappers assigned Alliances of this type even if the foliage appeared recently dead (yellowish in color), as the rhizomes may still be alive. However, long-dead foliage (grayish in color) was not mapped as since rhizomes were most likely dead.

Typha (*angustifolia*, *domingensis*, *latifolia*) Herbaceous Alliance (3416)

PHOTOINTERPRETATION SIGNATURE: *Typha* stands are often bordered by open water and either another herbaceous type (often *Phragmites australis*) or *Tamarix* spp. thickets. They usually appear mottled in both true color and CIR due to dieback in portions of the stand as well as areas of the flexible leaves matting in different directions. Live foliage appears as a dark green in true color and a medium, vibrant red in CIR. Dead foliage appears as a light straw color.



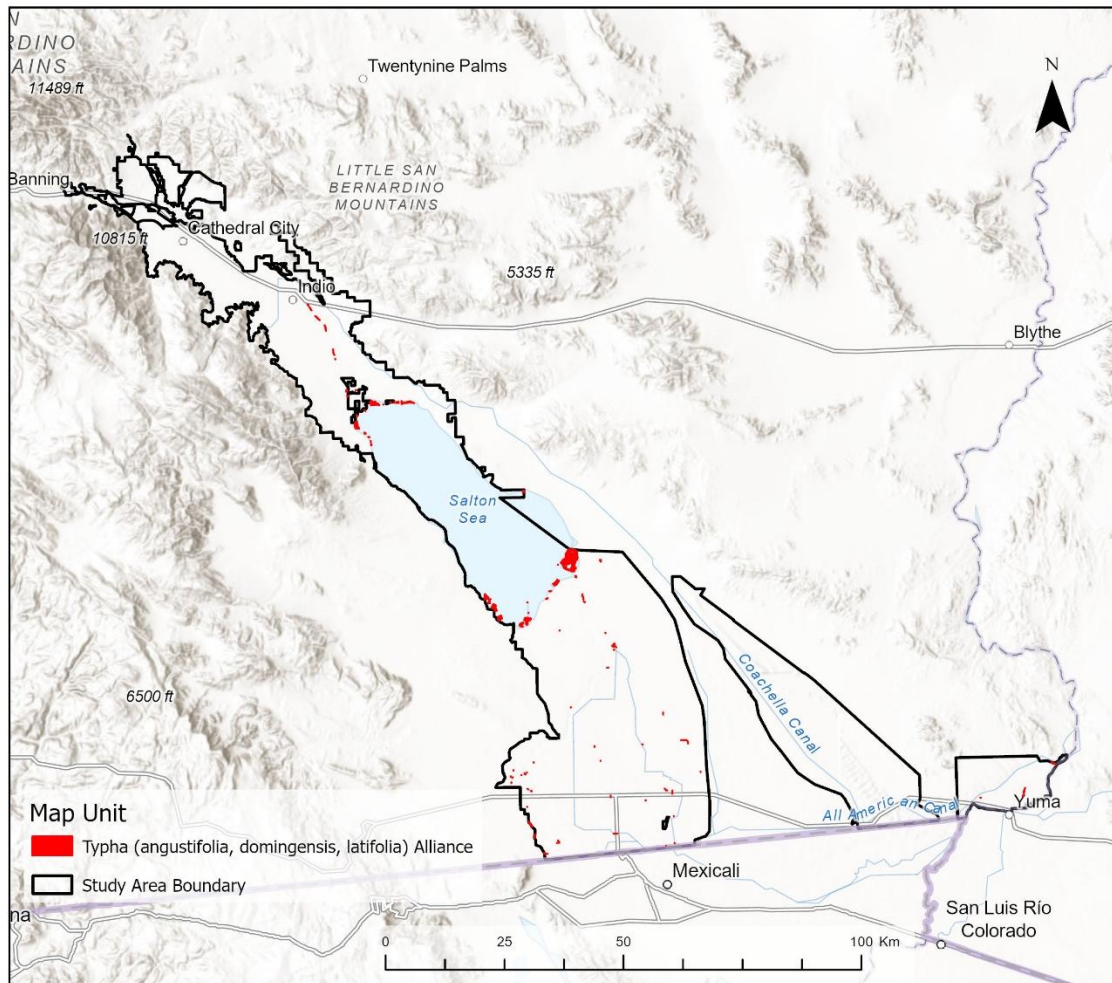
This stand of *Typha* was mapped in the Finney Lake in the Imperial Valley subarea.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Phragmites australis* – *Arundo donax* Semi-natural Stands (1431) – Dense stands of *Phragmites australis* and/or *Arundo donax* often grow directly adjacent to *Typha*, complicating polygon boundary delineation. However, *Phragmites australis* and *Arundo donax* grow much taller and more rigid, which is often apparent on imagery, and their coloration is a noticeably brighter green-yellow in true color and a slightly brighter red in CIR. The texture is also more uniform and softer than *Typha* stands.
- *Bolboschoenus maritimus*, *Schoenoplectus americanus* Mapping Unit (3715) – Mappable *Schoenoplectus/Bolboschoenus* stands occurred along the Colorado River within the Winterhaven subarea, and within marsh areas around the Salton Sea, often alongside or within larger stands of *Typha*. Differentiation using imagery is difficult, but *Schoenoplectus/Bolboschoenus* tends to appear shorter, less mottled, and with a softer texture. Live foliage appears slightly

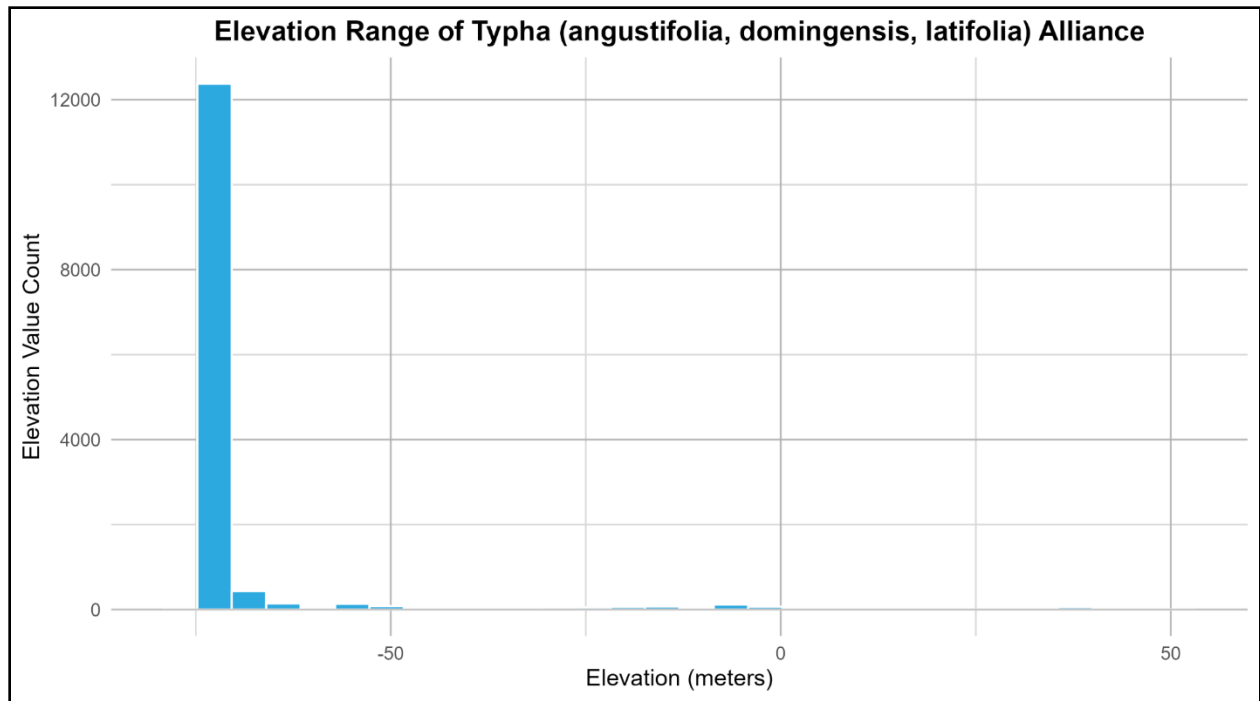
Typha (*angustifolia*, *domingensis*, *latifolia*) Herbaceous Alliance (3416)

dark green/red and mixes with gray/dark brown dead foliage left over from past growing seasons.



PROJECT DISTRIBUTION: Massive cattail marshes are present within the large riparian zones along the north and south shores of the Salton Sea. The largest mapped cattail marsh (nearly 750 acres) covers much of the landscape directly east of Mullet Island on the southeast shore of the Salton Sea. Outside of these large marshes, smaller stands of *Typha* are found lining irrigation and wastewater channels throughout the agricultural areas of the Coachella Valley and Imperial Valley subareas, including large drainages such as the Whitewater stormwater channel and the Alamo and New Rivers. Mappers also assigned a small number of cattail marshes near the Colorado River in the Winterhaven subarea.

Typha (angustifolia, domingensis, latifolia) Herbaceous Alliance (3416)



Unvegetated wash and river bottom Mapping Unit (6114)

Unvegetated wash and river bottom Mapping Unit (6114)

MMU: 0.5 acres

MMW: 22 meters

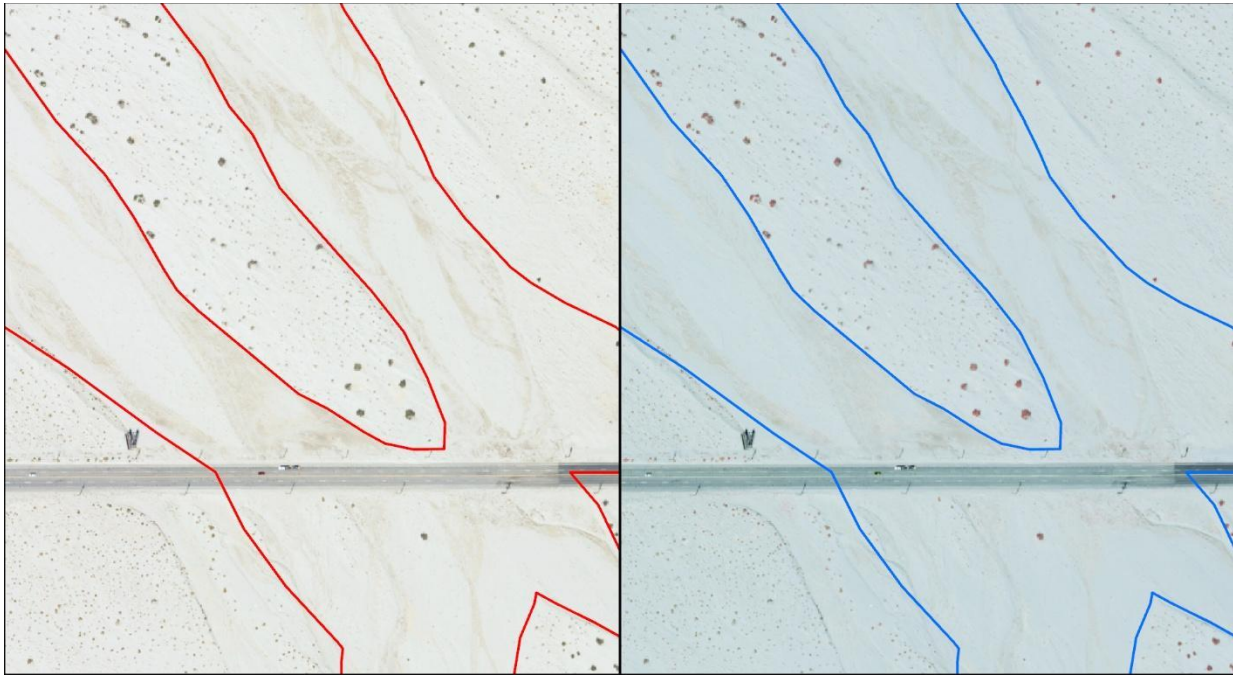


This recently-flooded wash is part of Super Creek in the Coachella Valley subarea.

SUMMARY: Mappers used this Mapping Unit to identify sections of large, active washes that lack significant, evenly distributed vegetation cover (less than 2% absolute cover) due to intermittent flooding. The substrate of these washes is mostly sand with a mix of gravel, rock, and boulders. Large amounts of debris transported from upstream may be present. This Mapping Unit represents both natural washes, such as those found in the Whitewater Floodplain, as well as the sandy, unvegetated sections of the Whitewater Storm Channel bottom. Mappers did not assign this Map Unit to the earthen walls of the storm channel.

Unvegetated wash and river bottom Mapping Unit (6114)

PHOTOINTERPRETATION SIGNATURE: Unvegetated wash bottoms will have a bright tan to white appearance with swaths of darker sediment deposited throughout. Natural washes flow in a downslope direction and have curvilinear edges and are sometimes contained within steep-walled canyons or bluffs. Major storm channels follow a more linear, anthropogenically-determined path, however the bottoms of the channels can still be cut with somewhat curvilinear margins.

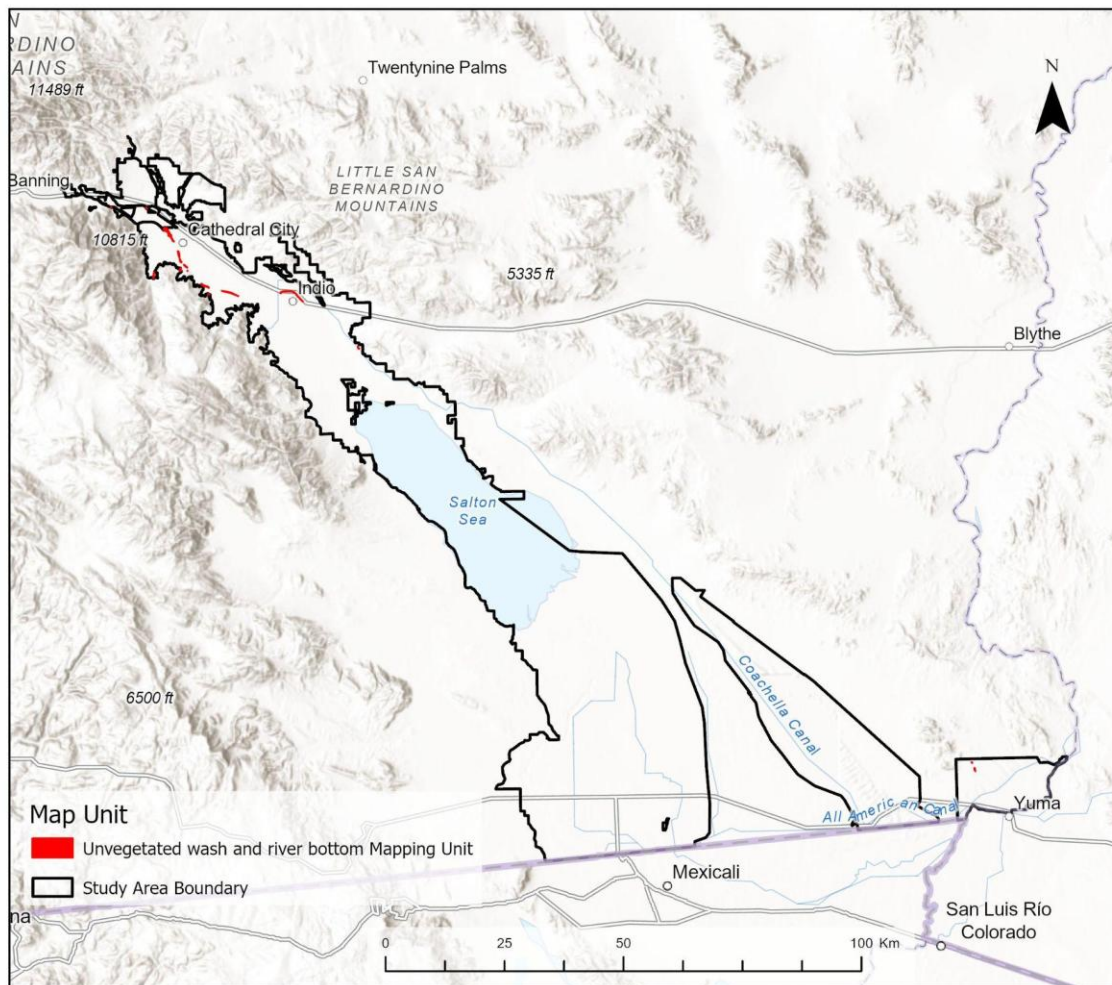


This wash network is part of the Whitewater Floodplain as it enters Palm Springs from the north and is funneled into the Whitewater Storm Channel.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

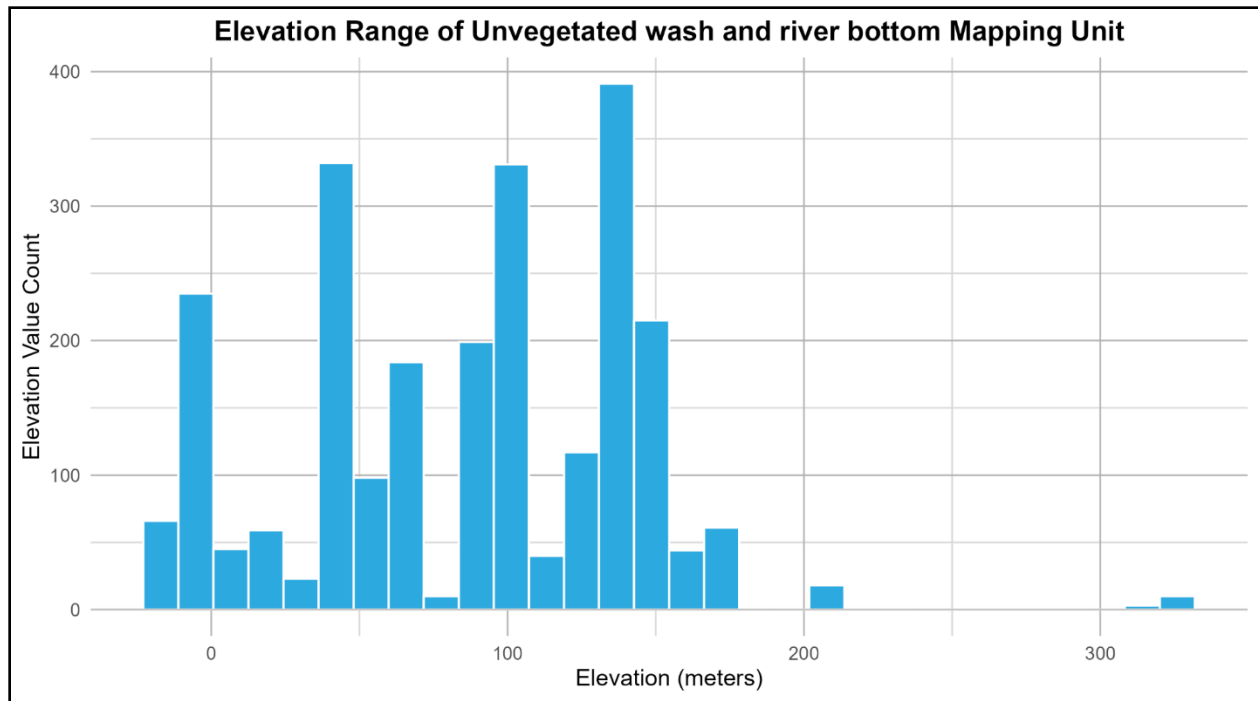
- Anthropogenic Areas of Little or No Vegetation (9320) – Anthropogenically cleared areas usually follow parcel lines or have margins following straight lines. There are often signs of grading/tilling.
- *Chorizanthe rigida* – *Geraea canescens* Desert Pavement Alliance (6117) – Washes may be present across a desert pavement landscape, but they are small, shallow, and too narrow to map. The closely-packed rocks and gravel forming the “pavement” usually have a distinct dark varnish.
- Sparsely vegetated playa (Ephemeral annuals) Mapping Unit (6116) – Playas are contained within a basin and normally lack a long, linear shape seen with washes that exhibit directional flow.

Unvegetated wash and river bottom Mapping Unit (6114)



PROJECT DISTRIBUTION: In the Coachella Valley subarea, unvegetated washes occur at a small portion of the San Geronio River and within the Whitewater Floodplain and Whitewater Storm Channel which cuts through the major urban area from Palm Springs to Indio. Mappers delineated two polygons of unvegetated wash and river bottom Mapping Unit (6114) within the vast desert pavement area on the north half of the Winterhaven subarea.

Unvegetated wash and river bottom Mapping Unit (6114)



Warm Desert Ruderal Grassland Group (2340)

Warm Desert Ruderal Grassland Group (2340)

MMU: 10 acres

MMW: 101 meters

Exotics: High



This photo shows a graded field now covered primarily by nonnative weeds such as *Brassica tournefortii* and *Schismus* species.

SUMMARY: This Group describes areas dominated by nonnative herbaceous species that could not be accurately identified from aerial imagery. These species likely include nonnative mustards such as *Brassica tournefortii* and *Sysimbrium irio* and grasses such as *Schismus* spp. This Group is commonly found on graded plots that became dominated by nonnative weeds after seasonal precipitation. Composition and cover of species varies between seasons based on the amount of rainfall.

Warm Desert Ruderal Grassland Group (2340)

PHOTOINTERPRETATION SIGNATURE: This Group is normally bound within graded parcels and so follows the linear property lines. Shrub and tree cover is less than 2% and herbs appear as various shades of green (true color) and red (CIR) when live, however mappers most often assigned this type when the herb cover was completely or mostly dead, resulting in a straw-color to brown (true color) to gray-brown (CIR).

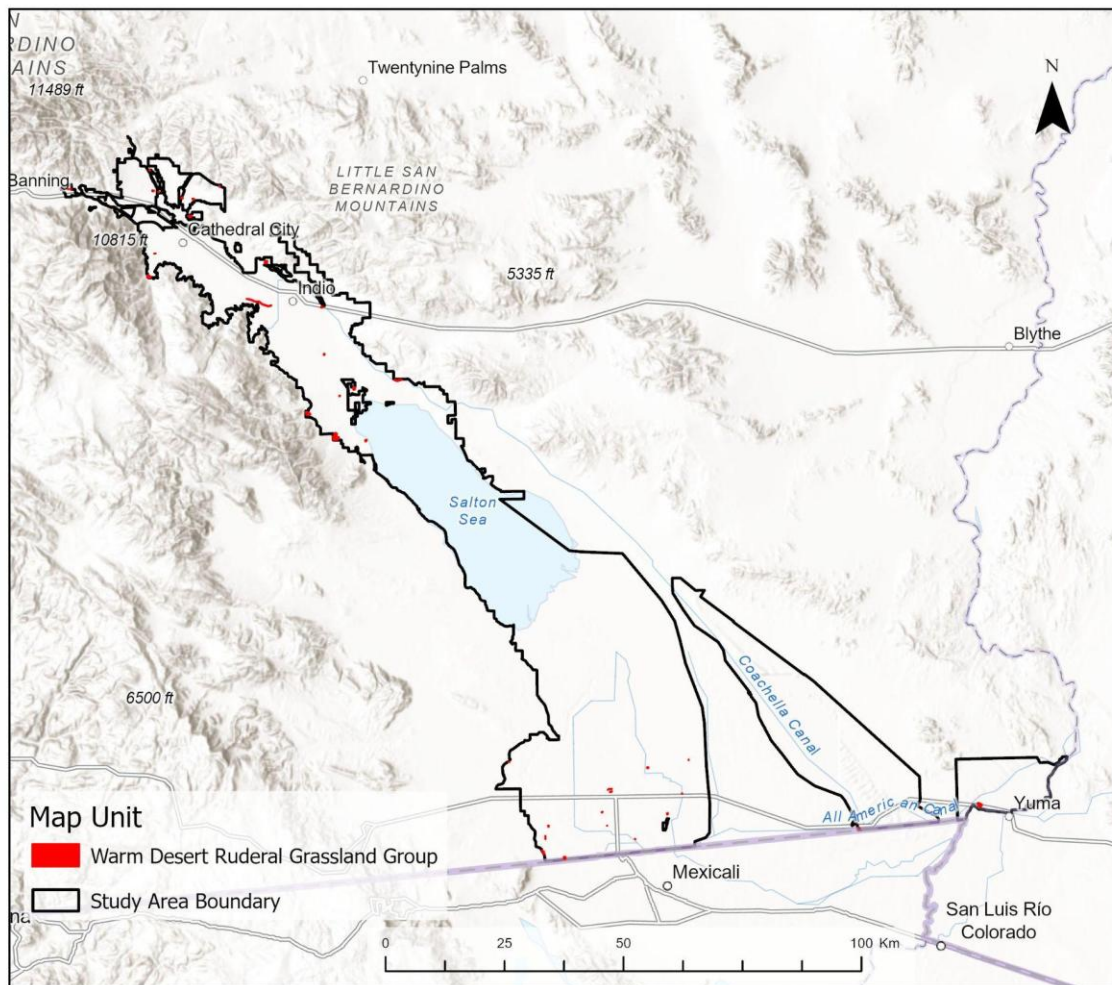


This graded parcel in Desert Hot Springs is now covered with recently-dead nonnative herbs.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

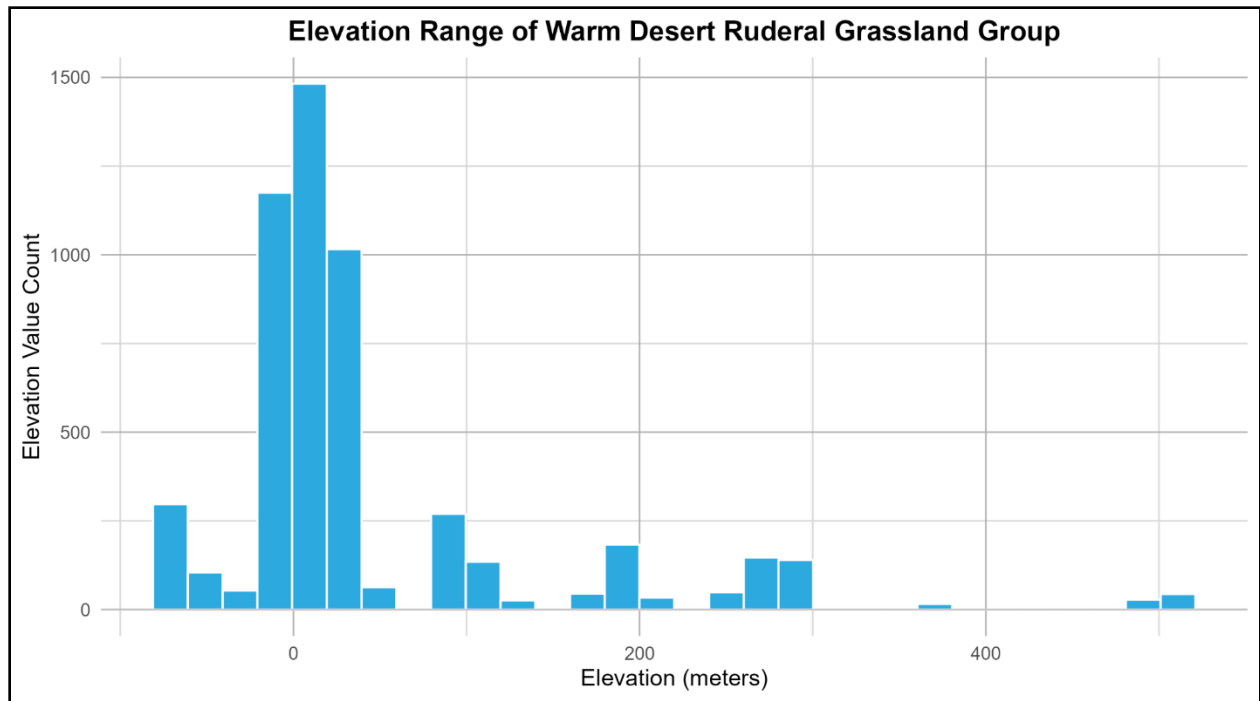
- *Brassica tournefortii* – *Malcolmia africana* Semi-natural Alliance (2331) – *Brassica tournefortii* and *Sysimbrium irio* are often components of Warm Desert Ruderal Grassland Group stands, so field verification of species composition may lead to placement into this Alliance.
- *Bromus rubens* – *Schismus (arabicus, barbatus)* Semi-natural Alliance (2332) – *Schismus* species are often components of Warm Desert Ruderal Grassland Group stands, so field verification of species composition may lead to placement into this Alliance.
- Desert Forb Provisional Mapping Unit (6125) – Field verification is required to differentiate this Mapping Unit, which is comprised of predominantly native herbs, from the nonnative Warm Desert Ruderal Grassland Group.

Warm Desert Ruderal Grassland Group (2340)



PROJECT DISTRIBUTION: This Group occurred mostly in the Coachella Valley subarea throughout less developed parts of the valley. It also occurred more rarely in the southern portion of the Imperial Valley subarea, once in the far-south of the Algodones Dunes subarea, and once in the Winterhaven subarea bordering the I-8 freeway.

Warm Desert Ruderal Grassland Group (2340)



Washingtonia filifera Woodland Alliance (1415)

***Washingtonia filifera* Woodland Alliance (1415)**

California fan palm oasis

Rarity: G3S3

MMU: 0.5 acres

MMW: 22 meters

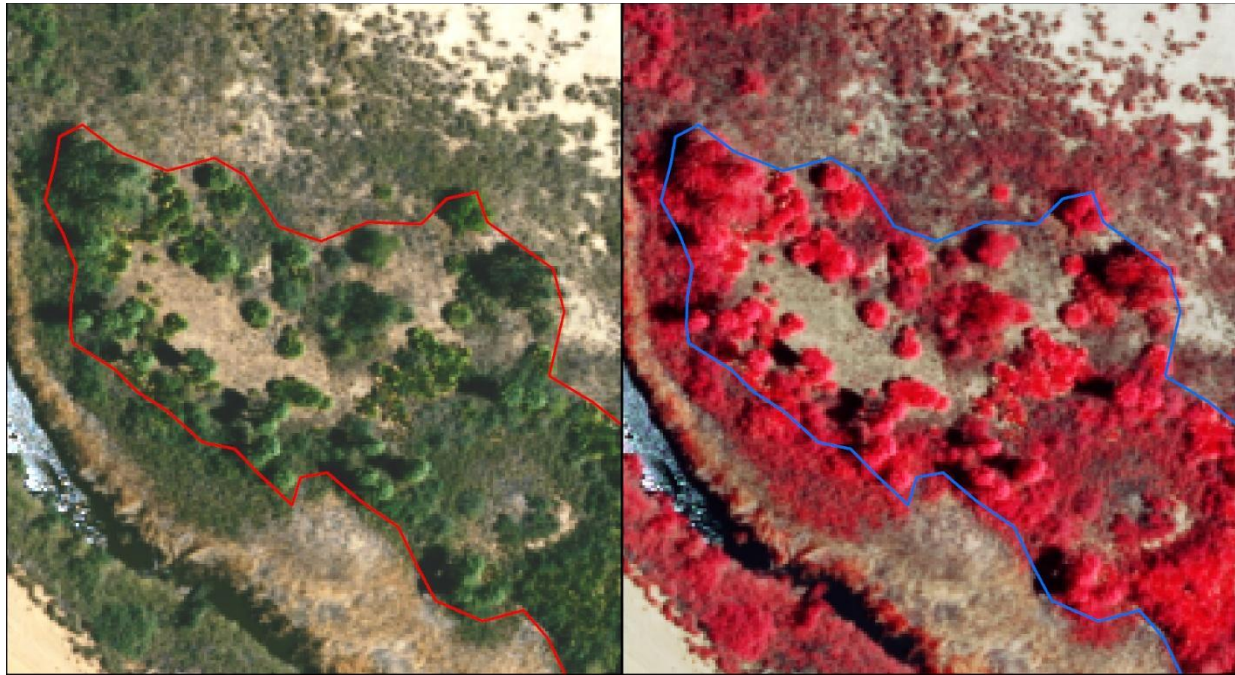


This naturally-occurring stand of *Washingtonia filifera* is in the Pushawalla Palms oasis in the Indio Hills of the Coachella Valley (slightly outside this project's mapping area).

SUMMARY: Mappers used this Alliance for stands of naturally-occurring *Washingtonia filifera* where the palms are characteristic, dominant to codominant, and reach >3% absolute cover in the tree canopy. These oases are associated with naturally occurring water sources, such as springs and seeps along faultlines (as is common in the Coachella Valley) or along the Colorado River. This is opposed to the ruderal/anthropogenically influenced palm groves common within the agricultural areas of the Coachella Valley, Imperial Valley, and Winterhaven mapping subareas. These ruderal groves are presumed to be unviable if anthropogenic water sources, such as aqueducts, agricultural drainages, or artificial ponds, are removed. These ruderal groves are treated under the *Phoenix dactylifera* – *Washingtonia filifera* Woodland Alliance (1621).

Washingtonia filifera Woodland Alliance (1415)

PHOTOINTERPRETATION SIGNATURE: *Washingtonia filifera* have essentially the same appearance from imagery – distinct, similarly-sized neatly round crowns of green-yellow leaves with pale green highlights (true color) or bright red with pink highlights (CIR). These trees can grow extremely tall, and as a result distinct shadows are often visible. These oases usually have a dense understory of alkaline-adapted riparian species including *Pluchea sericea*, *Prosopis glandulosa*, and *Distichlis spicata*.



This grove of primarily *Washingtonia filifera* is along the Colorado River in the Winterhaven subarea.

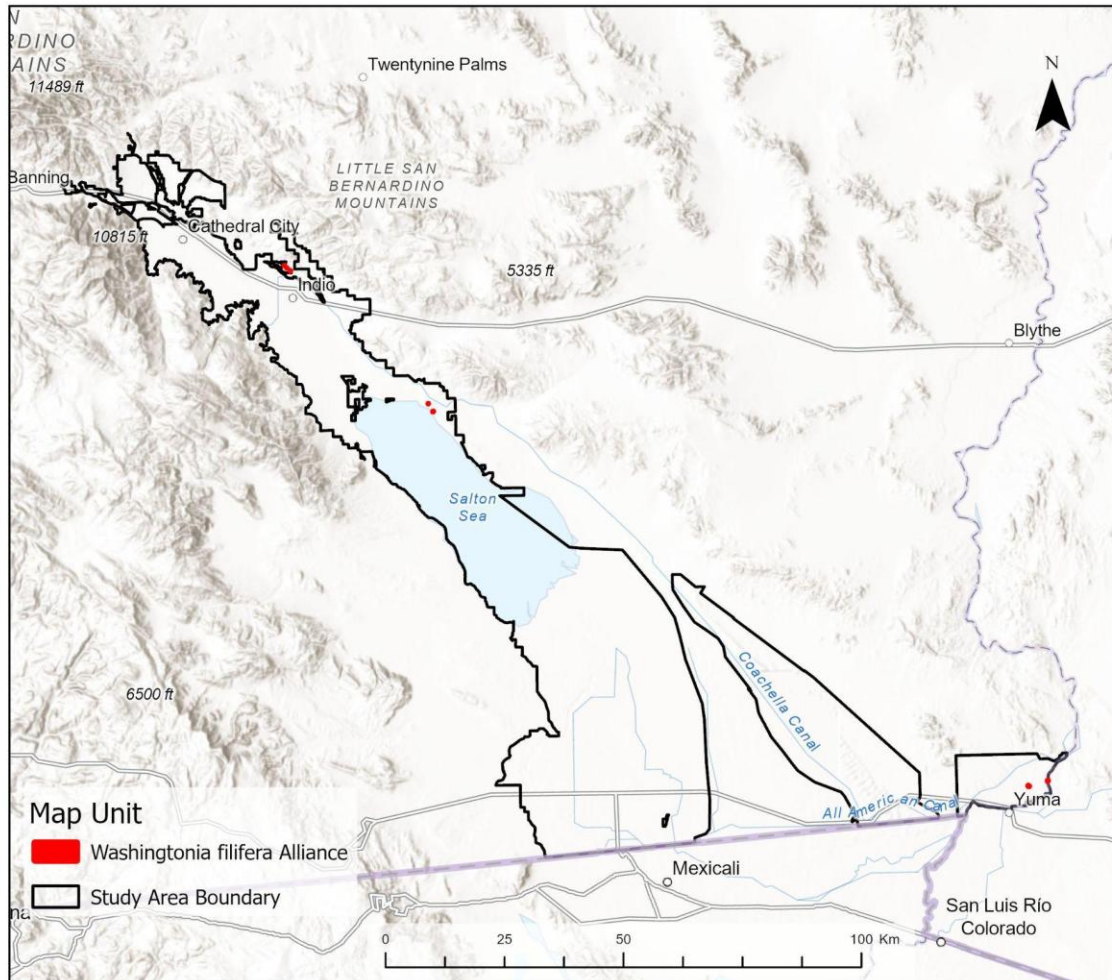
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Phoenix dactylifera* – *Washingtonia filifera* Woodland Alliance (1621) – Determining species of *Washingtonia* can be difficult or impossible using just aerial imagery, however *Phoenix dactylifera* has a distinct blue-green color and shorter stature that help with identification. When significant cover of *Phoenix dactylifera* is not present, mappers used local knowledge of location of natural springs and geological features (prominent fault lines) to determine if a stand of *Washingtonia* sp. is ruderal or not.

Washingtonia filifera Woodland Alliance (1415)

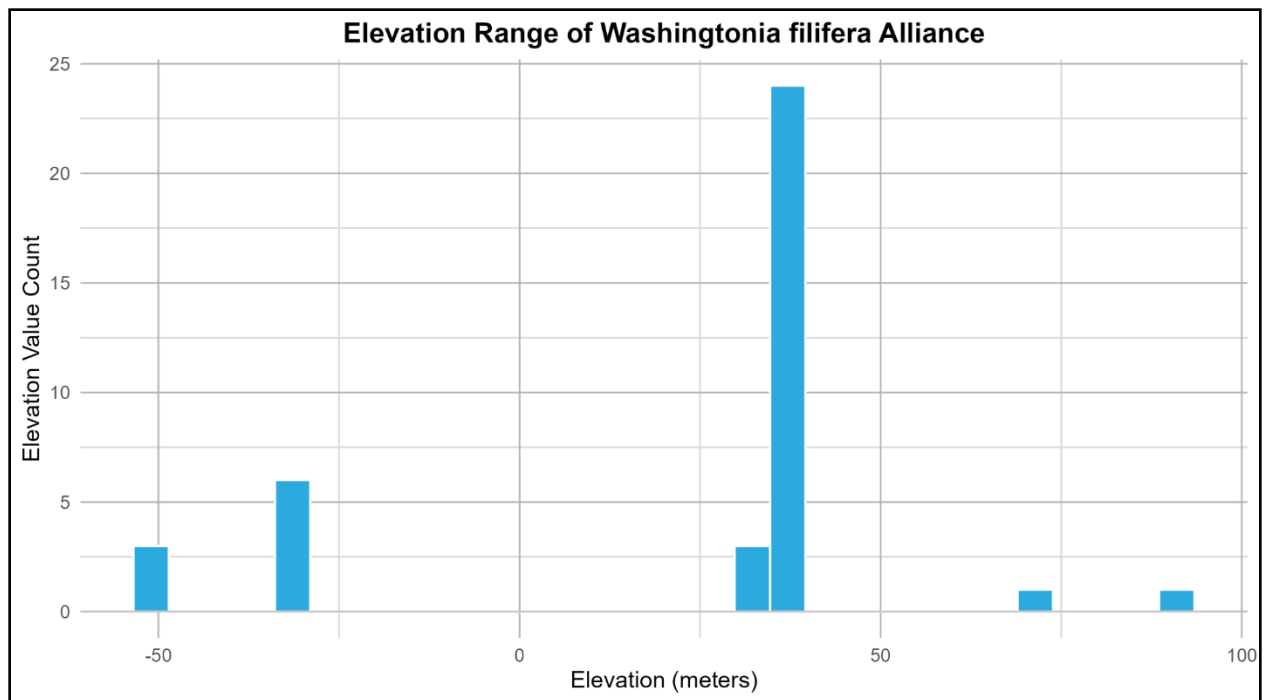
MAPPING CONSIDERATIONS:

- Mappers recorded percent cover of palm species in the Hardwood Cover attribute.



PROJECT DISTRIBUTION: This Alliance occurred primarily in the Coachella Valley along the San Andreas Fault in the Indio Hills. This faultline produces a multitude of springs that support large *Washingtonia filifera* oases. Most of the area of these oases was previously mapped with the Coachella Valley Floor mapping project (ds2898), however some small portions extended into this mapping area. Additional oases were mapped near the community of North Shore on the north side of the Salton Sea, as well as along the Colorado River in the Winterhaven subarea.

Washingtonia filifera Woodland Alliance (1415)



Agriculture (9200)

Agriculture (9200)

MMU: 2.5 acres

MMW: 50 meters

Land Use Code: Agriculture (includes nurseries) – 2000 or Water Transfer (major canals, aqueducts, and agricultural Channels) – 1436

Exotics: High

Anthropogenic Alteration: High

Inapplicable Modifiers: Roadedness, Development Disturbance

SUMMARY: The Agriculture (9200) Map Unit serves as a more general categorization of agricultural activity that cannot be placed accurately into the more specific orchards and vineyard (9210), non-woody row and field agriculture (9220), and irrigated pastures (9230). Mappers used this class for three main categories: agricultural operations that are covered by plastic housing and therefore exact use cannot be determined, cattle operations, and large agricultural canals and drainages (usually termed “laterals” or “lateral drains” on maps). These categories are explained more in the Mapping Considerations section below.

PHOTOINTERPRETATION SIGNATURE: This Map Unit describes a variety of very different anthropogenic features. With covered agriculture operations, growing areas often appear as rows of light blue or white plastic, and can be mistaken for a solar power generating facility. Dairy farms consist of a large earthen-floored plot of land with a grid of shelters for the cows. The soil in these operations is usually a dark brown, and individual cows can be seen using aerial imagery. Agricultural drainages have at least one long, earthen-banked channel, often with water, and usually with associated streets or access roads.

Agriculture (9200)

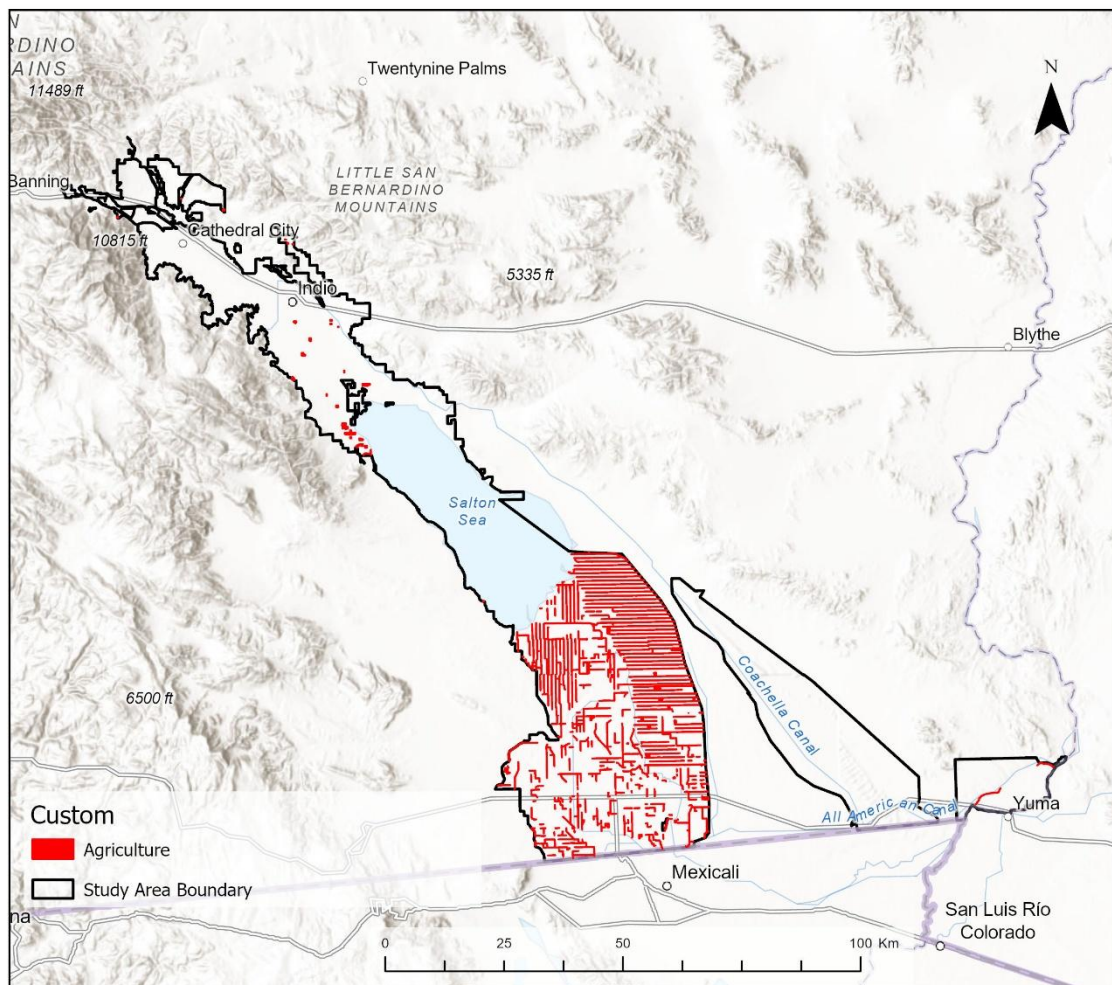


Examples of a covered agricultural operation (left) and a cattle operation/dairy farm with adjacent water transfer channels (right).

MAPPING CONSIDERATIONS:

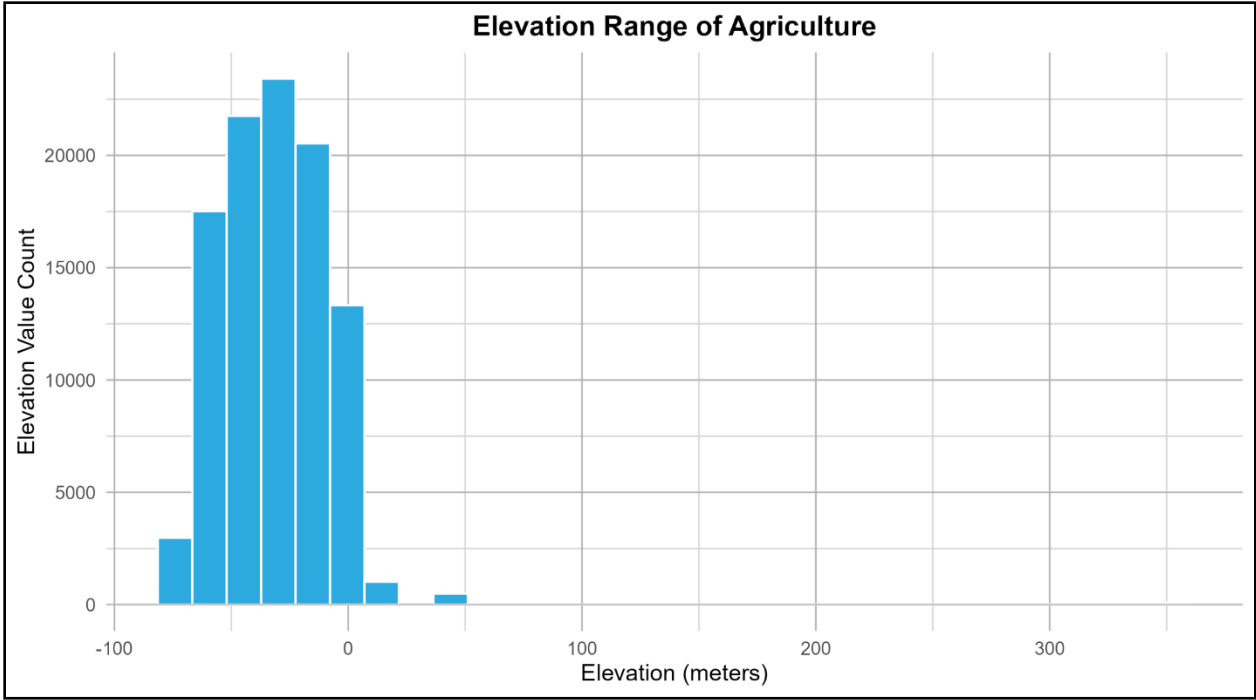
- Concealed agricultural operations/grow houses – these operations are common in the eastern Coachella Valley, and since exact use cannot be determined from imagery (row crops versus ornamental/nursery plants) mappers assigned these areas a more general Agriculture (9200) Map Unit with a Land Use code of “Agriculture (Includes Nurseries)” and map at a standard 2.5 acre MMU.
- Cattle/dairy facilities – The Imperial Valley is home to several large cattle operations, which mappers assigned to Agriculture (9200) with a Land Use code of “Agriculture (Includes Nurseries)” and map at a standard 2.5 acre MMU.
- Large agricultural drainages/laterals – these manmade drainages cross large areas of the Imperial Valley and provide water and drainage to agricultural operations. As with the DRECP, mappers assigned these drainages as Agriculture (9200) with a Land Use of “Water Transfer” only if they met the MMU for agriculture (2.5 acres with an average MMW of approximately 45m), contained two parallel channels OR one large channel with apparent permanent water OR at least one channel with a dedicated parallelling access road. Often, a paved public road runs between two parallelling channels, in which case mappers included the separating road within the Agriculture (9200) polygon delineating the channels.

Agriculture (9200)



PROJECT DISTRIBUTION: Mappers used this Map Unit primarily to describe the complex network of agricultural drainages throughout the Imperial Valley subarea, and to a lesser extent in the Winterhaven subarea. This Map Unit also occurred in the eastern Coachella Valley, largely for the numerous large covered agricultural facilities there. This type did not occur in the Algodones Dunes subarea.

Agriculture (9200)



Anthropogenic Areas of Little or No Vegetation (9320)

Anthropogenic Areas of Little or No Vegetation (9320)

MMU: 2.5 acres

MMW: 50 meters

Inapplicable Modifiers: Exotics



Example of intentionally cleared land in the Coachella Valley subarea.

SUMMARY: Mappers used this Map Unit to mark large areas (2.5 acre MMU) where vegetation had been intentionally removed by means such as scraping or tilling, resulting in <2% total vegetation cover across the polygon, and also lack significant built-up features. Common examples of Anthropogenic Areas of Little or No Vegetation include parcels graded as preparation for development (but before structures are built), agricultural fields that have been fallow for at least 5 years, undeveloped urban parcels that are intentionally kept free of vegetation, and areas cleared for equipment staging, often following utilities such as large canals and railroads. Evidence of clearing is usually visible, such as till marks and heavy vehicle tracks.

Anthropogenic Areas of Little or No Vegetation (9320)

PHOTOINTERPRETATION SIGNATURE: This Map Unit is defined by its lack of vegetation (<2% absolute cover) and evidence of clearing or tilling from heavy machinery or berms or trenches. Signs of grading are often linear and parallel, covering the entire plot.

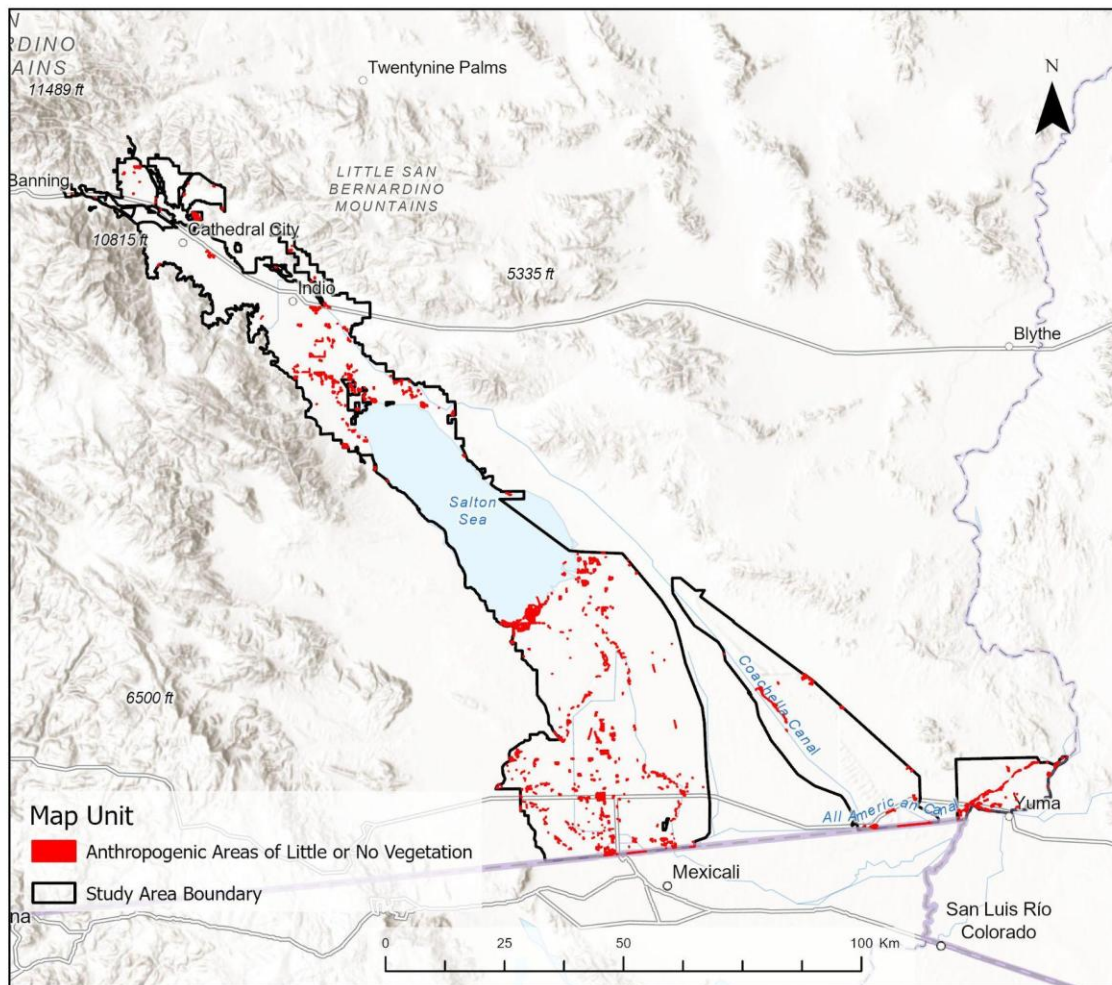


Example of a recently-cleared plot of land in the Winterhaven subarea.

MAPPING CONSIDERATIONS:

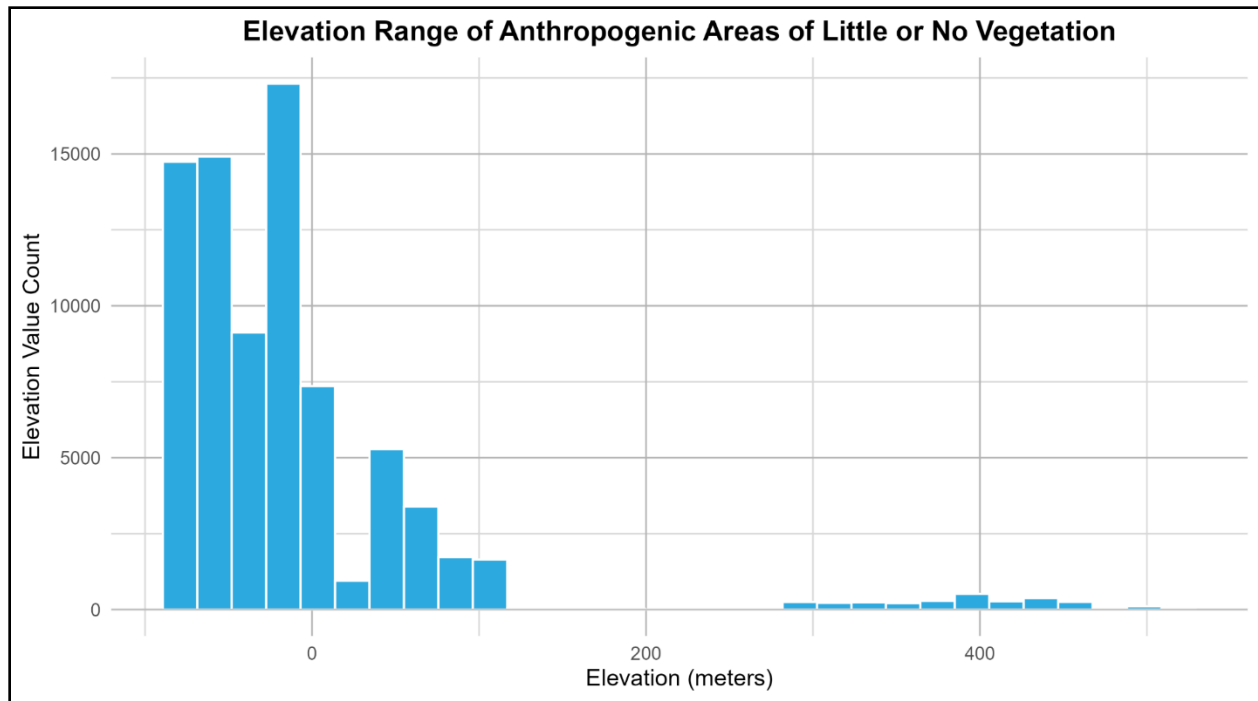
- Mappers did not consider small off-highway vehicle staging areas as Anthropogenic Areas of Little or No Vegetation unless there was evidence of use for camping (fire rings, visible campers, etc.).
- Some apparent areas of this Map Unit may actually fall under a different Map Unit, such as large (>10 acre) Water Impoundment Features (9805) and Sparsely Vegetated Recently Burned Areas (9701) depending on the function of the area or its fire history.
- Mappers considered large dirt-covered landfills as Anthropogenic Areas of Little or No Vegetation with a Land Use code of Urban (1000).
- Mappers considered pit mines and quarries with sparse or no vegetation cover as Built-Up Urban (9300) with a Land Use code of Urban (1000).

Anthropogenic Areas of Little or No Vegetation (9320)



PROJECT DISTRIBUTION: Anthropogenic Areas of Little or No Vegetation occurred in all four mapping subareas. This Map Unit is most common in the agricultural areas of the Coachella Valley, Imperial Valley, and Winterhaven.

Anthropogenic Areas of Little or No Vegetation (9320)



Built-Up & Urban Disturbance (9300)

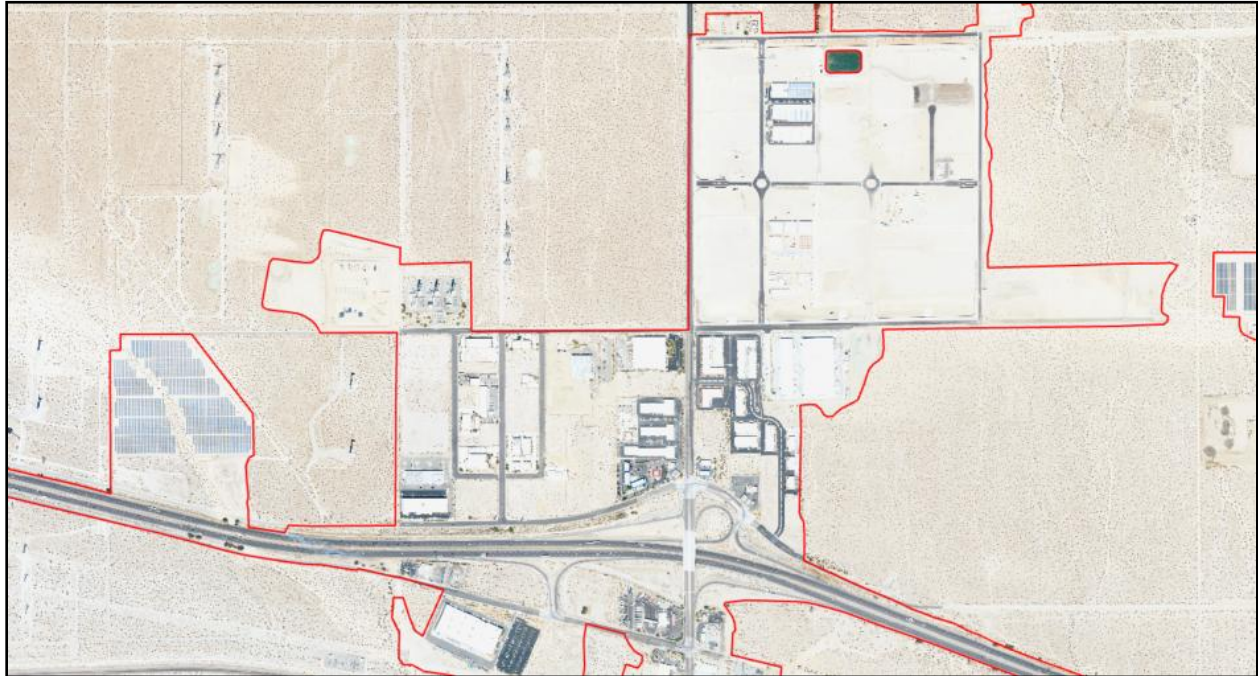
Built-Up & Urban Disturbance (9300)

MMU: 2.5 acres

MMW: 50 meters

Land Use Code: Urban (1000)

Inapplicable Modifiers: Exotics, Roadedness, Altered Hydrologic Regime



This junction of the I-10 freeway and Indian Canyon Drive in Desert Hot Springs demonstrates several types of Built-Up Urban infrastructure, including a solar farm, planned development parcels, a freeway, and industrial/warehouse structures.

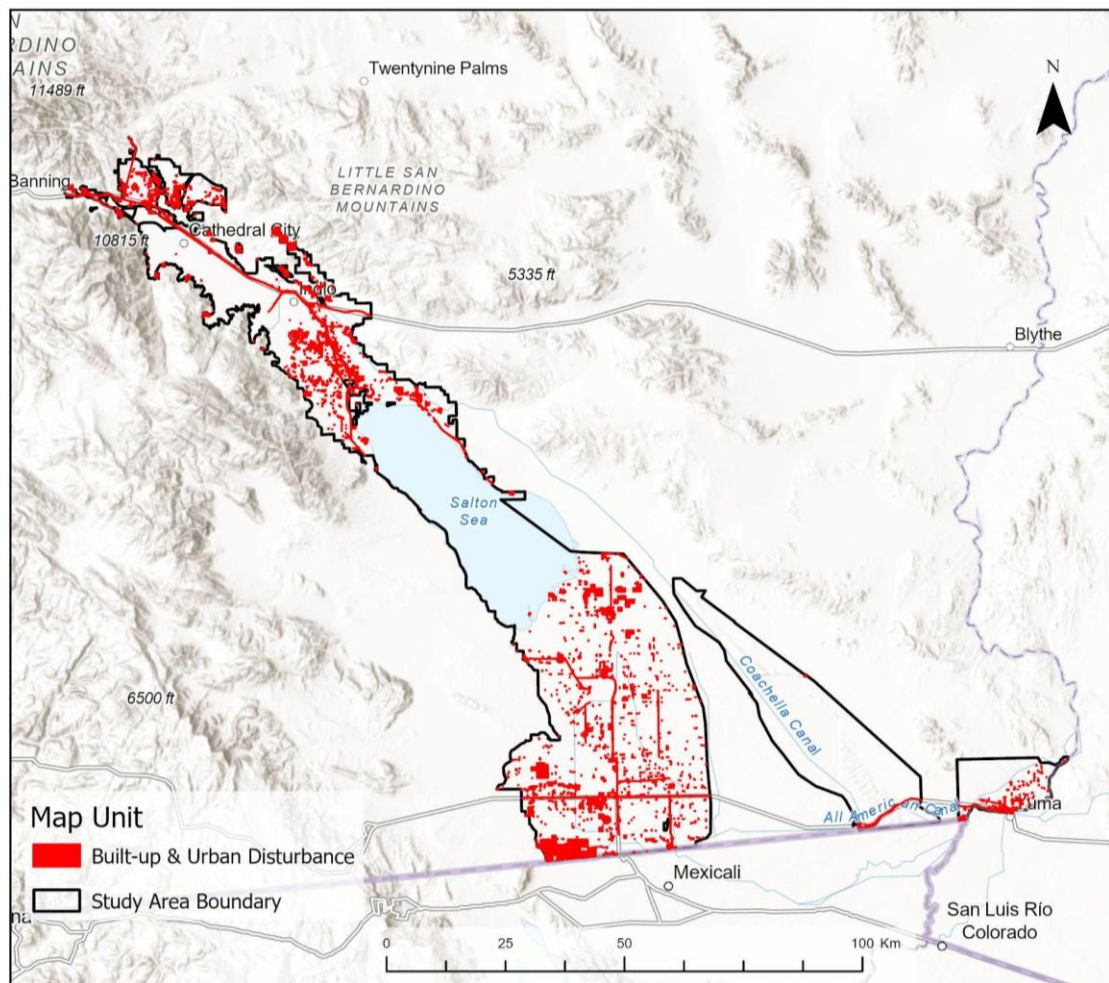
SUMMARY: Mappers used this Map Unit to describe areas of urbanization that include structures (residential, industrial, utility, etc.), parking lots, major highways and freeways, and railroads that meet the MMU and MMW requirements but fall below the total area needed to map as an 1-square mile minimum area Urban Window (9310).

MAPPING CONSIDERATIONS:

- Delineation of Built-Up Urban polygons generally follows parcel boundaries, often visible as a difference in vegetation, rows of planted ornamentals, or a fenceline.
- Berms and access roads associated with railroads, highways, and freeways are included in the Built-Up Urban polygon unless they are vegetated, in which case they are mapped as the appropriate vegetation type.

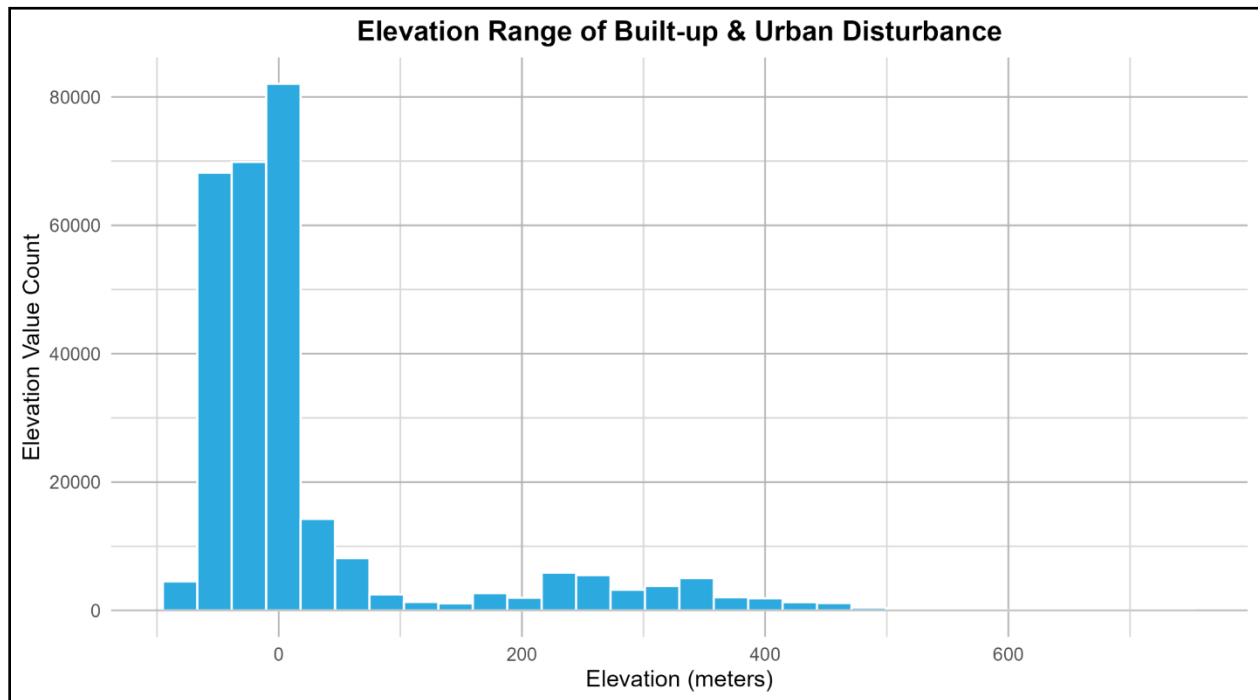
Built-Up & Urban Disturbance (9300)

- Landfills are mapped as Anthropogenic Areas of Little or No Vegetation (9320) with a Land Use code of “Urban”.
- Freshly graded plots of land that are part of an ongoing construction project are mapped as 9300 even if no structures have been erected yet. Long-abandoned graded plots that lack mappable vegetation are considered 9320.
- Scraped lots adjacent to or within 9300 polygons were included with 9300 polygons if they did not meet the MMU for Anthropogenic Areas of Little or No Vegetation (9320).
- Mappers included flood control basins with 9300 polygons unless they exceeded 10 acres in size, in which case mappers assigned them to Water Impoundment Features (9805).
- In cases where at least 10% natural vegetation remains within the footprint of an urban development, mappers “dual coded” this area as the corresponding natural vegetation type with a Land Use code of 1000 (Urban) and an appropriate Development Disturbance modifier.



Built-Up & Urban Disturbance (9300)

PROJECT DISTRIBUTION: Built-Up Urban polygons occurred throughout most of the Coachella and Imperial Valley subareas. In the Algodones Dunes, this Map Unit was restricted to Glamis and the I-8 freeway. Only the southern portion of the Winterhaven subarea (south of the All American Canal) contained this Map Unit.



Exotic Trees (9500)

Exotic Trees (9500)

MMU: 1 acre

MMW: 32 meters

Exotics: High

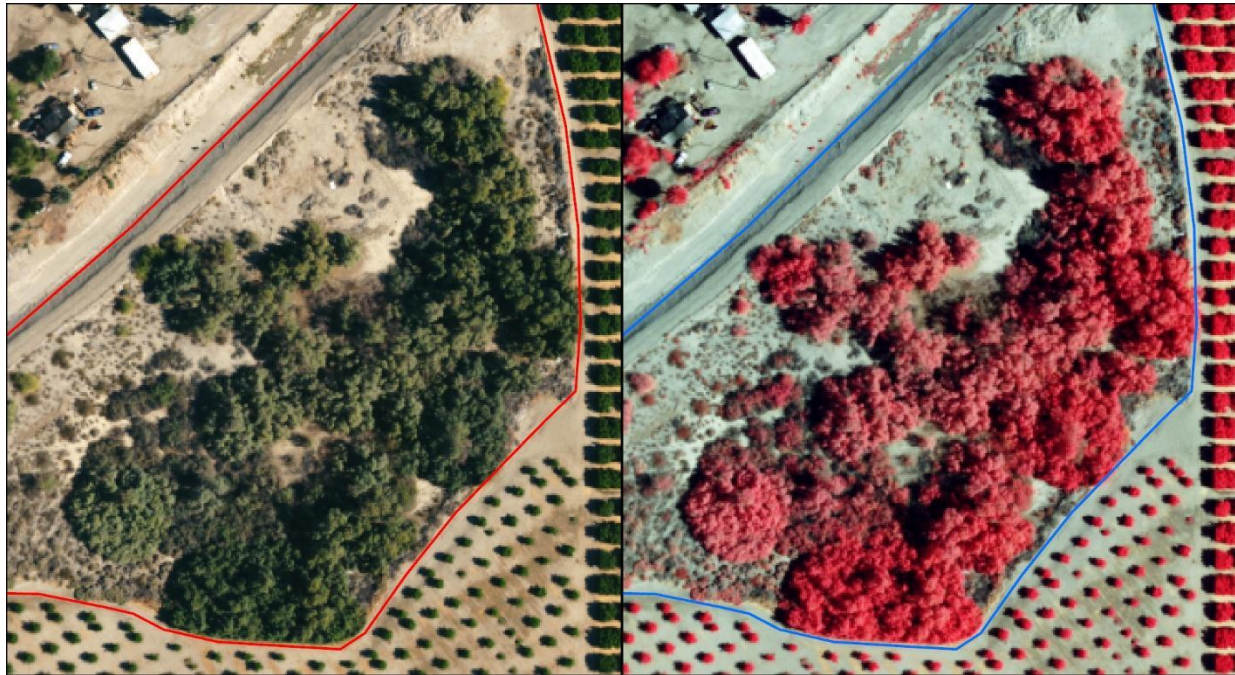


This dense stand of primarily exotic trees surrounds a small structure in the Imperial Valley.

SUMMARY: Mappers used this Map Unit to delineate patches of nonnative/exotic trees at >1 acre area. Common exotic tree species encountered include athel tamarisk (*Tamarix aphylla*), eucalyptus species, and ornamental species of mesquite (*Prosopis* spp.) and palo verde (*Parkinsonia* spp.). These exotic trees are usually intentionally planted on residential parcels, parks, camp grounds, and lining roads and railroads.

Exotic Trees (9500)

PHOTOINTERPRETATION SIGNATURE: The exact photointerpretation signature of exotic tree stands will vary based on species present, however they are generally easy to identify using a combination of large size and association with heavily developed sites (residences, parks, railroads, highways). The pattern of planting is usually in single rows or random/clumped, not in neat grid-like patterns seen in orchards.



Dense clusters of athel tamarisk (*Tamarix aphylla*) such as this are common throughout the mapping area. Compare this to the orchard trees on the right and bottom of the photos.

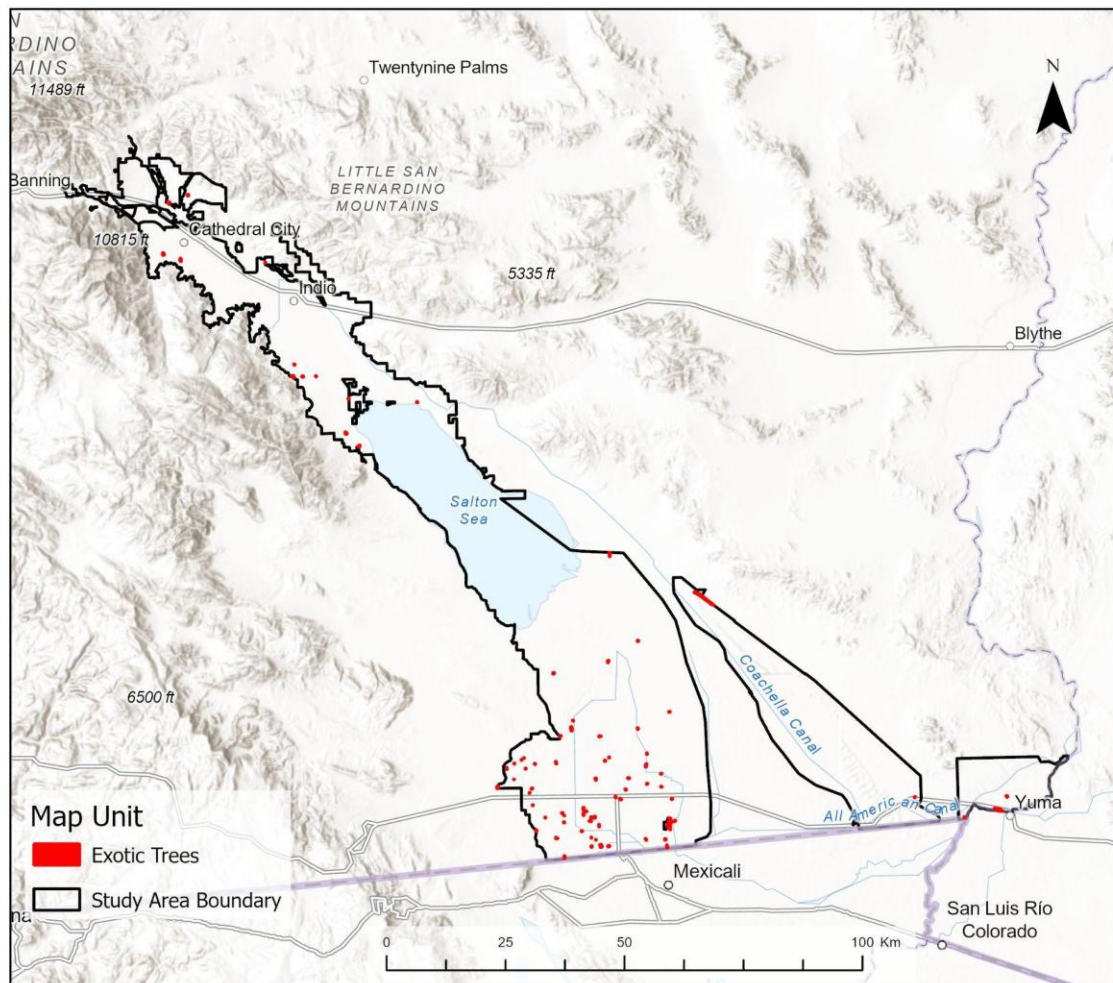
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- *Tamarix* spp. Semi-natural Alliance (1432) – Shrubby *Tamarix* can have a similar color to tree *Tamarix* (*Tamarix aphylla*), so mappers should look for shadows of trees, indicating height, and overall larger crown size.
- *Prosopis glandulosa* – *Prosopis velutina* – *Prosopis pubescens* Woodland Alliance (4222) – Native *Prosopis* stands have a much softer crown texture, have neatly-curved crown margins, and are usually much shorter and lack shadows.
- *Populus fremontii* – *Fraxinus velutina* – *Salix gooddingii* Woodland Alliance (1411) – Stands of this type are usually associated with more natural settings, such as riparian marshes and riversides, while exotic trees are usually in close proximity to urban features.

Exotic Trees (9500)

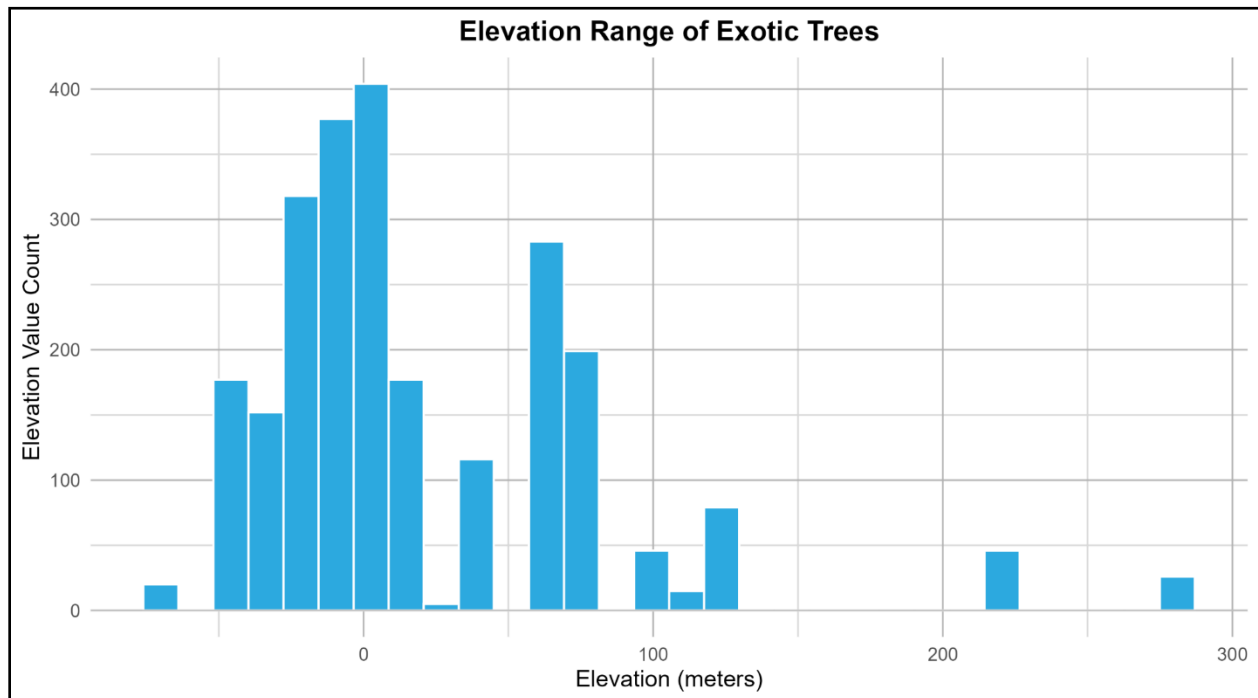
MAPPING CONSIDERATIONS:

- Ornamental/nonnative palm trees that are not associated with a nursery or agricultural operation (e.g. date palm orchards) are treated in the *Phoenix dactylifera* – *Washingtonia filifera* Semi-Natural Alliance (1434).
- Only tamarisk species that are considered trees are placed in this Map Unit (i.e. *Tamarix aphylla*).
- Mappers considered all Exotic Tree stands within this mapping project to be a riparian type with a 1 acre MMU (the DRECP also considered upland types mapped at a 10 acre MMU).



Exotic Trees (9500)

PROJECT DISTRIBUTION: This Map Unit occurred in every subarea, however it was most prevalent throughout the predominantly agricultural Imperial Valley subarea where ornamental trees are commonly used to cover vacant parcels and add privacy and shade to otherwise extremely exposed small residential structures.



Irrigated Pastures (9230)

Irrigated Pastures (9230)

MMU: 2.5 acres

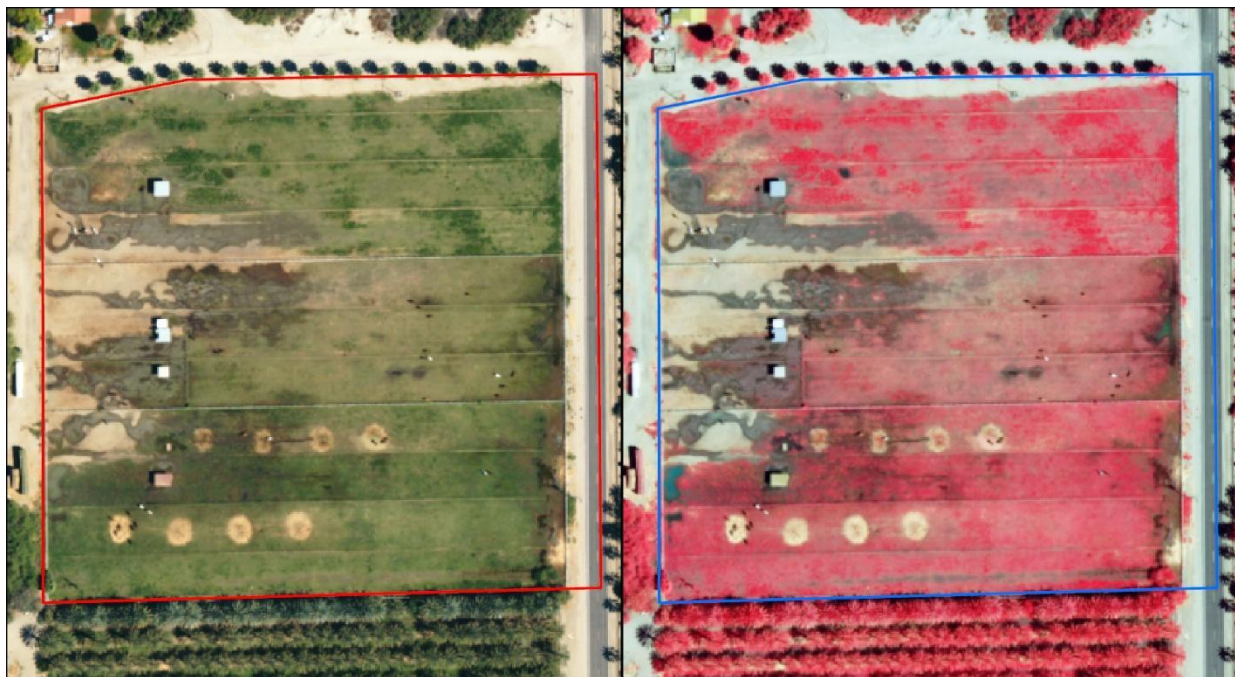
MMW: 50 meters

Land Use Code: Improved Pastureland (Irrigated) – 2300

Inapplicable Modifiers: Exotics

SUMMARY: Mappers applied this Map Unit to areas of artificially irrigated grass/herbs primarily for the purpose of livestock grazing. These grazing areas can be easily confused with plots growing annual crops, however it is sometimes possible to see grazing animals and small shelter structures that would not be present within food crop agricultural plots.

PHOTOINTERPRETATION SIGNATURE: Irrigated pastures are usually bounded by straight borders but can sometimes be irregularly shaped. Various forage grasses and herbs are present with the plots and appear as mottled, multi-shade greens (true color) and reds (CIR). There are often patches of dead forbs throughout. Grazing animals and shelter structures are often visible. Irrigated pastures usually appear finely divided into long, thin rectangles, as seen in the examples below.

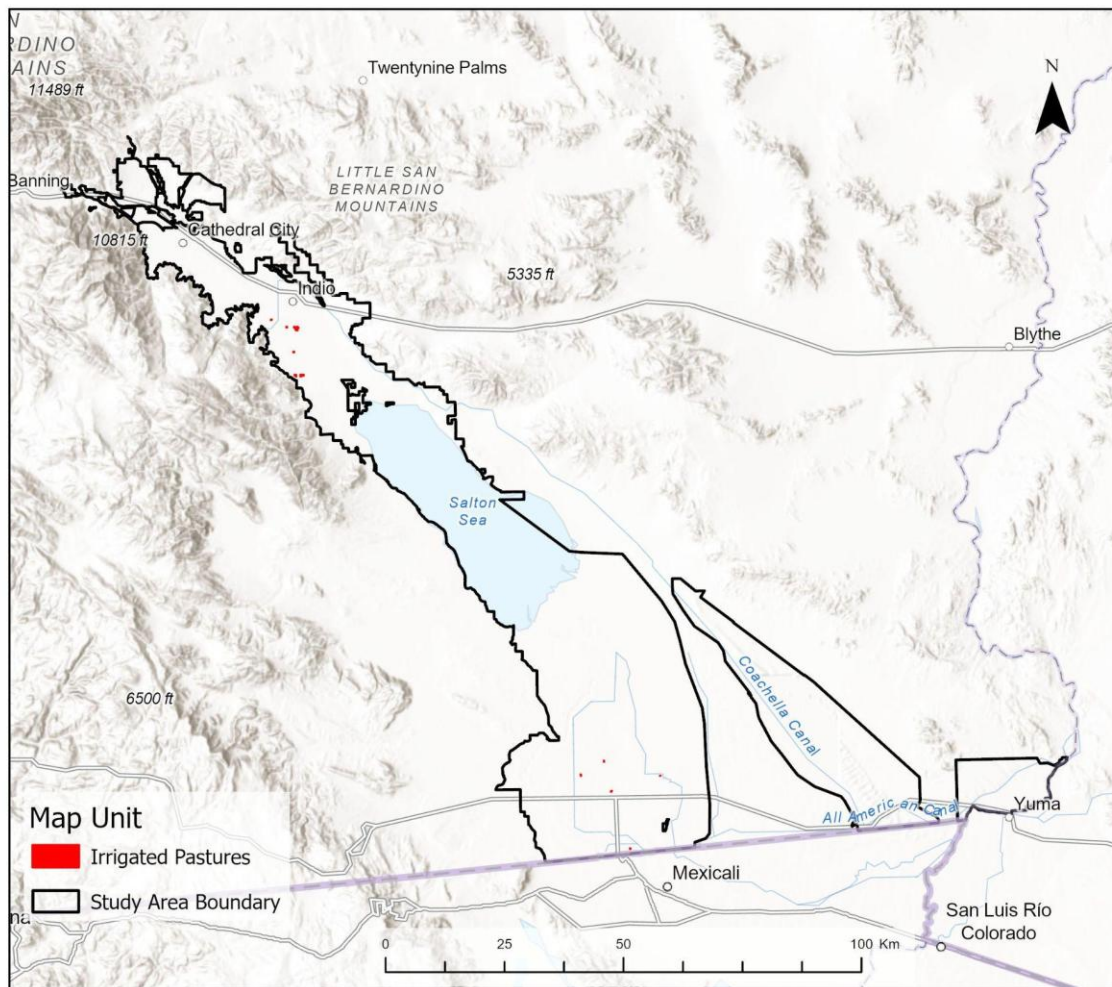


This example of irrigated pastures from the eastern Coachella Valley clearly shows a group of horses and shelter structures.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

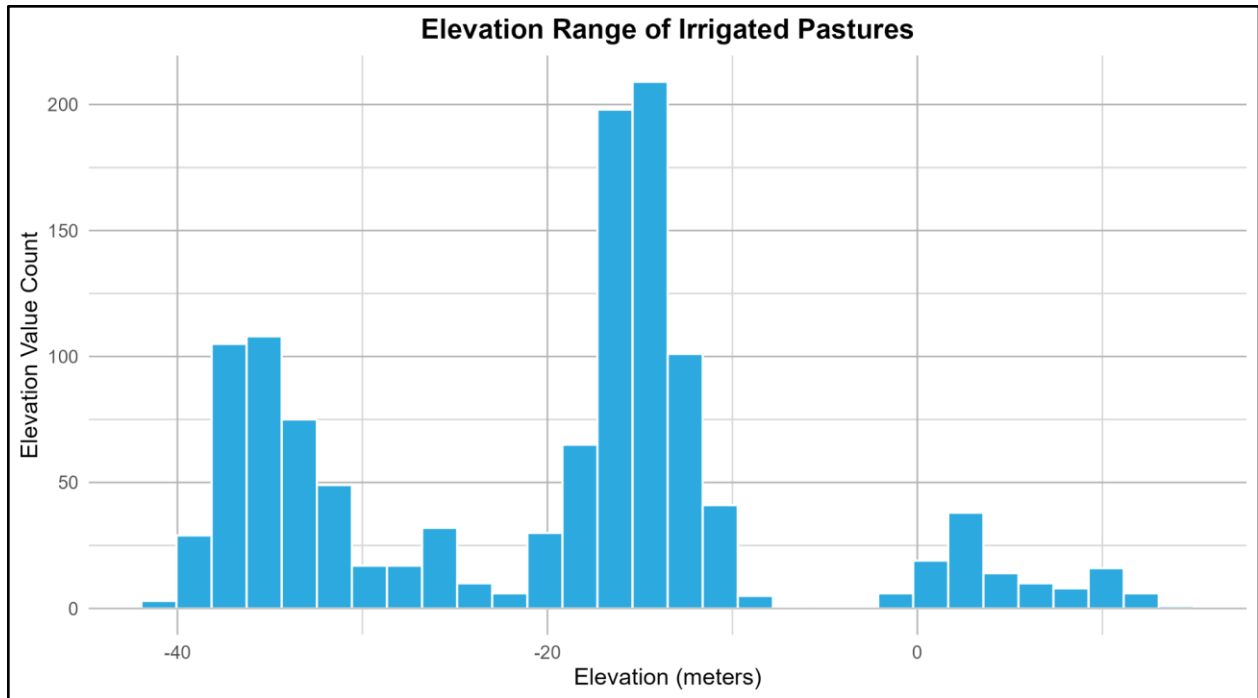
- Non-woody Row and Field Agriculture (9220) – the presence of long, thin rectangular divisions, shelter structures, grazing animals, and seemingly random patches of dead forbs can help separate agricultural plots for food crops, which typically have none of these features, from irrigated pastures.
- *Cynodon dactylon* – *Crypsis* spp. – *Paspalum* spp. Semi-Natural Alliance (3716) – stands of *Cynodon dactylon* are usually not contained within large constructed plots, and are instead associated with roadside ditches, berms lining agricultural canals, and other areas of high soil moisture.
- *Distichlis spicata* – (*Juncus cooperi* – *Frankenia salina*) Interior Herbaceous Alliance (3726) – Similar to stands of *Cynodon dactylon*, *Distichlis spicata* is not normally bound within fenced/divided parcels and instead occurs more frequently in undeveloped, highly saline areas such as around the shores of the Salton Sea.

Irrigated Pastures (9230)



PROJECT DISTRIBUTIONS: Mappers delineated irrigated pastures in the eastern Coachella Valley and southern Imperial Valley, both of which are surrounded by extensive agricultural operations. This Map Unit did not occur in the Algodones Dunes or Winterhaven subareas.

Irrigated Pastures (9230)



Major Canals and Aqueducts (Open Water) (9804)

Major Canals and Aqueducts (Open Water) (9804)

MMU: 0.5 acres

MMW: 22 meters

Land Use Code: Water Transfer (1436)

Inapplicable Modifiers: Exotics, Roadedness, Altered Hydrologic Regime

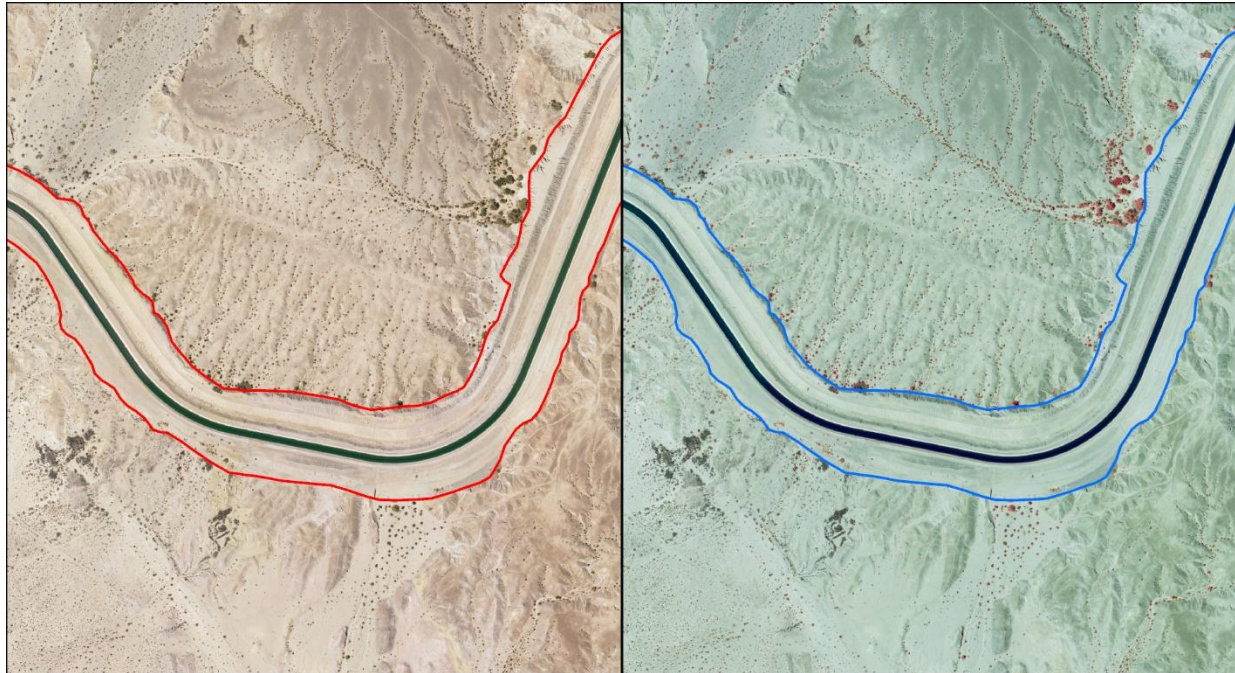


This photo shows the Westside Main Canal outside the town of Brawley in the Imperial Valley subarea. The thin strips of *Pluchea sericea* lining the banks were not wide enough to map separately.

SUMMARY: This Map Unit is used to represent major canals or water diversion channels within the mapping area. These canals have permanent above-ground, visible water and are significantly wider than the many smaller agricultural drainages crossing parts of the Coachella Valley, Imperial Valley, and Winterhaven mapping subareas. Major canals mapped in this project include the Coachella Canal, All American Canal, Westside Main Canal, Central Main Canal, and the Yuma Main Canal. Mappers also used this Map Unit for a seemingly unnamed large channel along the south tip of the Salton Sea that crosses the Sonny Bono National Wildlife Refuge Unit 1 restoration area.

Major Canals and Aqueducts (Open Water) (9804)

PHOTOINTERPRETATION SIGNATURE: These major canals are easily recognized by the volume of water visible from imagery. Additionally, they are also usually named on maps, unlike many of the smaller drainages innervating the agricultural areas (although some of the major agricultural drainages are named “laterals”, e.g. Trifolium Lateral, which were not treated in this Map Unit).



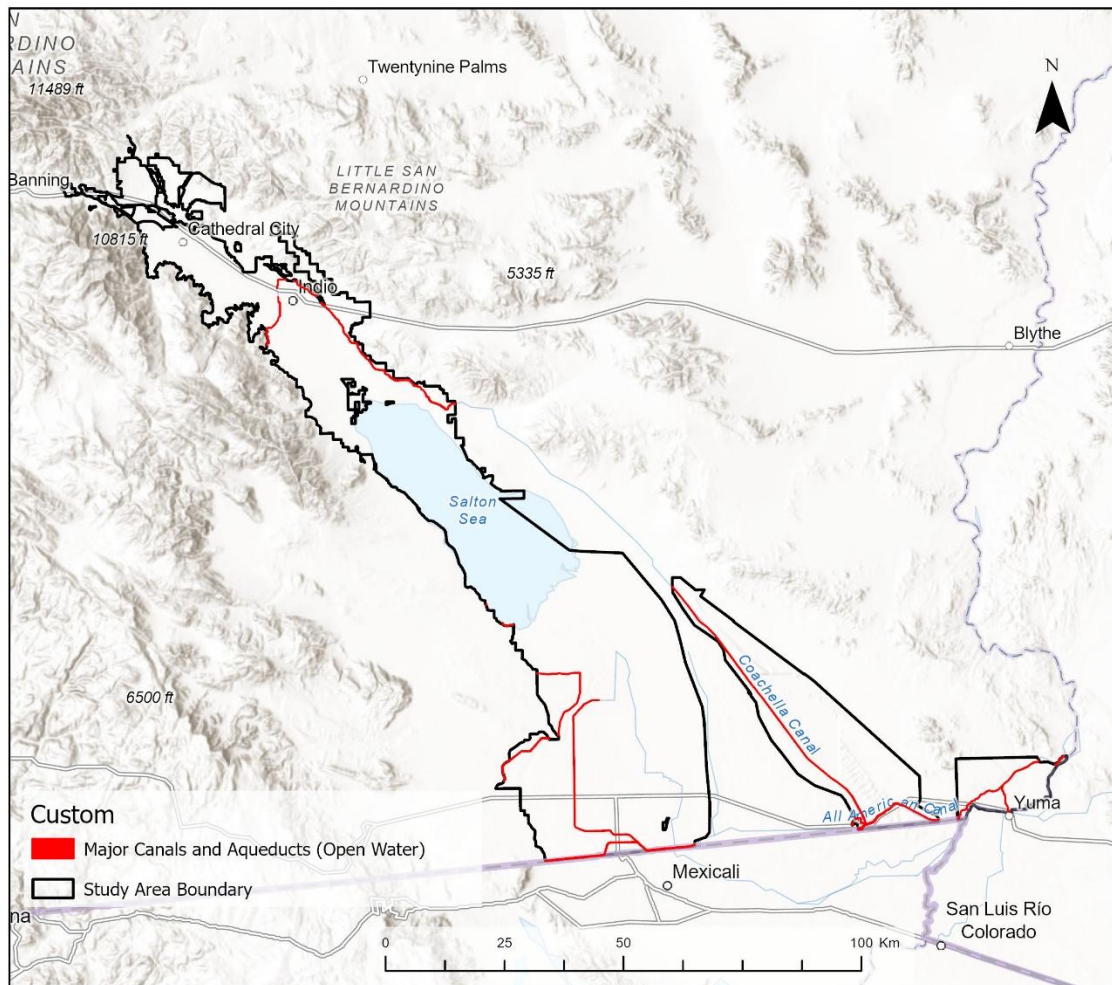
This polygon delineates a small section of the Coachella Canal and its associated access road and embankments.

MAPPING CONSIDERATIONS:

- Major canals/aqueducts are mapped using a riparian/water (0.5) acre MMU, unlike many other anthropogenic Map Unit.
- Major canal polygons contain both the water surface and adjacent paralleling access roads. Large pump stations or other utility features associated with canals are mapped separately, usually as Built-Up Urban (9300), if they reach the required MMU of 2.5 acres.
- Most canal banks are intentionally kept vegetation-free, however the All American Canal in the Winterhaven subarea is lined with miles-long strips of *Phragmites australis*. For this case, mappers assigned only the exposed water to Major Canals and Aqueducts (Open Water) (9804), then mapped the *Phragmites australis* as a separate polygon of *Phragmites australis* – *Arundo donax* Semi-natural Alliance (1431). These vegetated polygons, on average, met or exceeded the 15m MMW used for vegetation associated with canals and agricultural drainages (slightly lower than the normal 22m MMW used for stands of riparian

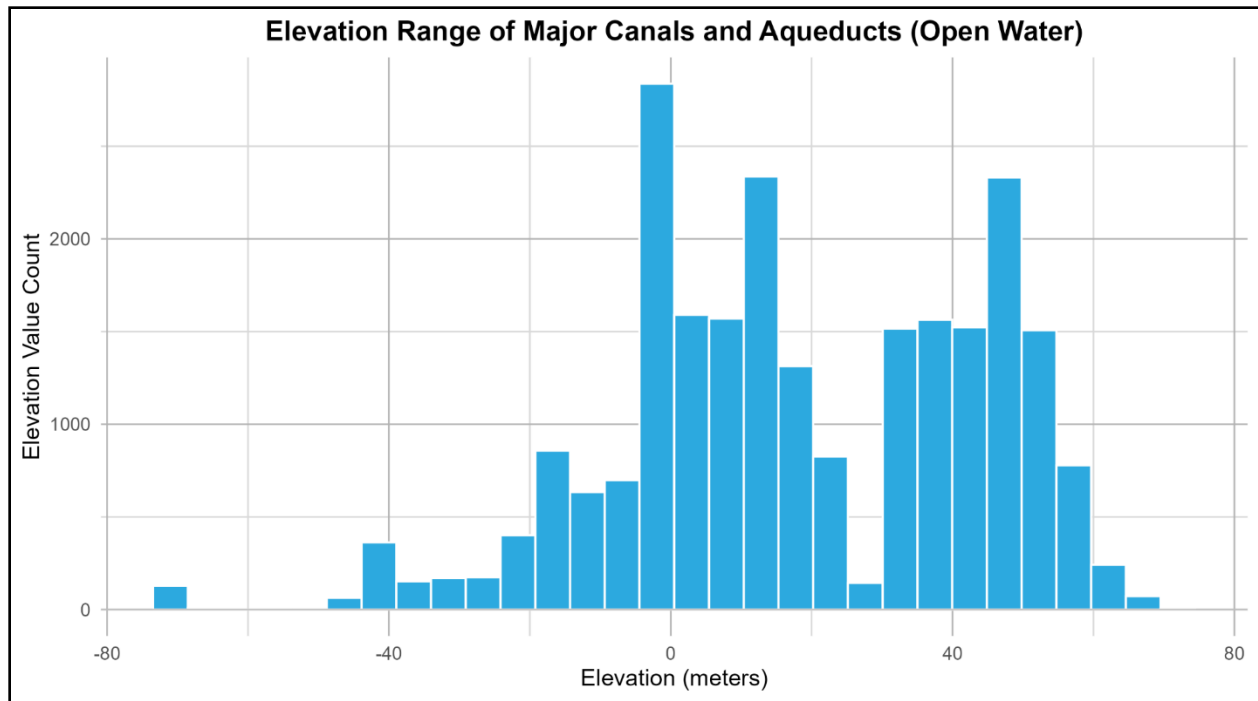
Major Canals and Aqueducts (Open Water) (9804)

vegetation not associated with canals or agricultural drainages). In this area, the adjacent access roads were usually expanded outward into large, scraped areas with associated berms, which mappers delineated separately as Anthropogenic Areas of Little or No Vegetation (9320).



PROJECT DISTRIBUTION: Major canals mapped in this project include the Coachella Canal in the Coachella Valley and Algodones Dunes subareas, the All American Canal in the Algodones and Winterhaven subareas, Westside Main Canal, and the Central Main Canal in the Imperial Valley subarea, and the Yuma Main Canal in the Winterhaven subarea. Mappers also used this Map Unit for a seemingly unnamed large channel along the south tip of the Salton Sea that crosses the Sonny Bono National Wildlife Refuge Unit 1 restoration area.

Major Canals and Aqueducts (Open Water) (9804)



Non-woody Row and Field Agriculture (9220)

Non-woody Row and Field Agriculture (9220)

MMU: 2.5 acres

MMW: 50 meters

Land Use Code: Non-woody Row & Field Crops (2100)

Exotics: High

Anthropogenic Alteration: High

Inapplicable Modifiers: All cover class fields, Roadedness, Development



This photo shows a typical agricultural plot growing annual crops in the eastern Coachella Valley.

SUMMARY: This Map Unit classifies the multitude of agricultural plots used to grow annual crops within the Coachella Valley, Imperial Valley, and Winterhaven subareas. These irrigated plots are usually rectangular-sided and may or may not be planted at the time of mapping. Mappers only assigned fallow fields to this Mapping Unit if it had been worked or planted within the past 5 years. If not, the plot was mapped according to its current vegetation type (usually opportunistic small shrubs or weedy annuals) or as Anthropogenic Areas of Little or No Vegetation (9320) if <2% vegetation cover was present. Mappers used Google Earth to examine past imagery to make this assessment.

Non-woody Row and Field Agriculture (9220)

PHOTOINTERPRETATION SIGNATURE: Agricultural fields are almost always linear-sided and often contain visible planting rows or till marks. A variety of crops are grown within this mapping area, so photointerpretation signatures of the plants will vary widely, but all herbaceous crops generally have a soft texture and bright coloration.



This example of herbaceous agriculture from the eastern Coachella Valley demonstrates the variety of possible photo signatures.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

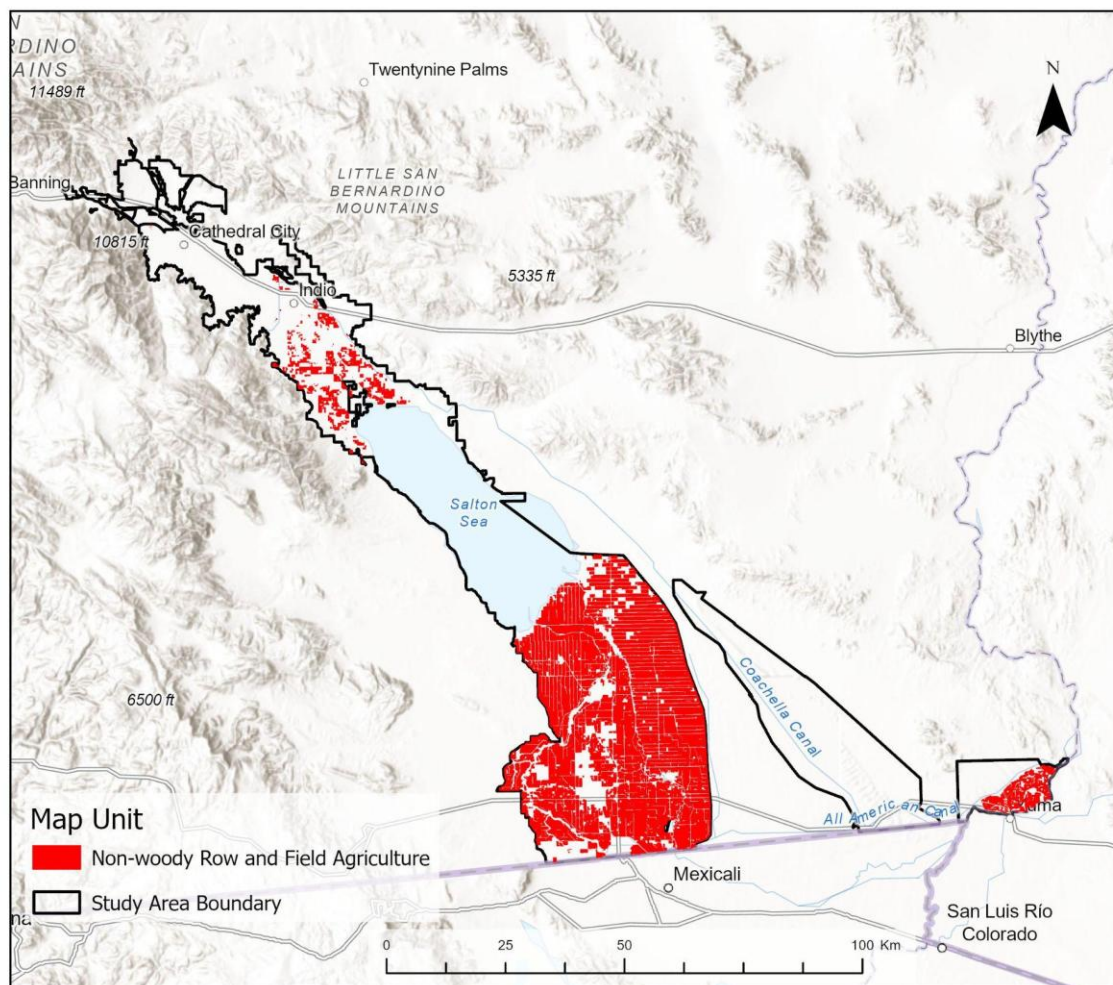
- Woody Agriculture (orchards, vineyards) (9210) – Orchards with young or small plants may appear similar to fields planted with annual crops, however one can almost always identify individual plants in orchards, and rarely so with herbaceous crops.
- Anthropogenic Areas of Little or No Vegetation (9320) – If an annual crop field has been worked at least 5 years prior to the date of imagery, then mappers assigned it to Non-woody Row and Field Agriculture (9220). If it had not been worked within the last 5 years, and it contains <2% vegetation cover, then mappers assigned it to Anthropogenic Areas of Little or No Vegetation (9320).
- Warm Desert Ruderal Grassland Group (2340) – Mappers identified several long-abandoned (greater than 5 years) agricultural fields with enough weedy herbaceous cover to be classified as this Map Unit. Mappers used Google Earth to examine past imagery and determine approximate time since the field was last worked, which helps determine if visible herbaceous growth was weeds or annual crops.

Non-woody Row and Field Agriculture (9220)

MAPPING CONSIDERATIONS:

- Agricultural fields must be worked within the last 5 years to be mapped as this Map Unit.
- Structures, equipment staging areas, access roads, and water retention ponds that are sub MMU to map separately are included within associated agricultural polygons.
- Mappers attributed all active agricultural fields with an “Exotics” modifier of “High”.
- Mappers attributed all active agricultural fields with a “Anthropogenic Alteration” modifier of “High”.

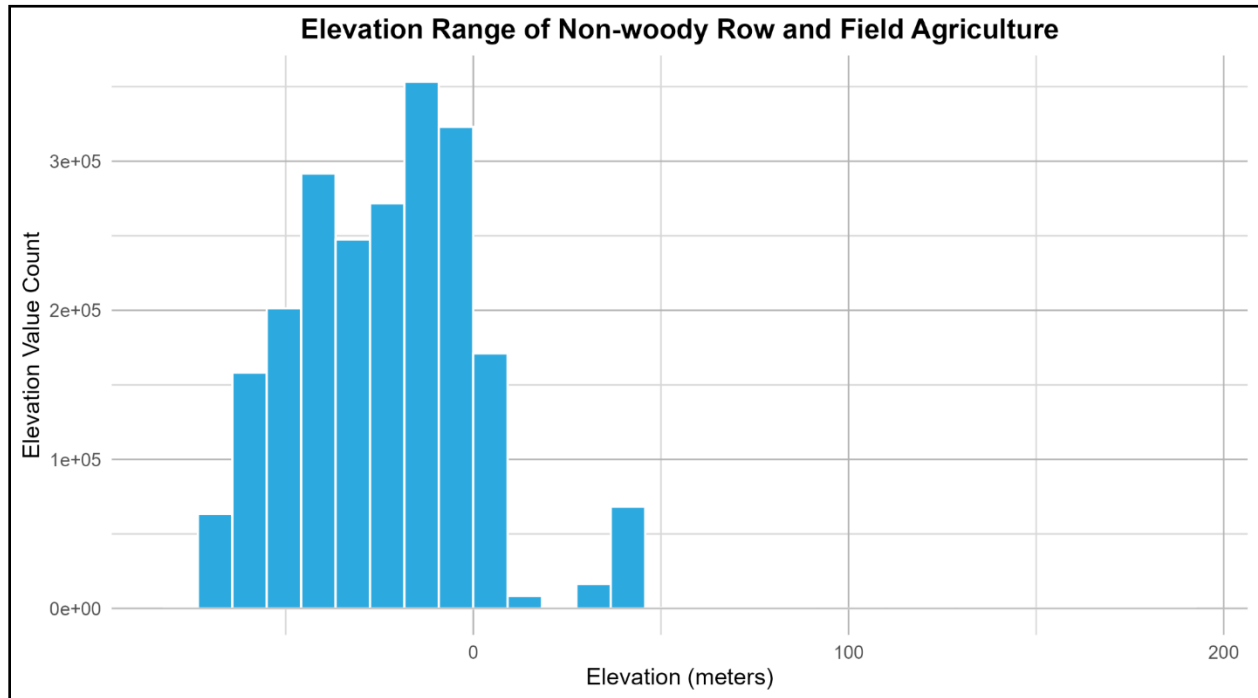
Non-woody Row and Field Agriculture (9220)



PROJECT DISTRIBUTION: Non-woody agricultural fields occurred in every mapping subarea except for the Algodones Dunes. Most of the eastern half of the Coachella

Non-woody Row and Field Agriculture (9220)

Valley, west of the Coachella Canal, is devoted to agriculture, as is most of the Imperial Valley and the Winterhaven subarea south of the All American Canal.



Perennial Stream Channel (Open Water) (9801)

Perennial Stream Channel (Open Water) (9801)

MMU: 0.5 acres

MMW: 22 meters

Land Use Code: Water (9800)

Inapplicable Modifiers: Exotics, Roadedness, Development Disturbance, Anthropogenic Alteration, Altered Hydrologic Regime



This is a photo of the Alamo River in the Imperial Valley shortly before it empties into the Salton Sea.

SUMMARY: Mappers used this Map Unit for large rivers or streams with perennial water. Within this mapping area, this includes the New and Alamo Rivers in the Imperial Valley subarea and the Colorado River in the Winterhaven subarea. Mappers only delineated the water when using this Map Unit – vegetation or cleared areas on the banks were treated separately. The polygons must have less than 10% vegetation, usually comprised of aquatic or wetland herbaceous species like *Typha*, *Schoenoplectus*, or *Bolboschoenus*.

Perennial Stream Channel (Open Water) (9801)

PHOTOINTERPRETATION SIGNATURE: These are large, mostly natural water channels that have easily visible surface water across all or nearly all of the feature. The course of the river or stream should be mostly curvilinear as opposed to aqueducts or agricultural channels which usually have straight margins. The banks are often lined by thick vegetation of species such as *Tamarix* sp. and *Phragmites australis*. The water in these rivers appears as a dark blue to black in true color and CIR imagery.



These images show a section of the Alamo River in the Imperial Valley subarea.

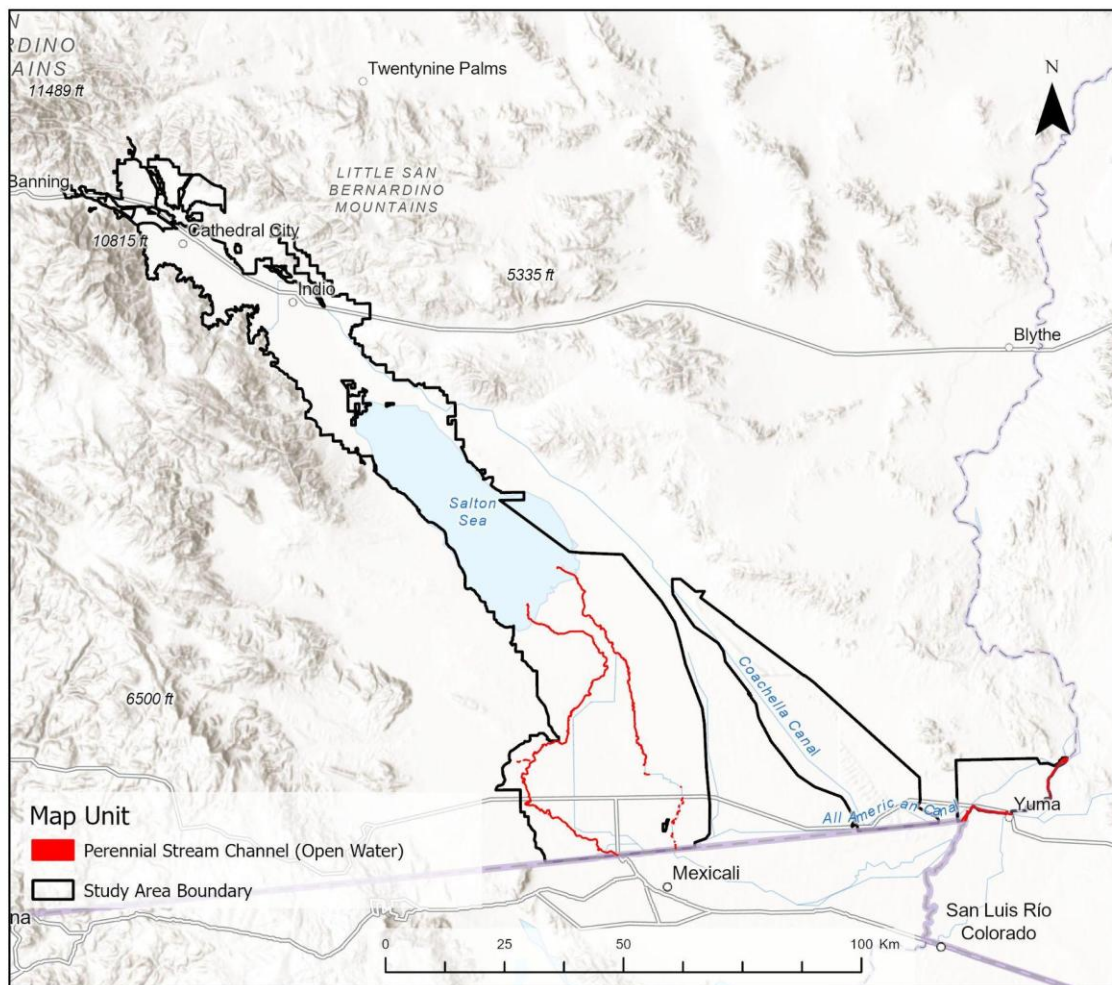
TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

- Water (9800) – This Map Unit is used for artificial water sources that are not tied to industrial practices, such as agriculture or sewage treatment. Examples include artificial ponds in residential complexes and golf courses.
- Water Impoundment Feature (9805) – This Map Unit is used for artificial water sources tied to industrial or agricultural (when dry) operations. It also includes unvegetated flood control basins greater than 10 acres in size.

Perennial Stream Channel (Open Water) (9801)

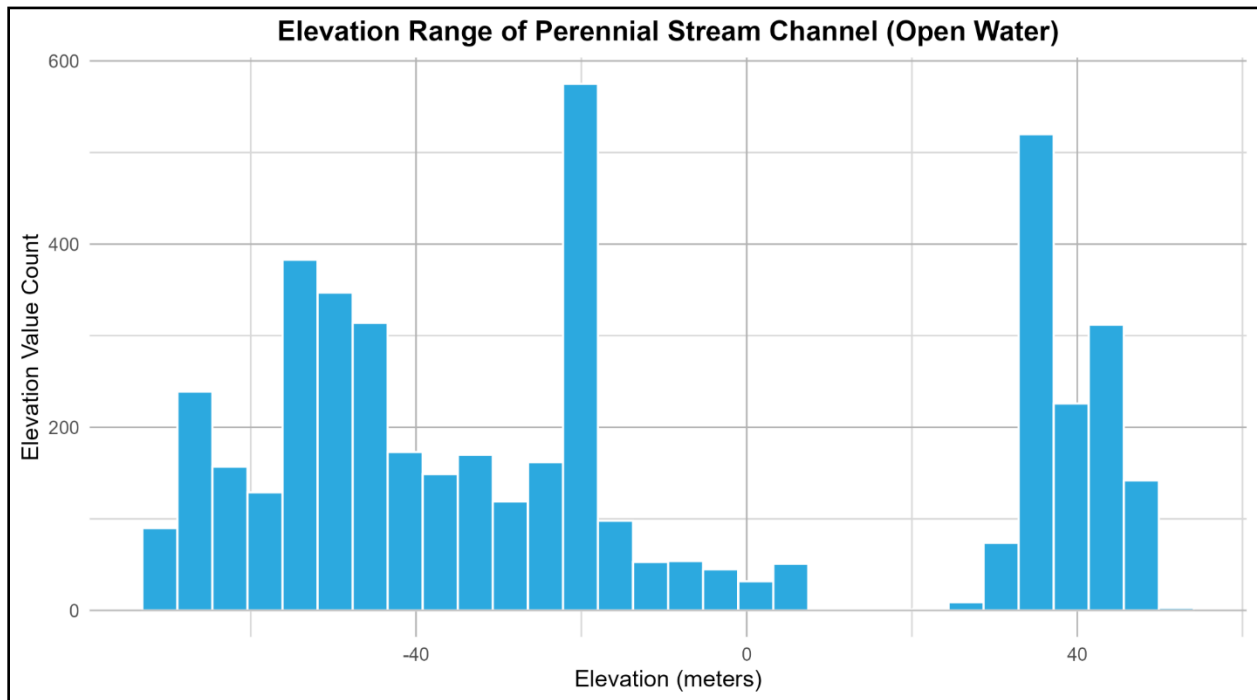
MAPPING CONSIDERATIONS:

- The New and Alamo Rivers are narrower than the typical MMU of 22m in most areas, however mappers chose to still map these rivers due to their ecological importance.
- Polygons delineating a stream or river can include small sections of vegetation (approximately 10-20m in length) that completely span the width of the river, blocking view of the open water, in order to preserve the continuity of the polygon as a whole. This occurred at some points along the Alamo River at places where the river narrowed significantly.



Perennial Stream Channel (Open Water) (9801)

PROJECT DISTRIBUTION: Mappers delineated two rivers in the Imperial Valley subarea, the New and Alamo Rivers, which both span the length of the subarea from south to north and empty into the Salton Sea. The Colorado River forms much of the southern and eastern boundary of the Winterhaven subarea. Perennial stream channels did not occur in the Coachella Valley or Algodones Dunes subareas.



Urban Window (9310)

Urban Window (9310)

MMU: 640 acres (1 square mile)

MMW: 805 meters

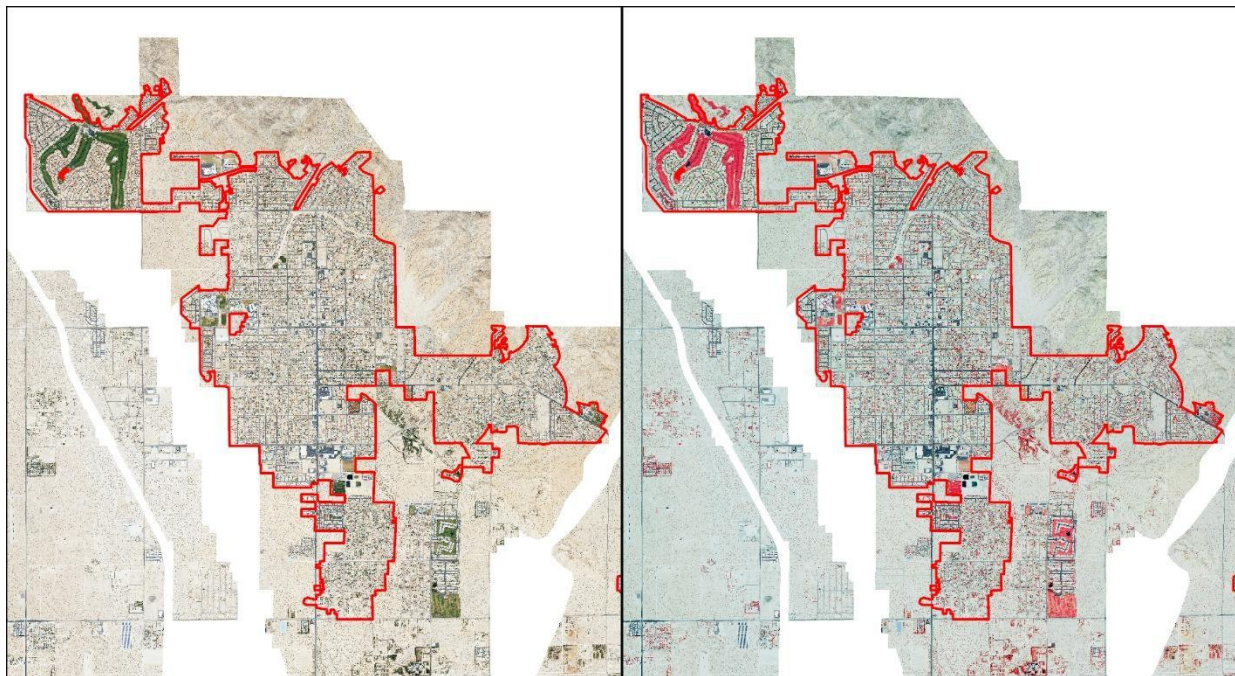
Land Use Code: 1000

Development Disturbance: High

Inapplicable Modifiers: Exotics, Roadedness, Altered Hydrologic Regime

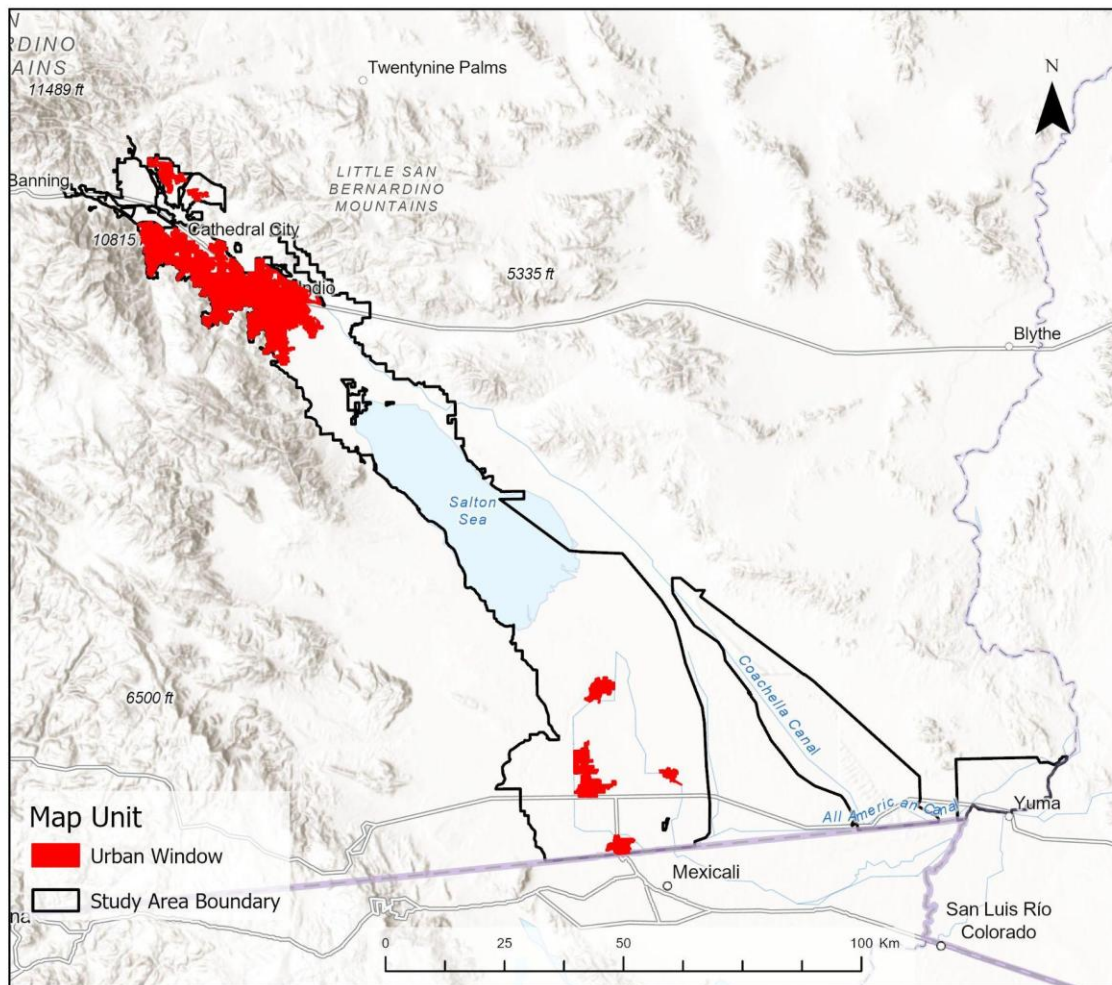
SUMMARY: Urban Widows are defined as a continuous area of urban development that covers a minimum of 1 square mile (640 acres). The features included in Urban Windows are essentially the same as for Built-Up and Urban Disturbance (9300) and include residential and commercial structures, major highways and freeways, railroads, residential roads, parking lots, developed parks, golf courses, etc. The rules for delineating other Map Units from within an Urban Window polygon are discussed in the “Mapping Considerations” section below.

PHOTOINTERPRETATION SIGNATURE: This Map Unit encompasses a wide range of built-up features found in towns and cities.



These photos show the 4310-acre Urban Window polygon encompassing the main urbanized area of Desert Hot Springs in the Coachella Valley.

Urban Window (9310)

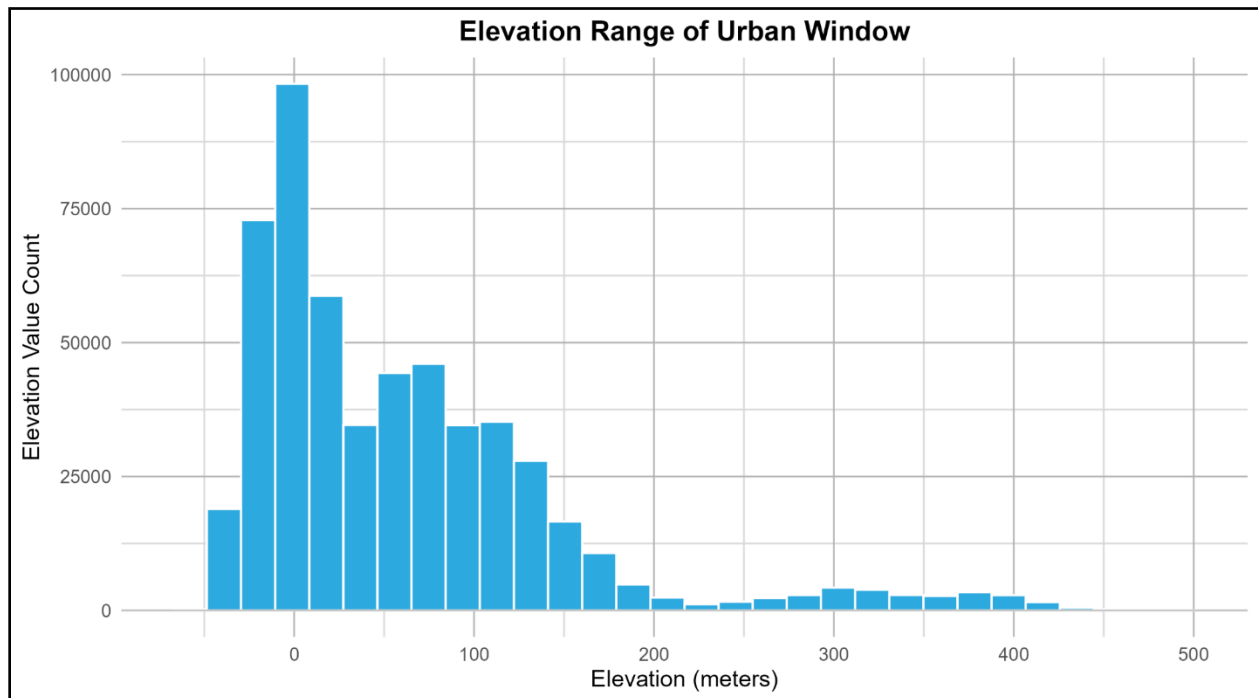


PROJECT DISTRIBUTION: Mappers delineated Urban Windows around the cities and communities of Desert Hot Springs, Desert Edge, Palm Springs, Cathedral City, Rancho Mirage, Palm Desert, Indian Wells, Indio, Coachella, and Thermal in the Coachella Valley subarea. In the Imperial Valley subarea, mappers used Urban Windows for the towns of Brawley, Imperial, El Centro, Holtville, and Calexico. Urban Windows did not occur in the Algodones Dunes or Winterhaven subareas.

Urban Window (9310)

MAPPING CONSIDERATIONS:

- Mappers only delineated vegetation mapping units from within an Urban Window if the vegetation stand was at least 10 acres in size and not intersected or disrupted by roads, railroads, or structures.
- Mappers delineated Water (9800) within Urban Windows at a normal MMU (0.5 acres). This consisted primarily of ponds on golf courses.
- Although primarily vegetated, mappers included golf courses and public parks within Urban Window polygons.



Water Impoundment Feature (9805)

Water Impoundment Feature (9805)

MMU: 2.5 acres

MMW: 71 meters

Land Use: Water Impoundment Feature (9810)

Development Disturbance: High

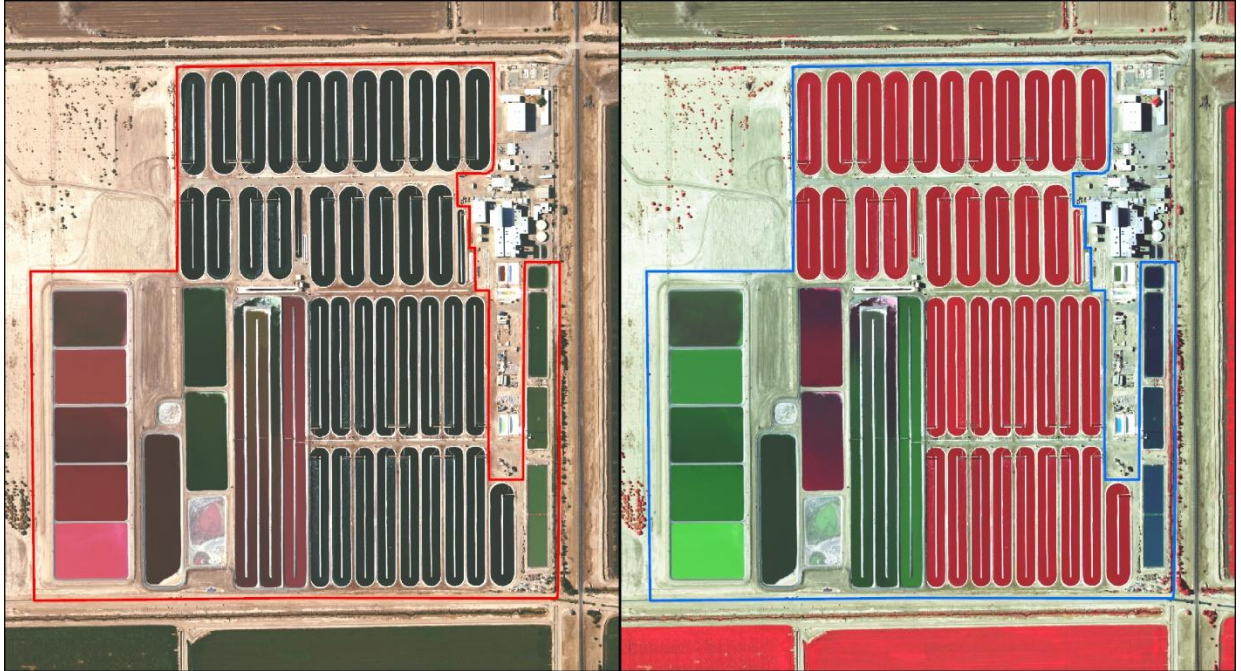
Anthropogenic Alteration: High

Inapplicable Modifiers: Exotics, Roadedness, Altered Hydrologic Regime

SUMMARY: Water Impoundment Features are defined as anthropogenically created structures to store water for agricultural, flood control, sewage treatment, groundwater recharge. This Map Unit also applies to artificial water retention associated with other industrial practices. For instance, there is a large facility north of the town of Calipatria in the Imperial Valley subarea that contains a large network of outdoor ponds for growing Spirulina. mappers only assigned dry agricultural impoundment features to 9805; if an agricultural impoundment feature contained water, mappers assigned it to Water (9800). Mappers delineated unvegetated floodwater control basins separately as 9805 only if they were larger than 10 acres in size, otherwise mappers included in associated Built-Up Urban (9300) or Urban Window (9310) polygons.

PHOTOINTERPRETATION SIGNATURE: Water Impoundment Features can appear as a wide variety of colors due to varying depths of water and contents (algal or bacterial bloom, wastewater, Spirulina, etc.). Most features that contain water are a dark blue to nearly black in both true color and CIR. Other colors can range from dark to bright green, red, orange, brown, and yellow. Dry agricultural holding ponds should appear as bare ground without mappable vegetation cover. The combination of built-up berms, cement embankments, obviously manmade dimensions (margins that are either perfectly straight or semicircular), and division of features into smaller holding ponds, and association with industrial facilities, are all indications that it is a Water Impoundment Feature of anthropogenic origin to be mapped as 9805.

Water Impoundment Feature (9805)

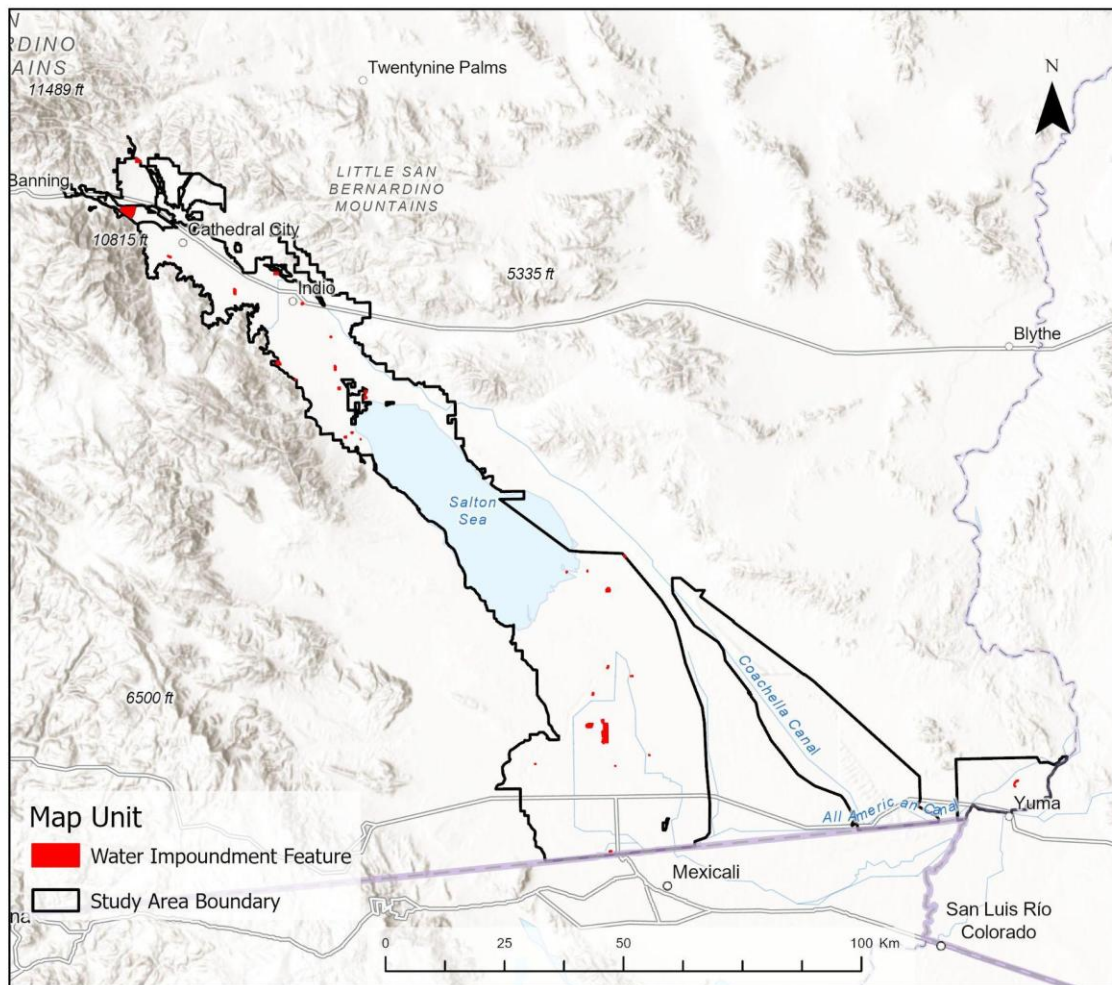


This Spirulina aquaculture facility in the Imperial Valley subarea demonstrates the wide variety of possible water colors.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

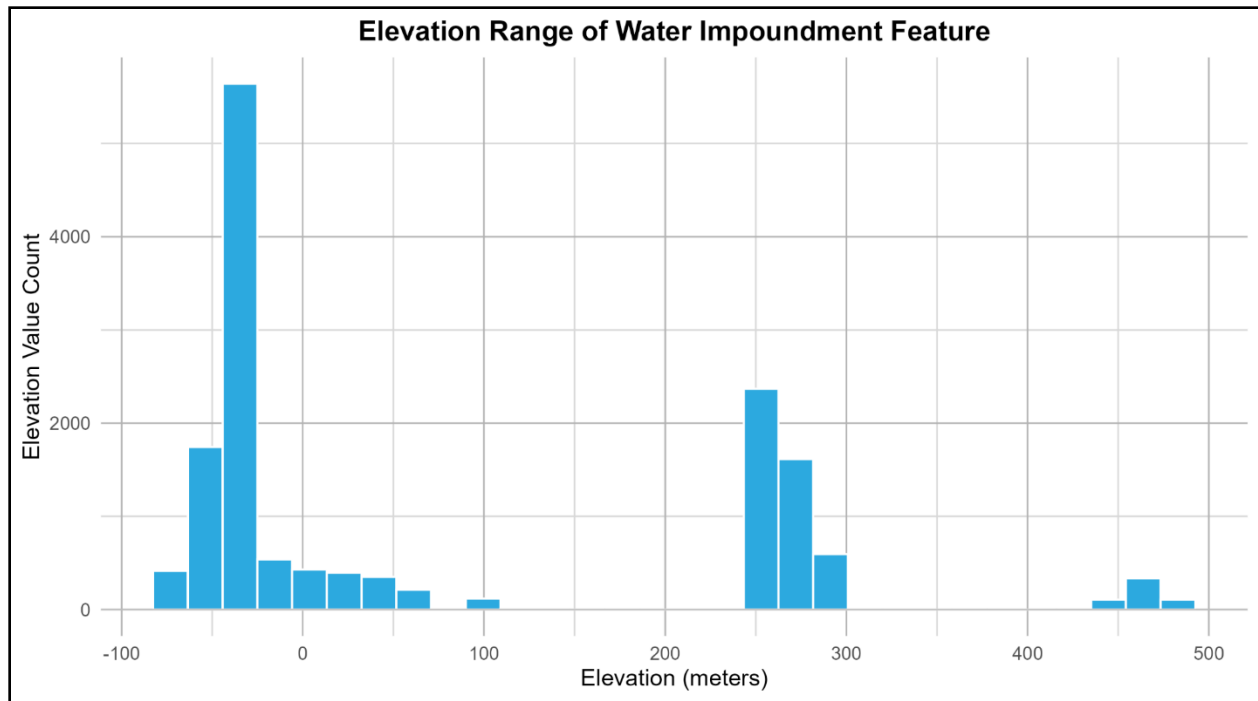
- Water (9800) – This Map Unit is used for artificial water sources that are not tied to industrial practices, such as agriculture or sewage treatment. Examples include artificial ponds in residential complexes and golf courses.
- Perennial Stream Channel (Open Water) (9801) – This Map Unit describes perennially flowing channels following primarily natural courses. Examples include the Colorado River in the Winterhaven subarea and the New and Alamo Rivers in the Imperial Valley subarea.

Water Impoundment Feature (9805)



PROJECT DISTRIBUTION: In the Coachella Valley, the most prominent Water Impoundment Feature is the large percolation pond complex north of Palm Springs used for recharging ground water supply via input from the Colorado River Aqueduct. Other features in the Coachella Valley and Imperial Valley subareas include a variety of sewage treatment plants, flood control basins, and other industrial practices, including farmed Spirulina. Mappers identified only one Water Impoundment Feature in the Winterhaven subarea, what appears to be a flood control basin, and mappers identified no features in the Algodones Dunes subarea.

Water Impoundment Feature (9805)



Water (9800)

Water (9800)

MMU: 1 acre

MMW: 32 meters

Land Use Code: Water (9800)

Inapplicable Modifiers: Exotics, Roadedness, Altered Hydrologic Regime

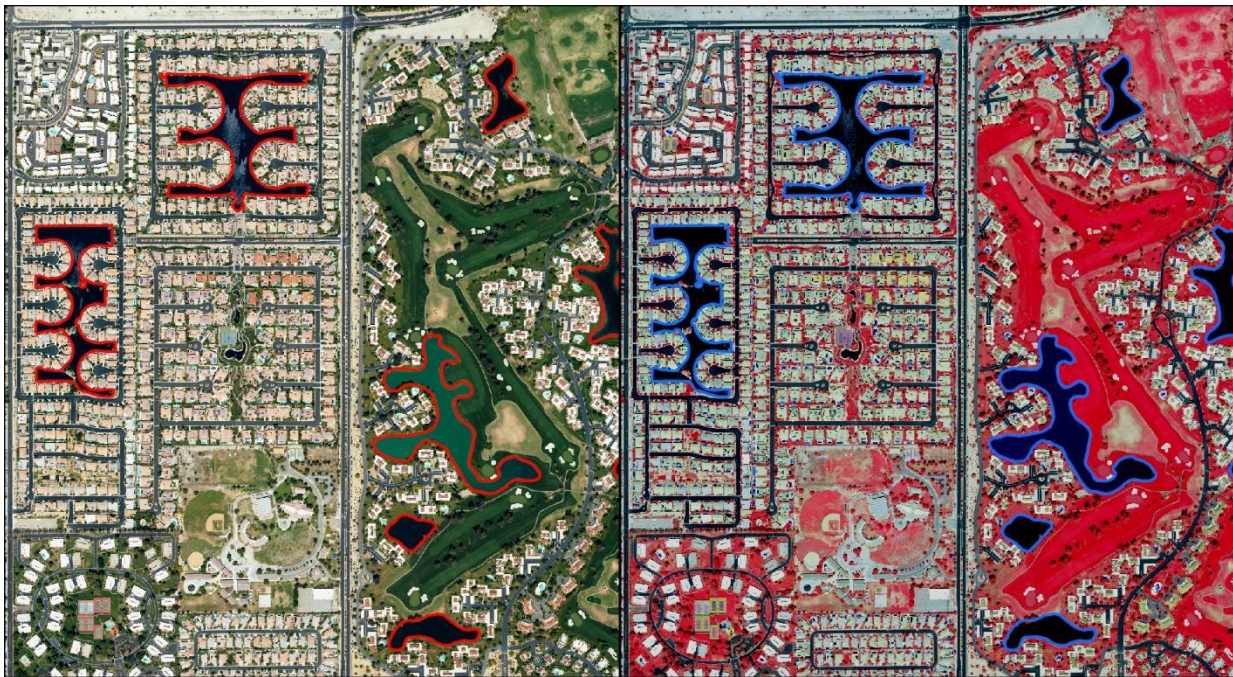


This photo shows one of the artificially created lakes within the Imperial Valley mapping subarea.

SUMMARY: Mappers used the Water (9800) Map Unit to indicate bodies of water greater than 1 acre in size that are artificially filled. Examples include the multitude of small artificial ponds throughout the many golf courses in the Coachella Valley, agricultural ponds that contain water (if dry, mappers assigned them to Water Impoundment Features (9805)), recreational ponds and lakes, and the Salton Sea. While the Salton Sea naturally fills when major storm events cause the Colorado River to change course and flood the Salton Basin, we consider the current Salton Sea to be primarily artificially maintained via input from agricultural runoff. Mappers also classified small ponds or bodies of water adjacent to rivers and creeks as 9800, as per the DRECP. Mappers and field teams otherwise did not encounter any naturally occurring lakes or ponds within this mapping area.

Water (9800)

PHOTOINTERPRETATION SIGNATURE: In true color, water bodies appear primarily dark blue to nearly black, depending on depth. Some bodies of water will have a green or yellow/orange hue, presumably from algal or bacterial blooms, respectively. Using CIR, most water bodies appear as black or extremely dark blue. Ponds experiencing bacterial blooms appear as a bright turquoise color. Some aquatic vegetation may be present within Water polygons, but they must be below MMU to map separately (0.5 acres). In the case of the Salton Sea or small bodies of water adjacent to rivers and creeks, the features have the appearance of naturally-shaped bodies of water. However, most polygons of this type are clearly manmade and exhibit straight edges, geometric forms, or are encompassed by golf courses.

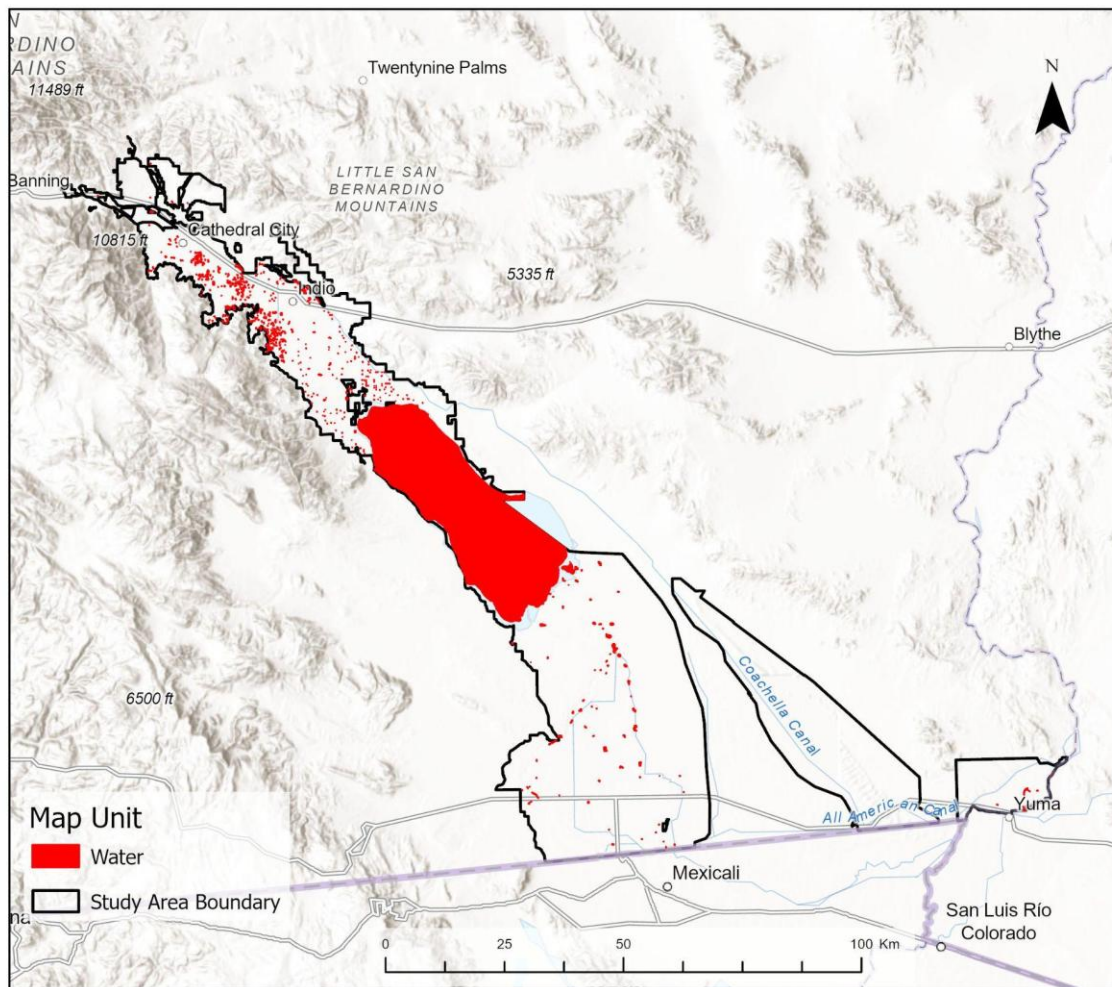


These photos demonstrate the network of water bodies within the Coachella Valley mapping subarea, including ponds within golf courses and residential complexes.

TYPES WITH SIMILAR PHOTOINTERPRETATION SIGNATURES:

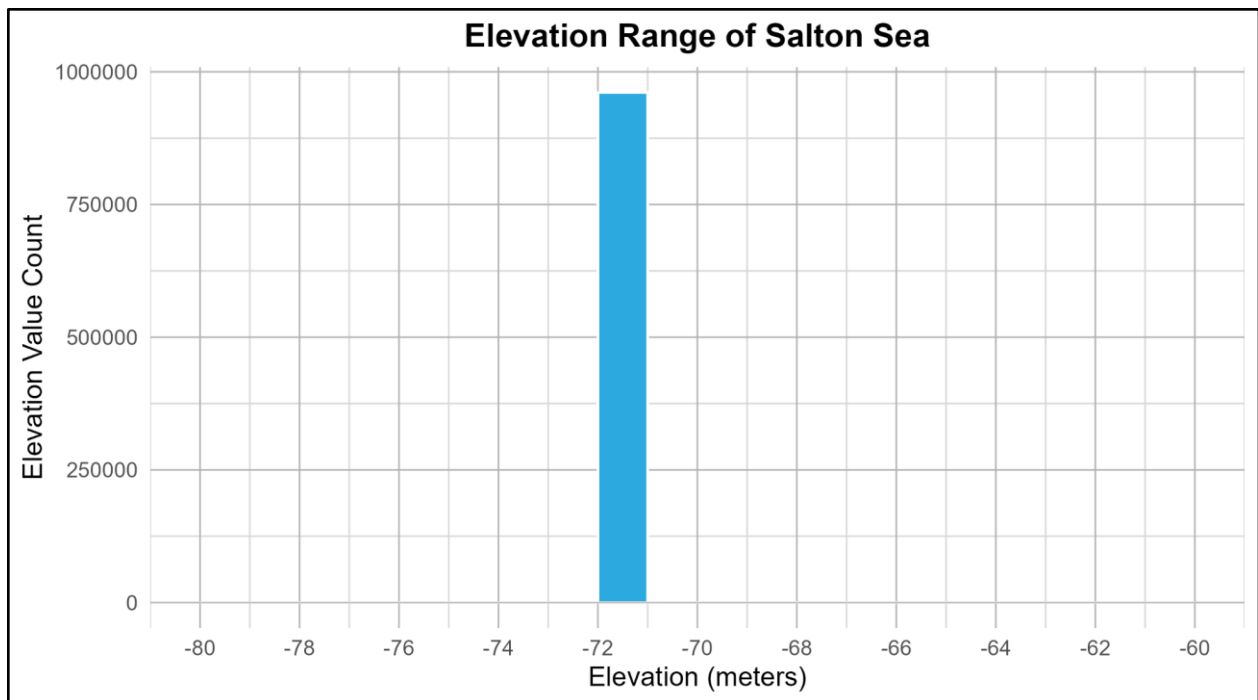
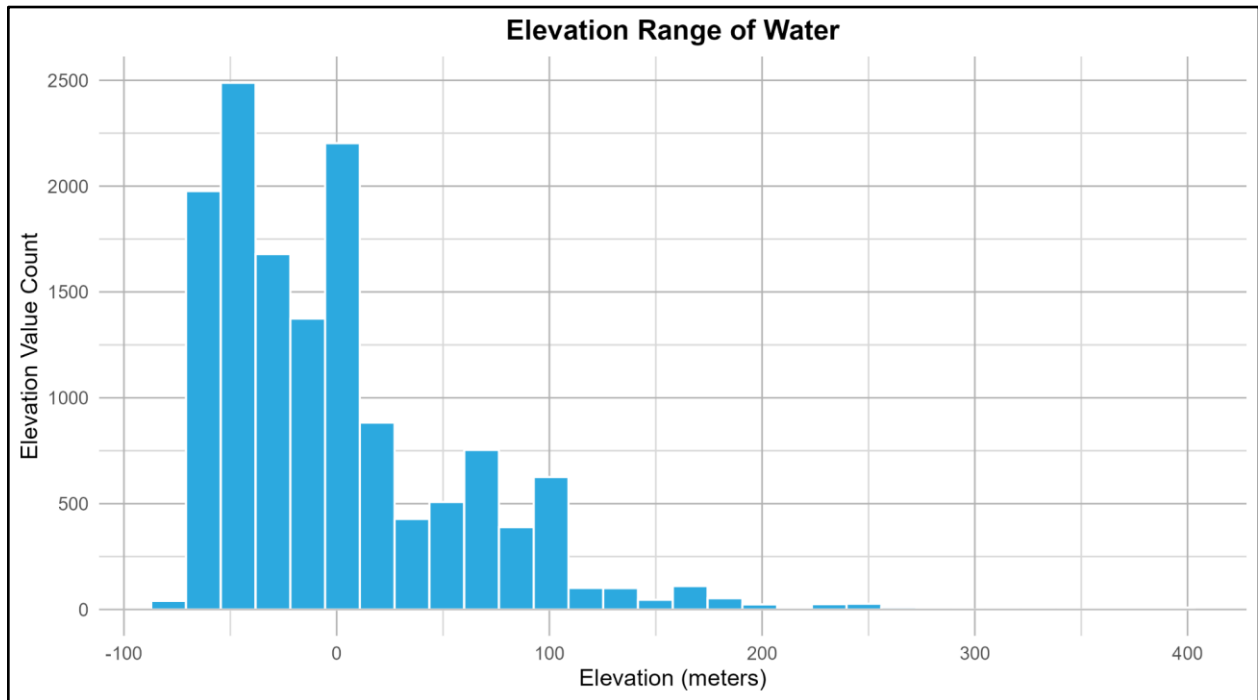
- Water Impoundment Feature (9805) – This Map Unit is used for artificial water sources tied to industrial or agricultural (when dry) operations. It also includes unvegetated flood control basins greater than 10 acres in size.
- Perennial Stream Channel (Open Water) (9801) – This Map Unit describes perennially flowing channels following primarily natural courses. Examples include the Colorado River in the Winterhaven subarea and the New and Alamo Rivers in the Imperial Valley subarea.

Water (9800)



PROJECT DISTRIBUTION: This Map Unit occurred in all subareas except the Algodones Dunes. Artificial ponds and lakes within golf courses in the Coachella Valley subarea were a major contributor to the total number of polygons of this type. The Salton Sea, which mappers assigned as this type, joins the Coachella Valley and Imperial Valley subareas, and is by far the largest polygon mapped in this project (193,696 acres). Only seven Water polygons occurred in the Winterhaven subarea, primarily associated with the Colorado River.

Water (9800)



Note: for clarity, due to its massive size, the elevation graph for the single polygon Water (9800) polygon encompassing the entire Salton Sea (second graph) was separated from all other Water (9800) polygons within the mapping area (first graph).

Woody Agriculture (orchards, vineyards) (9210)

Woody Agriculture (orchards, vineyards) (9210)

MMU: 2.5 acres

MMW: 71 meters

Land Use Code: Orchards & Vineyards (2200)

Exotics: High

AnthroAlt: High

Inapplicable Modifiers: Roadedness, Development Disturbance



Date Palm plantations such as this one are common in the eastern Coachella Valley and Imperial Valley.

SUMMARY: This agriculture Map Unit is used specifically for orchards and vineyards. Date palm plantations, which are common in the Coachella and Imperial Valley subareas, are included in this Map Unit. Agriculture pertaining to annual crops is treated in the Non-woody Row and Field Agriculture (9220). Abandoned orchards and vineyards are still mapped as 9210 as long as rooted, live trees are present, although some abandoned operations may be missing a substantial portion of the original plants.

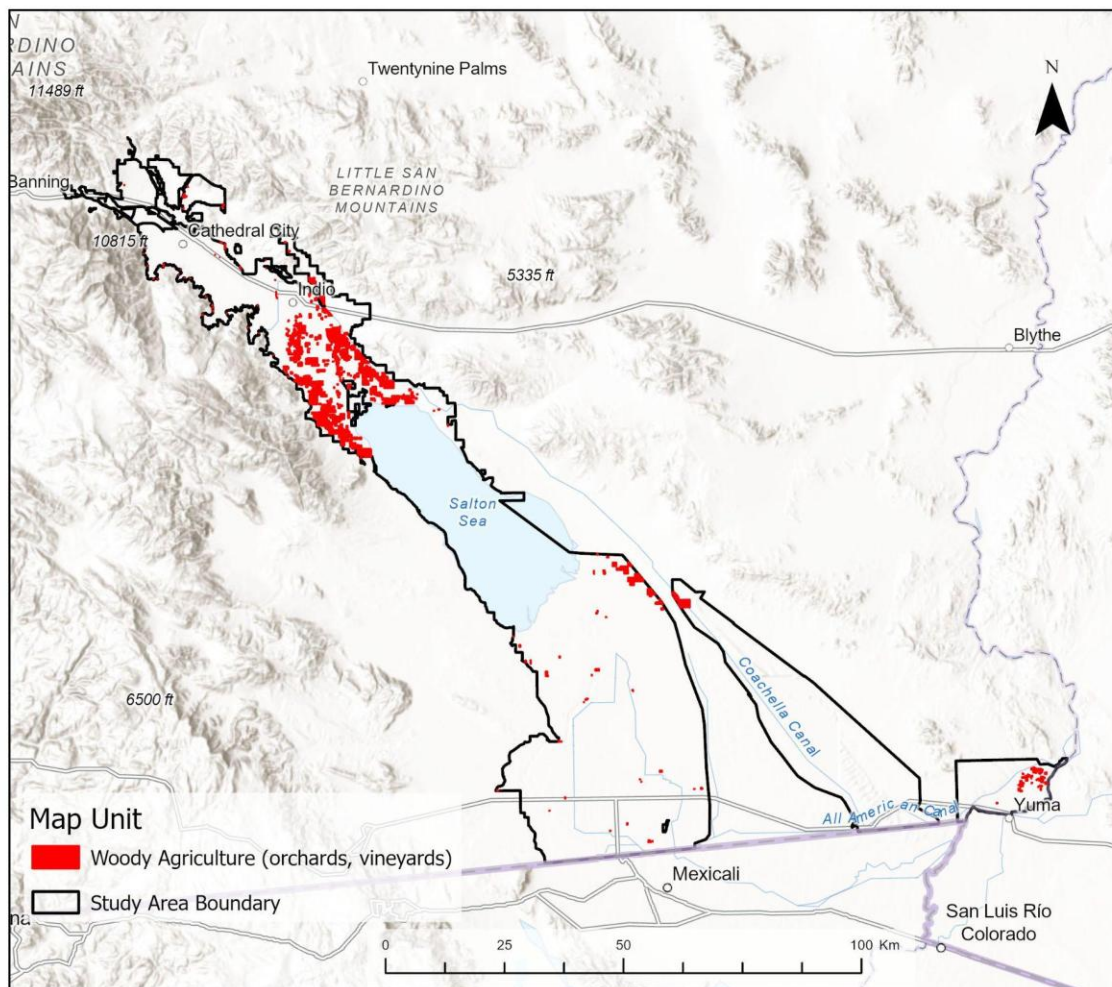
Woody Agriculture (orchards, vineyards) (9210)

PHOTOINTERPRETATION SIGNATURE: The color of the foliage varies depending on the species of tree or vine being grown. The most reliable way to identify this Map Unit is by looking for neatly planted rows of large plants that are usually individually identifiable, as opposed to annual crops which grow together and appear as unbroken swaths of vegetation on imagery. Exposed soil is usually visible between the rows, although patches of weeds (e.g. *Cynodon dactylon*) may be present in the understory. Foliage of newly planted saplings may be hard to see using imagery, but these plots are identifiable by a perfectly laid grid-like pattern of dark points. Two commonly cultivated trees in this mapping area are citrus, which have a very regular, round crown, and date palms, which have the appearance of serrated margins and a dark blue-green color in true color.



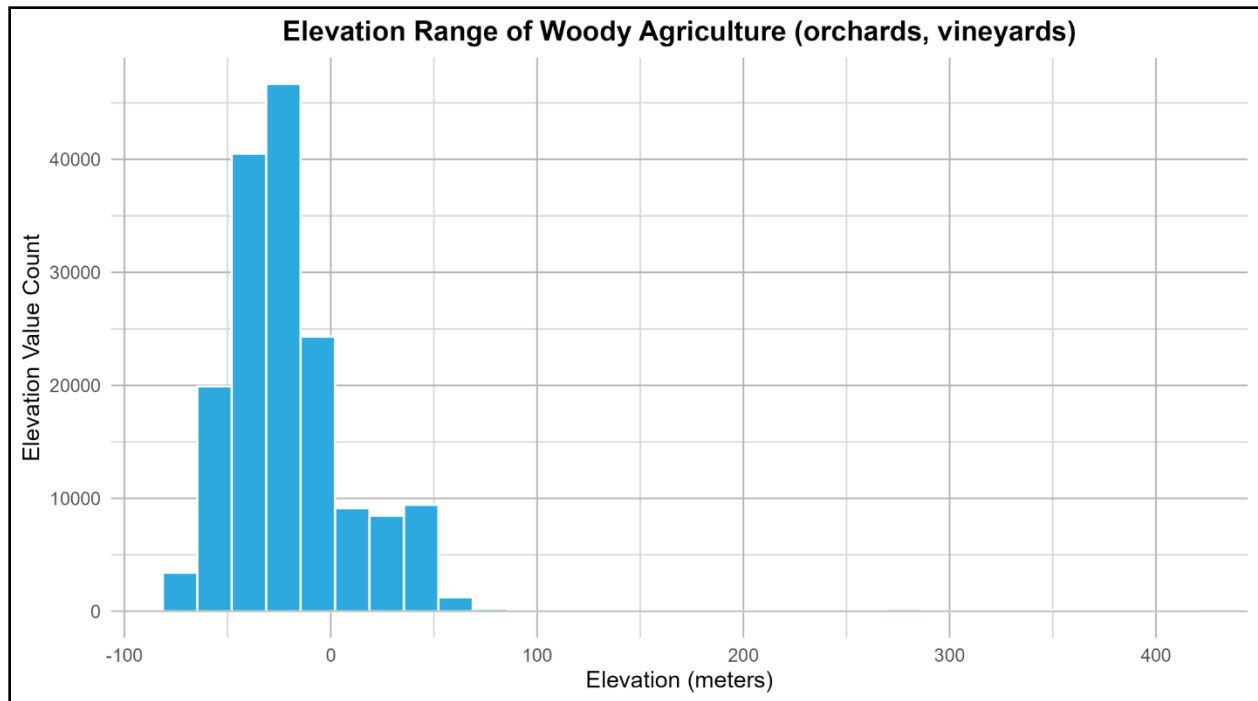
These orchards in the eastern Coachella Valley are a combination of citrus (bright green trees in the center and middle-top) and date palms (left side and top right corner).

Woody Agriculture (orchards, vineyards) (9210)



PROJECT DISTRIBUTION: Orchards occur at the highest density in the eastern Coachella Valley, reaching down to the north shore of the Salton Sea. The majority of these orchards grow citrus or date palms, however there are also vineyards and ornamental palm plantations. The agriculture in the Imperial Valley is primarily annual crops, but there are a small number of orchards scattered throughout the subarea, with a higher density occurring in the northwest corner near the community of Calipatria. This area of higher orchard density spans directly eastward into the northern tip of the Algodones Dunes subarea. The rest of the Algodones Dunes subarea lacks orchards and vineyards. There are a variety of orchards in the Winterhaven subarea, primarily date palm plantations centered around the community of Bard.

Woody Agriculture (orchards, vineyards) (9210)



APPENDIX B: VEGETATION CLASSIFICATION AND HIERARCHY

The final vegetation classification and hierarchy was developed for this Colorado Desert vegetation map using the full SOMO Vegetation Classification and Hierarchy (Version 2/28/2026)

Biome

Subbiome

Formation

Division

Macrogroup

Group

Map Unit: Mapping Unit or Alliance (VegCode)

Brackish Tidal Wetland Biome MB1

Coastal Brackish Tidal Wetland Subbiome MB1.a

Coastal Saltmarsh & Reedbed Formation MB1.a3

Temperate & Boreal Pacific Coastal Salt Marsh Division D035

North American Pacific Coastal Salt Marsh Macrogroup M081

Temperate Pacific Salt Marsh Group G499

Bolboschoenus maritimus Alliance (3717)

Desert & Semi-desert Biome TT5

Cool Semi-desert Subbiome TT5.a

Cool Desert & Semi-desert Shrub-Steppe Formation TT5.a1

Western North American Cool Semi-Desert Scrub & Grassland Division D040

Intermountain Saltbush Scrub Macrogroup M093

Intermountain Shadscale - Saltbush Scrub Group G300

Atriplex canescens Alliance (5111)

Atriplex polycarpa Alliance (4113)

Warm Desert & Semi-desert Subbiome TT5.b

Succulent-Thorny Desert & Semi-desert Formation TT5.b1

Southwest North American Warm Desert Division D353

Mojave-Sonoran Semi-Desert Scrub Macrogroup M088

Mojave-Sonoran Bajada & Valley Desert Scrub Group G295

Ambrosia dumosa Alliance (4111)

Encelia farinosa Alliance (4114)

Larrea tridentata – *Ambrosia dumosa* Alliance (4115)

Larrea tridentata – *Encelia farinosa* Alliance (4118)

Larrea tridentata Alliance (4119)

North American Warm Semi-Desert Dune & Sand Flats Group G675 (6120)

Desert Forb Provisional Mapping Unit

Dicoria canescens – *Abronia villosa* – *Panicum urvilleanum* Alliance (6121)

Eriogonum deserticola Mapping Unit (6124)

North American Warm Desert Ruderal Scrub & Grassland Macrogroup M512

Warm Desert Ruderal Grassland Group G677 (2340)

Brassica tournefortii – *Malcolmia africana* Semi-natural Alliance (2331)

Bromus rubens – *Schismus (arabicus, barbatus)* Semi-natural Alliance (2332)

North American Warm Semi-Desert Cliff, Scree & Rock Macrogroup M117

North American Warm Semi-Desert Cliff, Scree & Pavement Sparse Vegetation Group G569 (6110)

Atriplex hymenelytra Alliance (6111)

Chorizanthe rigida – *Geraea canescens* Desert Pavement Alliance (6117)

Mud Hills sparsely vegetated ephemeral herbs Mapping Unit (6113)

Unvegetated wash and river bottom Mapping Unit (6114)

North American Warm-Desert Xeric-Riparian Scrub Macrogroup M092

Warm Semi-Desert Shrub & Herb Dry Wash & Colluvial Slope Group G541

Ambrosia salsola – *Bebbia juncea* Alliance (7211)

Chilopsis linearis – *Psoralea argyrea* Alliance (7222)

Ephedra californica – *Ephedra trifurca* Alliance (4211)
Ericameria paniculata Alliance (4213)
Lepidospartum squamatum Alliance (4212)
Parkinsonia florida – *Olneya tesota* Alliance (4227)
Psorothamnus emoryi Mapping Unit (4232)
Psorothamnus fremontii – *Psorothamnus polydenius* Alliance (4219)
Psorothamnus schottii Mapping Unit (4231)
Senegalia greggii – *Hyptis emoryi* – *Justicia californica* Alliance (4226)

Palustrine Wetland Biome TP1

Emergent Open Wetland Subbiome TP1.b

Inland Salt Marsh Formation TP1.b3

North American Western Interior Brackish Marsh, Playa & Shrubland Division D036

North American Desert Alkali-Saline Marsh, Playa & Shrubland Macrogroup M082

North American Desert Alkaline-Saline Marsh & Playa Group G538

Distichlis spicata – (*Juncus cooperi* – *Frankenia salina*) Interior Alliance (3726)

North American Desert Alkaline-Saline Marsh & Playa Group (3710)

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

North American Desert Alkaline-Saline Wet Scrub Group G537

Allenrolfea occidentalis Alliance (3721)

Atriplex lentiformis Alliance (3722)

Pluchea sericea Alliance (4221)

Suaeda moquinii Alliance (7411)

-

Marsh, Wet Meadow & Shrub Wetland Formation TP1.b1

North American Desert & Arid West Freshwater Marsh & Bosque Division D032

Arid West Interior Freshwater Marsh & Wet Meadow Macrogroup M888 (3400)

Arid West Interior Freshwater Marsh Group G531 (3410)

Phragmites australis ssp. americanus Association (3417)

Schoenoplectus (acutus, californicus) Alliance (3412)

Schoenoplectus americanus – *Schoenoplectus pungens* Alliance (3718)
Typha (*angustifolia*, *domingensis*, *latifolia*) Alliance (3416)
Warm Desert Lowland Freshwater Marsh, Wet Meadow & Shrubland Macrogroup M076
North American Warm Desert Riparian Low Bosque & Shrubland Group G533
Baccharis emoryi – *Baccharis sergiloides* Alliance (1423)
Prosopis glandulosa – *Prosopis velutina* – *Prosopis pubescens* Alliance (4222)

Western North American Temperate Freshwater Marsh, Wet Meadow & Shrubland Division D031
Western North American Ruderal Marsh, Wet Meadow & Shrubland Macrogroup M301
Western Ruderal Marsh, Wet Meadow & Shrubland Group G524 (7110)
Cynodon dactylon – *Crypsis* spp. – *Paspalum* spp. Alliance (3716)
Phragmites australis – *Arundo donax* Semi-natural Alliance (1431)

Forested Wetland Subbiome TP1.a

Temperate-Boreal Forested Wetland Formation

Western North American Arid Flooded Forest Division
Western Arid Lowland Flooded Forest Macrogroup
Californian Mediterranean Riparian Forest Group
Populus fremontii – *Fraxinus velutina* – *Salix gooddingii* Alliance (1411)
Salix gooddingii – *Salix laevigata* Alliance (1416)
Southwest Warm Desert Riparian Forest Group
Washingtonia filifera Alliance (1415)
Western Arid Ruderal Riparian Forest & Scrub Macrogroup
Western Arid Ruderal Lowland Riparian Forest & Scrub Group
Phoenix dactylifera – *Washingtonia filifera* Alliance (1621)
Tamarix spp. Semi-natural Alliance (1432)

Shallow Water Wetland Subbiome TP1.d

Shallow Water Aquatic Vegetation Formation TP1.d1

North American Freshwater Aquatic Vegetation Division D049

North American Temperate Ruderal Aquatic Vegetation Macrogroup M401 (3450)

Temperate-Boreal Grassland & Shrubland Biome TT4

Mediterranean-Dry Grassland & Shrubland Subbiome TT4.a

Mediterranean-Seasonally Dry Heath, Scrub & Grassland Formation TT4.a1

Californian Chapparral, Coastal Scrub & Grassland Division D327

Californian Annual & Perennial Grassland Macrogroup M045

Californian Annual Grassland & Forb Meadow Group G766 (2310)

Miscellaneous Classes

Agriculture (9200)

Woody Agriculture (orchards, vineyards) (9210)

Non-woody Row and Field Agriculture (9220)

Irrigated Pastures (9230)

Built-up & Urban Disturbance (9300)

Urban Window (9310)

Anthropogenic Areas of Little or No Vegetation (9320)

Exotic Trees (9500)

Burn Areas (9700)

Sparsely Vegetated Recently Burned Areas (9701)

Water (9800)

Perennial Stream Channel (Open Water) (9801)

Major Canals and Aqueducts (Open Water) (9804)

Water Impoundment Feature (9805)

APPENDIX C: VEGETATION KEY

Provided by CDFW, March 2026

APPENDIX D: FIELD FORMS AND PROTOCOLS FOR RECONNAISSANCE, RAPID ASSESSMENT AND RELEVÉ, AND ACCURACY ASSESSMENT SURVEYS

APPENDIX D CONTENTS

CDFW Protocol For Reconnaissance	D-2
Reconnaissance Field Form	D-7
CDFW-CNPS Protocol for the Combined Vegetation Rapid Assessment and Relevé ..	D-8
Combined Vegetation Rapid Assessment and Relevé Field Form	D-21
CDFW-CNPS Protocol for the Accuracy Assessment	D-23
Accuracy Assessment Form	D-31

CDFW PROTOCOL FOR RECONNAISSANCE (MARCH 30, 2017)

This protocol describes the methodology for the reconnaissance technique as recorded in the Recon Field Form dated March 30, 2017. Reconnaissance surveys (recons) are complementary to relevés and rapid assessments but collect only a small subset of the data gathered using the more detailed methods. Recons are generally used as an aid to digital vegetation mapping, to determine the boundaries of a stand, or to illustrate a particular vegetation signature. For more background on the relevé and rapid assessment sampling methods, see the relevé and rapid assessment protocol at <http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=18599>.

Definitions of fields in the form

I. LOCATIONAL/ENVIRONMENTAL DESCRIPTION

Recorder: The full name of the recorder should be provided for the first field form for the day. On successive forms, initials can be recorded.

Other Surveyors: The full name of each person assisting should be provided for the first field form for the day. On successive forms, initials of each person assisting can be recorded.

Date: Date of the sampling.

Return?: Check this box if team members should return to this spot at a later date to take a recon or RA/relevé. This can be used if the phenology is not conducive to identification of the major species, or if there is not enough time to take the survey.

Waypoint ID: The Waypoint ID in this format: GPS device name + date (yymmdd) + time (hhmm). For example, for a survey taken on iPad "V" on March 27 at 1:45 in the afternoon, the Waypoint ID will be "V1803271345."

UID: The ID number of a reference point or polygon which this reconnaissance describes.

Location Name: The name of the property, park, or the location within large holdings (like USFS or BLM properties).

GPS name: The name/number assigned to the GPS unit.

Projected? Yes / No / Base / Digitized: Circle the appropriate option:

Yes - The point is a projected, or offset point. The surveyor used a bearing and distance to project the point to match what they are describing with the survey.

No - The surveyors are in the vegetation they are describing and the point is where the observer was standing for photographs. This location can also be used as a base location for an offset survey.

Base - Base point only. This is where a surveyor was standing when taking an offset survey to describe vegetation not at that point. No plant data or vegetation descriptions are associated with this location. However, cardinal photos taken at this point will be stored in a directory of this name.

Digitized – An offset point was created on the GPS unit without taking bearing and distance readings. This option should only be used when the imagery on the GPS unit is unique and unmistakable.

Bearing (°): The compass bearing from the Base point to the Projected point.

Distance (m): The distance in meters from the Base point to the Projected point, determined by use of a range finder.

Inclination (°): The vertical offset from the Base point to the Projected point.

Base Waypoint ID: For a projected or digitized point, this is the location where the surveyor was standing when the information was collected. Cardinal photographs will be taken at this point and will be stored on the computer under this ID. Photographs of the stand vegetation will be taken from this point and will be stored on the computer under the Projected point's ID.


Base / Projected UTMs or Decimal degrees: If the point is projected or digitized, circle whether the coordinates of the base point or the offset point have been recorded. These will generally be for the offset point.

GPS error: ft./m./PDOP: The accuracy of the GPS location. Record the error reading and circle the appropriate units.

GPS coordinates: Record either UTM coordinates, easting (**UTME**) and northing (**UTMN**), or decimal degrees, **LAT** (latitude) and **LONG** (longitude). Record this information from a GPS unit.

Stand Size: Estimate the size of the entire stand in which the sample is taken and circle the appropriate range. As a measure, one acre is similar in size to a football field.

View Radius: Enter the radius, in meters, of the viewable area of the stand from the survey point; the radius should be a minimum of 20 meters.

Camera/Photos: Write the name camera, JPG numbers, and direction of photos. Take four photos in the main cardinal directions (N, E, S, W) clockwise from the north, from the GPS location. This symbol can be used to indicate the cardinal photos: . If additional photos are taken in other directions, please note the JPG numbers and a description of each photo.

Exposure: (Enter Actual ° and circle general category): While facing in the general downhill direction, read degrees of the compass for the aspect or the direction you are standing, using degrees from north, adjusted for declination. Average the reading over the entire stand. If estimating the exposure, write "N/A" for the actual degrees, and circle the general

category chosen. "Variable" may be selected if the same, homogenous stand of vegetation occurs across a varied range of slope exposures.

Steepness, Actual: (Enter Actual ° and circle general category): Read degree slope from your compass/clinometer by following the manufacturer's directions for use. If estimating, write "N/A" for the actual degrees, and circle the general category chosen.

II. HABITAT AND VEGETATION DESCRIPTION

Field alliance name: Name of alliance following the most recent Manual of California Vegetation (Sawyer, Keeler-Wolf, and Evens 2009), using scientific nomenclature, *e.g.*, *Quercus agrifolia*. An alliance is based on the dominant or diagnostic species of the stand, and usually reflects the uppermost and/or dominant height stratum. A dominant species covers the greatest area. A diagnostic species is consistently found in some vegetation types but not others.

Please note: The field-assessed alliance name may not exist in the present classification, in which case you can provide a new alliance name in this field.

Comments: Briefly describe the stand age/seral stage, disturbance history, nature and extent of land use, and other site environmental and vegetation factors that will aid in the mapping effort.

% Cover:

Conifer: The total cover of all the conifer trees taking into consideration the porosity, or the holes, in the vegetation. This is an estimate of the absolute conifer cover, disregarding the overlap of individual trees.

Hardwood: The total cover of all the hardwood trees taking into consideration the porosity, or the holes, in the vegetation. This is an estimate of the absolute hardwood tree cover, disregarding the overlap¹ of individual trees.

Total Tree: The total cover of all the trees taking into consideration the porosity, or the holes, in the vegetation. This is an estimate of the absolute tree cover, disregarding the overlap¹ of individual trees.

Regen Tree: The total foliar cover of seedlings and saplings, disregarding overlap¹ of individual recruits. See seedling and sapling definitions below.

Shrub: The total cover of all the shrubs taking into consideration the porosity, or the holes, in the vegetation. This is an estimate of the absolute shrub cover, disregarding the overlap¹ of individual shrubs.

¹ Porosity reduces the total cover of the canopy. Overlapping strata should not be included in the total cover percent; for instance, if a shrub is growing under a tree, only the cover of the tree will be added into the total; the cover of the shrub will be disregarded, except for the amount by which it fills in the porosity of the tree canopy.

Herb: The total cover of all the herbs taking into consideration the porosity, or the holes, in the vegetation. This is an estimate of the absolute herbaceous cover, disregarding the overlap¹ of individual herbs.

Total Veg: The total cover of all vascular vegetation taking into consideration the porosity, or the holes, in the vegetation. This is an estimate of the absolute vegetation cover, disregarding the overlap¹ of the various tree, shrub, and/or herbaceous layers and species.

Exotics (L,M,H): The extent to which the stand is impacted by exotic/non-native species. Divide the total exotic cover (e.g. 25% *Bromus diandrus* + 8% *Bromus madritensis* + 5% *Centaurea melitensis* = 38% total exotics) by the Total Veg cover (e.g. 80% total) and multiply by 100 to get the % relative cover of exotics (e.g. 38% total exotics / 80% total cover = 48% relative exotic cover). **L** = 0-33% *relative* cover of exotics; **M** = 34-66% relative cover, and **H** = >66% relative cover.

Species List and Coverage

List the species that are dominant or that are characteristically consistent throughout the stand. This list is used if there is some uncertainty in the field-assessed alliance name, so the most common species should be listed. In the interests of time and efficiency, this species list should not be exhaustive.

Strata:

T = Tree. A woody perennial plant that has a single trunk.

A = SApling. 1" - <6" dbh and young in age, OR small trees that are <1" dbh, are clearly of appreciable age, and are kept short by repeated browsing, burning, or other disturbance. Includes trees that are re-sprouting from roots or stumps following fire, logging or other disturbance. These re-sprouts may exhibit a shrubby form, with multiple small trunks, but are species that are generally considered trees. If a majority of the trunks are >6" dbh, then the re-sprouts would be recorded under the "Tree" stratum.

E = SEedling. A tree species clearly of a very young age that is < 1" dbh or has not reached breast height. Applies only to trees propagating from seed; re-sprouts are not recorded here even if they meet the size requirements.

S = Shrub. A perennial, woody plant, that is multi-branched and doesn't die back to the ground every year.

H = Herb. An annual or perennial that dies down to ground level every year.

N = Non-vascular. Includes moss, lichen, liverworts, hornworts, cryptogammic crust, and algae.

When one or more tree species are regenerating, the Tree, Seedling and/or Sapling strata may be noted on the same line, e.g.:

Strata	Species	%Cover	C
T/A/E	Quercus douglasii	40/<1/<1	

Species: Use Jepson Manual nomenclature. When uncertain of an identification (which you intend to confirm later) use parentheses to indicate what part of the determination needs to be confirmed. For example, you could write out *Brassica (nigra)* if you are sure it is a *Brassica* but you need further clarification on the specific epithet.

% cover: provide the % absolute aerial cover for each species listed. All species percent covers may total over 100% because of overlap.

Collections: If a species collection is made, it should be indicated in the blank column next to “% cover” with a “C” (for collected). If the species is later keyed out, cross out the species name or description and write the keyed species name in pen on the data sheet. Do not erase what was written in the field, because this information can be used if specimens get mixed up later. If the specimen is then thrown out, add a “T” to the “C” in that column (CT = thrown out after confirmation) or cross out the “C”. If the specimen is kept but is still not confidently identified, add a “U” to the “C” (CU = collected and unconfirmed). In this case the unconfirmed species epithet should be put in parentheses [e.g. *Hordeum (murinum)*]. If the specimen is kept and is confidently identified, add a “C” to the existing “C” (CC = collected and confirmed). If the specimen is later deposited in an herbarium, add a “D” to the existing “C” (CD = collected and deposited) and note the receiving herbarium.

RECONNAISSANCE FIELD FORM

RECON FIELD FORM (March 6, 2019, with slope/aspect)

Recorder:		Other Surveyors:		Date:		Return? <input type="checkbox"/>																																																																																																	
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CDFW-CNPS PROTOCOL FOR THE COMBINED VEGETATION RAPID ASSESSMENT AND RELEVÉ (APRIL 16, 2024)

Introduction

This protocol describes the methodology for both the Relevé and Rapid Assessment (RA) vegetation sampling techniques as recorded in the Combined Vegetation Rapid Assessment and Relevé Field Form. The same environmental data are collected for both techniques. However, the relevé is a plot demarcated with a measuring tape, and all species within the plot are recorded along with cover values. The rapid assessment sample is not based on a taped plot, but is based on a visually estimated, usually circular area within a representative portion of the entire stand, with up to 20 of the dominant or characteristic species and their cover values recorded.

In general, collect rapid assessments in woody vegetation and relevés in herbaceous vegetation. When working in an area that has not been sampled before, RAs in woody vegetation may list more than 20 species.

Defining a Stand

A stand is the basic physical unit of vegetation in a landscape. It has no set size. Some vegetation stands are very small, such as a portion of a vernal pool, and some may be several square kilometers in size, such as a forest type.

A stand is defined by three main unifying characteristics:

- 1) It has **compositional** integrity. Throughout the site, the combination of species is similar. The stand is differentiated from adjacent stands by a discernable boundary that may be abrupt or indistinct.
- 2) It has **structural** integrity. It has a similar history or environmental setting that affords relatively similar horizontal and vertical spacing of plant species. For example, a hillside forest originally dominated by the same species that burned on the upper part of the slopes but not the lower would be divided into two stands. Likewise, sparse woodland occupying a slope with very shallow rocky soils would be considered a different stand from an adjacent slope with deeper, moister soil and a denser woodland or forest of the same species.
- 3) It is typically a **repeating** pattern on the landscape, in which the plant assemblage occurs in other sites with similar plant composition and environmental setting.

The structural and compositional features of a stand are often combined into a term called **homogeneity**. For an area of vegetated ground to meet the requirements of a stand, it must be homogeneous (uniform in structure and composition throughout).

Stands vary in size and may be sampled even if they are below a “minimum mapping unit” area (a mapping rule of set size such as 1 acre or 1/2 acre specific to a mapping project). For example, a vernal pool is often mapped at the group level because it is small in area, while multiple vernal pool alliances or associations may exist and be sampled as separate

stands within a broader map polygon.

Selecting a bounded plot (Relevé) or representative area (Rapid Assessment) to sample within a stand

Stands to be sampled may be selected by evaluation prior to a site visit (e.g., from aerial photos) or they may be selected on site during reconnaissance to determine extent and boundaries, location of other similar stands, etc.

Because many stands are large, it may be difficult to summarize the species composition, cover, and structure of an entire stand. A sample of vegetation is selected to be representative of the entire stand and should be conducted in a standardized way to ensure that it can be compared to samples of other stands. This means that you are not randomly selecting a plot; on the contrary, you are actively using your own best judgment to find a representative example of the stand.

Selecting a relevé plot or RA area requires that you see enough of the stand you are sampling to feel comfortable in choosing a representative plot location. Take a brief walk through the stand and look for variations in species composition and in stand structure. In hilly or mountainous terrain, look for a vantage point from which you can get a representative view of the whole stand. Variations in vegetation that are repeated throughout the stand should be included in your plot. Once you assess the variation within the stand, attempt to locate a sample area that captures the stand's common species composition and structural condition.

Tracking sampled vegetation types

For large projects, the number of samples should be tracked daily or weekly by field-assessed Alliance and Association type so that samples are distributed as evenly as possible over types and time is not wasted collecting excessive numbers of samples of certain types. When multiple teams are in the field in the same week, daily communication between teams about Alliances and Associations sampled can ensure even sampling. *Prior to selecting a stand to sample, determine if what you are going to sample is needed based on this tracking.*

Selecting samples to avoid spatial autocorrelation

Do not place more than one sample within a stand. For large projects, separate sample locations to limit spatial autocorrelation. Try to spread samples representing the same vegetation type at least 500 to 1000 meters apart. When possible, do not sample adjacent stands, especially if the adjacent stand is within the same life form (tree, shrub, herb). For example, samples taken from different formations, subclasses, or classes (e.g., wetlands vs. uplands, lithomorphic vs. mesomorphic) adjacent to one-another have a lower probability of sharing species and may be sampled within 1000 meters of each other. However, avoid sampling adjacent stands that tend to have overlapping species even if they are technically different formations, such as a grassland adjacent to an open oak woodland. Flexibility may be necessary in the case of sensitive natural community types

that may have limited sampling opportunities across the landscape or in cases where there are obvious ecological distinctions between adjacent stands and they share very little species overlap (e.g., distinct rings of a single vernal pool or variation within a single fen).

Plot Size

All relevés of the same type of vegetation need to be an equivalent size if they are to be analyzed together. Plot size is dependent on the type of vegetation under study. Therefore, general guidelines for plot sizes of tree, shrub, and herbaceous communities have been established. Sufficient work has been done in temperate vegetation to be confident the following conventions will capture a comprehensive list of species:

- Herbaceous communities: 100 m² plot
- Special herbaceous communities of small size, such as vernal pools, fens: 10 m² plot
- Shrublands and riparian forest/woodlands: 400 m² plot
- Open desert and other shrublands with widely dispersed but regularly occurring woody species: 1000 m² plot
- Upland Forest and woodland communities: 1000 m² plot

Plot Shape

A relevé has no fixed shape, though plot shape should reflect the character of the stand and is either a square, rectangle, or circle. Adjust the orientation and dimensions of the plot to represent the best approximation of stand homogeneity. If the stand is about the same size as a Relevé, the plot boundaries may be similar to that of the entire stand. If sampling streamside riparian or other linear communities, the plot dimensions should not go beyond the community's natural ecological boundaries. Thus, a relatively long, narrow plot capturing the vegetation within the stand, but not outside it, would be appropriate. Overarching plants do not need to be rooted within the plot to be included in the species list, however, species present along the edges of the plot that are clearly part of the adjacent stand should be excluded from the plot.

Location of GPS Points

For Relevés, one point will be considered the plot identifier (ID point) and should be in the SW corner of a rectangular or square plot, if possible, or in the center of a circular plot. If it is taken in another location, this should be noted in the Site History section.

Definitions of fields in the Field Form

I. LOCATIONAL/ENVIRONMENTAL DESCRIPTION

Relevé or RA: Circle the appropriate survey type.

Database #: This is the unique ID number for Relevés and Rapid Assessments, in the form of *PPPPxxxx*, where *PPPP* is the 4-character project code and *xxxx* is a unique 4-digit number (e.g. CARR0001 for Carrizo sample #1). If this is a long-term plot, a character from A to Z can be added to the unique ID for each re-sampling survey; so the first re-sample for CARR0001 would be CARR0001A.

Base Points: For a projected RA (GPS within stand = No), a Base Point will be taken where the surveyors are standing and a separate point will be projected into the stand. The ID of the basepoint is B_*PPPPxxxx*, i.e. B_CARR0001.

Photo Points: Occasionally, stand photos will be taken from a vantage point outside the stand, or in a place other than the survey point. The ID for this point is *PPPPxxxx_P#*, i.e. the first Photo Point for CARR0001 will be CARR0001_P1.

Date: Date of the sampling.

UID: The unique ID number of a reference point or allocation target that this survey describes (optional).

Name of recorder: The full name of the recorder should be provided on the first field form of the day. On successive forms, initials can be recorded.

Other Surveyors: The full names of each person assisting should be provided on the first field form of the day. On successive forms, initials of each person assisting can be recorded.

Location Name: The name of the property, location, park, or landowner name of permitted private properties. E.g. the specific name of the County Regional Park (Gibson Ranch), USFS (Angeles NF), BLM property (Mojave Trails NM) or the owner name of a private parcel as it appears on your permit. Specific descriptions of where the stand and observer are within the stand belongs in the Site History field. Roadside/Right of Way surveys must include "Roadside" before the property name.

GPS name: The name/number assigned to each GPS unit. This can be the serial number if another number is not assigned.

Bearing°, left axis at ID point of Long / Short side: Relevé only. For square or rectangular plots: from the ID Point, looking towards the plot, record the bearing of the axis to your left. If the plot is a rectangle, indicate whether the left side of the plot is the long or short side of the rectangle by circling "long" or "short" side (no need to circle anything for square plots). If there are no stand constraints, set up the plot with boundaries running in the cardinal directions and place the ID Point in the SW corner.

UTM coordinates: Easting (**UTME**) and northing (**UTMN**) location coordinates using the Universal Transverse Mercator (UTM) grid. Record the information from your GPS unit. These coordinates are always the base point of the survey. Soil samples and photos are taken from this point, and exposure, steepness, topography, etc. are measured here. If the GPS point is not within the stand (i.e., the point is projected or digitized in the field), these are the UTM's of the base point. Important: a projected point or a point digitized in the field must always have a base point associated with it (projected surveys with estimates of distance and bearing are preferred over digitization). A base point can serve as the base for several distance surveys.

For Relevé plots, take the waypoint in the southwest corner of the plot whenever possible or in the center of a circular plot.

Zone: Universal Transverse Mercator zone. Zone 10 is for California west of the 120th longitude; zone 11 is for California east of 120th longitude (the straight portion of California's eastern boundary).

NAD83: This is the default GPS datum. If you use a different one, cross this out and write in the correct datum.

GPS error: ft./ m./ PDOP: Circle the appropriate unit of measure and record the error reading from the GPS unit.

Decimal degrees: *Use this only if your GPS unit will not record UTM coordinates.*

Latitude–Longitude reading in decimal degrees. Record the information from your GPS unit. These coordinates are always the base point of the survey. Soil samples and photos are taken from this point, and exposure, steepness, topography, etc. are measured here.

For Relevé plots, take the waypoint in the southwest corner of the plot whenever possible or in the center of a circular plot.


GPS within stand? Yes / No: Circle “Yes” to denote that the GPS waypoint was taken directly within or at the edge of the stand being assessed for a Rapid Assessment, or circle “No” if the waypoint was taken at a distance from the stand (such as with a binocular view of the stand). If the point is taken at the edge of the stand, note direction to the center of the stand.

If No, cite from GPS to stand: distance (m), bearing°, inclination°: From the base GPS point, measure the distance to the projected point using a range finder. Record the compass bearing from the base point to the projected point; record the inclination if the base and projected points are not at the same elevation.

and record Base point ID: This is the ID of the base GPS point, where the surveyors were standing to record the distance survey. This is required for both projected points and points digitized in the field (gathering projection data is preferred).

and Projected UTM: These are the coordinates of the projected point, the point being surveyed. They are generated in the field if the GPS units have the ability to calculate projected points. If the GPS unit does not have this capability, make a note to that effect and leave these fields blank. Note that a digitized point, e.g., using your finger to plunk the location that you are surveying in Collector, is NOT a projected point and is not recommended.

Camera Name: Write the camera name or code as identified by the users.

Cardinal photos at ID point: Take four photos in landscape orientation for each cardinal direction (N, E, S, W) starting clockwise towards the north, from the ID Point, and record the jpeg numbers here. This symbol can be used to indicate the cardinal photos: . Try to include the horizon line in each photo (if possible while getting a good representation of the vegetation). If this is a distance survey to a projected point, take the four cardinal photos at the base point and at least one photo of the stand. A digital camera with a minimum 10 megapixel resolution is required.

Other photos: This may include cardinal photos at additional corners or other relevant photos. We recommend a diagonal photo facing NE from the SW corner when sampling an herbaceous relevé. Notes regarding photo locations or subjects can go here.

Stand Size: Estimate the size of the entire stand in which the sample is taken. As a measure, one acre is about 4,000 square meters (approximately 64 x 64 m), or 208 feet by 208 feet. One acre is similar in size to a football field.

Plot Area (m²): Relevé only. Circle “100” for a 100m² plot or record the appropriate plot size.

Plot Dimensions: Relevé only. Record the length and width of the plot in meters.

RA Radius: Rapid Assessments only. Estimate the radius of the area of the stand viewable from your sample point. This value is separate from the Stand Size of vegetation being sampled and any additional details/constraints can be documented in the Site History.

The radius must fall completely within the stand boundary and therefore cannot be greater than the distance from the sample point to the edge of the stand in any direction. If you can see the entire stand, then the radius will be the distance from your GPS point to the closest edge of the stand. For example, the radius will be constrained in long linear stands to the minimum width of the stand and thus the RA radius may not capture the full area that you survey. If your point is on the edge of the stand, record the radius into the stand, but note your location and the direction to which the RA Radius applies in the Site History section. RA Radius informs mappers and the image analysts of the dimensions of the stand visible from the sample point, so they can make connections between the vegetation on the ground and information in imagery and other GIS datasets.

Exposure: (Enter Actual ° and circle general category): While facing in the general downhill direction, read degrees of the compass for the aspect or the direction you are standing, using degrees from north, adjusted for declination. Average the reading over the entire stand, even if you are sampling a Relevé plot, since your plot is representative of the stand. If estimating rather than measuring the exposure, write “N/A” for the actual degrees, and circle the general category chosen. “Variable” may be selected if the same, homogenous stand of vegetation occurs across a varied range of slope exposures.

Steepness: (Enter Actual ° and circle general category): Read degree slope from your clinometer or compass with built in clinometer by following the manufacturer’s directions for use. Make sure to average the reading across the entire stand, even if you are sampling in a Relevé plot, since your plot is representative of the stand. If estimating rather than measuring, write “N/A” for the actual degrees, and circle the general category chosen.

Topography: First assess the broad (**Macro**) topographic feature or general position of the stand relative to the immediately surrounding landscape. This attribute does not refer to the watershed as a whole, but to a cross section of the topography at the location of your stand. For instance, if your stand is located along a small creek in a narrow, v-shaped canyon, your position would be at the “Bottom,” even if the canyon itself slopes downward. Since stands can occupy more than just a single slope position, **circle all the positions that apply.**

Then, assess the local (**Micro**) topographic features or the lay of the area within the stand being sampled (e.g., surface is flat or concave). **Circle only one of the microtopographic descriptors.**

Geology code: Geological parent material of stand. If exact type is unknown, use a more general category (e.g., igneous, metamorphic, sedimentary). *See code list for types.*

Soil Texture code: Record soil texture that is characteristic of the plot (e.g., coarse loamy sand, sandy clay loam). *See soil texture key for types.*

Upland or Wetland/Riparian: Indicate if the stand is in an upland or wetland/riparian setting. (wetland and riparian are one category.) Note that a site need not be officially delineated (as in the Army Corps of Engineer's wetland delineation protocols) as a wetland to qualify as such in this context (e.g., seasonally wet meadow).

% Surface cover: The abiotic substrates of the plot. The total should sum to 100%. It is helpful to imagine "mowing off" all of the live vegetation at the base of the plants and removing it – you will be estimating what is left covering the surface. Note that non-vascular cover (lichens, mosses, cryptobiotic crusts), including "basal area" of ground attachment, is not estimated in this section.

- **H₂O:** Percent surface cover of running or standing water, ignoring the substrate below the water.
- **BA Stems:** Percent surface cover of the basal area of vascular plant stems at the ground surface. For most vegetation types, BA is 1-3% cover.
- **Litter:** Percent surface cover of litter, thatch, duff, or wood on the ground.
- **Bedrock:** Percent surface cover of bedrock, including outcrops.
- **Boulder:** Percent surface cover of rocks >60 cm in the longest dimension.
- **Stone:** Percent surface cover of rocks >25–60 cm in the longest dimension.
- **Cobble:** Percent surface cover of rocks >7.5–25 cm in the longest dimension.
- **Gravel:** Percent surface cover of rocks 2 mm–7.5 cm in the longest dimension.
- **Fines:** Percent surface cover of bare ground and fine sediment <2 mm in the longest dimension (e.g., dirt, sand).

% Current year bioturbation: Estimate the percent of the plot exhibiting soil disturbance by any organism that lives underground. Do not include disturbance by ungulates. Note that this is a separate estimation from surface cover.

Past bioturbation present? Circle Yes if there is evidence of bioturbation from previous years in the plot.

% Hoof punch: Note the percent of the plot surface that has been punched down by hooves (cattle or native grazers) in wet soil. Depressions must be >2 cm deep.

Fire Evidence: Circle Yes if there is visible evidence of fire within the stand, and note the type of evidence in the "Site history, stand age, comments section," for example, "charred dead stems of *Quercus berberidifolia* extending 2 feet above resprouting shrubs." If you are certain of the year of the fire, put this in the Site history section. You may also record more general historic

information if you lack the precise date of a fire (such as most recent fire appears to be 10-20 years ago).

Site history, stand age, comments: Briefly describe the stand including details about age/seral stage, disturbance history, nature and extent of land use, and other environmental and vegetation factors, such as distribution of species. Examples of disturbance history: fire, landslides, avalanching, drought, flood, animal burrowing, or pest outbreak. Also, try to estimate year or frequency of disturbance. Examples of land use: grazing, timber harvest, or mining. Examples of other site factors: exposed rocks, soil with fine-textured sediments, high litter/duff build-up, multi-storied vegetation structure, or other stand dynamics. Note any structural and phenological constraints to estimates of strata cover and height and any peculiarities of the site or observation that impact the vegetation measurements taken.

Examples include: late phenology within deciduous tree stands reducing cover estimates or pygmy forests or other stunted growth. Include any additional details or constraints about the extent of the area assessed, meaning the area that has contributed to strata, height, and cover estimates. Also include any important site information about the location of the stand or the observers, like adjacency to something visible on imagery or something like “point taken near the north boundary of the stand because of steep slope”

Disturbance code / Intensity (L,M,H): List codes for potential or existing impacts on the stability of the plant community. See code list for impacts and definitions of levels of disturbance.

Characterize each impact each as **L** (=Light), **M** (=Moderate), or **H** (=Heavy). Disturbance is evaluated on a stand basis.

II. HABITAT AND VEGETATION DESCRIPTION

California Wildlife Habitat Relationships (CWHR)

For CWHR, identify a size/age/height class for the plot using the following tree, shrub, and/or herbaceous categories. These categories are based on functional life forms. This data links the structural components of sampled stands within the SCV classification to the CWHR classification.

Tree DBH: Circle one of the tree size classes provided when the tree canopy closure exceeds 10% of the total cover, or if young tree density indicates imminent tree dominance. Size class is based on the average diameter at breast height (dbh) of each trunk (standard breast height is 4.5ft or 137cm). When marking the main size class, make sure to estimate the mean diameter of all trees over the entire stand, weighing the mean toward the larger tree dbh's if large trees are consistent in the stand, though they may be low in cover. The “**T6 multi-layered**” dbh size class signifies a multi-layered tree canopy, with a size class T3 and/or T4 layer growing under a T5 layer and a distinct height separation between the classes. Stands in the T6 class must contain a total absolute tree cover that exceeds 60% including at least 10% cover of size class 5 (>24” dbh) trees growing over a distinct layer of trees in size classes 3 (>6-11” dbh) or 4 (>11-24” dbh) with at least 10% combined cover.

Shrub: Circle one of the shrub classes provided when shrub canopy closure exceeds 10% (except in desert types) by recording which class is predominant in the survey. Shrub class is

based on the average amount of crown decadence (dead standing vegetation on live shrubs when looking across the crowns of the shrubs).

Herbaceous: Circle one of the herb height classes when herbaceous cover exceeds 2% by recording the predominant class in the survey. Note: *This height class is based on the average plant height at maturity, not necessarily at the time of observation.*

Desert Riparian Tree/Shrub: Circle one of the size classes by measuring mean stem height (whether tree and/or shrub stand).

Desert Palm/Joshua Tree: Circle one of the palm or Joshua tree size classes by averaging all the stem-base diameters (i.e., mean diameter of all stem-base sizes). Diameter is measured at the plant's base above the bulge near the ground.

III. INTERPRETATION OF STAND

Field-assessed vegetation Alliance name: Enter the name of the Alliance following the [Manual of California Vegetation \(MCV\) Online](#). Please use scientific nomenclature, e.g., *Quercus agrifolia* forest. Alliance and association names in the MCV follow the USDA Plants nomenclature in order to conform with the national standard. An Alliance is based on the dominant or diagnostic species of the stand, and usually reflects the uppermost and/or dominant height stratum. A dominant species tends to cover the greatest area, while a diagnostic species is consistently found in some vegetation types but not others.

The field-assessed Alliance name may not always exist in the current MCV, in which case you can provide a new or proposed Alliance name in this field. If this is the case, also make sure to state that it is not in the MCV under "Explain" below.

Field-assessed Association name (optional): Enter the name of the species in the Alliance and additional dominant/diagnostic species from any strata. In following naming conventions, species in differing strata are separated with a slash, and species in the uppermost stratum are listed first (e.g., *Quercus douglasii* / *Toxicodendron diversilobum*). Species in the same stratum are separated with a dash (e.g., *Quercus lobata* – *Quercus douglasii*).

The field-assessed Association name may not exist in the current MCV, in which you can provide a new or proposed Association name in this field.

Adjacent Alliances/direction: Identify other vegetation types that are directly adjacent to the stand being assessed by noting the dominant species (or known type). Also note the distance in meters from the GPS waypoint and the direction (general or in degrees) of the adjacent alliance (e.g., *Amsinckia tessellata* / 50m, 360° N or *Eriogonum fasciculatum* / 100m, 110°).

Confidence in Alliance identification: (L, M, H) With respect to the "Field-assessed Alliance name," note whether you have L (=Low), M (=Moderate), or H (=High) confidence in the interpretation of this Alliance name.

Explain: Please elaborate if your "Confidence in Alliance identification" is low or moderate. Low confidence can occur from such things as a poor view of the stand, an unusual mix of species

that does not meet the criteria of any described Alliance, or a low confidence in your ability to identify species that are significant members of the stand.

Phenology: Indicate early (E), peak (P), or late (L) phenology for each of the strata. For herbs, this generally indicates if species are in flower and/or fruit and are therefore identifiable. For shrubs and trees, this attribute generally refers to cover, e.g., a tree that is fully leafed out will be considered peak (P) even if it is not in flower. Phenology is useful for cover estimation and species identification issues and can be elaborated upon in the next field or in the Site History.

Other identification or mapping information: Discuss any further problems with the identification of the assessment or issues that may be of interest to mappers. Note if this sample represents a type that is likely too small to map.

IV. VEGETATION DESCRIPTION

Database #: Copy the database # from Page 1.

Overall Cover of Vegetation

Provide an estimate of cover for the life-form categories below. Record a specific number for the total aerial cover or “bird’s-eye view” looking from above for each category, estimating cover for living plants only. Litter/duff should not be included in these estimates. The porosity of the vegetation should be taken into consideration when estimating percent foliar cover for all categories below: consider how much of the sky you can see when you are standing under the canopy of a tree, or how much light passes through the canopy of the shrub layer to help you estimate foliar cover.

% NonVasc cover: The total cover of all lichens, bryophytes (mosses, liverworts, hornworts), and cryptogamic crust on substrate surfaces including downed logs, rocks and soil, and horizontal surfaces (tree branches) but not on standing or inclined trees or vertical rock surfaces.

Total % Vasc Veg cover: The total cover of all vascular vegetation taking into consideration the porosity, or the holes, in the vegetation, and disregarding overlap¹ of the various tree, shrub, and/or herbaceous layers and species.

% Cover by Layer

Conifer Tree /Hardwood Tree: The total foliar cover (considering porosity) of all live tree species, disregarding overlap¹ of individual trees. Estimate conifer and hardwood covers separately. **Please note:** These cover values should not include the coverage of regenerating tree species (i.e., tree seedlings and saplings).

¹ Porosity reduces the total cover of the canopy. Overlapping strata should not be included in the total cover percent; for instance, if a shrub is growing under a tree, only the cover of the tree will be added into the total; the cover of the shrub will be disregarded, except for the amount by which it fills in the porosity of the tree canopy.

Regenerating Tree: The total foliar cover of seedlings and saplings, disregarding overlap¹ of individual recruits. See seedling and sapling definitions below.

Shrub: The total foliar cover (considering porosity) of all live shrub species disregarding overlap¹ of individual shrubs.

Herbaceous: The total cover (considering porosity) of all herbaceous species, disregarding overlap¹ of individual herbs.

Height Class by Layer

Note the modal height for conifer tree / hardwood tree, regenerating tree, shrub, and herbaceous categories. Modal height is based on the count of the most frequent height of plants within each layer. Record a modal average height value for each category by estimating the mean height for each group. Please use the following height intervals to record a height class: 1 = <1/2 m, 2 = 1/2-1 m, 3 = 1-2 m, 4 = 2-5 m, 5 = 5-10 m, 6 = 10-15 m, 7 = 15-20 m, 8 = 20-35 m, 9 = 35-50 m, 10 => 50 m.

Note: For the herbaceous layer height, this height class is based on the modal average plant height at the time of observation, as opposed to how this is recorded in the CWHR section (at maturity).

Species List and Coverage

For Rapid Assessments: List up to 20 species that are dominant or that are characteristically consistent within the assessment area. These species may or may not be abundant, but they should be consistent representatives in the survey. When different layers of vegetation occur, make sure to list species from each stratum. As a general guide, make sure to list at least 1-2 of the most abundant species per stratum. There is a heavy line on the form under the 20th line to limit the RA section of the species list.

Note: If constant, diagnostic, or interesting species occur outside the assessment area but in the stand, list the species and estimated stand cover in the Site History section.

For Relevés: list all species present in the plot, using a second species list page if necessary.

** If using a second species list page, note "Continued" on the bottom of the first page and be sure to note the Database # on the second page.

For both sample types, provide the stratum:

T = Tree. A woody perennial plant that has a single trunk.

A = SApling. 1" - <6" dbh and young in age, OR small trees that are <1" dbh, are clearly of appreciable age, and are kept short by repeated browsing, burning, or other disturbance. Includes trees that are re-sprouting from roots or stumps following fire, logging or other disturbance. These re-sprouts may exhibit a shrubby form, with multiple small trunks, but are species that are generally considered trees. If a majority of the trunks are >6" dbh, then the re-sprouts would be included under the "Tree" stratum.

E = SEedling. A tree species clearly of a very young age that is <1" dbh OR has not reached breast height. Applies only to trees propagating from seed; resprouts are not recorded here even if they meet the size requirements.

S = Shrub. A perennial, woody plant, that is multi-branched and doesn't die back to the ground every year.

H = Herb. An annual or perennial that dies down to ground level every year.

N = Non-vascular. Includes moss, lichen, liverworts, hornworts, cryptogammic crust, and algae.

Be consistent and don't break up a single species into two separate strata. The only time it would be appropriate to do so is when one or more tree species are regenerating, in which case the SEedling and/or SApling strata should be recorded for that species. These may be noted on the same line, e.g.:

Strata	Species	% Cover	C
T/A/E	<i>Quercus douglasii</i>	40/<1/<1	

In some cases, the stratum of a particular species might not be obvious. Some examples are *Juniperus californica*, which has the size and growth habit of a shrub, but it is considered a tree, and mistletoe, which is considered a shrub. It is useful to have a list of species with ambiguous strata for each project. Consult the MCV or contact VegCAMP if you are unsure.

C. If a species collection is made, it should be indicated in the collection column with a "C" (for collected). If the species is later keyed out, cross out the species name or description and write the keyed species name in pen on the data sheet. Do not erase what was written in the field, because this information can be used if specimens get mixed up later. If the specimen is then thrown out, add a "T" to the "C" in the collection column (CT = thrown out after confirmation) or cross out the "C". If the specimen is kept but is still not confidently identified, add a "U" to the "C" in the collection column (CU = collected and unconfirmed). In this case the unconfirmed species epithet should be put in parentheses [e.g., *Hordeum (murinum)*]. If the specimen is kept and is confidently identified, add a "C" to the existing "C" in the collection column (CC = collected and confirmed). If the specimen is later deposited in an herbarium, add a "D" to the existing "C" in the collection column (CD = collected and deposited) and note the receiving herbarium.

Using Jepson eFlora nomenclature, write out the scientific name of each plant to the finest taxonomic level possible. In general, do not abbreviate names except for dominant species that do not have ambiguous codes. If you aren't sure there aren't duplicate codes, don't use a code. When uncertain of an identification (which you intend to confirm later) use parentheses to indicate what part of the determination needs to be confirmed. For example, you could write out *Brassica (nigra)* if you are sure it is a *Brassica* but you need further clarification on the specific epithet.

Provide the % absolute foliar cover for each species listed, considering porosity. When estimating, it is often helpful to think of coverage in terms of the following cover intervals at first:

<1%, 1-5%, >5-15%, >15-25%, >25-50%, >50-75%, >75%.

Record the <1% cover in one of two categories:

“+” for <1% but not rare or solitary individual (in most cases)

“r” for rare in plot or solitary individuals.

Keeping these classes in mind, refine your estimate to a specific percentage. The sum of all species percent covers may total over 100% because of overlap.

Include the percent cover of snags (standing dead) of trees and shrubs. Use the code “SNAG.”

Note their species, if known, in the “Species” column (i.e. SNAG – *Quercus wislizeni*).

For Rapid Assessments, make sure that the major non-native species occurring in the stand also are listed in the space provided in the species list with their strata and % cover.

For Relevés, all native and non-native species should be included in the species list.

Unusual species: List species that are locally or regionally rare, endangered, or atypical (e.g., range extension or range limit) within the stand. This field will be useful to the Program for obtaining data on regionally or locally significant populations of plants.

Note: Field forms are generally filled out in pencil, so that changes may be made easily while working in the plot or stand. Once out of the stand, however, entries on the field form should not be erased, but should be crossed out and corrected in a different-colored ink.

COMBINED VEGETATION RAPID ASSESSMENT AND RELEVÉ FIELD FORM

Combined Vegetation Rapid Assessment and Relevé Field Form (Revised January 10, 2024)

For Office Use:	Final database #:	Final vegetation type:	Alliance: _____ Association: _____
I. LOCATIONAL/ENVIRONMENTAL DESCRIPTION			circle: Relevé or RA
Database #:	Date:	Name of recorder:	
		Other surveyors:	
	UID:	Location Name:	
GPS name: _____ For Relevé only: Bearing°, left axis at ID point _____ of <u>Long</u> / <u>Short</u> side			
UTME _____ UTMN _____ Zone: 11 NAD83 GPS error: ft./ m./ PDOP _____			
Decimal degrees: LAT _____ LONG _____			
GPS within stand? Yes / No If No, cite from GPS to stand: distance (m) _____ bearing ° _____ inclination ° _____			
and record: Base point ID _____ Projected UTMs: UTME _____ UTMN _____			
Camera Name: _____ Cardinal photos at ID point: _____			
Other photos: _____			
Stand Size (acres): <1, 1-5, >5 Plot Area (m²): 100 / _____ Plot Dimensions _____ x _____ m RA Radius _____ m			
Exposure, Actual °: _____ NE NW SE SW Flat Variable Steepness, Actual °: _____ 0° 1-5° > 5-25° > 25			
Topography: Macro: top upper mid lower bottom Micro: convex flat concave undulating			
Geology code: _____ Soil Texture code: _____ Upland or Wetland/Riparian (circle one) Landform _____			
% Surface cover: (Incl. outcrops) (>60cm diam) (25-60cm) (7.5-25cm) (2mm-7.5cm) (Incl sand, mud)			
H2O:	BA Stems:	Litter:	Bedrock: Boulder: Stone: Cobble: Gravel: Fines: =100%
% Current year bioturbation _____ Past bioturbation present? Yes / No % Hoof punch _____			
Fire evidence: Yes / No (circle one) If yes, describe in Site history section, including date of fire, if known.			
Site history, stand age, comments:			
Disturbance code / Intensity (L,M,H): _____ / _____ / _____ / _____ / _____ "Other" _____ / _____			
II. HABITAT DESCRIPTION			
Tree DBH : T1 (<1" dbh), T2 (1-6" dbh), T3 (6-11" dbh), T4 (11-24" dbh), T5 (>24" dbh), T6 multi-layered (T3 or T4 layer under T5, >60% cover)			
Shrub: S1 seedling (<3 yr. old), S2 young (<1% dead), S3 mature (1-25% dead), S4 decadent (>25% dead)			
Herbaceous: H1 (<12" plant ht.), H2 (>12" ht.)			
Desert Riparian Tree/Shrub: 1 (<2ft. stem ht.), 2 (2-10ft. ht.), 3 (10-20ft. ht.), 4 (>20ft. ht.)			
Desert Palm/Joshua Tree: 1 (<1.5" base diameter), 2 (1.5-6" diam.), 3 (>6" diam.)			
III. INTERPRETATION OF STAND			
Field-assessed vegetation Alliance name: _____			
Field-assessed Association name (optional): _____			
Adjacent Alliances/direction: _____ / _____, _____ / _____			
Confidence in Alliance identification: L M H Explain: _____			
Phenology (E,P,L): Herb _____ Shrub _____ Tree _____ Other identification or mapping information: _____			

(Revised January 10, 2024)

SPECIES SHEET

Recorder & Date:

% NonVasc cover:_____ Total % Vasc Veg cover:_____

1003

☐
☐

Height classes: 1=<1/2m, 2=1/2-1m, 3=1-2m, 4=2-5m, 5=5-10m, 6=10-15m, 7=15-20m, 8=20-35m, 9=35-50m, 10=>50m

Stratum categories: T=Tree, A = SApling, E = SEedling, S = Shrub, H= Herb, N= Non-vascular

% Cover Intervals for reference: r = trace, + = <1%, 1-5%, >5-15%, >15-25%, >25-50%, >50-75%, >75%

Unusual species: _____

CDFW-CNPS PROTOCOL FOR THE ACCURACY ASSESSMENT (OCTOBER 3, 2023)

INTRODUCTION

This protocol describes Accuracy Assessment (AA) data collection procedures. The primary purpose of the AA fieldwork is to supply data to test the accuracy of a specific vegetation map. The information collected can also contribute additional data for the classification of vegetation communities. The primary sampling units are the vegetation polygons delineated by photo-interpreters in the creation of the vegetation map.

If an entire AA polygon cannot be fully investigated due to terrain or other reasons, as much of the polygon as can be evaluated should be assessed.

Note that a delineated polygon may differ from the conventional definition of a stand of vegetation. A stand is the basic physical unit of vegetation in a landscape. It has no set size. Some stands of vegetation are very small while some may be several square kilometers in size.

DEFINING A STAND

A stand is defined by two main unifying characteristics:

1. It has compositional integrity. Throughout the site, the combination of species is similar. The stand is differentiated from adjacent stands by a discernable boundary that may be abrupt or indistinct.
2. It has structural integrity. It has a similar history or environmental setting that affords relatively similar horizontal and vertical spacing of plant species. For example, a hillside forest originally dominated by the same species that burned on the upper part of the slopes, but not the lower, would be divided into two stands. Likewise, sparse woodland occupying a slope with very shallow rocky soils would be considered a different stand from an adjacent slope with deeper, moister soil and a denser woodland or forest of the same species.

The structural and compositional features of a stand are often combined into a term called homogeneity. For an area of vegetated ground to meet the requirements of a stand, it must be homogeneous.

A properly delineated polygon may contain more than one stand. One example is a stand that is below the minimum mapping unit (MMU); it cannot be mapped separately and will be absorbed into the surrounding vegetation type. Another example is vegetation that is difficult to identify accurately on photo imagery. Several similar-looking stands may be grouped into one polygon and assigned a vegetation type at a high level, such as Group.

SELECTING A LOCATION TO SAMPLE WITHIN A POLYGON (FOR SUBSAMPLES ONLY):

If assessing a large polygon, it may be difficult to summarize the species composition, cover, and structure of the entire area. We are also usually trying to capture the most information as efficiently as possible. Thus, we may be forced to select a representative portion of the delineated polygon to sample.

When taking a subsample, the main point to remember is to select an area that, in as many ways possible, is representative of that entire polygon. This means that you are not randomly selecting a sample location; on the contrary, you are actively using your own best judgment to find a representative example of the polygon.

Selecting an assessment site requires that you see enough of the polygon you are sampling to feel comfortable in choosing a representative sample location. If possible, take a brief walk through the polygon and figure out where the boundary lines are drawn. Look for variations in species composition and in stand structure. In the process, decide whether the polygon includes more than one mappable vegetation type or if the stand boundaries don't seem to match up with the polygon delineation. **If more than one vegetation type is present, fill out an AA form for each type ONLY IF each type is mappable (i.e., it is large enough to meet MMU and can be delineated without creating unreasonably shaped polygons).** Small variations in vegetation that are repeated throughout the polygon should be included in your subsample. Once you assess the variation within the polygon, attempt to find an area that captures the stand's species composition and structural condition to sample.

If it appears that the polygon represents a group-level classification and consists of multiple alliance stands, make notes about alliances. Assess the polygon's mapping unit but don't provide a field alliance / association that doesn't apply to the whole polygon.

HOW TO ENTER FIELDS ON THE FORM:

Recorder: The full name of the recorder should be provided for the first field form for the day. On successive forms, initials can be recorded.

Other Surveyors: The full names of each person assisting should be provided for the first field form for the day. On successive forms, initials of each person assisting can be recorded.

Date: The date the AA point was sampled. Use the standard U.S. format of "month-day-year" or use letters to write out the month.

Waypoint ID: The Waypoint ID in this format: GPS device name + date (yymmdd) + 24-hour time (hhmm). For example, for a survey taken on iPad "V" on March 27, 2018 at 1:45pm in the afternoon, the Waypoint ID will be "V1803271345." It is also acceptable to use the Polygon UID. If using this method, then for base points, the format would be

B_ 'PolygonUID' and if there is a multiple point assessment the format would be 'PolygonUID'_1, PolygonUID_2, etc.

Note that the GPS point should be taken away from the edge of the polygon, and near the center of the subsample (if one is used).

Polygon UID: The unique identifier (UID) assigned to each polygon, displayed in the GPS data and on paper maps.

Location Name: The name of the property, park, or the location within large holdings (like USFS or BLM properties).

GPS name: The name/number assigned to the GPS unit/device name.

Projected? Yes / No / Base / Digitized: Circle the appropriate option

Yes - The point is a projected, or offset point. The surveyors used a bearing, distance, and inclination to project the point into the polygon they are describing.

No - The surveyor is within the boundary of the polygon being assessed and the point is where the observer was standing for photographs. This location can also be used as a base location for an offset survey.

Base - Base point only. This is where a surveyor was standing when taking an offset survey to describe vegetation not at that point. No plant data or vegetation descriptions are associated with this location. However, cardinal photos taken at this point will be stored in a directory of this name.

Digitized -An offset point was created on the GPS unit without taking bearing and distance readings. This option should only be used when the imagery on the GPS unit is unique and unmistakable.

If Projected = Yes

Distance (m): The distance in meters from the Base point to the Projected point, determined by use of a range finder.

Bearing (°): The compass bearing from the Base point to the Projected point.

Inclination (°): The vertical offset from the Base point to the Projected point.

If Projected = Yes or Digitized

Base Waypoint ID: The location where the surveyor was standing when the information was collected. Cardinal photographs will be taken at this point and will be stored on the computer under this ID. Photographs of the stand vegetation will be taken from this point and will be stored on the computer under the Projected point's ID.

Base UTM / Projected UTM: If the point is projected or digitized, circle whether the UTM coordinates of the base point or the projected point have been recorded. These will generally be for the base point.


UTM coordinates: Easting (**UTME**) and Northing (**UTMN**) location coordinates using the Universal Transverse Mercator (UTM) grid. Record this information from a GPS unit.

Zone: Universal Transverse Mercator zone. Zone 10 is for California west of the 120th longitude; zone 11 is for California east of 120th longitude (the straight portion of California's eastern boundary).

NAD83: This is the default GPS datum. If you use a different one, cross this out and write in the correct datum.

GPS error: ft/ m/ PDOP: Circle the appropriate unit of measure and record the error reading from the GPS unit.

Decimal degrees: *Use this if your GPS unit is not recording UTM coordinates.* Latitude–Longitude reading in decimal degrees, with 6 decimal places. Record the information from your GPS unit.

Camera Name / Photo #s: Write the name or the camera, JPG numbers, and direction of photos. *Take four photos in the main cardinal directions (N, E, S, W) clockwise from the north, from the GPS location.* This symbol can be used to indicate the cardinal photos:  Make sure to take additional photos of the general composition of the stand if the cardinal photos do not do an adequate job; note the JPG numbers and a description and direction of each additional photo. **A digital camera with a minimum 10 megapixel resolution is required.**

Species list and coverage

List up to twelve species that are dominant or that are characteristically consistent throughout the stand. These species may or may not be abundant, but they should be constant representatives in the survey. When different layers of vegetation occur in the stand, make sure to list species from each stratum. As a general guide, make sure to list at least 1-2 of the most abundant species per stratum.

Strata:

T = Tree. A woody perennial plant that has a single trunk.

A = SApling. 1" - <6" dbh and young in age, OR small trees that are <1" dbh, are clearly of appreciable age, and are kept short by repeated browsing, burning, or other disturbance.

Includes trees that are re-sprouting from roots or stumps following fire, logging or other disturbance. These re-sprouts may exhibit a shrubby form, with multiple small trunks, but are species that are generally considered trees. If a majority of the trunks are >6" dbh, then the re-sprouts would be recorded under the "Tree" stratum.

E = SEedling. A tree species clearly of a very young age that is <1" dbh or has not reached breast height. Applies only to trees propagating from seed; re-sprouts are not recorded here even if they meet the size requirements.

S = Shrub A perennial, woody plant that is multi-branched and doesn't die back to the ground every year.

H = Herb An annual or perennial that dies down to ground level every year.

N = Non-vascular Includes mosses, liverworts, hornworts, and algae.

Be consistent and break up a single tree species into two+ separate strata, if multiple strata are observed. If using an electronic form, break up tree species into separate records for each stratum. If using a paper form, combine tree species into a single record.

In some cases, the stratum of a particular species might not be obvious. Some examples are *Juniperus californica*, which has the size and growth habit of a shrub, but it is considered a tree, and mistletoe, which is considered a shrub. It is useful to have a list of species with ambiguous strata for each project. Consult the MCV or contact VegCAMP if you are unsure.

Species: Use Jepson Manual nomenclature, write out the scientific name of each plant to the finest taxonomic level possible. When uncertain of an identification (which you intend to confirm later) use parentheses to indicate what part of the determination needs to be confirmed. For example, you could write out *Brassica (nigra)* if you are sure it is a *Brassica* but you need further clarification on the specific epithet.

% cover: provide the % absolute aerial cover for each species listed, considering porosity. When estimating, it is often helpful to think of coverage in terms of the following cover intervals at first:

<1%, 1-5%, >5-15%, >15-25%, >25-50%, >50-75%, >75%.

Keeping these classes in mind, refine your estimate to a specific percentage. The sum of all species percent covers may total over 100% because of overlap. Cover should reflect what is within the portion of the polygon you can observe. Record the <1% cover in one of two categories: "r" for trace (i.e., rare in plot, or solitary individuals, entered into database as 0.1) and "+" for <1% but not rare or solitary individuals (entered into database as 0.2).

C: If a species collection is made, it should be indicated with a "C" (for collected). If the species is later keyed out, cross out the species name or description and write the keyed species name in pen on the data sheet. Do not erase what was written in the field, because this information can be used if specimens get mixed up later. If the specimen is then thrown out, add a "T" to the "C" in that column (CT = thrown out after confirmation) or cross out the "C". If the specimen is kept but is still not confidently identified, add a "U" to the "C" (CU = collected and unconfirmed). In this case the unconfirmed species epithet should be put in parentheses [e.g. *Hordeum (murinum)*]. If the

specimen is kept and is confidently identified, add a “C” to the existing “C” (CC = collected and confirmed). If the specimen is later deposited in an herbarium, add a “D” to the existing “C” (CD = collected and deposited) and note the receiving herbarium.

Notes: Describe the stand age or seral stage, disturbance history, nature and extent of land use, and other site environmental and vegetation factors. Include recommendations for line-work revision, discernibility of the vegetation based on season and topography, problems with classification interpretation, homogeneity of vegetation, and unusual sightings of plants or animals.

Map Unit Name: Enter the vegetation type name here. Refer to the Vegetation Mapping Key to select the type. If the vegetation in this polygon does not exactly match the descriptions in the key, enter the best-fitting vegetation type here and the second-best type in the next field. For further verification of the vegetation, refer to the Stand Tables.

Secondary (Optional): Assign a second-best-fitting name for the vegetation within the polygon. Assign a secondary code **only** if there is some ambiguity in assigning the polygon to a primary vegetation. Note the reason for assigning a secondary call within the “*Confidence in map unit ID*” field below.

Confidence in map unit ID? L M H Explain: Note the level of confidence you feel in the map unit identification by circling **Low**, **Moderate**, or **High**. This is an area to describe how well the stand characteristics match the Vegetation Key. Are all diagnostic species present in proper proportions? If not, how do they differ? If a secondary type is identified, what made the stand type ambiguous? ***Note that if you choose low or moderate confidence, you should have a secondary call, as an alternative way to classify the vegetation.***

Linework problems: Check the box if the polygon boundary line does not surround a distinct vegetation type. Examples for which you would check the box include situations where there is more than one type of mappable vegetation within the polygon, when a portion of the boundary includes part of an adjacent stand, or when the stand continues beyond the polygon boundary. If checked, provide comments in the Notes section to explain.

More than 1 vegetation type in this polygon: Check if there is more than one vegetation type within the polygon. If the polygon includes more than one type, take a separate GPS point and fill out an AA form for each **mappable** vegetation type. If these other types are smaller than the MMU, and therefore would not be expected to be mapped, just note the additional vegetation types in the Notes section.

Vegetation change since imagery taken: Check the box if the vegetation in the polygon has changed since the aerial imagery used as the base of the

vegetation map was taken. If yes, provide a description in the Notes section of how the vegetation has changed (for example: burned, developed, visible dominance change over time).

Field Alliance: Enter the vegetation alliance name here. Refer to the Vegetation Key to select the type. If the vegetation in this polygon does not exactly match the descriptions in the key, enter the best-fitting vegetation type here and describe issues in the notes. If the polygon contains multiple alliances, and has been mapped at the group level, don't fill this in. You can add Notes to cover those.

Field Association: Enter the vegetation association name here. Refer to the Vegetation Key to select the type. If the vegetation in this polygon does not exactly match the descriptions in the key, it is okay to leave at the alliance level with notes. If the polygon contains multiple associations, and has been mapped at the alliance level, don't fill this in. You can add Notes to cover those.

% Cover by Layer

Conifer Cover: The total foliar cover (considering porosity) of all live conifer trees, disregarding overlap of individual trees.

Hardwood Cover: The total foliar cover (considering porosity) of all live hardwood trees, disregarding overlap of individual trees.

Total Tree Cover: The total foliar cover (considering porosity) of all live tree species, disregarding overlap of individual trees. This value may be less than the sum of the conifer and hardwood covers due to overlap.

Shrub Cover: The total foliar cover (considering porosity) of all live shrubs, disregarding overlap.

Herb Cover Class: The total cover (considering porosity) of all herbaceous species, disregarding overlap. Circle the appropriate cover class range.

<2% 2–9% 10–40% >40%

Tree Height: Circle the height range of the modal tree height.

<0.5m 0.5-1m 1-2m 2-5m 5-10m 10-15m 15-20m 20-35m 35-50m
>50 m NA

Tree DBH: Circle one of the tree size classes provided. Size class is based on the average diameter at breast height (dbh) of each trunk (standard breast height is 4.5ft or 137cm).

When marking the main size class, make sure to estimate the mean diameter of all trees over the entire stand, weighing the mean toward the larger tree dbh's if large trees are consistent in the stand, though they may be low in cover. The "**T6 multi-layered**" dbh size class signifies a multi-layered tree canopy, with a size class T3 and/or T4 layer growing under a T5 layer and a

distinct height separation between the classes. Stands in the T6 class must contain a total absolute tree cover that exceeds 60% including at least 10% cover of size class 5 (>24" dbh) trees growing over a distinct layer of trees in size classes 3 (>6-11" dbh) or 4 (>11-24" dbh) with at least 10% combined cover.

Exotics: Circle the appropriate level:

None or not visible

1. Light, less than 33% of total cover is non-native
 2. Moderate, between 33% and 66% of total cover is non-native
 3. Heavy, more than 66% of total cover is non-native
- Not Applicable

Estimated area of identifiable vegetation viewed:

Enter a rough estimate of the **percent of the polygon** that you were able to assess from your point AND any additional area that you were able to view while driving or walking around or through the polygon.

Is this a "multiple" point assessment?:

Circle **NO** or **YES**. If Yes, fill in the sequence and total number of points for this polygon (e.g., 1 of 2 points for this polygon).

ACCURACY ASSESSMENT FORM

Accuracy Assessment Form

(Revised October 3, 2023)

Surveyor: _____		Other Surveyors: _____		Date: _____		<input type="checkbox"/>							
Location Name: _____								<input type="checkbox"/>					
Waypoint ID:	GPS Name _____		Projected? Yes / No / Base					<input type="checkbox"/>					
	If Yes, enter: Distance (m): _____		Bearing (°): _____		Inclination (°): _____			<input type="checkbox"/>					
	If Yes, enter: Base Waypoint ID: _____												
	Polygon UID:				Record either UTM's or Decimal Degrees								
					Zone: 11 NAD83								
				Base UTM's / Projected UTM's (circle one)				GPS error: ft / m / PDOP _____					
				UTME _____ UTMN _____									
				Decimal degrees: LAT _____ LONG _____									
Camera name: _____				Photo #s: _____									
Strata	Species	% cover	C	Strata	Species	% cover	C	<input type="checkbox"/>					
Notes:								<input type="checkbox"/>					
Map Unit Name: _____				Secondary: _____				<input type="checkbox"/>					
Confidence in map unit ID: L M H Explain:								<input type="checkbox"/>					
Describe above:	Linework problems <input type="checkbox"/>		More than 1 vegetation type in this polygon <input type="checkbox"/>		Vegetation change since imagery taken <input type="checkbox"/>			<input type="checkbox"/>					
Field Alliance: _____				Field Association: _____				<input type="checkbox"/>					
Conifer Cover: _____		Hardwood Cover: _____		Total Tree Cover: _____		Shrub Cover: _____		<input type="checkbox"/>					
Herb Cover Class		<2%	2-9%	10-40%	>40%			<input type="checkbox"/>					
Tree Height		<0.5m	0.5-1m	1-2m	2-5m	5-10m	10-15m	15-20m	20-35m	35-50m	>50 m	NA	<input type="checkbox"/>
Tree DBH : T1 (<1" dbh), T2 (1-6" dbh), T3 (6-11" dbh), T4 (11-24" dbh), T5 (>24" dbh), T6 multi-layered (T3 or T4 layer under T5, >60% cover)													<input type="checkbox"/>
Exotics (relative cover)				None or not visible		<33%	33-66%	>66%	NA		<input type="checkbox"/>		
Estimated % of polygon viewed _____				Is this a multiple point assessment? No / Yes		If "Yes," point _____ of _____			<input type="checkbox"/>				

E - 1

Pfl. Map Use Name	Final Map Class																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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APPENDIX F: GLOSSARY OF TERMS & LIST OF ACRONYMS

Adapted from the 2021 Desert Renewable Energy Program Mapping Report (Reyes et al. 2021)

Absolute cover – Refers to the actual percentage of the ground (surface of the plot or stand) that is covered by a species or group of species. Absolute cover of all species or groups if added in a stand or plot may total greater or less than 100% because it is not a proportional number.

Aeolian – landforms or sediment that is shaped by wind.

Alliance – Plant communities based on dominant/diagnostic species of uppermost or dominant stratum. Part of the National Vegetation Classification System (NVCS) hierarchy.

Association – The most botanically detailed plant community designation based on dominant species and multiple co- or subdominant indicator species from any strata. Part of the NVCS hierarchy.

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

Characteristic – Present in at least 75% of the samples for that vegetation type, with no restriction on cover.

Co-dominant – Two or more abundant species with high cover in relation to other species in the layer with the highest canopy cover. We typically define co-dominant species as those with at least 30% relative cover.

Cover – The primary metric used to quantify the abundance of a particular species or a particular vegetation layer within a plot. It was measured by estimating the aerial extent of the living plants, or the “bird’s-eye view” looking from above for each category.

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

Dense/Continuous cover – Used to describe individual layers of vegetation (tree, shrub, herb, or subdivisions of them) where there is greater than 66 percent absolute cover.

Desiccation – the state of being thoroughly dried up.

Dominant – An abundant species with high cover in relation to other species in the layer with highest canopy cover. We typically define dominant species as those with at least 50% relative cover within a particular layer.

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

Endemic – A species whose distribution is limited or restricted to a certain place.

Emergent – A plant (or vegetation layer) is considered emergent if it includes plants that rise above a predominant vegetation layer, but that are sparse in cover. It is considered as a member of the next tallest layer but typically has an absolute cover < 10%.

Erg – an inland aeolian (wind-blown) sand system or dune field

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

Group – a vegetation classification unit of intermediate rank (6th level) defined by combinations of relatively narrow sets of diagnostic plant species (including dominants and co-dominants), broadly similar composition, and diagnostic growth forms that reflect biogeographic differences in mesoclimate, geology, substrates, hydrology, and disturbance regimes.

Halophyte – salt tolerant plant that grows in soil or waters with high salinity.

Herb – Is any vascular plant species that has no main woody stem-development, and includes grasses, forbs, and perennial species that die-back seasonally.

Macrogroup – a vegetation classification unit of intermediate rank (5th level) defined by combinations of moderate sets of diagnostic plant species and diagnostic growth forms that reflect biogeographic differences in composition and sub-continental to regional differences in mesoclimate, geology, substrates, hydrology, and disturbance regimes.

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

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

Miscellaneous Classes – mapping classes that describe built-up or anthropogenically altered features, such as urban areas, agricultural fields, and aqueducts.

Open – Used to describe individual layers of vegetation (tree, shrub, herb, or subdivisions of them) where the cover is less than 33 percent absolute cover.

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

Playa – the sandy, salty, or mud-caked flat floor of a desert basin having interior drainage, usually occupied by a shallow lake during or after prolonged, heavy rains.

Producer – Producer refers to the mapper, or photo-interpreter, which determined the vegetation or mapping type in the map.

Provisional Mapping Units – Mappable vegetation types that do not fit into the current classification and currently lack data to be defined in the MCV.

Psammophytic – a plant that grows in sand or sandy soil.

Relative cover – Refers to the amount of the surface of the plot or stand sampled that is covered by one species (or physiognomic group) as compared to (relative to) the

amount of surface of the plot or stand covered by all species (in that group). Thus, 50% relative cover means that half of the total cover of all species or physiognomic groups is composed of the single species or group in question. Standardized layers of herb, shrub, and tree are used to determine relative cover. Relative cover values are proportional numbers and, if added, total 100% for each stand (sample).

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

Semi-natural vegetation – Stands characterized by naturalized non-native species. Note that NVC vegetation types use “ruderal” to describe these plant communities.

Shrub – Is normally a multi-stemmed woody plant that generally has several erect, spreading, or prostrate stems and that is usually between 0.2 meters and 5 meters tall, giving it a bushy appearance. Definitions are blurred at the low and the high ends of the height scales. At the tall end, shrubs may approach trees in size (such as *Senegalia greggii*). At the low end, woody perennial herbs or sub-shrubs of various species are often difficult to categorize into a single life-form; usually sub-shrubs (per USDA-NRCS 2014) were categorized in the “shrub” category.

Signature – the visual characteristics of objects on an aerial photograph that allow one to differentiate them. The characteristics include tone, shape, size, pattern, texture, and shadow.

Sometimes – Present in 25 to 50% of the samples with no restriction on cover.

Sonoran Basin and Range Ecoregion – areas fall within the Colorado Desert section of the Sonoran Desert, the areas west of the Colorado River, which generally lack regular summer rainfall and where temperatures are hotter than the rest of the Sonoran Desert.

Sparse – Used to describe individual layers of vegetation (tree, shrub, herb, or subdivisions of them) where the *average* cover value is <2% absolute cover (though the range in cover could be <1-9% cover).

Stand – The basic physical unit of vegetation in a landscape. It has no set size. Some vegetation stands are very small such as wetland seeps, and some may be several square kilometers in size such as desert or forest types. A stand is defined by two main unifying characteristics:

It has *compositional* integrity. Throughout the site, the combination of species is similar. The stand is differentiated from adjacent stands by a discernable boundary that may be abrupt or gradual.

It has *structural* integrity. It has a similar history or environmental setting, affording relatively similar horizontal and vertical spacing of plant species. For example, a hillside forest formerly dominated by the same species, but that has burned on the upper part of the slope and not the lower is divided into two stands. Likewise, a sparse woodland

occupying a slope with shallow rocky soils is considered a different stand from an adjacent slope of a denser woodland/forest with deep moister soil and the same species.

Sub-dominant – Used to describe an important species in the stand that is less than 30% relative cover.

Taxon (taxa pl.) – Taxonomic group of organisms, referred to by minimum rank, either species, subspecies, or variety

Tree – Is a one-stemmed woody plant that normally grows to be greater than 5 meters tall. In some cases, trees may be multiple stemmed (ramifying) after fire or other disturbance, but size of mature plants is typically greater than 5 m and undisturbed individuals of these species are usually single stemmed.

User – User refers to the team in the field determining the type in the accuracy assessment process.

Usually/Often – Present in 50 to 75% of the samples, with no restriction on cover.

List of Acronyms Used

AA – Accuracy Assessment

AIS – Aerial Information Systems, Inc.

CalIPC – California Invasive Plant Council

CCB – Center for Conservation Biology

CCH2 – California Consortium of Herbaria 2

CDFG – California Department of Fish and Game

CDFW – California Department of Fish and Wildlife (name changed 1/1/13)

CIR – Color Infrared

CNDDb – California Natural Diversity Database

CNPS – California Native Plant Society

CPAD – California Protected Areas Database

CVCC – Coachella Valley Conservation Commission

CVMSHCP – Coachella Valley Multiple Species Habitat Conservation Plan

DRECP – Desert Renewable Energy Conservation Plan

ESRI – Environmental Systems Research Institute

GIS – Geographic Information System

GPS – Global Positioning System

HxGN – Hexagon Imagery Extends California

MMU – Minimum Mapping Unit

MMW – Minimum Mapping Width

NAIP – National Agricultural Imagery Program

NVCS – National Vegetation Classification Standards

OHV – Off-Highway Vehicle

PI – Photointerpretation, photo interpreter

SNCs – Sensitive Natural Communities

SCV – Survey of California Vegetation

UCR – University of California, Riverside

USGS – US Geological Survey

VegCAMP – Vegetation Classification and Mapping Program