Coachella Valley Conservation Commission

September 30th, 2019

Coachella Valley Multiple Species Habitat Conservation Plan &

Natural Community Conservation Plan

Valley Floor Reserve Units

2013 & 2018 Vegetation Map Report

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Final report

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EXECUTIVE SUMMARY

The University of California Riverside's Center for Conservation Biology (CCB) has created fine-scale vegetation maps for a number of Conservation Areas under the jurisdiction of the Coachella Valley Multiple Species Habitat Conservation Plan (CVMSHCP) under contract with the Coachella Valley Conservation Commission (CVCC). The primary purpose for creating these maps is provide a landscape-scale approach to monitoring changes due to land use, invasive species, recreation, hydrology, and climate. These digital maps, documenting changes and their causes, are then tools for prioritizing future conservation actions. The vegetation classification follows Federal Geographic Data Committee (FGDC) and National Vegetation Classification Standards (NVCS; Federal Geographic Data Committee 2008). The classification is meant to align with previous and concurrent efforts previous survey and classification work done by California Department of Fish and Wildlife's Vegetation Classification and Mapping Program (VegCaMP) and Aerial Information Systems (AIS) for the Desert Renewable Energy Conservation Plan Area as well as the southeastern Salton Sea Mid-Desert Area, and by the National Park Service for Joshua Tree National Park. This unit was mapped using the California Department of Fish and Wildlife (CDFW) and California Natural Plant Society Combined (CNPS) Vegetation Classification and Mapping Program protocol (CNPS 2014).

The primary purpose was to develop a dynamic and accurate vegetation map for the Coachella Valley Floor Reserve Management Unit (Figure 1), so that it may be applied to further conservation efforts and assist with management of the 27 species and 27 natural communities listed within the plan. Map polygons were assessed for vegetation type, percent cover, presence of exotics, anthropogenic disturbance, and roadedness.

This map and report describes a map correction for the year 2013 as well as an updated map for the year 2018 for the area within the 95,000 acres that fall within the 18 CVMSHCP Management Units on the Coachella "Valley Floor." Within the study areas, rapid assessment protocol vegetation plots, basic vegetation assessment plots and supplemental reconnaissance observations were obtained within the study at pre-determined points in order to document the plant community, disturbances, and invasive species across space and types. Heads-up photo- interpretation of 2013 local flight true-color imagery, fine-scale National Agriculture Imagery Project (NAIP) imagery (USDA, 2012, 2014, 2016 and 2018) and field information were combined to produce delineations of vegetation alliances and associations according to the California Department of Fish and Wildlife classification system, outlined in the Manual of California Vegetation (MCV) Second Edition (Sawyer *et al.* 2009).

The first version of the Valley Floor final vegetation map was completed in 2014, however, the map will be referred to as a corrected 2013 map to match the imagery date. For the present 2013 map correction, the classification of the original map was updated to match alliance and association names used in the MCV online. For the 2018 map update, additional field data was collected in 2018, which was incorporated into the both the 2013 map correction (as

appropriate) and the 2018 map update. The 2018 map delineation was done by photo-interpretation of updated imagery, with a focus on stand changes, mortality, cover and land use changes, and other anthropogenic changes. There were 187 total vegetation assessments done in 2014, documenting plant community cover generally following the guidelines in the CNPS 2011 Vegetation Rapid Assessment Protocol (CNPS 2011). For the 2013 map correction and the 2018 map, 116 Rapid Assessments were recorded throughout the area using the updated Rapid Assessment protocol (CNPS 2016) from December 2017 through February 2018.

To better focus on conservation of particular habitats, there are several alliances where the minimum mapping unit (MMU) is less than an acre; including *Prosopis glandulosa* Woodland Alliance, and *Washingtonia fillifera* Shrubland Alliance, as well as wetlands and certain wash types which displayed complexity that would necessitate delineation. In order to better delineate habitat for the aeolian suite of species covered under the Plan, the following provisional alliances were used: Dicoria canescens--Oenothera deltoides Sparsely Vegetated Active Dune Provisional Alliance; Larrea tridentata / Abronia villosa Stabilized Sand Fields Provisional Alliance; and Psorothamnus arboresens / Dicoria canescens Ephemeral Sand Fields Provisional Alliance.

Because of the very small detectable changes in vegetation cover and the short time period between maps (5 years) as well as the difficulty reliably detecting true changes in live cover due to imagery limitations the following changes should be in interpreted as preliminary findings. The largest amount of land cover for both 2013 and 2018 maps is classified under the *Larrea tridentata -- Encelia farinosa* Shrubland Alliance, representing over 10,000 hectares followed by the *Larrea tridentata -- Ambrosia dumosa* Shrubland Alliance at almost 7,000 hectares. The largest mapped declines in area from 2013-2018 type mapped were the *Larrea tridentata -- Ambrosia dumosa,* the *Atriplex canescens* type (-81 ha) and the *Tamarix* spp. type (-27 ha). The largest increases were in the Disturbed/Built-up (+114 ha) and the Non-vegetated Habitat types (Table 1). Shrub cover was characterized by an increase in areas with no or 0-1% cover, and a decrease overall in areas with 1-50% cover overall. In terms of roadedness, development, and anthropogenic alteration, there was a general trend towards an increase in the area demonstrating anthropogenic disturbance overall, and less overall area showing no disturbance.

Overall, an increase in anthropogenic effects and a decrease in shrub cover reflects an area that is still subject to human pressure, despite protection under the CVMSCHP. This map should continue to guide land management efforts in terms of condition and threats to specific habitat, and any necessary changes in management to meet the objectives laid out in the Plan.

INTRODUCTION

Conservation Background

This vegetation map is a tool to aid in species monitoring and management in the Valley Floor area of the Coachella Valley Multiple Species Habitat and Natural Community Conservation Plan (CVMSHCP/NCCP). At the end of the twentieth century, 27 species and 27 vegetation communities in the Coachella Valley were identified as being affected by pressures of land development and conversion of habitats. The most direct threat to the biodiversity of the area is habitat loss. From 1996 to 2008, citizens, scientists, land managers, and federal and state agencies of the Valley developed a conservation plan that offered protection to these species and preserved over 250,000 acres of open space (Figure 1). The plan was approved by federal and state agencies and was implemented in 2008, all cities involved in the collaborative effort. This comprehensive land planning essentially protects the ecological drivers and processes to enhance sustainability of community biodiversity. The plan is science-based and investigates hypotheses related to the persistence of species on conservation lands through adapting monitoring and management.

The vegetation mapping is funded by the Coachella Valley Conservation Commission to provide data on characteristics of the vegetation within the Plan Area and to complement concurrent species and habitat monitoring. The outdated map, created before 1999, was based on the older Holland classification (Holland 1986). As part of the CVMSHCP/NCCP monitoring program, a phased work plan to remap all 746,000 acres of our Conservation Areas began in 2012.

Updated vegetation maps are an essential element of monitoring for covered species and natural communities and provide a baseline to monitor natural communities and landscape-scale vegetation change. These data are key to conservation of biological diversity in the Plan area, especially given the impacts of increasing periods of drought and the effects of climate change. Understanding habitat requirements, extent and spatial continuity for species will help to guide the development of land management actions that support recovery and sustainability of healthy populations. Data produced under this effort is publicly available and supports concurrent CVMSHCP/NCCP monitoring.

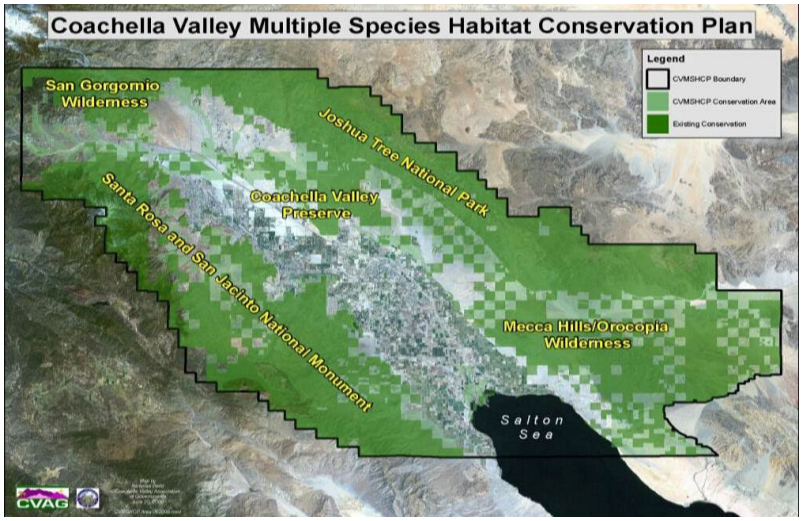

Figure 1: Coachella Valley Multiple Species Habitat Conservation Plan Boundary in relation to Joshua Tree National Park, the Santa Rosa and San Jacinto National Monument, the Coachella Valley USFWS Preserve, Wilderness areas, and the Salton Sea.

Geography and Climate

The Coachella Valley is situated in the Colorado Desert in the northwest portion of the much larger Sonoran Desert, and consists of a variety of habitats. One hundred miles east of Los Angeles, California, it is bordered on the west by the San Jacinto, San Gorgonio, and Santa Rosa Mountain Ranges. The Valley lies at the northwest end of the Colorado Desert, and to the east of the Valley lies the Salton Sea. The Coachella Valley is an extremely arid desert region that is characterized by aeolian sand communities, fan palm oases, creosote shrub, alluvial fan, and salt scrub communities.

Precipitation is the primary driver for vegetation growth in the Coachella Valley, which experiences both summer and winter precipitation events. Rains are highly variable from year to year, but tend to be more frequent at the far west end of the valley, due to the rain shadow of the San Jacinto, Santa Rosa, and San Bernardino mountain ranges. This causes a gradient of increasing temperature and aridity from west to east, as elevation decreases. During rare monsoonal events in July to September, weather systems that originate in the Gulf of Mexico, bring heavy but isolated thunderstorms to the valley. During average years, the greatest proportion of the annual rainfall comes from winter rains, which originate in the northwest and move into the area in October through May.

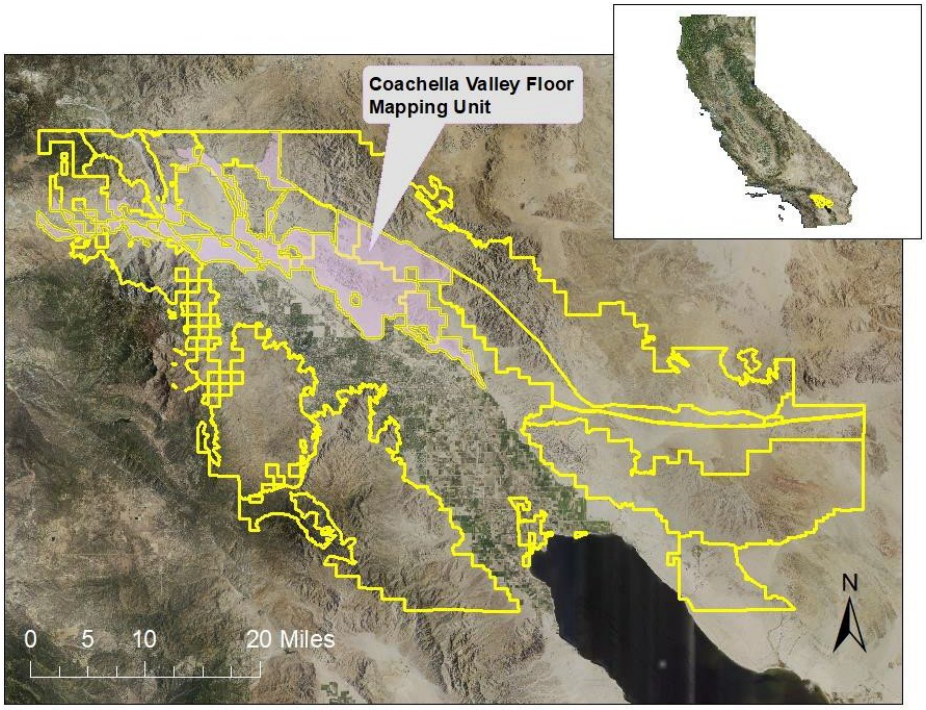

Figure 2. Areas of conservation within the Multiple Species Habitat Conservation Plan Conservation areas (in yellow) that were described in the Coachella Valley Floor Vegetation Map (in lavender).

The Valley Floor Vegetation Mapping Unit:

Cabazon, East Indio Hills, Indio Hills Palms, Indio Hills/Joshua Tree National Park Linkage, West Deception Canyon, Thousand Palms, Edom Hill, Willow Hole, Long Canyon, Whitewater Floodplain and the Highway 111 /I-10, Upper Mission Creek/Big Morongo Canyon, Snow Creek/Windy Point, Stubbe and Cottonwood Canyon Conservation Areas

The conservation areas in this mapping unit comprise a band of fragmented habitat from the Banning Pass, along the I-10 corridor north of the major urban areas, ending on the eastern end of the Indio Hills, near the base of the Fargo Canyon alluvial plain. The landownership within the conservation areas mapped is a mix of Federal and Tribal Lands (~35%), Private lands (~25%), county and local government (~20%), state government (~10%), private conservation (5%) and utility (1%) (Riverside County Data, 2019) in over 6,000 parcels. The unit abuts several federally-designated wilderness areas, including the San Jacinto Wilderness to the southwest, the Mecca Hills Wilderness to the southeast, the Joshua Tree Wilderness to the north and the San Gorgonio Wilderness to the northwest.

This mapping unit includes wildlife corridors which traverse Interstate 10 and provide a critical corridor between the Peninsular (San Jacinto Wilderness) and Transverse (San Gorgonio and Joshua Tree Wilderness) mountain ranges. The upland areas run into the Mojave Desert

transition zone, characterized by oaks and junipers at upper elevations. In the lowland areas, this unit is characterized by desert scrub and annual plant communities typical of the Colorado Desert. Here, these lands encompass the type of aeolian habitats (active dune, and sand fields) that have been heavily reduced from development pressures over the past century. This unit encompasses habitat for many of the Plan's listed species inhabiting the more mesic end of the valley into transition habitats, such as the Le Conte's Thrasher (*Toxostoma lecontei*) and the triple-ribbed milkvetch (*Astragalus tricarinatus*), as well as species that inhabit the aeolian habitats on the valley floor, such as the Coachella Valley Fringe-Toed Lizard and the Coachella Valley Milkvetch (*Astragalus lentiginosus* var *coachellae*). For details about each of the mapping units, conservation goals and conserved habitat, the interested reader is directed to the Plan documents.

This group of units also arguably faces the most intense anthropogenic pressures within the Plan area. Even within Conservation Areas, the patchwork of multiple landownership, each with particular regulatory environments creates challenges for management. As well, the pressures of sanctioned and unsanctioned disturbance threaten natural communities, such as development, new roads, maintenance activities, and other anthropogenic change/disturbance (e.g. hydrologic regime). The habitat within these units are pieces of a fragmented landscape, and with an increase in boundary area as compared to land area (wildland-urban interface), these areas face greater threats from abutment of urban and suburban areas, coming as foot traffic, debris, off- highway vehicle tires, and invasive species. Beyond the physical incursions of disturbance, these areas are also under threat from a shift to a hotter and drier climate as a result of climate changes, and deposition of nitrogen from air pollution. Thus, a great effort was made to detect and attribute the updated map with any shifts in natural communities that have occurred.

RECONNAISSANCE

Field visits throughout the mapping area allowed CCB staff to better match types detected on aerial imagery to the identity of the dominant tree/shrub cover on the ground. Photo interpreters identified photo signatures by evaluating ecological characteristics of each vegetation type relation to landscape characteristics such as topographic features. For the first iteration of the 2013 map, between March 2013 and April 2014, CCB staff trained with Joshua Tree National Park vegetation ecologists and then conducted surveys throughout the mapping area as a reconnaissance of vegetation types. There were 187 total vegetation assessments done in 2014, documenting plant community cover generally following the guidelines in the

CNPS 2011 Vegetation Rapid Assessment Protocol (CNPS 2011). For the 2013 map correction and the 2018 map, 116 Rapid Assessments were recorded throughout the area using the updated Rapid Assessment protocol (CNPS 2016) from December 2017 through February 2018. Additional reconnaissance information was drawn from CCB surveys throughout the area in coordination with other monitoring and research activities (Figure 3).

The aim was to gather information from across the mapping unit, especially in a diversity of habitats and in areas where little was known about the vegetation types from previous visits. At each point, a minimum of live cover by perennial species was documented, along with additional information such as disturbance and cardinal photos (available upon request). 2018 Rapid Assessments included the full suite of data required on the Rapid Assessment Protocol form (CNPS 2016).

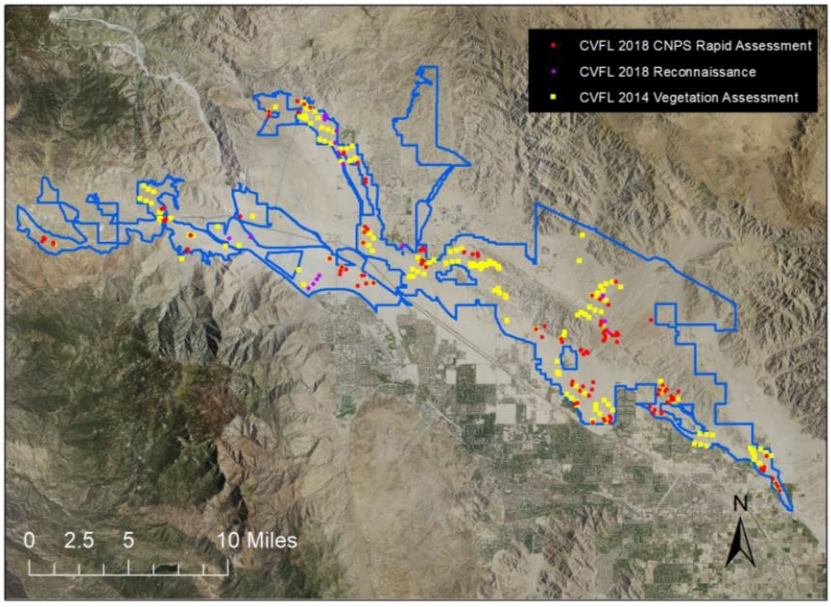

Figure 3: Distribution of 2014 (2013 map) basic Vegetation Assessments, 2018 Rapid Assessments and 2018 reconnaissance visits within the vegetation mapping area, in the Coachella Valley, California.

DELINEATION

Lines are drawn both to distinguish between alliance and association types and to indicate vegetation cover and landscape variables within a type, generally following Menke and others (2013). Due to the fine resolution of the 2013 aerial imagery provided by the Coachella Valley Conservation Commission (three inch resolution, true-color imagery), the photo interpreter drafted boundaries separating vegetation types (Alliances) at 1:1500 scale and attributed other categories using field information and relevant datasets. Additional information, from color-

infrared 2014 fine-scale National Agriculture Imagery Project (NAIP) imagery (USDA, 2014), was used to assess the amount of live cover.

The 2018 map update was begun using the delineations from 2014. The photo interpreter used 2016 and 2018 NAIP RGB and color-infrared imagery to assess each polygon and determine if the boundary, alliance, association, cover class or any other category (as below) had changed sufficiently (as in changed cover or category classes) to warrant a map change. As necessary, further corrections were made to the 2013 map if prior errors or additional field information was significant enough to warrant a change. Unfortunately, there was not adequate funding to acquire for 2018 true-color imagery at a similar (3 inch resolution) resolution to 2013. In addition, the 2018 NAIP flight data were taken in October of 2018 (according to the metadata), whereas the NAIP program flights are usually flown in the springtime and the data itself was available starting April of 2019. These factors led not only a delay of the mapping effort, but also a problem with interpretation of live % cover using the color-infrared data, because of differences

in spring vs. fall phenology. Where indicated, the photo-interpreter used 2016 NAIP data to confirm major changes seen in live % cover. However, the lack of matching and adequate aerial imagery did negatively impact this effort.

Percent cover was attributed to each polygon for tree and shrub cover, and as available from field surveys, for the herbaceous cover. For most of the open desert, cover did not exceed 25% except in smaller polygons delineating riparian areas, Mesquite bosques or California fan palm oases.
Additionally, percent cover of exotic species (as available), roadedness, anthropogenic alteration and development were quantified (see Menke 2013 for cover classes/categories). Generally, polygons were mapped to a 2.5 acre minimum mapping unit (MMU), but specialized and important vegetation, Mesquite bosques and California fan palm oases, were mapped with no minimum MMU with the aim of detecting fine-scale change in stand distribution. Therefore, for other purposes, such as comparison with other regional vegetation maps, these types may need to be aligned with other protocols.

CLASSIFICATION OF VEGETATION FOR THE MAPPING AREA

The map classification is based largely on work done in areas for previous and ongoing projects: Vegetation Mapping of Anza-Borrego Desert State Park and Environs (Keeler-Wolf *et al.* 1998), the Western Riverside County MSHCP Vegetation Map (2004), Vegetation of Joshua

Tree National Park (La Doux *et al.* 2013), and the Vegetation Map in Support of the Desert Renewable Energy Conservation Plan (Menke, 2013) and by the UCR Center for Conservation Biology in previous maps (most recently Sweet et al. 2017).

There are several new provisional alliances developed from our previous work in the CVMSHCP area, including the Mecca Hills and Orocopia Mountains Map (2016) and the Dos Palmas Conservation Area Map (2016); these new provisional alliances are described in the respective reports. Any provisional alliance that has not been yet adopted into the MCV schema as reflected in the MCV online (http://vegetation.cnps.org/, accessed June 2017) are still listed as "Provisional" in this map and geodatabase.

Several dune classifications were required to better delineate between conservation areas in aeolian sand fields, ephemeral sand fields, and stabilized sand fields, as the CVMSHCP identifies these sand-transport areas as vital to the health of the ecosystem. They do not exist as part of the MCV, but are included here to assist with conservation monitoring and management of these types and area extents locally for the federally-endangered Coachella Valley fringe-toed lizard, and Coachella Valley milkvetch and the flat tailed horned lizard. In order to differentiate these areas from a description of the substrate (e.g. "dune") and general types (e.g. "non- vegetated habitat"), or the *Dicoria canescens—Abronia villosa* general type listed in the MCV, the following provisional alliances were used: *Dicoria canescens--Oenothera deltoides* Sparsely

Vegetated Active Dune Provisional Alliance; *Larrea tridentata / Abronia villosa* Stabilized Sand Fields Provisional Alliance; and *Psorothamnus arboresens / Dicoria canescens* Ephemeral Sand Fields Provisional Alliance. These types, while likely sampled adequately, need to be summarized and the data analyzed before being proposed to the NVCS.

In some areas, non-native species are so prevalent that they are the dominant cover within the ecosystem and are recognized as distinctive vegetation types in California, including *Bromus rubens* / *Schismus barbatus* Semi-Natural Herbaceous Stands and *Tamarix* spp. Semi-natural Shrubland Stands (Sawyer et al. 2009). In these cases, the "exotic species cover" field was entered, even without field sampling. In all other cases, these were not entered, as the presence of exotic annual species was not adequately documented.

Other than the sand and dune types, the desert pavement type and the exotic annual grass type, there are two other mapping classes that have less than 2% woody vegetation cover: the Disturbed/Built-Up type, and a generic Non-vegetated Habitat type. In cases of cleared/bulldozed land, the photo interpreted chose to generally designate "Disturbed/Built-

Up" if the clearing appeared to be thorough and semi-permanent, whereas the Non-vegetated Habitat type would be used if the clearing appeared to be from e.g. OHV's, fire, or other non-deliberate means. In some cases, especially in the western end of the Coachella Valley, there is sufficient rainfall to support non-native grass stands that meet the *Bromus rubens / Schismus barbatus type*, such as in areas that may have been cleared for cattle grazing or ranching. In these cases, the exotic grass type was used. The interpreter recognizes that there is some ambiguity regarding these categories, especially in the western end of the mapping area in this desert region and therefore, these should be interpreted with some caution.

The nested hierarchy, including the Macrogroup and Group, was based on the National Vegetation Classification System (Federal Geographic Data Committee 2008); specifically, the recommendations of Evens (2014) to align the NVCS with the Manual of California Vegetation (Sawyer *et al.* 2009).

FINDINGS

The vegetation map for the Valley Floor Mapping Unit of the Coachella Valley Multiple Species Habitat Conservation Plan includes 1183 polygons (2013) and 1214 polygons (2018) with 41 Alliances (2013 and 2018) and 81 (2013) and 82 (2018) Associations (Table 1; Appendix Tables 1 & 2). Because of the very small changes in vegetation cover and the difficulty reliably detecting true changes in live cover, the following changes should be in interpreted as preliminary findings. The changes noted here are changes in the amount of area per category; as the attribute data is categorical (the categories are also uneven and not a proxy for continuous data) analysis showing average changes over space were not possible. Some of the changes found may be artifacts of the mapping process. For instance, for the disturbance categories, these may be affected by changes such as polygons being split or reassigned, and the child polygons containing more or less of the disturbance type assigned to the parent polygon. However, to the degree that multiple indicators agree on the same directionality (increase or decrease), these may be taken as indications of likely changes in the landscape.

The largest amount of land cover for both 2013 and 2018 maps is classified under the *Larrea tridentata -- Encelia farinosa* Shrubland Alliance, representing over 10,000 hectares followed by the *Larrea tridentata -- Ambrosia dumosa* Shrubland Alliance at almost 7,000 hectares. The largest mapped declines in area from 2013-2018 type mapped were the *Larrea tridentata -- Ambrosia dumosa,* the *Atriplex canescens* type (-81 ha) and the *Tamarix* spp. type (-27 ha). The former may be due to conversion to other types, such as the disturbance-responsive *Encelia*

farinosa type (+28.5 acres) or conversion to non-vegetated habitat (+60 ha). The latter may be due to invasive plant control and management activities. The largest increases were in the Disturbed/Built-up (+114 ha) and the Non-vegetated Habitat types (Table 1).

Alliance Name	ALLIANCE AREA (ha) 2013	ALLIANCE AREA (ha) 2018	Difference (ha)
Acacia greggii Shrubland Alliance	739.5	729.2	-10.3
Ambrosia dumosa Shrubland Alliance	109.6	113.1	3.5
Ambrosia salsola Shrubland Alliance	1752.1	1749.4	-2.7
Atriplex canescens Shrubland Alliance	727.7	678.8	-48.9
Atriplex canescens--Atriplex polycarpa Shrubland Provisional Alliance	57.3	57.2	-0.1
Atriplex lentiformis Shrubland Alliance	0.4	0.4	0.0
Atriplex polycarpa Shrubland Alliance	35.7	35.7	0.0
Bromus rubens--Schismus (arabicus & barbatus) Herbaceous Semi-Natural Alliance	151.1	133.6	-17.5
Chilopsis linearis Woodland Alliance	344.8	353.6	8.8
Dicoria canescens--Oenothera deltoides Sparsely Vegetated Active Dune Provisional Alliance	174.0	174.4	0.4
Disturbed/built-up	1323.7	1438.1	114.4
Encelia farinosa Shrubland Alliance	978.9	1007.4	28.5
Ephedra californica Shrubland Alliance	99.9	99.9	0.0
Ericameria paniculata Shrubland Alliance	331.9	331.9	0.0
Geraea canescens--Chorizanthe rigida Desert Pavement Annual Herbaceous Alliance	1029.2	1028.2	-1.0
Hyptis emoryi Shrubland Alliance	53.9	53.9	0.0
Isocoma acradenia Shrubland Provisional Alliance	6.1	6.1	0.0
Juniperus californica Woodland Alliance	329.8	329.8	0.0
Larrea tridentata / Abronia villosa Stabilized Sand Fields Provisional Alliance	2146.3	2134.4	-11.9
Larrea tridentata Shrubland Alliance	3163.3	3180.8	17.5
Larrea tridentata--Ambrosia dumosa Shrubland Alliance	7492.4	7411.4	-81.0
Larrea tridentata--Encelia farinosa Shrubland Alliance	10118.0	10115.5	-2.5
Lepidospartum squamatum Shrubland Alliance	820.1	805.4	-14.7
Non-vegetated Habitat (less than 2% absolute cover)	3783.4	3843.6	60.2
Parkinsonia florida--Olneya tesota Woodland Alliance	32.9	32.9	0.0
Peucephyllum schottii Provisional Shrubland Alliance	9.9	9.9	0.0
Phragmites australis Herbaceous Alliance	2.1	2.8	0.7
Pleuraphis rigida Herbaceous Alliance	101.1	101.1	0.0
Pluchea sericea Shrubland Alliance	8.7	9.0	0.3
Populus fremontii Forest Alliance	3.6	3.6	0.0
Prosopis glandulosa Woodland Alliance	169.4	160.7	-8.8
Psorothamnus arboresens / Dicoria canescens Ephemeral Sand Fields Provisional Alliance	358.5	351.9	-6.6
Psorothamnus schottii Shrubland Provisional Alliance	602.6	602.6	0.0
Psorothamnus spinosus Woodland Alliance	107.2	105.8	-1.5

Quercus cornelius-mulleri Shrubland Alliance	28.5	28.5	0.0
Rhus ovata Shrubland Alliance	1.2	1.2	0.0
Salix exigua Shrubland Alliance	1.6	1.6	0.0
Suaeda moquinii Shrubland Alliance	4.0	4.0	0.0
Tamarix spp. Shrubland Semi-Natural Alliance	70.7	43.8	-26.9
Viguiera parishii Shrubland Alliance	2.3	2.3	0.0
Washingtonia filifera Woodland Alliance	26.4	26.2	-0.3

Table 1: Vegetation cover alliance designations in the Coachella Valley Floor Mapping Unit. Shown is the amount of area mapped per alliance in the respective maps (2013 Map Correction, 2018 Map Update), and the absolute change in hectares.

In general, tree cover changes from 2013-2018 were mixed, with less area having no estimated tree cover, an increase in area having 0-1% trees (mainly influenced by an increase in disturbed/built-up areas with 0-1% urban-type tree cover), and with slight declines in the number of hectares with 1-25% cover of trees. Shrub cover was characterized by an increase in areas with no or 0-1% cover, and a decrease overall in areas with 1-50% cover overall (Table 2).

TREE COVER CATEGORY	2013 Area (ha)	2018 Area (ha)	Difference (ha)	Difference (%)
none	13300.4	13128.6	-171.8	-0.7
>0-1%	22344.8	22582.0	237.2	0.5
>1-5%	1119.7	1103.7	-16.0	-0.7
>5-15%	482.3	438.6	-43.8	-4.8
>15-25%	22.0	16.1	-5.9	-15.4
>25-50%	22.3	22.3	0.0	-0.1
>50-75%	8.3	8.6	0.3	1.9
>75-100%				

SHRUB COVER CATEGORY	2013 Area (ha)	2018 Area (ha)	Difference (ha)	Difference (%)
none	254.7	306.6276548	51.9	9.2
>0-1%	4624.2	4894.746207	270.6	2.8
>1-5%	14912.7	14719.50527	-193.2	-0.7

>5-15%	16041.0	15932.46632	-108.5	-0.3
>15-25%	1106.7	1086.71041	-20.0	-0.9
>25-50%	350.0	348.099469	-1.9	-0.3
>50-75%	5.8	7.231186	1.4	10.7
>75-100%	4.8	4.5	-0.3	0.0

Table 2: Tree and shrub cover categories mapped within the Coachella Valley Floor Mapping Unit and changes, 2013-2018. Shown is the amount of area mapped per category in the respective maps (2013 map correction, 2018 map update), and absolute change in hectares, and the percent change with respect to the category.

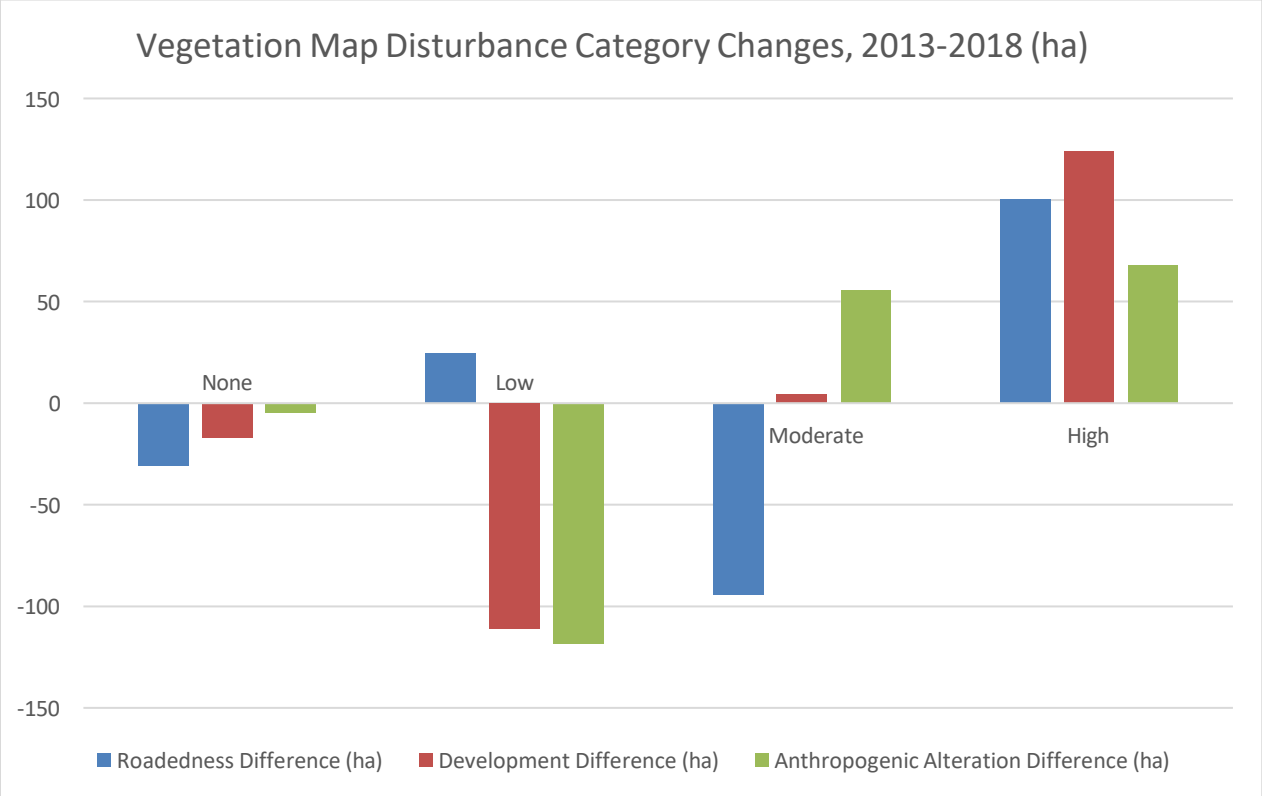

Figure 4: Changes in the area covered by disturbance categories for roadedness, development and anthropogenic alteration in the Coachella Valley Floor Mapping Unit from 2013 to 2018. Shown is the absolute change in hectares mapped per category.

As noted above, changes the area by disturbance type should be interpreted with caution based on artifacts of the mapping process itself. However, there was a general trend towards an increase in the area demonstrating anthropogenic disturbance overall, and less overall area showing no disturbance (Figure 4). While there was less area showing low development and

anthropogenic alteration, there was an increase in areas showing moderate or high levels of these disturbances. In terms of roadedness, the general pattern suggests that areas shifted from “none” to “low,” and from “moderate” to “high.”

SUMMARY AND RECOMMENDATIONS

The mapping was limited by available imagery, and in the future, fine-scale imagery that matches the original imagery with respect to resolution and phenology would be ideal to detect true change. This map reflects a conservative look at changes that may have occurred as the 2013 color-infrared NAIP is particular to a drought period in spring, and the 2018 NAIP reflects a return to normal precipitation in the fall.

Overall, an increase in anthropogenic effects and a decrease in shrub cover reflects an area that is still subject to human pressure, despite protection under the CVMSCHP. This map should continue to guide land management efforts in several ways. First, as it was intended, this map may be used to target areas of habitat for monitoring of the covered species under the Plan. Secondly, this map may indicate changes to the amount of habitat available, and human pressures/impacts on each specific area of land that may need to be addressed with management. Last, although most of the changes indicated should be investigated further, this map may help guide decisions overall about any broader problems that may indicate the need for new land management or protection that could be afforded.

In the context ongoing climate changes, these maps provide a baseline for further monitoring of the status of vegetation. The changes here indicate occurred as the Valley recovered from the 2011-2015 drought period, and thus are perhaps an optimistic look and not fully reflective of any long-term trajectory. Some types saw increases in cover, and others declined. Vegetation mapping as a tool, especially at scales of 1:1500 is not ideal to detect small, widespread changes. The mapper was only able to identify broad areas of change, and thus this effort should be repeated at a longer interval for these sparsely-vegetated types.

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APPENDIX TABLE 1: ALLIANCES IDENTIFIED

Alliance Name	Common Name
Acacia greggii Shrubland Alliance	Catclaw acacia thorn scrub
Ambrosia dumosa Shrubland Alliance	White bursage scrub
Ambrosia salsola Shrubland Alliance	Cheesebush scrub
Atriplex canescens Shrubland Alliance	Fourwing saltbush scrub
Atriplex canescens--Atriplex polycarpa Shrubland Provisional Alliance	Fourwing saltbush - allscale scrub
Atriplex lentiformis Shrubland Alliance	Quailbush scrub
Atriplex polycarpa Shrubland Alliance	Allscale scrub
Bromus rubens--Schismus (arabicus & barbatus) Herbaceous Semi-Natural Alliance	Red brome or Mediterranean grass grasslands
Chilopsis linearis Woodland Alliance	Desert willow woodland
Dicoria canescens--Oenothera deltoides Sparsely Vegetated Active Dune Provisional Alliance	Desert twinbugs - birdcage primrose active dunes
Disturbed/built-up	Disturbed/built-up
Encelia farinosa Shrubland Alliance	California brittle bush scrub
Ephedra californica Shrubland Alliance	California joint fir scrub
Ericameria paniculata Shrubland Alliance	Black-stem rabbitbrush scrub
Geraea canescens--Chorizanthe rigida Desert Pavement Annual Herbaceous Alliance	Desert Gold -- Spiny Herb Desert Pavement Annual Herbaceous Alliance
Hyptis emoryi Shrubland Alliance	Desert lavender scrub
Isocoma acradenia Shrubland Provisional Alliance	Alkali goldenbush scrub
Juniperus californica Woodland Alliance	California juniper woodland
Larrea tridentata / Abronia villosa Stabilized Sand Fields Provisional Alliance	Creosote bush / sand verbena stabilized sand fields
Larrea tridentata Shrubland Alliance	Creosote bush scrub
Larrea tridentata--Ambrosia dumosa Shrubland Alliance	Creosote bush - white burr sage scrub
Larrea tridentata--Encelia farinosa Shrubland Alliance	Creosote bush - brittle bush scrub
Lepidospartum squamatum Shrubland Alliance	Scale broom scrub
Non-vegetated Habitat (less than 2% absolute cover)	Non-vegetated habitat
Parkinsonia florida--Olneya tesota Woodland Alliance	Blue palo verde - ironwood woodland
Peucephyllum schottii Provisional Shrubland Alliance	Pygmy-cedar scrub
Phragmites australis Herbaceous Alliance	Common reed marshes
Pleuraphis rigida Herbaceous Alliance	Big galleta shrub-steppe
Pluchea sericea Shrubland Alliance	Arrow weed thickets
Populus fremontii Forest Alliance	Fremont cottonwood forest
Prosopis glandulosa Woodland Alliance	Mesquite bosque, mesquite thicket
Psorothamnus arboresens / Dicoria canescens Ephemeral Sand Fields Provisional Alliance	California indigo bush - desert twinbugs ephemeral sand fields
Psorothamnus schottii Shrubland Provisional Alliance	Schott's indigobush scrub
Psorothamnus spinosus Woodland Alliance	Smoke tree woodland

Quercus cornelius-mulleri Shrubland Alliance	Muller oak chaparral
Rhus ovata Shrubland Alliance	Sugarbush chaparral
Salix exigua Shrubland Alliance	Sandbar willow thickets
Suaeda moquinii Shrubland Alliance	Bush seepweed scrub
Tamarix spp. Shrubland Semi-Natural Alliance	Tamarisk thickets
Viguiera parishii Shrubland Alliance	Parish's goldeneye scrub
Washingtonia filifera Woodland Alliance	California fan palm oasis

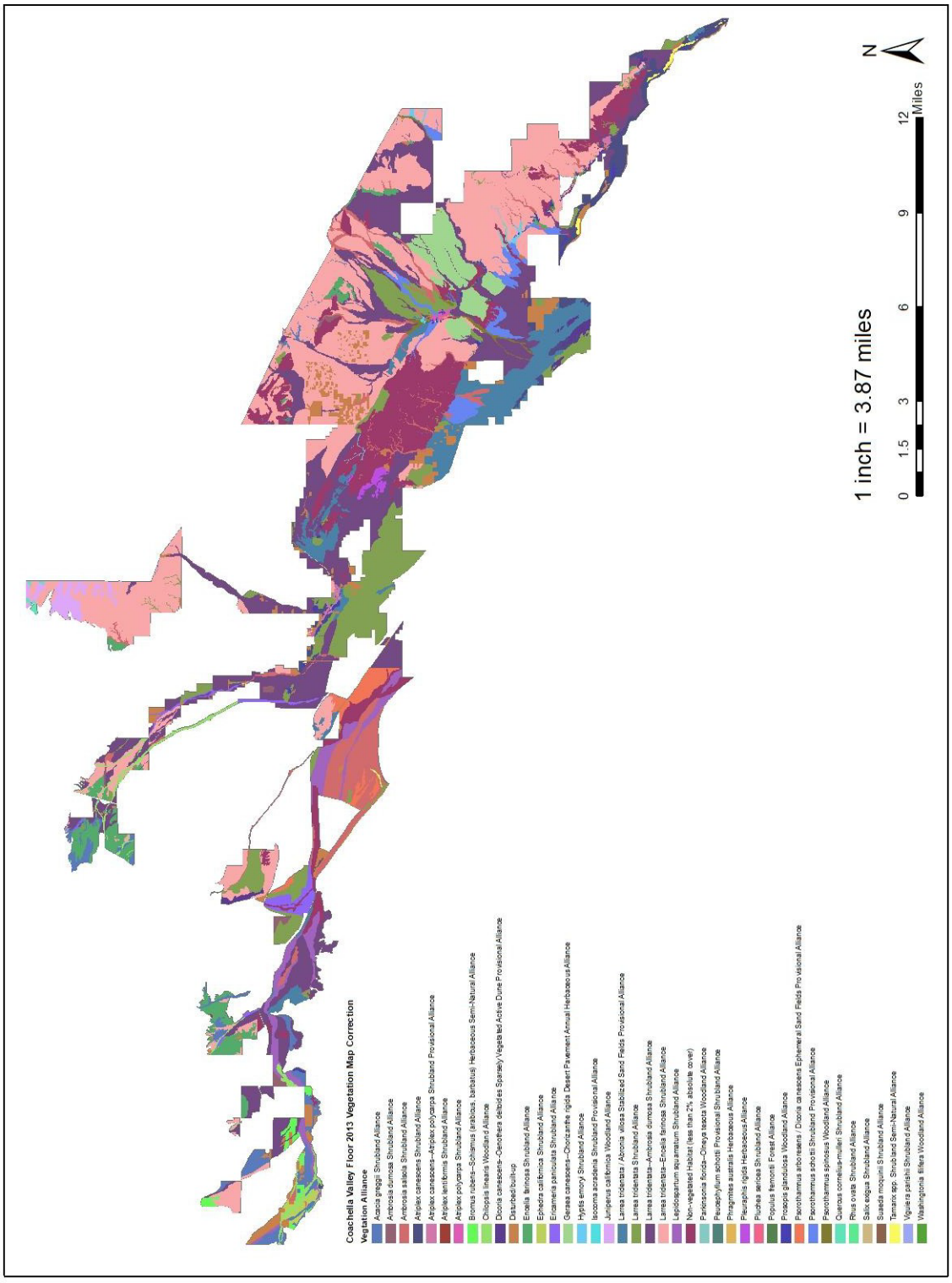
APPENDIX TABLE 2: ASSOCIATIONS IDENTIFIED

Association Name
Acacia greggii / Chilopsis linearis / Ericameria paniculata--Ambrosia salsola Association
Acacia greggii--Encelia farinosa--Ambrosia dumosa Association
Acacia greggii--Larrea tridentata--Encelia farinosa--Ambrosia dumosa Association
Ambrosia salsola--Bebbia juncea Association
Ambrosia salsola--Hyptis emoryi Association
Ambrosia salsola--Larrea tridentata Association
Ambrosia salsola--Larrea tridentata--Ambrosia dumosa--Psorothamnus arborescens Association
Atriplex canescens--Ambrosia salsola Association
Atriplex canescens--Atriplex ploycarpa Association
Atriplex canescens--Atriplex polycarpa--Larrea tridentata Association
Atriplex canescens--Larrea tridentata Association
Atriplex canescens--Larrea tridentata--Ambrosia dumosa Association
Atriplex polycarpa--Larrea tridentata Association
Chilopsis linearis / Ephedra californica--Psorothamnus arborescens--Ambrosia salsola Association
Chilopsis linearis / Ericameria paniculata--Ambrosia salsola Association
Dicoria canescens--Oenothera deltoides / Atriplex canescens Association
Dicoria canescens--Oenothera deltoides / Larrea tridentata--Atriplex spp. Association
Encelia farinosa--Ambrosia dumosa Association
Encelia farinosa--Ephedra nevadensis Association
Encelia farinosa--Larrea tridentata--Ambrosia dumosa Association
Ephedra californica--Ambrosia salsola Association
Ericameria paniculata--Ambrosia salsola Association
Larrea tridentata / Pleuraphis rigida Association
Larrea tridentata Association
Larrea tridentata--Ambrosia dumosa / Chilopsis linearis Association
Larrea tridentata--Ambrosia dumosa / Pleuraphis rigida Association
Larrea tridentata--Ambrosia dumosa Association
Larrea tridentata--Ambrosia dumosa--Atriplex canescens Association
Larrea tridentata--Ambrosia dumosa--Atriplex polycarpa Association

Larrea tridentata--Ambrosia dumosa--Atriplex spp.-- Petalonyx thurberii Association
Larrea tridentata--Ambrosia dumosa--Encelia farinosa Association
Larrea tridentata--Ambrosia dumosa--Encelia farinosa--Psorothamnus arborescens Association
Larrea tridentata--Ambrosia dumosa--Ephedra californica--Psorothamnus arborescens Association
Larrea tridentata--Ambrosia dumosa--Ephedra nevadensis --Encelia farinosa Association
Larrea tridentata--Ambrosia dumosa--Ericameria paniculata--Ambrosia salsola Association
Larrea tridentata--Ambrosia dumosa--Hyptis emorii Association
Larrea tridentata--Ambrosia dumosa--Krameria grayi Association
Larrea tridentata--Ambrosia dumosa--Psorothamnus arborescens Association
Larrea tridentata--Ambrosia dumosa--Psorothamnus schottii--Encelia farinosa Association
Larrea tridentata--Ambrosia salsola Association
Larrea tridentata--Ambrosia salsola--Psorothamnus schottii Association
Larrea tridentata--Atriplex canescens Association
Larrea tridentata--Atriplex polycarpa Association
Larrea tridentata--Encelia farinosa Association
Larrea tridentata--Encelia farinosa--Ambrosia dumosa Shrubland Association
Larrea tridentata--Encelia farinosa--Ambrosia dumosa--Yucca schidigera Association
Larrea tridentata--Encelia farinosa--Ambrosia salsola Association
Larrea tridentata--Encelia farinosa--Atriplex canescens Association
Larrea tridentata--Encelia farinosa--Ephedra californica Association
Larrea tridentata--Encelia farinosa--Ephedra californica--Psorothamnus arborescens--Ambrosia salsola Association
Larrea tridentata--Encelia farinosa--Psorothamnus schottii Association
Larrea tridentata--Encelia farinosa--Psorothamnus schottii--Association
Larrea tridentata--Krameria grayi Association
Larrea tridentata--Psorothamnus spinosus--Hyptis emoryi--Acacia greggii Association
Lepidospartum squamatum / Chilopsis linearis / Ericameria paniculata--Ambrosia salsola Association
Lepidospartum squamatum--Ambrosia salsola Association
none
Non--vegetated Habitat / Atriplex canescens Association
Non-vegetated Habitat / Larrea tridentata / Pleuraphis rigida Association
Non-vegetated Habitat / Larrea tridentata Association
Non-vegetated Habitat / Larrea tridentata--Ambrosia dumosa Association
Non-vegetated Habitat / Larrea tridentata--Encelia farinosa--Pleurocoronis pluriseta Association
Non-vegetated Habitat / Pleuraphis rigida Association
Pleuraphis rigida / Larrea tridentata--Encelia farinosa--Pleurocoronis pluriseta Association
Prosopis glandulosa / Atriplex canescens Association
Prosopis glandulosa / Atriplex polycarpa Association
Prosopis glandulosa / Atriplex spp--Suaeda moquinii Association
Prosopis glandulosa / Hyptis emoryi--Psorothamnus schottii Association
Prosopis glandulosa / Larrea tridentata Association
Prosopis glandulosa / Larrea tridentata--Atriplex spp. Association
Prosopis glandulosa--Washingtonia filifera Association

Psorotamnus arborescens--Larrea tridentata Association
Psorothamnus arboresens / Dicoria canescens Ephemeral Sand Fields Association
Psorothamnus schottii--Larrea tridentata Association
Psorothamnus spinosus / Ambrosia salsola--Atriplex spp. Association
Tamarix spp.--Atriplex canescens Association
Washingtonia filifera / Phragmites australis Association
Washingtonia filifera / Prosopis glandulosa Association
Washingtonia filifera / Prosopis glandulosa--Atriplex spp--Suaeda moquinii Association

APPENDIX 3: 2013 COACHELLA VALLEY FLOOR VEGETATION MAP



APPENDIX 4: 2018 COACHELLA VALLEY FLOOR VEGETATION MAP