



Coachella Valley Conservation Commission

September 2019

**Coachella Valley Multiple Species Habitat Conservation Plan &
Natural Community Conservation Plan
Dos Palmas Conservation Area
2013 & 2018 Vegetation Map 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 to 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 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).

This report and the related vegetation maps update those from the 2016 mapping effort (Sweet *et al.* 2016). The primary purpose was to develop an updated vegetation map for the Dos Palmas Conservation Area (Reserve Management Unit 4 under the Plan), 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.

The original Dos Palmas Conservation Area 2013 status vegetation map and report were completed in 2016. The report and related map describe a map correction for the 2013 map as well as an updated map for the year 2018 covering the approximately 25,800 acres that comprise the Dos Palmas Conservation Area. 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), other 2018 imagery 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 Dos Palmas map was completed in 2016, however, the map will be referred to as a corrected 2013 map to match the imagery date, and further detail about the

original map is contained in that report (Sweet et al. 2017). 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. One hundred ninety-one partial Rapid Assessment plots were conducted in 2015-2016 within the study area, and an additional 222 Rapid Assessments were completed in 2018, plus additional reconnaissance field information that was collected.

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 filifera* 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 CVMSHCP, several provisional alliances were used, including the *Larrea tridentata* / *Abronia villosa* Stabilized Sand Fields Provisional Alliance and the *Cladium californica* Provisional Alliance. The largest amount of land cover for both 2013 and 2018 maps is classified under the Non-vegetated Habitat map type, representing over 2,400 hectares, followed by the *Tamarix* spp. type at 1,600 hectares.

There are several reasons for which the following changes should be interpreted as preliminary findings: the very small detectable changes in vegetation cover and the short time period between maps (5 years); the difficulty in reliably detecting true changes in live cover; and limitations in the availability of matching imagery. The largest mapped declines in area from 2013-2018 type mapped were the *Allenrolfea occidentalis* (-25 ha), the *Prosopis glandulosa* type (-15 ha), and the *Atriplex canescens*-*Atriplex polycarpa* type (-12 ha). The largest increases were in the Non-vegetated Habitat type (+47 ha) and the *Tamarix* spp. types (+21 ha). Shrub cover was characterized by an increase in areas with 1-5% cover, and a decrease overall in areas with 5-50% cover, and an increase in areas with 75-100% cover (the latter due to *Tamarix* spp. being mapped as shrubs in the MCV).

The Dos Palmas Conservation Area contains a Bureau of Land Management designated Area of Critical Environmental Concern, hosting federally endangered species. It is also a land area undergoing environmental change due to several factors, including the spread and removal of exotic plants, as well as changes in water availability. Status of vegetation on the ground in some areas has already indicated change in vegetation cover or identity from the 2013 imagery to the 2018 imagery. Some areas seem to recover due to management actions, showing increases in live cover after water was returned to the area, whereas some stands, especially *Prosopis glandulosa* in the northeast area, continued to decline from 2013 to present.

Conservation Background

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 the Coachella Valley Multiple Species Habitat and Natural Community Conservation Plan (CVMSHCP/NCCP), a conservation plan that preserved over 250,000 acres of open space (Figure 1). The CVMSHCP/NCCP identified 27 species and 27 vegetation communities within the Coachella Valley for protection. Reasons for each species/vegetation community being included under the CVMSHCP/NCCP conservation umbrella varied; however, in general they were due to on-going concerns of the species/vegetation communities being vulnerable to the pressures of land development and habitat conversion. Federal and state agencies approved and signed the plan in 2008. This vegetation map is a tool to aid in species monitoring and management in the Dos Palmas Conservation Area of the CVMSHCP/NCCP. This comprehensive land planning essentially protects local 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.

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.

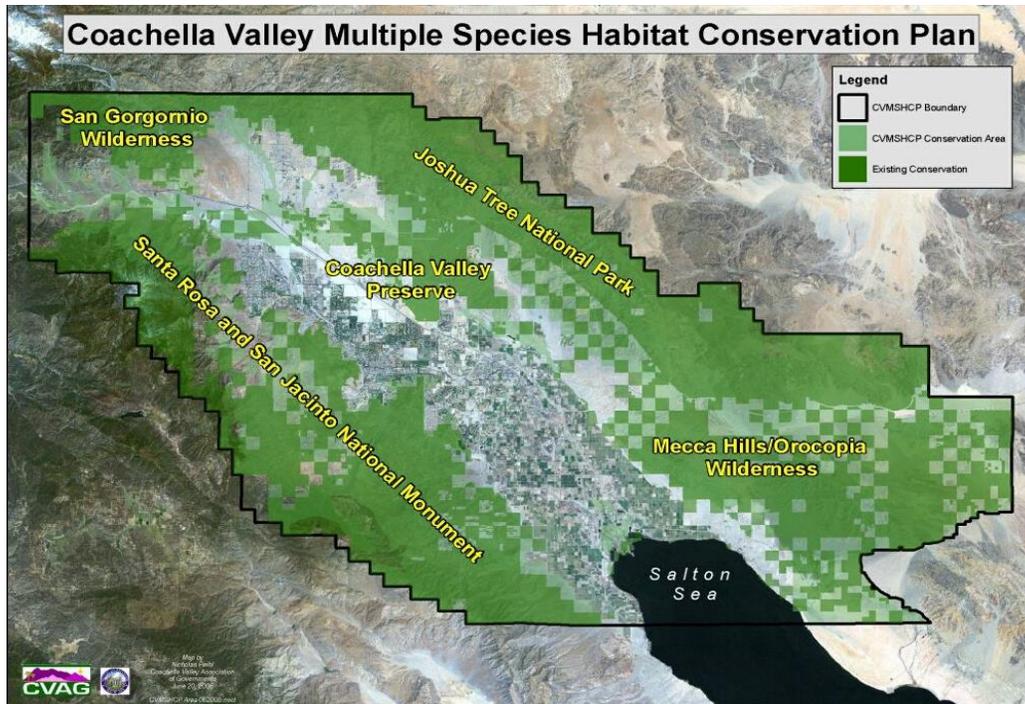


Figure 1: Coachella Valley Multiple Species Habitat Conservation Plan Boundary in relation to Joshua Tree National Park, the Santa Rosa and San Jacinto National Monument, the Coachella Valley USFWS Preserve, Wilderness areas, and the Salton Sea.

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 bush scrub, 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 less frequent in the central and eastern end of the valley, due to the rain shadow of the San Jacinto, Santa Rosa, and San Bernardino mountain ranges. Due to the varying proximity to coastal storms, the rain shadow, and decreasing elevation, there is a gradient of increasing temperature and aridity from west to east. 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 to the northwest of the valley and move into the area in October through May.

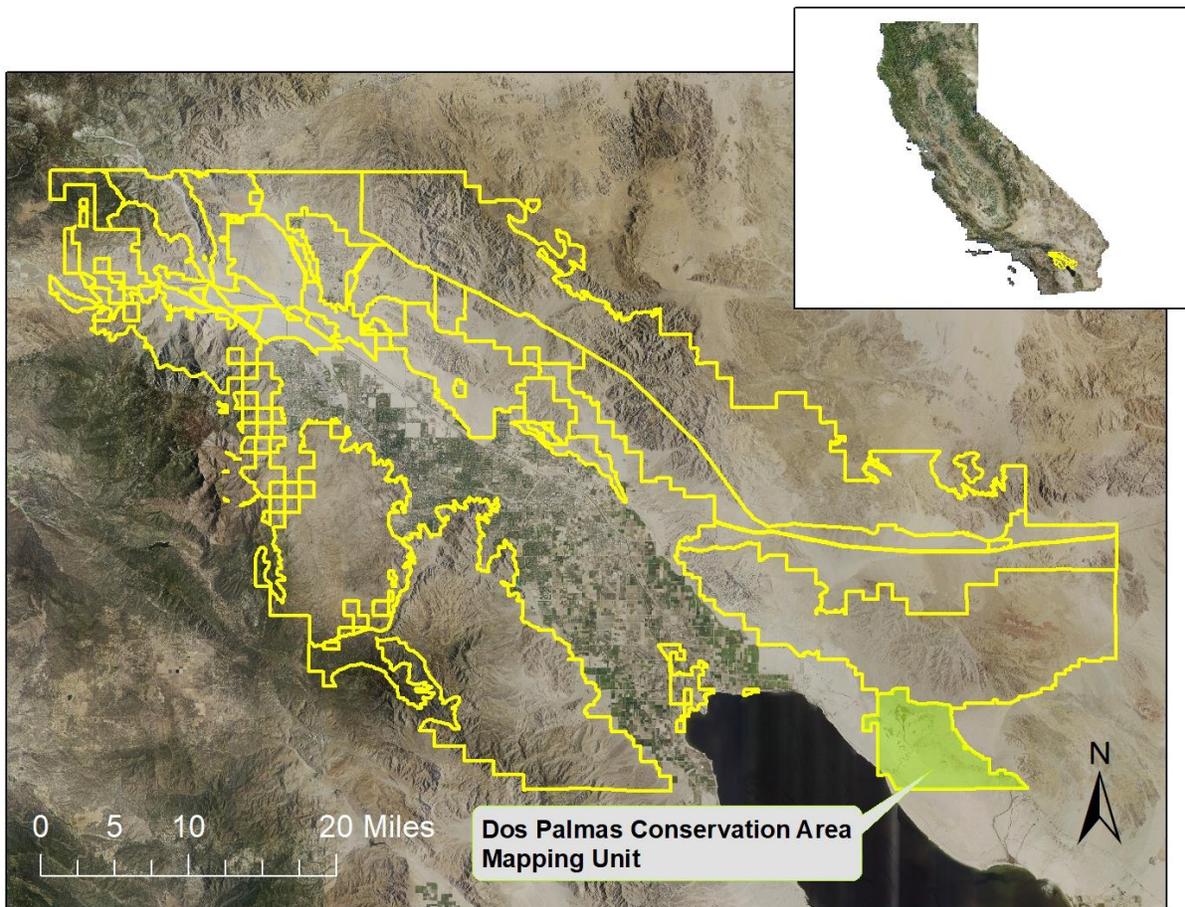


Figure 2. Areas of conservation within the Multiple Species Habitat Conservation Plan Conservation areas (in yellow) that were described in the Dos Palmas Conservation Area Map (in green).

Dos Palmas Conservation Area

Dos Palmas Conservation Area (hereafter, DPCA) (Figure 2) comprises over 27,000 acres as the southernmost in a contiguous chain of conserved lands, from the Joshua Tree Conservation area, the Desert Tortoise Linkage Area, and the Mecca Hills/Orocopia Mountains (Figure 3). To the west it is bounded by non-conserved land and the Salton Sea State Recreation Area, and to the east, the Chocolate Mountains Aerial Gunnery Range. DPCA terminates at the Imperial County line to the south. Within DPCA are two specially-designated areas: the Bureau of Land Management manages the Dos Palmas Area of Critical Environmental Concern (designated in 1980 under the California Desert Conservation Area Plan) and the California Department of Fish and Wildlife manages the Oasis Springs Ecological Reserve (designated in 1993). The remaining lands within DPCA are administered by the federal Bureau of Reclamation, San Diego County

Water Authority, the Coachella Valley Water district, the California Department of Transportation, California State Parks (Salton Sea Recreation Area) and many private conservation land holdings, including the Center for Natural Lands Management, Friends of the Desert Mountains and The Nature Conservancy (Dos Palmas Conservation Area Reserve Management Unit 4 Plan).



Figure 3: Contiguous conserved land areas in the Plan adjacent to Dos Palmas Conservation Area. CVMSHCP conservation boundaries in yellow.

This Conservation Area contains a variety of habitats and sensitive species, including desert pupfish, flat-tailed horned lizard, crissal thrasher, least Bell's vireo (in migration, but occasionally breeding here), southwestern willow flycatcher (in migration), Yuma clapper rail, California black rail, yellow breasted chat, Coachella Valley round-tailed ground squirrel, and southern yellow bat, among others. A general habitat map for DPCA was produced prior, in conjunction with the inception of the Plan, to document the distribution of conserved natural communities according to Holland Type (1986). These habitats were: mesquite hummocks, Sonoran creosote bush scrub, desert sink scrub, arrowweed scrub, cismontane alkali marsh, mesquite bosque, desert dry wash woodland, and desert fan palm oasis woodland in addition to one non-native habitat type, Tamarisk scrub (see (CVCC, *Final Recirculated Coachella Valley MSHCP—September 2007*, Figure 4-24c).

Subsequent mapping by AMEC Foster Wheeler (AMEC) circa 2009 provided vegetation delineation of central marsh areas and areas within DPCA to the north and west. AMEC delineated the natural communities vegetation within the Holland types listed in the Plan, and additionally: alkali seep, desert saltbush scrub and Phragmites (*Phragmites australis*) stands. Additional non-Holland type areas delineated were: open water, developed, and disturbed/built up. The 2013 and the current mapping project encompass the entire Conservation Area, and include many vegetation types not present in the former AMEC map area. In addition, this new effort utilizes the most current CDFW mapping classification system (as above), further refines the map both to a finer spatial scale and with finer taxonomic precision. The new maps also incorporate land and vegetation changes since the earlier Holland-Type map. The correction of the 2013 map and this report is meant to update and replace the prior 2013 vegetation map and report (Sweet *et al.* 2016), while adding 2018 status information.

These new vegetation maps support conservation goals for managing under listed threats to habitats in this management unit: invasive species; threats to hydrological regime/processes; climate change and habitat fragmentation, wildfire management, off-highway vehicle use, and other anthropogenic surface disturbance (CVMSHCP, Section 8). Understanding habitat requirements 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, as it does not contain location information on state or federally-listed threatened or endangered species, is publicly available and supports concurrent CVMSHCP/NCCP monitoring.

RECONNAISSANCE

For the original 2013 produced by UCR CCB, 2013 map, initial research on the vegetation communities present in this Conservation Area included a review of existing vegetation maps (CVCC 2007, AMEC, circa 2009) and development of a preliminary database of possible plant species, alliances and associations. To determine the plant communities that might be encountered during field surveys, CCB staff consulted with Bureau of Land Management staff, who provided a plant species list from past survey data. As well, the site was visited for preliminary reconnaissance/plant identification in June 2015, and a preliminary working list of plant species was developed using the Calflora database (www.calflora.org, accessed July 2015) during July-August of 2015 for use by the field staff.

Between November 2015 and June 2016, CCB staff conducted surveys throughout the mapping area as a reconnaissance of vegetation types. The purpose of these field visits was to calibrate the photo-interpretation of aerial imagery to existing vegetation types within the area. The CNPS California Native Plant Society/Department of Fish and Game Protocol for Combined Vegetation and Rapid Assessment and Relevé Sampling Field Form was used for Rapid Assessment surveys in the study area (CNPS 2011, 2014). The study area was traversed on foot

and by vehicle, and vegetation was assessed at optimal and accessible points, sited according to relevé plot protocol (see CNPS 2014). The field staff completed 194 plots (hereafter “RA plots”), both opportunistically-located as well as targeted at priority areas according to the photo interpreter’s (Lynn Sweet’s, hereafter, LS) preference and priorities. A significant effort was made to access areas where little was known about the vegetation types from previous visits, or where few reconnaissance points existed. At each point, a RA assessment form was completed, resulting in a database containing perennial vegetation percent cover (and annual cover of key species such as *Abronia villosa*, where it was likely to define the alliance); UTM easting and northing coordinates (NAD 1983 datum, Zone 11N); slope, aspect and elevation; percent surface cover of vegetation, litter and abiotic substrates; and other data (see protocol, CNPS 2014; Appendix A: VAP Plot Database 2016). As well, file numbers for photos at each point in four cardinal directions were recorded (photo database available upon request from CCB). For each RA plot, the field team assessed and assigned an alliance and association.

Because the 2013 vegetation map is tied to aerial imagery acquired by CVCC in 2013 (with the goal of a temporally-uniform snapshot of vegetation across the Plan Area), there is a 3-year gap between the temporal reference period for this map and the state of vegetation as it was recorded on RA plot field surveys. The field team sampled in upland, seasonally-wet and wetland vegetation areas within Dos Palmas. In many cases, dead, dying, or dormant vegetation was encountered. When this occurred, although the field team filled out an assessment form appropriate to the date of the survey (2015 or 2016 as appropriate), the field team also used a visual assessment to decide whether the vegetation was living during the 2013 time period of the map and relayed this information to LS (see additional notes in the following section for information on final assignment of vegetation types in these cases).

In sum, 194 RA plots were used for delineation within this study area, plus an additional 47 modified/basic RA plots that were completed prior, at monitoring points (but not necessarily presence points) for other covered species (*Salvia graeteeae*, Orocopia sage; *Toxostoma crissalis*, crissal thrasher; and *Toxostoma lecontei*, Le Conte’s thrasher), all completed in 2014-2015. Additionally, 132 opportunistic rapid observation plots (where only dominant perennial identity was recorded at the point location) were collected as needed, especially for areas identified by the aerial imagery that were problematic for interpretation.

For the 2018 map, 221 Rapid Assessment plots were completed between October 2018 and January 2019. In addition, about 180 locations were visited where basic reconnaissance information was recorded. Plots were located throughout the mapping area and an effort was made to repeat assessments at previous locations, as well as recording information from new areas. The plot data were recorded on tablets (Samsung Galaxy Tab A2 SM-T390, Samsung.com) using a Survey123 App form (versions 3.0-3.2, survey123.arcgis.com, ESRI,

2019) containing the same fields as the CNPS 2016 Combined Vegetation Rapid Assessment and Relevé Field Form (Revised April 28, 2016) (Figure 4).

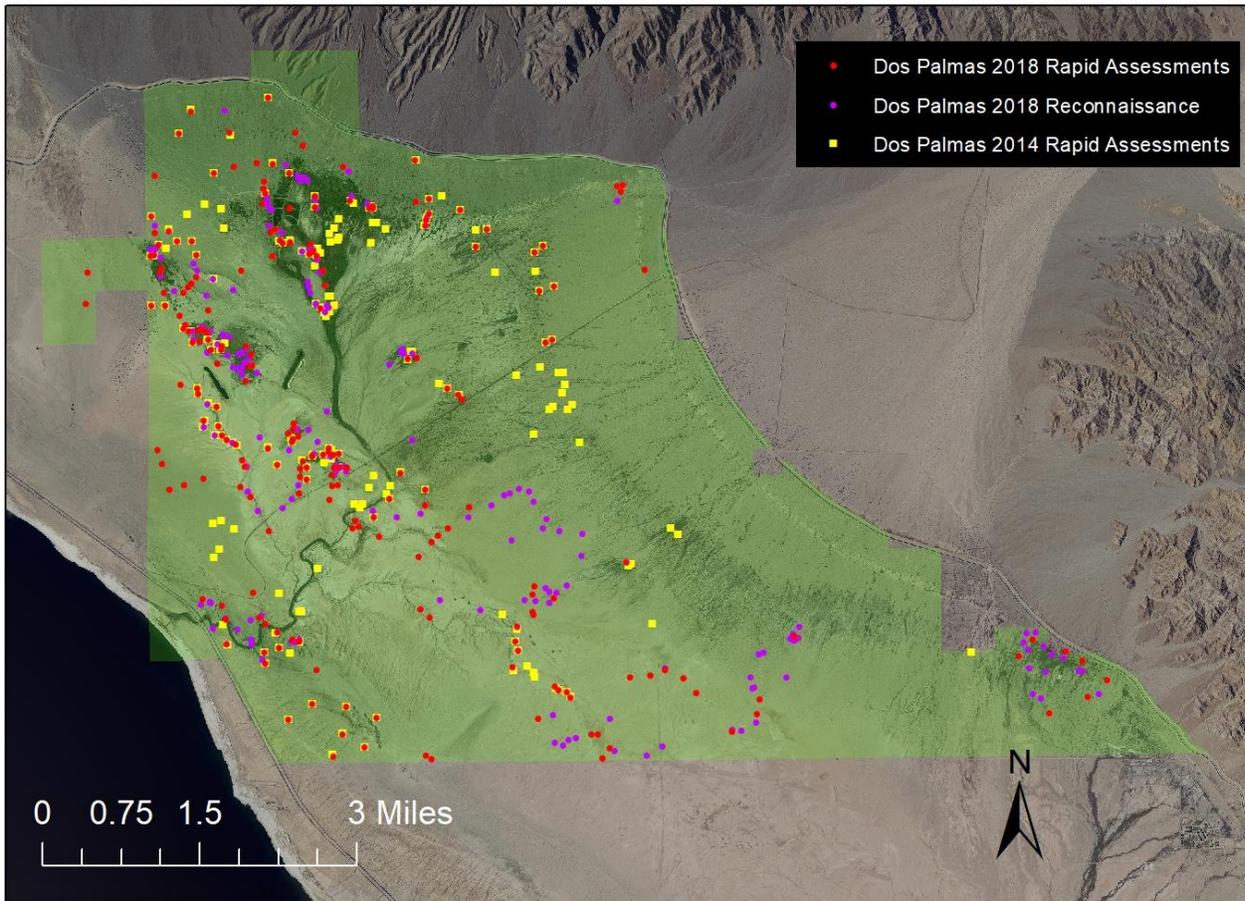


Figure 4: Distribution of 2014 (2013 map) basic Vegetation Assessments, 2018 Rapid Assessments and 2018 basic reconnaissance visits within the vegetation mapping area, in the Coachella Valley, California.

AERIAL PHOTO INTERPRETATION AND DELINEATION

Photo interpretation of vegetation types employed heads-up digitizing techniques. For the 2013 map, this was accomplished using three-inch resolution true-color (RGB) 2013 aerial imagery provided by the Coachella Valley Conservation Commission from local flights, primarily. This was supplemented with 2014 one-meter imagery from the National Agricultural Imagery Program (NAIP) on the edges of the mapping area that the CVCC imagery did not cover. As well, information was pulled from a variety of other sources to identify phenological stage where CVCC imagery showed dormant vegetation (i.e. the spring-captured imagery showed primarily dormant *Typha*, *Phragmites*). Thus, imagery from sources such as ESRI WorldImagery, while not used as the primary basis for any decision, was useful as supporting information.

For the 2018 map, several sources were used. The primary imagery used to assess vegetation types and boundaries was the 60cm resolution 2018 NAIP imagery. However, since the NAIP imagery was not available until the spring of 2019, earlier procurement of supplemental imagery was required to complete the map. 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, LS 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. In the fall of 2018, CVCC purchased ortho-rectified 30cm resolution imagery (aerial acquisition date October 2018) from DigitalGlobe (<https://www.digitalglobe.com/>) and this was used to begin mapping for the north and central areas (Figure 5). These delineations were re-verified once the NAIP imagery was acquired. Unfortunately, there is a phenological difference between the original 2013 CVCC imagery captured in the springtime, and the 2018 NAIP and DigitalGlobe imagery, both acquired in the fall. The color-infrared (CIR) imagery from NAIP 2014, 2016 and 2018 were also used to assess the amount of live cover present.

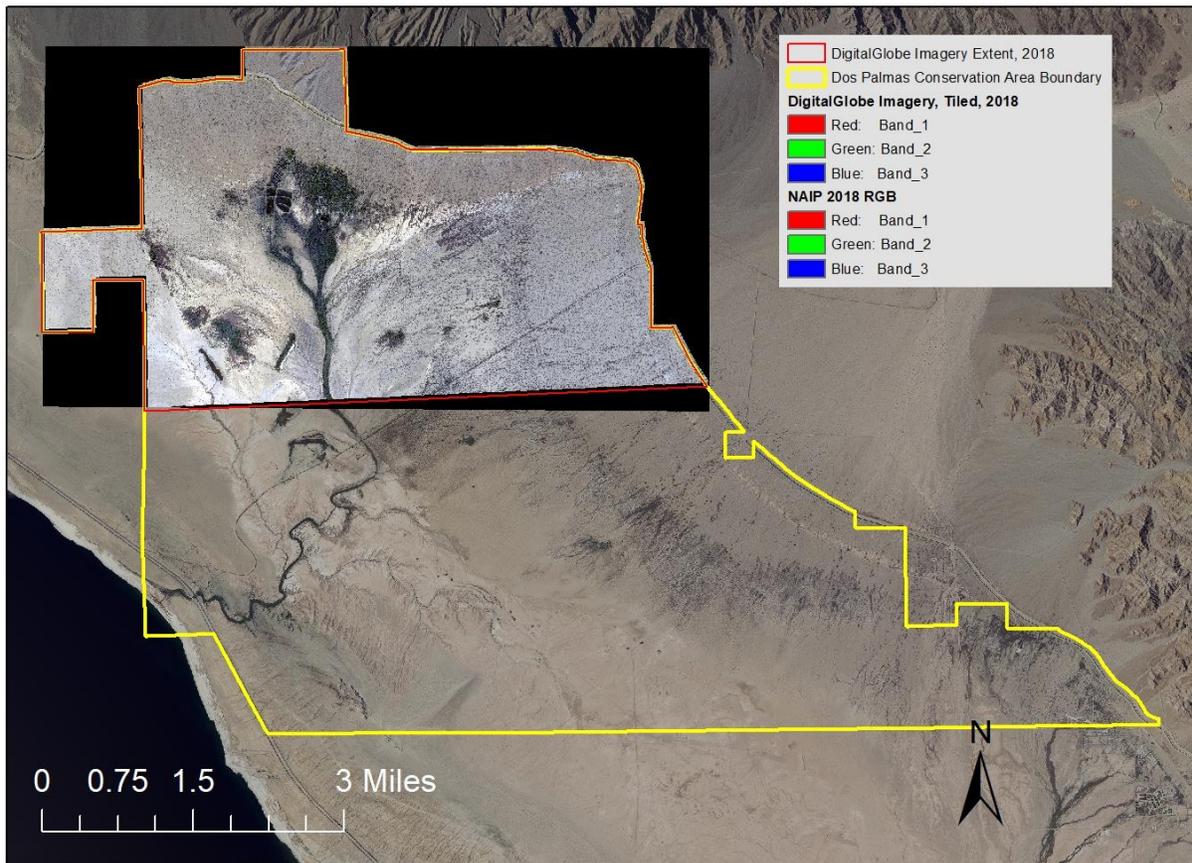


Figure 5: Imagery used for the 2018 vegetation map. Shown is the 30cm DigitalGlobe imagery acquired and the 60cm 2018 NAIP imagery for the Dos Palmas vegetation mapping area, in the Coachella Valley, California.

Vegetation delineation was done using a line feature class, assigned to type using point feature class, and finally, a polygon feature class was created, attributed with alliance and other attributes. Continuous quality control checks were performed using query tools in ArcGIS as well as the utilization of a secondary reviewer from the team (other than the photo-interpreter-LS) to review polygon assignments, identify problematic vegetation assignments errors and discrepancies as monitoring continued, and all were incorporated into the final geodatabase.

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), LS drafted boundaries separating vegetation types (Alliances) at 1:1500 scale and attributed other categories using field information and relevant datasets. LS used the verified vegetation type locations (vegetation type photo signatures) to identify vegetation across the landscape, additionally using ecological characteristics of vegetation types in relation to landscape characteristics such as topographic features. For example, where imagery alone was unable to resolve the vegetation type in a minor seasonally-flooded non-saline wash area, LS considered vegetation types that were likely to occur in that area, such as *Acacia greggii*, *Ambrosia dumosa*, or *Lycium brevipes*.

Cover was quantified as non-vegetated habitat where it was less than 2%. Some coordinates for plots such as those done specifically for flooded wetland vegetation fall outside of the plot boundaries due to the extremely delicate habitat and accessibility challenges of flooded habitats, as in for *Schoenoplectus americanus*, *Typha dominguensis* and occasionally for *Phragmites australis*. For these surveys, the cover estimates, as they currently stand, apply to the projected coordinate locations indicated in the VAP database where applicable.

The 2018 map update was begun using the delineations from 2014. LS used the newer 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.

For most alliances occurring in expansive areas, a minimum mapping unit of 2.4 acres (~1 ha) was observed. For the purposes of the CVMSHCP, habitat of sensitive species is of particular concern and therefore to improve the ability of researchers and land managers to target wildlife habitat that is patchily-distributed, there are several alliances where the minimum mapping unit (MMU) is less than an acre. A finer visualization scale was used in some cases to delineate

wetland types occurring in narrow bands and patchy areas. These include *Prosopis glandulosa* Woodland Alliance (habitat for the covered species, *Toxostoma crissalis*, crissal thrasher), *Cladium californica* Provisional Alliance (*Cladium californicum* is a 2B.2 rank rare plant fairly endangered in California (CNPS, 2016)), *Washingtonia filifera* Woodland Alliance (supporting federally endangered *Cyprinodon macularius*, desert pupfish), as well as wetlands types (some support the federally endangered *Rallus longirostris yumanensis*, Yuma clapper rail and other sensitive species), and as well as certain wash types which displayed complexity that necessitated delineation (generally, Groups G531, G533 and G538; see “Classification...” section below). Therefore, for other purposes, such as comparison with other regional vegetation maps, these types may need to be aligned with other protocols.

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 and others 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.

For polygons in which the VA plot data indicated significant mortality of the vegetation or dormant vegetation, LS visually assessed the greenness of the vegetation in the aerial imagery to decide how much of the dominant alliance vegetation was in fact living in 2013. Often, remaining basal sprouts or a small percentage of the vegetation remained alive, with sufficient cover remaining alive to pass the assignment rules for the dominant vegetation type. In very few areas was enough of the dominant vegetation dead, with certainty on the ground and from the aerial imagery, to justify assigning a different alliance, including the non-vegetated assignment where <2% perennial vegetation cover remained. Because of the one-year turnaround time from sampling to map production, and the timing of surveys in early winter for the 2013 map (when much of the central marsh area vegetation was dormant, including *Typha dominguensis*), it was impossible to determine with absolute certainty when and if mortality has occurred in all cases. Where the vegetation could be clearly identified but where it was ambiguous as to whether the dominant vegetation type was sufficiently alive in 2013 after using the decision process described above, LS defaulted to the assumption that the vegetation in question was still alive during the time stamp represented by the map in lieu of assigning a different alliance. For this reason, it should be noted that there are areas depicted in the 2013 map which during 2015 field surveys appeared to contain primarily dead vegetation.

As well, significant management activities are occurring at DPCA. Bureau of Land Management staff are controlling invasive Tamarisk (*Tamarix* spp.), which cover a large portion of DPCA; treatments have included cutting and herbicide application in small areas, as well as removal with large equipment in heavily-infested areas (L. Sweet, *pers. obs.*). Because Tamarisk is so prevalent, and where it occurs, it becomes the dominant (if not sole) species in the local ecosystem, it is recognized as a distinctive vegetation type in California, the *Tamarix* spp. Shrubland Semi-Natural Alliance (Sawyer *et al.* 2009). In most cases, it was straight-forward to identify tamarisk from the aerial imagery and determine when it was removed, so the vegetation type was assigned to either Tamarisk or to the appropriate land cover type present following removal. Occasionally this was Non-Vegetated Habitat type due to low (<2%) cover of any perennial vegetation. Because ecological recovery is slow following perturbation, due to climatic drought, flood, landscape-scale management activities, and changes in hydrologic regime, it will take some time to determine the true distribution of live vegetation and a newer iteration of the map was thus undertaken to represent changes that have happened since 2013. It is recommended, due to ongoing changes within DPCA, that that periodic updates should be published as additional information and newer imagery becomes available.

CLASSIFICATION OF DOS PALMAS CONSERVATION AREA VEGETATION

Classification of the vegetation was done based on prior vegetation Mapping of Anza-Borrego Desert State Park and Environs (Keeler-Wolf *et al.* 1998), the Western Riverside County MSHCP Vegetation Map (2004), Vegetation of Joshua Tree National Park (La Doux *et al.* 2013), and the Vegetation Map in Support of the Desert Renewable Energy Conservation Plan (Menke *et al.*, 2013) and by the UCR Center for Conservation Biology in previous maps (most recently Sweet *et al.* 2017). There were several RA plots for which the existing list of alliances from the Manual of California Vegetation Online (<http://vegetation.cnps.org/>, accessed December 2015-June 28, 2016; July 5, 2019) was not adequate. Thus, we have described several new provisional vegetation alliances that occur in the area. These new alliances are described below in the Provisional Alliance Descriptions section. The provisional alliances identified during this study were based on relevé plot observations and subsequent classification, and these will be proposed to the NVCS upon adequate funded time, including the *Atriplex canescens*--*Atriplex polycarpa* Shrubland Provisional Alliance, the *Larrea tridentata* / *Abronia villosa* Stabilized Sand Fields Provisional alliance, the *Psoralea schottii* Provisional Alliance, and the *Cladium californicum* Provisional Alliance.

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).

Class 1. Forest to Open Woodland

Subclass 1.B. Temperate & Boreal Forest

Formation 1.B.3. Temperate Flooded & Swamp Forest

Division 1.B.3.Nd. Southwestern North American Flooded & Swamp Forest

Macrogroup M298. Warm Southwest Semi-natural Flooded & Swamp Forest

Group G510. Southwestern North American Semi-natural Riparian Forest & Scrub

Tamarix spp. Shrubland Semi-Natural Alliance

Macrogroup M036. Warm Southwest Riparian Forest

Group G508. Sonoran-Chihuahuan Warm Desert Riparian Woodland

Populus fremontii Forest Alliance

Washingtonia filifera Woodland Alliance

Phoenix dactylifera Semi-Natural Woodland Provisional Alliance

Class 2. Shrubland & Grassland

Subclass 2.B. Temperate & Boreal Grassland & Shrubland

Formation 2.B.6. Temperate & Boreal Freshwater Marsh, Wet Meadow & Shrubland

Division 2.B.6.Nb. Western North American Freshwater Shrubland, Wet Meadow & Marsh

Macrogroup M073. Western North American Temperate Lowland Wet Shrubland, Wet Meadow & Marsh

Group G531. Arid West Interior Freshwater Emergent Marsh

Schoenoplectus americanus Herbaceous Alliance

Typha (angustifolia, domingensis, latifolia) Alliance

Phragmites australis Herbaceous Alliance

Division 2.B.6.Nc. Southwestern North American Warm Desert Freshwater Marsh

Macrogroup M076. Warm Desert Freshwater Shrubland, Meadow & Marsh

Group G533. North American Warm Desert Riparian Low Bosque & Shrubland

Baccharis sergiloides Shrubland Alliance

Prosopis glandulosa Woodland Alliance

Cladium californicum Herbaceous Provisional Alliance

Pluchea sericea Shrubland Alliance

Prosopis pubescens Woodland Alliance

Formation 2.B.7. Salt Marsh

Division 2.B.7.Nd. North American Western Interior Brackish Marsh

Macrogroup M082. Cool Semi-Desert Alkaline-Saline Wetland

Group G537. North American Desert & Semi-Desert Alkaline-Saline Shrub Wetland

Suaeda moquinii Shrubland Alliance

Allenrolfea occidentalis Shrubland Alliance

Atriplex lentiformis Shrubland Alliance

Isocoma acradenia Shrubland Provisional Alliance

Group 538. Western North American Desert & Semi-Desert Alkaline-Saline Herbaceous Wetland & Playa

Anemopsis californica Herbaceous Alliance
Sesuvium verrucosum Herbaceous Alliance
Bolboschoenus maritimus Herbaceous Alliance
Distichlis spicata Herbaceous Alliance
Juncus acutus Herbaceous Provisional Alliance
Juncus cooperi Herbaceous Alliance

Class 3. Desert & Semi-Desert

Subclass 3.A. Warm Desert & Semi-Desert Woodland, Scrub & Grassland

Formation 3.A.2. Warm Desert & Semi-Desert Scrub & Grassland

Division 3.A.2.Na. North American Warm Desert Scrub & Grassland

Macrogroup M088. Mojave-Sonoran Semi-Desert Scrub

Group G295. Mojave-Sonoran Bajada & Valley Desert Scrub

Ambrosia dumosa Shrubland Alliance
Encelia farinosa Shrubland Alliance
Larrea tridentata--Ambrosia dumosa Shrubland Alliance
Larrea tridentata--Encelia farinosa Shrubland Alliance
Larrea tridentata Shrubland Alliance
Psorothamnus schottii Shrubland Provisional Alliance
Salvia greatae Shrubland Provisional Alliance
Larrea tridentata / Abronia villosa Stabilized Sand Fields Provisional Alliance
Psorothamnus arboresens / Dicoria canescens Ephemeral Sand Fields Provisional Alliance

Group G675. North American Warm Semi-Desert Dunes & Sand Flats

Psorothamnus arboresens / Dicoria canescens Ephemeral Sand Fields Provisional Alliance

Subclass 3.B. Cool Semi-Desert Scrub & Grassland

Formation 3.B.1. Cool Semi-Desert Scrub & Grassland

Division 3.B.1.Ne. Western North American Cool Semi-Desert Scrub & Grassland

Macrogroup M093. Great Basin Saltbush Scrub

Group G300. Intermountain Shadscale - Saltbush Scrub

Atriplex canescens--Atriplex polycarpa Shrubland Provisional Alliance
Atriplex canescens Shrubland Alliance
Atriplex polycarpa Shrubland Alliance

Class 3. Desert & Semi-Desert

Subclass 3.A. Warm Desert & Semi-Desert Woodland, Scrub & Grassland

Formation 3.A.2. Warm Desert & Semi-Desert Scrub & Grassland

Division 3.A.2.Na. North American Warm Desert Scrub & Grassland

Macrogroup M092. North American Warm-Desert Xero-Riparian Scrub

Group G541. Warm Semi-Desert Shrub & Herb Dry Wash

Acacia greggii Shrubland Alliance

Ambrosia salsola Shrubland Alliance

Chilopsis linearis Woodland Alliance

Ericameria paniculata Shrubland Alliance

Hyptis emoryi Shrubland Alliance

Justicia californica Shrubland Alliance

Lepidospartum squamatum Shrubland Alliance

Parkinsonia florida--Olneya tesota Woodland Alliance

Psorothamnus spinosus Woodland Alliance

Xylorhiza cognata Shrubland Provisional Alliance

Lycium brevipes Shrubland Provisional Alliance

Class 6. Rock Vegetation

Subclass 6.C. Desert & Semi-Desert Rock Vegetation

Formation 6.C.1. Warm Desert & Semi-Desert Cliff, Scree & Other Rock Vegetation

Division 6.C.1.Na. North American Warm Semi-Desert Cliff, Scree & Rock Vegetation

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

Group G569. North American Warm Semi-Desert Cliff, Scree & Pavement Sparse Vegetation

Atriplex hymenelytra Shrubland Alliance

Non-Vegetated Land Cover Types

Disturbed/built-up

Non-vegetated Habitat (less than 2% absolute cover)

Playa

Water

PROVISIONAL ALLIANCE DESCRIPTIONS

Atriplex canescens—*Atriplex polycarpa* Provisional Alliance

Four-winged saltbush—allscale scrub provisional alliance

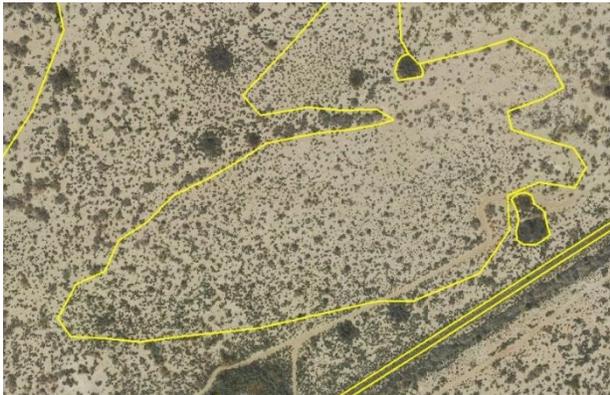


The image on the left shows an *Atriplex canescens*—*Atriplex polycarpa* photo signature with Mesquite hummocks to the north and southwest and a non-vegetated playa surrounding the remaining sides. The photo on the right shows a sparse *Atriplex canescens*—*Atriplex polycarpa* stand with *Lycium brevipes* and *Ambrosia dumosa* mixed into the shrub layer in very low density.

DESCRIPTION: Polygons mapped as this Provisional Alliance are strongly dominated by *Atriplex canescens* and *Atriplex polycarpa*, with each plant typically comprising at least 2 percent absolute cover in the shrub canopy and no other species having greater or equal cover than their combined totals. *Atriplex canescens*—*Atriplex polycarpa* stands are typically upslope from sparsely- or non-vegetated stands in salt flats on the north eastern shores of the Salton Sea in the DPCA.

Isocoma acradenia Shrubland Provisional Alliance

Alkali goldenbush scrub provisional alliance



The image on the left shows an *Isocoma acradenia* photo signature that is surrounded on three sides by Tamarisk thickets that contain low levels of *Isocoma acradenia* mixed into its understory and small mesquite bosques on the east side. The photo on the right shows an *Isocoma acradenia* stand with a few creosote bushes and the leading edge of a tamarisk thicket coming in from the west.

DESCRIPTION: Polygons mapped as this Provisional Alliance are dominated by *Isocoma acradenia*, typically comprising more than 5 percent absolute cover at the DPCA, but requiring at least 2 percent absolute cover in the shrub canopy and no other species having equal or greater cover. At DPCA, these stands are typically found either in sinks or in the upland, upslope from water sources. They surround mesquite bosques, tamarisk thickets and other hydrophilic species.

***Cladium californicum* Herbaceous Provisional Alliance**

California sawgrass beds provisional alliance



The image on the left shows a *Cladium californicum* photo signature with *Prosopis pubescens* and *Pluchea sericea* thickets surrounding it. The photo on the right shows a dense *Cladium californicum* area with *Pluchea sericea* in the foreground and *Washingtonia filifera* and *Prosopis pubescens* in the background.

DESCRIPTION: Polygons mapped as this Provisional Alliance are dominated by *Cladium californicum*, comprising greater than 50% absolute cover in the tall grass and shrub canopy with no other species having greater or equal cover. *Cladium californicum* areas typically occur at DPCA in areas with high surface water, low overstory cover, and often at springs associated with *Washingtonia filifera* fan palm oases.

***Lycium brevipes* Shrubland Provisional Alliance**

Baja desert thorn scrub provisional alliance



The image on the left shows a *Lycium brevipes* photo signature in an upland seasonally-wet wash surrounded by non-vegetated areas. The photo on the right shows a *Lycium brevipes* stand with *Tamarix spp.*, and other occasional shrubs including *Ambrosia dumosa*, *Encelia farinosa*, and *Allenrolfea occidentalis*.

DESCRIPTION: Polygons mapped as this Provisional Alliance are strongly dominated by *Lycium brevipes*, with each plant typically comprising at least 2 percent absolute cover in the shrub canopy and no other species having greater or equal cover. These areas were typically in the upland, away from the marsh in minor washes that occasionally fill during flood events. Occasional stands were associated with the less-saline upper environments next to wetlands.

***Phoenix dactylifera* Semi-Natural Woodland Provisional Alliance**

Date palm naturalized groves provisional alliance

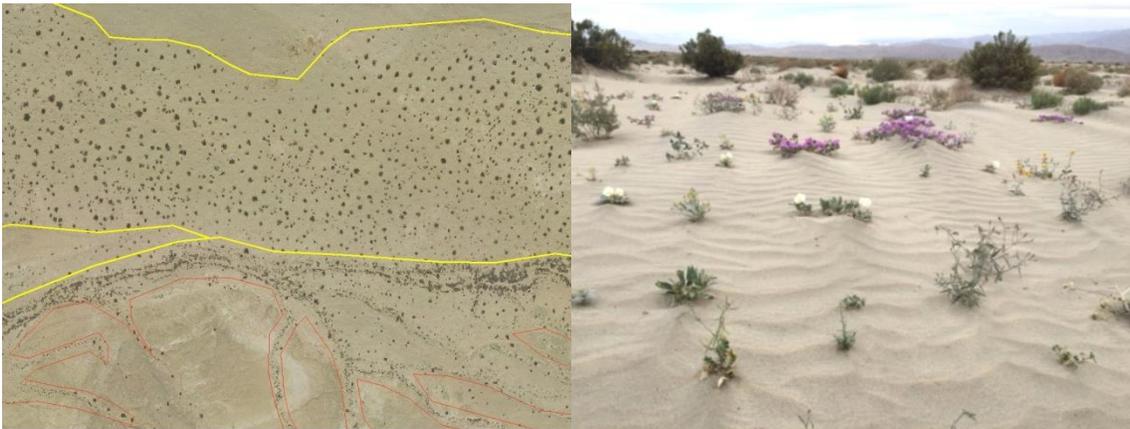


This image on the left shows a *Phoenix dactylifera* photo signature with a *Washingtonia filifera* Woodland surrounding it on the south boundary and an *Isocoma acradenia* Shrubland on the north boundary. The image on the right shows a *Phoenix dactylifera* stand with *Pluchea sericea* in the foreground and *Washingtonia filifera* in the background.

DESCRIPTION: Polygons mapped as this Provisional Alliance are strongly dominated by *Phoenix dactylifera* comprising at least 3 percent absolute cover in the tree canopy and at least 60 percent relative cover in the tree canopy with no other species having greater or equal cover. This alliance is typically found near desert seeps and springs, along fault lines where ground water is continuously available to them.

***Larrea tridentata* / *Abronia villosa* Stabilized Sand Fields Shrubland Provisional Alliance**

Creosote bush / sand verbena stabilized sand fields provisional alliance



This image shows a *Larrea tridentata* / *Abronia villosa* photo signature with a non-vegetated playa along the north boundary and *Allenrolfea occidentalis* Shrubland to the south. The photo on the right shows a sand field with *Larrea tridentata* in the background and *Abronia villosa* in the center of the photo mixed with other dune annuals.

DESCRIPTION: Polygons mapped as this Provisional Alliance are dominated by *Larrea tridentata* and *Abronia villosa*, with a combined absolute cover of each plant of greater than 2 percent and typically comprising at least 2 percent absolute cover in the shrub canopy and at least 2 percent cover in the herbaceous layer, respectively.

Psorothamnus schottii Shrubland Provisional Alliance

Schott's indigo bush scrub provisional alliance



The image on the left shows a *Psorothamnus schottii* photo signature with a non-vegetated area to the southeast and a *Parkinsonia florida*—*Olneya tesota* woodland alliance to the north and west. The photo on right shows a *Psorothamnus schottii* stand with *Larrea tridentata* mixed in at very low cover and *Parkinsonia florida* woodland in the background.

DESCRIPTION: Polygons mapped as this Provisional Alliance are strongly dominated by *Psorothamnus schottii*, comprising at least 2 percent, but usually 5 percent absolute cover in the shrub canopy with no other species having greater cover in the shrub or tree canopies. They typically occur on rocky alluvial slopes where they receive seasonal runoff.

FINDINGS

The vegetation map for the Dos Palmas Conservation Area Unit of the Coachella Valley Multiple Species Habitat Conservation Plan includes 1248 polygons (2013) and 1271 polygons (2018) with 37 Alliances (2013 and 2018) and 126 Associations (2013 and 2018). Because of the very small changes in vegetation cover and the difficulty reliably detecting true changes in live cover, the following changes should be 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.

Table 1: Vegetation cover alliance designations in the Dos Palmas Conservation Area 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.

Alliance Name	ALLIANCE AREA (ha) 2013	ALLIANCE AREA (ha) 2018	Difference (ha)
<i>Allenrolfea occidentalis</i> Shrubland Alliance	669.9	645.2	-24.7
<i>Ambrosia dumosa</i> Shrubland Alliance	157.9	153.4	-4.5
<i>Ambrosia salsola</i> Shrubland Alliance	75.0	75.0	0.0
<i>Atriplex canescens</i> Shrubland Alliance	383.1	387.7	4.6
<i>Atriplex canescens</i> -- <i>Atriplex polycarpa</i> Shrubland Provisional Alliance	114.8	102.9	-11.9
<i>Atriplex hymenelytra</i> Shrubland Alliance	42.3	43.0	0.7
<i>Atriplex lentiformis</i> Shrubland Alliance	2.1	2.1	0.0
<i>Atriplex polycarpa</i> Shrubland Alliance	113.4	113.4	0.0
<i>Bolboschoenus maritimus</i> Herbaceous Alliance	0.1	0.1	0.0
<i>Chilopsis linearis</i> Woodland Alliance	0.1	0.1	0.0
<i>Cladium californicum</i> Herbaceous Provisional Alliance	6.4	6.5	0.1
<i>Distichlis spicata</i> Herbaceous Alliance	18.3	15.5	-2.8
Disturbed/built-up	222.4	222.5	0.1
<i>Encelia farinosa</i> Shrubland Alliance	9.3	9.3	0.0
<i>Isocoma acradenia</i> Shrubland Provisional Alliance	170.0	169.9	-0.1
<i>Juncus cooperi</i> Herbaceous Alliance	7.4	7.2	-0.2
<i>Larrea tridentata</i> / <i>Abronia villosa</i> Stabilized Sand Fields Provisional Alliance	228.5	228.5	0.0
<i>Larrea tridentata</i> Shrubland Alliance	1183.0	1199.7	16.8
<i>Larrea tridentata</i> -- <i>Ambrosia dumosa</i> Shrubland Alliance	989.2	988.7	-0.5
<i>Larrea tridentata</i> -- <i>Encelia farinosa</i> Shrubland Alliance	12.9	12.9	0.0
<i>Lycium brevipes</i> Shrubland Provisional Alliance	46.6	46.5	-0.1
Non-vegetated Habitat (less than 2% absolute cover)	2413.0	2460.3	47.3
<i>Parkinsonia florida</i> -- <i>Olneya tesota</i> Woodland Alliance	1116.1	1116.1	0.0
<i>Phoenix dactylifera</i> Semi-Natural Woodland Provisional Alliance	0.3	0.3	0.0
<i>Phragmites australis</i> Herbaceous Alliance	38.3	31.0	-7.3
Playa	44.9	44.9	0.0
<i>Pluchea sericea</i> Shrubland Alliance	45.2	40.4	-4.7
<i>Prosopis glandulosa</i> Woodland Alliance	205.5	190.3	-15.2
<i>Prosopis pubescens</i> Woodland Alliance	9.1	8.5	-0.7
<i>Psoralea schottii</i> Shrubland Provisional Alliance	18.1	18.1	0.0
<i>Psoralea spinosa</i> Woodland Alliance	16.8	16.8	0.0
<i>Schoenoplectus americanus</i> Herbaceous Alliance	7.9	7.2	-0.7
<i>Suaeda moquinii</i> Shrubland Alliance	84.2	83.3	-0.9
<i>Tamarix</i> spp. Shrubland Semi-Natural Alliance	1639.1	1660.3	21.3
<i>Typha</i> (<i>angustifolia</i> , <i>domingensis</i> , <i>latifolia</i>) Alliance	32.2	27.7	-4.5
<i>Washingtonia filifera</i> Woodland Alliance	106.9	107.0	0.2
Water	47.0	34.9	-12.1

The largest amount of land cover for both 2013 and 2018 maps is classified under the Non-Vegetated Habitat category, representing over 2400 hectares followed by the *Tamarix* spp. Shrubland Semi-natural Alliance at over 1600 hectares. The largest mapped declines in area from 2013-2018 type mapped were the *Allenrolfea occidentalis* Shrubland Alliance (-25 ha) and the *Prosopis glandulosa* Woodland Alliance (-15 ha). The former may be due to conversion to other types, such as the Non-vegetated Habitat (+47 ha) or to *Tamarix* spp. Shrubland Semi-natural Alliance (+21 ha), the two biggest per-alliance gains in acreage. The latter may be due to mortality in this species, notably not throughout the mapping area, but in the northeast area of the mapping unit.

Table 2: Tree and shrub cover categories mapped within the Dos Palmas Conservation Area 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.

	TREE COVER CATEGORY				SHRUB COVER CATEGORY			
	2013 Area (ha)	2018 Area (ha)	Difference (ha)	Difference (%)	2013 Area (ha)	2018 Area (ha)	Difference (ha)	Difference (%)
none	5338.302	5347.042	8.7	0.1	158.0319	147.2973	-10.7	-3.5
>0-1%	3313.542	3314.641	1.1	0.0	2568.874	2594.417	25.5	0.5
>1-5%	876.4861	866.0099	-10.5	-0.6	1605.285	1810.262	205.0	6.0
>5-15%	628.4334	612.9566	-15.5	-1.2	4168.267	4088.595	-79.7	-1.0
>15-25%	76.14905	96.73369	20.6	11.9	1508.778	1416.866	-91.9	-3.1
>25-50%	32.46877	30.041	-2.4	-3.9	206.6583	155.4522	-51.2	-14.1
>50-75%	9.037141	7.407397	-1.6	-9.9	60.19751	62.60779	2.4	2.0
>75-100%	2.830561	2.417881	-0.4	-7.9	1.158412	1.751733	0.6	20.4

Shrub cover was characterized by an increase in areas with 1-5% cover, and a decrease overall in areas with 5-50% cover, and an increase in areas with 75-100% cover (the latter due to *Tamarix* spp. being mapped as shrubs in the MCV). There was a slight increase in the area covered by 1-5% tree cover, and also a decline in the area covered by 25-100% cover. The decline is likely explained by the shrinkage in area and cover class changes for *Prosopis glandulosa*, since the other tree types mapped (*Prosopis pubescens*, *Olneya tesota* and *Parkinsonia florida*) do not generally rise to those higher levels of cover.

SUMMARY AND RECOMMENDATIONS

Dos Palmas Conservation Area is undergoing environmental change due to several factors, including the spread and removal of exotic plants, as well as changes in water availability. 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 multi-year drought period in spring, and the 2018 NAIP reflects a return to normal precipitation overall, and was taken in the fall. Status of vegetation on the ground in some areas has already indicated change in vegetation cover or identity from the 2013 imagery to the 2018 imagery, with some areas recovering after water was returned to the area, whereas some stands, especially *Prosopis glandulosa* in the northeast area, are continuing to decline from 2013.

In the context of ongoing climate changes, these maps provide a baseline for further monitoring of the status of vegetation. The changes here occurred as Dos Palmas area recovered from the 2011-2015 drought period, and then received additional water inputs during the period between mapping snapshots. Thus, a long-term trajectory for any particular type may be difficult to ascertain with certainty from the changes noted here. Some types saw increases in cover due to the return to a wetter climate period and increased hydrologic input, and others declined, perhaps due to the inability to rebound from these short-term improvements in moisture availability. Vegetation mapping as a tool, especially at scales of 1:1500 is not ideal to detect small, widespread changes. LS 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.

Overall a decrease in native shrub cover reflects an area that is still subject to pressures of climate change and hydrologic alteration, 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.

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APPENDIX TABLE 1: ALLIANCES AND LANDSCAPE ATTRIBUTES IDENTIFIED

Alliance Name	Common Name
Allenrolfea occidentalis Shrubland Alliance	Iodine bush 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 hymenelytra Shrubland Alliance	Desert holly scrub
Atriplex lentiformis Shrubland Alliance	Quailbush scrub
Atriplex polycarpa Shrubland Alliance	Allscale scrub
Bolboschoenus maritimus Herbaceous Alliance	Salt marsh bulrush marshes
Chilopsis linearis Woodland Alliance	Desert willow woodland
Cladium californicum Herbaceous Provisional Alliance	California sawgrass beds
Distichlis spicata Herbaceous Alliance	Salt grass flats
Disturbed/built-up	Disturbed/built-up
Encelia farinosa Shrubland Alliance	California brittle bush scrub
Isocoma acradenia Shrubland Provisional Alliance	Alkali goldenbush scrub
Juncus cooperi Herbaceous Alliance	Cooper's rush marsh
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
Lycium brevipes Shrubland Provisional Alliance	Baja desert thorn scrub
Non-vegetated Habitat (less than 2% absolute cover)	Non-vegetated habitat
Parkinsonia florida--Olneya tesota Woodland Alliance	Blue palo verde - ironwood woodland
Phoenix dactylifera Semi-Natural Woodland Provisional Alliance	Date palm naturalized groves
Phragmites australis Herbaceous Alliance	Common reed marshes
Playa	Playa (non-vegetated)
Pluchea sericea Shrubland Alliance	Arrow weed thickets
Prosopis glandulosa Woodland Alliance	Mesquite bosque, mesquite thicket
Prosopis pubescens Woodland Alliance	Screwbean mesquite bosques
Psoralea schottii Shrubland Provisional Alliance	Schott's indigobush scrub
Psoralea spinosa Woodland Alliance	Smoke tree woodland
Schoenoplectus americanus Herbaceous Alliance	American bulrush marsh
Suaeda moquinii Shrubland Alliance	Bush seepweed scrub
Tamarix spp. Shrubland Semi-Natural Alliance	Tamarisk thickets
Typha (angustifolia, domingensis, latifolia) Alliance	Cattail marshes
Washingtonia filifera Woodland Alliance	California fan palm oasis
Water	Water

APPENDIX TABLE 2: ASSOCIATIONS IDENTIFIED

Association
Allenrolfea occidentalis / Distichlis spicata Association
Allenrolfea occidentalis / Juncus cooperi Association
Allenrolfea occidentalis Association
Allenrolfea occidentalis--Atriplex canescens Association
Allenrolfea occidentalis--Isocoma acradenia Association
Allenrolfea occidentalis--Lycium brevipes / Distichlis spicata Association
Allenrolfea occidentalis--Lycium brevipes Association
Allenrolfea occidentalis--Pluchea sericea Association
Allenrolfea occidentalis--Suaeda moquinii Association
Allenrolfea occidentalis--Tamarix spp. / Distichlis spicata Association
Allenrolfea occidentalis--Tamarix spp. Association
Ambrosia dumosa / Atriplex canescens Association
Ambrosia dumosa--Atriplex canescens Association
Ambrosia dumosa--Atriplex hymenelytra Association
Ambrosia dumosa--Larrea tridentata Association
Ambrosia dumosa--Psoralea emoryi Association
Ambrosia salsola--Psoralea schottii Association
Atriplex canescens / Prosopis glandulosa Association
Atriplex canescens--Atriplex polycarpa Association
Atriplex canescens--Atriplex polycarpa / Parkinsonia florida Association
Atriplex canescens--Atriplex polycarpa Association
Atriplex canescens--Atriplex polycarpa--Larrea tridentata Association
Atriplex canescens--Atriplex polycarpa--Lycium brevipes Association
Atriplex canescens--Atriplex polycarpa--Psoralea emoryi Association
Atriplex canescens--Atriplex polycarpa--Suaeda moquinii Association
Atriplex canescens--Larrea tridentata Association
Atriplex hymenelytra--Isocoma acradenia Association
Atriplex lentiformes / Allenrolfea occidentalis Association
Atriplex polycarpa--Larrea tridentata Association
Bolboschoenus maritimus--Phragmites australis Association
Cladium californicum / Pluchea sericea Association
Distichlis spicata / Allenrolfea occidentalis Association
Distichlis spicata / Bolboschoenus maritimus / Typha domingensis Association
Distichlis spicata / Isocoma acradenia Association
Distichlis spicata--Juncus cooperi Association
Encelia farinosa--Atriplex hymenelytra Association
Isocoma acradenia--Atriplex canescens Association
Isocoma acradenia--Atriplex canescens--Atriplex polycarpa Association
Isocoma acradenia--Atriplex hymenelytra Association
Isocoma acradenia--Lycium brevipes Association

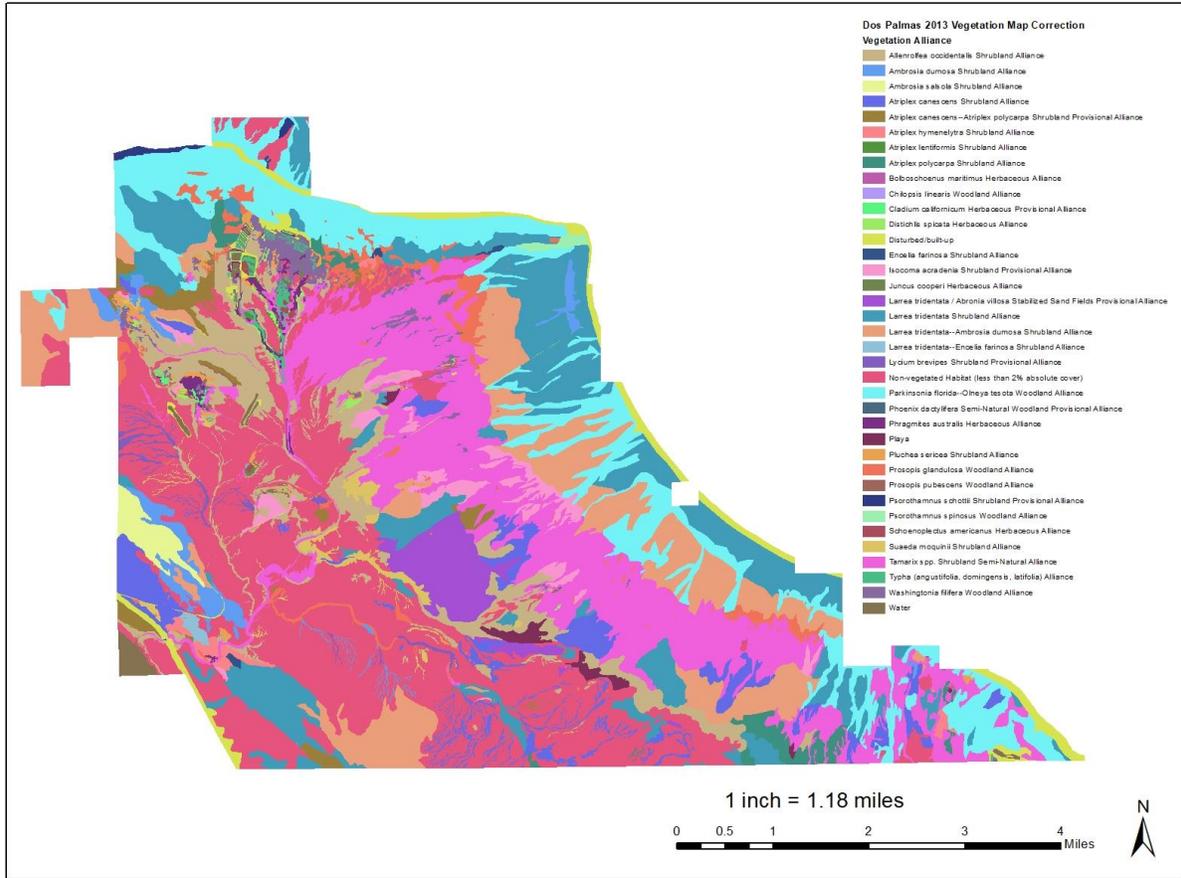
Isocoma acradenia--Pluchea sericea Association
Juncus cooperi / Baccharis sarothroides Association
Juncus cooperi / Phragmites australis Association
Juncus cooperi / Tamarix spp. Association
Larrea tridentata / wash Association
Larrea tridentata Association
Larrea tridentata--Ambrosia dumosa Association
Larrea tridentata--Ambrosia dumosa--Atriplex canescens Association
Larrea tridentata--Ambrosia dumosa--Atriplex hymenelytra Association
Larrea tridentata--Ambrosia dumosa--Encelia farinosa Association
Larrea tridentata--Ambrosia dumosa--Isocoma acradenia 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--Psorothamnus schottii--Association
Larrea tridentata--Lycium brevipes / Olneya tesota Association
Larrea tridentata--Psorothamnus schottii Association
Larrea tridentata--Tamarix spp. Association
Lycium brevipes--Allenrolfea occidentalis Association
Lycium brevipes--Atriplex canescens Association
Lycium brevipes--Tamarix spp. Association
none
Non-vegetated Habitat (less than 2% absolute cover)
Non--vegetated Habitat / Allenrolfea occidentalis Association
Non--vegetated Habitat / Atriplex canescens Association
Non-vegetated Habitat / Larrea tridentata Association
Non--vegetated Habitat / Psorothamnus emoryi Association
Non--vegetated Habitat / Tamarix spp Association
Olneya tesota / Larrea tridentata Association
Olneya tesota / Larrea tridentata--Atriplex polycarpa Association
Olneya tesota / Larrea tridentata--Encelia farinosa Association
Parkinsonia florida / Encelia farinosa Association
Parkinsonia florida / Larrea tridentata--Encelia farinosa Association
Parkinsonia florida / Larrea tridentata--Psorothamnus schottii Association
Parkinsonia florida / Psorothamnus schottii Association
Parkinsonia florida--Olneya tesota / Acacia greggii Association
Parkinsonia florida--Olneya tesota / Larrea tridentata--Ambrosia dumosa Association
Phoenix dactylifera--Washingtonia filifera / Tamarix spp. Association
Phragmites australis / Allenrolfea occidentalis Association
Phragmites australis Association
Phragmites australis--Schoenoplectus americanus Association

Phragmites australis--Typha domingensis Association
Pluchea sericea / Prosopis glandulosa Association
Pluchea sericea Association
Pluchea sericea--Allenrolfea occidentalis Association
Pluchea sericea--Atriplex polycarpa Association
Pluchea sericea--Tamarix spp. Association
Prosopis glandulosa / Allenrolfea occidentalis Association
Prosopis glandulosa / Atriplex canescens Association
Prosopis glandulosa / Larrea tridentata Association
Prosopis glandulosa / Larrea tridentata--Atriplex spp. Association
Prosopis glandulosa / Lycium brevipes--Atriplex canescens Association
Prosopis glandulosa / Suaeda moquinii Association
Prosopis glandulosa Association
Prosopis glandulosa--Parkinsonia florida Association
Prosopis glandulosa--Tamarix spp. Association
Prosopis glandulosa--Washingtonia filifera Association
Prosopis pubescens / Pluchea sericea / Distichlis spicata Association
Psoralea argemone / Ambrosia salsola--Atriplex spp. Association
Schoenoplectus americanus Association
Schoenoplectus americanus--Phragmites australis Association
Schoenoplectus americanus--Tamarix ramosissima Association
Suaeda moquinii Association
Suaeda moquinii--Allenrolfea occidentalis Association
Suaeda moquinii--Atriplex canescens Association
Tamarix spp. Association
Tamarix spp.--Allenrolfea occidentalis Association
Tamarix spp.--Atriplex canescens Association
Tamarix spp.--Baccharis sarathroides Association
Tamarix spp.--Isocoma acradenia Association
Tamarix spp.--Lycium brevipes Association
Tamarix spp.--Pluchea sericea Association
Tamarix spp.--Prosopis glandulosa Association
Typha domingensis / Tamarix spp. Association
Typha domingensis--Distichlis spicata Association
Typha dominguensis / Juncus cooperi Association
Washingtonia filifera / Phragmites australis Association
Washingtonia filifera / Prosopis glandulosa Association
Washingtonia filifera / Prosopis glandulosa--Atriplex spp--Suaeda moquinii Association
Washingtonia filifera / Prosopis pubescens Association
Washingtonia filifera / spring (Atriplex--Baccharis--Pluchea) Association
Washingtonia filifera / Tamarix spp. Association
Washingtonia filifera / Tamarix spp.--Isocoma acradenia Association

Washingtonia filifera / Typha domingensis / Juncus cooperi Association
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Washingtonia filifera--Phoenix dactylifera Association
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APPENDIX 3: 2013 DOS PALMAS CONSERVATION AREA VEGETATION MAP



APPENDIX 4: 2018 DOS PALMAS CONSERVATION AREA VEGETATION MAP

