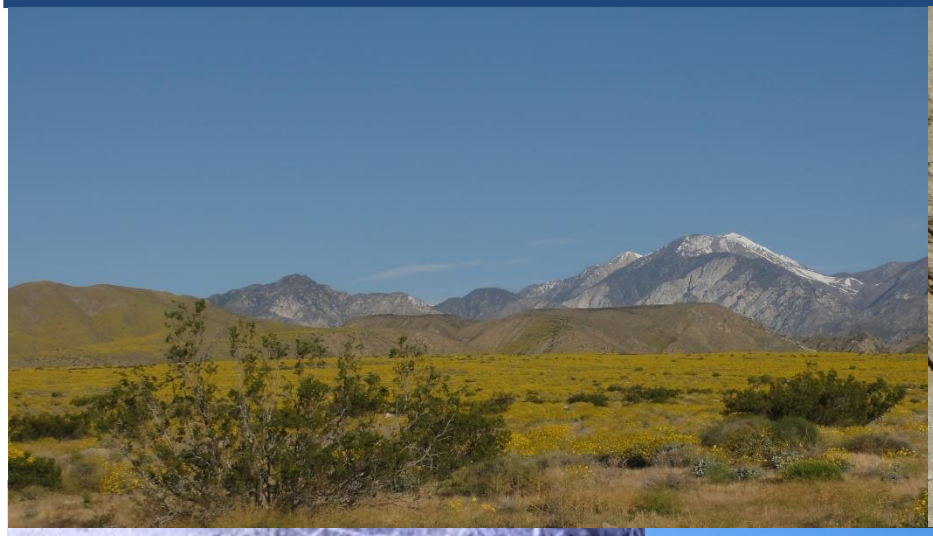
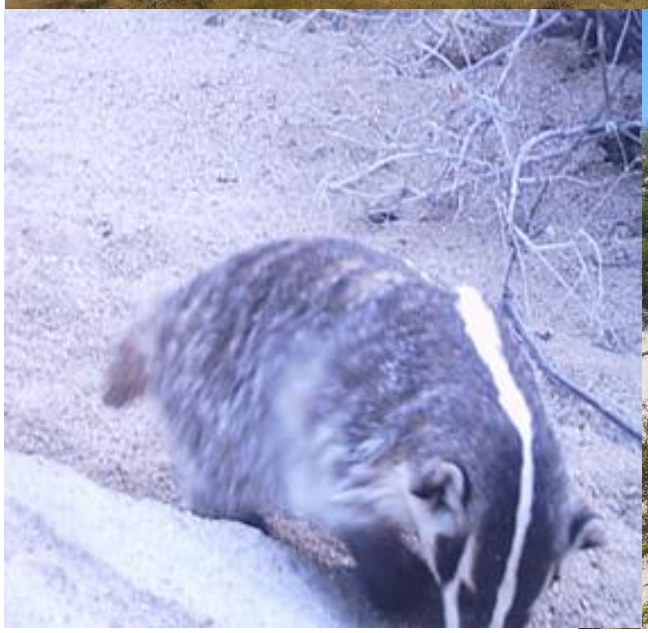
Coachella Valley
Multiple Species Habitat Conservation Plan/
Natural Community Conservation Plan

2016 Annual Report





Submitted by
Coachella Valley Conservation Commission

April 2017

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I. Introduction

The Coachella Valley Multiple Species Habitat Conservation Plan/Natural Community Conservation Plan (CVMSHCP) is a regional multi-agency conservation plan that provides for the long-term conservation of ecological diversity in the Coachella Valley region of Riverside County. Significant progress has been made in plan implementation since state and federal permits were issued in September and October 2008. The term of the permits is 75 years, which is the length of time required to fully fund implementation of the CVMSHCP. This report describes the progress made on plan implementation for the 2016 calendar year.

The CVMSHCP includes an area of approximately 1.1 million acres in the Coachella Valley region within Riverside County. The plan area boundaries were established to incorporate the watersheds of the Coachella Valley within the jurisdictional boundaries of CVAG and within Riverside County. Indian Reservation Lands are not included in the CVMSHCP although coordination and collaboration with tribal governments has been ongoing.

The Coachella Valley Conservation Commission (CVCC) is the agency responsible for CVMSHCP implementation. The CVCC is comprised of elected representatives of the Local Permittees including Riverside County, the cities of Cathedral City, Coachella, Desert Hot Springs, Indian Wells, Indio, La Quinta, Palm Desert, Palm Springs, and Rancho Mirage, the Coachella Valley Water District, Mission Springs Water District, and the Imperial Irrigation District. The Riverside County Flood Control and Water Conservation District (County Flood Control), Riverside County Regional Park and Open Space District (County Parks), and Riverside County Waste Resources Management District (County Waste) are also Local Permittees. Other Permittees include three state agencies, the California Department of Parks and Recreation (State Parks), the Coachella Valley Mountains Conservancy (CVMC), and the California Department of Transportation (CalTrans). A major amendment to include the City of Desert Hot Springs and Mission Springs Water District as Permittees was approved by the CVCC in March 2014 and all local Permittees approved the major amendment in 2014. The US Fish and Wildlife Service (USFWS) approved the Major Amendment in December 2015. The final approval of the Major Amendment by California Department of Fish and Wildlife (CDFW) was in August 2016.

The CVMSHCP involves the establishment of an MSHCP Reserve System to ensure the conservation of the covered species and conserved natural communities in perpetuity. The existing conservation lands managed by local, state, or federal agencies, or non-profit conservation organizations form the backbone of the MSHCP Reserve System. To complete the assembly of the MSHCP Reserve System, lands are acquired or otherwise conserved by the CVCC on behalf of the Permittees, or by other acquisition partners in three major categories:

- Lands acquired or otherwise conserved by the CVCC on behalf of the Permittees, or through Permittee contributions
- Lands acquired by state and federal agencies to meet their obligations under the CVMSHCP
- Complementary Conservation lands including lands acquired to consolidate public ownership in areas such as Joshua Tree National Park and the Santa Rosa and San Jacinto Mountains National Monument. These acquisitions are not a Permittee obligation but are complementary to the Plan.

In addition to acquisition, land in the MSHCP Reserve System may be conserved through dedication, deed restriction, granting a conservation easement, or other means of permanent conservation. To meet the goals of the CVMSHCP, the Permittees are obligated to acquire or otherwise conserve 100,600 acres in the Reserve System. State and federal agencies are

expected to acquire 39,850 acres of conservation land. Complementary conservation is anticipated to add an additional 69,290 acres to the MSHCP Reserve System. Figure 1 shows the progress as of December 31, 2016 toward the land acquisition goals identified in Table 4-1 of the CVMSHCP.

Figure 1: CVMSHCP Progress Toward Conservation Goals

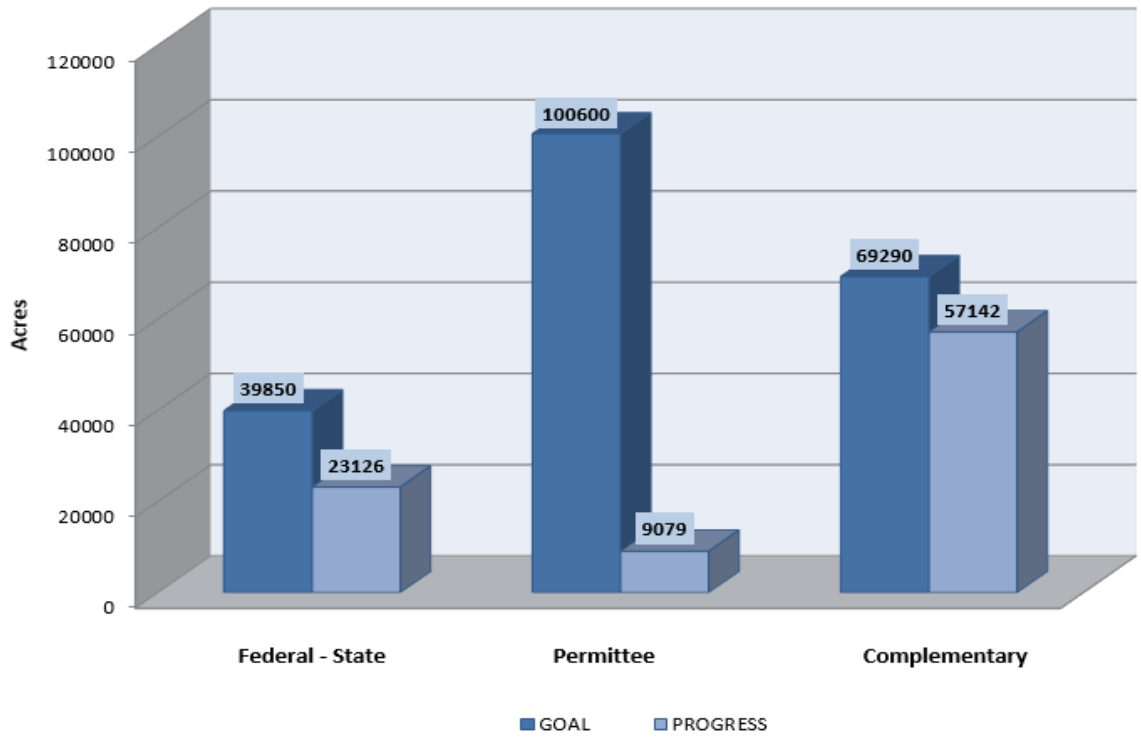


Table 1 demonstrates our progress on reserve assembly by showing the acres of conservation land protected since the issuance of the federal permit in October 2008. Significant progress has been made with over 89,000 acres of conservation lands acquired by various local, state and federal partners since 1996.

CVCC completed a major update of the land acquisition database in cooperation with the Coachella Valley Mountains Conservancy, CDFW and USFWS in 2013. Most of the land conserved since 1996 has been accomplished by entities other than CVCC and the records associated with acquisitions have not always been complete or consistent. Additional updates were made in early 2016 which are reflected in this report. As a result, some corrections to the numbers reported in Table 1 in prior annual reports have been made. All acquisition records and the acreage figures used thoughout the 2016 Annual Report have now been updated and made consistent with the rules shown in Appendix 1.

Table 1: Summary of Annual Progress on Reserve Assembly

Conservation Credit	Goal	Total Progress	1996 - 2010	2011	2012	2013	2014	2015	2016
Federal - State	39,850	23,126	17,132	869	1,819	1,060	1681	296	270
Permittee	100,600	9,079	6,323	383	315	601	242	416	799
Complementary	69,290	57,142	47,574	4,207	1,760	671	957	1,441	532
Total	**209,740**	**89,347**	**71,029**	**5,459**	**3,894**	**2,332**	**2,880**	**2,153**	**1,600**

Once acquired, lands within the Conservation Areas are held in public or private ownership and are managed for conservation and/or open space values. Management of these lands contributes to the conservation of the Covered Species and the conserved natural communities included in the Plan. Table 2 identifies the allocation of land management responsibility, based on the entity that ultimately holds title to the land.

Table 2: Acres of Management Credit

Management Credit	Progress (acres)
Federal - State	57,434
Permittee	11,408
Complementary	20,505
Total	**89,347**

Reporting Requirements:

This Annual Report describes the activities for the period from January 1, 2016 to the end of the calendar year on December 31, 2016. As required by Section 6.4 of the CVMSHCP, this Annual Report will be presented at the CVCC meeting of April 13, 2017, where the report will be made available to the public. The report is also posted on the CVMSHCP website, www.cvmshcp.org.

II. Status of Conservation Areas: Conservation and Authorized Disturbance

The CVMSHCP identifies both qualitiative and quantitative conservation goals and objectives that must be met to ensure the persistence of the Covered Species and natural communities. The quantitative approach is designed to be as objective as possible. The CVMSHCP includes specific acreage requirements for both the amount of authorized disturbance that can occur and the acres that must be conserved within each Conservation Area. These acreage requirements are identified in conservation objectives for each Covered Species and natural community as well as for essential ecological processes and biological corridors and linkages. The conservation objectives provide one measure of the progress toward meeting the requirements of the CVMSHCP under the state and federal permits. This report provides a detailed accounting of the status of the conservation objectives for each of the Conservation Areas up to December 31, 2016. The planning process for the CVMSHCP was initiated on November 11, 1996, which is the

baseline date for the acreages listed in the tables in Sections 4, 9, 10 and throughout the CVMSHCP document. This Annual Report provides an update of these baseline tables to account for all the Conservation and Authorized Disturbance that has occurred between January 1, 2016 and December 31, 2016 (see Appendix IV).

Table 3 provides a summary of the amount of conservation and the acres of disturbance authorized within Conservation Areas in 2016. Authorized disturbance results from development projects in the Conservation Areas. In 2016, there was 0 acres of Authorized Disturbance reported. The Total Authorized Disturbance in Table 3 includes Authorized Disturbance in years since 1996 that had not been reported to CVCC in the year in which the Disturbance occurred.

Table 3: Conservation and Authorized Disturbance Within Conservation Areas

Conservation Area	Conservation Goal	Conserved in 2016	Conserved Since 1996	Allowed Authorized Disturbance	Authorized Disturbance in 2016	Total Authorized Disturbance since 1996
Cabazon	2,340	0	0	260	0	0
CV Stormwater Channel and Delta	3,870	39	39	430	0	5
Desert Tortoise and Linkage	46,350	190	4,289	5,150	0	14
Dos Palmas	12,870	186	3,855	1,430	0	0
East Indio Hills	2,790	0	0	310	0	0
Edom Hill	3,060	0	2,069	340	0	1
Highway 111/I-10	350	0	54	40	0	0
Indio Hills Palms	2,290	0	1,039	250	0	0
Indio Hills/Joshua Tree National Park Linkage	10,530	0	8,980	1,170	0	5
Joshua Tree National Park	35,600	297	13,246	1,600	0	0
Long Canyon	0	0	0	0	0	0
Mecca Hills/Orocopia Mountains	23,670	40	6,577	2,630	0	0
Santa Rosa and San Jacinto Mountains	55,890	95	30,687	5,110	0	9
Snow Creek/Windy Point	2,340	0	889	260	0	0
Stubbe and Cottonwood Canyons	2,430	0	875	270	0	29
Thousand Palms	8,040	663	4,308	920	0	54
Upper Mission Creek/Big Morongo Canyon	10,810	39	6,654	990	0	21

Conservation Area	Conservation Goal	Conserved in 2016	Conserved Since 1996	Allowed Authorized Disturbance	Authorized Disturbance in 2016	Total Authorized Disturbance since 1996
West Deception Canyon	1,063	0	1,792	100	0	0
Whitewater Canyon	1,440	0	956	160	0	1
Whitewater Floodplain	4,140	5	572	460	0	32
Willow Hole	4,920	46	2,465	540	0	6
Total	234,793	1,600	89,347	22,420	0	177

III. Biological Monitoring Program

The CVMSHCP outlines a scientifically-based monitoring program for species, natural communities and landscapes listed under the Plan. To ensure long-term conservation goals are attained, monitoring activities are based on a three-phased approach and consist of: 1) assessing baseline conditions and identifying threats and stressors; 2) performing focused monitoring including threats and stressors, once they are determined; and 3) conducting adaptive management actions whereby the scientific method is employed to develop and implement best management practices.

In 2016, CVCC combined the Reserve Management Unit Committee and the Biological Working Group to better integrate both the land management and biological monitoring aspects of the Plan. The Reserve Management Unit Committee and Biological Working Group (RMUC/BWG), which includes land managers within the Conservation Areas, as well as Wildlife Agency and other professional biologists, capitalizes on the expertise and resources of all our agency partners as well as the UC Riverside - Center for Conservation Biology. The RMUC/BWG met regularly to discuss updates on biological issues and adaptive management strategies. One of their tasks is to assess current monitoring protocols to align them with research goals and management needs outlined within the CVMSHCP, as well as vetting completed monitoring activities. During the spring, they assess the monitoring priorities to be brought forth to the Reserve Management Oversight Committee as the recommended annual work plan. A three to five-year strategic plan provides an outline of what monitoring has been completed, and outlines priorities for the following year's monitoring needs. This strategic monitoring plan lists specific objectives for identifying and managing threats and stressors, environmental variables that influence the persistence of the covered species. The CVCC Habitat Conservation Management Analyst continued to manage contracts and logistics for monitoring and land management efforts, including coordinating meetings of the Reserve Management Unit Committees and the Biological Working Group.

To support these goals, CVCC has actively pursued grant funding for monitoring programs. CVCC received funding for a project from the Natural Community Conservation Planning Local Assistance Grant (LAG) program in June 2016, in the amount of $54,967 to support "*Monitoring Nesting Success of Riparian Birds to Assess Effectiveness of Brown Headed Cowbird Removal."* This project will support a concurrent nesting study and augment cowbird management in the Dos Palmas Conservation Area, Chino Canyon, and Coachella Valley Stormwater Channel and Delta Conservation Area. Two other LAG funded programs, "*Vegetation Mapping of Peninsular Bighorn Sheep Habitat*" and "*Developing an Effective Agassiz's Desert Tortoise Monitoring Program*"

continued throughout 2016. CVCC subcontracted with the United States Geological Survey to monitor tortoise populations and demography within a focal plot in the Desert Tortoise and Linkage Conservation Area, using radiotelemetry to locate the tortoises, and provide population estimates. CVCC also subcontracted with Aerial Information Systems, Inc. to map the vegetation within essential bighorn sheep habitat, within the Santa Rosa and San Jacinto Mountains Conservation Area. In April 2016, a grant was received from Coachella Valley Mountains Conservancy, funded through the Proposition 1 Grant Program, in the amount of $114,268 for tamarisk removal and "*Mesquite Restoration and Groundwater Monitoring*" in the Willow Hole Conservation Area.

Peninsular bighorn sheep monitoring continued with tracking GPS telemetry collars that were fitted to sheep in the Santa Rosa and San Jacinto Mountains Conservation Area in October 2014 and November 2015. A California Department of Fish and Wildlife report on a helicopter survey completed in November 2016, and the population estimates developed from that survey, was released in December 2016 and is included as Appendix IIC. During the bighorn captures in 2014 and 2015, blood and serum samples were collected from each bighorn sheep to provide data on health and genetic status. The recently collected samples were combined with stored tissue samples collected in the past from sheep in the Santa Rosa and San Jacinto Mountains and are included in health and genetic studies in progress. CVCC received a Bureau of Reclamation Grant in the amount of $48,750 in July 2014 for "*Genetic and Health Profiles of Peninsular Bighorn Sheep in the Northern Peninsular Range*." Under a contract with CVCC, Oregon State University is completing a genetic analysis of bighorn sheep in the Santa Rosa and San Jacinto Mountains; this study is supported by additional funding from CVCC ($40,000) and U.S. Fish and Wildlife Service ($11,000). CVCC, USFWS, and CDFW are also working with University of California Davis on a disease study to be completed in 2017-2018.

In June 2016, a contract with UC Riverside (UCR) - Center for Conservation Biology was approved for monitoring of triple-ribbed milkvetch, aeolian sand species, burrowing owls, Palm Springs pocket mouse, little San Bernardino Mountains linanthus, Sahara mustard control research, and vegetation mapping. In fall of 2016, UCR began the task of mapping the vegetation in the remaining areas of Sand to Snow National Monument and Coachella Valley Stormwater Channel and Delta Conservation Area that remain unmapped, as well as finishing the vegetation mapping for Desert Tortoise and Linkage Conservation Area to correspond with the tortoise monitoring. UCR also assisted in advising the RMUC and BWG on developing focused research questions for protocols. In coordination with the RMUC and Biological Working Group, UCR provides guidance and input on the development of the monitoring program tasks and performs the majority of monitoring efforts with their team of ecologists who have specialties in various aspects of the Coachella Valley desert ecology. UCR also assisted with providing support for the desert tortoise and vegetation mapping projects as needed. The 2015-2016 Annual Monitoring Report submitted by UCR can be found in Appendix II-A, the "Dos Palmas Vegetation Map Report" can be found in Appendix II-B.

2016 Biological Monitoring Activities

Photos: 1 –Coachella Valley milkvetch in bloom in the Edom Hill Conservation Area; 2 –Flat-tailed horned lizard; 3 – Burrowing owl withthin Coachella Valley Stormwater Channel and Delta Conservation Area; 4 – Female tortoise getting fitted with radio, weighed and x-rayed for eggs in the Desert Tortoise and Linkage Conservation Area; 5- Peninsular bighorn sheep on golf course next to escape habitat; 6-Track of a Peninsular bighorn sheep ewe over time using readout from the GPS collars.

IV. Land Management Program

Management of lands acquired by CVCC and other local Permittees is coordinated with management of the existing conservation lands owned by state, federal and non-profit agencies. The Reserve Management Oversight Committee (RMOC) is the inter-agency group that provides a forum for coordination of management and monitoring lands within the Reserve System and makes recommendations to the CVCC. The Reserve Management Oversight Committee is supported by the Reserve Management Unit Committees.

The Reserve Management Oversight Committee held regular quarterly meetings on January 27, April 27, and October 26, 2016. Each RMOC meeting included a report regarding the Monitoring Program and the Land Management Program. The RMOC reviewed the Reserve Management and Monitoring work plans, biological monitoring and management priority activities, and tentative budget at the April 27, 2016 meeting. The recommendations from the RMOC were incorporated into the CVCC budget for FY 2016/2017 and presented to the CVCC at their June 2016 meeting. The July 2016 RMOC meeting was cancelled due to a lack of agenda items. CVCC staff continues to coordinate with the RMOC and RMUCs to ensure that monitoring and research activities inform and support management of the Reserve Management Units.

Reserve Management Unit Committees

The six Reserve Management Units (RMUs) facilitate coordinated management by local, state and federal agencies to achieve the Conservation Objectives within the MSHCP Reserve System. The Reserve Management Unit Committee meetings were combined to reduce demands on staff time and provide for better coordination. The RMUC met at various field locations to discuss management and monitoring issues on site, March 8 and October 4, 2016. The March 8 RMUC meeting included a visit to the Coachella Valley Fringe-toed Lizard Preserve, and the Whitewater Floodplain Conservation Area. The October 4 meeting took place at the Willow Hole, Edom Hill and Upper Mission Creek/Big Morongo Canyon Conservation Areas. Because many of the same staff members are involved in both the Biological Working Group and the RMUC and staff resources are limited, the RMUC tried to focus on field visits to better understand the unique issues of each conservation area. The group discussed prioritizing invasive species and off-road vehicle control management efforts, increasing volunteer activities, and coordination on grant opportunities. The RMUC then combined with the BWG during the March 22, April 19, May 17, and June 19 meetings to discuss management and monitoring priorities and get reports of monitoring results.

Trails Management Subcommittee

The Trails Management Subcommittee (TMS) meetings were held on January 20, February 17, March 16, April 20, May 18, October 19, and November 16, 2016. During 2016, the TMS focused on a region-wide review of trails in the Santa Rosa and San Jacinto Mountains to identify management and monitoring needs. This review includes: 1) identifying safety and signage needs along the trails; 2) refining the GIS trails map to identify authorized and unauthorized trails and potential new trails; and 3) establishing trail improvement and signage priorities. In 2016, CVCC partners, Friends of the Desert Mountains and their volunteer crew worked closely with the cities of La Quinta and Palm Desert to fix trail hazards and install clear directional and safety signage. Friends' volunteers have also done work on trails in Palm Springs and Rancho Mirage and are taking the lead on trail restoration throughout the valley. CVCC staff is also working with the Greater Palm Springs Convention & Visitors Bureau and Friends of the Desert Mountains to develop a trails website/app to provide information to residents and visitors about trails in the

Coachella Valley. This effort will provide a way to disseminate information on trail etiquette, environmentally friendly trail use, and safety in a usable and accessible platform. The Subcommittee also works with jurisdictions on existing ordinances that relate to trail use.

Land Improvement: Acquisition Cleanups

In 2016 the CVCC Acquisitions Manager performed pre-acquisition site inspections and job walks on 18 properties in multiple Conservation Areas. During these inspections the Land Acquisitions Manager identified illegal dumping, hazardous conditions, OHV & equestrian activity, and the existence of listed species, as well as determined property fencing requirements. As per CVCC's standard Purchase & Sale Agreements, willing sellers are required to clean up illegal dumping and blight prior to closing. Contractors are met in the field by the Acquisitions Manager prior to a required cleanup to review the agency's standards and specifications for the particular site in question. After cleanup, the job site is re-inspected to certify that cleanups meet the requirements, and if they are found lacking, the seller is notified if additional work will be necessary. After closing, CVCC monitors the sites at least annually for ongoing management/fencing requirements. This year, CVCC was directly responsible for removing an estimated 112 tons of refuse, including 53 tires, from the Coachella Valley, covering more than 925 acres and providing over $36,575 to local contractors for cleanup services.

Property Management & Monitoring

Monitoring the status of CVCC conservation lands is an essential and ongoing activity. Regular site visits and patrols are conducted on a biweekly basis to various CVCC properties. Illegal dumping, OHV use and shooting continue to be a problem on some of the Reserve lands. In 2016, approximately 18,000 linear feet of post and cable were installed within the Upper Mission Creek and Big Morongo Canyon Conservation Area to protect the reserve lands. The continuous monthly monitoring of the fence and adjacent areas proved that the fence was successful in dissuading further dumping or OHV activity in Desert Hot Springs. There was a spike in vandalism once again, in the fall between October and December; CVCC continued with a fencing maintenance contract which allowed the vandalized areas to be fixed a quickly as possible. A 28 foot wide gate was also installed at East Deception Canyon to limit illegal dumping and shooting. A week-long cleanup was held at the Edison access road in Stubbe and Cottonwood Canyons, on CVCC properties with the help of volunteers from the Urban Conservation Corps. The Urban Conservation Corps, with an office in Indio, employs youth ages 18 to 25 to work on conservation projects. CR&R Waste Services generously donated a rollaway container which the crew filled with illegally dumped furniture and debris. The following photos illustrate the management efforts of 2016.

2016 Land Management Activities

Photos: 1 – Vandalism to gate in Desert Hot Springs; 2 – Urban Conservation Corps volunteers; 3 – Urban Conservation Corps removing illegal dumping from Stubbe and Cottonwood Canyon Conservation Area; 4 – Gate at East Deception Canyon; 5 – A run of the 18,000 linear feet of post and cable fencing installed in Upper Mission Creek / Big Morong Canyon Conservation Area.

V. Land Acquisition to Achieve the Conservation Goals and Objectives of the CVMSHCP

In 2016, CVCC completed 11 transactions acquiring 14 parcels totaling 799 acres at a cost of $915,504 in CVCC funds. All of these acquisitions are listed in Table 4. Friends of the Desert Mountains acquired 11 parcels totaling 415 acres with $86,906 in funds from Coachella Valley Mountains Conservancy and $40,733 in Resource Legacy Funds, along with $7,771 in Friends of the Desert Mountain funds. A table of CVCC acquisitions and otherwise conserved lands recorded during the period from January 1, 2016 to December 31, 2016 can be found in Appendix III. Parcels acquired are listed by Assessor Parcel Number (APN**)** and the acreage listed is the recorded acreage from the Riverside County Assessor.

Table 4: Lands Acquired by CVCC in 2016

Project	Acres	Conservation Area	Purchase Price
Cho-Sky Valley	483.14	Thousand Palms	$ 264,000
Cho-Sky Valley	160.19	Thousand Palms	$ 160,000
Curci	4.91	Whitewater Floodplain	$ 15,500
CVCC - Pasker-Sadowski	5.04	Willow Hole	$ 15,328
Gellman	0.34	Willow Hole	$ 12,500
Hermozi	39.42	CV Stormwater Channel and Delta	$ 394,000
Justice Estate Donation	0.24	Willow Hole	$ 525
Justice Estate Donation	0.23	Willow Hole	$ 525
Klawitter	5.00	Willow Hole	$ 17,500
Mears	2.55	Willow Hole	$ 8,750
Mears	2.39	Willow Hole	$ 8,750
Tax Default 2015 - Agreement 4421	10.00	Desert Tortoise and Linkage	$ 2,533
Tax Default 2015 - Agreement 4421	5.01	Dos Palmas	$ 3,364
Tax Default 2015 - Agreement 4421	80.73	Dos Palmas	$ 12,229
Total Purchases	799.20		$ 915,504

Figure 2 shows the acquisitions completed by all local, state, and federal acquisition partners in 2016 by Conservation Area. Figure 3 shows the acquisitions by CVCC. Funding for land acquisition and CVMSHCP Reserve Assembly comes from a variety of sources including local, state, and federal agencies. CVCC acquires lands with funding from CVMSHCP development mitigation fees and CVAG contributions to mitigate for regional roads and other transportation projects. In addition, as shown in Figure 4, funding from land acquisition partners continues to be an important source of land acquisition dollars. Significant federal funding has been provided through the U.S. Fish and Wildlife Service's Cooperative Endangered Species Conservation Fund, referred to as Section 6. State funding comes from several sources. The Coachella Valley Mountains Conservancy contributes significantly to the acquisition of conservation lands through grants to various organizations, including CVCC. The state Wildlife Conservation Board/ California Department of Fish and Wildlife is another major source of funding. The non-profit Friends of the Desert Mountains has acquired lands using grants from CVMC, private donations, and other sources; many of these lands have been transferred to CVCC. Other agencies and non-profits have provided funds for land conservation. Figure 5 shows the lands acquired in 2016 by all acquisition partners. CVCC gratefully acknowledges the support from our partners.

Figure 2: Total Acquisitions in 2016 by Conservation Area

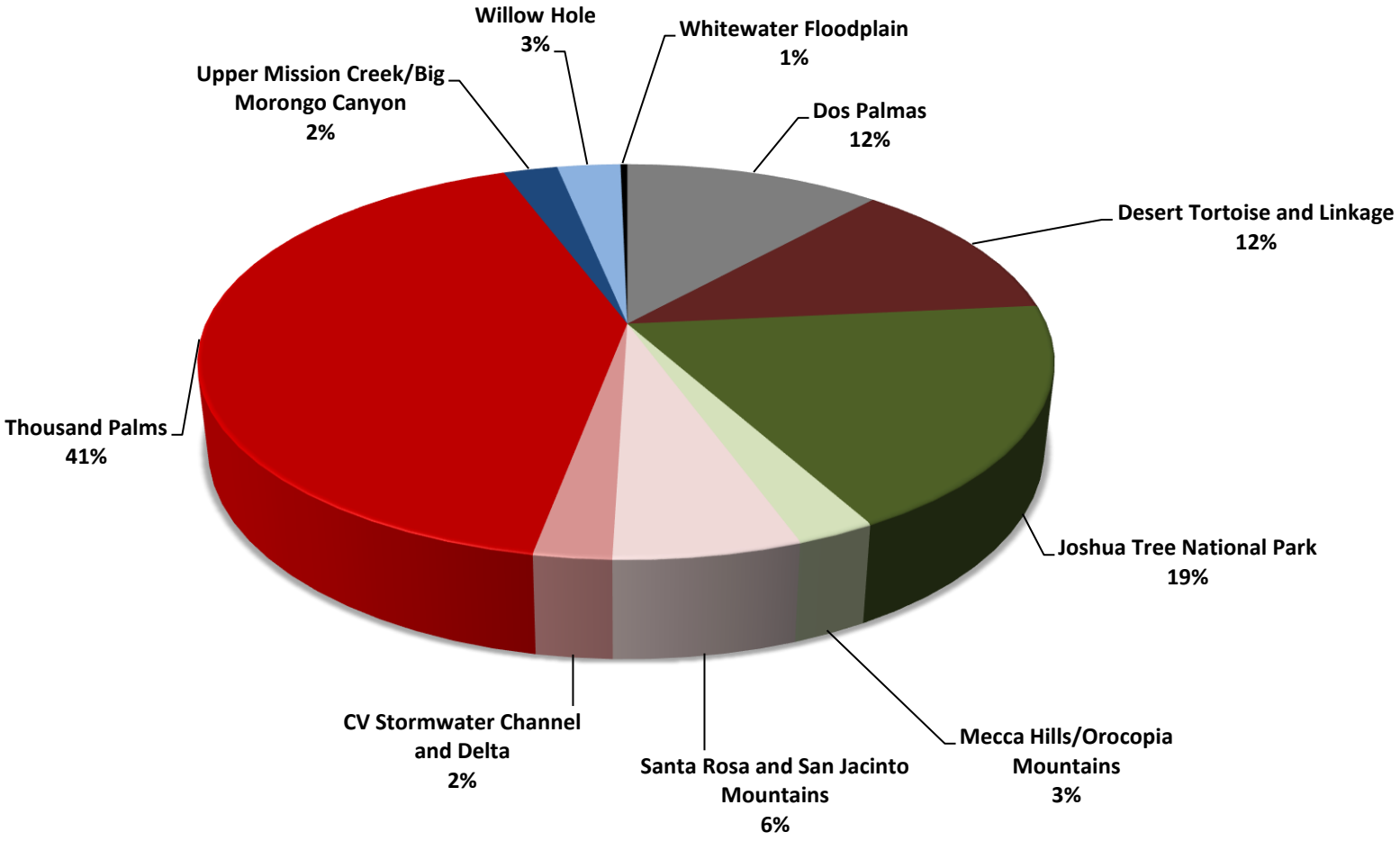


Figure 3: CVCC Acquisitions in 2016 by Conservation Area

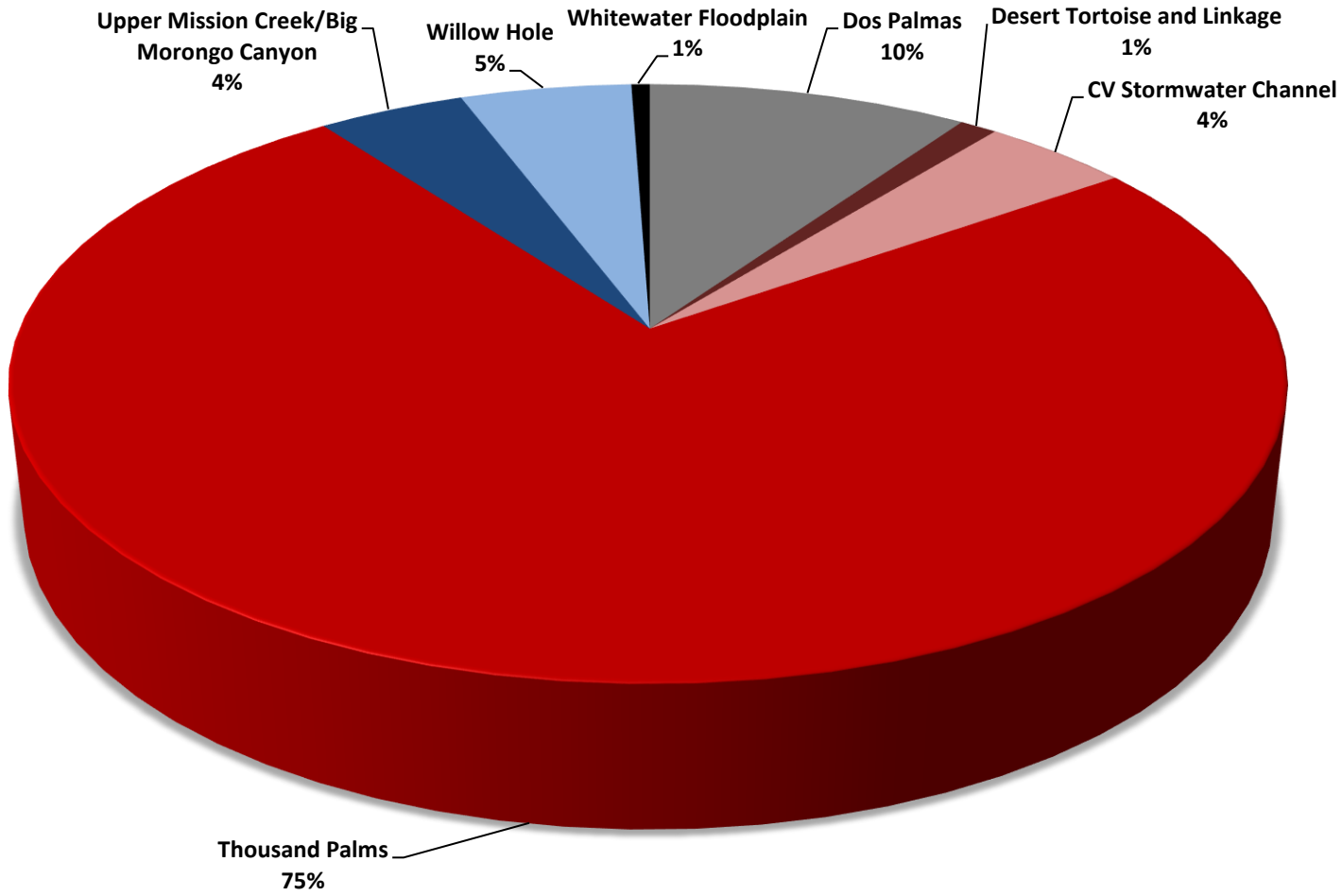


Figure 4: Funding Sources for Land Acquisition and Reserve Assembly

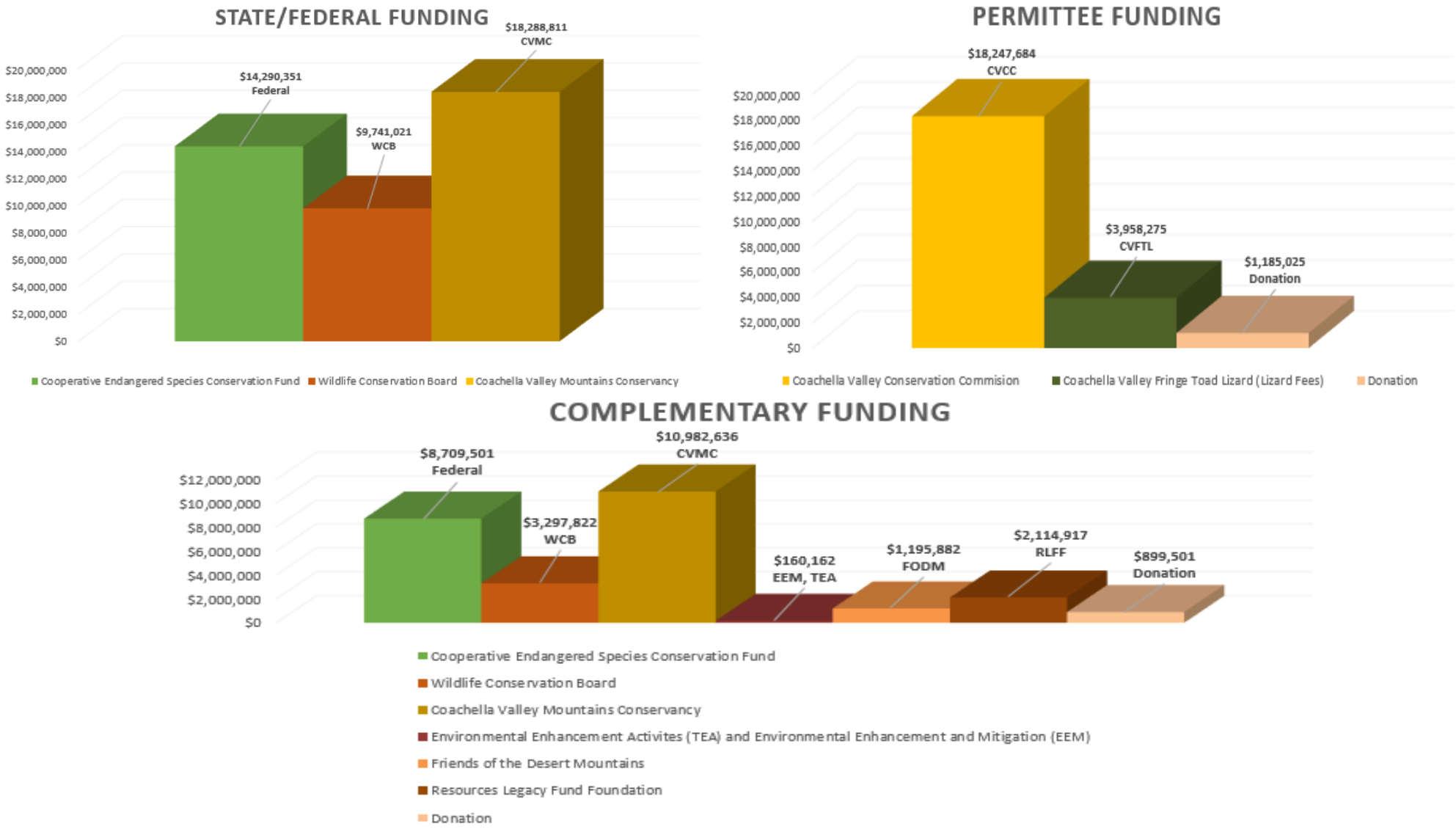
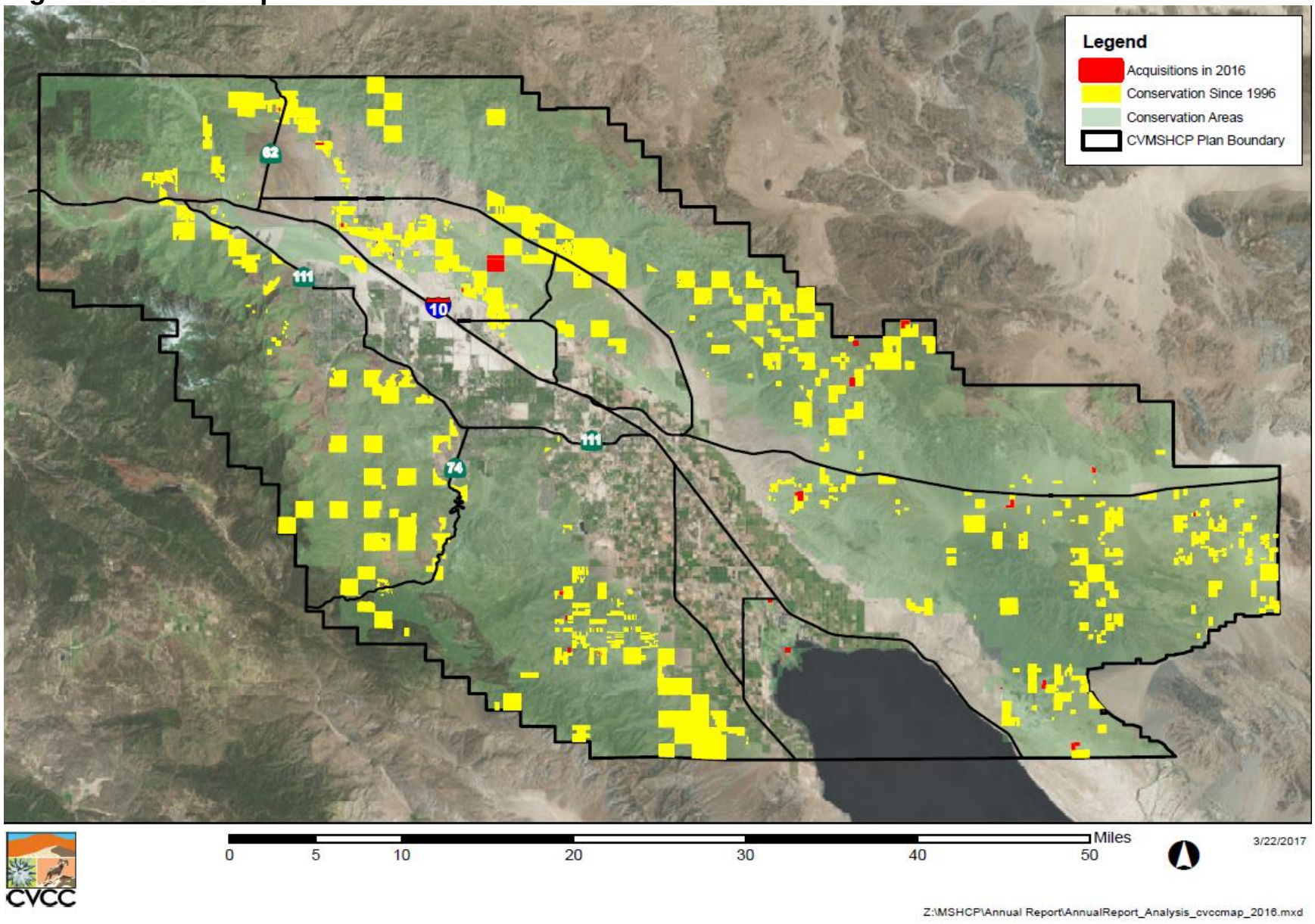


Figure 5: Land Acquisitions in 2016



VI. Conservation and Authorized Disturbance Within Conservation Areas

The progress toward achieving the Conservation Goals and Objectives for the CVMSHCP is reported here from two different perspectives, by Conservation Objective and by Covered Species or natural community. The CVMSHCP includes Conservation Objectives for conserving Core Habitat for Covered Species and conserved natural communities, Essential Ecological Processes necessary to maintain habitat viability, and Biological Corridors and Linkages within each of the 21 Conservation Areas. The amount of conservation and the amount of disturbance are reported in the same tables for comparative purposes. This Annual Report includes the conservation and authorized disturbance from January 1 to December 31, 2016.

The progress toward our goals in terms of the Conservation Objectives is presented in Appendix IV.

VII. Covered Activities Outside Conservation Areas

The CVMSHCP allows for development and other Covered Activities outside the Conservation Areas which do not have to meet specific conservation objectives A table that includes an accounting of the number of acres of Core Habitat and Other Conserved Habitat for the Covered Species and conserved natural communities that have been developed or impacted by Covered Activities outside the Conservation Areas can be found in Appendix V. This information is listed for each of the Permittees with lands impacted by covered activities outside the Conservation Areas.

Development inside Conservation Areas has been carefully tracked and subject to review under the 1996 Memorandum of Understanding that began the planning process for the CVMSHCP. For development outside Conservation Areas, the acre figures in the table are estimates derived from the Developed area of the California Department of Conservation, Division of Land Resource Protection, Farmland Mapping and Monitoring Program GIS coverages from 1996 and 2014.

See http://www.conservation.ca.gov/dlrp/FMMP/Pages/Index.aspx for more detail on the Farmland Mapping and Monitoring Program.

VIII. Status of Covered Species

An overview of the status of each of the Covered Species for each Conservation Area can be found in Appendix IV.

IX. Significant Issues in Plan Implementation

Among the most significant issues in Plan Implementation in 2016 was the completion of the Major Amendment to include the City of Desert Hot Springs and Mission Springs Water District

as CVMSHCP Permittees. The Major Amendment required a Supplemental Environmental Impact Report/Environmental Impact Statement. It also required all members of the CVCC to approve the Major Amendment. The CVCC approved the Major Amendment and certified the Supplemental EIR/EIS on March 13, 2014. The City of Desert Hot Springs and Mission Springs Water District approved the Major Amendment in April 2014. The Major Amendment was then circulated to all CVCC member agencies as well as the state Permittees (Caltrans, California State Parks, Coachella Valley Mountains Conservancy). Subsequently all other local Permittees approved the Major Amendment as of July 29, 2014. The Major Amendment was approved by the State Permittees as of September 2015. On December 8, 2015, the USFWS signed the permit for the Major Amendment. The California Department of Fish and Wildlife approved the Major Amendment in August 2016.

Another significant project is the La Quinta Peninsular Bighorn Sheep Barrier Project. This project was initiated in 2014 in response to a letter from the U.S. Fish and Wildlife Service and the California Department of Fish and Wildlife expressing their concerns about bighorn sheep using artificial sources of food and water in unfenced areas in the City of La Quinta. Terra Nova Planning and Research, Inc. of Palm Desert is working with CVCC on the Environmental Impact Report for this project. A Public Scoping Meeting was held at La Quinta City Hall on March 10, 2016. Public comments were received at the meeting and during the scoping process. Public concerns included barrier location and alignment, potential impacts to the health and safety of the bighorn sheep, and potential aesthetic impacts. CVCC staff worked with the local property owners, the City of La Quinta, U.S. Fish and Wildlife Service, California Department of Fish and Wildlife, and BLM to develop a range of alternatives for the proposes barrier as well as an analysis of other options. A federal Environmental Assessment is also being prepared in coordination with the Bureau of Reclamation as fencing associated with the Coachella Canal will require their input and approval. One section of the fence has been installed by CVWD adjacent to SilverRock golf course as part of their work on the canal in fall 2014. CVCC staff made presentations to homeowners associations and met with property owners a number of times to hear their concerns and discuss options. The Draft EIR was release in early January 2017 with a 45-day public comment period. The final environmental documents are anticipated in spring 2017. Public meetings and community outreach are planned as part of this process.

X. Expenditures for CVMSHCP: 2016/2017 Budget

http://www.cvag.org/library/pdf_files/admin/CVCC%20Financials%20Reports%20FY_2016_2017/CVCC%20FY16-17%20Budget.pdf

BUDGET BY PROGRAMS - FY 2016/2017

	MANAGEMENT AND MONITORING	GENERAL ADMINISTRATION	LAND ACQUISITION	ENDOWMENT	LIZARD ENDOWMENT	TRAVERTINE MANAGEMENT	MANAGEMENT CONTINGENCY	IN-LIEU FEE	TOTAL
BEGINNING FUND BALANCE	$ 301,667	$ 204,082	$ 3,966,483	$ 6,694,414	$ 309,217	$ 504,992	$ 3,491,313	$ 76,666	$ 15,548,834
REVENUES:									
Development Mitigation Fees	$ 227,862	$ -	$ 1,112,503	$ -	$ -	$ -	$ -	$ -	$ 1,340,365
Agencies Mitigation Fees	-	-	-	570,000	-	-	-	-	570,000
Tipping Fees	-	395,000	-	-	-	-	-	-	395,000
Contributions	-	-	-	-	-	-	-	-	-
Grants	268,204	-	1,500,000	-	-	-	-	-	1,768,204
Other Revenue	-	-	-	-	-	-	-	-	-
Investment Income	1,200	1,000	13,500	24,000	1,200	2,000	12,000	7	54,907
Total Revenues	$ 497,266	$ 396,000	$ 2,626,003	$ 594,000	$ 1,200	$ 2,000	$ 12,000	$ 7	$ 4,128,476
EXPENDITURES:									
Administrative Fees	$ 2,279	$ -	$ 11,125	$ -	$ -	$ -	$ -	$ -	$ 13,404
Accounting / Bank Service Charges	-	3,000	-	-	-	-	-	430	3,430
Comprehensive Insurance	-	10,308	-	-	-	-	-	-	10,308
Per Diem Payments	-	10,200	-	-	-	-	-	-	10,200
Per Diem Taxes	-	885	-	-	-	-	-	-	885
Office Supplies	-	3,000	-	-	-	-	-	-	3,000
Printing	-	5,000	-	-	-	-	-	-	5,000
Land Improvements	1,000,000	-	240,000	-	-	-	-	-	1,240,000
Legal Services	-	50,000	-	-	-	-	-	-	50,000
Professional Services	2,000	9,630	105,000	-	-	-	-	-	116,630
Consultants (Regular funds)	669,157	409,041	313,370	-	-	-	-	-	1,391,568
Consultants (Grant funds)	348,204	-	-	-	-	-	-	-	348,204
Land Acquisitions	-	-	3,500,000	-	-	-	-	-	3,500,000
Furniture and Equipment	-	2,500	-	-	-	-	-	-	2,500
Sub-Total Expenditures	$ 2,021,640	$ 503,564	$ 4,169,495	$ -	$ -	$ -	$ -	$ 430	$ 6,695,129
OTHER									
Operating Transfers Out	$ -	$ -	$ -	$ 448,290	$ -	$ -	$ 1,000,000	$ -	$ 1,448,290
Operating Transfers In	(1,448,290)	-	-	-	-	-	-	-	(1,448,290)
Sub-Total Other	$ (1,448,290)	$ -	$ -	$ 448,290	$ -	$ -	$ 1,000,000	$ -	$ -
Total Expenditures and Other	$ 573,350	$ 503,564	$ 4,169,495	$ 448,290	$ -	$ -	$ 1,000,000	$ 430	$ 6,695,129
Net Excess (Deficit)	$ (76,084)	$ (107,564)	$ (1,543,492)	$ 145,710	$ 1,200	$ 2,000	$ (988,000)	$ (423)	$ (2,566,653)
ENDING FUND BALANCE	$ 225,583	$ 96,518	$ 2,422,991	$ 6,840,124	$ 310,417	$ 506,992	$ 2,503,313	$ 76,243	$ 12,982,181

XI. Compliance Activities of Permittees

All Permittees are in compliance with requirements of the CVMSHCP. CVCC completed Three Joint Project Reviews in 2016.

All the cities are complying with the fee exemption language in the new ordinances (there are no exempted projects under county jurisdiction). All jurisdictions report their Local Development Mitigation Fee (LDMF) activity and remit the revenue to CVCC monthly. CVCC reviews all LDMF reports and receipts monthly. In 2016, a total of $1,837,703 was collected under the LDMF program, a 27% increase over the 2015 calendar year.

XII. Annual Audit

CVCC approved their Fiscal Year 2016/2017 budget at the June 9, 2016 meeting.

The audit of the expenditures for the period July 1, 2015 to June 30, 2016 was approved by CVCC on March 10, 2016. The financial report was designed to provide citizens, members, and resource providers with a general overview of the CVCC's finances, and to show accountability for the money it receives. Questions about this report or additional financial information can be obtained by contacting the CVCC Auditor, at 73-710 Fred Waring Drive, Suite 200, Palm Desert, CA 92260. Annual CVCC audits are available at http://cvag.org/cvcc_financial_reports.htm.

XIII. Unauthorized Activities and Enforcement

Off-highway vehicles and dumping continue to be issues. In 2016, areas where these problems were reported included Stubbe/Cottonwood Canyon, Willow Hole, Upper Mission Creek/Big Morongo Canyon, and Thousand Palms Conservation Areas. Further discussion of management of these issues is included in section IV. Currently CVCC forwards reports of OHVs and dumping to the appropriate law enforcement agency. CVCC is working to develop an agreement with the Bureau of Land Management (BLM) under which CVCC would contribute funds to hire additional BLM law enforcement rangers to focus on the Conservation Areas.

XIV. In-Lieu Fee Program

In 2014, CVCC completed the Enabling Instrument for an In-Lieu Fee Program (ILFP) with the U.S. Army Corps of Engineers. The ILFP would allow organizations that need to mitigate for unavoidable Impacts to Waters of the U.S. that result from activities authorized under section 404 of the Clean Water Act and section 401 of the Clean Water Act water quality certifications to do so by paying a fee to CVCC. CVCC will perform restoration projects that are pre-approved as mitigation by ACOE and the cost of these projects, including endowment, contingency, planning and staff time would be paid from the ILFP. Much like the CVMSHCP, the ILFP will replace piecemeal mitigations that often require

years to be approved with a coordinated approach that complements other conservation efforts.

In November 2016, CVCC approved a contract with ICF International to create an In-Lieu Fee Program Development Plan. CVCC and ICF International selected the Coachella Valley Stormwater and Delta Conservation Area as the potential site for the Development Plan. A 40 acre parcel (729-150-009) was purchased in July 2016 as the site for the first project. In November 2016, CVCC installed six wells on the parcel to determine the suitability of soils and hydrology for the restoration Development Plan. The information obtained from these wells will be included in the Development Plan and submitted to the ACOE for approval. Numerous site visits by ICF, CVCC staff and others have been made and ICF has created a conceptual plan for restoration of the 40-acre site. The ILFP restoration and enhancement project supports the goals of the Coachella Valley Multiple Species Habitat Conservation Plan.

The In-Lieu Fee Program Enabling Instrument allows CVCC to sell 50 acres of Advance Credits, with the actual restoration project to begin within three growing seasons of the first sale of an Advance Credit. The first Advance Credit was sold in May 2016. Table 5 lists the Advance Credit purchases in 2016.

Table 5: In-Lieu Fee Program Advance Credit Purchases

Applicant	Mitigation Type	Acres Purchased	Date of Purchase
City of Palm Springs	Restoration/Rehabilitation	.35	May 31, 2016
Caltrans	Enhancement	.18	December 2, 2016

Appendix I
Rules for Land Acquisition and Management Credit

Acquisition Credit

In general, the source of funds for acquisition gets the credit of acres with the following modifications:

1) Per Plan Section 4.2.1 (p. 4-10), purchases with state or federal funding will be considered Complementary in the following Conservation Areas: Joshua Tree National Park, the Santa Rosa and San Jacinto Mountains, the Mecca Hills and Orocopia Mountains, and Snow Creek/Windy Point. Purchases within these areas with CVCC funds will be considered Permittee.
    a. If land purchased with non-federal/state funding in these areas is transferred to CVCC ownership, it will be considered a donation and CVCC will receive Permittee credit if they take title. Examples include:
        i. Purchases by Friends of Desert Mountains (FODM) – only if funds are from private foundations (e.g. Resources Legacy Fund);
        ii. Donations from landowners.

2) Acquisitions in Fluvial Sand Transport Only Areas will be credited to the funding entity (Permittee, Complementary, and Federal/State).
    a. If federal/state funds will be counted as federal/state acquisition
    b. If land purchased with non-federal/state funding in these areas is transferred to CVCC, it will be considered a donation and CVCC will receive Permittee credit.

3) For 2015 Annual Report parcels adjacent to Conservation Areas will not be counted but will be included in the overall database and flagged for consideration after the issue of a legal instrument for conservation is resolved.

4) If a grant requires a matching amount, that portion of the grant will be credited to the source of the match. This includes cash contributions and in-kind contributions from bargain sales (not addressed in the plan). However, as “mitigation” cannot be used as a match for Section 6 grants, Permittees cannot receive acre credit for Section 6 matches.

5) Mitigation for projects outside Plan Area (Wildlands, Inc. is the only current example ~ 7,000 acres) or mitigation for project not Covered as part of the Plan (Southern California Edison purchase of the mitigation value of CVCC in 2014) are included in the database but are zero for all credit and noted “conserved but it does not count for the Annual Report or Plan acreage numbers.”

6) No Acres within any Tribal Land are counted for the CVMSHCP under any circumstances as Tribal Land is “Not A Part” of the CVMSHCP Plan Area.

Appendix IIA
Biological Monitoring Program 2015-2016 Year-End Report

Coachella Valley Conservation Commission

September 2016

Coachella Valley Multiple Species Habitat Conservation Plan

& Natural Community Conservation Plan

2015-2016 Biological Monitoring Year-End Report

Prepared by
the University of California Riverside's
Center for Conservation Biology
for the
Coachella Valley Conservation Commission

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AEOLIAN SAND COMMUNITY MONITORING

The Coachella Valley Multiple Species Habitat Conservation Plan and Natural Communities Conservation Plan (CVMSHCP/NCCP, or Plan) was established in 2008 to ensure regional conservation of plant and animal species, natural communities and landscape scale ecological processes across the Coachella Valley. Areas where conservation must occur throughout the life of the Plan are designated by a Conservation Area Reserve system which is designed to include representative native plants, animals and natural communities across their modeled natural ranges of variation in the valley. The types and extent of Conservation requirements for covered species, natural communities and landscapes within these reserves are defined by specific goals and objectives that are intended to support ecologically-based principles.

Compared to levels extant prior to the onset of the extensive suburban-golf course development of the 1970s, aeolian sand fields and dunes of the Coachella Valley have lost more spatial extent (total area and proportionally) than any other habitat type. The 1986 Coachella Valley fringe-toed lizard HCP and the current CVMSHCP designs included protection for the remaining aeolian sand habitats that still had even partially intact sand source-sand transport corridor-habitat connectivity at the time those plans were developed. Still, using a baseline of the 1986 Coachella Valley fringe-toed lizard HCP, or 1996 (the onset of planning and development for the CVMSHCP), many of the aeolian sand species have continued to decline – even within conservation areas.

- Fringe-toed lizards are now extirpated from the east end of the Indio Hills Conservation Area, and several isolated sand patches in the central-western Indio Hills conserved areas.
- Fringe-toed lizards have a reduced areas of occupancy in the Snow Creek Conservation Area, the Willow Hole Conservation Area, and Thousand Palms Preserve (all due to reduced sand transport levels).
- Flat-tailed horned lizards are extirpated from the Whitewater Floodplain Preserve and may be extirpated from the east end of the Indio Hills Conservation Area.
- Flat-tailed horned lizard areas of occupancy have been reduced within the Thousand Palms Preserve, up to 100-150 m along the perimeter and the more northern plots where this species was common 10 years ago.
- Harvester ants, a key diet element of both the fringe-toed lizard and flat-tailed horned lizard have been in decline since the early 2000s.

Many causes for these declines have been identified, published and presented. Some are natural precipitation-driven oscillations typical of all populations in arid environments. Leading anthropogenic stressors include Sahara mustard (nearly eliminating native annual plant flowering and so the successful production of seeds to repopulate the seed bank, altering and reducing detritus accumulations, and promoting sand stabilization), fragmentation and urban edge effects (enhanced predation levels), reduced sand flows (Snow Creek: San Gorgonio wash,

Willow Hole), off-road vehicle trespass (Stebbins' dune, Willow Hole, Fault line dunes, Windy Point, Dos Palmas, east end of the Indio Hills), and climate change (or at least prevalent climate change-like weather conditions). Although locally we can have little effect on climate change, by understanding and addressing other stressors we may be able to increase the resiliency of this natural system, and all of its species components, as we shift to a warmer-drier environment.

Aeolian Sand Community Descriptions

Aeolian sand communities of the Coachella Valley floor include active dunes, stabilized dunes (also referred to as mesquite hummocks), ephemeral sand fields, and sand fields (also referred to as active or stabilized sand fields). These communities were initially defined based on distinct geomorphologies (Table 1), but also have distinct species associations and abundances (Barrows and Allen 2007).

TABLE 1. GEOMORPHIC CHARACTERISTICS AND SPECIES ASSOCIATIONS OF THE FOUR COMMUNITY DIVISIONS OF THE COACHELLA VALLEY AEOLIAN SAND LANDSCAPE. SPECIES IN BOLD TYPE ARE THOSE WHOSE POPULATIONS CAN REACH THE HIGHEST ABUNDANCE WHEN HABITAT CONDITIONS ARE APPROPRIATE.

Geomorphic and Habitat Characteristics	Active Dunes	Sand Fields	Ephemeral Sand Fields	Stabilized Dunes
Aeolian sand depth	> 3 m	0-2 m	0-2 m	> 3 m
Base substrate	aeolian sand	silt, cemented sands	gravel, rocks	aeolian sand
Shrub Density	sparse	moderate	moderate	dense
Wind velocity	moderate	moderate	high	moderate
Sand movement	high	moderate	very high	low
Precipitation gradient	extreme aridity	extreme aridity	moderate to relatively mesic	moderate
Covered species primarily associated with this community	**fringe-toed lizard** **sand-treader cricket** milkvetch round-tailed ground squirrel flat-tailed horned lizard	fringe-toed lizard round-tailed ground squirrel **flat-tailed horned lizard**	**fringe-toed lizard** **sand-treader cricket** **milkvetch** **Jerusalem cricket**	fringe-toed lizard **round-tailed ground squirrel** sand-treader cricket

Those communities that have undergone the greatest amount of loss or degradation due to human development include the active sand dunes and stabilized sand fields which would have occupied much of the central portion of the valley floor (Figure 1). Over 90% of these communities have been lost (Figure 2) (Barrows et al 2008). Another community which has lost much of its original extent is the stabilized dune, or mesquite hummock community type. Most of that loss occurred in the eastern portions of the valley in what are now the cities of La Quinta, Indio and Coachella. Ephemeral sand fields have been least impacted by human development, likely due to the high intensity wind and sand movement characterizing this community, making it less hospitable to human uses. Since the establishment of the original Fringe-toed Lizard Habitat Conservation Plan in 1986, fringe-toed lizards have been extirpated from a cluster of habitat patches in the east Indio Hills, from a dune in Thousand Palms Canyon, from multiple sand patches in the western Indio Hills, and from nearly all unprotected sites on the Coachella Valley floor. In the 1980s flat-tailed horned lizards occurred from the Whitewater Floodplain Preserve to the east Indio Hills; today they are restricted to the Thousand Palms Preserve. The general locations where these communities still occur are shown in Figure 1.

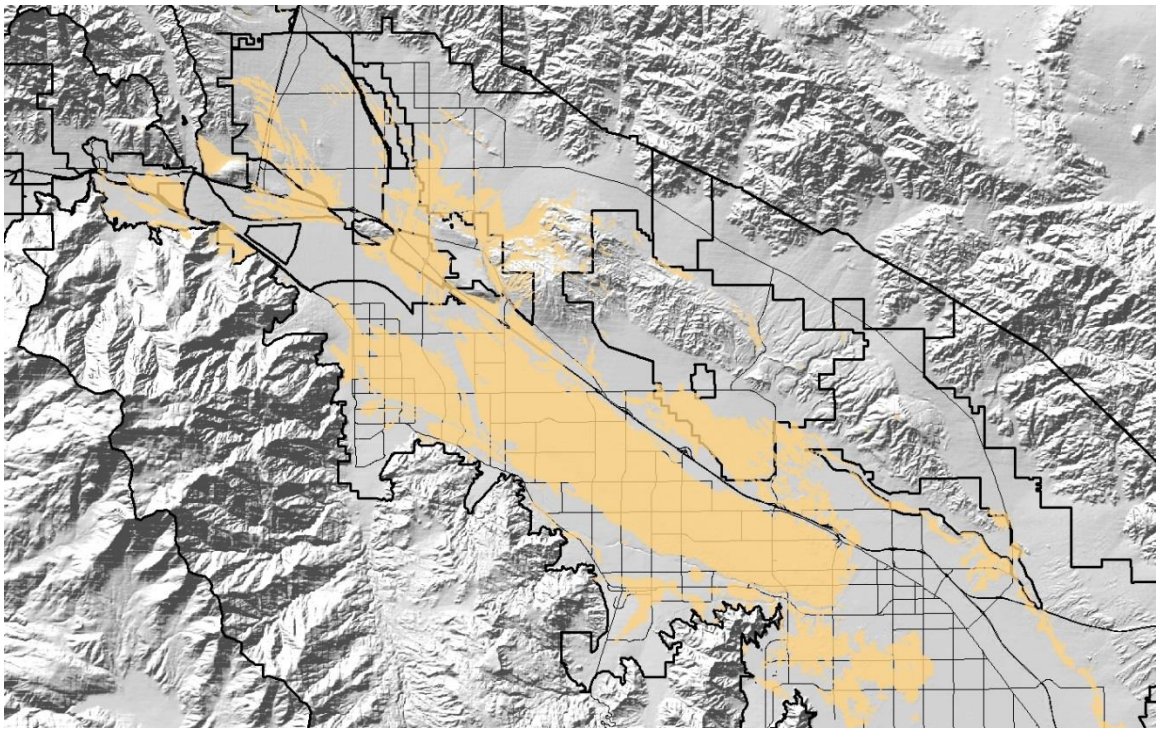

FIGURE 1. HISTORIC DISTRIBUTION OF THE AEOLIAN SAND COMMUNITIES OF THE COACHELLA VALLEY BASED ON SOILS MAPS. THIS SAND "SEA" OCCUPIED APPROXIMATELY 33,000 HA (81,750 AC / 127 SQ. MI.).

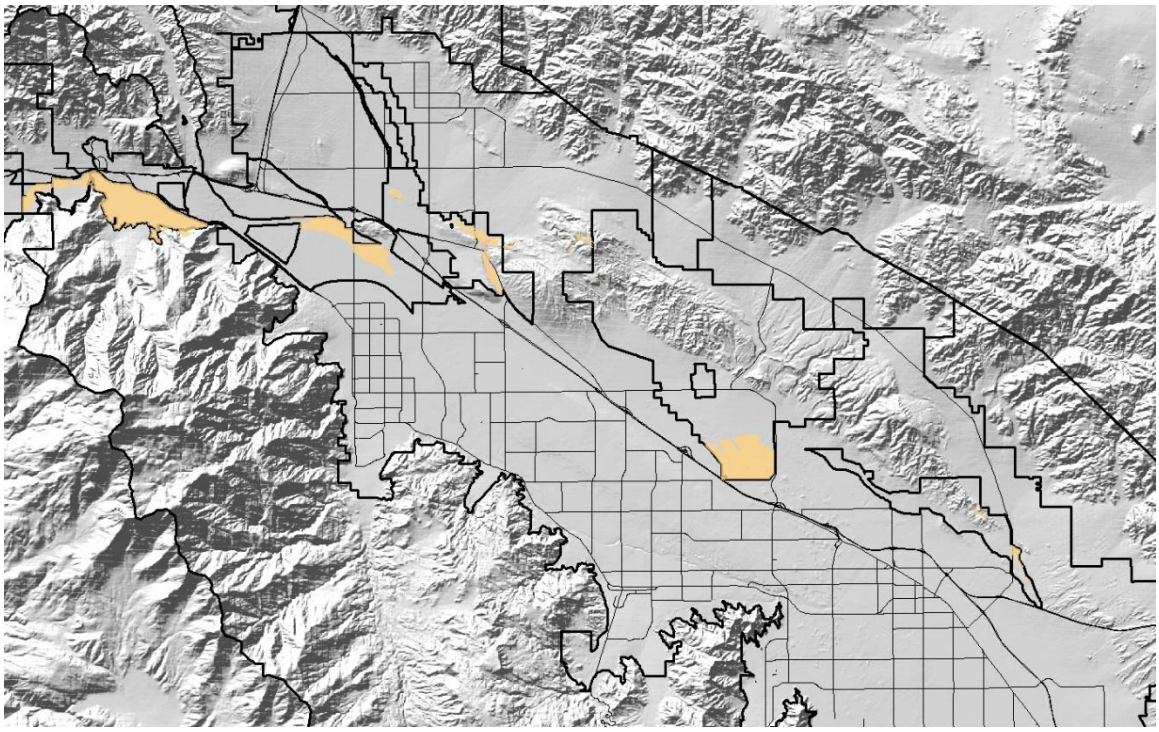

FIGURE 2. CURRENT EXTENT OF THE AEOLIAN SAND COMMUNITIES OF THE COACHELLA VALLEY IN CONSERVATION AREAS BASED ON RECENT VEGETATION/COMMUNITY MAPPING. THIS REMAINING AREA INCLUDES APPROXIMATELY 2,480 HA (6,130 AC) AND IS 7.5% OF THE HISTORIC AEOLIAN SAND AREA.

Flat-tailed Horned Lizard

Flat-tailed horned lizards reach their northern-most distribution within the CVMSHCP, and are currently under consideration to be protected as Threatened under the California State ESA. These lizards once occurred at least as far west as what is now the Whitewater Floodplain Preserve and along the southern slopes of Edom Hill (Barrows et al. 2008). Today their known CVMSHCP distribution is confined to the southern Thousand Palms Preserve and the Dos Palmas ACEC, east of the railroad and north of Bat Cave Butte. The reasons for their disappearance, or reduction to below detectable levels, from the rest of their original CVMSHCP distribution include:

- Habitat fragmentation. This species periodically will go on long "walkabouts" that can exceed several kilometers or more in length. The reason for these extended movements and often later returns to their original locations are not fully understood, but may be related to searches for mates, food and/or nesting substrates. Fragmentation by roads and powerlines where automobiles and potential predators lurk put the lizards at risk of increased mortality as they approach and attempt to cross these barriers during their "walkabouts". That the two largest areas set aside for this species, the Thousand Palms Preserve and the Dos Palmas ACEC, are the only sites where they still reside supports this hypothesis.

- Predation. Edge effects reducing habitat available to flat-tailed horned lizards, from augmented predation as a result of predator nest sites provided on near-by country clubs, have previously been documented (Barrows et al. 2006). That effect remains today. Removing power lines or shifting palm trimming to the early spring could reduce this impact. With the potential State listing of this lizard there should be renewed attention to implementing this management recommendation. Additionally mesquite dunes tend to be "predator rich" with large numbers of round-tailed ground squirrels, roadrunners, shrikes, coyotes and sidewinders relative to non-mesquite aeolian sand areas; all are known to prey on flat-tailed horned lizards (especially the ground squirrels). No flat-tailed or desert horned lizards have ever been detected in over 30 years of surveys at the particularly dense mesquite dune system at Willow Hole. Planting mesquite for wind breaks or to enhance habitat for other species in areas where flat-tailed horned lizards still occur will likely reduce habitat suitability for this species.
- Recent Climate. This species thrives in the hot and dry Colorado Desert (but not too hot and dry – see below). The cooler-wetter western portions of the Coachella Valley may have been at best peripherally suitable habitat. From 1950 to 1970 there was a decades-long, "mid-century drought" that, in the absence of habitat fragmentation from roads, would have rendered those western valley habitats more suitable for flat-tailed horned lizards. During wetter-cooler periods in the 1980s and 1990s their numbers declined and eventually disappeared from those western areas. Climate alone as an explanation for this species' decline in the western valley is likely overly simplistic. Fragmentation (see above), fluctuations in substrate to a more gravel and rock matrix more suitable for desert horned lizards, and comparatively low harvester ant numbers, each likely contributed as well.
- Future Climate Change. Dos Palmas represents the only other known flat-tail population within the CVMSHCP. In 2015 we established seven plots adjacent to sites where BLM (Mark Masser) found them in 2005. The flat-tailed horned lizard population in the Dos Palmas ACEC may represent a harbinger of future conditions for this species elsewhere, including the other occupied habitat within the CVMSHCP. The Dos Palmas habitat is hotter and drier than other occupied sites. It is too far east and south to benefit as much from the winter rains entering the valley from the northwest, and may not be south enough to be a regular beneficiary of the summer monsoons that typically support resources on occupied habitats farther south. The result is very low harvester ant abundance, and very low flat-tailed horned lizard abundance (for details, see section containing Figures 25-26), as well as observed low hatchling/juvenile growth rates compared to measurements taken at the Thousand Palms Preserve. As climate change progresses, Dos Palmas may no longer be suitable habitat, and sites such as the Thousand Palms Preserve may approach the current Dos Palmas in terms of its ability to sustain this species. This could mean as much as a 60% decline in carrying capacity (based on current differences in density), but nevertheless a persistent, albeit fragile, population.

- Invasive Species. The relationship between flat-tailed horned lizard abundance and rainfall is complicated (for details, see section containing Figures 23-24). Above normal rainfall in 1998 may have catalyzed an extremely high flat-tail population on the Thousand Palms Preserve from 1999-2001 (Barrows and Allen 2009). Similarly above average rainfall in 2005 corresponded to an increased flat-tail population. However above average rainfall from 2009-2011 was coincident with a decline in flat-tails, and the subsequent drought has resulted in a population increase. The reason for this more recent negative correlation with rainfall is the impact of Sahara mustard (Barrows et al. 2009; Barrows and Allen 2010; Hulton et al. 2013). Plots with the densest and increasing mustard infestation show the most negative responses by the flat-tails. The question is how climate change will interact with mustard infestations. If droughts prevail and summer monsoons become a more common catalyst for food resource dynamics, the mustard's impacts could become trivial.
- Disturbance. At the Dos Palmas ACEC, we do not know the extent of the occupied habitat. Off-highway vehicles are impacting much of the potential habitat (but no severe impacts have occurred where the seven plots are located). The impact of disturbance from OHV use on flat-tailed horned lizards remains to be determined.

Coachella Valley Fringe-toed Lizard

Coachella Valley fringe-toed lizards are endemic to the aeolian sand communities of the Coachella Valley. They once occupied a roughly 100 mi^2 expanse of the valley floor, but are now only found in about 5% of that original range (Barrows et al. 2008). This species was the catalyst that initiated conservation efforts in the Coachella Valley. The lizard was listed as Threatened under the federal Endangered Species Act, and Endangered under the California State ESA in 1980, and was the focus for the first implementation of section 10a of the federal ESA resulting in a preserve system in 1986. That preserve system was deemed inadequate both due to insufficient protection for the ecosystem processes that deliver sand to the preserves, as well as because there were many additional species and habitats that warranted protection, and was so expanded into the CVMSHCP in 2008.

Fringe-toed lizards are still present within each of the four core preserves established for this species. Outside the core preserves this species is in decline, or has declined to below detectable levels (or is absent) (Barrows and Allen 2007). Within the core preserves there are strikingly different stressors as well as responses to annual rainfall and the food resources that rainfall catalyzes.

Stressors

Data collected to date for this suite of aeolian sand associated reptiles has shown some to be sensitive to the effects of habitat stabilization (fringe-toed lizards [Barrows 2006; Barrows and Allen 2007a; 2010]), habitat fragmentation (flat-tailed horned lizards [Barrows et al. 2006]), invasive species (fringe-toed lizards, flat-tailed horned lizards [Barrows et al. 2009; Barrows and Allen 2010], and climate change (fringe-toed lizards [Barrows et al., 2008]). Some of these

stressors are dynamic in the sense that the intensity of invasive species and climate change varies by year, the duration of those effects changes, and there are likely synergistic relationships that intensify negative impacts. The effects of those dynamics and synergisms on the persistence of the populations of these species are unknown.

SAHARA MUSTARD

The Thousand Palms Preserve has the worst invasive species infestation (Sahara mustard, *Brassica tournefortii*), is likely to have the worst impacts from climate change due to its location at the hotter-drier end of the climate gradient in the Coachella Valley, and has the greatest edge effect impacts. It also has the largest remaining habitat area, largest fringe-toed lizard population. Despite its size, the fringe-toed lizard population has declined dramatically, and so the current status of the population is unknown. That decline is in excess of what would be predicted by drought alone based on previous droughts, and a drought-mustard interaction is suspected. This is also the only flat-tailed horned lizard population (north of the Salton Sea) and has been and continues to be impacted by augmented predation – nest and perch sites provided for kestrels, shrikes and roadrunners from adjacent anthropogenic landscapes (Barrows et al. 2006). The impacts of both drought and mustard on flat-tails is complicated; the first year or two of a drought, when the mustard is absent, seems to benefit this species, but longer droughts may inevitably result in population declines

Control of this invasive annual weed has been hampered by long-term drought and the magnitude of the infestation (many 1000s of ha) requiring an investment of resources so far unavailable from the land management agencies. With the exception of the Whitewater Floodplain Preserve, the food webs of the Coachella Valley aeolian sand habitats are detritus-based (Barrows 2012); the Whitewater Floodplain Preserve is perennial plant productivity-based. One of the insidious effects of Sahara mustard is that it appears to change/reduce detritus accumulations following wet years when native annual plants create that detritus resource. It is that store of detritus that then sustains the biotic systems of the dunes and sand fields, especially during dry years.

Harvester ants are a key trophic component of the aeolian sand habitats of the Coachella Valley. While harvester ants are seed gatherers they also consume detritus, and seeds are important, high nutritional value components of detritus. Harvester ants readily collect Sahara mustard seeds, however their numbers not only do not increase, but appear to decrease, when Sahara mustard dominates the landscape, despite the hyper abundance of mustard seeds (Hulton et al. 2013). Answers to this apparent conundrum may be related to missing essential nutrients available with a diet of numerous native annual plant seeds, but possibly absent on a diet of mustard seeds alone, or difficulty eating mustard seeds, possibly due to harder seed coats than occur with the native annual plant seeds. Understanding drivers of the harvester ant populations is essential to determining the sustainability of the flat-tailed horned lizard fringe-toed lizard populations.

FRAGMENTATION AND URBAN EDGE EFFECTS

Genetic analyses to date have revealed that up until the mid-late 1990s the genetic characterization of fringe-toed lizards in the Coachella Valley was mostly panmictic (all are potential mating partners and so no spatial structure to the patterns of genetic heterogeneity). One exception was the east end of the Indio Hill population, a population that was extirpated during the 2000-2004 drought. Resampling in 2008, following the 2000-2004 drought, revealed genetic structure separating all the existing aeolian sand habitat core areas. Genetic heterogeneity had not necessarily declined but gene frequencies shifted resulting in distinct inter-site population structure.

We published an analysis of the urban edge effect on the aeolian sand species (Barrows et al. 2006); especially impacted were flat-tailed horned lizards which were eliminated from a 100-150 m zone along the Thousand Palms Preserve perimeter. The cause was augmented predation, primarily from kestrels nesting in adjacent suburban palm trees, but also roadrunners nesting and being "fed" in those same suburban areas. There were two possible management actions to be taken. The suburban neighborhoods could have their palm trees trimmed annually in mid-summer. If the trees were trimmed in late winter-early spring nest platforms for the kestrels would be reduced or eliminated. Another action would be to remove or bury the perimeter power line, though it is understood that both of these options are extremely expensive. The predatory birds sit on that power line and spot flat-tails before conducting their predatory sorties. The hope was that if the CVWD moved 38th Avenue south as planned for a new flood control channel, and/or the property to the south was developed, that dealing with the power lines could be a condition for development. The economic downturn has kept either option from occurring and the 100-150 m flat-tail dead zone still remains.

OFF-ROAD VEHICLE IMPACTS

Off-road vehicle trespass on conserved lands has been dramatically reduced on most CVMSHCP conserved lands. Still, that trespass continues at many locations. One site where that trespass was especially heavy, but has since mostly been controlled is "Stebbins' Dune." This is the site where Robert Stebbins (author of Reptiles and Amphibians or Western North America) conducted his graduate studies field work on fringe-toed lizards in the 1940s; it is the area between Edom Hill and Flat-top Hill adjacent to Varner Road. There are currently no monitoring plots there as this was a relatively recent purchase (within the past 5+ years). I did visit the site once while it was still being impacted by off-roaders and found other than the creosote bushes, little or no ground cover, and very coarse sand, as apparently the finer sands more typical of fringe-toed lizard habitat had been blown off the site due to constant vehicle disturbance.

Monitoring Objectives

URBANIZATION AND FRAGMENTATION – Metrics to be collected:

- Species distributions with respect to conservation area edges
- Occurrence of predators (feral and natural)
- Reproductive recruitment rates for selected species

INVASIVE SPECIES – Metrics to be collected:

- Measure the occurrence (density and percentage cover) of invasive exotic annual plants as well as the same metrics for native annual plants
- Measure the patterns of occurrence of invasive and native species at the landscape level
- Measure the relative abundance of native versus exotic species
- Determine variables (e.g. sand quality and quantity; rainfall) that favor invasive species and natives
- Determine the effectiveness of control efforts

COMMUNITY TRAJECTORIES/BIOTIC SUSTAINABILITY/EFFECT OF CLIMATE CHANGE – Metrics to be collected:

- Occurrence and changes in relative abundance of species with respect to resources including annual rainfall patterns, annual plants, perennial plants, arthropods, exotic species and sand characteristics
- Occurrence and changes in relative abundance of species with respect to the East-West temperature and precipitation gradient across the Coachella Valley

Methods

BIOTIC MONITORING METHODOLOGY

Since 2002 monitoring protocols have been under development for species occurring within the aeolian sand communities of the Coachella Valley. Monitoring protocols for two of the aeolian sand community reptiles (the Coachella Valley fringe-toed lizard, *Uma inornata*, and the flat-tailed horned lizard, *Phrynosoma mcallii*), sand treader crickets (*Macrobaenetes valgum*), round-tailed ground squirrel (*Xerospermophilus tereticaudus*), and Coachella Valley milkvetch (*Astragalus lentiginosus* var *coachellae*). The approach adopted here includes measures of food resources, cover, sand conditions, species associations (including small mammals and terrestrial birds) and food web linkages (potential predator and prey species) layered onto each plot, and so is community based by design.

The basic design of the recommended surveys includes a set of randomly placed study plots, each 10 m x 100 m (0.1 ha) (Fig. 5). The distribution of current plots is shown in Figure 3a & 3b. Each plot is marked with a tall fiberglass stakes at the beginning, middle, and end so that a biologist conducting surveys can easily determine their position within each plot. The stakes are too flexible and thin to become perches for predatory birds and have a biased impact on the

species being surveyed, and no birds have been observed using these stakes as perches. Between January and July data are collected each year for annual and perennial vegetation, including Coachella Valley milkvetch (February to March), arthropods (April), and vertebrates (May through July, and for a sub-set of those plots again in September and October).

The plots are distributed across the subdivisions of the aeolian sand habitats described in Table 1. The number of plots in each habitat or community type primarily reflects the areal extent of those communities in conservation ownership (Table 2). Over time the number of plots have been reduced as experimental questions have been answered, and as available funding was shifted to other covered species. Originally 154 plots were established in order to assess the level of habitat heterogeneity that occurs across the aeolian sand communities of the Coachella Valley (Figure 3a). Each plot was surveyed for at least three years within the 2002 to 2008; however many of those were deemed either redundant or were designed to answer a specific research questions regarding the impact of suburban edges of the population trajectories of the species that comprise the sand communities (Barrows et al., 2006). From that set of 154, the core of 93 study plots has been identified to assess the temporal and spatial variability within aeolian sand habitats across the Coachella Valley. An additional seven plots were established within the Dos Palmas Conservation Area (ACEC) in 2014 (Figure 3b). Study sites were located in a stratified random manner whenever possible, stratified by community types as defined by Barrows and Allen (2007b) (Table 1). The dominance of honey mesquite, *Prosopis glandulosa*, on the stable dunes created a logistical problem as dense mesquite copses were impenetrable. Plots there were thus confined to open areas and so were non-randomly placed. Data from these plots characterized those open areas but not the community as a whole. Using GIS software (ArcView 3.2, ESRI) we calculated the extent of the open areas (13%) versus the mesquite copses and other dense vegetation (87%) and then adjusted the relative abundance of those reptiles restricted to the open areas (i.e. *Uma inornata, Dipsosaurus dorsalis, Callisaurus draconoides, Phrynosoma platyrhinos*) downward proportionately.

TABLE 2. THE NUMBER OF AEOLIAN SAND COMMUNITY PLOTS SURVEYED ANNUALLY OVER THE PAST 11 YEARS.

Community Type	Total number of plots established	Plots Surveyed 2005-2012	Plots Surveyed in 2013, 2015	Plots Surveyed in 2014	Plots Surveyed in 2016
Active Sand Dune	27	27	26	0	22
Eastern Stabilized Sand Fields	74	39	26	0	19
Dos Palmas Sand Fields	7	0	0	7	7
Central Ephemeral Sand Fields	18	12	12	0	12
Western Ephemeral Sand Fields	6	6	6	0	6
Western Stabilized Sand fields (Snow Creek)	12	6	6	0	0
Mesquite Dunes	17	17	17		11
Total	154	107	93		77

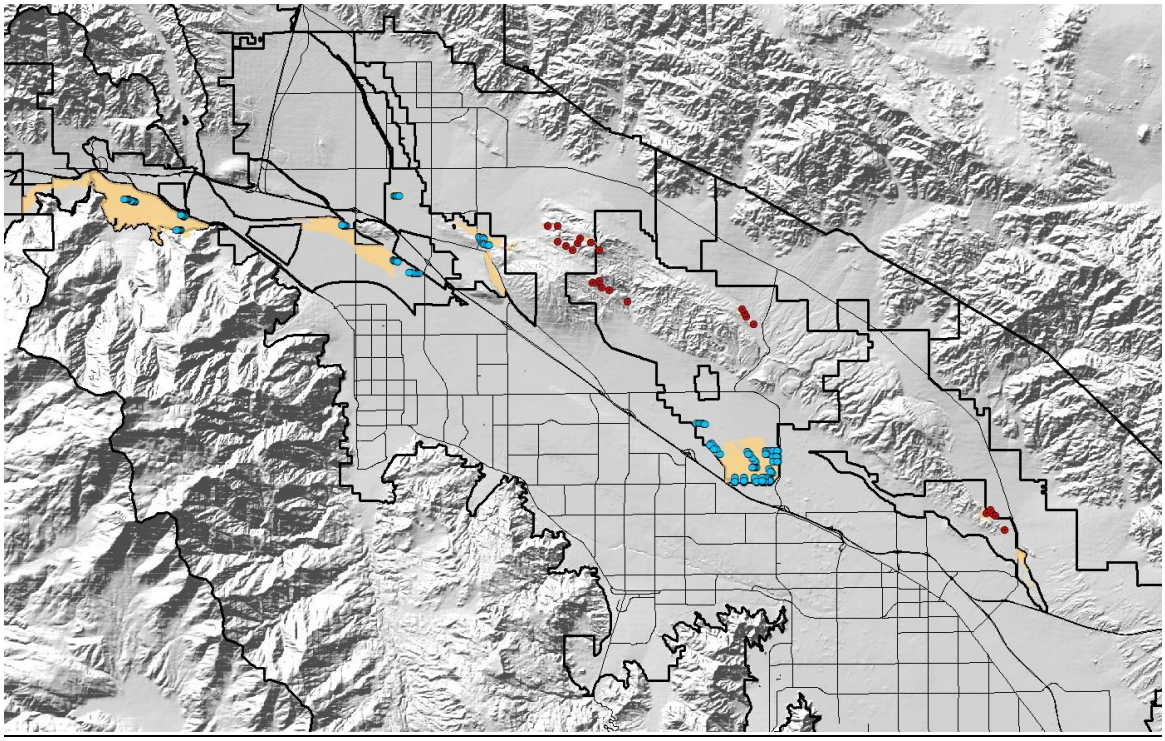

FIGURE 3A. DISTRIBUTION OF 154 MONITORING PLOTS (BLUE DOTS) SUPERIMPOSED ON THE REMAINING AEOLIAN SAND HABITAT PROTECTED BY THE CVMSHCP. RED DOTS ARE LOCATED ON SMALL ISOLATED SAND PATCHES WHERE ANNUAL PRESENCE-ABSENCE SURVEYS OCCUR.

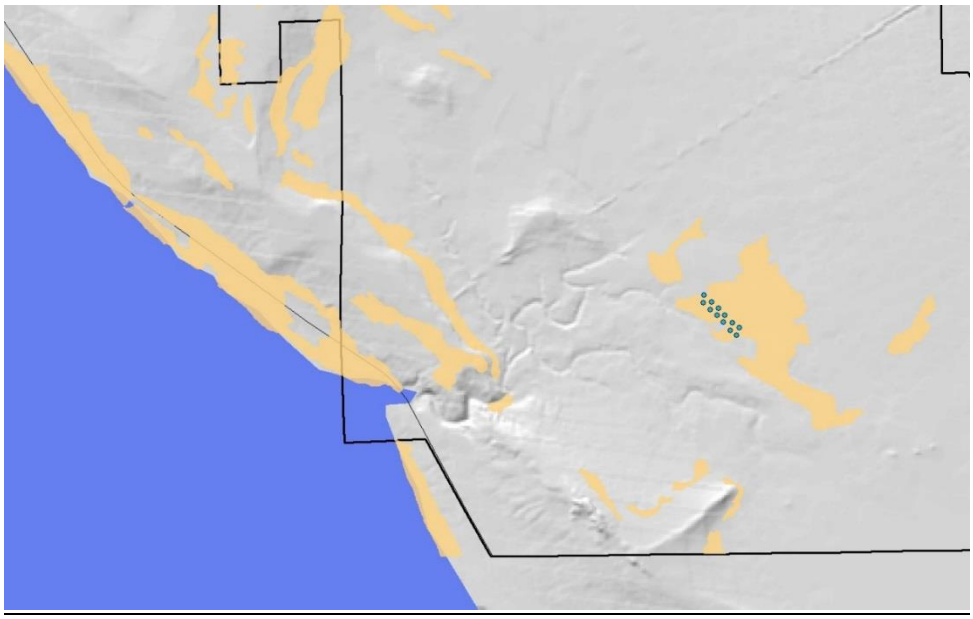

FIGURE 3B. DISTRIBUTION OF 7 MONITORING PLOTS (BLUE DOTS) SUPERIMPOSED ON THE REMAINING AEOLIAN SAND HABITAT AT THE DOS PALMAS ACEC. DOS PALMAS CONSERVATION AREA BOUNDARIES ARE IN BLACK AND THE SALTON SEA IS REPRESENTED BY BLUE SYMBOLOGY.

Reptiles

The fine aeolian sand of the Coachella Valley's dune fields provide an opportunity unique to sand dunes to quantify the occurrence and abundance of terrestrial reptiles, small mammals and some birds (e.g. burrowing owls, roadrunners) occurring within plots by enumerating numbers of individuals of each species by tracks they left as they moved across or within each plot. While tracks left in the sand provide direct evidence that a species resides within or traversed the survey plot, this protocol also includes searching for and observing the species; both methods are employed simultaneously increasing detection rates above those for either method alone. In cases where the substrate is less suitable for tracking, the sands and silts being too coarse or cemented to leave clear tracks, only direct searches for the species can be used. When the substrate is conducive identifying tracks, reptiles can be identified to species and age class by their diagnostic tracks; thereby, variability in detection plaguing many other survey methods, caused by differences in activity times, cryptic coloration, or stealthy behavior, are largely nullified. We have found this survey method (tracking combined with direct species sightings) to be robust in the sense that we are able to detect species occurrences even when they are rare and/or nocturnal in the area being surveyed.

Extensive training is required before biologists conduct combined tracking-sighting surveys. Biologists must be proficient at species identification and enumeration, training levels similar to what would be required for conducting avian surveys where both sightings and vocalizations are used for identification. Our method, focused on enumerating individuals by the tracks they left and sightings of active individuals requires no handling of any lizard, cricket or squirrel nor chasing that could constitute harassment (however brief). Therefore this protocol limits observer impacts to the extent possible. All vertebrates are surveyed simultaneously providing a community-level measure of the species occurring on that habitat.

Our survey data are most accurately characterized as the number individuals of each species that occurred on each plot each survey day, averaged over six independent surveys per season; for reporting purposes we refer to this statistic as the mean relative abundance of each species / 0.01 ha (the plot area). In 2002 we conducted a power analysis and determined that 6 repetitions per plot were sufficient to detect between plot and year differences when the mean plot difference was ≥ 1.7 lizards at $\alpha = 0.05$, $\beta = 0.80$ for a two sample z-test. Mean relative abundance of the lizards can readily be incorporated to measures of reproductive success (mean relative abundance of hatchlings surveyed in the fall / mean relative abundance of adults surveyed in the late spring, or mean relative abundance of juveniles surveyed in the late spring / mean relative abundance of adults surveyed in the late spring), and population growth (natural log of the product of the mean relative abundance of all lizards surveyed in the late spring in year 2 / mean relative abundance of all lizards surveyed in the late spring in year 1). Data for each plot is considered independent.

Reptile surveys occur between May and July. Due to the timing of our surveys, reproductive responses have a one year lag to temporally variable environmental conditions. The

reproductive responses (hatchling lizards and snakes) emerge from late summer through early winter, depending on the number and timing of clutches the adult reptiles produced. There is no single period in the fall when the total hatchling cohorts are present and active on the sand surface. The total recruitment effort is thus measured during the following year's survey period. Nevertheless a selected number of plots have been surveyed in the fall (September-October). These plots provide a snapshot of the lizards' reproductive effort and provide a basis for estimates of reproductive success.

All surveys begin in the morning after the sand surface temperature had risen sufficiently (35^{o} C) so that diurnal reptiles are active. Consistent time of day and temperature reduces those variables' contributions to between survey variability. Surveys continue until late morning when the high angle of the sun reduces the observer's ability to distinguish and identify the tracks across the sand, and coincides with the cessation of activity for the diurnal reptiles due to high surface temperatures. We used track characteristics to identify individuals as well in order to quantify species' abundance. Track size, unique features, and following tracks off of the plots helped insure that each counted track represented a unique individual for each survey. Because late afternoon and evening breezes usually "wipe the sand clean" the next day's accumulation of tracks could be readily distinguished from those from the previous day.

Isolated sand patches in the western Indio Hills include populations of fringe-toed lizards, Coachella Valley milkvetch, sand-treader crickets, and ground squirrels. No flat-tailed horned lizards have been located there despite more than a decade of searching; desert horned lizards are however relatively common there. Because of the small irregular size of the sand patches, employing a plot-based sampling design as has been done on the larger, core habitat sites, would not be possible. Here the primary metric is simply presence or absence; each sand patch is walked until the focal species presence is documented, or that the entire patch has been covered.

Coachella Valley Milkvetch (Astragalus lentiginosus var. coachellae)

Coachella Valley milkvetch are annual or sometimes biennial plants. The biennial habit is generally restricted to the western, cooler-wetter portion of the Coachella Valley and to years when high levels of sand moisture stay close to the surface through the summer. These plants usually occur at low densities so we have employed a total count / 10 m x 100 m plot survey protocol. The counts occur coincident to the general vegetation surveys in February-March, but are re-surveyed coincident with the arthropod surveys in April and sand compaction data collection in May to ensure all plants are counted. Data are reported as densities (plants/ 0.1 ha).

Habitat Measures

All perennial shrubs are counted by species within the 0.1 ha plots. Annual plants were counted and cover estimated in a 1 m^2 frame placed at 12 locations along the midline of each plot. Four samples were taken on alternating sides of the center line at each end point, and two samples were taken on each side of the center point. In each frame all individual plants were counted by species to determine species densities, and for each species we made a visual estimate of its

percent cover within each frame. These values were then averaged for each species for the 12 frames of each plot (Figure 4).

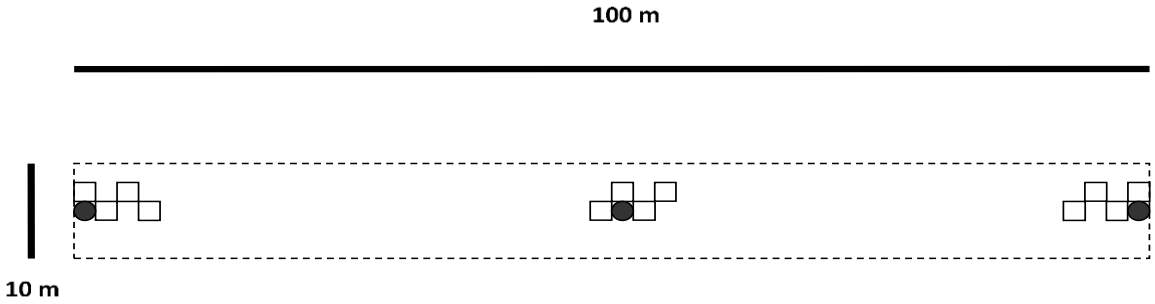

FIGURE 4. SCHEMATIC OF BASIC PLOT DESIGN (NOT TO SCALE). THE TWELVE SMALL SQUARES REPRESENT LOCATIONS FOR 1 M^2 FRAME PLACEMENT FOR ANNUAL VEGETATION DENSITY AND COVER ESTIMATES. THE SOLID CIRCLES REPRESENT THE APPROXIMATE LOCATION OF THREE ARTHROPOD PITFALL TRAPS (ALWAYS REMOVED AFTER SAMPLING OCCURS).

Sand compaction has been described as a key habitat variable for *Uma inornata* (Barrows, 1997, 2006). Sand compaction is measured at 25 points, approximately 4 m apart, along the plot midline, each year, using a hand-held pocket penetrometer with an adapter foot for loose soils (Ben Meadows Company, Janesville, WI, USA). Data are recorded as the force (kg / cm^2) required for the penetrometer "foot" to go beneath the sand surface.

Arthropod Sampling

We sample arthropods using dry, un-baited pitfall traps. Previous sampling had shown April to be a peak activity period for the harvester ants and arthropod abundance and species richness, thus pitfall surveys are confined to this month alone. The pitfall traps measure 11 cm wide at the mouth, 14 cm deep, 1.0 L in volume (Fabri-Kal Corp., model no. PK32T 21), and include a tight fitting funnel that inhibit the ability of the ants to escape once they have fallen into the trap. A board measuring 20 cm x 20 cm x 0.5 cm is placed over the pitfall trap and elevated 1-2 cm with three wooden blocks, providing shade and cover for the arthropods captured by the trap. We place three pitfall traps within each plot, one at each end and the third at the plot middle (Figure 4). We collect the contents within 24 hrs of opening the traps. Arthropod data are summarized as the mean number counted per species per pitfall per plot.

The goal of this monitoring program is to both identify whether the covered aeolian sand species' populations are sustainable within each of the core conservation areas, and if not to identify management responses if potential problems are identified. A first step is to identify whether the populations, and the resources upon which they depend, are responding predictably to the variable precipitation that is typical of desert systems. Within that framework it is important to keep in mind that the entire region is in the midst of a long-term drought that has extended from 2012-2016, and as of yet has shown no signs of ebbing. Over the past 17 years rainfall has reached or exceeded the long-term average level just three years (Figure 5). Desert

species are adapted to surviving drought, however prolonged drought such as the one we are now experiencing is historically rare if not unprecedented, and may be a harbinger of what will become the norm under predicted levels of anthropogenic climate change. Documenting how species respond to these conditions may provide a window as to how populations protected under the CVMSHCP will persist under those predicted hotter and drier conditions.

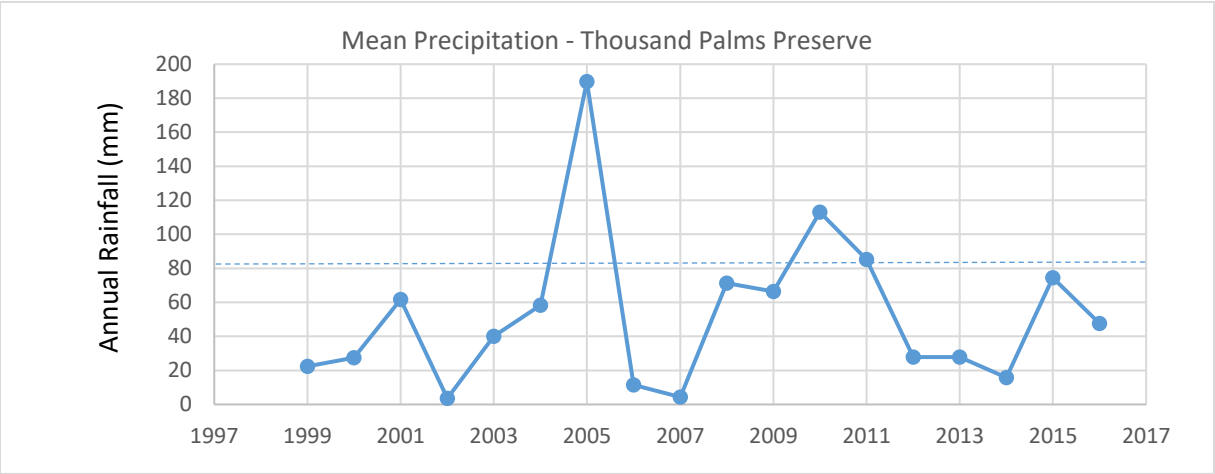

FIGURE 5. ANNUAL RAINFALL AT THE THOUSAND PALMS PRESERVE OVER THE PAST 17 YEARS. THE DASHED LINE INDICATES THE 1928-2016 AVERAGE FOR THIS LOCATION.

In addition to climate change, fragmented populations and invasive plants represent significant threats to the persistence of populations of covered species within the core aeolian sand preserves. Vandergast et al. (2015) described the recent development of distinct genetic structure for Coachella Valley fringe-toed lizards in each of the core aeolian sand preserves. Those genetic shifts are indicative of population fragmentation and isolation. What was not determined is whether or not those genetic shifts represent adaptive changes to local conditions, or are evidence of more random genetic drift. This distinction is important in terms of potential management responses. If the latter is the case, physically moving lizards between core areas to restore the original panmixic genetic condition may be warranted to prevent reduced genetic heterogeneity that could lead to reduced population persistence. In contrast if those shifts are adaptive, and if there is no further erosion of genetic diversity, then moving animals between core sites could be counterproductive, or at best a waste of resources. If funded, a proposal to re-sample the genetics of each core area will clarify genetic trajectories and provide a better indication of appropriate management strategies. In addition, a signal of reduced genetic heterogeneity that could lead to reduced population persistence would be diminished reproductive recruitment within populations that is otherwise not explained by the vagaries of annual weather or other stressors such as invasive species. Such a signal has not been seen on any of the core aeolian preserves.

An additional potential stressor addressed in our analyses is the impact of the invasive plant species *Brassica tournefortii*, Sahara mustard. Other invasive plants occurring within the aeolian sand habitats include Mediterranean split-grass, *Schismus barbatus*, and Russian thistle, *Salsola tragus*. Russian thistle has not been shown to reduce the abundance of native species at the densities observed here since 1990, and may enhance reproductive recruitment in fringe-toed lizards by providing cover from predation (Barrows 1997). Similarly, on the aeolian sand habitats, the split-grass has yet to reach densities that have a measurable impact on biodiversity. Conversely, the negative impacts of Sahara mustard have been well documented (Barrows et al. 2009, Hulton et al. 2013). The on-going drought and a greater influence of summer monsoonal rains, coupled with control efforts, have kept the mustard from achieving the high densities observed in 2005, and 2008-2012. The reduced mustard density has resulted in a "release" and positive response by several species in 2016.

Native Annual Plants vs Sahara Mustard

Desert annual plants are closely tied to annual rainfall, however the magnitude of their response here in the Coachella Valley has been less predictable (Figure 6). In 2005 there was a near identical response by both native annual plants and Sahara mustard, however the mustard over-topped the natives and significantly reduced the natives' ability to set seed (Barrows et al. 2009). In the subsequent wet years of 2008-2011 the mustard responded as expected, however the native's response was muted (Figures 6, 7 & 8).

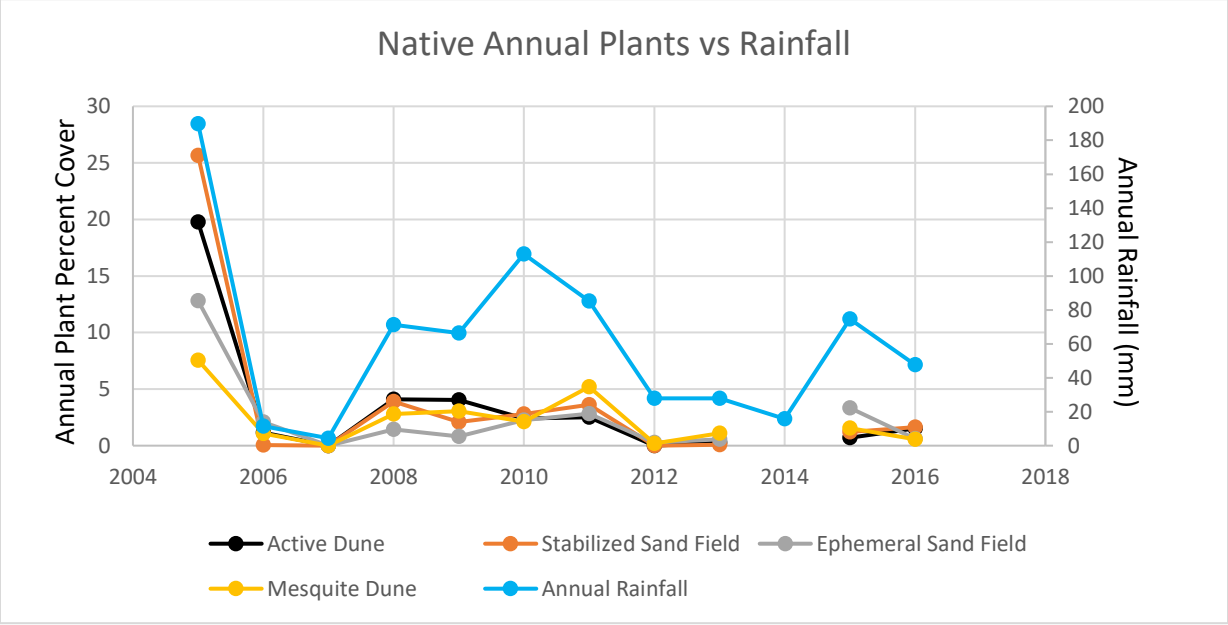

FIGURE 6. RELATIONSHIP IN TIME AND SPACE BETWEEN NATIVE ANNUAL PLANT COVER AND ANNUAL RAINFALL. THE AMOUNT OF RAINFALL VARIES ACROSS THE WEST TO EAST GRADIENT OF THE COACHELLA VALLEY. RAINFALL HERE IS FOR THE THOUSAND PALMS PRESERVE; RAINFALL AMOUNTS ARE PROGRESSIVELY HIGHER AT THE MORE WESTERN CORE AREAS.

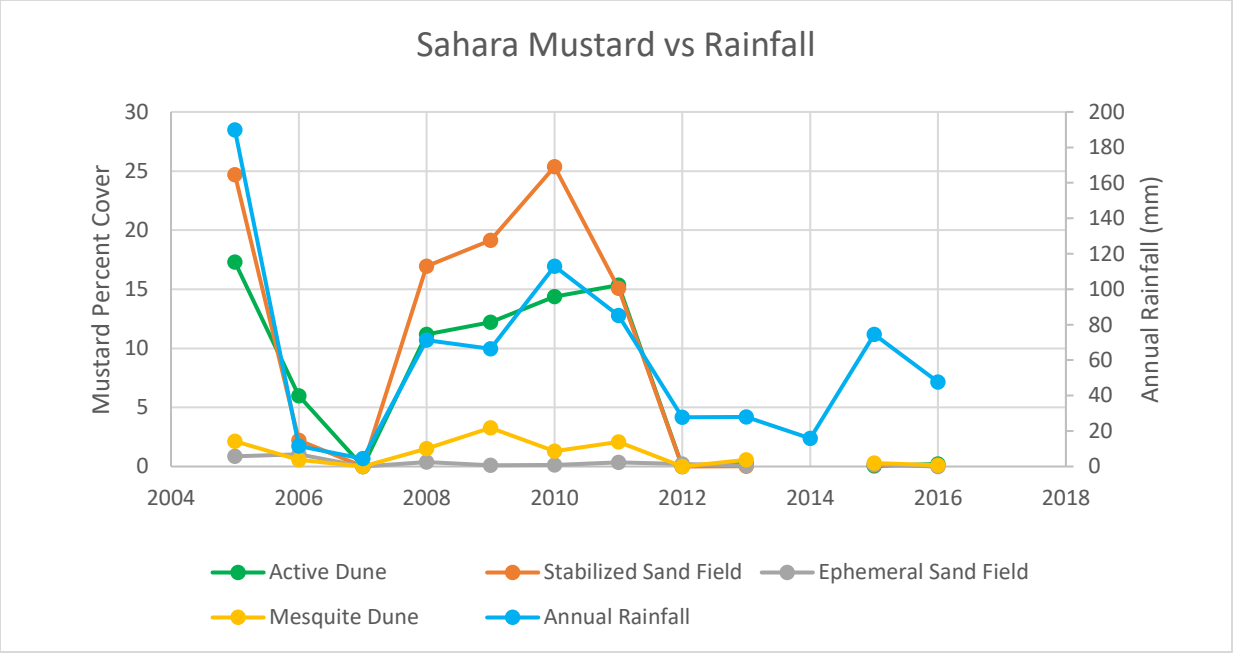

FIGURE 7. RELATIONSHIP IN TIME AND SPACE BETWEEN SAHARA MUSTARD COVER AND ANNUAL RAINFALL. THE AMOUNT OF RAINFALL VARIES ACROSS THE WEST TO EAST GRADIENT OF THE COACHELLA VALLEY. RAINFALL HERE IS FOR THE THOUSAND PALMS PRESERVE; RAINFALL AMOUNTS ARE PROGRESSIVELY HIGHER AT THE MORE WESTERN CORE AREAS.

An explanation for the divergence in responses was that he lack of seed set in 2005 by native annuals in 2005 was "swamped" by a substantial seed set by the mustard. This resulted in the seed bank then being dominated by the mustard, and so in the next wet cycle of 2008-2011 the mustard seedlings far outnumbered the native annuals. During those years the ability of the mustard to overtop and so inhibit seed set in the native annuals continued, exacerbating the dominance of mustard seeds in the soil seed bank. The reduced response by the mustard in 2015-2016 appeared to be due to the timing of the rain (September in 2014-2015; February-March-April in 2015-2016). Sahara mustard germinates more readily from late fall and early winter rains. In addition to the shift in the onset of rains, there was considerable mustard control (hand pulling) by various volunteer groups which further reduced the mustard cover. In both 2015 (and again in 2016) it was the first time since 2005 that native annuals were greater in percent cover than Sahara mustard.

That mustard control effort should be continued, increased and focused on the Thousand Palms Preserve where the active dunes and stabilized sand fields are most susceptible to high mustard densities.

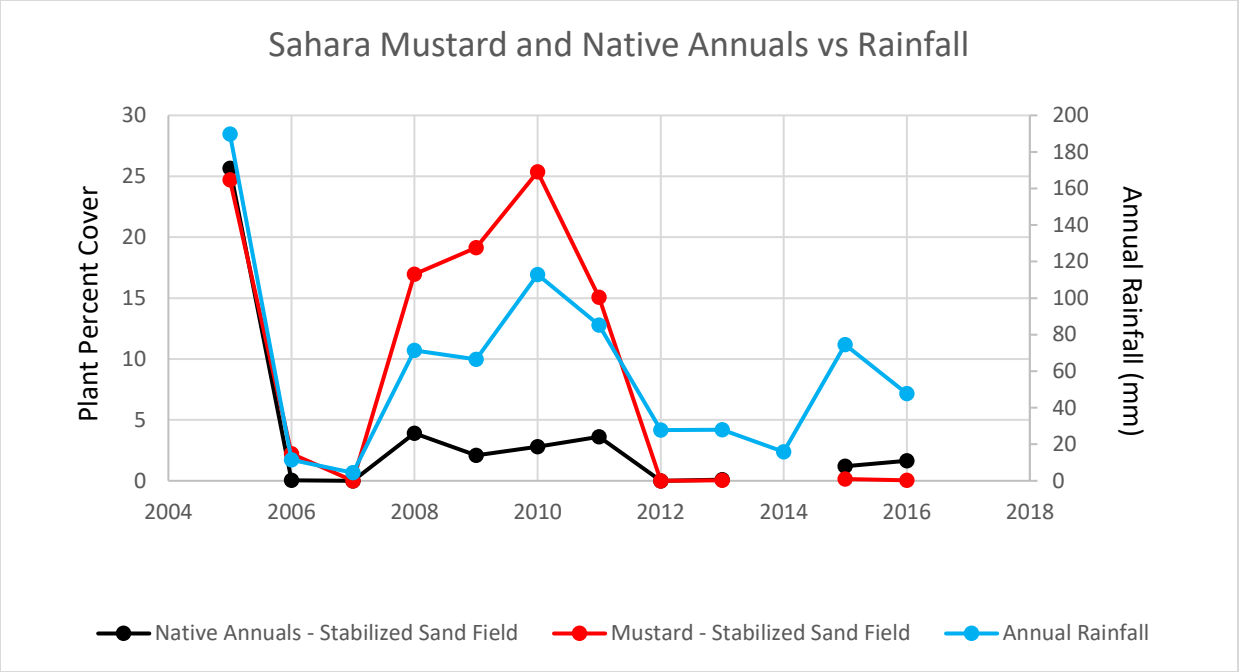

FIGURE 8. COMPARISON OF THE TEMPORAL CHANGES IN THE PERCENT COVER OF SAHARA MUSTARD AND NATIVE ANNUAL PLANTS ON THE STABILIZED SAND FIELD HABITAT TYPE WITHIN THE THOUSAND PALMS PRESERVE.

Coachella Valley Milkvetch

Coachella Valley milkvetch, *Astragalus lentiginosus* var *coachellae*, occurs in its greatest abundance on the ephemeral sand fields, which are represented on the Whitewater Floodplain Preserve south of the railroad and between Indian Avenue and Gene Autry Trail, and just west of Windy Point. Much fewer numbers occur farther east on the Thousand Palms Preserve, likely due to less rain, less wind, and finer sand particles, reducing their seed scarification capacity. At habitats with reduced sand movement, including stabilized sand fields and mesquite dunes this species is much rarer and less predictable in its occurrence. The ephemeral sand dunes are the least impacted by Sahara mustard of the four aeolian sand habitat types and so that invasive weed likely has little or no impact on this *Astragalus*. However on the active dunes of the Coachella Valley preserve mustard can reach high densities (Figure 7). There Sahara mustard can have a significant impact on milkvetch abundance (Barrows et al. 2009).

There is a general correlation between annual rainfall and milkvetch abundance; more so in the drier active dunes than the cooler-wetter ephemeral sand fields (Figure 9). Especially in the western valley, this species is often a biennial and so the rainfall correlation can have a lag time, as is evidenced in 2011-2012 for the ephemeral sand field. Another factor is the need for seed scarification by sand abrasion. Even moderate rains following several years of drought, when sand movement tends to be higher, can yield high numbers of milkvetch.

Other than Sahara mustard control on the Active Dunes, this species does not appear to need any focused management actions.

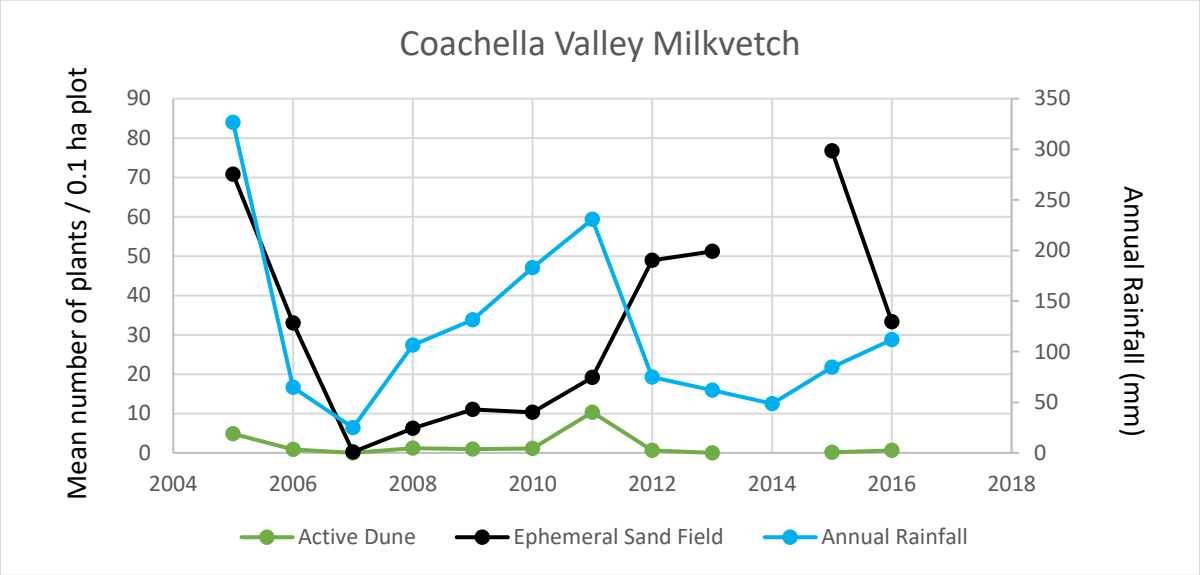

FIGURE 9. TEMPORAL AND SPATIAL DYNAMICS OF THE COACHELLA VALLEY MILKVETCH COMPARED TO ANNUAL RAINFALL.

Arthropods (ants)

Ants are the primary prey of flat-tailed horned lizards, and the most common arthropod prey of Coachella Valley fringe-toed lizards. Understanding the ants' temporal and spatial patterns of abundance should therefore contribute to the understanding of the population dynamics of those lizard species. Those ant species consumed by the lizards include *Pogonomyrmex* spp. (red harvester ants), *Messor* sp. (black harvester ants), and *Myrmecocystus* spp. (honey-pot ants), and so those genera were combined into a single metric, "ants" for these analyses.

Ants occurring on the active dunes and stabilized sand fields were most abundant, and showed the greatest degree of inter-year variability among all core habitat areas in the Coachella Valley (Figure 10). Examining this pattern further, there was a strong correlation between annual rainfall and a three year lag-response by the ants (Figure 11).

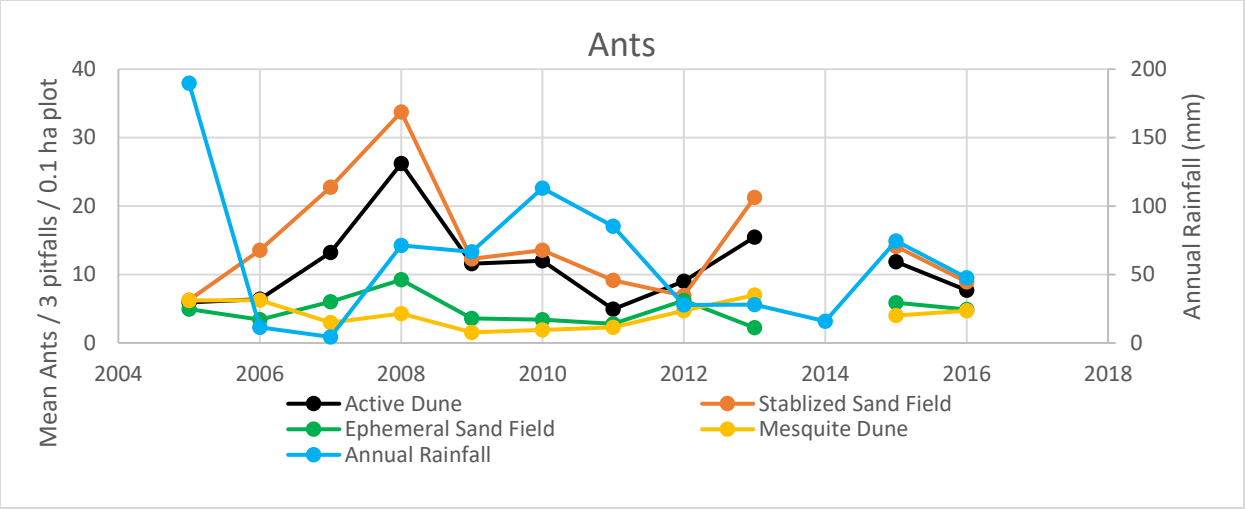

FIGURE 10. TEMPORAL AND SPATIAL PATTERNS OF THE ANT PREY SPECIES CONSUMED BY FLAT-TAILED HORNED LIZARDS AND FRINGE-TOED LIZARDS IN THE COACHELLA VALLEY.

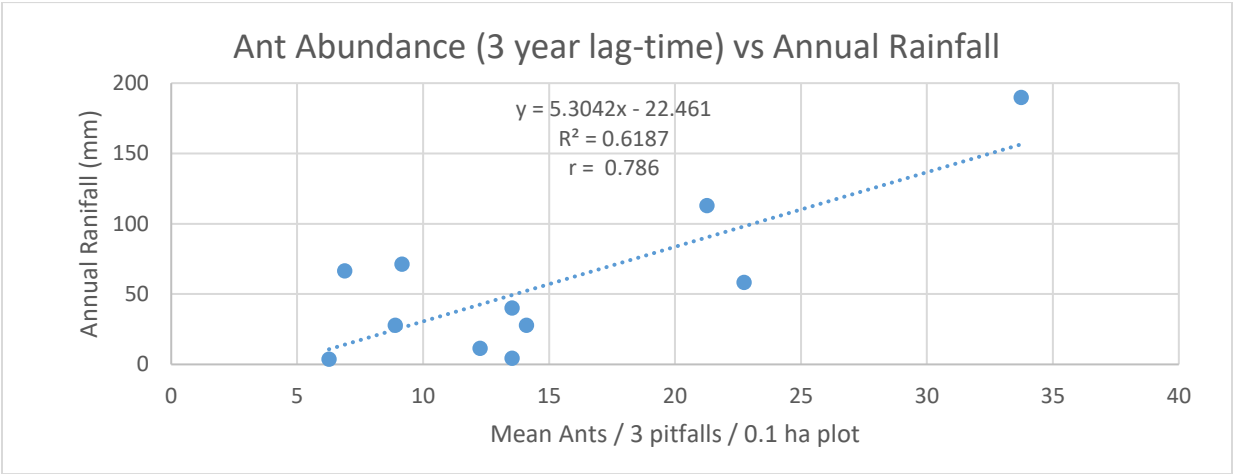

FIGURE 11. REGRESSION AND CORRELATION OF ANNUAL RAINFALL VERSUS A THREE YEAR LAG TIME IN ANT ABUNDANCE ON THE STABILIZED SAND FIELDS.

It is not clear why there appeared to be such a strong correlation between the rainfall and a three year lag-time in ant abundance. One explanation may be the ants' reliance on detritus/seeds which can be available independent of a given year's rainfall and primary productivity (Barrows 2012). Unfortunately there are no other long-term natural history studies describing population dynamics for this region and for this suite of ant genera. One possibility is that Sahara mustard has an inhibitory effect on the ants, although none were found in a previous mustard removal experiment (Barrows et al. 2009). However a later multi-year

analysis did show that locations with the highest mustard densities did result in a reduction in ant abundance (Hulton et al. 2013). Figure 12 does appear to show an inverse relationship between ant and mustard abundance, however statistically that correlation was weak (r = -0.0615). The gap in data collection in 2014 may have prevented detection of a statistically significant negative correlation.

Even with somewhat ambiguous results, support for on-going and accelerated mustard control efforts is warranted, until more data can be collected.

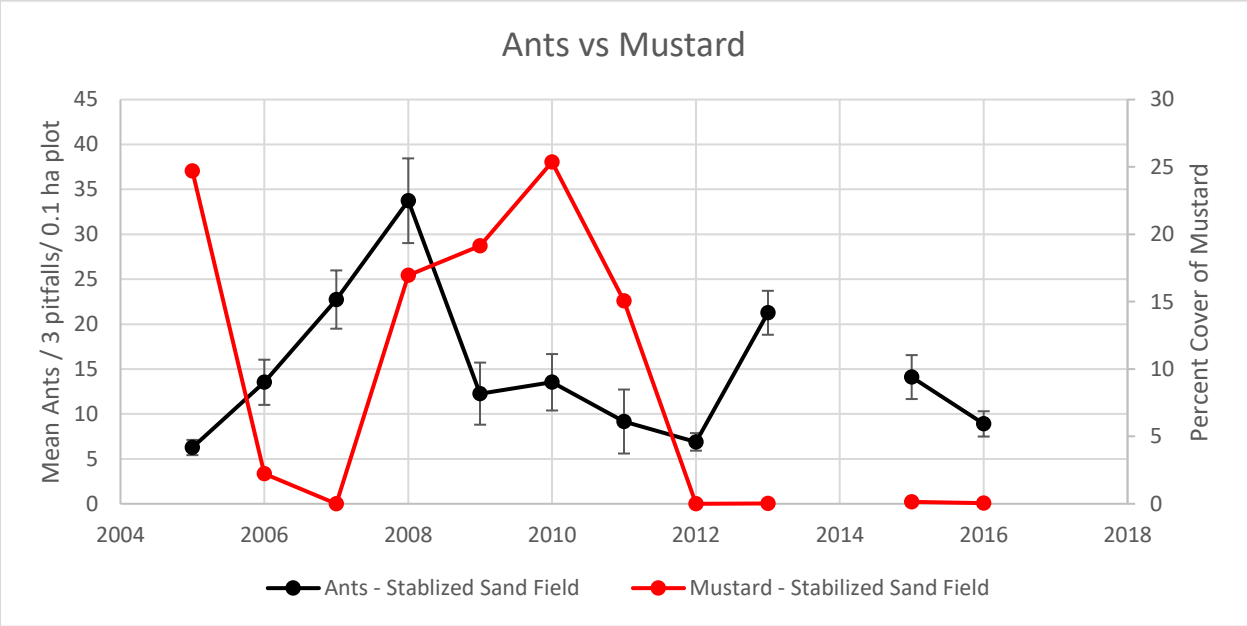

FIGURE 12. TEMPORAL SHIFTS IN ANTS AND MUSTARD ABUNDANCE ON THE STABILIZED SAND FIELD HABITAT ON THE THOUSAND PALMS PRESERVE. ERROR BARS INDICATE ONE STANDARD ERROR.

Coachella Valley Fringe-toed Lizards

Coachella Valley fringe-toed lizards, *Uma inornata*, (UMIN) precipitated the first conservation planning efforts in the Coachella Valley in the early 1980s, culminating in 1986 with the first habitat conservation plan (HCP) initiated in the U.S. after the 1982 amendment to the Federal Endangered Species Act authorized 10a permits (HCPs). By 1990 it was clear that this HCP's design had failed to adequately ensure that the physical processes that maintain the lizards' habitat would be protected, as well as failed to protect an additional remaining viable habitat area west of Windy Point. This precipitated a broader, more encompassing conservation planning effort that resulted in the CVMSHCP signed in 2008. Each of the four core UMIN habitats protected under the CVMSHCP have a distinct character, sand source and climatic regime, and so not surprisingly different UMIN densities and population dynamics. Each will be analyzed separately here.

Active dunes and stabilized sand fields are now restricted to the Thousand Palms Preserve, north or I-10, east of the unincorporated community of Thousand Palms. Subjected to the same climatic regimes and sand sources, these habitats occur at the hottest and driest end of the remaining occupied aeolian sand habitats in this valley. These are also the habitats most severely impacted by Sahara mustard. Therefore, from both climate change and invasive species these habitats could be most at risk. They are isolated from all other core areas, but this the largest remaining protected habitat area so, compared to other core areas, fragmentation may be of lesser concern. The active dunes have deep sands with sparse vegetation; the stabilized sand fields have generally much denser vegetation with a thinner "veneer" of sand over laying cemented sand, silts, and clay. With the assumption that in extremely arid regions precipitation stimulates primary productivity, which then is the base input of energy that feeds arthropods, lizards, birds, and mammals, each core habitat was first analyzed to see how closely precipitation predicts the population dynamics of the UMIN. Deviations from a close correlation between annual rainfall and the UMIN population dynamics may indicate the influence of alternative energy inputs or additional stressors that then may require management action. Because theses lizards' hatchlings don't emerge until mid-summer through the fall (depending upon the number of clutches laid), there is a lag time of one year between when the surveys occur (May-June-July) and when there is a numerical response to that year's resource conditions. Therefore the graphs include a one year shift in annual precipitation values so that rainfall and its effect are then coincident.

The active dunes habitat consistently has the highest population density of UMIN than any other habitat (Figure 13). Even in the driest years UMIN numbers here exceed other core areas, in part due to the afore mentioned lag time in ant abundance, meaning ants can be an abundant food source even in the driest years. Annual rainfall and the UMIN population dynamics are closely correlated on this site ($r = 0.667$) (Figure 14). Over 45% of the annual variation in mean UMIN is explained by rainfall alone. Despite being seemingly at risk from both climate change and invasive species, this population currently appears secure.

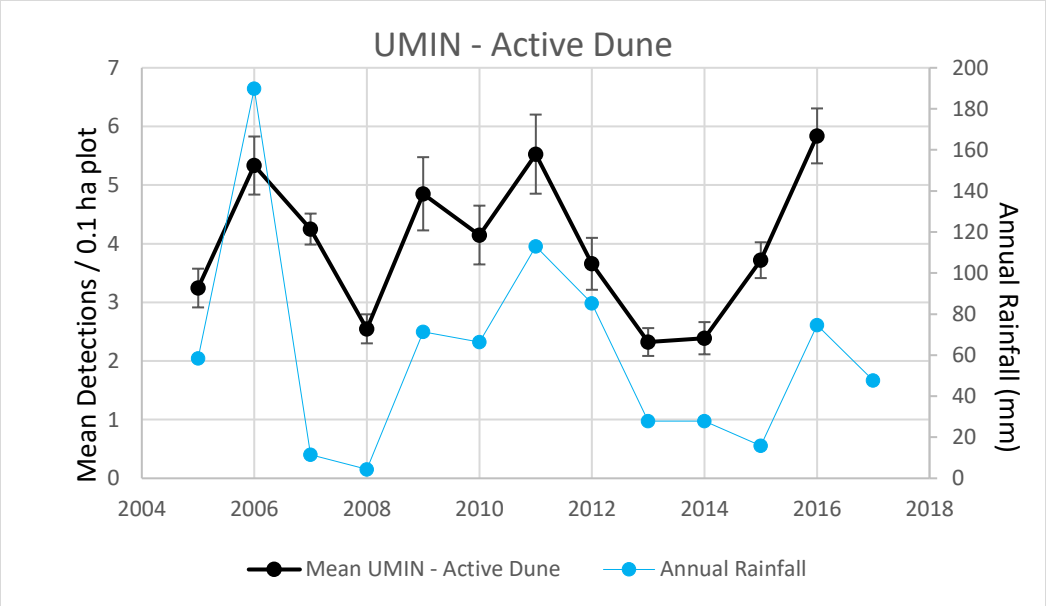

FIGURE 13. TEMPORAL DYNAMICS IN THE POPULATION OF COACHELLA VALLEY FRINGE-TOED LIZARDS OCCUPYING THE ACTIVE DUNES AT THE THOUSAND PALMS PRESERVE. RAINFALL VALUES ARE SHIFTED FORWARD 1 YEAR TO BETTER DEMONSTRATE THE RELATIONSHIP OF THESE VARIABLES AND 2016 IS INCLUDED TO DISPLAY WHAT UMIN VALUES MIGHT BE EXPECTED NEXT YEAR. ERROR BARS INDICATE ONE STANDARD ERROR.

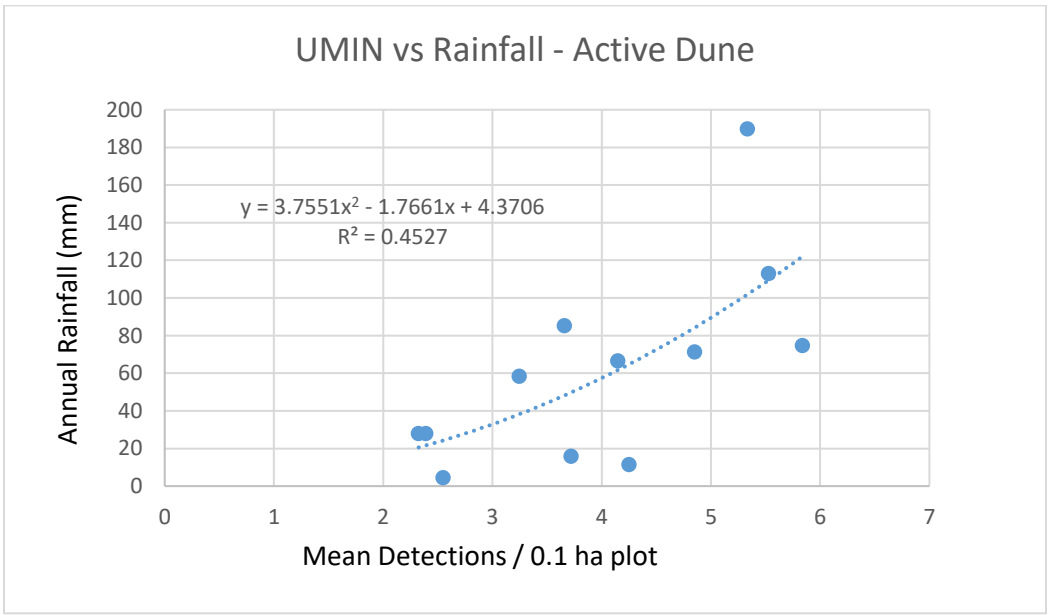

FIGURE 14. A REGRESSION OF FRINGE TOED LIZARD POPULATION DYNAMICS VERSUS ANNUAL RAINFALL WITH A 1 YEAR TIME LAG

The stabilized sand fields generally surround the active dunes at the Thousand Palms Preserve, yet despite this close physical connection, the UMIN population dynamics have been very different (Figure 15). Rather than closely tracking rainfall, just 14% of the UMIN population dynamics can be explained by precipitation with a correlation of just r = 0.119. (Figure 16). The question then is what is causing the difference? Comparing patterns of abundance between UMIN and Sahara mustard reveals an inverse relationship, with over 36% of the variation in UMIN dynamics explained by mustard cover, with a negative correlation of r = -0.4296 (Figures 17 & 18). What is especially telling is that with the moderate (but still below average) rainfall of 2014-2015, and with the mustard nearly absent due to the later onset of rains and control efforts in 2016, the UMIN population on the stabilized sand fields reached levels nearly identical to those on the active dunes. Ongoing and accelerated mustard control is clearly warranted for this habitat.

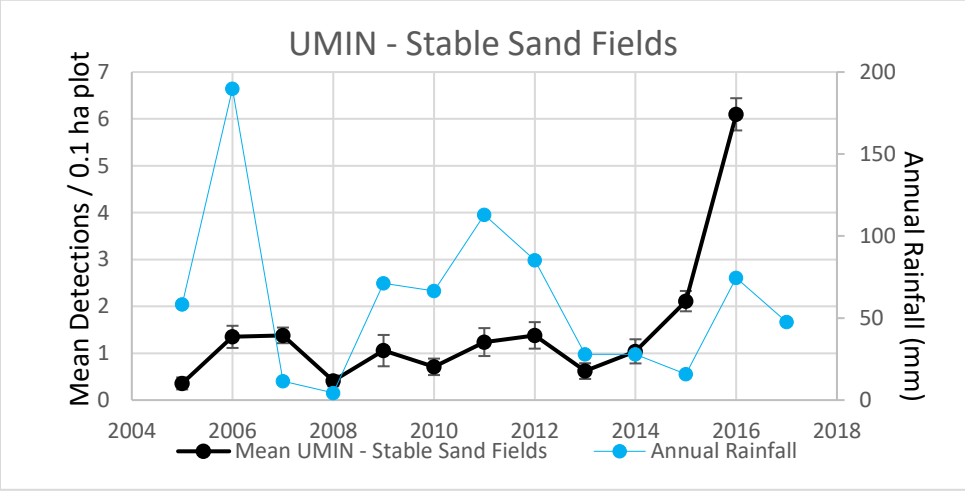

FIGURE 15. TEMPORAL DYNAMICS IN THE POPULATION OF COACHELLA VALLEY FRINGE-TOED LIZARDS OCCUPYING THE STABILIZED SAND FIELDS AT THE THOUSAND PALMS PRESERVE. RAINFALL VALUES ARE SHIFTED FORWARD 1 YEAR TO BETTER DEMONSTRATE THE RELATIONSHIP OF THESE VARIABLES AND 2016 IS INCLUDED TO DISPLAY WHAT UMIN VALUES MIGHT BE EXPECTED NEXT YEAR. ERROR BARS INDICATE ONE STANDARD ERROR.

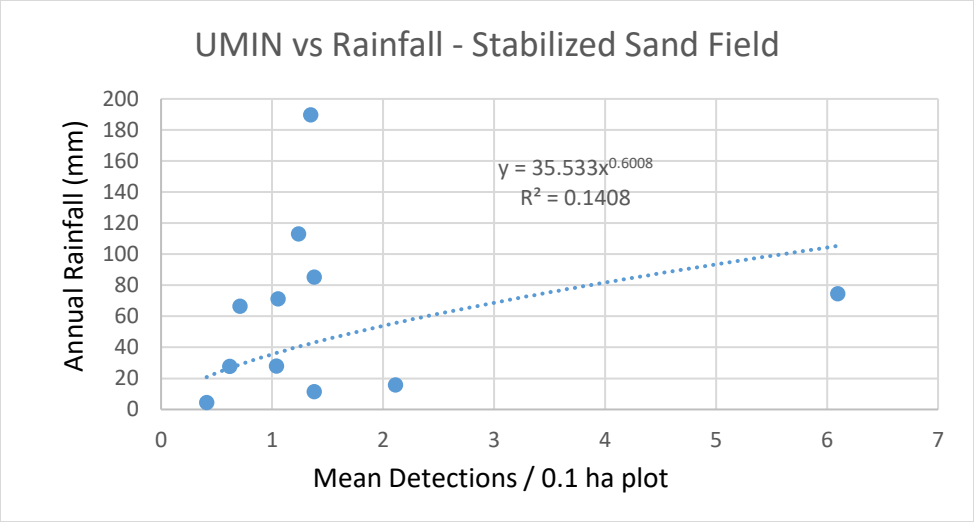

FIGURE 16. A REGRESSION OF FRINGE TOED LIZARD POPULATION DYNAMICS VERSUS ANNUAL RAINFALL WITH A 1 YEAR TIME LAG.

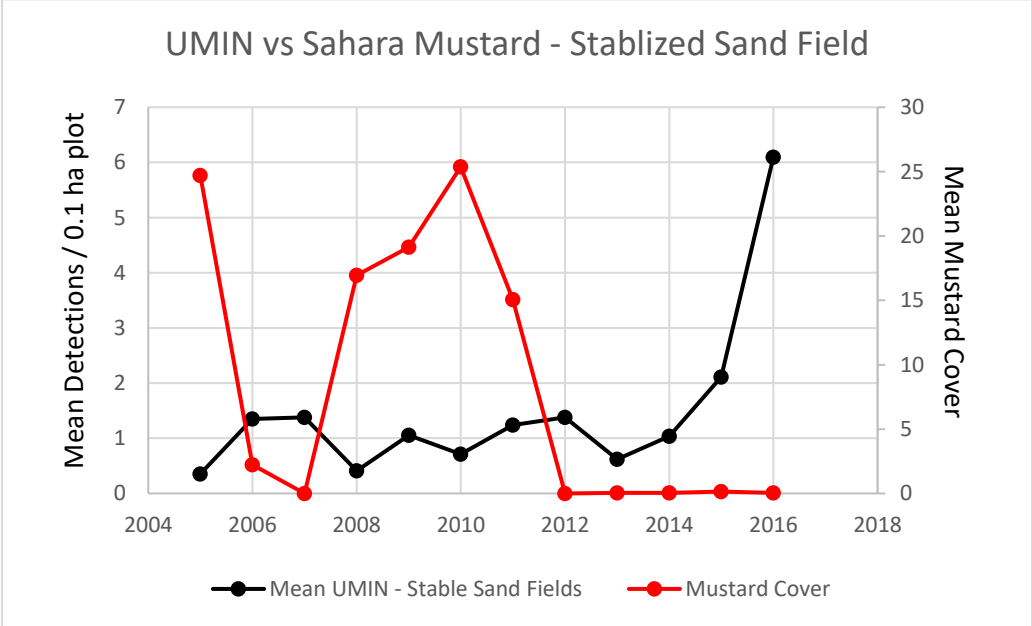

FIGURE 17. TEMPORAL DYNAMICS IN THE POPULATION OF COACHELLA VALLEY FRINGE-TOED LIZARDS OCCUPYING THE STABILIZED SAND FIELDS AT THE THOUSAND PALMS PRESERVE COMPARED TO SAHARA MUSTARD ABUNDANCE.

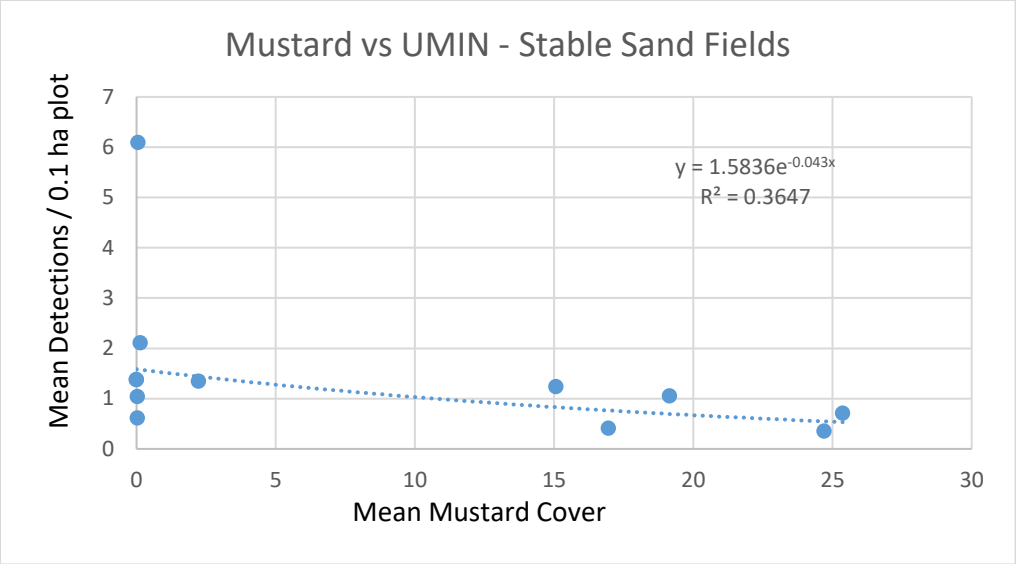

FIGURE 18. A REGRESSION OF FRINGE TOED LIZARD POPULATION DYNAMICS SAHARA MUSTARD ABUNDANCE.

Ephemeral sand fields are so called because the wind energy and its ability to move sand at these sites can exceed the more episodic, stochastic inputs of sand, resulting in a habitat that shifts from being well supplied with sand to being "sand starved" over just a few years. This habitat occurs throughout the Whitewater Floodplain Preserve (WWFPP) south of I-10 and the railroad right of way and between Indian Avenue and Gene Autry Trail. It also occurs west of Indian Avenue extending almost to Snow Creek Road, although not all of that area is within a designated core area and not all of the designated core area has been purchased and therefore in conservation ownership. There are three clusters of six plots each, providing us with the opportunity to compare the effects of a "wave" of sand moving across the landscape versus the background effects of annual precipitation.

Figure 19 demonstrates the effect of the "sand wave" as it gradually moves across the landscape. ESF 13-18 is a cluster of six plots 1.6 km west of ESF 7-12; as the sand source here is the Whitewater River, the western sites receive sand first. In 2005 the entire site was sand starved, but the heavy rains that year included flooding which brought new sand to the western edge of the WWFPP. Sympatric zebra-tailed lizards, *Callisaurus draconoides* (CADR), were included in this Figure because their habitat suitability is not dependent on aeolian sand. In 2005-2006 the CADR population was fairly high in response to the resources catalyzed by those rains, but on those same sand starved plots UMIN populations showed little response to those resources. As the sand wave moved across the WWFPP the UMIN population increased until

2013 when the western ESF 13-18 plots began once again to become sand starved. The more eastern ESF 7-12 plots were still within the tail end of the sand wave until 2016, when their populations also dropped. Ensuring new sand inputs are not blocked is the primary management objective for this site.

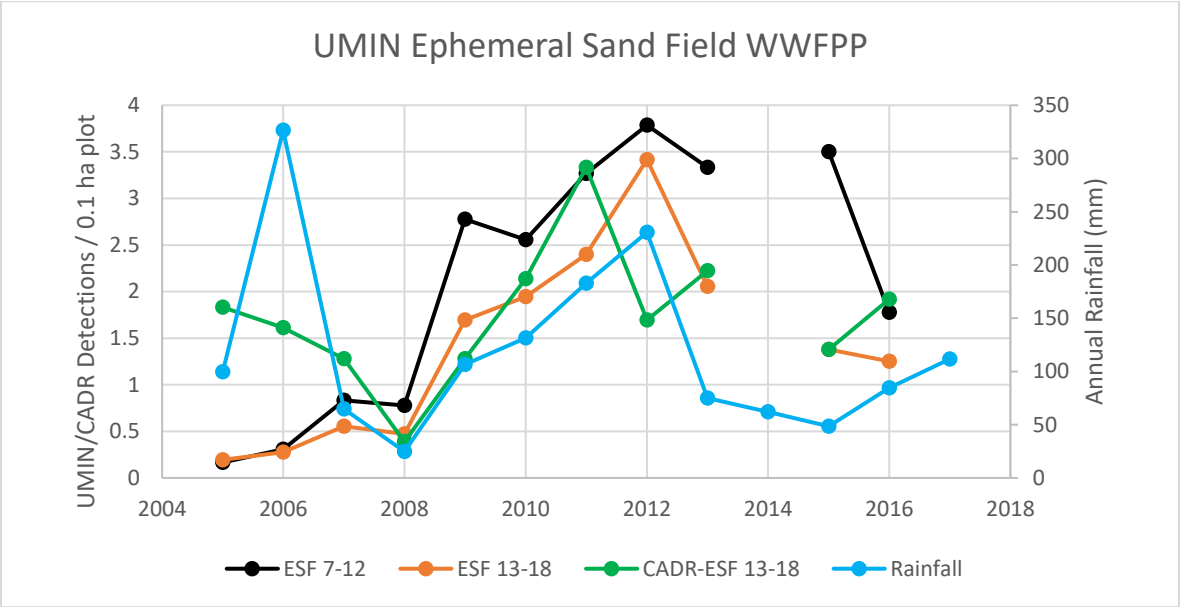

FIGURE 19. TEMPORAL DYNAMICS IN THE POPULATION OF COACHELLA VALLEY FRINGE-TOED LIZARDS AND ZEBRA-TAILED LIZARDS OCCUPYING TWO SEPARATE PLOT CLUSTERS WITHIN THE WHITEWATER FLOODPLAIN PRESERVE (WWFPP) COMPARED TO RAINFALL. RAINFALL VALUES ARE SHIFTED FORWARD 1 YEAR TO BETTER DEMONSTRATE THE RELATIONSHIP OF THESE VARIABLES AND 2016 IS INCLUDED TO DISPLAY WHAT UMIN VALUES MIGHT BE EXPECTED NEXT YEAR.

For both the Windy Point and Willow Hole Core Conservation Areas the UNIM populations responded little to not at all to annual changes in precipitation (Figures 20 & 21). At Willow Hole the primary habitat, mesquite dunes, the honey mesquite are the dominant vegetation and are deep rooted, tapping into relatively high ground water along the San Andreas earthquake fault. Being independent from the vagaries of annual rainfall, primary productivity is more stable and so likely are the other biotic elements tied to that primary productivity. Figure 10 supports that prediction for ants. The relatively low UMIN population level may then be related to top-down population control – predators and parasites. Lizard predator populations, sidewinders, roadrunners and shrikes, are consistently higher in that habitat. Sahara mustard does occur here and seems to be expanding, but is no where near the densities found in the stabilized sand fields and active dunes.

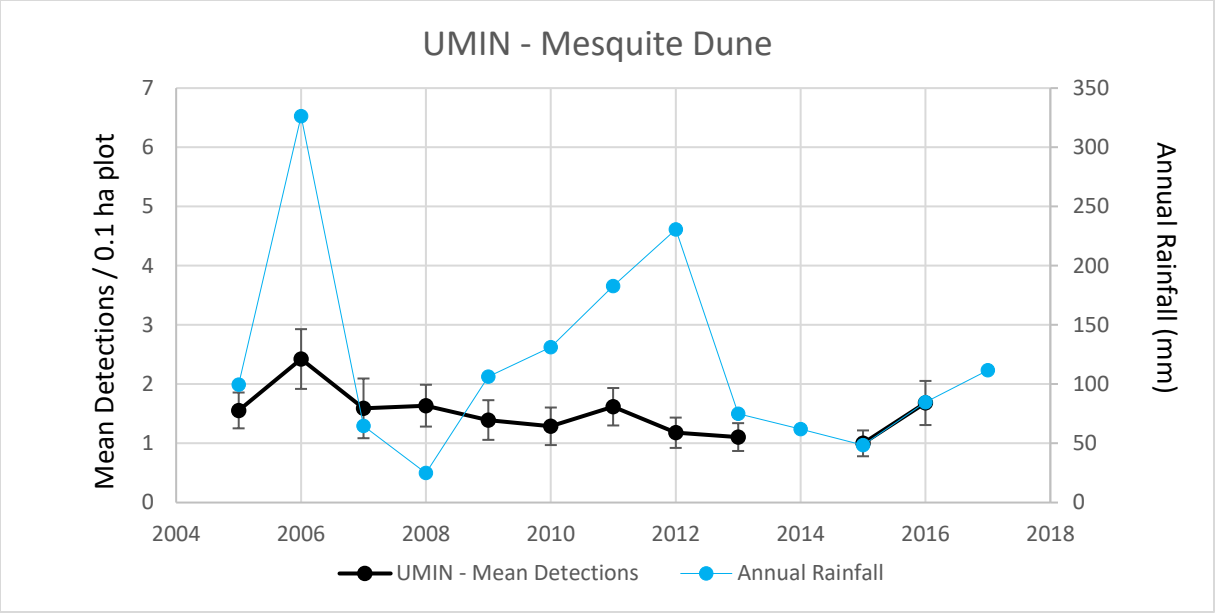

FIGURE 20. TEMPORAL DYNAMICS IN THE POPULATION OF COACHELLA VALLEY FRINGE-TOED LIZARDS OCCUPYING THE MESQUITE DUNES OF THE WILLOW HOLE CORE AREA. RAINFALL VALUES ARE SHIFTED FORWARD 1 YEAR TO BETTER DEMONSTRATE THE RELATIONSHIP OF THESE VARIABLES AND 2016 IS INCLUDED TO DISPLAY WHAT UMIN VALUES MIGHT BE EXPECTED NEXT YEAR. ERROR BARS INDICATE ONE STANDARD ERROR.

For Windy Point the lack of UMIN responses to rainfall dynamics may be because the rainfall there is so consistently high that drought rarely occurs (Figure 21). The only significant drop in the UMIN population occurred in the middle of the current drought. With the more consistent rainfall, and sand levels, the reason for the relatively low UMIN population is unclear. Like the mesquite dunes there could be a greater top-down population control, or the cooler-wetter conditions themselves may limit reproductive success. No anthropogenic stressors are apparent.

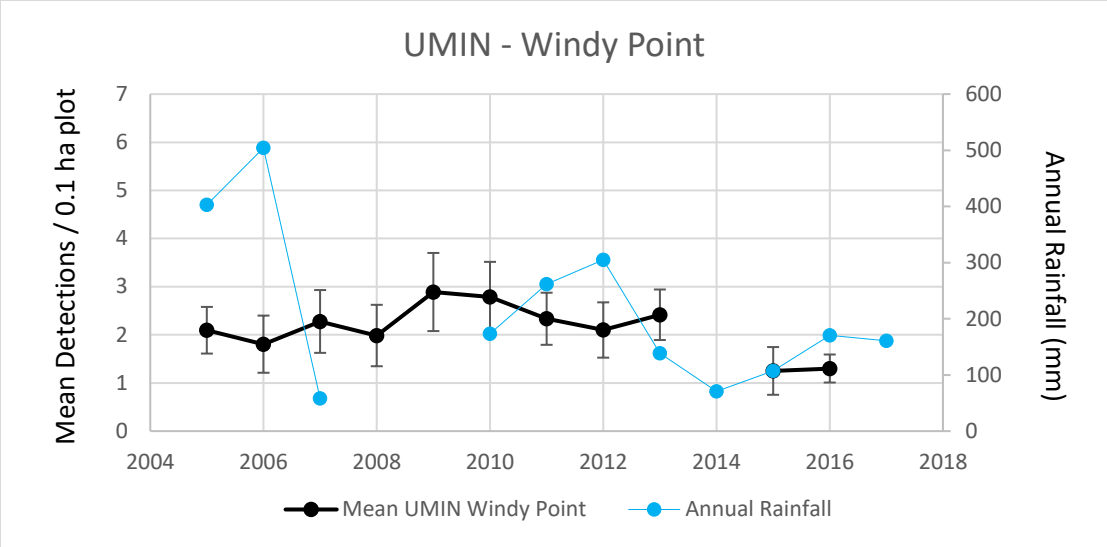

FIGURE 21. TEMPORAL DYNAMICS IN THE POPULATION OF COACHELLA VALLEY FRINGE-TOED LIZARDS OCCUPYING THE EPHEMERAL SAND FIELDS AT THE WINDY POINT CORE AREA. RAINFALL VALUES ARE SHIFTED FORWARD 1 YEAR TO BETTER DEMONSTRATE THE RELATIONSHIP OF THESE VARIABLES AND 2016 IS INCLUDED TO DISPLAY WHAT UMIN VALUES MIGHT BE EXPECTED NEXT YEAR. ERROR BARS INDICATE ONE STANDARD ERROR.

Due to the small size of the sand islands in the west Indio Hills our standard 0.1 ha plot surveys could not be employed. We therefore determined occupancy alone by extensive searches of each sand island. These islands create a metapopulation dynamic in which any one island may or may not be occupied in any given year, but unoccupied islands can then become occupied through immigration. Over the course of these surveys there appears to be a consistent trajectory of reduced sand in most of the islands, a trajectory that may be reflected in the lower occupancy in the most recent years. Sahara mustard densities are high on some islands, but sand loss through natural erosion appears to be the largest threat.

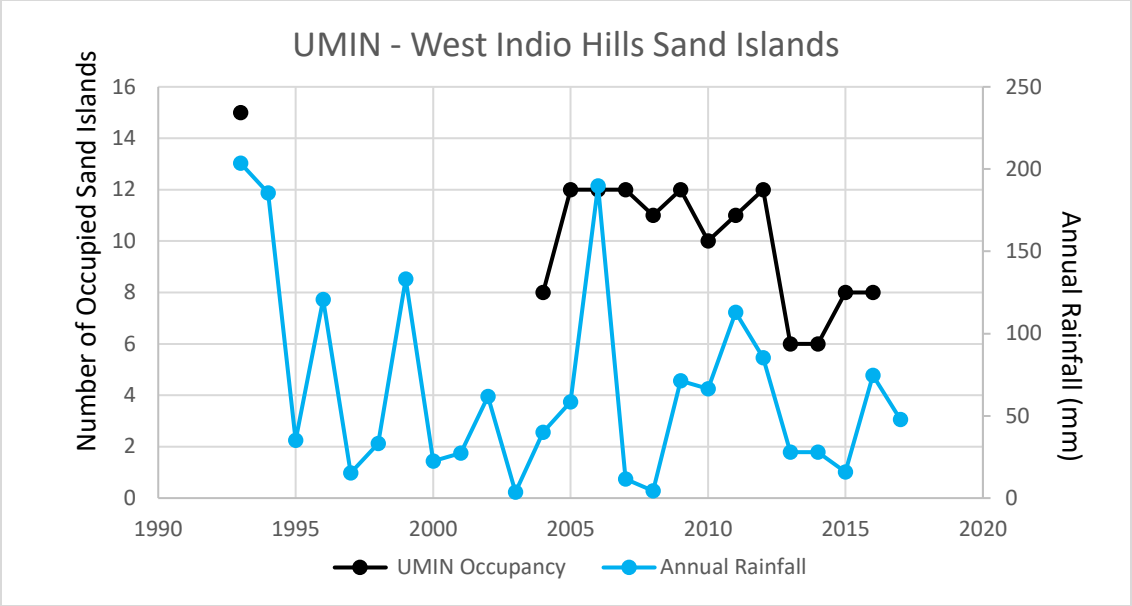

FIGURE 22. TEMPORAL DYNAMICS IN THE OCCUPANCY OF COACHELLA VALLEY FRINGE-TOED LIZARDS IN THE ISOLATED SAND ISLANDS OF THE WEST INDIO HILLS. RAINFALL VALUES ARE SHIFTED FORWARD 1 YEAR TO BETTER DEMONSTRATE THE RELATIONSHIP OF THESE VARIABLES AND 2016 IS INCLUDED TO DISPLAY WHAT UMIN VALUES MIGHT BE EXPECTED NEXT YEAR.

Flat-tailed Horned Lizards

Flat-tailed horned lizards, *Phrynosoma mcallii* (PHMC), reach their northern most distribution in the Coachella Valley. They were much more widely distributed here as recently as the 1980s when they were regularly found as far west as the WWFPP and Edom Hill. Today they are occasionally found south of I-10 in the vicinity of Bob Hope Drive (Cahuilla Indian Reservation lands), but are otherwise only known to occur on the Thousand Palms Preserve and the Dos Palmas Preserve, near the Riverside – Imperial County line. Within the Thousand Palms Preserve they can still be fairly common (Figures 23 & 24).

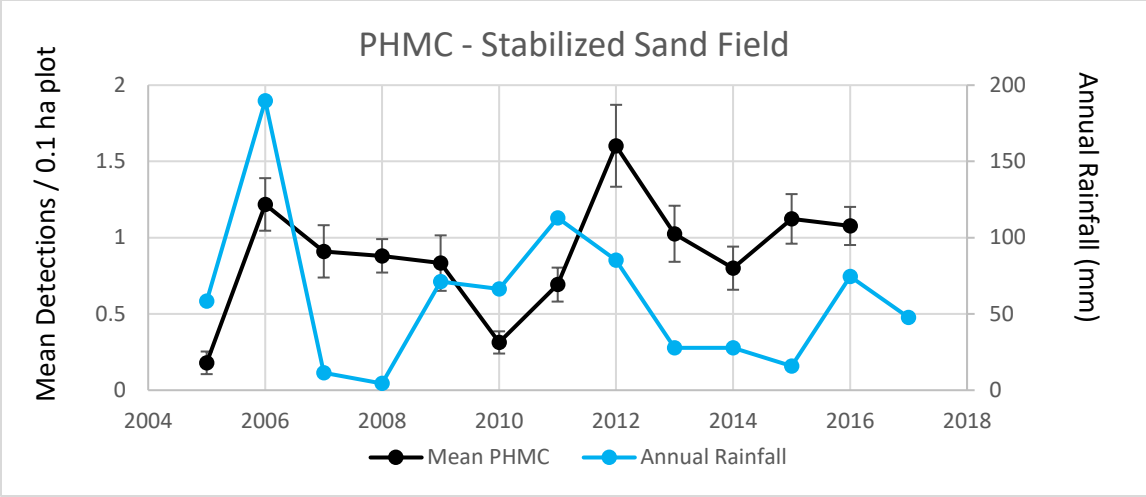

FIGURE 23. TEMPORAL DYNAMICS IN THE POPULATION OF FLAT-TAILED HORNED LIZARDS OCCUPYING THE STABILIZED SAND FIELDS AT THE THOUSAND PALMS PRESERVE CORE AREA. RAINFALL VALUES ARE SHIFTED FORWARD 1 YEAR TO BETTER DEMONSTRATE THE RELATIONSHIP OF THESE VARIABLES AND 2016 IS INCLUDED TO DISPLAY WHAT PHMC VALUES MIGHT BE EXPECTED NEXT YEAR. ERROR BARS INDICATE ONE STANDARD ERROR

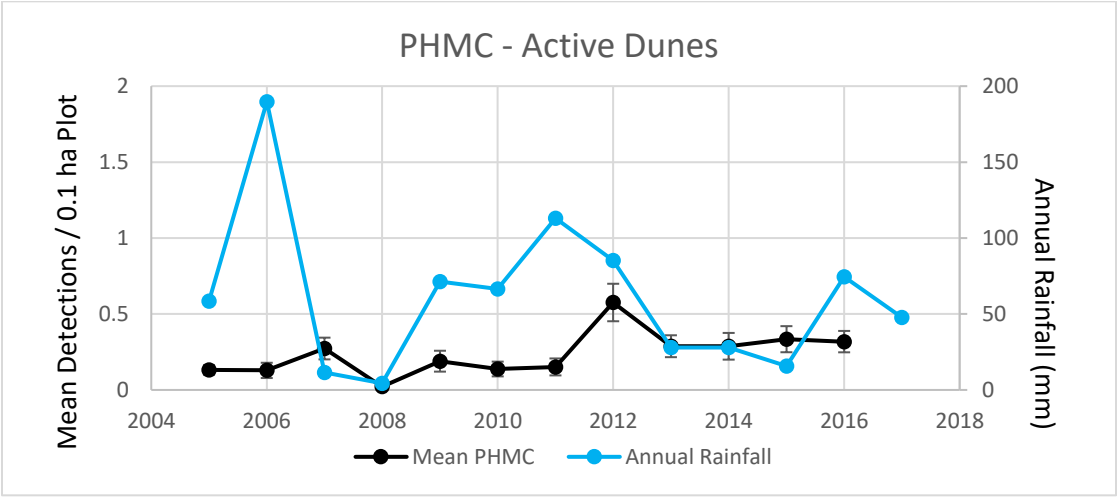

FIGURE 24. TEMPORAL DYNAMICS IN THE POPULATION OF FLAT-TAILED HORNED LIZARDS OCCUPYING THE ACTIVE DUNES AT THE THOUSAND PALMS PRESERVE CORE AREA. RAINFALL VALUES ARE SHIFTED FORWARD 1 YEAR TO BETTER DEMONSTRATE THE RELATIONSHIP OF THESE VARIABLES AND 2016 IS INCLUDED TO DISPLAY WHAT PHMC VALUES MIGHT BE EXPECTED NEXT YEAR. ERROR BARS INDICATE ONE STANDARD ERROR.

PHMC temporal population dynamics on the stabilized sand field habitat indicate a complex pattern which is sometimes broadly and positively aligned with rainfall patterns (Figure 23, 2006, 2012-2016, r = 0.4296) but in other years there was a negative correlation (r = -0.3640). On the active dune habitat no correlation no apparent. In trying to identify what factor did impact the PHMC population dynamics we first assessed their relationship with their primary food, ants (Figure 25). No correlation was found (r = 0.0459), nor did the regression model explain any significant level of variation (Figure 26). We then assessed the influence of Sahara mustard (Figures 27 & 28). Sahara mustard percent cover explained over 70% of the population dynamics in PHMC with a correlation of r = 0.8396. Although this is a positive correlation it is apparent that in the years 2008-2011, when the mustard was continuously present, the mustard reduced the PHMC potential response to otherwise higher primary productivity; the PHMC's prey, ants, showed the same decline during that period (Figures 12 & 25). Managing Sahara mustard is clearly a high priority to provide for sustainable PHMC populations here.

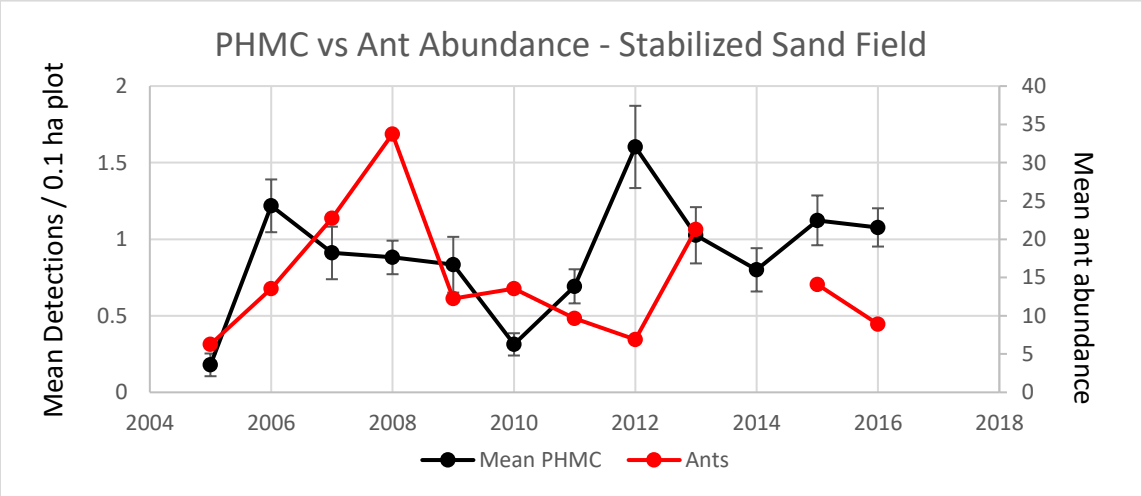

FIGURE 25. TEMPORAL DYNAMICS IN THE POPULATION OF FLAT-TAILED HORNED LIZARDS OCCUPYING THE STABILIZED SAND FIELD HABITAT AT THE THOUSAND PALMS PRESERVE CORE AREA IN RELATIONSHIP TO ANT ABUNDANCE. ERROR BARS INDICATE ONE STANDARD ERROR.

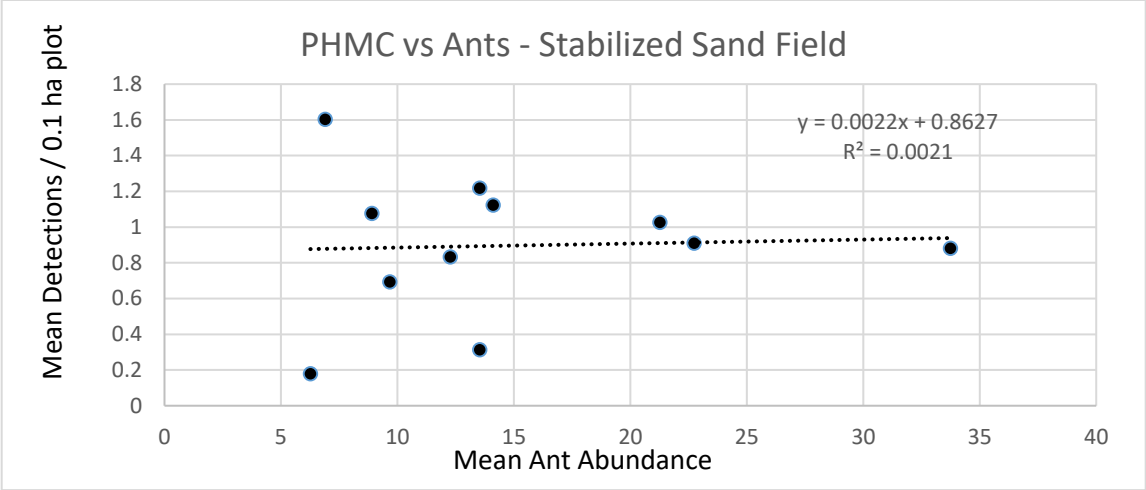

FIGURE 26. LINEAR REGRESSION OF THE POPULATION OF FLAT-TAILED HORNED LIZARDS OCCUPYING THE STABILIZED SAND FIELD HABITAT AT THE THOUSAND PALMS PRESERVE CORE AREA IN RELATIONSHIP TO ANT ABUNDANCE.

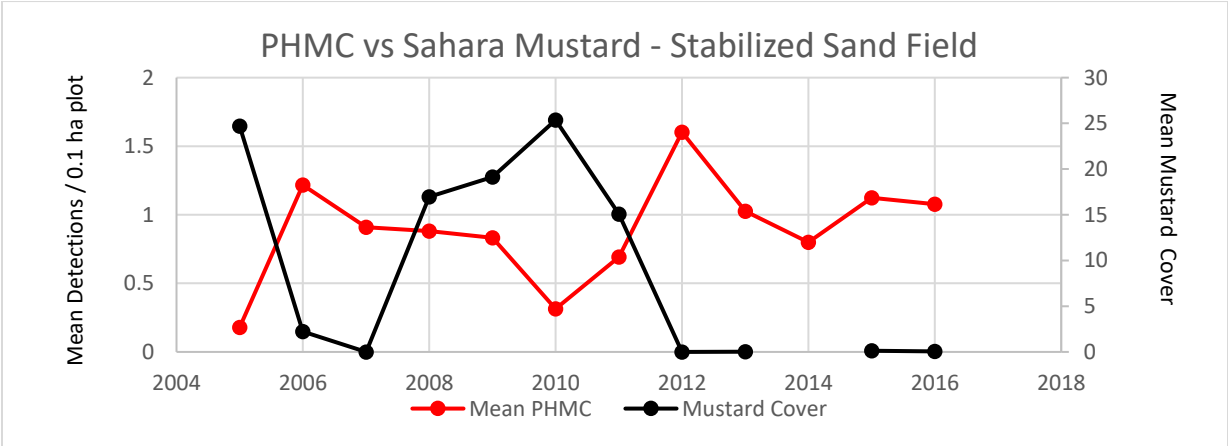

FIGURE 27. TEMPORAL DYNAMICS IN THE POPULATION OF FLAT-TAILED HORNED LIZARDS OCCUPYING THE STABILIZED SAND FIELD HABITAT AT THE THOUSAND PALMS PRESERVE CORE AREA IN RELATIONSHIP TO SAHARA MUSTARD.

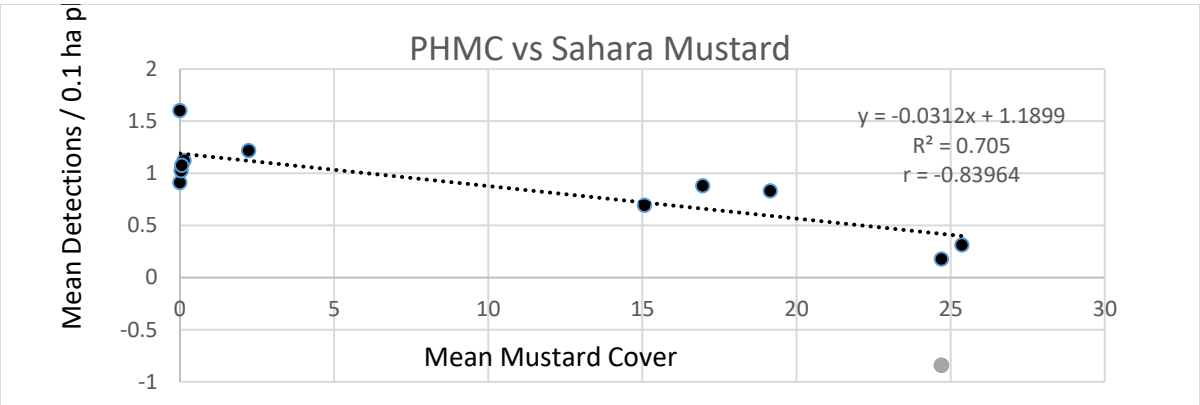

FIGURE 28. LINEAR REGRESSION OF THE POPULATION OF FLAT-TAILED HORNED LIZARDS OCCUPYING THE STABILIZED SAND FIELD HABITAT AT THE THOUSAND PALMS PRESERVE CORE AREA IN RELATIONSHIP TO SAHARA MUSTARD.

At Dos Palmas the PHMC population is low, given that the current drought has been most severe there (based on vegetation condition – no local rain gauge data was available), they seem to be sustaining their numbers with low, but consistent reproductive success (Figure 29).

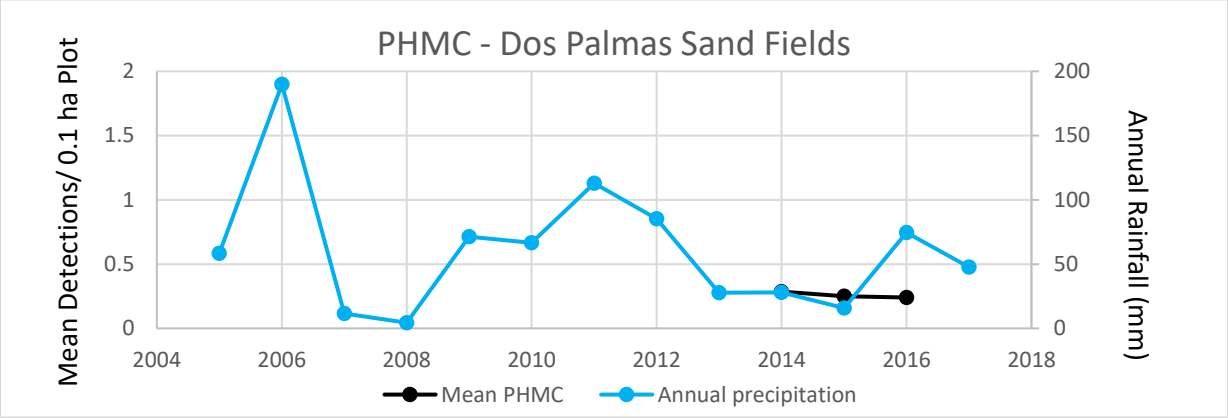

FIGURE 29. TEMPORAL DYNAMICS IN THE POPULATION OF FLAT-TAILED HORNED LIZARDS AT THE DOS PALMAS PRESERVE CORE AREA. RAINFALL VALUES ARE SHIFTED FORWARD 1 YEAR TO BETTER DEMONSTRATE THE RELATIONSHIP OF THESE VARIABLES AND 2016 IS INCLUDED TO DISPLAY WHAT PHMC VALUES MIGHT BE EXPECTED NEXT YEAR.

Palm Springs Pocket Mouse

The Palm Springs pocket mouse, *Perognathus longimembris bangsi*, (PELO), occurs throughout the Coachella Valley's aeolian sand habitats, but is not restricted to those habitats. PELO are also found in sandy soils on the benches above incised desert washes (Barrows et al. 2011). However, because of the distinctive tracks this species leaves on the fine aeolian sands they are most easily quantified in this habitat. Based on our tracking data, within the aeolian sand habitats PELO are most abundant on the ephemeral sand fields in the western portions of the valley (Figure 30). Their populations appear to fluctuate in general, though not exactly, with

annual rainfall. Overall PELO appear to have tolerated the current drought quite well, reaching their highest numbers on all sites in 2016. No apparent management actions are warranted based on these data.

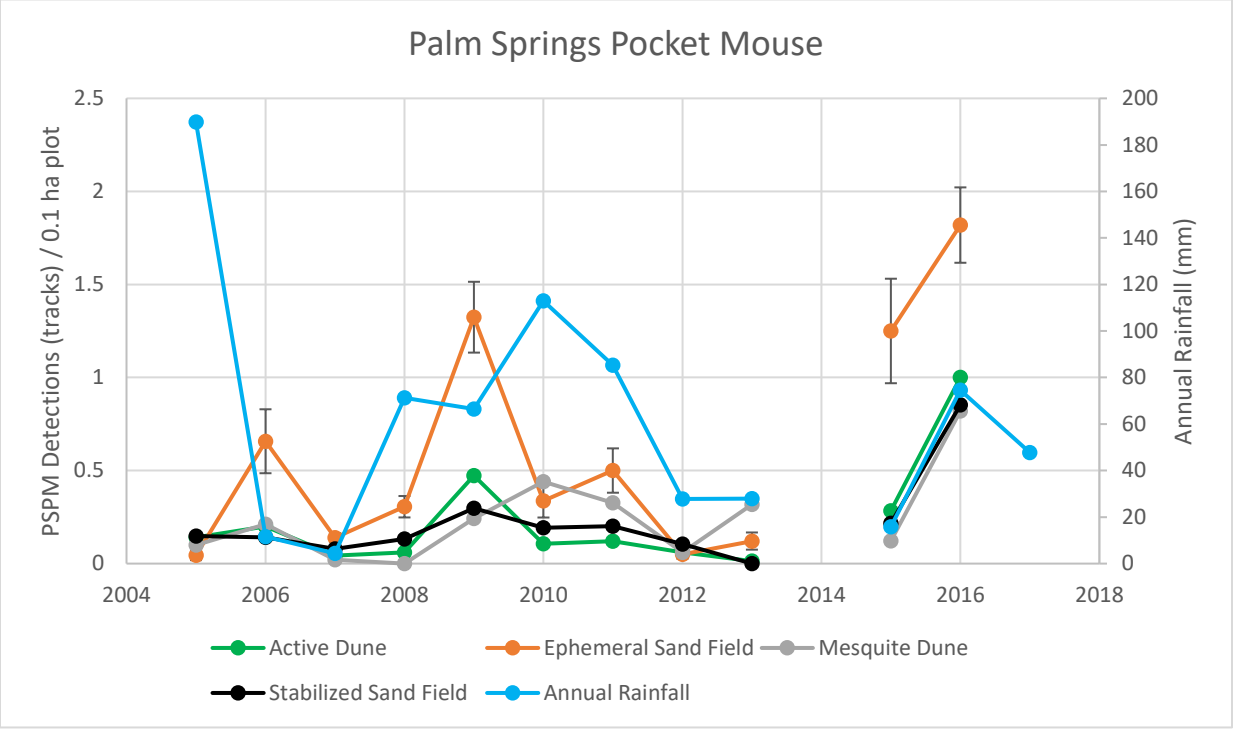

FIGURE 30. RELATIONSHIP IN TIME AND SPACE BETWEEN PALM SPRINGS POCKET MICE AND ANNUAL RAINFALL. THE AMOUNT OF RAINFALL VARIES ACROSS THE WEST TO EAST GRADIENT OF THE COACHELLA VALLEY. RAINFALL HERE IS FOR THE THOUSAND PALMS PRESERVE; RAINFALL AMOUNTS ARE PROGRESSIVELY HIGHER AT THE MORE WESTERN CORE AREAS. RAINFALL VALUES ARE SHIFTED FORWARD 1 YEAR TO BETTER DEMONSTRATE THE RELATIONSHIP OF THESE VARIABLES AND 2016 IS INCLUDED TO DISPLAY WHAT PALM SPRINGS POCKED MOUSE VALUES MIGHT BE EXPECTED NEXT YEAR. ERROR BARS INDICATE ONE STANDARD ERROR.

Coachella Valley Round-tailed Ground Squirrel

Coachella Valley round-tailed ground squirrels, *Xerospermophilus tereticaudus* (XETE) have occurred in all of the aeolian sand habitats of the Coachella Valley, but are increasingly restricted to the mesquite dunes (Figure 31). The decline outside the mesquite dunes is dramatic without easy explanation. At least in part it may be related to the long-term drought; at the Thousand Palms Preserve XETE are abundant within the irrigated borders of the preserve, but exceedingly rare within the preserve, whereas the mesquite dunes are the most mesic aeolian sand habitat in the valley. That said even in the mesquite dunes there was a severe population decline during the wet years of 2008-2011. With no evidence to support it, one hypothesis is that there was an epizootic disease outbreak within that population during those years. It is not clear what, if any management action might be taken to re-establish XETE within the other core

areas. If drought is indeed all or part of the cause for their decline elsewhere, any action would likely be futile until a wetter cycle returns. Assuming a wetter cycle does return, the XETE occurring in irrigated areas surrounding the natural habitats will likely repopulated those habitats.

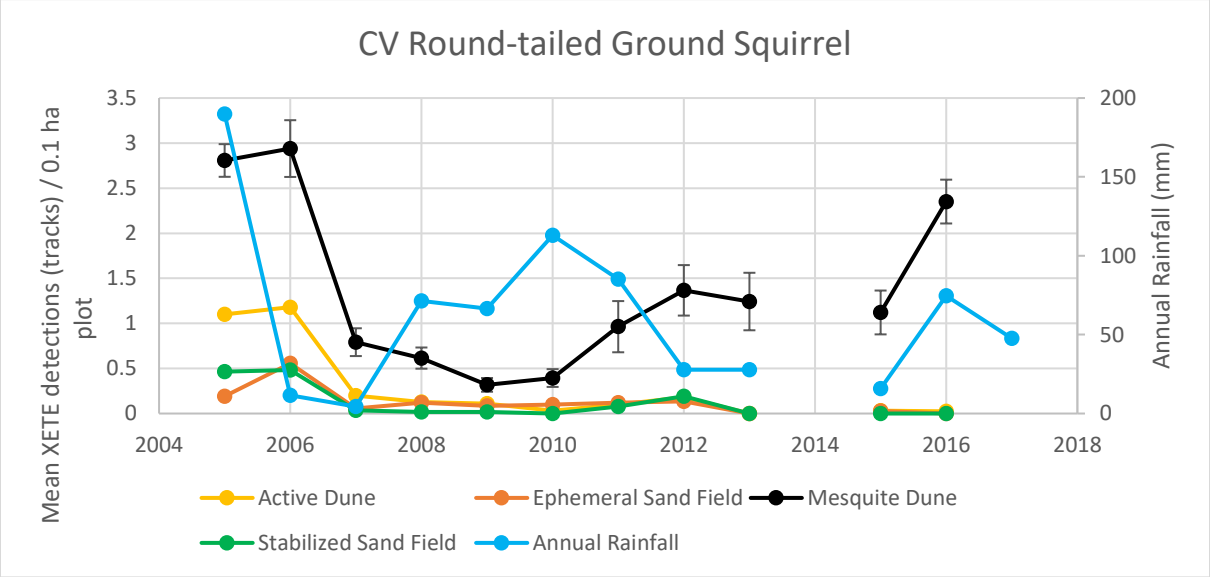

FIGURE 30. RELATIONSHIP IN TIME AND SPACE BETWEEN CV ROUND-TAILED GROUND SQUIRRELS AND ANNUAL RAINFALL. THE AMOUNT OF RAINFALL VARIES ACROSS THE WEST TO EAST GRADIENT OF THE COACHELLA VALLEY. RAINFALL HERE IS FOR THE THOUSAND PALMS PRESERVE; RAINFALL AMOUNTS ARE PROGRESSIVELY HIGHER AT THE MORE WESTERN CORE AREAS. RAINFALL VALUES ARE SHIFTED FORWARD 1 YEAR TO BETTER DEMONSTRATE THE RELATIONSHIP OF THESE VARIABLES AND 2016 IS INCLUDED TO DISPLAY WHAT CV ROUND-TAILED GROUND SQUIRREL VALUES MIGHT BE EXPECTED NEXT YEAR. ERROR BARS INDICATE ONE STANDARD ERROR.

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SAHARA MUSTARD RESEARCH AND COORDINATION

Invasive plants often represent a threat to maintaining native biodiversity and ecosystem functions; within the southwestern arid lands, including the CVMSHC, Sahara mustard, *Brassica tournefortii*, is among the weeds with the greatest potential to erode biodiversity and so is a threat to the CVMSHCP meeting its management and protection objectives. For Sahara mustard this threat has been well documented (Barrows et al. 2009; Barrows and Allen 2010; Hulton et al. 2013). Despite being aware of the need to control this weed, controlling Sahara mustard at the spatial scale necessary to have population-level impacts has proved to be logistically and economically challenging. Sahara mustard's impacts are most severe during wet years, and is much less abundant during dry years and years with later/summer rain. Some of the largest-scale efforts to control mustard in the CVMSHCP areas has been by hand pulling, by paid and volunteer staff. Challenges to this approach include the labor involved with pulling and bagging plants (per common protocol) and disposal of biomass.

This year, UC Riverside's Center for Conservation Biology, hereafter the CCB, was able to investigate a special set of questions due to the increase in rainfall this year following a 3-year drought. First, we set up an experiment to test the efficacy of a more simple hand-pulling control technique since Sahara mustard was in low-medium density this year and amenable to hand-pulling. Second, as part of our ongoing study on the abundance of Sahara mustard and its impacts in Aeolian Sand Communities, we were able to investigate what effects this drought and subsequent return to near-normal precipitation this year had on the abundance of Sahara mustard and native annual species (see Aeolian Sand Communities report).

Research and Experimentation

The CCB has been performing research on invasive plants in the Coachella Valley since 2005. In 2009, we initiated a study on the control of mustard by spraying over the perennial shrub, *Larrea tridentata*. This study, which needs to be repeated in order to provide conclusive results, has so far suggested that early-season application of glyphosate as a control measure for Sahara mustard provides effective control of mustard, while minimizing impacts on *Larrea.*

In 2015, CCB consulted with UC Cooperative Extension staff to plan a repeat of the prior year herbicide control experiment, which is contingent upon early season rainfall sufficient to grow Sahara mustard to a size where foliar application would be effective *before* dormancy break in *Larrea*. Precipitation in the winter of 2015-2016 came later than expected, and additionally, emergence of Sahara mustard was spotty as predicted after a 3-year drought, either due to a reduction of the seedbank over the drought period or due to inadequate rainfall. As a result of these conditions, an herbicide control experiment was not possible.

CCB biologists decided this year to undertake an experiment testing two different hand-pulling control protocols in partnership with Friends of the Desert Mountains (FODM). The goal of this experiment was to ascertain whether it is necessary to bag Sahara mustard in order to achieve sufficient control. In April, 2016, 5 m x 25 m plots were delineated on a parcel of land owned by

FDM in the Edom Hill Conservation Area, where Sahara Mustard established in low-moderate density this year. Three blocks of three plots each were established, located within a 1 ha area.

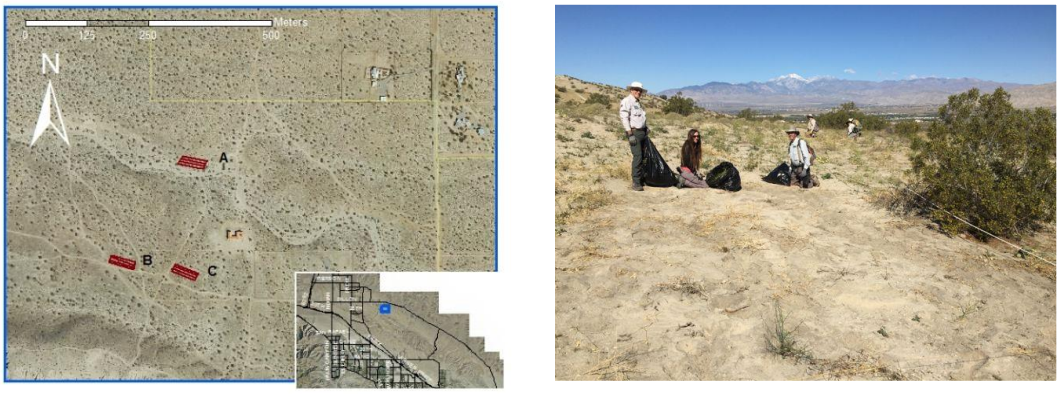

FIGURE 31: LEFT: APPROXIMATE PLOT LOCATIONS FOR THE THREE STUDY BLOCKS, EACH TESTING PULLING AND BAGGING, PULLING AND LEAVING, AND AN UNTREATED CONTROL ON THE SUPPRESSION OF SAHARA MUSTARD (AS MEASURED BY THE ABUNDANCE OF SAHARA MUSTARD IN THE FOLLOWING SEASON). EDOM HILL CONSERVATION AREA, DESERT HOT SPRINGS. RIGHT: VOLUNTEERS AFTER THEIR WORK HAND-PULLING AND BAGGING SAHARA MUSTARD AT THE PLOT IN EDOM HILL CONSERVATION AREA

Treatments within each block were randomized, and were: pull and bag (mustard plants were pulled and all were bagged); pull and leave (mustard plants were pulled and left in place); and the comparison control (no treatment). Pre-experiment data including species richness and cover was taken pre-treatment. In late March, a team of 6 people applied the treatments. Results, including the percent cover and density of Sahara mustard as well as native species richness and cover, in the bagged, non-bagged and control plots will be measured in spring of 2017, if measurable Sahara mustard emerges, and if so results will be disseminated with the annual report in 2017. If results are promising when they are assessed in the winter-spring of 2017, the experiment can be expanded or repeated. These results would provide invaluable information to organizations involved in hand-pulling Sahara mustard as a control method about if and when they might need to bag biomass, reducing labor and other costs if successful.

Monitoring

On-going monitoring included in the Aeolian Sand Communities report is aimed at determining how the 3-year drought has affected Sahara mustard populations, and whether dynamic population shifts by the mustard can result in coexistence with covered species, or whether control efforts are warranted. In 2016, CCB repeated monitoring of the abundance of Sahara mustard and native species on permanent vegetation transects in Aeolian Sand Community areas. See Aeolian Monitoring report for results.

Occurrence of invasive species was also recorded in conjunction with vegetation mapping (vegetation assessment plots) in the Dos Palmas Conservation Area, as well as during surveys

for covered species, such as Little San Bernardino Mountains Linanthus (*Linanthus maculatus)*, crissal thrasher (*Toxostoma crissalis)*, and Le Conte's thrasher (*Toxostoma lecontei)*. Data will be available in the Vegetation Mapping Report's supporting material, the Vegetation Assessment Plot database (VAP database).

ADVISORY ROLE

CCB has continued to participate in regional coordination efforts, supporting invasive species coordination and management. In 2016, staff has actively participated on the steering committee for the Low Desert Weed Management Area, and staff has also authored an article for the statewide California Invasive Plant Council (Cal-IPC) Newsletter about this effort. UCR has continued to be a resource to local and statewide weed management coordination efforts, including membership on the board of the Cal-IPC, assistance to FODM on their volunteer efforts, and consultation with a local school district about curriculum content on the topic of invasive plants.

LITTLE SAN BERNARDINO MOUNTAINS LINANTHUS MONITORING

Little San Bernardino Mountains Linanthus (*Linanthus maculatus*, hereafter *L. maculatus*; Fig. 32) is a small annual herb endemic to southern California. Within the Coachella Valley it is restricted to the mouth of Dry Morongo Canyon near Desert Hot Springs, Whitewater Canyon and from Whitewater to Palm Springs (Sanders 2006). Populations also exist on the north side of the San Bernardino Mountains at the mouth of Rattlesnake Canyon and at the northern edge of Joshua Tree National Park in the Little San Bernardino Mountains; these localities are part of the West Mojave Planning Area (Sanders 2006). *L. maculatus* is categorized as California Rare Plant Rank 1B.2 (fairly endangered in California and elsewhere, with 20-80% occurrences threatened / moderate degree and immediacy of threat; CNPS 2015). This species is elusive and little is known about its natural history. During the century following its first collection and description in 1889 only a few populations were discovered. Over the last few decades more populations have been identified and *L. maculatus* habitat has become better understood (Sanders 2006); however, because of the extreme fluctuations in abundance and distribution year to year, more information is needed in order to understand the habitat niche of this species, as well as stressors affecting those microhabitats.

It grows in loose, well aerated sand flats on low sandy benches at the margins of washes, dry canyons and alluvial fans in Sonoran and Mojave Desert scrub and Joshua tree woodland communities at elevations between 195-2075m (CNPS 2015, Sanders 2006). It does not occupy substrates with hard surface layers of clay or rock, or loose aeolian sand within and away from washes. On a fine scale, the open microsites this species occupies are absent of shrubs, trees, competing species, or dense stands of weedy annuals (Sanders 2006). To germinate, the species likely requires sheet floods that inundate the soil with moisture but do not incise wash channels or erode the sandy topsoil. Most aspects of this species' biology, including mode of pollination, dispersal, germination requirements, and seed longevity, are not known (Patterson 1989). Threats to this species include invasive species, climate change, urban development and OHV recreation.

In 2002, a master database of historic occurrence records was compiled for all five plant species covered under the Coachella Valley Multiple Species Habitat Conservation Plan (Allen et al. 2005). Data were mined querying various herbaria and museums and required considerable effort to remove duplicate points and identify points that were precise enough for geo-referencing. A research team from UC Riverside's Center for Conservation Biology then attempted to locate historic occurrence locations on public land for each species and document the existing populations through 500m^2 vegetation relevés. For *L. maculatus*, only 2 unique historic records occurred on public lands. In 2003 no *L. maculatus* were found at either site, however in 2004 individuals were observed at one of those sites (n = 1781), and the population

was found again in 2005 (n = 2800; Allen et al. 2005). In 2014, permanent transects were set up at historic locations of *L. maculatus* (see 2014 CVMSCHP annual monitoring report) and *L. maculatus* was detected at 3 of them, as well as being documented at several adjacent locations adjacent to transects 7, 11 and 12 (Fig. 33).

FIGURE 32: L. MACULATUS PLANTS IN 2016 WERE SMALL AND ABUNDANT WHERE LOCATED. AT LEFT, A TYPICALLY-SIZED INDIVIDUAL WHEN *L. MACULATUS WAS* FIRST DETECTED THIS YEAR, MARCH 1, 2016, WHEN MANY PLANTS HAD ONLY 1-2 FLOWERS PER PLANT (L. SWEET¸ *PERS OBS.).* MIDDLE PHOTO SHOWS THE CONDITION OF PLANTS AT A SITE 300M FROM THE FIRST PHOTO ON APRIL 13, 2016: MULTI-FLOWERED INDIVIDUALS WERE SEEN, MANY MULTI-STEMMED AND LANKY. AT RIGHT, ALSO ON APRIL 13, 2016 SURVEYORS DETECTED MOST PLANTS AT THE SITE IN SOME STAGE OF SENESCENCE. THE SCALE RULERS SHOWN ARE METRIC (SMALL TICKS ARE MM).

Objectives

L. maculatus presents a conservation challenge since it does not geminate every year, and when it does populations appear to shift in occurrence and abundance across a broad alluvial landscape. Predicting where and when *L. maculatus* germinates, and what stressors exist that may limit its occurrence is only the beginning set of questions that need to be addressed. Once they are answered finer scale questions including pollinators, seeding, seed longevity would allow a clearer understanding of the trajectory and sustainability of this species' populations. In 2016 surveys for *L. maculatus* were carried out as part of the Coachella Valley Multiple Species Habitat Conservation Monitoring Plan by the UC Riverside's Center for Conservation Biology. Surveys were conducted following the guidelines and objectives outlined by the CVMSHCP and carried out using the Alluvial Fan Monitoring Protocol and approved by the CVMSHCP's Biological Working Group. In addition to surveying permanent transects, we searched elsewhere in order to map additional populations. Furthermore, in order to better understand microhabitat preferences, species associations, and possible competition with invasive species,

an additional protocol that allowed for the measure of incidental populations when *L. maculatus* were absent from the permanent plots was employed. The primary objectives for this monitoring effort were to assess the current abundance and distribution for populations of this species, document habitat attributes and identify potential stressors that may affect its persistence, in particular its tolerance to the presence of the invasive, non-native grass, *Schismus barbatus*, but including other invasive species, OHV operations and trampling by foot traffic.

Methods

DATA COLLECTION

L. maculatus plants were surveyed within twelve 10x100 m plots that were selected based upon previous occurrence records along the Mission Creek and Dry Morongo drainages and within (Fig. 2). Surveyors walked the length of each plot twice each monitoring year from March–April (at least two weeks apart) and recorded the maximum length (along longest axis), and width (perpendicular to the length) of each stand of *L. maculatus* occurring within the plot.

Due to lack of detection on the permanent transects, six temporary transects were surveyed in areas where *L. maculatus* was found growing near the existing transects. This allowed surveyors to document information about where the species *is* occurring this year, instead of solely information about where it is absent, since so little is known about the natural history, microhabitat requirements, associated species and tolerance to invasive species of *L. maculatus*. The new temporary transects were divided into high- or low-density categories based on density of *L. maculatus* detected based on preliminary visual scans (Fig. 3). Eight paired high- and low-density areas were surveyed. The low-density areas were either areas of recent observations of *L. maculatus* (permanent transects), or microsites adjacent to newly-discovered high-density areas. Transects were run through patches of *L. maculatus* of varying density (high- vs. low-density), but of similar habitat (e.g., slope, aspect, associated species, soil characteristics, hydrology characteristics). Surveyors then used 1 m^2 plot frames and record number of *L. maculatus*, *S. barbatus* cover, native annual cover, associated species, slope and aspect were recorded. Special attention was paid to the presence and density of *S. barbatus* in an effort to detect the relationship between percent cover of *S. barbatus* and the density of *L. maculatus*.

Results

PERMANENT TRANSECTS

Surveys revealed only two *L. maculatus* occurrences (sites 7 and 12) within the 12 established survey transects. The transects were each visited twice throughout the survey season, with the exceptions of sites 1-5 which were only visited once as a late summer-early fall rain event in 2014 caused mud flows in the mouth of Dry Morongo Canyon resulted in a hard silt layer in the wash and on the wash benches apparently covering suitable microhabitats and preventing successful germination. Where the silt flow occurred, little to no annual vegetation was present at all (J. Heintz & L. Sweet, *pers. obs*).

It should be noted that at site 12 the *L. maculatus* plants were found outside of the sub-sampling plot frame, but within the transect proper (Table 1). In mid-March during a re-survey, several incidental *L. maculatus* patches were found, including many near pre-existing transects (Table 1).

EXTENT MAPPING

Many new populations of *L. maculatus* were documented during this effort. *L. maculatus* occurred most abundantly near site 12 at the confluence of the Big Morongo Wash and Mission Creek and continued downstream to the southeast; the furthest extent of the population was never reached due to survey time constraints (Fig. 2). Density of incidental patches seemed to decline to the northwest of site 12 which is counter to what surveys from 2014-2015 reported with very few incidences occurring near site 7. Outside of the previously designated sites and the 2016 temporary transects there were 67 new occurrences (Table 1). The population seemed to be mainly to the southeast of the survey area just downstream of where the Big Morongo wash and Mission Creek come closest together (near site 12), as opposed to last year where the highest density reported was further northwest closer to the mouth of Dry Morongo Canyon. Many of the *L. maculatus* occurrences, especially to the southeast, occurred in areas with light to moderate human foot traffic and OHV use.

HIGH-DENSITY AND LOW-DENSITY COMPARISON ON TEMPORARY TRANSECTS

L. maculatus commonly co-occurred with several native annual species including *Cryptantha micrantha, Filago depressa* and *Nemacladus rubescens*; however, appeared to be absent from high densities of weedy annuals particularly *S. barbatus*, which occurred in higher density adjacent to the *L. maculatus* patches but in very low density, if present, within patches (Table 1). Statistical ANOVA comparison of high- to low-density *S. barbatus* plots with number of *L. maculatus* co-occurring within the plot found there to be highly significant differences in the occurrence of *L. maculatus*. Plots centered on transects with a low-density of *S. barbatus* contained a higher

average of nearly 10 *L. maculatus* per plot ($p = 0.0039$) versus plots with a high-density of *S. barbatus*, which contained an average of less than 1 ($p < 0.0001$, Table 1).

During the 2016 surveys, 246 individual *L. maculatus* were recorded within temporary transects while incidental occurrences discovered during the population extent mapping outside of these temporary transects likely surpassed this number by an order of magnitude (Table 2; J. Heintz & L. Sweet, *pers. obs*). In all cases, *L. maculatus* occurred in open, course-sandy microhabitats, beyond the shade of large shrubs (Fig. 34).

Discussion

Overall, the results of these studies underscored some of the difficulties involved in rare plant study, including the difficulty of detection at a useful scale for surveys, the lack of a predictable window available for detection, and the large variability in time and space for *L. maculatus* populations. However, our surveys allowed us to contribute to the Consortium of California Herbaria, an update/extension to the intra-regional extent of *L. maculatus*, and additional documentation of associated species and microhabitat characteristics, indicating directions for further study.

Areas that support *L. maculatus* populations are also areas showing a pattern of increased nitrogen deposition. In arid climates, the limiting factors for plant growth are often water and nitrogen, with nitrogen having a greater positive effect on invasive grasses than on native forbs (Hooper and Johnson 1999, Rao and Allen 2010). Near the study area containing *L. maculatus* populations, at the San Gorgonio Pass, models estimate that 9 – 11 kg ha^{-1} yr^{-1} of NO_X is being delivered from the Los Angeles Basin (Fenn et al. 2010). Nitrogen deposition has been shown to be correlated with high *S. barbatus* growth, and where this and other invasive grass species are present, lower native species richness than similar areas not exposed to higher nitrogen (Rao and Allen, 2010). Thus nitrogen deposition may threaten *L. maculatus* because it is correlated with high *S. barbatus* growth, an invasive species that may be impacting *L. maculatus,* as suggested here (Rao and Allen, 2010).

Many of the *L. maculatus* occurrences, especially to the southeast, occurred in areas with light to moderate human foot traffic and OHV use. It is unknown how long these trails have been in use, but many *L. maculatus* were growing inside tire tracks or on berms caused by OHV's. The openness, lack of large shrubs and absence of channeling that is characteristic of *L. maculatus* habitat makes it particularly susceptible to human traffic, as these are the same conditions that make off trail travel the easiest for both hikers and OHV operators.

In regard to this species' inter-annual variability, *L. maculatus* populations have been recorded as undergoing "booms and busts"; while some populations have been estimated to range into

the 1000s of plants, several years or decades may pass before another population is recorded (Sanders 2006). For example, in Dry Morongo Canyon a few hundred plants were recorded in 1992 and 1995, but only six were found in 1996. Also in 1996 at the nearby mouth of Big Morongo Canyon north of Indian Avenue 10,000 individuals were recorded (Sanders 2006); however, no individuals were found there during the four years of monitoring for this species. This is again highlighted by the discrepancies between the 2015 and 2016 monitoring years with only two occurrences of *L. maculatus* occurring in pre-existing transects and the majority of incidental sightings happening further southeast than were recorded previously. Because of this lack of predictability, combining temporary transects with permanent transects will allow surveyors to collect data on current growing conditions as well as rates of recurrence and will be able to provide a higher quantity and quality of data for future surveys of this rare plant.

Since so little is known about the natural history, microhabitat requirements, associated species and tolerance to invasive species of *L. maculatus*, we anticipate that the data collected in this additional study and future surveys, should they be able to be repeated, will elicit more complex relationships to the habitat will be discovered in the course of additional analysis.

We recommend that surveys continue on a yearly basis to establish the precipitation threshold required for this species to germinate successfully, its tolerance to invasive species and to better understand its current range within the Coachella Valley. Sites with known occurrence locations should continue to be revisited with each future survey effort and the environmental variables documented and reanalyzed for change. Along with tracking recent occurrences, it is also important study how the range is changing over time by focusing searches on the margins of *L. maculatus* known habitat. By revisiting historic sites and suitable microhabitats along the periphery of the historic records and the modeled habitat it will allow researchers to detect if the range is expanding, contracting or even shifting due to various pressures (e.g., development, invasive species, nitrogen deposition, climate change). UCR researchers are working in consultation with rare plant biologists in adjacent jurisdictions (e.g. Joshua Tree National Park) in order to share data about *L. maculatus* occurrence and biology as well as to standardize rare plant monitoring protocols with the aim of providing useful information for effective management. This information will enable surveys to be timed more effectively, cited appropriately and allow for continued evaluation of OHV recreational activity and invasive species impacts to this species.

TABLE 3: ANOVA RESULTS COMPARING THE NUMBER OF LINANTHUS MACULATUS AT VARYING SCHISMUS BARBATUS

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
LIMA_LowDensity	21	208	9.904	159.790
SCBA_LowDensity	21	29	1.381	2.3476

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	762.881	1	762.881	9.410	0.004	4.085
Within Groups	3242.762	40	81.069			
Total	4005.642857	41				

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
LIMA_HighDensity	60	38	0.633	5.117
SCBA_HighDensity	60	245	4.083	11.032

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	357.075	1	357.075	44.220	<0.001	3.921
Within Groups	952.837	118	8.075			
Total	1309.912	119				

TABLE 4: OCCURRENCE RECORDS FOR L. MACULATUS COUNTED DURING THE 2016 SURVEY SEASON.

Record	Site	Date	UTM_X	UTM_Y	Site comments
LIMA_13	Incidental	3/3/2016	542268	3759519	
LIMA_14	Incidental	3/3/2016	542274	3759517	
LIMA_15	Incidental	3/3/2016	542280	3759515	
LIMA_16	Incidental	3/3/2016	542284	3759513	
LIMA_17	Incidental	3/3/2016	542286	3957512	
LIMA_18	Incidental	3/3/2016	542288	3759512	
LIMA_19	Incidental	3/3/2016	542299	3759506	
LIMA_20	Incidental	3/3/2016	542302	3759507	
LIMA_21	Site 12	3/3/2016	542305	3759507	Site 12, but outside of plot frame.
LIMA_22	Incidental	3/3/2016	542307	3759505	
LIMA_23	Incidental	3/3/2016	542313	3759504	
LIMA_24	Incidental	3/3/2016	541695	3760189	
LIMA_25	Incidental	3/4/2016	540159	3760948	
LIMA_26	Incidental	3/4/2016	541379	3760612	
LIMA_27	Incidental	3/16/2016	542286	3759403	North end of ribbon
LIMA_28	Incidental	3/16/2016	542345	3759378	
LIMA_29	Incidental	3/16/2016	542382	3759369	Odd microhabitat
LIMA_30	Incidental	3/16/2016	542409	3759359	In OHV tracks
LIMA_31	Incidental	3/16/2016	542413	3759333	Odd microhabitat
LIMA_32	Incidental	3/16/2016	542422	3759331	South end of ribbon
LIMA_33	Incidental	3/16/2016	542491	3759201	
LIMA_34	Incidental	3/16/2016	542508	3759182	
LIMA_35	Incidental	3/16/2016	542525	3759157	
LIMA_36	Incidental	3/16/2016	542527	3759147	With low density SCBA
LIMA_37	Incidental	3/16/2016	542545	3759121	
LIMA_38	Incidental	3/16/2016	542556	3759097	Two braided washes
LIMA_39	Incidental	3/16/2016	542573	3759067	Narrow wash; density starting to thin
LIMA_40	Incidental	3/16/2016	542624	3759010	Narrow wash; small group of LIMA; density thinning out
LIMA_41	Incidental	3/16/2016	542639	9758991	Narrow wash; density thinning out
LIMA_42	Incidental	3/16/2016	542712	3758928	Density thinning out
LIMA_43	Incidental	3/16/2016	542725	3758930	Wash opens back up and becomes wider
LIMA_44	Incidental	3/16/2016	542779	3758860	Wash opens back up and becomes wider
LIMA_45	Incidental	3/16/2016	542766	3758840	
LIMA_46	Incidental	3/16/2016	542891	3758800	
LIMA_47	Incidental	3/16/2016	543101	3758597	
LIMA_48	Incidental	3/16/2016	543096	3758579	
LIMA_49	Incidental	3/16/2016	543278	3758681	Small patch in heavily used OHV/Moto-X area

LIMA_50	Incidental	3/16/2016	543288	3758839	Big Morongo Wash
LIMA_51	Incidental	3/16/2016	542412	3759427	
LIMA_52	Incidental	3/16/2016	542366	3759453	
LIMA_53	Incidental	3/16/2016	542364	3759458	
LIMA_54	Incidental	3/16/2016	542418	3759339	
LIMA_55	Incidental	3/16/2016	542412	3759441	
LIMA_56	Incidental	3/16/2016	542659	3758965	
LIMA_57	Incidental	3/16/2016	542881	3758806	
LIMA_58	Incidental	3/16/2016	542490	3759204	
LIMA_59	Incidental	3/16/2016	542704	3758927	
LIMA_60	Incidental	3/16/2016	542737	3758897	
LIMA_61	Incidental	3/16/2016	542682	3758941	
LIMA_62	Incidental	3/16/2016	542624	3759013	
LIMA_63	Incidental	3/16/2016	543278	3758840	
LIMA_64	Incidental	3/16/2016	542429	3759404	
LIMA_65	Incidental	3/16/2016	543274	3758682	
LIMA_66	Incidental	3/16/2016	542572	3759069	
LIMA_67	Incidental	3/16/2016	542552	3759098	
LIMA_68	Incidental	3/16/2016	543094	3758582	
LIMA_69	Incidental	3/16/2016	543094	3758598	
LIMA_70	Incidental	3/16/2016	542549	3759115	
LIMA_71	Incidental	3/16/2016	543068	3758632	
LIMA_72	Incidental	3/16/2016	542419	3759334	
LIMA_73	Incidental	3/16/2016	542774	3758864	
LIMA_74	Incidental	3/16/2016	542520	3759158	
LIMA_75	Incidental	3/17/2016	539461	3761929	Approx location, Worsley Rd. area
LIMA_76	Incidental	3/17/2016	539442	3761944	Approx location, Worsley Rd. area
LIMA_77	Incidental	3/17/2016	539454	3761939	Approx location, Worsley Rd. area
LIMA_78	Incidental	3/17/2016	541991	3759948	specimen
LIMA_79	Incidental	3/17/2016	541985	3759957	specimen

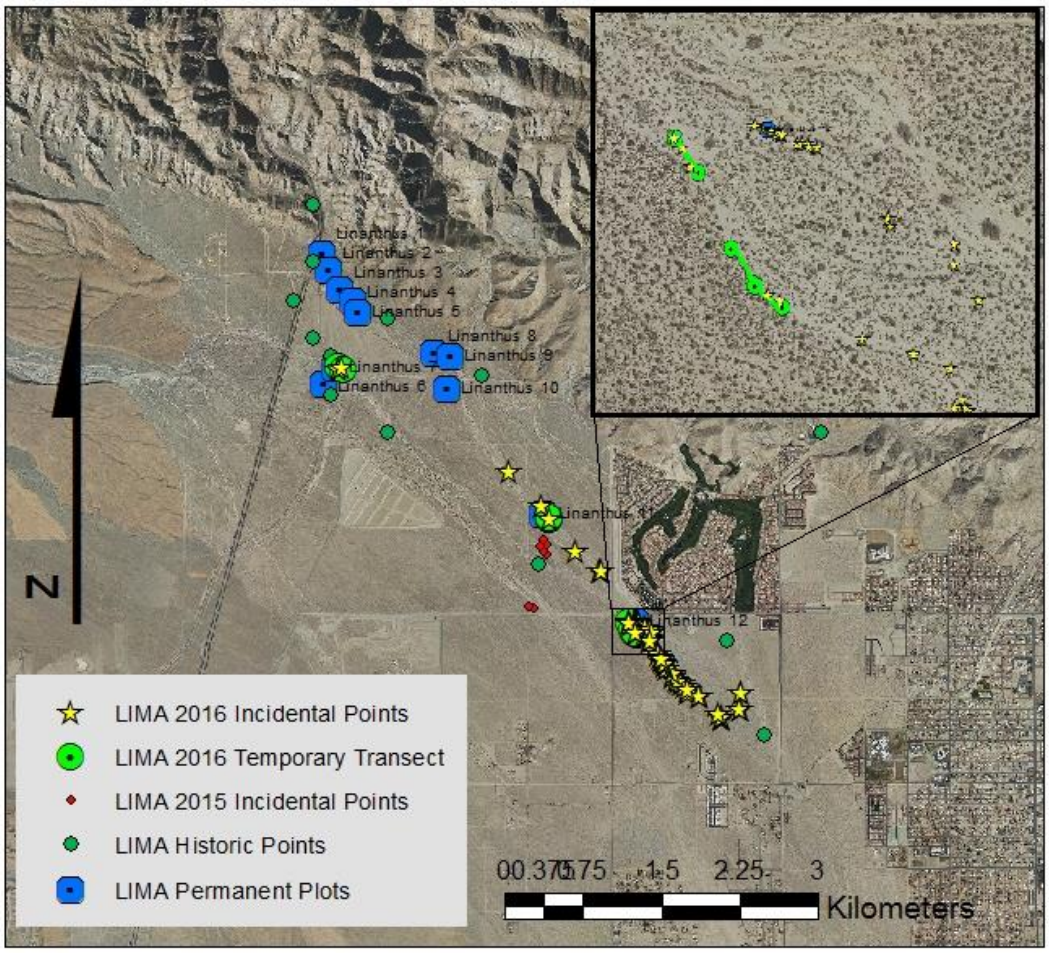

FIGURE 33: TRANSECT LOCATIONS FOR 2013-2016 SURVEY EFFORTS ARE LIGHT BLUE CIRCLES. INCIDENTAL OCCURRENCES FOR 2015 & 2016 ARE YELLOW CIRCLES & STARS, RESPECTIVELY.

FIGURE 34: HIGH-DENSITY TEMPORARY TRANSECT THROUGH L. MACULATUS PATCH HIGHLIGHTED WITH BLACK LINE. LOW-DENSITY TEMPORARY TRANSECT THROUGH L. MACULATUS PATCH HIGHLIGHTED WITH YELLOW ARROW (LEFT) AND YELLOW LINE (RIGHT). ORANGE PIN-FLAGS MARK INDIVIDUAL L. MACULATUS. REFERRED TO IN INSET OF FIGURE 2.

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LECONTE'S THRASHER MONITORING

The Le Conte's Thrasher (*Toxostoma lecontei*), hereafter LCTH, is listed as a California Bird Species of Special Concern (Shuford and Gardali 2008). Its home range extends from Arizona, Utah, Nevada, Northern Mexico and to California which contains the majority of this species' range. It prefers sparsely vegetated desert flats, alluvial fans and washes with saltbush (*Atriplex spp.),* cholla (*Cylindropuntia spp.,* see Title Page), creosote (*Larrea tridentate*) and joint fir (*Ephedra spp.*) (Sheppard 1970, 1973). It also does not migrate or travel outside of its home range making it particularly vulnerable to changes in its environment such as loss of habitat due to urbanization (Laudenslayer et al. 1992), which is why this bird is a covered species under the Coachella Valley Multiple Species Habitat Conservation Plan (CVMHSCP). The goal of this monitoring was to access the status of the population of breeding individuals by comparing it to the baseline monitoring conducted in 2013.

This species can be difficult to locate due to their shy and elusive nature. Foraging and travel occur on the ground around the bases of shrubs, under vegetation where their feather coloration easily conceals them (Sheppard 1996). Another difficulty with locating LCTH is they do not vocalize year round, instead calling mostly in mid-winter to defend their territory for nesting (Allen et al. 2005, Fletcher 2009, Jongsomjit et al. 2012). Also, nests are concealed at approximately 1 m above the ground preferably in the dense branches of trees or cholla cactus. On the other hand the repeated use of the same area by breeding pairs year to year aids in survey detection and long-term monitoring (Sheppard 1996).

Various studies conducted throughout LCTH's range have found the best survey method varies greatly depending upon the area (Allen et al. 2015, Fletcher 2009, Jongsomjit et al. 2012). Therefore, research was conducted by Darrel Hutchinson in 2004 – 2005 to develop a protocol specific to LCTH within the Coachella Valley. His research reported that call-broadcast surveys were more effective than passive detection alone and the call-broadcasts yielded the best responses in December and January during nest building/pair bonding, as well as May and June during post-breeding, as opposed to during February to April (nestling and brooding), when response to call-broadcasts was sporadic. The success rate of passive walking detection surveys were consistently lower than that of call-broadcast surveys; however, the passive detections method was more effective than call-broadcast from April – June. The is likely due to LCTH adults actively foraging and raising young within their home range and not concerned by the call of a competing reproductive male (Allen et al. 2005).

In the last surveys for LCTH in the Coachella Valley in 2013-2014 LCTH response to call did vary in the months of February and March: only one of the three birds that were sighted were reported to have called back. All three of these sightings correlated with Hutchinson's findings that LCTH do not consistently call back during these months.

Objectives

Monitoring of LCTH for CVMSHCP was conducted from 2015-2016 assess the population of breeding individuals. The data collected were to then be compared against baseline population data collected in surveys from 2013-2014. The winter of 2016 was chosen as it was forecast to be an El Niño year with expected above average rainfall and it was hypothesized that the LCTH population would engage in breeding due to increased resources from the above average precipitation. Another goal of surveyors was to analyze and refine current survey techniques to maximize sightings during future monitoring efforts.

Methods

SITE SELECTION

The same survey protocol approved by the Biological Working Group (BWG) for the 2013-2014 LCTH monitoring was used for the 2015-2016 surveys. During the 2013-2014 monitoring effort 16 sites were chosen based on historic sightings and site access for researchers, as well as, hypothesized suitable habitat characteristics (vegetation characteristics/species composition). In 2016, 6 out of 16 sites were monitored because vegetation surveys performed at the 2013-2014 sites indicated that the probability of the habitat being suitable for breeding pairs of LCTH was lower at the remaining 10 sites. The sites chosen were LCTH02, LCTH06, LCTH07, LCTH12, LCTH15 and LCTH17 (Fig. 36), of which LCTH02 was the only site that LCTH was detected in 2014.

DATA COLLECTION

Transects and call-broadcast surveys were utilized for the 6 sites. There were 3 pre-determined points for call-broadcasts to be performed on each transect and 2 transects per site. The transects were 1000 meters long and 1000 m apart, with call-broadcast points on the ends and the middle each 500 meters apart (Fig. 35). At each point, after an initial detection period of 2 minutes, the call-back recording was played for 2 minutes, then surveyors listened for 2 minutes. This was repeated 2 times, during which all species of birds detected were recorded. If a confirmed LCTH either called back or was observed at a point, the surveyors were to record behavior, time and location then immediately continue onto the next point. The same speaker that was utilized in 2013-2014 (X-mini, MINI II capsule speaker) was used for the 2015-2016 surveys. The same LCTH call recorded by Hutchinson at Desert Hot Springs, CA in 2004 was also used. Each site was visited three times, except site LCTH02 which was visited four times. Sites were visited three times during the sampling period to maximize detection probability (Conway and Simon 2003).

Survey days and times were subject to weather condition criteria. Surveys were only performed when both sustained winds and gusts were at or below 33 kilometers per hour (20 miles per hour) and precipitation could not be greater than a light sprinkle. If either of these criteria were

exceeded, the surveys were not performed or be abandoned if in progress. These thresholds were chosen to ensure that the surveyors could hear and see any present birds as well as to allow the LCTH call-broadcast to be carried in all directions.

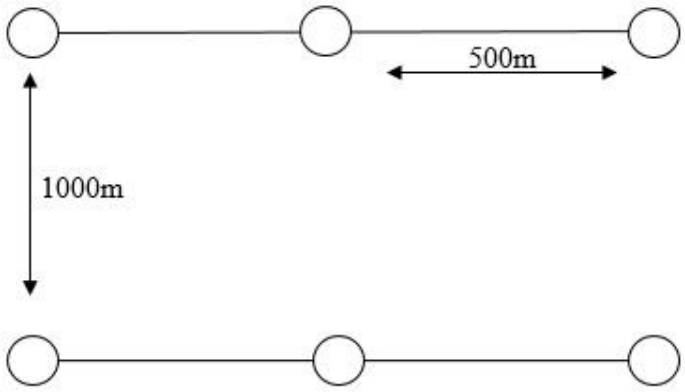

FIGURE 35. PLOT CONFIGURATION, CONSISTING OF TWO TRANSECTS AND SIX CALL-BROADCAST POINTS, FOR EACH LCTH SURVEY SITE.

Results

Weather conditions restricted surveyors on some dates, but no transects needed to be abandoned while in progress. 25 species of birds were recorded during the surveys. However, no confirmed LCTH were found at any of the six sites during the 2016 survey effort. LCTH02, the site which LCTH was sighted in 2014, was revisited a fourth time in late February, using a non-standard combination active/passive detection effort. During this visit two Sage Thrashers (*Oreoscoptes montanus*) and a possible but unconfirmed detection of LCTH were observed. The possible LCTH sighting could not be confirmed as surveyors were only able to approach and take pictures of a family of three Thrashers from 150 meters away. It is considered likely to be LCTH as there was ideal, sparse vegetation and the call sounded different from the California Thrasher's calls (*Toxostoma redivivum*), hereafter CATH, heard that day. Tentative identification was based on bill curvature and feather coloration of the bird in the picture taken (Fig. 4), but due to an inability to get a clear picture, it was not possible to fully confirm.

Discussion

The survey sites were all in suitable habitat (where documented habitat preferences matched existing site vegetation) and historic sites where LCTH have been previously been observed. All sites were surveyed at least three times between January and February with CATH observed singing and responding to our call-broadcasts in late January at site LCTH02 which would indicate that the call-back recording was of sufficient volume and broadcasted sufficiently for LCTH to call back, if present. Thus, using consistent survey techniques no detections, a decline in the local breeding population may have occurred.

The lack of LCTH found at historic Coachella Valley sites in 2014 and in 2016 may be explained by 1) persistent drought reducing food resources; 2) habitat disturbance and shooting at LCTH02; and/or 3) at LCTH02 agonistic responses or inhibition from the CATH population there. Surveys for Le Conte's thrashers in Joshua Tree National Park in 2016 revealed thrashers present only at sites with California Juniper, *Juniperus californica*, present (Jeff Rangitsch, pers. comm.). California Junipers are found at substantially higher elevations than any of the Coachella Valley sites, and may indicate a shift to higher elevations by this species in the National Park, locations with cooler temperatures, more rainfall, and likely higher food resources than occur at lower elevations such as those in the Coachella Valley.

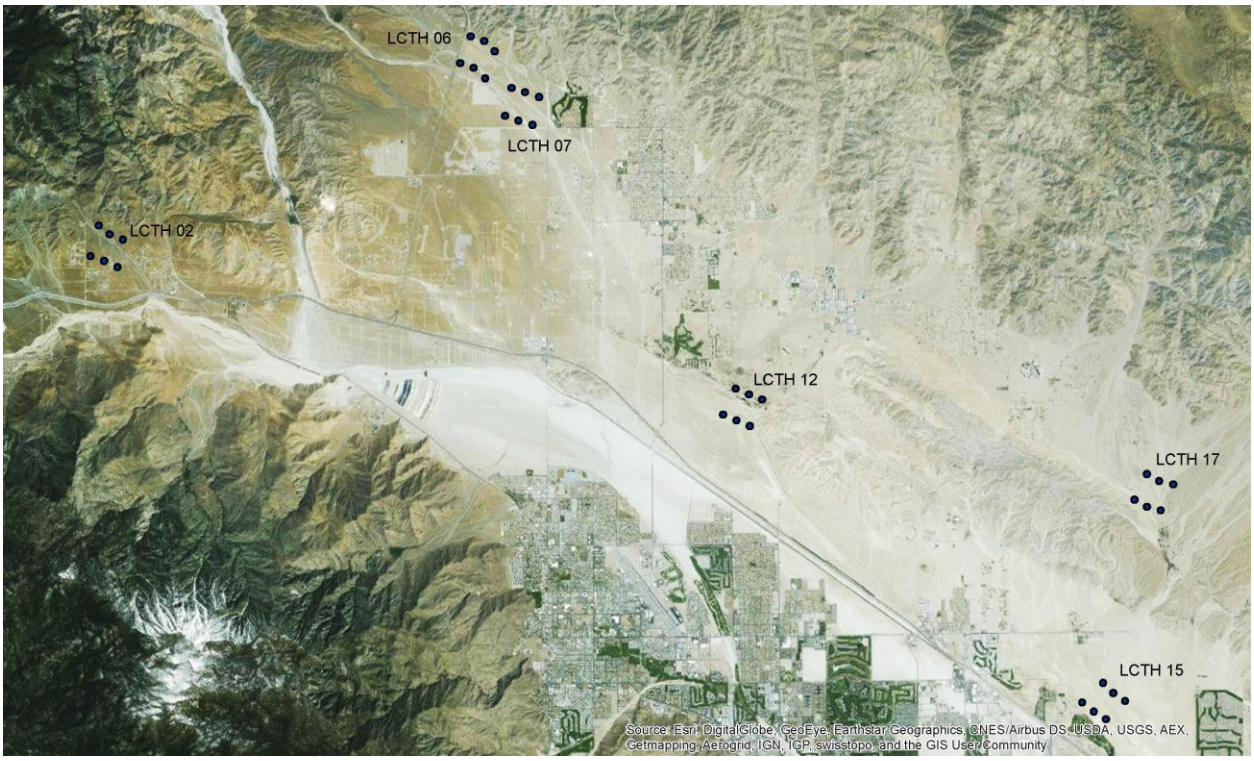

FIGURE 36. DISTRIBUTION OF LCTH SITES IN THE WESTERN COACHELLA VALLEY. BLUE DOTS INDICATE CALL-BROADCAST POINTS VISITED DURING 2015-2016 SURVEYS.

FIGURE 37. PROBABLE LE CONTE'S THRASHER (*TOXOSTOMA LECONTEI*) ENCOUNTERED AT LCTH02'S FOURTH VISIT

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TABLE 5. INCIDENTAL BIRD SIGHTINGS DOCUMENTED AT EACH VISIT TO THE CALL-BROADCAST POINTS DURING THE LE CONTE'S THRASHER FOCUSED SURVEYS

	LCTH02			LCTH06			LCTH07			LCTH12			LCTH15			LCTH17		
Bird Species	First Visit	Second Visit	Third Visit	First Visit	Second Visit	Third Visit	First Visit	Second Visit	Third Visit	First Visit	Second Visit	Third Visit	First Visit	Second Visit	Third Visit	First Visit	Second Visit	Third Visit
Anna's Hummingbird	0	0	0	2	0	1	2	4	1	0	0	0	0	0	0	0	0	0
Blue-gray Gnatcatcher	0	0	1	0	0	0	0	0	1	0	0	1	1	0	4	0	0	0
Black-throated Sparrow	0	1	1	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0
Brewer's Sparrow	14	4	1	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0
Cactus Wren	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
California Thrasher	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Common Raven	7	1	3	1	0	0	1	0	7	4	0	1	5	6	2	0	4	2
Costa's Hummingbird	0	0	0	6	3	5	1	4	4	0	0	0	0	0	0	0	0	1
Great Egret	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
House Finch	0	0	0	12	1	1	0	0	0	6	4	0	12	2	7	0	0	0
LeContes Thrasher	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lesser Gold finch	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0
Loggerhead Shrike	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0
Mountain Chickadee	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Mourning Dove	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Northern Flicker	0	2	0	0	0	0	0	0	0	3	0	1	0	0	0	0	0	0
Phainopepla	0	0	0	3	0	0	0	0	0	7	4	3	0	0	0	0	0	0
Red-tailed Hawk	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
Rock Wren	0	0	0	1	7	2	0	1	3	1	0	1	0	0	0	2	0	7
Sage Sparrow	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1
Say's Phoebe	0	0	0	1	0	0	2	0	2	0	0	0	3	1	2	2	0	0
Unknown Bird	0	2	0	4	1	4	5	0	0	0	1	2	1	0	1	1	0	2
Unknown Hawk	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0
Unknown Hummingbird	0	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0
Unknown Sparrow	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Unknown Thrasher	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unknown Gnatcatcher	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Verdin	0	0	0	0	1	1	0	0	0	0	0	4	0	2	1	1	2	1
Western Blue Bird	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0
Western Meadowlark	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0
White-crowned Sparrow	0	16	2	7	10	15	1	25	3	2	0	0	0	0	0	0	0	0
White-Throated Swift	0	0	0	0	0	0	0	0	0	0	1	1	14	0	3	0	0	0

CRISSAL THRASHER MONITORING

Crissal Thrashers (*Toxostoma crissale, T. crissale*), hereafter CRTH, are widely distributed across arid regions of southwestern United States, south-central Mexico, and northeast Baja California. Preferred habitat consists of patches of dense vegetation such as riparian scrub thickets and dry wash woodlands (Shuford and Gardali 2008). Within California they are most abundant along the Colorado River and have been historically associated with mesquite (*Prosopis* species) stands although they can commonly be found in dry wash woodlands dominated by ironwood, palo verde, saltbush and saltcedar (Rosenberg et al. 1991, Laudenslayer 1992, Fletcher 2009, Cody 1999). CRTH are currently considered a Priority 3 Bird Species of Special Concern (Shuford and Gardali 2008) due to habitat loss and degradation and invasion of alien species.

CRTH are regarded as cryptic due to their foraging behavior on the ground beneath dense shrubs and trees (Laudenslayer 1992, Fletcher 2009). They primarily consume beetles and will also subsidize their diet with caterpillars, maggots, grasshoppers, and ants throughout the year (Rosenberg et al. 1991). Water is often present at sites where they are found, although its presence is not thought to be a critical habitat component (Dobkin and Granholm 1990, Shuford and Gardali 2008). This species is a year-round resident in California and has been found to breed from February to late July (Cody 1999).

CRTH monitoring in 2014 by the UC Riverside Center for Conservation Biology (CCB) established an initial baseline as required by the CVMSHCP. In addition to monitoring CRTH surveyors also surveyed vegetation (releves) at broadcast-call sites to identify potential habitat attributes. These data were to help determine habitat suitability for this species in order to facilitate the development of hypotheses and models designed in aiding sustainable conservation. During the 2014 monitoring efforts a total of ten CRTH were detected between two Conservation Areas: Dos Palmas and the CV Stormwater Channel Delta. Six CRTH were detected at the Dos Palmas Conservation Area, one of which was detected during focused surveys for Le Conte's Thrashers. Four detections occurred in the CV Stormwater Channel Delta Conservation Area.

Objectives

These surveys were carried out to evaluate the status of CRTH populations by comparing it to the baseline occurrence records collected in 2014. This year, 2016, was chosen because it was predicted to be an El Niño with higher than average rainfall (it turned out to be less than half average rainfall). It was hypothesized that with more rain the CRTH population would increase or remain the same. Surveys for CRTH were conducted following the protocols revised Coachella Valley Conservation Commission's Biological Working Group (BWG).

Methods

SITE SELECTION

In 2014 call-broadcast surveys were conducted at 60 sites set 250m apart in the two Conservation Areas deemed as Core Habitat for CRTH. This year of these 60 sites, 20 were chosen for three visits based upon the occurrence of suitable habitat and that CRTH were observed at or near the site in 2014. Nineteen sites were visited once due to unsuitable habitat, but with previous nearby historic CRTH reports (but not detected during the 2014 surveys sightings). An additional 19 sites were not visited at all due to unsuitable habitat, no recent or historic sightings, and recent fires that had reduced vegetation cover. Exceptions included survey point 59 (CRTH59) which was visited twice and CRTH46 which was visited four times (Appendix 1). Surveyed sites were in the core Dos Palmas Conservation Area (Fig. 38) and the Coachella Valley Stormwater Channel and Delta Conservation Area (Fig. 39). The 2016 survey effort focused on these two main areas, with 9 survey sites in Dos Palmas and 11 sites in the Stormwater Channel and Delta Conservation Area. These two areas represent very different habitat types. Dos Palmas Conservation Area is dominated by California fan palms (*Washingtonia filifera)* and honey mesquite (*Prosopis glandulosa*), with surrounding salt scrub and dry wash woodlands. The CV Stormwater Channel and Delta Conservation Area is dominated by riparian vegetation and saltcedar (*Tamarisk ramosissima*), interspersed with natural and agricultural palm oases and dense thickets.

DATA COLLECTION

To increase detection probability, points were visited three times during the sampling period (Conway and Simon 2003). Previous studies have found call-broadcast surveys to be extremely effective with this genus (England and Laudenslayer 1989, Sheppard 1970). To obtain the most optimum conditions we followed the guidelines of previous studies that call-broadcast surveys should only be performed when sustained winds are no greater than Beaufort Scale 4 (20-28 km/hr), and when there is no rainfall (Conway and Simon 2008). Surveyors abandoned surveys if winds excited this threshold or if it began to rain more than a light sprinkle.

A field recording of a singing male CRTH (obtained from Stokes Field Guide to Bird Songs) was used for the call-broadcast surveys, this same call was used during monitoring in 2014. The recording was looped to create a 60 second sound file on an mp3 player, which was then broadcast through an amplified field speaker at peak volume. We used the same speaker (X-mini, MINI II capsule speaker) as the 2014 monitoring of CRTH. At each broadcast point two observers surveyed simultaneously beginning with a passive detection period of two minutes where they scanned vegetation and the surrounding landscape for birds, followed by the 60 second song broadcast. After each broadcast, a two minute detection period followed where observers scanned with binoculars and listened for a vocal response. If no response was

detected, observers repeated the 1 minute playback / 2 minute detection period twice. If CRTH were detected then data was collected detailing the response time, direction and distance, type/duration of vocals, and behaviors of the CRTH. Surveyors would then move onto the next point. All incidental bird sightings were also recorded at points (Appendix 2).

Results

There were a combined total of 68 bird species found at call-broadcast points, however CRTH (a presumed pair) were detected at just one survey point, CRTH26, in the Dos Palmas Conservation area; CRTH were detected at CRTH26 at all three site visits (See Fig. 40). The first CRTH was detected during the initial passive detection at 8:44am on 9 May 2016 singing on top of a honey mesquite. It then flew to a snag (Picture on cover page) then into the largest P. glandulosa thicket next to the survey point CRTH26. Surveyors played the first 10 seconds of the call and the CRTH called back. We then walked onto the next point. When surveyors were walking back through the area at 10:49am a CRTH was observed at CRTH26. It was assumed to be the same CRTH as it was seen flying nearby the same honey mesquite hummock to the west into a nearby fan palm stand. On the second visit to CRTH26 a CRTH was observed at 8:53am during the initial passive detection. The CRTH flew from the southeast near fan palms to the northwest into a stand of arrow weed (Pluchea sericea). This bird did not approach or sing back to the broadcast call. On the third visit of CRTH26, two CRTH were observed at 8:34am after the third call-broadcast during the third and final detection. The two CRTH flew from the southeast into nearby Prosopis glandulosa. Neither CRTH vocally responded to the Stokes recording; instead they moved further south into the largest Prosopis glandulosa in the area, next to point CRTH26.

Discussion

In 2014 CRTH were observed at four survey points in the Dos Palmas Conservation area, CRTH17, 25, 26, and 27. Given the proximity of some of the points it is possible that the same birds were moving between CRTH25-27, however in 2016 no such movements were observed. Again in 2014, CRTH were found at four survey points in the Coachella Valley Stormwater Channel and Delta Conservation area (CRTH43, 45, 46, and 57). In 2016 we observed CRTH only in the Dos Palmas Conservation area, all at the same point, CRTH26. The consistent detection of CRTH during each visit to CRTH26 broadcast point supports the reliability of the protocol and survey results. Without the third call-broadcast and final detection CRTH would not have occurred on the third visit to that site. There were no sightings of CRTH this year in the Coachella Valley Stormwater Channel and Delta Conservation Area. CRTH were observed there in 2014 monitoring and studies have found they will utilize saltcedar when mesquite hummocks are not available (Hunter et al. 1988). This year's lack of CRTH in the Stormwater Channel could be attributed to (1) CRTH moving out of the area into more ideal habitat, (2) a decline in population due to spread of saltcedar and the replacement of ideal habitat near the

Salton Sea (Patten et al. 2003), or (3) natural fluctuations in the population since the Salton Sea is the border of CRTH current territory.

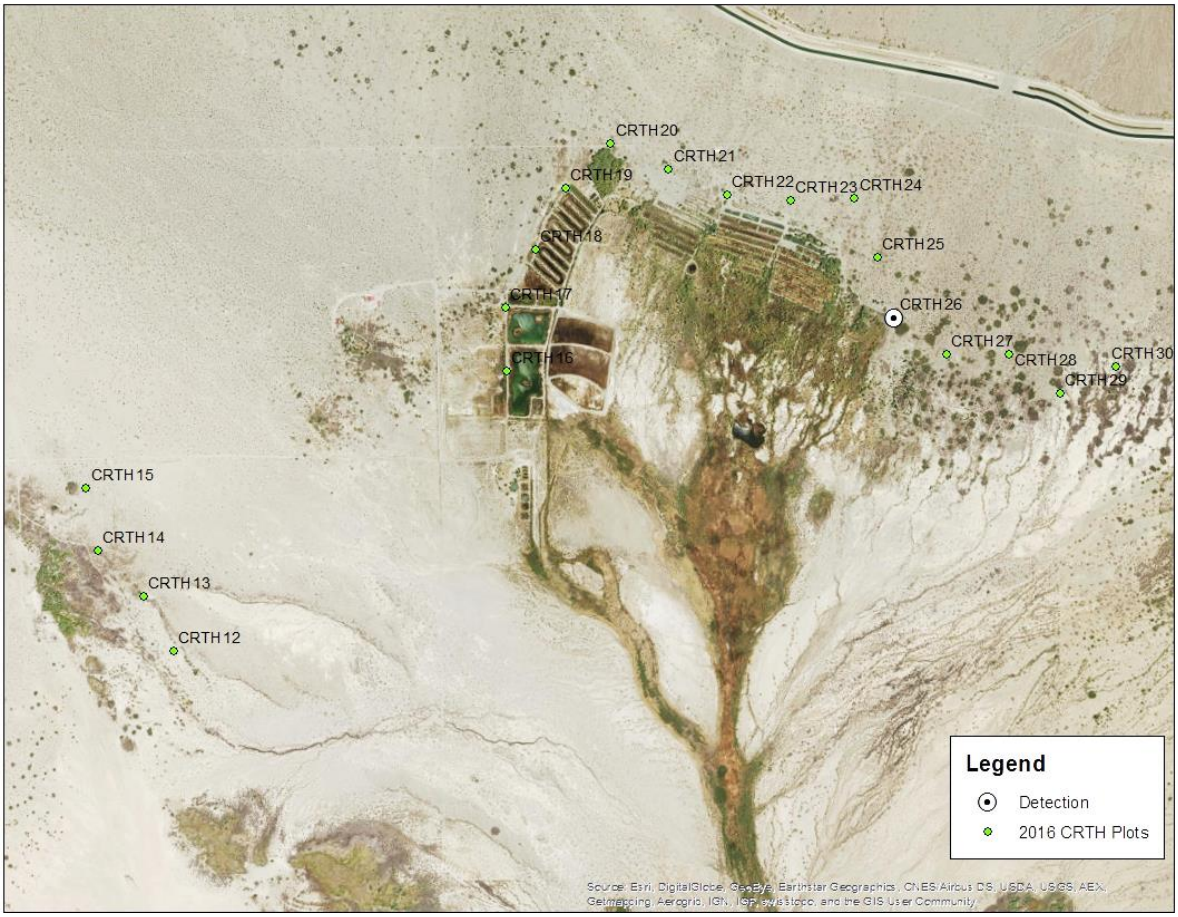

FIGURE 38. DISTRIBUTION OF 2016 CRTH SITES AND DETECTIONS IN THE DOS PALMAS CONSERVATION AREA

FIGURE 39. DISTRIBUTION OF 2016 CRTH SITES AND DETECTIONS IN THE COACHELLA VALLEY STORMWATER CHANNEL AND DELTA CONSERVATION AREA

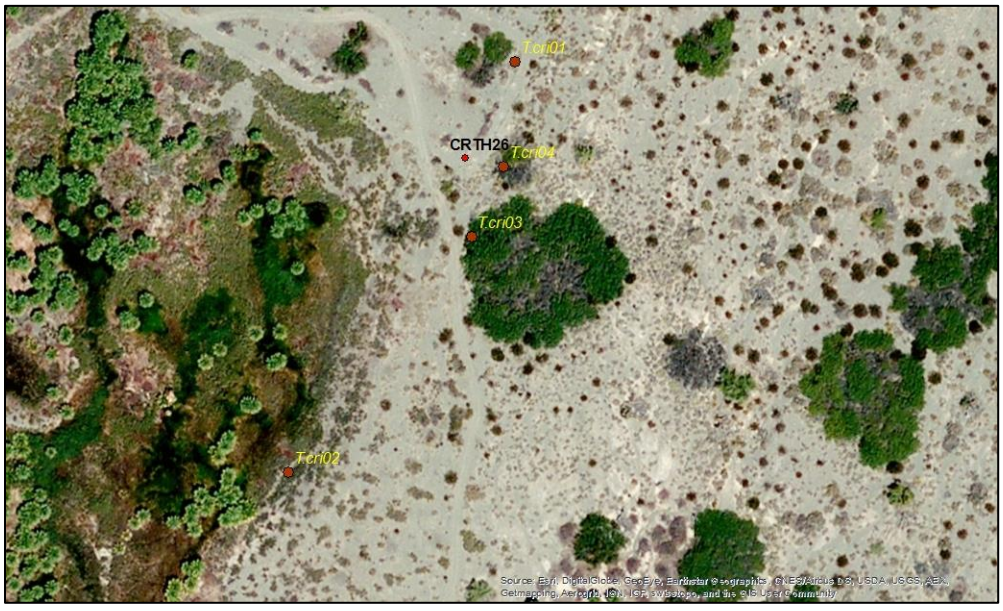

FIGURE 40. CRISSAL THRASHER (*TOXOSTOMA CRISSALE*) OBSERVATIONS AT CRTH26.

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TABLE 6. BREAKDOWN OF 2016 CRTH SITE VISITS

2016 Site Visits	
At least 1 Visit	Three Visits
CRTH 12	CRTH 16
CRTH 13	CRTH 17
CRTH 14	CRTH 18
CRTH 15	CRTH 19
CRTH 21	CRTH 20
CRTH 22	CRTH 25
CRTH 23	CRTH 26
CRTH 24	CRTH 27
CRTH 29	CRTH 28
CRTH 30	CRTH 43
CRTH 41	CRTH 44
CRTH 42	CRTH 45
CRTH 51	CRTH 46
CRTH 52	CRTH 47
CRTH 53	CRTH 48
CRTH 54	CRTH 49
CRTH 55	CRTH 50
CRTH 60	CRTH 56
CRTH 59	CRTH 57
	CRTH 58

TABLE 7. INCIDENTAL BIRD SIGHTINGS DOCUMENTED AT EACH VISIT TO THE CALL-BROADCAST POINTS DURING THE CRISSAL THRASHER FOCUSED SURVEYS

All CRTH site visits							
Bird Species	12 to 15	16 to 19	20 to 24	25 to 30	41 to 50	51 to 55	56 to 60
Abert's Towhee	0	0	0	0	4	0	1
American Kestrel	0	3	0	0	0	1	0
Ash-throated Fly Catcher	0	0	2	1	0	0	0
Barn Swallow	0	25	0	0	0	0	3
Bell's Vireo	0	0	3	1	0	0	0
Bewick's Wren	0	0	0	0	16	0	4
Black Phoebe	0	0	0	0	0	0	0
Black-headed Grosbeak	0	0	2	0	0	0	0
Black-tailed Gnatcatcher	3	2	0	8	18	3	5
Black-throated Gray Warbler	0	1	0	0	0	0	0
Blue Grosbeak	0	0	0	0	0	0	3
Brewer's Blackbird	0	0	0	0	1	0	0
Brown-headed Cowbird	0	0	0	0	20	0	3
Bullock's Oriole	0	0	0	0	0	1	0
Cliff Swallow	0	0	7	0	3	0	0
Common Raven	1	3	1	4	0	0	0
Common Yellowthroat	0	3	0	0	3	0	2
Cooper's Hawk	0	0	0	0	1	0	0
Costa's Hummingbird	0	0	0	0	1	0	0
Crissal Thrasher	0	0	0	4	0	0	0
Eurasian Collared-Dove	0	0	0	0	4	0	0
European Starling	0	0	0	0	1	0	0
Gambel's Quail	0	2	2	15	5	1	0
Great-tailed Grackle	0	2	0	0	21	0	0
Hooded Oriole	0	1	3	0	2	0	0
House Finch	0	0	2	3	2	1	0
Ladder-backed Woodpecker	0	1	4	1	3	2	0
Lesser Nighthawk	0	0	0	0	4	1	2
Loggerhead Shrike	1	0	0	1	1	0	0
MacGilivray's Warbler	1	0	1	0	0	0	0
Mourning Dove	1	10	4	6	36	1	10
Olive-sided Flycatcher	0	1	1	0	0	0	0
Phainopepla	1	20	0	17	21	0	0
Purple Finch	0	1	0	0	0	0	0
Red-winged Blackbird	0	0	0	0	0	1	0
Savannah Sparrow	0	0	0	0	1	0	0
Say's Phoebe	0	0	0	0	1	0	0
Song Sparrow	0	0	0	0	3	0	4
Tree Swallow	0	0	0	0	0	1	0
Vaux's Swift	0	0	1	0	0	0	0
Verdin	0	0	3	5	13	2	5
Warbling Vireo	0	0	0	0	2	0	0
Western Kingbird	0	1	0	1	4	2	6
Western Tanager	0	3	0	2	3	0	0
Western Wood-Pewee	2	0	0	1	1	0	2
White-crowned Sparrow	0	0	0	1	0	0	0
White-throated Swift	0	0	0	0	0	0	5
White-winged Dove	4	12	2	18	15	1	6
Willow Flycatcher	1	0	0	0	0	0	0
Wilson's Warbler	2	2	1	2	1	1	1
Yellow Warbler	0	0	0	1	1	1	0
Yellow-rumped Warbler	0	9	0	1	2	1	0

Appendix IIB
Dos Palmas Vegetation Map Report

Coachella Valley Conservation Commission

June 2016

Coachella Valley Multiple Species Habitat Conservation Plan &
Natural Community Conservation Plan

Dos Palmas Conservation Area

Vegetation Map Report

Lynn C. Sweet, Cameron Barrows, Robert Johnson, James Heintz and Roxann Merizan

Center for Conservation Biology, University of California, Riverside

Final Report

Prepared for: Coachella Valley Conservation Commission.

CONTENTS

EXECUTIVE SUMMARY

The University of California, Riverside Center for Conservation Biology (CCB) created a fine-scale vegetation map of the Dos Palmas Conservation Area (Reserve Management Unit 4 under the Plan) in the Coachella Valley of Riverside County, California covers approximately 25,800 acres. This map and report were prepared for the Coachella Valley Multiple Species Habitat Conservation Plan (MSHCP) under contract with the Coachella Valley Conservation Commission (CVCC). The primary purpose was to develop a dynamic and accurate vegetation map for the Dos Palmas Conservation Area, so that it may be applied to future conservation efforts, and assist with management of the 27 species and 27 natural communities listed within the Plan. This unit is the third major part of the ongoing initiative to map all conservation units within the Plan area. The Dos Palmas Conservation Area final vegetation map and report were completed in 2016. Fieldwork, photo-interpretation and mapping were performed from 2015-2016. One hundred nintety-one reconnaissance vegetation assessment plots were conducted within the study area, in addition to one hundred thirty-two rapid observations of vegetation at pre-determined points. Photo-interpretation of 2013 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 Second Edition (Sawyer *et al.* 2009). Thus, the current version of the map best represents the status of vegetation in 2013.

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 (in progress), 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 2011, 2014). The map was produced by applying heads-up digitizing techniques using six-inch resolution true-color (RGB) 2013 aerial imagery provided by the Coachella Valley Conservation Commission from local flights as well as 2013 six-inch imagery from the National Agricultural Imagery Program (NAIP). Map polygons were assessed for vegetation type, percent cover, presence of exotics, anthropogenic disturbance, and roadedness.

This, the current version of the vegetation classification for the Dos Palmas Conservation Area of the Coachella Valley MSHCP includes approximately 1,240 polygons with 32 Alliances and 113 Associations. Vegetation alliances were assigned for all vegetated polygons, and the additional Association attribute was assigned where field plot data (Vegetation Assessment Plot or rapid observation) was available within the polygon boundaries, or association was clearly ascertained from aerial imagery. This unit has several map classes that have less than 2% absolute vegetation cover, including Disturbed/Built-Up, Playa, Water, and a generic Non-Vegetated Habitat type. The largest amount of land cover is of the Non-Vegetated Habitat type, encompassing 5,928 acres (2400 ha). Of the alliances within the vegetated areas, the largest

amount of vegetation area is classified under the Tamarix spp. Shrubland Semi-Natural Alliance. This Alliance covers a total of 4,150 acres (1680 ha), representing 16.1% of the total area within the map. In addition to published Alliances, an additional seven new provisional alliances were identified and described. This report and accompanying data are to be released at the end of 2016.

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. Thus, periodically, a review of the original polygons and fieldwork will be need to be performed to update the map and determine change across the landscape.

INTRODUCTION

This vegetation map is a tool to help aid in species monitoring and management in the Dos Palmas Conservation Area of the Coachella Valley MSHCP and Natural Community Conservation Plan. 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.

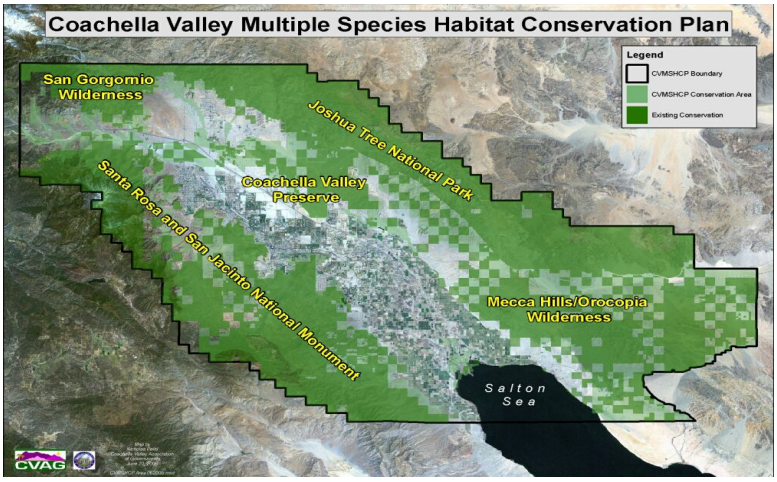


Figure 1: Coachella Valley Multiple Species Habitat Conservation Plan Boundary in relation to Joshua Tree National Park, the Santa Rosa and San Jacinto National Monument, the Coachella Valley USFWS Preserve, Wilderness areas, and the Salton Sea.

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 Coachella Valley is situated in the Colorado Desert which is situated on the northwest portion of the much larger Sonoran Desert, and consists of a variety of habitats. One hundred miles east of Los Angeles, it is bordered on the west by the San Jacinto, San Gorgonio, and Santa Rosa Mountain Ranges. The Valley lies at the northwest boundaries 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 of the Coachella 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 aridness from west to east, as elevation decreases. During rare monsoonal events in July to September, rare monsoonal events that originate in the Gulf of Mexico, bring heavy but isolated thunderstorms to the Valley. During average years, the vast amount of reliable moisture comes from winter rains, which originate in the northwest and move into the area in October through May, contributing the greatest proportion of the annual rainfall.

Dos Palmas Conservation Area

Dos Palmas Conservation Area (hereafter, DPCA) 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 2). To the west it is bounded by non-conserved land and the Salton Sea, 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). Additional lands 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) among 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).

This Conservation Area contains a variety of special habitats, and sensitive species, including desert pupfish, Orocopia Sage, desert tortoise, flat-tailed horned lizard, Le Conte's Thrasher, crissal thrasher, least Bell's vireo, southwestern willow flycatcher, the Yuma clapper rail, yellow breasted chat, Coachella Valley round-tailed ground squirrel, Palm Springs pocket mouse and southern yellow bat among others. A general habitat map for DPCA was produced prior with the inception of the plan to document the distribution of conserved natural communities according to Holland Type (1986) in DPCA: mesquite hummocks, Sonoran creosote bush scrub, desert sink scrub, arroweed 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).

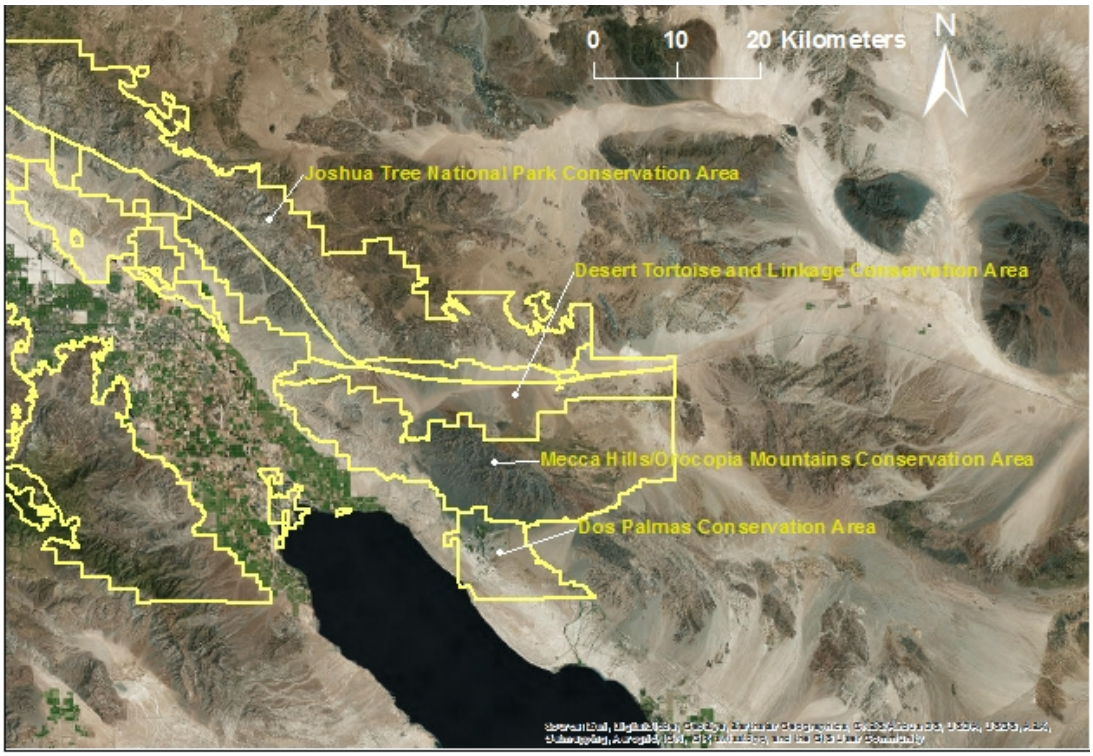


Figure 2: Contiguous conserved land areas in the Plan adjacent to Dos Palmas Conservation Area. CVMSHCP conservation boundaries in yellow.

Subsequent mapping by AMEC Foster Wheeler (AMEC) circa 2009 provided vegetation delineation of central marsh areas (xx oasis) 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, disturbed and barren. The current mapping project encompasses the entire Conservation Area, and includes 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 map also incorporates land and vegetation changes since the earlier Holland-Type map.

PURPOSE

The Dos Palmas Conservation Area Vegetation Map was funded by the Coachella Valley Conservation Commission to provide data about the characteristics, extent, and distribution of the vegetation within the Dos Palmas Conservation Area, and to complement concurrent species and habitat monitoring. The outdated map of the Coachella Valley MSHCP areas, created before

1999, was based on the Holland classification system and was inconsistent with current standards prescribed by CDFW's Vegetation Classification and Mapping Program (VegCaMP). As part of the CVMSHCP/NCCP monitoring program, a phased work plan to remap all 746,000 acres of Conservation Areas began in 2012. This mapping unit over 25,000 acres, covers a variety of special, limited-distribution habitats and species of concern. The completion of the DPCA map updates the 2007 CVMSHCP/NCCP natural community map. This section of the map provides critical information to assist in monitoring habitat suitability in conservation areas, and quantifies attributes to help researchers understand the effects of environmental variability, including drought and climate change. An updated vegetation map was required to enhance understanding of species and their habitats, and identify management needs to ensure persistence of target species within the Plan area. The updated vegetation map is an essential element of monitoring for other covered species and natural communities and provides a baseline to monitor natural communities and landscape-scale vegetation change. Quantification of biotic habitat variables help document factors that may influence species population fluctuation. These data are key to conservation of biological diversity in the Plan area, in light of the 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 is publicly available and supports concurrent CVMSHCP/NCCP monitoring.

RECONNAISSANCE VEGETATION ASSESSMENT

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 relevé 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 vegetation assessment plots (hereafter "VA plots"), both opportunistically-located as well as targeted at priority areas according to the photo interpreter's 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 VA 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 VA plot, the field team assessed and assigned an alliance and association, which was subsequently reviewed and formally assigned at the office.

Because this 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 VA 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 the photo interpreter (see additional notes in the following section for information on final assignment of vegetation types in these cases).

In sum, 194 VA plots were used for delineation within this study area, plus an additional 47 VA plots that were completed prior, at monitoring points for other covered species (*Salvia graeteae*, 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 problematic vegetation types identified by the aerial imagery, and utilized for building the map.

AERIAL PHOTO INTERPRETATION AND DELINEATION

Photo interpretation of vegetation types employed heads-up digitizing techniques using six-inch resolution true-color (RGB) 2013 aerial imagery provided by the Coachella Valley Conservation Commission from local flights as well as 2013 six-inch imagery from the National Agricultural Imagery Program (NAIP) in areas 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 (various sources, see: https://www.arcgis.com/home/item.html?id=10df2279f9684e4a9f6a7f08febac2a9), while not used as the primary basis for any decision, was useful as supporting information.

The photo interpreter worked with a GIS specialist to establish a geodatabase containing domain tables that relate alliance, group and macrogroup for assigned types in ArcGIS 10.2. 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 (see

Appendix A: metadata for feature attributes). A comprehensive quality control effort was conducted by senior GIS staff to finalize polygons, and geodatabase domains (Alliance, Common Name, Association, Group and Macrogroup). 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) to review polygon assignments, identify problematic vegetation assignments errors and discrepancies as monitoring continued, and all were incorporated into the final geodatabase.

The photo interpreter 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, the photo interpreter considered vegetation types that were likely to occur in that area, such as *Acacia greggii, Ambrosia dumosa*, or *Lycium brevipes*.

For most alliances occurring in expansive areas, a minimum mapping unit of 2.47 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. 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).

Lines were drawn to delineate non-vegetated areas and vegetated areas, and within vegetated areas, to establish boundaries of alliance and association types (Figure 2, Appendix A, B). The photo interpreter drafted boundaries separating vegetation types (Alliances) generally at 1:1500 scale and attributed the type using VA plot information and relevant datasets. A finer visualization scale was used in some cases to delineate wetland types occurring in narrows bands and patchy areas. Absolute cover values from the VA plots was used to assist photo interpreters with delineating boundaries. 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 for accessing 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.

For polygons in which the VA plot data indicated significant mortality of the vegetation or dormant vegetation, the photo interpreter 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 small percentage of the vegetation remained alive, with

sufficient cover remaining alive to pass the assignment rules for the dominant vegetation type. In a 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 (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, the photo interpreter 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 map which now (in 2016) 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 domininant (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 is recommended in the near future to assess and represent changes that have happened since 2013.

The time period aimed at in this map to classify the vegetation state during the year 2013. This aligns with the overall mapping goal for the CVMSHCP area to have a uniform temporal snapshot of vegetation across the Plan area for this year. However, as a living map, polygons and assignments will be regularly reviewed, updated, or flagged for further field visits as part of ongoing monitoring within the mapping area. 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 IDENTIFIED

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 (1998), the Western Riverside County MSHCP Vegetation Map (2004), Vegetation of Joshua Tree National Park (2012), and the Vegetation Map in Support of the Desert Renewable Energy Conservation Plan (2012). There were 22 VA 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) 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, including the *Atriplex canescens--Atriplex polycarpa* Shrubland Provisional Alliance, the *Larrea tridentata / Abronia villosa* Stabilized Sand Fields Provisional alliance, the *Psorothamnus schottii* Provisional Alliance, the *Salvia greatae* Provisional Alliance (target species) and the *Cladium californicum* Provisional Alliance (target species).

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

Dunes

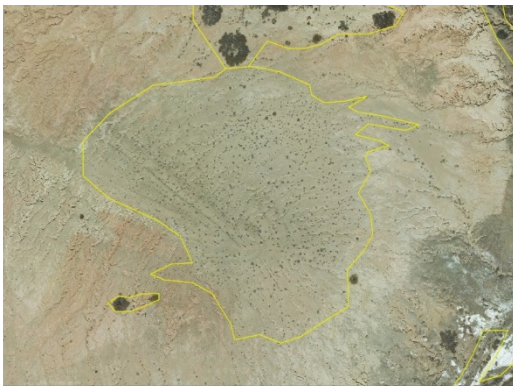
Non-vegetated Habitat (less than 2% absolute cover)

Playa

Water

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 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

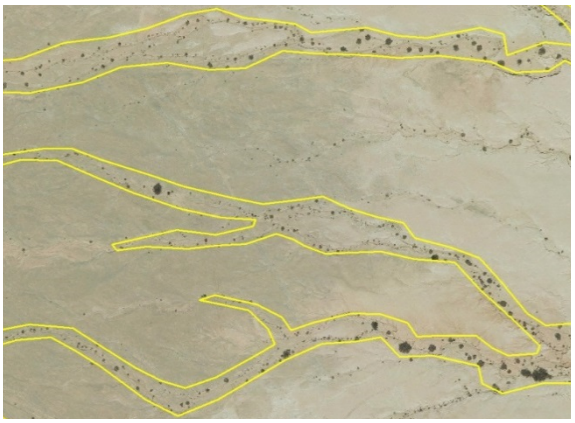
California sawgrass beds Provisional Alliance

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, often at springs associated with *Washingtonia filifera* fan palm oases.

Lycium brevipes Shrubland Provisional Alliance

Baja desert thorn Provisional Alliance

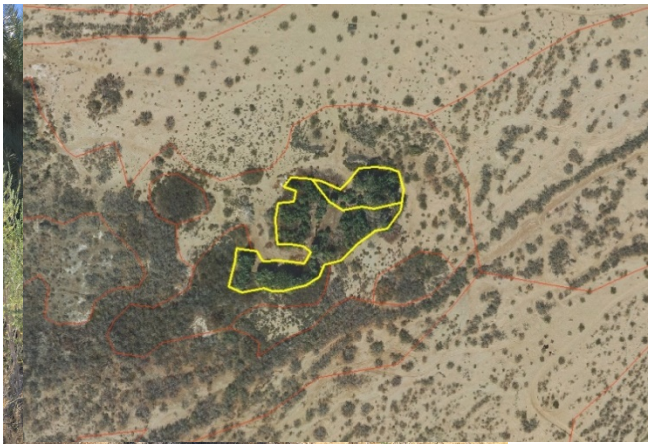


The image on the left shows a *Lycium brevipes* photo signature in an upland seasonally-wet washs, surrounded by non-vegetated areas. The photo on the right shows a *Lycium brevipes* stand with *Tamarix spp*., and other occasional shrubs *including Ambrosia dumosa, Encelia farinose,* and *Allenrolfea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

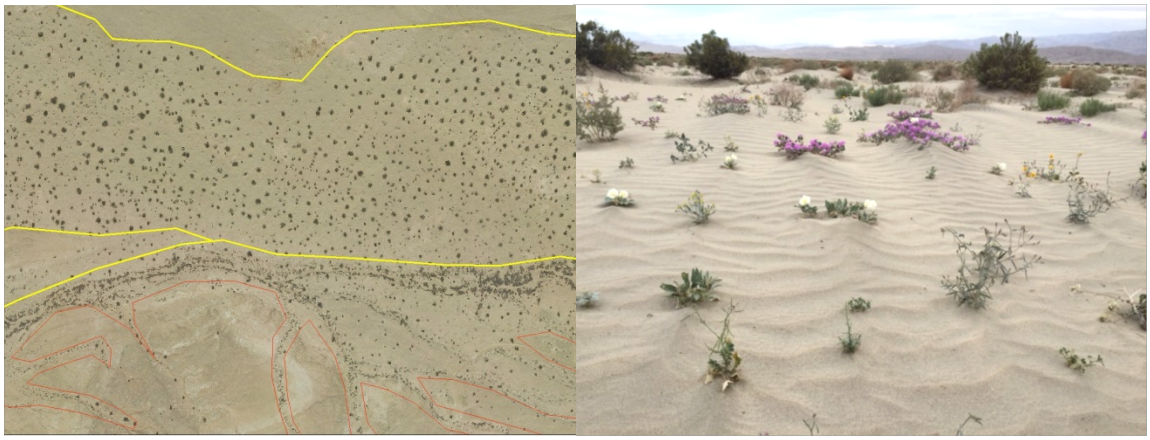


This image on the left shows a *Phoenix dactylifera* photo signature with a *Washingtonia filifera* Woodland surrounding it on the south boundary and an *Isocoma acradenia* Shrubland on the north boundary. The image on the right shows a *Phoenix dactylifera* stand with *Pluchea sericea* in the foreground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

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

Creosote bush / Desert sand verbena 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

Indigo bush 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.

ALLIANCES AND LANDSCAPE ATTRIBUTES IDENTIFIED

Alliance Common Name	Alliance	Area, ha	Area, acres	% of Area	% of Vegetated
Alkali goldenbush scrub	Isocoma acradenia Shrubland Provisional Alliance	170.6	421.5	1.6	2.2
Allscale scrub	Atriplex polycarpa Shrubland Alliance	150.0	370.6	1.4	1.9
American bulrush marsh	Schoenoplectus americanus Herbaceous Alliance	8.7	21.4	0.1	0.1
Arrow weed thickets	Pluchea sericea Shrubland Alliance	38.3	94.6	0.4	0.5
Baja desert thorn scrub	Lycium brevipes Shrubland Provisional Alliance	35.9	88.8	0.3	0.5
Blue palo verde - ironwood woodland	Parkinsonia florida--Olneya tesota Woodland Alliance	1158.8	2863.4	11.1	14.6
Bush seepweed scrub	Suaeda moquinii Shrubland Alliance	63.3	156.4	0.6	0.8
California brittle bush scrub	Encelia farinosa Shrubland Alliance	9.6	23.7	0.1	0.1
California fan palm oasis	Washingtonia filifera Woodland Alliance	106.9	264.2	1.0	1.3
California sawgrass beds	Cladium californicum Herbaceous Provisional Alliance	5.1	12.7	0.0	0.1
Cattail marshes	Typha (angustifolia, domingensis, latifolia) Alliance	36.1	89.1	0.3	0.5
Cheesebush scrub	Ambrosia salsola Shrubland Alliance	75.0	185.3	0.7	0.9
Common reed marshes	Phragmites australis Herbaceous Alliance	35.6	88.1	0.3	0.4
Cooper's rush marsh	Juncus cooperi Herbaceous Alliance	8.5	21.1	0.1	0.1
Creosote bush - white burr sage scrub	Larrea tridentata--Ambrosia dumosa Shrubland Alliance	992.5	2452.5	9.5	12.5
Creosote bush / sand verbena stabilized sand fields	Larrea tridentata / Abronia villosa Stabilized Sand Fields Provisional Alliance	278.9	689.1	2.7	3.5
Creosote bush scrub	Larrea tridentata Shrubland Alliance	1131.6	2796.3	10.9	14.3
Date palm naturalized groves	Phoenix dactylifera Semi-Natural Woodland Provisional Alliance	0.1	0.2	0.0	0.0
Desert holly scrub	Atriplex hymenelytra Shrubland Alliance	26.2	64.8	0.3	0.3
Desert willow woodland	Chilopsis linearis Woodland Alliance	0.1	0.4	0.0	0.0
Disturbed/built-up	Disturbed/built-up	204.5	505.3	2.0	2.6
Fourwing saltbush - allscale scrub	Atriplex canescens--Atriplex polycarpa Shrubland Provisional Alliance	136.9	338.4	1.3	1.7
Fourwing saltbush scrub	Atriplex canescens Shrubland Alliance	433.2	1070.4	4.2	5.5
Iodine bush scrub	Allenrolfea occidentalis Shrubland Alliance	796.4	1968.0	7.6	10.0
Mesquite bosque, mesquite thicket	Prosopis glandulosa Woodland Alliance	136.9	338.2	1.3	1.7
Non-vegetated habitat	Non-vegetated Habitat (less than 2% absolute cover)	2399.1	5928.3	23.0	--
Playa (non-vegetated)	Playa	48.4	119.5	0.5	--
Quailbush scrub	Atriplex lentiformis Shrubland Alliance	2.0	5.0	0.0	0.0
Salt grass flats	Distichlis spicata Herbaceous Alliance	23.7	58.5	0.2	0.3
Salt marsh bulrush marshes	Bolboschoenus maritimus Herbaceous Alliance	0.1	0.2	0.0	0.0
Schott's indigobush scrub	Psorothamnus schottii Shrubland Provisional Alliance	18.1	44.8	0.2	0.2
Screwbean mesquite bosques	Prosopis pubescens Woodland Alliance	19.1	47.2	0.2	0.2
Tamarisk thickets	Tamarix spp. Shrubland Semi-Natural Alliance	1679.5	4150.2	16.1	21.2
Water	Water	47.0	116.1	0.5	--
White bursage scrub	Ambrosia dumosa Shrubland Alliance	150.0	370.7	1.4	1.9

ASSOCIATIONS IDENTIFIED

Atriplex canescens--Larrea tridentata Association
Larrea tridentata Association
Larrea tridentata--Ambrosia dumosa Association
Larrea tridentata--Ambrosia dumosa--Atriplex canescens Association
Larrea tridentata--Ambrosia dumosa--Encelia farinosa Association
Larrea tridentata--Ambrosia salsola--Psorothamnus schottii Association
Larrea tridentata--Atriplex canescens Association
Larrea tridentata--Atriplex polycarpa Association
Non-vegetated Habitat / Larrea tridentata Association
Prosopis glandulosa / Atriplex canescens Association
Prosopis glandulosa / Atriplex polycarpa Association
Prosopis glandulosa / Larrea tridentata--Atriplex spp. Association
Tamarix spp.--Atriplex canescens Association
Washingtonia filifera / Prosopis glandulosa--Atriplex spp--Suaeda moquinii Association
Atriplex polycarpa--Larrea tridentata Association
Chilopsis linearis--Psorothamnus spinosus Association
Encelia farinosa--Atriplex hymelytra Association
Parkinsonia florida / Encelia farinosa Association
Parkinsonia florida / Larrea tridentata--Encelia farinosa Association
Parkinsonia florida / Psorothamnus schottii Association
Allenrolfea occidentalis--Atriplex canescens Association
Allenrolfea occidentalis--Isocoma acradenia Association
Allenrolfea occidentalis--Lycium brevipes / Distichlis spicata Association
Allenrolfea occidentalis--Pluchea sericea Association
Allenrolfea occidentalis--Suaeda moquinii Association
Allenrolfea occidentalis--Tamarix spp. / Distichlis spicata Association
Allenrolfea occidentalis--Tamarix spp. Association
Allenrolfea occidentalis / Distichlis spicata Association
Allenrolfea occidentalis / Juncus cooperi Association
Allenrolfea occidentalis / Juncus cooperi Association
Allenrolfea occidentalis Association
Ambrosia dumosa--Atriplex canescens Association
Ambrosia dumosa--Larrea tridentata Association
Ambrosia dumosa--Psorothamnus emoryi Association
Ambrosia dumosa / Atriplex canescens Association
Atriplex canescens--Atriplex polycarpa--Lycium brevipes Association
Atriplex canescens--Atriplex polycarpa--Psorothamnus emoryi Association
Atriplex canescens--Atriplex polycarpa--Suaeda moquinii Association

Atriplex canescens--Atriplex polycarpa / Parkinsonia florida Association
Atriplex canescens--Atriplex polycarpa Association
Atriplex hymenolytra--Isocoma acradenia Association
Atriplex lentiformes / Allenrolfea occidentalis Association
Bolboschoenus maritimus--Phragmites australis Association
Cladium californicum / Pluchea sericea Association
Distichlis spicata--Juncus cooperi Association
Distichlis spicata / Allenrolfea occidentalis Association
Distichlis spicata / Allenrolfea occidentalis Association
Distichlis spicata / Bolboschoenus maritimus / Typha domingensis Association
Distichlis spicata / Isocoma acradenia Association
Isocoma acradenia--Atriplex canescens--Atriplex polycarpa Association
Isocoma acradenia--Atriplex canescens Association
Isocoma acradenia--Atriplex hymenolytra Association
Isocoma acradenia--Lycium brevipes Association
Isocoma acradenia--Pluchea sericea Association
Juncus cooperi / Phragmites australis Association
Juncus cooperi / Tamarix spp. Association
Larrea tridentata--Ambrosia dumosa--Atriplex hymenelytra Association
Larrea tridentata--Ambrosia dumosa--Isocoma acradenia Association
Larrea tridentata--Lycium brevipes / Olneya tesota Association
Larrea tridentata--Psorothamnus schottii Association
Larrea tridentata--Tamarix spp. Association
Larrea tridentata / wash Association
Lycium brevipes--Allenrolfea occidentalis Association
Lycium brevipes--Atriplex canescens Association
Lycium brevipes--Tamarix spp. Association
Non--vegetated Habitat / Allenrolfea occidentalis Association
Non--vegetated Habitat / Larrea tridentata Association
Non--vegetated Habitat / Psorothamnus emoryi Association
Non-vegetated Habitat (less than 2% absolute cover)
Olneya tesota / Larrea tridentata--Atriplex polycarpa Association
Olneya tesota / Larrea tridentata Association
Parkinsonia florida--Olneya tesota / Larrea tridentata--Ambrosia dumosa Association
Parkinsonia florida / Larrea tridentata--Psorothamnus schottii Association
Phoenix dactylifera--Washingtonia filifera / Tamarix spp. Association
Phragmites australis--Typha domingensis Association
Phragmites australis / Allenrolfea occidentalis Association
Phragmites australis Association
Pluchea sericea--Allenrolfea occidentalis Association
Pluchea sericea--Atriplex polycarpa Association

Pluchea sericea--Tamarix spp. Association
Pluchea sericea / Prosopis glandulosa Association
Pluchea sericea Association
Prosopis glandulosa--Parkinsonia florida Association
Prosopis glandulosa--Tamarix spp. Association
Prosopis glandulosa / Allenrolfea occidentalis Association
Prosopis glandulosa / Lycium brevipes--Atriplex canescens Association
Prosopis glandulosa / Suaeda moquinii Association
Prosopis glandulosa Association
Prosopis pubescens / Distichlis spicata--Juncus cooperi Association
Prosopis pubescens / Pluchea sericea / Distichlis spicata Association
Schoenoplectus americanus--Phragmites australis Association
Suaeda moquinii--Allenrolfea occidentalis Association
Suaeda moquinii Association
Tamarix spp.--Allenrolfea occidentalis 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
Tamarix spp. Association
Typha domingensis / Tamarix spp. Association
Washingtonia filifera--Phoenix dactylifera Association
Washingtonia filifera / Prosopis glandulosa Association
Washingtonia filifera / Prosopis pubescens Association
Washingtonia filifera / spring (Atriplex--Baccharis--Pluchea) Association
Washingtonia filifera / Tamarix spp. Association
Washingtonia filifera / Typha domingensis / Juncus cooperi Association
Juncus cooperi / Baccharis sarothroides Association
Phragmites australis--Schoenoplectus americanus Association
Schoenoplectus americanus Association
Schoenoplectus americanus--Tamarix ramosissima Association
Typha dominguensis / Juncus cooperi Association
Washingtonia filifera / Phragmites australis Association

DOS PALMAS ALLIANCE MAP

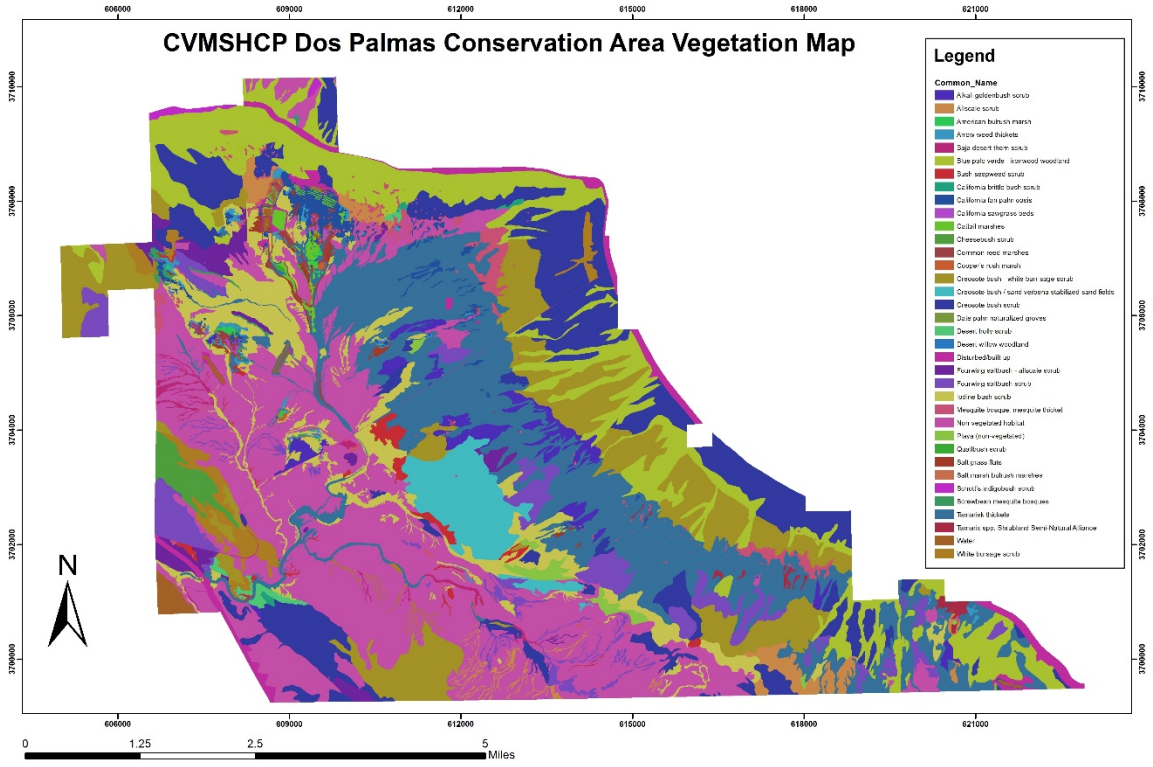


Figure 3: National Vegetation Classification System vegetation alliances in the Dos Palmas Conservation Area. See Appendix B for full-size PDF.

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APPENDICES

Appendix A: Dos Palmas Vegetation Geodatabase 2015
Geodatabase components:
"DOPA_VAP" (VAP database)
"DOPA_VegCover" (Vegetation Alliance Polygons)
File name and type: CVAG_DOPA_VegMap_2016.gdb
ArcGIS 10.2 Geodatabase

Appendix B: Dos Palmas Vegetation Alliance Map
File name and type: UCR_CCB_MeccaOrocopia_Veg_Alliances2015.pdf
File name and type: PDF

Appendix C: Metadata containing attribute definitions for the DOPA_VegCover component of the geodatabase.
File name and type: Geodatabase metadata DPA Veg Map CVMSHCP 2016.docx

Appendix III
Table of Acquisitions for Conservation in 2016

CVMSHCP Annual Report 2016 - Parcels Acquired for Conservation

Conservation Area	Acquisition Made By	APN	Sum of Acre
Dos Palmas Conservation Area	Coachella Valley Conservation Commission	731140007	80.73
		733120005	5.01
	Coachella Valley Conservation Commission Total		**85.75**
	Friends of the Desert Mountains	731140008	39.36
		733150047	20.24
		733150062	40.22
	Friends of the Desert Mountains Total		**99.81**
Dos Palmas Conservation Area Total			**185.56**
Desert Tortoise and Linkage Conservation Area	Coachella Valley Conservation Commission	709500006	10.00
	Coachella Valley Conservation Commission Total		**10.00**
	Friends of the Desert Mountains	715271003	99.52
		717100021	40.16
		717100023	40.14
	Friends of the Desert Mountains Total		**179.82**
Desert Tortoise and Linkage Conservation Area Total			**189.83**
Joshua Tree National Park Conservation Area	Mojave Desert Land Trust	705280001	120.06
		707210018	39.97
		707230025	80.32
		707290004	6.55
		709040006	20.01
		709040007	10.00
		709040014	20.00
		745080009	0.25
	Mojave Desert Land Trust Total		**297.16**
Joshua Tree National Park Conservation Area Total			**297.16**
Mecca Hills/Orocopia Mountains Conservation Area	Friends of the Desert Mountains	717100022	40.14
	Friends of the Desert Mountains Total		**40.14**
Mecca Hills/Orocopia Mountains Conservation Area Total			**40.14**
Santa Rosa and San Jacinto Mountains Conservation Area	Friends of the Desert Mountains	753120005	40.78
		753170010	19.79
		753330018	19.82
		753340017	14.49
	Friends of the Desert Mountains Total		**94.87**
Santa Rosa and San Jacinto Mountains Conservation Area Total			**94.87**
Coachella Valley Stormwater Channel and Delta Conservation Area	Coachella Valley Conservation Commission	727250016	39.42
	Coachella Valley Conservation Commission Total		**39.42**
Coachella Valley Stormwater Channel and Delta Conservation Area Total			**39.42**
Thousand Palms Conservation Area	Coachella Valley Conservation Commission	647450001	160.19
		647450002	483.14
		648130001	20.12
	Coachella Valley Conservation Commission Total		**663.45**
Thousand Palms Conservation Area Total			**663.45**
Upper Mission Creek/Big Morongo Canyon Conservation Area	Coachella Valley Conservation Commission	664090005	39.27
	Coachella Valley Conservation Commission Total		**39.27**
Upper Mission Creek/Big Morongo Canyon Conservation Area Total			**39.27**
Willow Hole Conservation Area	Coachella Valley Conservation Commission	660091003	0.34
		660092001	0.24
		660092002	0.23
		660200021	2.39
		660200024	2.55
		660280004	5.04
		669130001	30.06
		669130009	5.00
	Coachella Valley Conservation Commission Total		**45.84**
Willow Hole Conservation Area Total			**45.84**
Whitewater Floodplain Conservation Area	Coachella Valley Conservation Commission	660290021	4.91
	Coachella Valley Conservation Commission Total		**4.91**
Whitewater Floodplain Conservation Area Total			**4.91**
Grand Total			**1600.46**

Appendix IV
Status of Conservation Objectives by Conservation Area

CVMSHCP Annual Report 2016 - Conservation Objectives by Conservation Area

	Total Acres in Conservation Area	Acres of Disturbance Authorized (1996)	Remaining Acres To Be Conserved (1996)	Acres Conserved Since 1996	Acres Conserved in 2016	Percentage of Required Conservation Acquired	Acres of Permitted Disturbance	Acres of Rough Step
Cabazon Conservation Area - Riverside County								
Peninsular Bighorn Sheep - Essential Habitat	264	181	83	0	0	0%	0	18
Mesquite hummocks	13	1	12	0	0	0%	0	0
Southern sycamore-alder riparian woodland	9	1	9	0	0	0%	0	0
Sand Source	7,683	181	1,629	0	0	0%	0	18
Sand Transport	4,538	0	0	0	0	0%	0	0
Fornat Wash Corridor	641	10	631	0	0	0%	0	1
Coachella Valley Stormwater Channel and Delta Conservation Area - Riverside County								
Desert Pupfish - Core Habitat	25	0	25	0	0	0%	0	0
Crissal Thrasher - Core Habitat	896	87	781	39	39	5%	5	8
California Black Rail - Other Conserved Habitat	62	6	52	0	0	0%	0	1
Yuma Clapper Rail - Other Conserved Habitat	62	6	52	0	0	0%	0	1
Le Conte's Thrasher - Other Conserved Habitat	784	78	706	39	39	6%	5	7
Mesquite hummocks	74	7	67	15	15	23%	0	2
Coastal and valley freshwater marsh	61	6	63	0	0	0%	0	1
Desert sink scrub	1,349	114	1,026	0	0	0%	0	11
Desert saltbush scrub	792	79	713	24	24	3%	5	5

	Total Acres in Conservation Area	Acres of Disturbance Authorized (1996)	Remaining Acres To Be Conserved (1996)	Acres Conserved Since 1996	Acres Conserved in 2016	Percentage of Required Conservation Acquired	Acres of Permitted Disturbance	Acres of Rough Step
Desert Tortoise and Linkage Conservation Area - Coachella								
Desert Tortoise - Core Habitat	300	30	270	0	0	0%	0	3
Le Conte's Thrasher - Other Conserved Habitat	300	30	270	0	0	0%	0	3
Desert dry wash woodland	121	12	109	0	0	0%	0	1
Desert Tortoise and Linkage Conservation Area - Riverside County								
Desert Tortoise - Core Habitat	88,878	4,998	44,978	3,809	158	8%	14	867
Orocopia Sage - Core Habitat	779	44	398	0	0	0%	0	4
Mecca Aster - Core Habitat	4,731	206	1,852	272	0	15%	0	48
Le Conte's Thrasher - Other Conserved Habitat	49,114	2,813	25,319	1,191	140	5%	14	386
Desert dry wash woodland	13,443	752	6,771	577	72	9%	6	127
Desert Tortoise and Linkage Corridor	26,122	1,572	14,144	1,819	48	13%	0	339

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Dos Palmas Conservation Area - Riverside County								
Crissal Thrasher - Core Habitat	536	38	343	161	26	47%	0	20
Desert Pupfish - Refugia Locations	0	0	0	0	0	0%	0	0
California Black Rail - Other Conserved Habitat	597	37	334	271	5	81%	0	31
Le Conte's Thrasher - Other Conserved Habitat	14,882	743	6,689	2,373	26	35%	0	312
Yuma Clapper Rail - Other Conserved Habitat	682	42	374	292	5	78%	0	34
Predicted Flat-tailed Horned Lizard - Other Conserved Habitat	5,537	403	3,631	560	0	15%	0	96
Desert fan palm oasis woodland	125	6	50	29	0	58%	0	4
Arrowweed scrub	277	13	121	0	0	0%	0	1
Mesquite bosque	482	36	320	176	26	55%	0	21
Desert sink scrub	7,195	487	4,381	1,160	147	26%	0	165
Desert dry wash woodland	1,856	83	746	242	0	32%	0	33
Cismontane alkali marsh	321	23	205	200	0	98%	0	22
Mesquite hummocks	55	3	23	12	1	51%	0	2
East Indio Hills Conservation Area - Coachella								
Le Conte's Thrasher - Other Conserved Habitat	62	6	56	0	0	0%	0	1
Palm Springs Pocket Mouse - Other Conserved Habitat	8	1	7	0	0	0%	0	0
Coachella Valley Round-tailed Ground Squirrel - Other Conserved Habitat	6	1	5	0	0	0%	0	0
Predicted Flat-tailed Horned Lizard - Other Conserved Habitat	6	1	5	0	0	0%	0	0

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East Indio Hills Conservation Area - Indio								
Le Conte's Thrasher - Other Conserved Habitat	120	12	105	0	0	0%	0	1
Palm Springs Pocket Mouse - Other Conserved Habitat	117	11	103	0	0	0%	0	1
Coachella Valley Round-tailed Ground Squirrel - Other Conserved Habitat	117	11	103	0	0	0%	0	1
Predicted Flat-tailed Horned Lizard - Other Conserved Habitat	114	11	100	0	0	0%	0	1
Mesquite hummocks	2	0	2	0	0	0%	0	0
Stabilized shielded sand fields	114	11	100	0	0	0%	0	1
East Indio Hills Conservation Area - Riverside County								
Le Conte's Thrasher - Other Conserved Habitat	1,960	139	1,253	0	0	0%	0	14
Mecca Aster - Core Habitat	1,594	116	1,045	0	0	0%	0	12
Coachella Valley Round-tailed Ground Squirrel - Other Conserved Habitat	1,353	100	896	0	0	0%	0	10
Predicted Flat-tailed Horned Lizard - Other Conserved Habitat	525	46	415	0	0	0%	0	5
Palm Springs Pocket Mouse - Other Conserved Habitat	1,526	105	944	0	0	0%	0	11
Active desert dunes	5	1	4	0	0	0%	0	0
Desert saltbush scrub	8	1	7	0	0	0%	0	0
Stabilized desert sand fields	331	33	295	0	0	0%	0	3
Mesquite hummocks	43	4	39	0	0	0%	0	0
Stabilized shielded sand fields	401	28	256	0	0	0%	0	3

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Edom Hill Conservation Area - Cathedral City								
Coachella Valley Round-tailed Ground Squirrel - Other Conserved Habitat	134	13	121	102	0	84%	0	11
Coachella Valley Milkvetch - Other Conserved Habitat	151	15	136	102	0	75%	0	12
Palm Springs Pocket Mouse - Other Conserved Habitat	114	11	103	87	0	84%	0	9
Le Conte's Thrasher - Other Conserved Habitat	344	34	310	224	0	72%	0	26
Sand Source	345	34	310	224	0	72%	0	26
Edom Hill Conservation Area - Riverside County								
Coachella Valley Giant Sand-treader Cricket - Other Conserved Habitat	103	5	40	43	0	100%	0	5
Coachella Valley Milkvetch - Other Conserved Habitat	1,637	134	1,205	1,029	0	85%	0	116
Coachella Valley Fringe-toed Lizard - Other Conserved Habitat	103	5	40	43	0	100%	0	5
Coachella Valley Round-tailed Ground Squirrel - Other Conserved Habitat	1,701	145	1,302	1,115	0	86%	0	126
Palm Springs Pocket Mouse - Other Conserved Habitat	1,228	104	935	794	0	85%	0	90
Le Conte's Thrasher - Other Conserved Habitat	2,238	194	1,745	1,334	0	76%	1	152
Active sand fields	73	4	37	41	0	100%	0	4
Stabilized desert sand fields	29	1	3	2	0	67%	0	1
Sand Source	2,665	197	1,770	1,468	0	83%	0	167
Sand Transport	628	63	565	377	0	67%	1	43

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Highway 111/I-10 Conservation Area - Riverside County								
Coachella Valley Round-tailed Ground Squirrel - Other Conserved Habitat	389	39	350	54	0	15%	0	9
Coachella Valley Jerusalem Cricket - Other Conserved Habitat	372	37	335	51	0	15%	0	9
Le Conte's Thrasher - Other Conserved Habitat	389	39	350	54	0	15%	0	9
Coachella Valley Milkvetch - Other Conserved Habitat	372	37	335	51	0	15%	0	9
Palm Springs Pocket Mouse - Other Conserved Habitat	389	39	350	54	0	15%	0	9
Indio Hills Palms Conservation Area - Riverside County								
Mecca Aster - Core Habitat	6,091	255	2,290	1,039	0	45%	0	130
Le Conte's Thrasher - Other Conserved Habitat	106	1	7	0	0	0%	0	0
Desert fan palm oasis woodland	93	5	42	7	0	17%	0	1
Desert dry wash woodland	79	4	33	36	0	100%	0	4
Mesquite hummocks	3	1	1	0	0	0%	0	0
Indio Hills/Joshua Tree National Park Linkage Conservation Area - Riverside County								
Desert Tortoise - Core Habitat	10,308	859	7,735	6,542	0	85%	0	740
Le Conte's Thrasher - Other Conserved Habitat	6,396	606	5,457	5,450	0	100%	0	605
Sand Transport	7,304	681	6,132	5,771	0	94%	5	640
Sand Source	5,823	460	4,135	3,205	0	78%	0	367
Indio Hills / Joshua Tree National Park Corridor	13,127	1,141	10,267	8,976	0	87%	5	1,007

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Joshua Tree National Park Conservation Area - Riverside County								
Gray Vireo - Other Conserved Habitat	30,653	134	1,208	1,822	0	100%	0	195
Le Conte's Thrasher - Other Conserved Habitat	4,330	25	222	104	27	47%	0	13
Desert Tortoise - Core Habitat	127,161	1,708	15,367	12,607	297	82%	0	1,432
Desert dry wash woodland	2,195	13	119	192	0	100%	0	20
Mojave mixed woody scrub	57,099	800	7,195	6,349	9	88%	0	715
Desert fan palm oasis woodland	5	0	0	0	0	0%	0	0
Mojavean pinyon & juniper woodland	30,653	134	1,208	1,822	0	100%	0	195
Mecca Hills/Orocopia Mountains Conservation Area - Riverside County								
Desert Tortoise - Core Habitat	112,575	2,624	23,617	6,128	40	26%	0	875
Le Conte's Thrasher - Other Conserved Habitat	17,467	652	5,866	1,396	0	24%	0	205
Orocopia Sage - Core Habitat	66,180	1,803	16,227	4,144	0	26%	0	595
Mecca Aster - Core Habitat	31,655	465	4,181	867	40	21%	0	133
Desert fan palm oasis woodland	1	0	0	0	0	0%	0	0
Desert dry wash woodland	9,317	318	2,861	1,176	6	41%	0	149
Santa Rosa and San Jacinto Mountains Conservation Area - Cathedral City								
Desert Tortoise - Other Conserved Habitat	107	11	95	4	0	4%	0	2
Le Conte's Thrasher - Other Conserved Habitat	13	1	11	4	0	36%	0	0
Peninsular Bighorn Sheep - Rec Zone 2 - Essential Habitat	112	11	97	4	0	4%	0	2
Desert dry wash woodland	20	2	18	5	0	28%	0	1

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Santa Rosa and San Jacinto Mountains Conservation Area - Indian Wells								
Desert Tortoise - Other Conserved Habitat	4,375	111	999	0	0	0%	0	11
Le Conte's Thrasher - Other Conserved Habitat	419	23	206	0	0	0%	0	2
Peninsular Bighorn Sheep - Rec Zone 3 - Essential Habitat	4,617	114	1,158	0	0	0%	0	11
Desert dry wash woodland	128	7	66	0	0	0%	0	1
Santa Rosa and San Jacinto Mountains Conservation Area - La Quinta								
Desert Tortoise - Other Conserved Habitat	5,936	157	1,409	371	0	26%	7	46
Le Conte's Thrasher - Other Conserved Habitat	683	43	387	122	0	32%	0	17
Peninsular Bighorn Sheep - Rec Zone 3 - Essential Habitat	6,185	159	2,545	386	0	15%	0	38
Desert dry wash woodland	147	8	76	15	0	20%	0	2
Santa Rosa and San Jacinto Mountains Conservation Area - Palm Desert								
Le Conte's Thrasher - Other Conserved Habitat	43	4	33	0	0	0%	0	0
Desert Tortoise - Other Conserved Habitat	581	48	436	784	0	100%	0	82
Peninsular Bighorn Sheep - Rec Zone 3 - Essential Habitat	78	7	65	0	0	0%	0	1
Peninsular Bighorn Sheep - Rec Zone 2 - Essential Habitat	492	7	65	762	0	100%	0	75
Desert dry wash woodland	38	3	29	1	0	3%	0	0

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Santa Rosa and San Jacinto Mountains Conservation Area - Palm Springs								
Le Conte's Thrasher - Other Conserved Habitat	793	103	560	384	0	69%	0	74
Peninsular Bighorn Sheep - Rec Zone 1 - Essential Habitat	9,195	226	2,511	2,001	0	80%	0	185
Desert Tortoise - Other Conserved Habitat	22,571	1,317	8,856	4,388	0	50%	0	719
Peninsular Bighorn Sheep - Rec Zone 2 - Essential Habitat	18,426	866	4,700	3,495	0	74%	0	666
Gray Vireo - Other Conserved Habitat	8,416	431	3,883	1,837	0	47%	0	227
Desert dry wash woodland	40	4	36	41	0	100%	0	5
Peninsular juniper woodland & scrub	7,682	353	3,177	1,837	0	58%	0	219
Semi-desert chaparral	733	51	571	0	0	0%	0	5
Southern sycamore-alder riparian woodland	30	2	24	0	0	0%	0	0
Sonoran cottonwood-willow riparian forest	58	0	58	4	0	7%	0	0
Desert fan palm oasis woodland	218	9	76	52	0	68%	0	6
Southern arroyo willow riparian forest	16	0	0	0	0	0%	0	0
Santa Rosa and San Jacinto Mountains Conservation Area - Rancho Mirage								
Desert Tortoise - Other Conserved Habitat	5,249	147	1,326	1,206	0	91%	0	135
Le Conte's Thrasher - Other Conserved Habitat	19	2	17	0	0	0%	0	0
Peninsular Bighorn Sheep - Rec Zone 2 - Essential Habitat	5,262	42	450	1,209	0	100%	0	106
Desert dry wash woodland	19	1	9	4	0	44%	0	1

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Santa Rosa and San Jacinto Mountains Conservation Area - Riverside County								
Peninsular Bighorn Sheep - Rec Zone 2 - Essential Habitat	14,558	647	4,269	2,315	0	54%	0	380
Le Conte's Thrasher - Other Conserved Habitat	9,123	911	5,508	5,327	0	97%	0	884
Triple-ribbed Milkvetch - Known Locations	0	0	0	0	0	0%	0	0
Peninsular Bighorn Sheep - Rec Zone 1 - Essential Habitat	24,840	830	7,252	1,221	0	17%	0	209
Gray Vireo - Other Conserved Habitat	58,985	881	7,930	5,401		68%	0	628
Peninsular Bighorn Sheep - Rec Zone 3 - Essential Habitat	50,972	683	5,359	4,932	95	92%	0	634
Desert Tortoise - Other Conserved Habitat	86,875	2,950	23,856	15,630	95	66%	7	2,028
Peninsular Bighorn Sheep - Rec Zone 4 - Essential Habitat	34,597	258	2,325	7,522		100%	0	777
Southern sycamore-alder riparian woodland	518	12	117	5	0	4%	0	2
Red shank chaparral	12,514	253	2,274	1,810	0	80%	0	207
Semi-desert chaparral	16,869	233	2,093	928	0	44%	0	116
Peninsular juniper woodland & scrub	29,547	418	2,899	2,666	0	92%	0	388
Southern arroyo willow riparian forest	16	2	15	0	0	0%	0	0
Desert dry wash woodland	3,566	298	1,244	1,251	0	100%	0	300
Desert fan palm oasis woodland	716	45	404	0	0	0%	0	5

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Snow Creek/Windy Point Conservation Area - Palm Springs								
Coachella Valley Milkvetch - Core Habitat	910	91	816	179	0	22%	0	27
Peninsular Bighorn Sheep - Essential Habitat	180	16	144	22	0	15%	0	4
Coachella Valley Round-tailed Ground Squirrel - Core Habitat	934	93	838	182	0	22%	0	27
Coachella Valley Fringe-toed Lizard - Core Habitat	749	75	672	174	0	26%	0	25
Coachella Valley Giant Sand-treader Cricket - Core Habitat	749	75	672	174	0	26%	0	25
Coachella Valley Jerusalem Cricket - Core Habitat	908	90	815	178	0	22%	0	27
Palm Springs Pocket Mouse - Core Habitat	934	93	838	182	0	22%	0	27
Le Conte's Thrasher - Other Conserved Habitat	864	86	775	145	0	19%	0	23
Ephemeral sand fields	680	68	610	136	0	22%	0	20
Active desert dunes	69	7	62	40	0	65%	0	5
Highway 111 - Whitewater River Biological Corridor	276	27	247	182	0	74%	0	21

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Snow Creek/Windy Point Conservation Area - Riverside County								
Coachella Valley Milkvetch - Core Habitat	1,700	134	1,210	546	0	45%	0	68
Coachella Valley Round-tailed Ground Squirrel - Core Habitat	1,880	152	1,371	788	0	57%	0	94
Coachella Valley Fringe-toed Lizard - Core Habitat	625	55	502	334	0	67%	0	38
Peninsular Bighorn Sheep - Essential Habitat	525	49	443	0	0	0%	0	5
Coachella Valley Giant Sand-treader Cricket - Core Habitat	625	56	501	334	0	67%	0	39
Le Conte's Thrasher - Other Conserved Habitat	1,924	162	1,453	848	0	58%	0	101
Coachella Valley Jerusalem Cricket - Core Habitat	782	60	538	347	0	64%	0	41
Ephemeral sand fields	468	45	409	339	0	83%	0	38
Stabilized shielded sand fields	157	10	93	0	0	0%	0	1
Highway 111 - Whitewater River Biological Corridor	474	46	415	0	0	0%	0	5
Stubbe and Cottonwood Canyons Conservation Area - Riverside County								
Desert Tortoise - Core Habitat	5,735	253	2,276	851	0	37%	29	81
Le Conte's Thrasher - Other Conserved Habitat	1,265	123	1,111	647	0	58%	0	77
Desert dry wash woodland	289	26	229	112	0	49%	0	14
Sonoran cottonwood-willow riparian forest	267	3	25	0	0	0%	0	0
Sand Transport	1,375	125	1,129	651	0	58%	0	77
Stubbe Canyon Wash Corridor	1,181	117	1,058	696	0	66%	0	81

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Thousand Palms Conservation Area - Riverside County								
Coachella Valley Round-tailed Ground Squirrel - Core Habitat	8,513	468	2,974	1,681	96	57%	39	246
Coachella Valley Milkvetch - Core Habitat	4,403	111	1,001	823	75	82%	5	88
Desert Pupfish - Refugia Locations	0	0	0	0	0	0%	0	0
Coachella Valley Fringe-toed Lizard - Core Habitat	3,962	93	834	682	0	82%	0	78
Le Conte's Thrasher - Other Conserved Habitat	11,058	552	3,879	2,048	58	53%	34	283
Predicted Flat-tailed Horned Lizard - Core Habitat	4,148	97	877	713	0	81%	1	80
Mecca Aster - Core Habitat	11,745	297	2,676	1,547	595	58%	5	179
Coachella Valley Giant Sand-treader Cricket - Core Habitat	3,962	93	834	682	0	82%	0	78
Palm Springs Pocket Mouse - Core Habitat	11,707	518	3,588	2,056	96	57%	38	281
Desert dry wash woodland	748	4	34	0	0	0%	0	0
Active sand fields	3,543	91	820	677	0	83%	0	77
Active desert dunes	421	2	14	6	0	43%	0	1
Desert fan palm oasis woodland	137	0	0	0	0	0%	0	0
Sonoran cottonwood-willow riparian forest	4	0	0	0	0	0%	0	0
Mesquite hummocks	58	0	0	0	0	0%	0	0
Sand Transport	12,550	573	4,100	1,996	0	49%	52	256
Sand Source	13,056	412	3,712	2,291	0	62%	5	265
Thousand Palms Linkage	25,607	983	7,816	3,654	0	47%	57	455

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Upper Mission Creek/Big Morongo Canyon Conservation Area - Desert Hot Springs								
Coachella Valley Jerusalem Cricket - Other Conserved Habitat	49	0	49	40	0	82%	1	-1
Le Conte's Thrasher - Other Conserved Habitat	1,832	288	1,409	1,009	39	72%	2	212
Palm Springs Pocket Mouse - Core Habitat	1,748	270	1,403	998	39	71%	2	198
Little San Bernardino Mountains Linanthus - Core Habitat	1,020	53	967	623	34	64%	0	36
Desert Tortoise - Core Habitat	3,554	0	1,429	997	39	70%		0
Desert dry wash woodland	135	6	58	0	0	0%	0	1
Sand Transport	1,869	286	1,399	612	0	44%	2	139
Sand Source	343	0	6	0	0	0%	0	0
Highway 62 Corridor	73	7	66	0	0	0%	0	1
Upper Mission Creek/Big Morongo Canyon Conservation Area - Palm Springs								
Le Conte's Thrasher - Other Conserved Habitat	24	2	22	0	0	0%	0	0
Palm Springs Pocket Mouse - Other Conserved Habitat	24	2	22	0	0	0%	0	0

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Upper Mission Creek/Big Morongo Canyon Conservation Area - Riverside County								
Desert Tortoise - Core Habitat	24,122	887	7,984	4,943	0	62%	23	560
Triple-ribbed Milkvetch - Core Habitat	819	47	426	421	0	99%	0	46
Coachella Valley Jerusalem Cricket - Other Conserved Habitat	666	52	460	40	0	9%	11	-2
Le Conte's Thrasher - Other Conserved Habitat	1,871	146	1,323	632	0	48%	3	74
Palm Springs Pocket Mouse - Core Habitat	1,937	151	1,363	680	0	50%	2	81
Little San Bernardino Mountains Linanthus - Core Habitat	1,390	122	1,100	677	0	62%	0	80
Southern sycamore-alder riparian woodland	104	6	52	60	0	100%	0	7
Desert dry wash woodland	125	8	76	49	0	64%	0	5
Sonoran cottonwood-willow riparian forest	100	8	76	78	0	100%	0	8
Sand Transport	2,279	168	1,509	1,044	0	69%	0	121
Sand Source	19,789	721	6,488	4,281	0	66%	0	500
Highway 62 Corridor	907	79	715	569	0	80%	0	64
West Deception Canyon Conservation Area - Riverside County								
Sand Source	1,302	118	1,063	864	0	81%	0	98
Whitewater Canyon Conservation Area · Desert Hot Springs								
Desert Tortoise - Core Habitat	56	0	0	0	0	0%	0	0
Sand Source	56	0	0	0	0	0%	0	0

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Whitewater Canyon Conservation Area · Riverside County								
Desert Tortoise - Core Habitat	4,438	120	1,084	742	0	68%	1	85
Arroyo Toad - Core Habitat	2,082	78	706	676	0	96%	0	75
Little San Bernardino Mountains Linanthus - Other Conserved Habitat	579	39	348	277	0	80%	0	32
Triple-ribbed Milkvetch - Core Habitat	1,295	41	368	277	0	75%	0	32
Desert fan palm oasis woodland	1	0	0	0	0	0%	0	0
Sonoran cottonwood-willow riparian forest	166	11	107	105	0	98%	0	11
Sand Transport	1,392	48	435	338	0	78%	0	38
Sand Source	12,616	94	850	618	0	73%	1	70
Whitewater Canyon Corridor	223	22	201	0	0	0%	1	1
Whitewater Floodplain Conservation Area - Cathedral City								
Coachella Valley Milkvetch - Core Habitat	107	7	61	0	0	0%	0	1
Coachella Valley Round-tailed Ground Squirrel - Core Habitat	105	7	59	0	0	0%	0	1
Coachella Valley Fringe-toed Lizard - Core Habitat	107	7	61	0	0	0%	0	1
Le Conte's Thrasher - Other Conserved Habitat	107	7	61	0	0	0%	0	1
Palm Springs Pocket Mouse - Core Habitat	107	7	61	0	0	0%	0	1
Coachella Valley Giant Sand-treader Cricket - Core Habitat	107	7	61	0	0	0%	0	1
Active sand fields	49	5	43	0	0	0%	0	1
Whitewater River Corridor	28	2	18	0	0	0%	0	0

	Total Acres in Conservation Area	Acres of Disturbance Authorized (1996)	Remaining Acres To Be Conserved (1996)	Acres Conserved Since 1996	Acres Conserved in 2016	Percentage of Required Conservation Acquired	Acres of Permitted Disturbance	Acres of Rough Step
Whitewater Floodplain Conservation Area - Palm Springs								
Coachella Valley Round-tailed Ground Squirrel - Core Habitat	5,825	328	2,955	531	4	18%	42	44
Coachella Valley Milkvetch - Core Habitat	5,432	297	2,671	512	4	19%	37	44
Palm Springs Pocket Mouse - Core Habitat	6,173	347	3,122	549	4	18%	61	29
Coachella Valley Fringe-toed Lizard - Core Habitat	5,418	295	2,659	512	4	19%	37	44
Coachella Valley Giant Sand-treader Cricket - Core Habitat	5,418	295	2,659	512	4	19%	37	44
Le Conte's Thrasher - Other Conserved Habitat	6,495	381	3,433	563	4	16%	61	33
Ephemeral sand fields	2,873	132	1,185	213	0	18%	10	25
Stabilized desert sand fields	577	44	394	4	0	1%	0	5
Active sand fields	436	44	392	304	4	78%	0	35
Whitewater River Corridor	1,183	90	809	26	0	3%	13	-1

	Total Acres in Conservation Area	Acres of Disturbance Authorized (1996)	Remaining Acres To Be Conserved (1996)	Acres Conserved Since 1996	Acres Conserved in 2016	Percentage of Required Conservation Acquired	Acres of Permitted Disturbance	Acres of Rough Step
Whitewater Floodplain Conservation Area - Riverside County								
Coachella Valley Milkvetch - Core Habitat	96	6	58	0	0	0%	0	1
Coachella Valley Round-tailed Ground Squirrel - Core Habitat	185	11	100	0	0	0%	0	1
Coachella Valley Giant Sand-treader Cricket - Core Habitat	92	6	57	0	0	0%	0	1
Coachella Valley Fringe-toed Lizard - Core Habitat	92	6	57	0	0	0%	0	1
Palm Springs Pocket Mouse - Core Habitat	701	53	477	0	0	0%	10	-5
Le Conte's Thrasher - Other Conserved Habitat	706	53	480	0	0	0%	10	-5
Ephemeral sand fields	86	6	52	0	0	0%	0	1
Stabilized desert sand fields	5	1	4	0	0	0%	0	0
Whitewater River Corridor	701	53	475	0	0	0%	10	-5

	Total Acres in Conservation Area	Acres of Disturbance Authorized (1996)	Remaining Acres To Be Conserved (1996)	Acres Conserved Since 1996	Acres Conserved in 2016	Percentage of Required Conservation Acquired	Acres of Permitted Disturbance	Acres of Rough Step
Willow Hole Conservation Area - Cathedral City								
Coachella Valley Round-tailed Ground Squirrel - Core Habitat	1,485	140	1,256	610	10	49%	0	75
Coachella Valley Milkvetch - Core Habitat	938	87	782	187	10	24%	0	27
Coachella Valley Fringe-toed Lizard - Core Habitat	264	24	212	123	10	58%	0	15
Palm Springs Pocket Mouse - Core Habitat	1,147	107	959	606	10	63%	0	72
Le Conte's Thrasher - Other Conserved Habitat	1,795	167	1,505	624	10	41%	0	79
Ephemeral sand fields	227	20	178	101	10	57%	0	12
Active sand fields	37	4	33	22	0	67%	0	3
Stabilized desert sand fields	57	6	51	0	0	0%	0	1
Stabilized desert dunes	1	0	1	0	0	0%	0	0
Sand Transport	966	89	798	591	10	74%	0	68
Sand Source	833	79	710	33	0	5%	0	11

	Total Acres in Conservation Area	Acres of Disturbance Authorized (1996)	Remaining Acres To Be Conserved (1996)	Acres Conserved Since 1996	Acres Conserved in 2016	Percentage of Required Conservation Acquired	Acres of Permitted Disturbance	Acres of Rough Step
Willow Hole Conservation Area - Riverside County								
Coachella Valley Fringe-toed Lizard - Core Habitat	633	50	454	298	0	66%	6	29
Coachella Valley Milkvetch - Core Habitat	2,228	195	1,751	1,072	1	61%	6	121
Palm Springs Pocket Mouse - Core Habitat	3,465	298	2,684	1,470	1	55%	6	171
Le Conte's Thrasher - Other Conserved Habitat	3,601	298	2,677	1,454	1	54%	6	169
Desert saltbush scrub	169	17	152	136	0	89%	0	15
Mesquite hummocks	125	11	98	91	0	93%	0	10
Desert fan palm oasis woodland	1	0	0	0	0	0%	0	0
Stabilized desert sand fields	144	14	128	56	0	44%	2	5
Stabilized desert dunes	383	35	319	198	0	62%	4	19
Ephemeral sand fields	906	81	728	229	0	32%	0	31
Sand Transport	3,500	304	2,734	1,423	1	52%	6	167
Sand Source	186	2	17	8	0	47%	0	1
Mission Creek / Willow Wash Biological Corridor	509	44	397	11	0	3%	0	5

Appendix V
Covered Activity Impact Outside Conservation Areas

CVMSHCP Annual Report 2016 - Covered Activity Impact Outside Conservation Areas

Conservation Objective / Jurisdiction	Estimated Acres Disturbed Outside Conservation Areas
Arroyo Toad	
Riverside County	0
Arroyo Toad Total	**0**
California Black Rail	
Coachella	0
Indio	0
Riverside County	0
California Black Rail Total	**0**
Coachella Valley Fringe-toed Lizard	
Cathedral City	568
Coachella	9
Indian Wells	589
Indio	960
La Quinta	542
Palm Desert	874
Palm Springs	1362
Rancho Mirage	936
Riverside County	580
Coachella Valley Fringe-toed Lizard Total	**6420**
Coachella Valley Giant Sand-treader Cricket	
Cathedral City	568
Coachella	9
Indian Wells	589
Indio	960
La Quinta	542
Palm Desert	874
Palm Springs	1362
Rancho Mirage	936
Riverside County	580
Coachella Valley Giant Sand-treader Cricket Total	**6420**

CVMSHCP Annual Report 2016 - Covered Activity Impact Outside Conservation Areas

Conservation Objective / Jurisdiction	Estimated Acres Disturbed Outside Conservation Areas
Coachella Valley Jerusalem Cricket	
Cathedral City	577
Desert Hot Springs	5
Palm Desert	6
Palm Springs	1368
Rancho Mirage	887
Riverside County	107
Coachella Valley Jerusalem Cricket Total	**2950**
Coachella Valley Milkvetch	
Cathedral City	499
Desert Hot Springs	8
Indian Wells	493
La Quinta	1
Palm Desert	862
Palm Springs	956
Rancho Mirage	936
Riverside County	329
Coachella Valley Milkvetch Total	**4084**
Coachella Valley Round-tailed Ground Squirrel	
Cathedral City	804
Coachella	23
Desert Hot Springs	494
Indian Wells	918
Indio	1475
La Quinta	1409
Palm Desert	1218
Palm Springs	1646
Rancho Mirage	1089
Riverside County	1999
Coachella Valley Round-tailed Ground Squirrel Total	**11076**

CVMSHCP Annual Report 2016 - Covered Activity Impact Outside Conservation Areas

Conservation Objective / Jurisdiction	Estimated Acres Disturbed Outside Conservation Areas
Crissal Thrasher	
Cathedral City	0
Coachella	35
Desert Hot Springs	0
Indian Wells	21
Indio	236
La Quinta	670
Riverside County	253
Crissal Thrasher Total	**1215**
Desert Pupfish	
Indian Wells	0
NULL	0
Desert Pupfish Total	**0**
Desert Tortoise	
Cathedral City	15
Coachella	0
Desert Hot Springs	488
Indian Wells	220
Indio	0
La Quinta	438
Palm Desert	458
Palm Springs	32
Rancho Mirage	169
Riverside County	576
Desert Tortoise Total	**2396**
Gray Vireo	
Palm Springs	0
Riverside County	29
Gray Vireo Total	**29**

CVMSHCP Annual Report 2016 - Covered Activity Impact Outside Conservation Areas

Conservation Objective / Jurisdiction	Estimated Acres Disturbed Outside Conservation Areas
Le Conte's Thrasher	
Cathedral City	943
Coachella	45
Desert Hot Springs	1053
Indian Wells	1176
Indio	1476
La Quinta	1767
Palm Desert	1828
Palm Springs	1601
Rancho Mirage	1179
Riverside County	3189
Le Conte's Thrasher Total	**14257**
Least Bell's Vireo - Breeding Habitat	
Cathedral City	0
Coachella	2
Desert Hot Springs	0
Indian Wells	21
Indio	30
La Quinta	30
Palm Springs	0
Rancho Mirage	0
Riverside County	3
Least Bell's Vireo - Breeding Habitat Total	**86**
Least Bell's Vireo - Migratory Habitat	
Cathedral City	0
Coachella	4
Desert Hot Springs	0
Indian Wells	187
Indio	173
La Quinta	55
Palm Desert	167
Palm Springs	0
Rancho Mirage	45
Riverside County	201
Least Bell's Vireo - Migratory Habitat Total	**832**

CVMSHCP Annual Report 2016 - Covered Activity Impact Outside Conservation Areas

Conservation Objective / Jurisdiction	Estimated Acres Disturbed Outside Conservation Areas
Little San Bernardino Mountains Linanthus	
Desert Hot Springs	1
Riverside County	0
Little San Bernardino Mountains Linanthus Total	**1**
Mecca Aster	
Indio	1
Riverside County	0
Mecca Aster Total	**1**
Orocopia Sage	
Riverside County	7
Orocopia Sage Total	**7**
Palm Springs Pocket Mouse	
Cathedral City	809
Coachella	15
Desert Hot Springs	515
Indian Wells	937
Indio	1367
La Quinta	1268
Palm Desert	1292
Palm Springs	1682
Rancho Mirage	1136
Riverside County	2109
Palm Springs Pocket Mouse Total	11129
Peninsular Bighorn Sheep	
Cathedral City	4
Indian Wells	2
La Quinta	126
Palm Desert	209
Palm Springs	5
Rancho Mirage	5
Riverside County	23
Peninsular Bighorn Sheep Total	**375**

CVMSHCP Annual Report 2016 - Covered Activity Impact Outside Conservation Areas

Conservation Objective / Jurisdiction	Estimated Acres Disturbed Outside Conservation Areas
Potential Flat-tailed Horned Lizard	
Cathedral City	0
Desert Hot Springs	0
Palm Springs	12
Riverside County	7
Potential Flat-tailed Horned Lizard Total	**19**
Predicted Flat-tailed Horned Lizard	
Cathedral City	538
Coachella	3
Indian Wells	2
Indio	589
La Quinta	842
Palm Desert	545
Palm Springs	874
Rancho Mirage	1360
Riverside County	924
Predicted Flat-tailed Horned Lizard Total	**6452**
Southern Yellow Bat	
Cathedral City	0
Desert Hot Springs	1
Palm Springs	0
Rancho Mirage	0
Riverside County	0
Southern Yellow Bat Total	**1**
Southwestern Willow Flycatcher - Breeding Habitat	
Cathedral City	0
Coachella	0
Desert Hot Springs	0
Indio	0
Palm Springs	0
Rancho Mirage	0
Riverside County	0
Southwestern Willow Flycatcher - Breeding Habitat Total	**0**

CVMSHCP Annual Report 2016 - Covered Activity Impact Outside Conservation Areas

Conservation Objective / Jurisdiction	Estimated Acres Disturbed Outside Conservation Areas
Southwestern Willow Flycatcher - Migratory Habitat	
Cathedral City	5
Coachella	35
Desert Hot Springs	2
Indian Wells	209
Indio	236
La Quinta	731
Palm Desert	194
Palm Springs	7
Rancho Mirage	46
Riverside County	253
Southwestern Willow Flycatcher - Migratory Habitat Total	**1717**
Summer Tanager - Breeding Habitat	
Cathedral City	0
Coachella	0
Desert Hot Springs	0
Indio	0
Palm Springs	0
Rancho Mirage	0
Riverside County	0
Summer Tanager - Breeding Habitat Total	**0**
Summer Tanager - Migratory Habitat	
Cathedral City	5
Coachella	35
Desert Hot Springs	2
Indian Wells	209
Indio	236
La Quinta	731
Palm Desert	194
Palm Springs	7
Rancho Mirage	46
Riverside County	253
Summer Tanager - Migratory Habitat Total	**1717**

CVMSHCP Annual Report 2016 - Covered Activity Impact Outside Conservation Areas

Conservation Objective / Jurisdiction	Estimated Acres Disturbed Outside Conservation Areas
Triple-ribbed Milkvetch	
Palm Springs	0
Riverside County	0
Triple-ribbed Milkvetch Total	**0**
Yellow Warbler - Breeding Habitat	
Cathedral City	0
Coachella	0
Desert Hot Springs	0
Indio	0
Palm Springs	0
Rancho Mirage	0
Riverside County	0
Yellow Warbler - Breeding Habitat Total	**0**
Yellow Warbler - Migratory Habitat	
Cathedral City	5
Coachella	35
Desert Hot Springs	2
Indian Wells	209
Indio	238
La Quinta	731
Palm Desert	194
Palm Springs	7
Rancho Mirage	46
Riverside County	253
Yellow Warbler - Migratory Habitat Total	**1720**
Yellow-breasted Chat - Breeding Habitat	
Cathedral City	0
Coachella	0
Desert Hot Springs	0
Indio	0
Palm Springs	0
Rancho Mirage	0
Riverside County	0
Yellow-breasted Chat - Breeding Habitat Total	**0**

CVMSHCP Annual Report 2016 - Covered Activity Impact Outside Conservation Areas

Conservation Objective / Jurisdiction	Estimated Acres Disturbed Outside Conservation Areas
Yellow-breasted Chat - Migratory Habitat	
Cathedral City	5
Coachella	35
Desert Hot Springs	2
Indian Wells	209
Indio	236
La Quinta	731
Palm Desert	194
Palm Springs	7
Rancho Mirage	46
Riverside County	253
Yellow-breasted Chat - Migratory Habitat Total	**1717**
Yuma Clapper Rail	
Coachella	0
Indio	0
Riverside County	0
Yuma Clapper Rail Total	**0**
Active desert dunes	
Palm Springs	0
Riverside County	2
Active desert dunes Total	**2**
Active sand fields	
Cathedral City	0
Palm Springs	0
Riverside County	256
Active sand fields Total	**256**
Arrowweed scrub	
Riverside County	0
Arrowweed scrub Total	**0**
Chamise chaparral	
Riverside County	0
Chamise chaparral Total	**0**

CVMSHCP Annual Report 2016 - Covered Activity Impact Outside Conservation Areas

Conservation Objective / Jurisdiction	Estimated Acres Disturbed Outside Conservation Areas
Cismontane alkali marsh	
Riverside County	0
Cismontane alkali marsh Total	**0**
Coastal and valley freshwater marsh	
Coachella	0
Indio	0
Riverside County	0
Coastal and valley freshwater marsh Total	**0**
Desert dry wash woodland	
Cathedral City	0
Coachella	0
Desert Hot Springs	2
Indian Wells	187
Indio	0
La Quinta	55
Palm Desert	167
Palm Springs	0
Rancho Mirage	45
Riverside County	268
Desert dry wash woodland Total	**724**
Desert fan palm oasis woodland	
Cathedral City	0
Desert Hot Springs	0
Palm Springs	0
Rancho Mirage	0
Riverside County	0
Desert fan palm oasis woodland Total	**0**
Desert saltbush scrub	
Coachella	4
Indio	173
La Quinta	0
Riverside County	52
Desert saltbush scrub Total	**229**

CVMSHCP Annual Report 2016 - Covered Activity Impact Outside Conservation Areas

Conservation Objective / Jurisdiction	Estimated Acres Disturbed Outside Conservation Areas
Desert sink scrub	
Riverside County	60
Desert sink scrub Total	**60**
Ephemeral sand fields	
Cathedral City	0
Palm Springs	72
Riverside County	7
Ephemeral sand fields Total	**79**
Interior live oak chaparral	
Palm Springs	0
Riverside County	0
Interior live oak chaparral Total	**0**
Mesquite bosque	
Riverside County	0
Mesquite bosque Total	**0**
Mesquite hummocks	
Cathedral City	0
Coachella	2
Desert Hot Springs	0
Indian Wells	21
Indio	568
La Quinta	30
Riverside County	3
Mesquite hummocks Total	**624**
Mojave mixed woody scrub	
Desert Hot Springs	0
Riverside County	0
Mojave mixed woody scrub Total	**0**

CVMSHCP Annual Report 2016 - Covered Activity Impact Outside Conservation Areas

Conservation Objective / Jurisdiction	Estimated Acres Disturbed Outside Conservation Areas
Mojavean pinyon & juniper woodland	
Riverside County	0
Mojavean pinyon & juniper woodland Total	**0**
Peninsular juniper woodland & scrub	
Palm Springs	0
Riverside County	0
Peninsular juniper woodland & scrub Total	**0**
Red shank chaparral	
Riverside County	0
Red shank chaparral Total	**0**
Semi-desert chaparral	
Palm Springs	0
Riverside County	0
Semi-desert chaparral Total	**0**
Sonoran cottonwood-willow riparian forest	
Coachella	0
Indio	0
Palm Springs	0
Riverside County	0
Sonoran cottonwood-willow riparian forest Total	**0**
Sonoran creosote bush scrub	
Cathedral City	0
Coachella	47
Desert Hot Springs	0
Indian Wells	24
Indio	243
La Quinta	172
Palm Desert	183
Palm Springs	2
Rancho Mirage	20
Riverside County	524
Sonoran creosote bush scrub Total	**1215**

CVMSHCP Annual Report 2016 - Covered Activity Impact Outside Conservation Areas

Conservation Objective / Jurisdiction	Estimated Acres Disturbed Outside Conservation Areas
Sonoran mixed woody & succulent scrub	
Cathedral City	9
Desert Hot Springs	0
Indian Wells	0
Indio	1
La Quinta	7
Palm Desert	0
Palm Springs	242
Rancho Mirage	0
Riverside County	413
Sonoran mixed woody & succulent scrub Total	**672**
Southern arroyo willow riparian forest	
Palm Springs	0
Riverside County	0
Southern arroyo willow riparian forest Total	**0**
Southern sycamore-alder riparian woodland	
Palm Springs	0
Riverside County	0
Southern sycamore-alder riparian woodland Total	**0**
Stabilized desert dunes	
Cathedral City	0
Riverside County	0
Stabilized desert dunes Total	**0**
Stabilized desert sand fields	
Cathedral City	0
Indio	0
Palm Springs	0
Riverside County	0
Stabilized desert sand fields Total	**0**

CVMSHCP Annual Report 2016 - Covered Activity Impact Outside Conservation Areas

Conservation Objective / Jurisdiction	Estimated Acres Disturbed Outside Conservation Areas
Stabilized shielded sand fields	
Cathedral City	356
Coachella	0
Indian Wells	589
Indio	358
La Quinta	402
Palm Desert	315
Palm Springs	260
Rancho Mirage	534
Riverside County	67
Stabilized shielded sand fields Total	**2881**