State of California
Department of Fish and Wildlife

Memorandum

Date: September 30, 2016

To: Valerie Termini
Executive Director
Fish and Game Commission

From: Charlton H. Bonham
Director

Subject: Status Review of the Flat-tailed Horned Lizard

The Department of Fish and Wildlife (Department) has prepared the attached Status Review for the Fish and Game Commission (Commission) regarding the Center for Biological Diversity's Petition (Petition) to list the Flat-tailed Horned Lizard (*Phrynosoma mcallii*) as endangered pursuant to the California Endangered Species Act (CESA, specifically Fish and Game Code section 2074.6). The Commission received the petition on June 10, 2014. The attached report represents the Department's final written review of the status of the Flat-tailed Horned Lizard and is based upon the best scientific information available to the Department. In addition to evaluating whether the petitioned action was warranted (i.e., listing as endangered), the Department evaluated whether a listing of threatened was warranted. The status review contains the Department's recommendation that listing of Flat-tailed Horned Lizard as threatened or endangered is not warranted at this time.

Regarding the scientific determinations of the threats to the Flat-tailed Horned Lizard, the Department finds that the species is not at serious risk of extinction or endangerment due to the threats identified in the Petition and addressed in the attached status review.

If you have any questions or need additional information, please contact Rick Mayfield, Acting Chief, Wildlife Branch at (916) 445-3555 or (805) 914-9323.

Attachment

STATE OF CALIFORNIA
NATURAL RESOURCES AGENCY
DEPARTMENT OF FISH AND WILDLIFE

REPORT TO THE FISH AND GAME COMMISSION
A STATUS REVIEW OF THE
FLAT-TAILED HORNED LIZARD
(*PHRYNOSOMA MCALLII*) IN CALIFORNIA

CHARLTON H. BONHAM, DIRECTOR
CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

September 2016

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ACKNOWLEDGMENTS

This status review report was prepared by Laura Patterson. Betsy Bolster, Melanie Day, Margaret Mantor, and Sarah Wassmund provided assistance with portions of the report. Kristi Cripe prepared the figures; she, Melanie Gogol-Prokurat, Sandra Hill, and Diane Mastalir provided GIS analysis and maps. Preliminary review of a draft document was provided by the following California Department of Fish and Wildlife staff: Betsy Bolster, Eric Hollenbeck, Margaret Mantor, and Magdalena Rodriguez. The author received additional assistance from the following California Department of Fish and Wildlife employees: Jack Crayon and Eric Weiss.

The Department is extremely grateful for the valuable comments provided on an earlier draft of this report by the following reviewers: Cameron Barrows, Jim Rorabaugh, Kevin Young, and members of the Flat-tailed Horned Lizard Management Oversight Group and Interagency Coordinating Committee, particularly Rob Lovich. The conclusions in this report are those of the Department of Fish and Wildlife and do not necessarily reflect those of the reviewers.

The cover photograph was provided by Bruce Edley.

EXECUTIVE SUMMARY

On June 10, 2014, the California Fish and Game Commission (Commission) received "A Petition to List the Flat-tailed Horned Lizard (*Phrynosoma mcallii*) as Endangered under the California Endangered Species Act" (hereafter, the Petition), as submitted by the Center for Biological Diversity. At its public meeting on February 12, 2015 in Sacramento, California, the Commission considered the Petition, the California Department of Fish and Wildlife's (Department) petition evaluation and recommendation, and comments received. The Commission determined that sufficient information existed to indicate the petitioned action may be warranted and accepted the Petition for consideration. Upon publication of the Commission's notice of its findings, the Flat-tailed Horned Lizard was designated a candidate species on March 6, 2015.

The report contains the results of Department's status review, including independent peer review of the draft report by scientists with expertise relevant to the Flat-tailed Horned Lizard. Additionally, it provides the Commission with the most current, scientifically-based information available on the status of the Flat-tailed Horned Lizard in California and serves as the basis for the Department's recommendation to the Commission.

Flat-tailed Horned Lizards are typical of other horned lizards in the genus *Phrynosoma*, which are characterized by an ant-rich diet, squat dorsoventrally flattened bodies, cranial horns, body fringe, cryptic coloration, reluctance to run when approached, and a long active period. Flat-Tailed Horned Lizards have a relatively low reproductive output compared to other horned lizards and rarely live beyond three years. Ants, primarily harvester ants, comprise 97% of their diet, higher than any other species of horned lizard, but they also can opportunistically consume large quantities of smaller ants and other invertebrates. They have relatively long active seasons compared to other horned lizards and large home ranges for their size.

The Flat-tailed Horned Lizard has the smallest range of any horned lizard found within the United States and has among the smallest distributions of all horned lizards. The species is restricted to appropriate substrates within southeastern California, the extreme southwestern portion of Arizona, and the adjacent portions of northeastern Baja California and northwestern Sonora, Mexico. Approximately one-quarter of the species' range is within California, where it is confined to lower elevations throughout much of the Salton Trough, in sections of eastern San Diego County, central Riverside County, and western and southern Imperial County.

High quality Flat-tailed Horned Lizard habitat is characterized as areas of low relief with finely packed sandy soils that are covered with loose, fine, wind-blown sands. Favorable habitat is typically associated with the creosote bush shrub community, especially a creosote-bursage assemblage. Flat-tailed Horned Lizards have been recorded in a broad range of habitats in California, including sandy flats and hills, badlands, salt flats, and gravelly soils. They have also been found on rocky slopes at lower elevations, along the vegetated edges of active sand dunes, on stabilized sand fields, and, less frequently, within active dunes themselves. The species has also been observed in low densities using fallowed agricultural fields dominated by non-native weedy species.

Flat-tailed Horned Lizards have lost a substantial amount of habitat within their historical range in California due primarily to flooding of the Salton Sea in the early 1900s and urban and agricultural development in the Imperial, Coachella, and Borrego Valleys. The exact amount of habitat loss is difficult to determine as the species' current and historic range boundaries are not well-understood, a common problem for cryptic species. However, habitat loss has been estimated at approximately 60% in Imperial County, greater than 90% in Riverside County, and 10% in San Diego County.

Historically Flat-tailed Horned Lizards were considered rare and uncommon in many places, while simultaneously being considered the most common reptile in others, the former potentially owing to the species' cryptic coloration and low detectability. Loss of habitat and accounts of localized declines led to concern for the status of Flat-tailed Horned Lizards in the 1970s. Rangewide surveys in California were conducted in the late 1970s to determine the species' distribution and abundance, and population monitoring has occurred regularly since then. These surveys have revealed that Flat-tailed Horned Lizard abundance can fluctuate significantly over short periods of time, most often in response to precipitation and commensurate availability of resources. The species' low detectability and variable annual abundance makes identifying population declines challenging; however, the data available suggest the species is still relatively widespread, and significant, ongoing declines in abundance have not been reported over much of the species' range. The exception is the Coachella Valley, where the species has been extirpated from many of the locations it once inhabited as recently as the 1980s, and the remaining populations are small and isolated.

The Flat-tailed Horned Lizard is designated as a Priority 2 Species of Special Concern by the Department and as Sensitive Species by the Bureau of Land Management (BLM). The species was previously petitioned for listing as endangered under the California Endangered Species Act (CESA) in 1988. In 1989, the Department recommended the Commission list the Flat-tailed Horned Lizard as a threatened species under CESA, but the Commission voted against listing, citing insufficient scientific information on population densities. In 1993, the United States Fish and Wildlife Service (USFWS) published a proposed rule to list the Flat-tailed Horned Lizard as threatened under the federal Endangered Species Act (ESA). In 1997, multiple State and federal agencies entered into an Interagency Conservation Agreement to implement a Rangewide Management Strategy (RMS) aimed at maintaining self-sustaining populations of Flat-tailed Horned Lizards in perpetuity. That year, the USFWS withdrew its proposed listing rule. Subsequently, multiple court decisions led to the USFWS re-instating the proposed rule and re-evaluating the available data. After each reconsideration of the best science available, the agency determined that listing under the ESA was not warranted in 2003, 2006, and most recently in 2011. The Flat-tailed Horned Lizard is a covered species under the Coachella Valley Multiple Species Habitat Conservation Plan (CVMSHCP).

Approximately 77% of the Flat-tailed Horned Lizard's range in California is managed by public entities, and approximately 99% of those public lands are managed by agencies that implement the Flat-tailed Horned Lizard RMS. Approximately 60% of the species' range in California is managed by the BLM. Four Flat-tailed Horned Lizard Management Areas, comprising approximately 21% of the species' range in California, and one Research Area (5%) have been designated in California under the RMS. There are several conservation measures in the RMS, including population monitoring and research conducted in these areas. Additionally, within the Management Areas, there is a 1% cap on permanent habitat disturbance and a requirement for mitigation in the form of financial compensation for lost habitat. These funds are primarily used to acquire private inholdings within the Management Areas to ensure there are large areas of relatively intact habitat available for the species.

The Department has identified the following factors as potential threats to the continued existence of Flat-tailed Horned Lizards in California: habitat loss, degradation, and fragmentation associated with urban and renewable energy development, mining, off-highway vehicle use, and border activities; habitat fragmentation and mortality associated with heavily traveled roads; human subsidized predation; invasive species; and climate change. Overexploitation, competition, and disease are not considered threats to the species at this time.

Urban development in Imperial County along the shores of the Salton Sea, particularly on the east side, could eliminate the only potential habitat corridor between the population east of the Imperial Valley and the Dos Palmas population. Urban development in the Coachella Valley has already been planned and permitted through the CVMSHCP. Expansion of renewable energy development is expected to continue within the Flat-tailed Horned Lizard's range. Phase I of the Desert Renewable Energy Conservation Plan (i.e., the BLM Land Use Plan Amendment) is expected to reduce impacts to the species by focusing most renewable energy development on or near existing disturbed areas and existing transmission lines as opposed to relatively undisturbed open desert. However, the lack of county and city participation in the plan at this time could compromise its efficacy if relatively undisturbed private and local government managed lands are developed.

Sand and gravel mining are the most common mining activities currently within the Flat-tailed Horned Lizard's range, but the area available for mineral extraction in Imperial County is largely depleted. In addition, oil, gas, and gold exploration have proven unprofitable. Therefore, the threat to Flat-tailed Horned Lizards posed by mining is considered relatively small.

Off-highway vehicle (OHV) activity can degrade habitat quality and directly kill Flat-tailed Horned Lizards, but there is little evidence of significant population declines as a result of OHV activity. Nevertheless, it is reasonable to expect that where OHV use substantially reduces native shrubs or prey it may pose a threat to the species, particularly in areas where these habitat features are scarce.

Illegal immigration and narcotics smuggling across the California-Mexico border and U.S. Customs and Border Protection's infrastructure and operations degrade Flat-tailed Horned Lizard habitat near the border and may fragment populations. Both involve cross-country (i.e., off-trail) OHV travel and subsidize predators of Flat-tailed Horned Lizards, although in different ways. Illegal crossings are often evidenced by trash that attracts predators, while the border fence and surveillance towers provide perches and nesting platforms for them. While there are some adverse impacts to the species associated with construction of the border fence and intensive patrolling in its vicinity, increased border security may also benefit the species by reducing the amount of illegal border crossings and associated trash and cross-country pursuit.

Heavily traveled roads may pose a localized threat to Flat-tailed Horned Lizards through habitat fragmentation and edge effects associated with road mortality, which has the potential to create a population sink on both sides of the road. Major roads are often accompanied by transmission lines, which serve as perches and nesting platforms for avian predators. These types of anthropogenic increases in predation pose a threat to Flat-tailed Horned Lizards, but the severity of the threat likely depends on the vulnerability of the Flat-tailed Horned Lizard population (e.g., small and isolated in Coachella Valley vs. large and relatively intact in the Management Areas) and the surrounding land use. Development is relatively concentrated within the Coachella and Imperial Valleys, and this area of increased predation comprises a small fraction of the Flat-tailed Horned Lizard's range.

Invasive species like Sahara mustard appear to be playing a role in Flat-tailed Horned Lizard declines in portions of the species' range (e.g., the Coachella Valley). The degree to which invasive plants are having widespread population-level impacts, either alone or in conjunction with other factors, throughout the species' range in California is unknown. Invasive grasses increase the risk of fire, but fire is rare within most of the species' range to date.

Flat-tailed Horned Lizards live in a highly arid environment and have evolved with drought. Large, healthy populations are expected to rebound, but droughts, particularly longer droughts, may threaten small, isolated populations like those in the Coachella Valley. The threat posed by climate change is equivocal, and the degree to which it will threaten the continued survival of the species is unknown.

Listing under CESA would likely afford Flat-tailed Horned Lizards better protection through greater consideration during environmental planning and consultation with the Department, particularly for projects undertaken by State, local governments, and private citizens. As a Species of Special Concern, State and federal environmental review programs typically include assessment and disclosure of potential impacts to the Flat-tailed Horned Lizard in the California Environmental Quality Act and National Environmental Policy Act process. Adequate environmental review, coupled with continued implementation of the RMS and CVMSHCP, should reduce the likelihood that the aforementioned threats will significantly adversely impact Flat-tailed Horned Lizards in the foreseeable future.

A number of recommended management actions are described in the report. These actions could be undertaken, whether or not the Flat-tailed Horned Lizard is listed under CESA, by the Department as well as by other public agencies, non-governmental organizations, and private landowners in some cases. These include: re-evaluating the species' status in three to five years, increasing the Department's participation in RMS implementation, improving population and habitat monitoring, increasing habitat quality and quantity, reducing habitat fragmentation and its effects, reducing habitat loss and edge effects from renewable energy projects, and further investigating the impacts and potential uses of translocation.

The Department provides this status review report, including its recommendation, to the Commission in an advisory capacity based on the best scientific information available. In addition to evaluating whether the petitioned action (i.e., listing as endangered) was warranted, the Department also considered whether listing as threatened under CESA was warranted. In consideration of the scientific information contained herein, the Department has determined that listing the Flat-tailed Horned Lizard as either threatened or endangered under CESA is not warranted at this time.

REGULATORY FRAMEWORK

Petition Evaluation Process

“A Petition to List the Flat-tailed Horned Lizard (*Phrynosoma mcallii*) as Endangered under the California Endangered Species Act” (Petition) was submitted to the Fish and Game Commission (Commission) on June 10, 2014 by the Center for Biological Diversity. Commission staff transmitted the Petition to the Department of Fish and Wildlife (Department) pursuant to Fish and Game Code section 2073 on June 12, 2014, and published a formal notice of receipt of the Petition on July 11, 2014 (Cal. Reg. Notice Register 2014, No. 28-Z, p. 1238). The Department’s charge and focus in its advisory capacity to the Commission is scientific. A petition to list or delist a species under the California Endangered Species Act (CESA) must include “information regarding the population trend, range, distribution, abundance, and life history of a species, the factors affecting the ability of the population to survive and reproduce, the degree and immediacy of the threat, the impact of existing management efforts, suggestions for future management, and the availability and sources of information. The petition shall also include information regarding the kind of habitat necessary for species survival, a detailed distribution map, and other factors the Petitioner deems relevant.” (Fish & G. Code, § 2072.3.)

On September 30, 2014, the Department provided the Commission with its evaluation of the Petition, “Evaluation of the Petition from the Center for Biological Diversity to List the Flat-Tailed Horned Lizard (*Phrynosoma mcallii*) as Endangered Under the California Endangered Species Act,” to assist the Commission in making a determination as to whether the petitioned action may be warranted based on the sufficiency of scientific information. (Fish & G. Code, §§ 2073.5 & 2074.2; Cal. Code Regs., tit. 14, § 670.1, subds. (d) & (e).) Focusing on the information available to it relating to each of the relevant categories, the Department recommended to the Commission that the Petition be accepted.

At its scheduled public meeting on February 12, 2015, in Sacramento, California, the Commission considered the Petition, the Department’s petition evaluation and recommendation, and comments received. The Commission found that sufficient information existed to indicate the petitioned action may be warranted and accepted the Petition for consideration. Upon publication of the Commission's notice of its findings, the Flat-tailed Horned Lizard was designated a candidate species on March 6, 2015 (Cal. Reg. Notice Register 2015, No. 10-Z, p. 410).

Status Review Overview

The Commission’s action designating the Flat-Tailed Horned Lizard as a candidate species triggered the Department’s process for conducting a status review to inform the Commission’s decision on whether to list the species. At its scheduled public meeting on February 11, 2016, in Sacramento, California, the Commission granted the Department a six-month extension to facilitate external peer review.

This written status review report, based upon the best scientific information available and including independent peer review of the draft report by scientists with expertise relevant to Flat-tailed Horned Lizard, is intended to provide the Commission with the most current information available on the Flat-tailed Horned Lizard and to serve as the basis for the Department’s recommendation to the Commission on whether the petitioned action is warranted. The status review report also presents identification of habitat that may be essential to the continued existence of the species and provides management recommendations for recovery of the species. (Fish & G. Code, § 2074.6.). Receipt of this report is to be placed on the agenda for the next available meeting of the Commission after delivery. At that time, the report will be made available to the public for a 30-day public comment period prior to the Commission taking any action on the Petition.

Existing Regulatory Status

The Flat-tailed Horned Lizard was the subject of a previous CESA listing petition. Dr. Wilbur Mayhew and Ms. Barbara Carlson of the University of California at Riverside petitioned the Commission to list the Flat-tailed Horned Lizard as an endangered species under CESA on January 25, 1988. Consistent with the Department's recommendation, the Commission designated the Flat-tailed Horned Lizard as a candidate species for CESA listing on May 13, 1988. After completing the status review, the Department recommended listing the species as threatened; however, on June 22, 1989, the Commission voted against the proposed listing, citing insufficient scientific information on population densities (FGC 1989).

The Flat-tailed Horned Lizard also has a listing history under the federal Endangered Species Act (ESA). The United States Fish and Wildlife Service (USFWS) initially proposed to list the species as threatened under the ESA in 1993 (USFWS 1993); however, its determination was delayed in part due to Public Law No. 104-6, 109 Stat. 73, enacted in 1995, which placed a moratorium on new species' listings and critical habitat designations under the ESA. The moratorium was lifted in 1996. In 1997, the Department of the Interior Secretary was sued to compel the USFWS to make a listing determination within 60 days, at which point the USFWS withdrew its proposed listing (USFWS 1997). That decision sparked numerous additional court cases, the primary issue of each centered on whether or not the USFWS sufficiently analyzed Flat-tailed Horned Lizard population viability across its entire range. After multiple court-ordered re-evaluations, the USFWS withdrew its proposed rule to list, most recently in 2011 (USFWS 2003, 2006, 2011). One of the contributing factors in the USFWS's decisions not to list the Flat-tailed Horned Lizard was the development of an Interagency Conservation Agreement, signed by multiple federal and State agencies tasked with managing most of the species' habitat in the U.S. and Mexico, and the creation and implementation of a Rangewide Management Strategy (RMS) for the species.

The Flat-tailed Horned Lizard is listed as a Priority 2 Species of Special Concern (SSC) by the Department and as a Sensitive Species by the Bureau of Land Management (BLM). The Department's SSC designation is administrative and is intended to alert biologists, land managers, and others to a species' declining or at-risk status, to encourage additional management considerations for these species to ensure population viability, and to preclude the need for listing under CESA. SSCs are defined as species, subspecies, or distinct populations of an animal native to California that currently satisfies one or more of the following (not necessarily mutually exclusive) criteria: is extirpated from the state within the recent past; is listed under ESA (but not CESA) as threatened or endangered or meets the State's definition of threatened or endangered but has not been formally listed; is experiencing, or formerly experienced, serious (noncyclical) population declines or range retractions (that have not been reversed), which if continued or resumed, could qualify it for threatened or endangered status under CESA; has naturally small populations and/or range size and exhibits high susceptibility to risk from any factor(s) that, if realized, could lead to declines that would qualify it for threatened or endangered status (Thomson et al. 2016).

Neither of these designations provides the species with formal regulatory status like the ESA or CESA (see “Existing Management” section); however, the RMS requires conservation measures, including compensatory mitigation for, and a 1% cap on, permanent surface disturbance, within the Flat-tailed Horned Lizard Management Areas (MA) (Figure 1). There are four MAs within California (Borrego Badlands, West Mesa, Yuha Basin, and East Mesa) that comprise a minimum of 21% of the species’ range in the State (using the Department’s estimated current range map), as well as one Research Area (RA; Ocotillo Wells State Vehicular Recreation Area). Collectively, the MAs and RA will be referred to as the “RMS areas” in this status review. More information on the protections afforded to and efforts aimed at conserving the Flat-tailed Horned Lizard, including monitoring the species’ distribution through occupancy studies and its trends in abundance through demography surveys, is provided in the “Status and Trends in California” and “Existing Management” sections.

BIOLOGY AND ECOLOGY

Species Description

The Flat-tailed Horned Lizard, like all horned lizards in the genus *Phrynosoma*, has a dorsoventrally flattened body with spiny scales, including head spines or “horns,” and cryptic coloration, ranging from pale gray to light rust brown, which closely matches the substrate on which it lives. The Flat-tailed Horned Lizard has multiple diagnostic traits that distinguish it from other horned lizards, including a distinctive dark mid-dorsal stripe with a series of dark spots on either side; particularly long sharp occipital horns; a prominent umbilical scar on an otherwise unspotted white or cream venter; and, as its name suggests, a relatively long broad flattened tail (Funk 1981, Muth and Fisher 1992, Sherbrooke 2003, Young and Young 2000). Flat-tailed horned lizards also possess two lateral fringe scale rows and lack external ear openings (Funk 1981, Johnson and Spicer 1985). While adults can grow up to, and possibly greater than, 87 mm (3.4 in) snout-to-vent length (i.e., excluding tail length) (Boundy and Balgooyen 1998, McGrann et al. 2006), they typically range in size from 57-84 mm (2.2-3.3 in), while hatchlings are about 35-38 mm (1.4-1.5 in) (Howard 1974).

Taxonomy

Flat-tailed Horned Lizards (Class Reptilia, Order Squamata) belong to the Family Phrynosomatidae, a large and diverse group that, in addition to horned lizards, includes zebra-tailed, earless, rock, spiny, fringe-toed, tree, brush, and side-blotched lizards. Hallowell (1852) classified the species as *Anota m’callii*, but the current species’ classification is *Phrynosoma mcallii* (Crother et al. 2012). The genus *Phrynosoma* consists of a unique group of lizards known commonly as horned lizards or colloquially as horned toads (in Greek *phrynos* = toad and *soma* = body). This group, compared to other lizards, is characterized by strongly dorsoventrally flattened bodies; sharp spines; a reluctance to run when approached; long

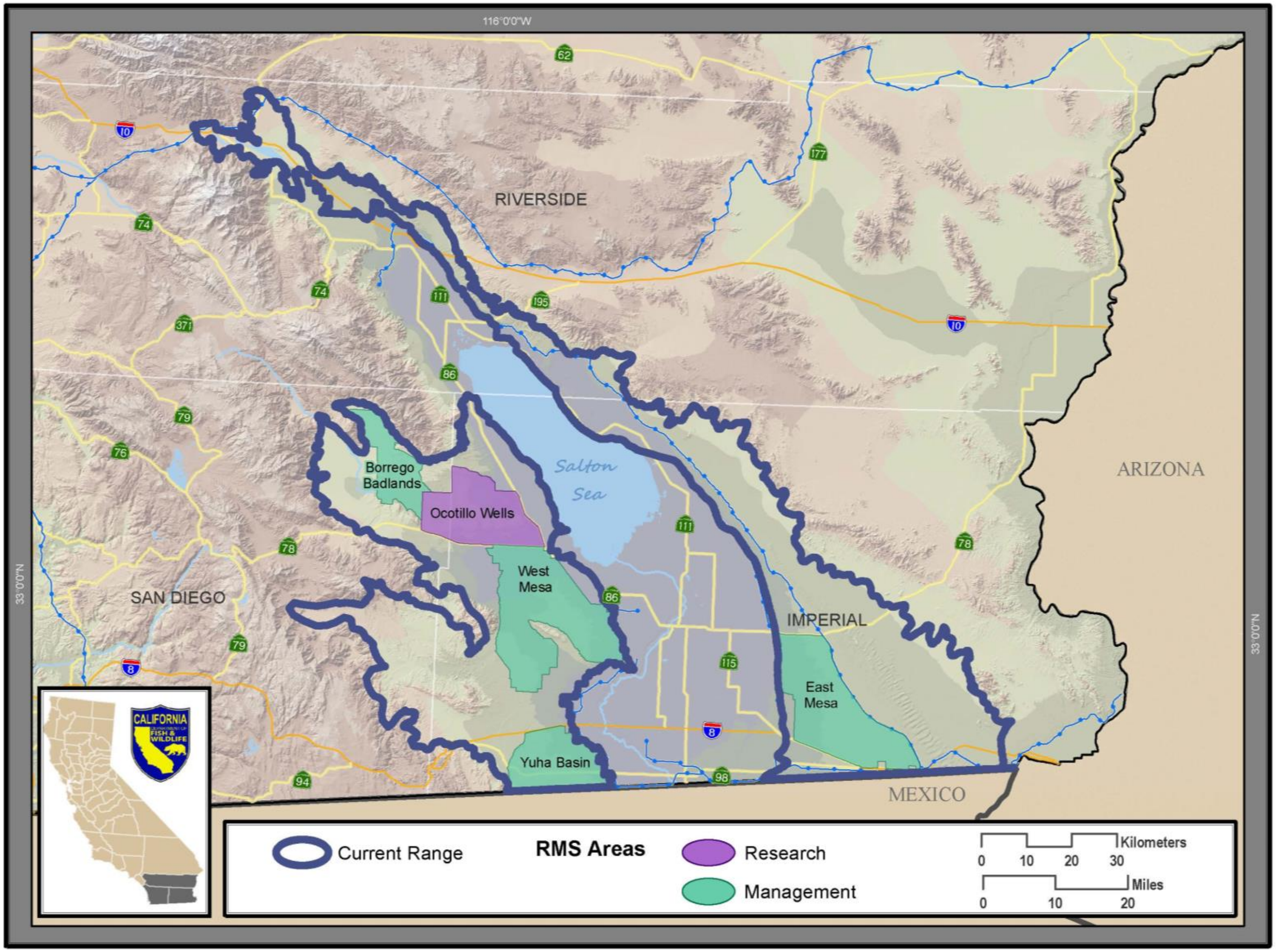


Figure 1. Flat-tailed Horned Lizard RMS Areas in California

Sources: CDFW GIS Library, FTHLICC

activity period; more variable body temperatures; a specialized, often ant-rich, diet; and specialized dentition that facilitates ant-eating (Pianka and Parker 1975).

Genetics

There are no recognized subspecies of Flat-tailed Horned Lizards (Crother et al. 2012), but two major clades (genetically similar groups) exist east and west of the Colorado River (Culver and Dee 2008, Mulcahy et al. 2006). The western clade is predominantly located in California and shows signs of some genetic differentiation east and west of the currently developed areas of the Imperial Valley using mitochondrial DNA (Mulcahy et al. 2006); however, there was no evidence of genetic differentiation among the California populations using microsatellite data (Culver and Dee 2008). The results of these studies suggest that the historic periodic flooding, which occurred in the Salton Trough, may have temporarily isolated Flat-tailed Horned Lizard populations east and west of the Imperial Valley and led to some divergence; however, limited gene flow across this area did occur when the area was dry, and records from the early to mid-1900s indicate the species occurred in this area prior to relatively recent human development (Mulcahy et al. 2006). Hybrids with morphological characters that are intermediate between Flat-tailed Horned Lizards and Desert Horned Lizards (*P. platyrhinos*) have been reported from near Ocotillo, California (Stebbins 2003) and between Flat-tailed Horned Lizards and Goode's Horned Lizards (*P. goodei*) near Yuma, Arizona (Mulcahy et al. 2006). A landscape genomics study through the Smithsonian National Museum of Natural History, funded by the RMS member agencies, is currently underway and is expected to provide a more thorough understanding of the relationships among and within currently geographically isolated Flat-tailed Horned Lizard populations.

Geographic Range and Distribution

The Flat-tailed Horned Lizard has the smallest range of any horned lizard found within the United States and has among the smallest ranges of all horned lizards (Sherbrooke 2003). The species is restricted to southeastern California, the extreme southwestern portion of Arizona, and the adjacent portions of northeastern Baja California and northwestern Sonora, Mexico (Funk 1981). The majority of the species' range is within Mexico, while the majority of the U.S. range is within California (USFWS 2011). In California, Flat-tailed Horned Lizards are distributed throughout much of the Salton Trough, in sections of eastern San Diego County, central Riverside County, and western and southern Imperial County. Flat-tailed Horned Lizards are most frequently found below 230 m (750 ft) in elevation, although they have been reported up to 520 m (1,700 ft) above sea level (Turner et al. 1980). The boundaries of the species' current and historical range are not precisely understood (FTHLICC 2003) (see "Range" in the "Status and Trends in California" section). Figure 2 shows the Department's best approximation of the Flat-tailed Horned Lizard's current potential range (referred to as "Current Range" in map legends), compared to the historic distribution estimated by the Flat-tailed Horned Lizard Interagency Coordinating Committee (FTHLICC 2003). These boundaries represent a coarse-scale approximation of the maximum extent that Flat-tailed Horned Lizards may occur where suitable habitat is present. The boundaries are based on aerial imagery interpretation of disturbed lands (e.g., urban and agricultural areas), soil types, elevation, and slope, when possible. Not all areas within the current range are occupied, and the species' current distribution is better understood in some areas (e.g., Coachella Valley) more than others.

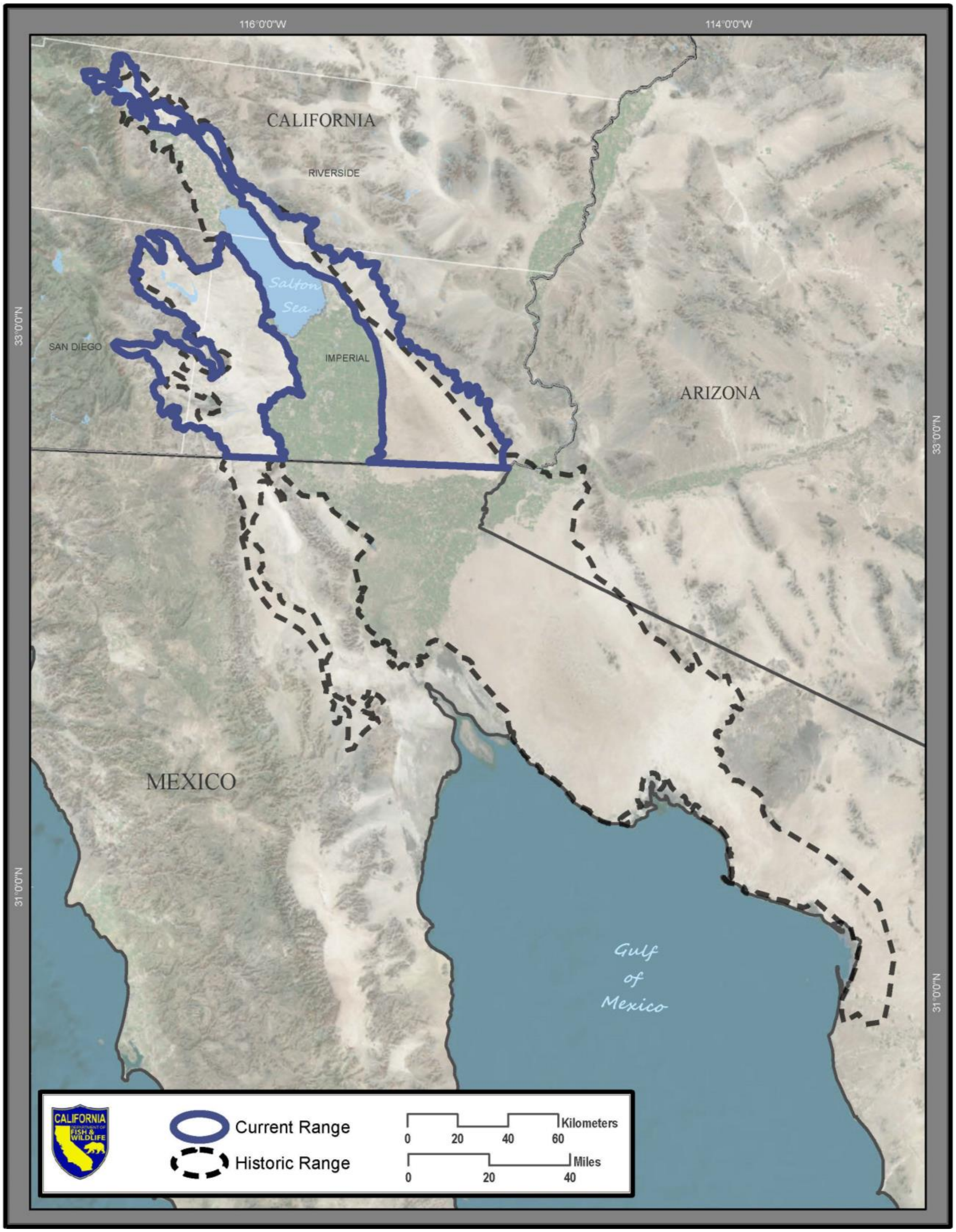


Figure 2. Flat-tailed Horned Lizard Current and Historic Range

Sources: CDFW GIS Library, FTHLICC

Figure 3 shows the distribution of Flat-tailed Horned Lizard observations categorized by date and depicting the RMS areas, as well as the two Coachella Valley Conservation Areas that are currently supporting Flat-tailed Horned Lizard populations. These observations do not represent an equal level of survey effort spatially or temporally, some historic records may not be mapped accurately, and some observations may be misidentifications with the co-occurring Desert Horned Lizard, so interpretation regarding current or historic occupancy in areas with no observations should be undertaken with some caution (see “Distribution” in the “Status and Trends in California” section below).

Growth, Reproduction, and Survival

Flat-tailed Horned Lizards have relatively long active periods, on average 277 days/year at one site in California, without any prolonged periods of inactivity or aestivation (dormancy during the summer) (Muth and Fisher 1992), providing ample time for growth and reproduction when conditions are favorable. Brumation (dormancy in the winter) usually begins on average in mid-November but can range from October through December (Grant and Doherty 2009, Muth and Fisher 1992, Wone and Beauchamp 2003), although some individuals, particularly juveniles, remain active in the winter (Muth and Fisher 1992). Muth and Fisher (1992) speculate that juveniles may not have the fat reserves to survive winter without feeding, or they may remain active to attain minimum reproductive size (60-66 mm [2.4-2.6 in]) (Howard 1974, Root 2010) as quickly as possible. Work by Grant and Doherty (2006) supports this notion; the smaller the Flat-tailed Horned Lizard, the more likely it was to delay entering brumation. Time of emergence from brumation is variable and can range from December to April, but typically occurs in February (Mayhew 1965, Wone and Beauchamp 2003). When surface temperatures reach 50°C (122ºF), most Flat-tailed Horned Lizards will retreat into self-constructed burrows or bury themselves in the sand, although Young and Young (2000) observed them at surface temperatures of 55°C (131ºF).

Flat-tailed Horned Lizards are oviparous (egg-laying) and are generally capable of mating upon emergence from brumation if they have reached the size of sexual maturity (Howard 1974, Muth and Fisher 1992). Females are capable of producing two separate clutches of eggs in good years with the first hatchlings appearing mid to late July, and the second set from late August through October (Howard 1974, Muth and Fisher 1992, Turner and Medica 1982). However, in dry years, females may only produce a single clutch that does not hatch until late August or September (Setser 2001, Young and Young 2000). The hatchling cohorts have a dramatic effect on the age structure of populations over the course of a year. Muth and Fisher (1992) observed that in May, 88% of the population was composed of adult-sized Flat-tailed Horned Lizards, but by September, 79% of the population was composed of juvenile-sized individuals.

Gravid females deposit their eggs in deep burrows over a period of two to four days (Young and Young 2000). Nests depths are variable depending on substrate and weather conditions (observed range: 14-90 cm [5.5-35.4 in]) but are deep enough to ensure that the eggs are laid in moist soil (Setser 2001, Young and Young 2000). Eggs incubate for approximately 52 days before hatching (Ibid.). Flat-tailed Horned Lizards produce small clutches (averaging 4.7 ± 0.16 eggs) and have the lowest productivity index (i.e., average clutch size x frequency) of the seven southwest horned lizard species studied by Howard (1974).

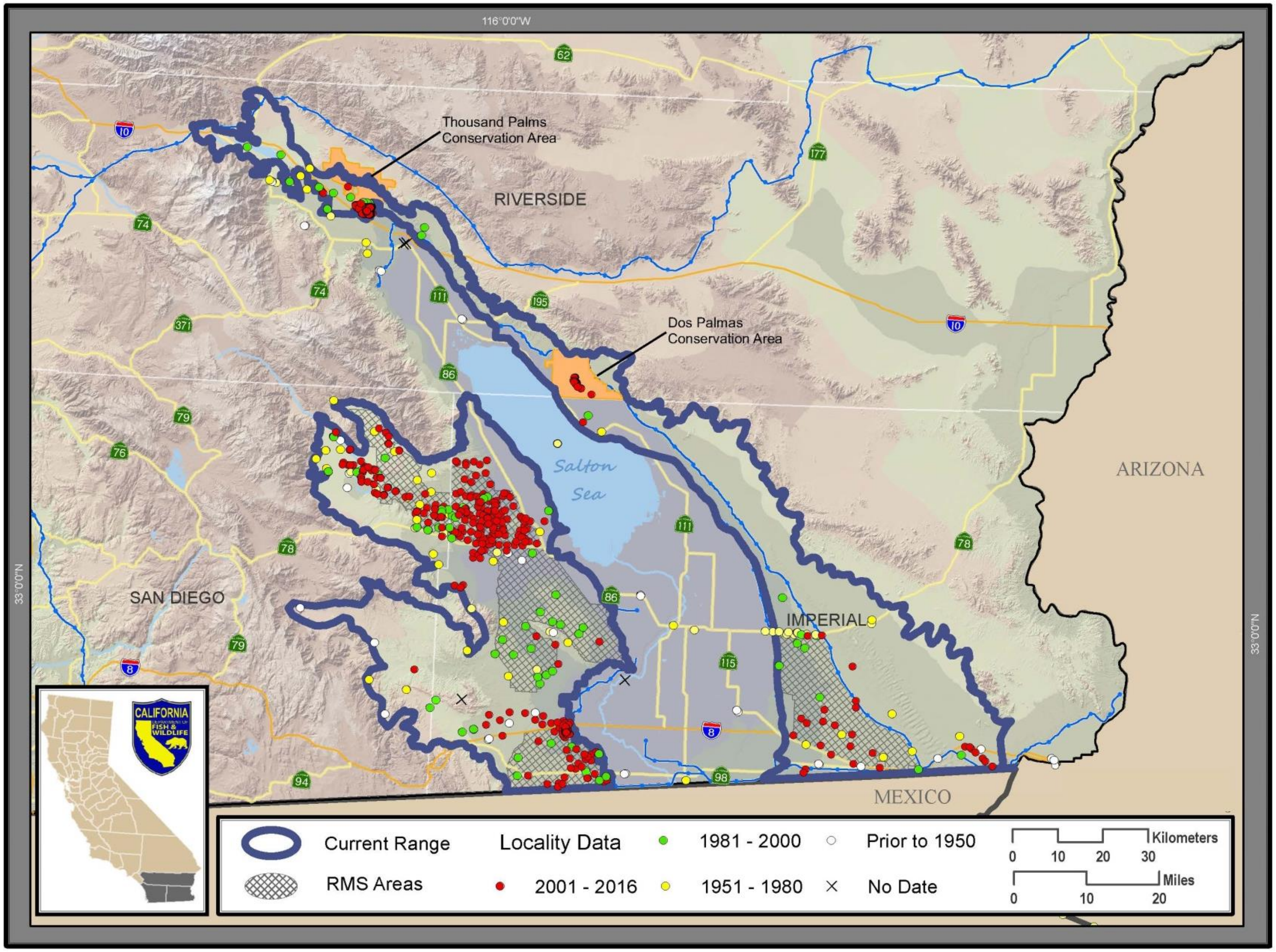


Figure 3. Flat-tailed Horned Lizard Observations in California

Sources: Cameron Barrows, CDFW Data Library, CDPR, CNDDB, CVMSHCP, FTHLICC, H.E.R.P., HerpNET

Juveniles grow quickly, but growth rate appears to be dependent on when and where hatchlings were born and resource availability. Under favorable conditions, hatchlings born in the first cohort are able to reach adult size prior to brumation and thus are able to breed at the beginning of the next year's active season, while hatchlings from a second cohort may not mature until the middle of the following summer, delaying breeding until their second year (Muth and Fisher 1992, Turner and Medica 1982, Young and Young 2000). Drought may also delay sexual maturity, since growth rates slow under these conditions (Young and Young 2000).

Flat-tailed Horned Lizards are typically short-lived, rarely surviving past three years of age, but individuals can live four or even six years (FTHLICC 2003, Leavitt 2013b, Young and Young 2000). Muth and Fisher (1992) estimated the mean annual survival rate at approximately 53% at a military site in the West Mesa MA, noting the lowest survival rates occurred in spring and summer. During brumation, survival is typically 100% (Grant and Doherty 2009, Muth and Fisher 1992). Barrows and Allen (2009) recorded 55-75% survival in the first year, 2-19% survival in the second year, and 2% survival in the third year. Annual survival estimates from demography surveys on East Mesa and West Mesa MAs between 2007 and 2013 varied substantially, ranging from 27%-70% and 4%-59%, respectively (Leavitt 2013b). Leavitt (2013b) noted that these estimates suggest low annual survival is the norm.

The largest natural cause of Flat-tailed Horned Lizard mortality is predation, which, based on telemetry data, has been recorded as high as 40-50% of the population in certain years (Goode and Parker 2015, Muth and Fisher 1992, Young and Young 2000). Primary predators of Flat-tailed Horned Lizards are Loggerhead Shrikes (*Lanius ludovicianus*) and Round-tailed Ground Squirrels (*Xerospermophilus tereticaudus*), but they are also preyed upon by a number of other reptiles, birds, and mammals, including Sidewinders (*Crotalus cerastes*), Coachwhips (*Coluber flagellum*), American Kestrels (*Falco sparverius*), Common Ravens (*Corvus corax*), and Kit Foxes (*Vulpes macrotis*) (Barrows et al. 2006, Duncan et al. 1994,Goode and Parker 2015, Muth and Fisher 1992, Young and Young 2000). Predation by some species, particularly birds and squirrels, increases near human development due to the availability of subsidized resources such as water and artificial perches (Barrows et al. 2006, Young and Young 2005).

To avoid predation, Flat-tailed Horned Lizards rely on their cryptic coloration and typically freeze instead of fleeing (Wone and Beauchamp 1995b). This can make them especially vulnerable to road mortality, which has also been suggested as a substantial source of mortality (Muth and Fisher 1992, Turner et al. 1980, Young and Young 2000). A draft population viability analysis (PVA) suggested that Flat-tailed Horned Lizard persistence is particularly sensitive to changes in mortality versus other factors such as reproductive output or growth (Fisher et al. 1998, FTHLICC 2003).

Diet and Food Habits

According to Johnson and Spicer (1985), although the Flat-tailed Horned Lizard is remarkably swift compared to other horned lizards, it is basically a “sit and wait” predator. Ants comprise 97% of the Flat-tailed Horned Lizard’s diet, higher than any other horned lizard species reviewed in Pianka and Parker (1975). Flat-tailed Horned Lizards primarily eat native harvester ants (genera *Messor* and *Pogonomyrmex*) but are known to eat smaller ants and other invertebrates opportunistically as well (FTHLICC 2003, Turner and Medica 1982, Young and

Young 2000). During a severe drought in 1997, Young and Young (2000) found less than half the number of ants per scat compared to scat collected during wetter years, and they observed that Flat-tailed Horned Lizards lost weight during drought conditions. In drought years, annual vegetation is depressed, resulting in decreased seed abundance, which in turn negatively affects the harvester ants that feed primarily on seeds (Barrows and Allen 2009). Freestanding water and dew are not commonly available in Flat-tailed Horned Lizard habitat, although Johnson and Spicer (1985) reported water harvesting by Flat-tailed Horned Lizards in captivity off their backs. In the wild, it is expected that the species primarily relies on preformed water (water found within their food) to maintain proper water balance (FTHLICC 2003).

Home Range and Territoriality

Compared to their size, Flat-tailed Horned Lizards have very large home ranges and do not appear to be territorial (Muth and Fisher 1992). Young (1999) investigated interactions among Flat-tailed Horned Lizards with overlapping home ranges and found that lizards were actively avoiding each other. Home range sizes among individual Flat-tailed Horned Lizards can vary widely even in the same area, but method of data collection and analysis, location, season, sex, climatic conditions, and density dependence may all be influential. Goode and Parker (2015) measured male home ranges from 0.04-6.8 ha (1-17 ac), and female home ranges from 0.02-14.5 ha (0.5-36 ac). These ranges overlap the lowest and highest mean home range sizes observed by other researchers (Muth and Fisher 1992, Setser 2001, Setser and Young 2000, Turner and Medica 1982, Young and Young 2000). Males appear to have larger home ranges than females, at least in spring and early summer, which can likely be attributed to searching for mates (Goode and Parker 2015, Setser and Young 2000, Turner and Medica 1982, Young 1999). Some gravid females will leave their home range, traveling as far as 1,647 m (1 mi) to deposit their eggs before returning to their original home range site (Setser 2001, Young and Young 2000). Climatic conditions, specifically drought, are presumed to reduce home range size and activity (Young and Young 2000).

Habitat that May be Essential for the Species' Continued Existence in California

Flat-tailed Horned Lizard habitat is characterized by hot summers ranging from 30-45^{0}C (86-113^{0}F) and generally mild winters in the very low 20s ^{0}C (high 60s, low 70s ^{0}F) (FTHLICC 2003, Johnson and Spicer 1985). Annual rainfall is typically low and varies spatially and temporally (Ibid.). Within the California portion of the species' range, rainfall averages approximately 5.8 cm (2.3 in) in El Centro and 13.5 cm (5.3 in) in Palm Springs (FTHLICC 2003) and predominantly falls during winter. The Arizona portion of the species' range also receives summer monsoonal rains (Johnson and Spicer 1985), which provide relief for plants and animals during a period of high stress (J. Rorabaugh pers. comm.). Flat-tailed Horned Lizard habitat is subjected to frequent drought conditions (Johnson and Spicer 1985) and flash floods during periods of heavy rain (Turner and Medica 1982). Although it is sympatric with the Desert Horned Lizard in some parts of its range, the Flat-tailed Horned Lizard occupies hotter, drier, and more severe habitats than any other *Phrynosoma* spp. (Johnson and Spicer 1985).

According to Turner et al. (1980), the best habitats for Flat-tailed Horned Lizards generally exhibit "surface soils of fine packed sand, or pavement, overlain intermittently with loose, fine sand." Most records of Flat-tailed Horned Lizards come from the creosote bush (*Larrea* *tridentata*)-white bursage (*Ambrosia dumosa*) assemblage, and occasionally saltbush (*Atriplex* spp.) (FTHLICC 2003, Turner et al. 1980). However, Flat-tailed Horned Lizards have been recorded in a broader range of habitats in California than in Arizona, including sandy flats and hills, badlands, salt flats, and gravelly soils (FTHLICC 2003). The species has also been found on rocky slopes at lower elevations, along the vegetated edges of active sand dunes, on stabilized sand fields, and less frequently, within active dunes themselves (Barrows and Allen 2009, Luckenbach and Bury 1983, Turner et al. 1980). The species has also been found in fallowed agricultural fields dominated by non-native weedy species (RECON 2010).

There are five habitats associated with Flat-tailed Horned Lizards in the California Wildlife Habitat Relationships System (CWHR) (Figure 4). CWHR is a state-of-the-art information system for California's wildlife that contains life history, geographic range, habitat relationships, and management information on 712 species of amphibians, reptiles, birds, and mammals known to occur in the state. Desert Scrub, Desert Wash, and Barren are considered high quality habitat for the Flat-tailed Horned Lizard, while Alkali Desert Scrub and Desert Succulent Scrub are considered marginal (CDFW 2014). Desert Scrub habitats typically are open, scattered assemblages of broadleaved evergreen or deciduous microphyll shrubs, usually between 0.5 and 2 m (1.6-6.6 ft) in height; canopy cover is generally less than 50%, usually much less; bare ground is often between plants; and creosote bush is often considered a dominant species (CDFG 1988). Desert Wash habitats are characterized by the presence of arborescent, often spiny, shrubs generally associated with intermittent streams (washes) or drier bajadas (alluvial deposits adjacent to washes), especially in the Sonoran Desert (Ibid.). Barren is considered any habitat with <2% total vegetation cover by herbaceous, desert, or non-wildland species and <10% cover by tree or shrub species (Ibid.).

A number of studies have attempted to identify habitat characteristics that are significantly correlated with presence and abundance of Flat-tailed Horned Lizards, but their results have varied. In most cases, there is a positive correlation between Flat-tailed Horned Lizard abundance and perennial plant density (Altman et al. 1980, Barrows and Allen 2009, Muth and Fisher 1992, Turner and Medica 1982). However, it should be noted that typical Flat-tailed Horned Lizard habitat is sparsely-vegetated, so maximum coverage of perennial plant density is likely never very high at any of the sites. Positive correlations have also been reported between Flat-tailed Horned Lizards and the abundance of sand (Gardner 2005, Hollenbeck 2004, Wright and Grant 2003), as well as harvester ant nests (Altman et al. 1980, Barrows and Allen 2009, Rorabaugh et al. 1987, Turner and Medica 1982). Barrows and Allen (2009) found that soil compaction was significantly correlated with Flat-tailed Horned Lizard abundance in opposite directions on stabilized sand fields (negative) and active dunes (positive), suggesting that the "availability of moderately compacted sands may be important to horned lizards for digging burrows that are used for thermoregulation and nesting." Brehme et al. (2009) observed that Flat-tailed Horned Lizards and other loose sand specialists were more common farther away from the Salton Sea shoreline than more generalist species of lizards, which reportedly benefit from habitat edges. Nearshore areas were dominated by alkali sink vegetation, which was a negative predictor of ant abundance, although harvester ants (*Pogonomyrmex californicus*) were found in similar densities throughout the study area (Ibid.).

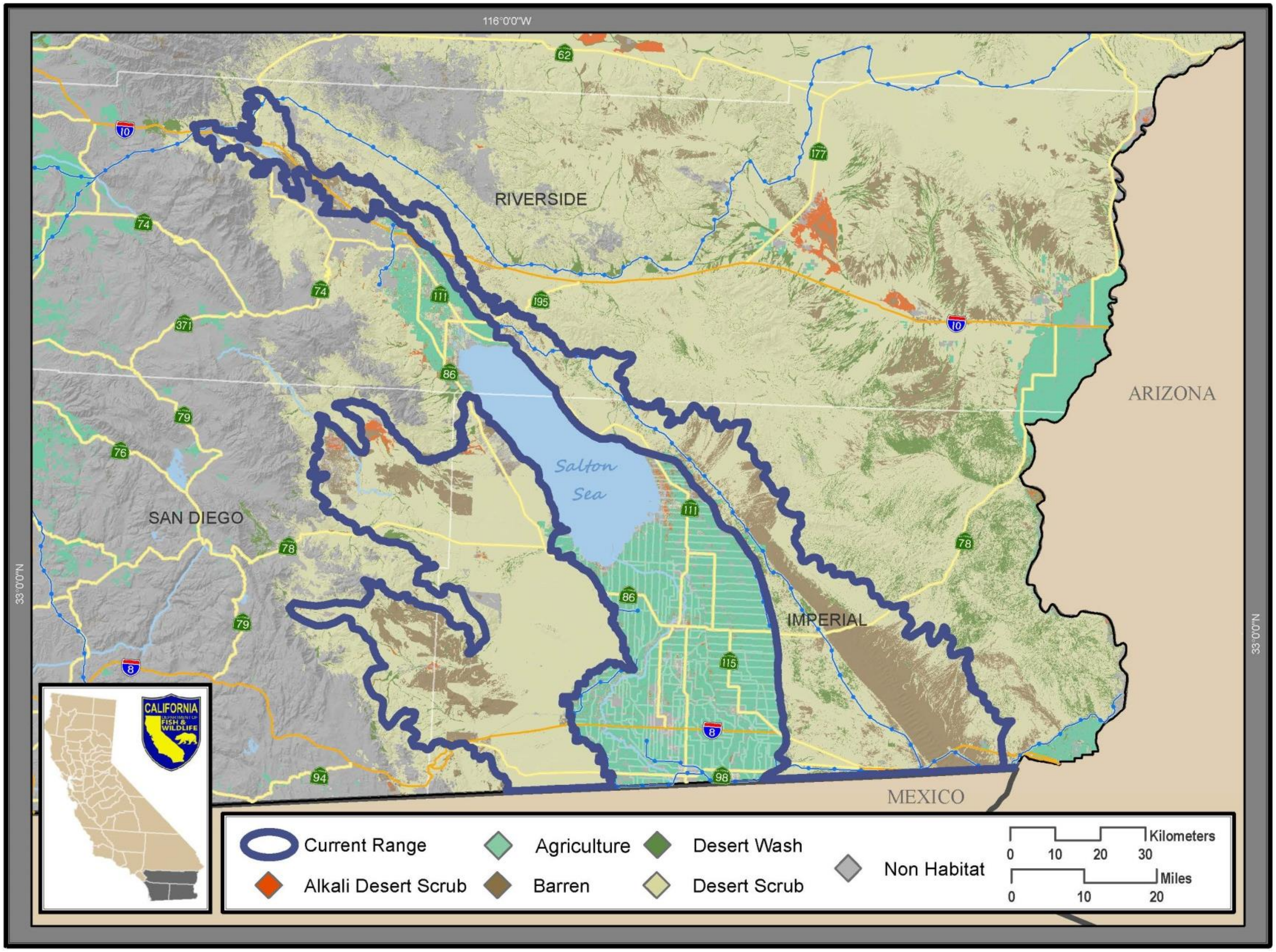


Figure 4. Flat-tailed Horned Lizard Habitat Associations

Sources: CDFW GIS Library

While Flat-tailed Horned Lizards can occur within a variety of different habitat types, it appears there are some minimum habitat requirements for supporting healthy populations. These include loose, friable soils for burrowing, scattered perennial vegetation for cover and thermoregulation, and sufficient populations of ants (C. Barrows pers. comm.[1], Barrows and Allen 2009, Turner et al. 1980). In addition, a rangewide habitat model, funded by the RMS member agencies, is currently underway and is expected to provide valuable insights into the environmental factors that may be used to better predict occupancy and density of Flat-tailed Horned Lizards.

STATUS AND TRENDS IN CALIFORNIA

Range

Uncertainty exists regarding what constituted historically suitable habitat available for the Flat-tailed Horned Lizard in California due in part to periodic Colorado River flooding of the Salton Trough (FTHLICC 2003, USFWS 2011). This uncertainty affects estimates of losses in the species' range and distribution because the vast majority of habitat converted to agriculture and urban development occurs within this area of historical flooding. Based on evidence of the historic Lake Cahuilla's ephemeral persistence and marginal suitability, the USFWS did not consider habitat within the lakebed (Figure 5) as part of the species' historical range (USFWS 2006, 2011).

Buckles et al. (2002) estimated the maximum elevation of Lake Cahuilla was 11.9 m (39 ft) above mean sea level. The lake fully filled 5 or 6 times in the past 1200 years, most recently in the late 1600s, and likely did not dry completely between the three most recent events (Philibosian et al. 2011). Based on an estimated period of 60 years to fully desiccate from peak elevation (Waters 1983), the lakebed likely dried up by the mid-1700s and remained that way until the current Salton Sea formed between 1905 and 1907 as the result of the Colorado River breaking through temporary gates built to control water flowing into irrigation canals for farms in Imperial Valley (Cohn 2000). These accounts, combined with genetic data and observations of Flat-tailed Horned Lizards from within the historic Lake Cahuilla lakebed, suggest at least some of this area would have supported suitable habitat for the species more often than not.

Hodges (1997) included the Salton Trough in her estimate of historic habitat, while omitting areas of unsuitable habitat containing marshes, obvious rocky mountains, new alluvial deposits, and the main body of the Algodones Dunes (Figure 5). Based on this, she concluded that the total possible inhabitable area of historic Flat-tailed Horned Lizard habitat in California was as large as 899,000 ha (2,221,468 ac) (Ibid.). Flooding of the Salton Sea, agricultural development, and urbanization were the primary sources of habitat loss, leading to a reduction in range of approximately 51% in Imperial County, 58% in Riverside County, and 9% in San Diego County (Ibid.). Hodges (1997) considered the Riverside County estimate to be very conservative, and more recently, Barrows et al. (2008) reported that an estimated 83-92% of suitable Flat-tailed Horned Lizard habitat has been lost here excluding the Salton Sea. With the Salton Sea included, the Flat-tailed Horned Lizard's loss of habitat approaches 99% in Riverside County due not only to conversion to golf courses, agriculture, and housing, but also fragmentation with too much edge (see "Fragmentation, Edge Effects, and Small Populations" section) and/or disrupted sand transportation processes (C. Barrows pers. comm.[2]).

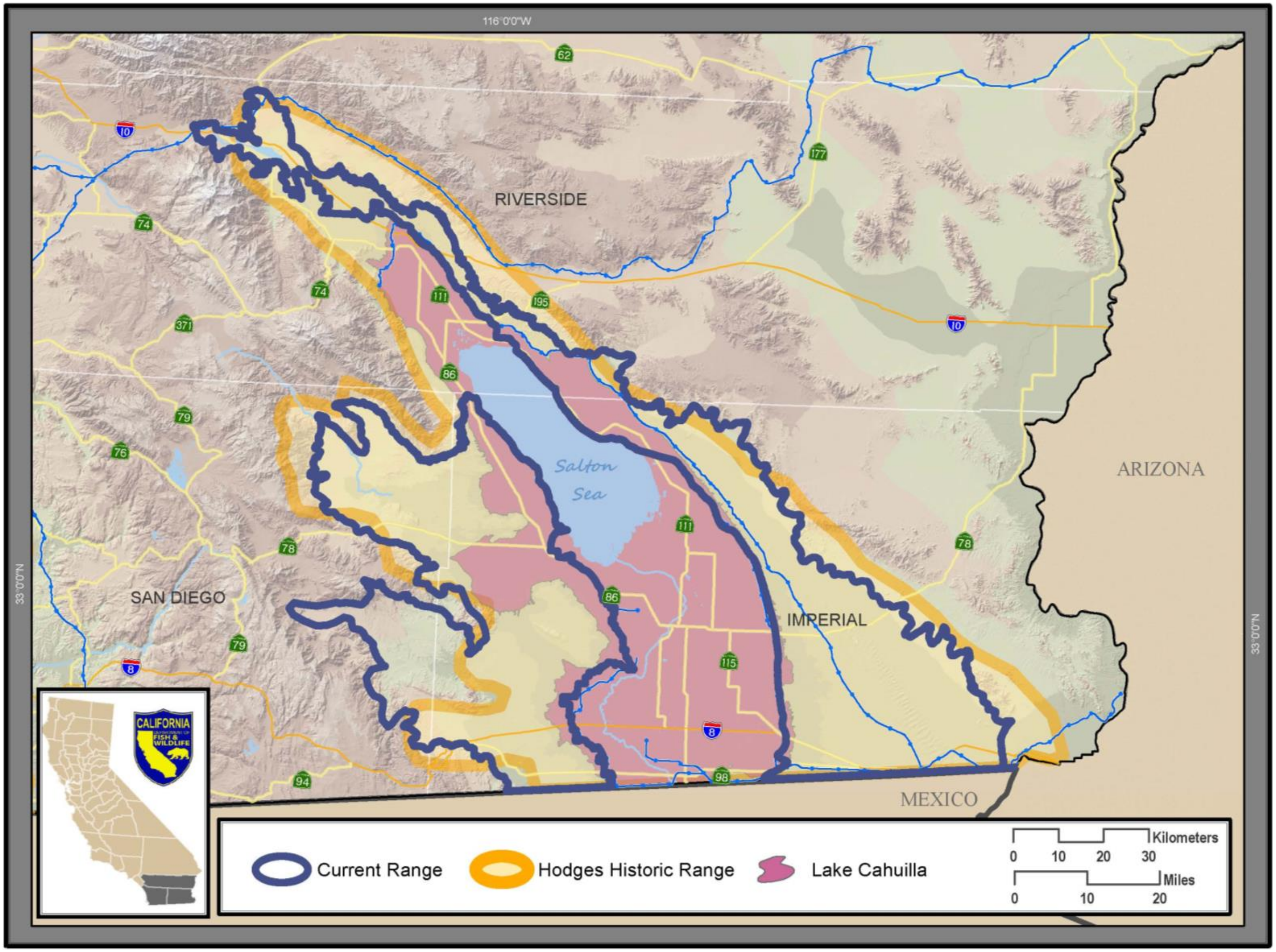


Figure 5. Historical Range Boundary Estimates Compared to Current Range Estimate

Sources: CDFW GIS Library, *sensu* Hodges (1997)

Regardless of the exact amount of loss, it is clear that the current Flat-tailed Horned Lizard range has been reduced from its historical extent due primarily to agricultural and urban development. As a result, connectivity, even if historically infrequent, between the populations east and west of the Imperial Valley has been lost to development, and connectivity between the Coachella Valley and the populations to the south appear to be lost as well, at least along the west side of the Salton Sea. A corridor connectivity study along the east side of the Salton Sea undertaken by the San Diego Natural History Museum, funded by the RMS member agencies, is currently underway and is expected to shed insights into the likelihood and feasibility of connectivity between the East Mesa and Dos Palmas populations.

Distribution

With the exception of the Coachella Valley, the Flat-tailed Horned Lizard's distribution within the species' California range appears to have remained fairly stable in the most of the areas for which data are available. As recently as the early 1980s, Flat-tailed Horned Lizards had a broader distribution in the Coachella Valley, occurring on what is now the Whitewater Floodplain Conservation Area, on the southern flanks of Edom Hill, and at the eastern end of the Indio Hills (CVCC 2013a). Currently, the only presumed remaining populations are on the Thousand Palms Conservation Area and farther south within the Dos Palmas Conservation Area (Ibid). If they do inhabit the other areas, it is at a density below detection levels (Ibid.). Additionally, declines have been observed along Highway 78 north of the East Mesa MA (Turner et al. 1980).

The distribution of Flat-tailed Horned Lizards within the RMS areas has been monitored using survey methods that incorporate the species' low detection probability into estimates of occupancy and local colonization and extinction rates (i.e., occupancy surveys in the RMS). Until recently, these methods included the use of sign (e.g., scat or tracks), which provide a much greater power to detect changes between survey periods than visual confirmation of a Flat-tailed Horned Lizard (Root 2010) but are also problematic. Several studies have demonstrated that Flat-tailed Horned Lizard sign is not always positively correlated with current presence or abundance (Beauchamp et al. 1998, Muth and Fisher 1992, Rorabaugh 1994, Rorabaugh et al. 1987, Turner and Medica 1982, Wone and Beauchamp 1995a, Wright 2002, Young and Young 2000). This is due to any number of reasons, including (1) the fact that substrate and weather (e.g., wind, rain) can affect detectability and persistence (minutes to months) of scat or tracks in the environment (Beauchamp et al. 1998, Rorabaugh 1994); (2) it is impossible to distinguish the difference between multiple scats per lizard vs. several lizards defecating once (Beauchamp et al. 1998); (3) lizards produce fewer and smaller scats during times of low resource availability like drought (Rorabaugh 1994, Young and Young 2000); (4) Flat-tailed Horned Lizard scat are indistinguishable from Desert and Goode's Horned Lizards where they are sympatric (Root 2010, Rorabaugh et al. 1987, Young and Young 2000); and (5) surveyors who concentrate on finding scat invariably find fewer lizards (Wone et al. 1994). At best, scat can serve as an indication that the area was at least used by a Flat-tailed Horned Lizards in areas where they are not sympatric with other horned lizards, even if only to pass through it (Root 2010). Table 1 depicts the estimated likelihood that a Flat-tailed Horned Lizard will be present at a random spot within the RMS areas ± their standard errors (S.E.), based solely on lizard observations (i.e., not including detection of scat).

Table 1. Occupancy Probability Estimates (± S.E.) for California RMS Areas[1]

	East Mesa	West Mesa	Yuha Basin	Borrego Badlands	Ocotillo Wells
2005		0.06 (± 0.03)			
2006	0.44 (± 0.08)				1.00 (± 0.00)
2007					1.00 (± 0.12)
2008			0.56 (± 0.18)		0.66 (± 0.15)
2009		0.86 (± 0.12)			0.86 (± 0.12)
2010	0.75 (± 0.19)				0.85 (± 0.12)
2011				0.42 (± 0.16)	0.91 (± 0.04)
2012				0.20 (± 0.07)	0.84 (± 0.07)
2013				0.10 (± 0.05)	0.78 (± 0.12)

[1] 2005-2010 data from Frary (2011); 2011-2013 data from Leavitt (2013b)

Occupancy probabilities were generally high across the RMS areas, particularly Ocotillo Wells, where extinction (0.07 ± 0.07) and colonization rates (0.00 ± 0.00) were estimated to be low (Leavitt 2013b). Despite being relatively close to Ocotillo Wells, occupancy probability and colonization rate estimates (0.01 ± 0.04) at Borrego Badlands were relatively low, and local extinction rates (0.54 ± 0.19) were predicted to be very high (Ibid.). Leavitt (2013b) posited that indications of a steady decline at Borrego Badlands are likely due to irregular sampling at that location and that this trend is an artifact of a poor sampling regime. Unfortunately, the relatively low power to detect changes from visual-only surveys, coupled with irregular and sometimes inconsistent monitoring on the MAs since 2005, has led in some cases to large standard errors and the inability to estimate population parameters (Grimsley and Leavitt 2016). Properly executed occupancy studies have far greater power to detect long-term changes in distribution when plots are sampled more frequently (i.e., annually vs. biennially or triennially) and all survey passes (days/plot) within the survey year are completed (Leavitt 2013b, Zylstra et al. 2010).

With the exception of the Coachella Valley, there are no quantitative distributional trend data on Flat-tailed Horned Lizards outside of the RMS areas. It should be noted that the MAs were chosen because they were thought to represent some of the highest quality contiguous habitat available to the species, and there are limits on permanent surface disturbance within them. Therefore, extrapolation of these occupancy estimates to the rest of the species' range may not be prudent because the relative quality of those habitats, as it compares to the RMS areas, is unknown.

Abundance

Obtaining reliable rangewide abundance or density estimates for Flat-tailed Horned Lizards is complicated due to the species' relatively low detectability and large home range size, as well as researchers' use of un-standardized, and in some cases, inappropriate survey methods (e.g., scat detection rates as an index of abundance). The Petition (Table 2, page 23 in CBD 2014) provides a list of abundance estimates based on scat and lizard observations per hour of survey effort using results of studies ranging from 1979-2001. These are not particularly informative beyond demonstrating the wide variability observed across sites and years.

Since then, only three studies have used solely Flat-tailed Horned Lizard observations and an appropriate sampling design to estimate abundance across the RMS areas (Table 2). Some sites (West Mesa 2003 and Yuha Basin 2004) suffered from sparse data (Grant and Doherty 2007), and their 95% confidence intervals (C.I.) reflect that. Hollenbeck (2006) estimated the abundance of juveniles, in addition to adults, because they were encountered throughout the duration of the study and accounted for a majority of the individual Flat-tailed Horned Lizards captured and recaptured. It should be noted that a minimum viable population size for this species has not been established. A new PVA, based on the information gained over years of monitoring the RMS areas, funded by the RMS member agencies, is currently underway. This information will be coupled with the landscape genomics information (see "Genetics" section above) to provide a clearer picture of the viability of Flat-tailed Horned Lizard populations within the RMS areas.

Table 2. Abundance and Density Estimates from California RMS Areas

RMS Area	Abundance	Lower C.I.	Upper C.I.	Lizards/ha	(Lizards/ac)
Yuha Basin 2002[1]	25,514	12,761	38,790	1.05	(0.42)
East Mesa 2003[1]	42,619	19,704	67,639	0.91	(0.37)
West Mesa 2003[1]	10,849	3,213	23,486	0.20	(0.08)
Ocotillo Wells 2003[2]	19,222	18,870	26,752	0.61	(0.25)
Yuha Basin 2004[1]	73,017	4,837	163,635	3.00	(1.21)
Ocotillo Wells 2005[3,4]	24,345	14,329	69,922	0.78	(0.32)
Ocotillo Wells 2005[3,5]	37,085	22,166	74,812	1.19	(0.48)

[1] Grant and Doherty (2007), [2] Hollenbeck (2004), [3] Hollenbeck (2006), [4] adults, [5] juveniles

There has only been one attempt at estimating the number of Flat-tailed Horned Lizards across the species' range. The USFWS (2011) used a density of 0.3 lizards/ha (0.1 lizards/ac) and its estimate of the Flat-tailed Horned Lizard's remaining range size to make that calculation. The density USFWS used was the smallest estimate derived by Root (2010) from data obtained between 2007 and 2009 on the MAs, a period of relatively low abundance (see "Population Trend" section). Within California, this amounted to approximately 73,000 individuals west of the Imperial Valley; 44,000 east of it; and 1,100 in the Coachella Valley. The USFWS (2011) acknowledged that there were numerous assumptions in its calculations that limited accuracy of the extrapolated population sizes, but it concluded that, even using the most conservative density estimate, the populations east and west of the Imperial Valley were large enough that any threats associated with small populations would be unlikely to occur. However, it also acknowledged that within these coarse-scale populations, barriers to movement fragment the habitat into various patches, which could result in deleterious effects from small population sizes (see "Fragmentation, Edge Effects, and Small Populations" section) (Ibid.).

Not surprisingly, an increased level of survey effort (i.e., number of surveyors and amount of time looking specifically for lizards) appears to increase the likelihood of encountering and detecting Flat-tailed Horned Lizards. For example, surveys by biological monitors and incidental observations by construction personnel trained to look out for Flat-tailed Horned Lizards can sometimes find unexpectedly high densities when compared to the density estimates derived from the RMS demography surveys. For example, prior to and during construction of the Imperial Solar Energy Center West's (CSolar) transmission line within the Yuha Basin MA in 2014, 152 Flat-tailed Horned Lizards were found along the 6.6 ha (16.3 ac) right-of-way, resulting in an approximate density of 23.0 lizards/ha (9.3 lizards/ac) (UltraSystems 2015) (Figure 6). This calculation is likely somewhat of an overestimate because some individuals may have returned to the construction site from where they were translocated; however, in the following year, Flat-tailed Horned Lizards translocated off the project site were marked prior to moving, and only 2 of 92 (2.2%) returned (Dudek 2016). In addition, a narrow linear project footprint is more likely to overlap multiple home ranges than the square plot used in RMS surveys. Nevertheless, to put the right-of-way density estimate into some local context, using the RMS survey protocol (i.e., capture-mark-recapture) from the Yuha Basin MA, the highest plot-level abundance estimate between 2007 and 2015 was 74.9 Flat-tailed Horned Lizards on a 9-ha (22 ac) plot or 8.3 lizards/ha (3.4 lizards/ac) in 2011, approximately one-third the estimated density along the transmission line (Grimsley and Leavitt 2016). The 2014 estimate (i.e., the same year as the construction surveys as well as the third consecutive year of drought) was 4.2 lizards/ha (1.7 lizards/ac), approximately one-fifth the estimated density along the transmission line (Ibid.). The solar facility portion of the CSolar project was located on 457 ha (1,130 ac) of abandoned agricultural fields that were considered barren or in the early seral stages of desert scrub in 2015 (UltraSystems 2015) but were dominated by non-native weeds such as Sahara mustard (*Brassica tournefortii*) and London rocket (*Sisymbrium irio*) five years prior (RECON 2010). In this degraded habitat, another 95 Flat-tailed Horned Lizards were found, or approximately 0.21 lizards/ha (0.08 lizards/ac) (Dudek 2016), approximately two-thirds the density used by the USFWS to estimate abundance across the species' range (USFWS 2011).

Population Trend

Flat-tailed Horned Lizard abundance appears to be highly sensitive to environmental conditions and can fluctuate considerably over short periods of time (Young and Young 2000). For example, within stabilized sand fields in the Coachella Valley, Barrows and Allen (2009) recorded the Flat-tailed Horned Lizard population declined by approximately 50% per year from 2002 to 2005, with a >90% decline overall; however, it was able to recover to the 2003 level within a year with no management action. This high level of variability coupled with the species' low detectability make accurate estimates of population trends challenging, and comparisons in abundance or rate of detection from a small number of time periods should be viewed with caution as they can give the impression of a precipitous decline or increase.

Aside from the work done in the Coachella Valley, until fairly recently, evidence of population declines were limited to anecdotal accounts (Altman 1980, Turner et al. 1980) that, while likely credible, may have at least partially been attributable to wet vs. dry years (Turner and Medica 1982) or use of Flat-tailed Horned Lizard sign (e.g., scat), which as previously mentioned is often unreliable as an index of abundance. The Department's 1989 status review relied primarily

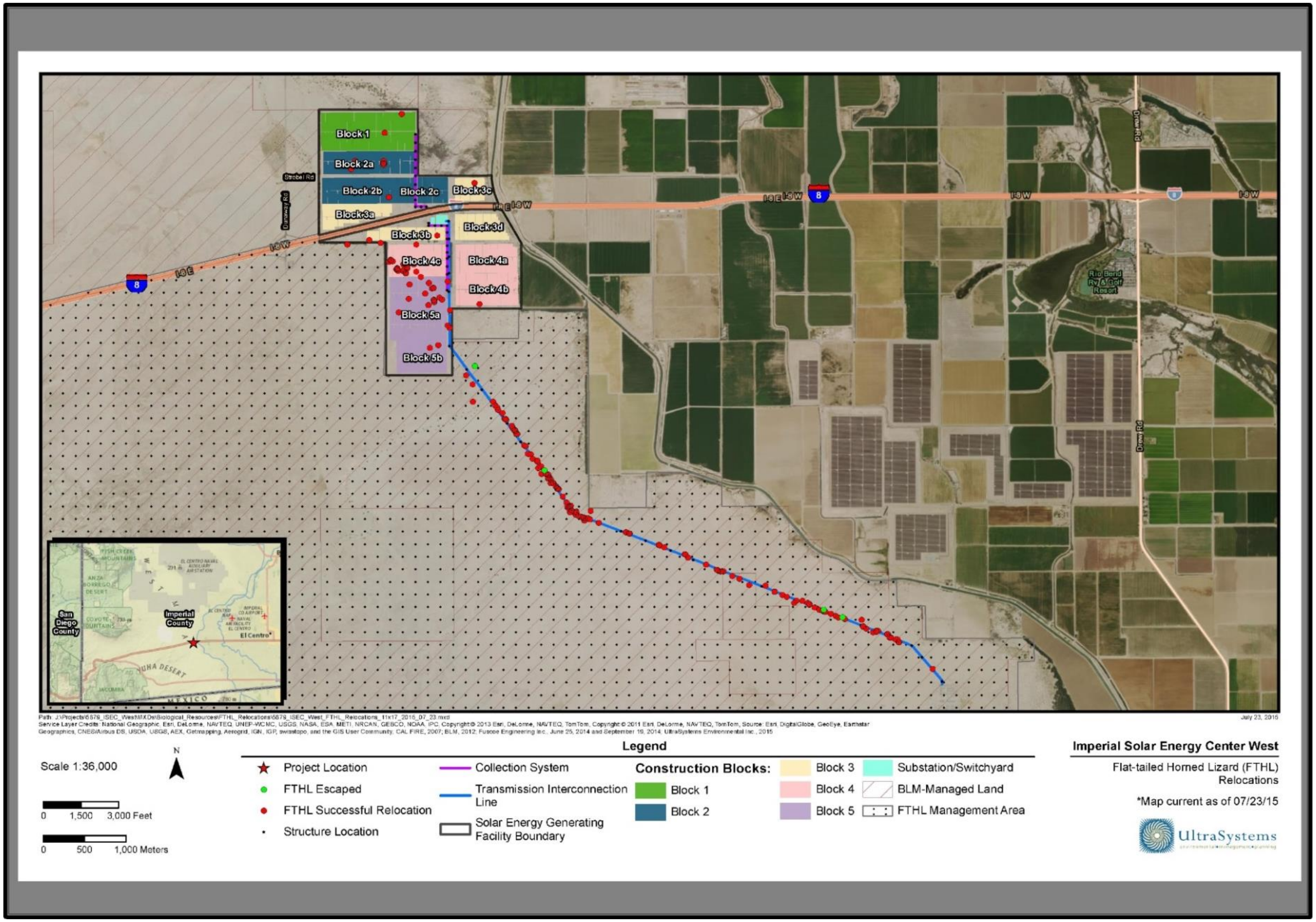


Figure 6. Flat-tailed Horned Lizard Observations (Translocations) within a Project Footprint

Source: UltraSystems (2015)

on these data as well as on personal communications of localized declines from land managers and herpetologists familiar with Flat-tailed Horned Lizards (Bolster and Nicol 1989). An oft-cited example of a significant decline was provided by Dr. Wilbur Mayhew, who studied Flat-tailed Horned Lizards extensively and was co-author of the 1988 CESA listing petition, along a stretch of Highway 78 between the Coachella and All-American Canals (Altman et al. 1980, Bolster and Nicol 1988, CBD 2014, Turner and Medica 1982). Between 1961 and 1964, Dr. Mayhew and his students collected 502 (live and dead) Flat-tailed Horned Lizards from this 11.2 km (7 mi) stretch (Altman et al. 1980, Turner and Medica 1982). By 1964, he noted they were not as abundant as in previous years, and by the early 1970s, their numbers along the well-traveled roadway were reportedly further reduced (Ibid.). Turner and Medica (1982) noted that rainfall during the winter of 1963-1964 was approximately one-third of the previous year and one-fifth the year before that, speculating that the low numbers in 1964 were more attributable to weather than other factors (but see the “Roads, Canals, and Railroads” section).

Wright (2002) compiled and analyzed the long-term Flat-tailed Horned Lizard scat and observation dataset from surveys conducted on BLM lands between 1979 and 2001. These data were used in the Department’s 1989 status review as the best available information at the time in terms of systematic sampling to detect population trends (Bolster and Nicol 1989). While Flat-tailed Horned Lizards appeared to be fairly widely distributed over the years, there were notable declines in abundance across the study areas in the mid-late1980s (i.e., the period immediately preceding the 1989 status review), which coincided with the 1987-1992 drought. However, over the entire 22 year span, Wright (2002) found no significant trend in lizard detection rate or proportion of transects with scat or lizards (Figure 7). He cautioned that survey methodologies were inconsistent across this period, and in all years except one, the survey effort was less than the estimated minimum necessary to have an 80% probability of being within 50% of the true mean sighting rate (Ibid.).

Use of a standardized mark-recapture protocol to detect Flat-tailed Horned Lizard population trends is a relatively recent development, only spanning from 2007 to 2015. Grimsley and Leavitt (2016) calculated Flat-tailed Horned Lizard abundance estimates (± S.E.) from demography surveys on 9-ha (22 ac) plots within the RMS areas over that period (Figure 8). Demography surveys only began at Ocotillo Wells in 2014, and they have never been conducted on Borrego Badlands. For the most part, the demography surveys have been carried out according to the RMS protocol where they have been conducted; however, occasionally, particularly early on, the full number of days was not achieved, which led to large standard errors and the inability to estimate population parameters in some cases (Grimsley and Leavitt 2016). Nevertheless, inference about population trends is still possible, and they generally appear to be cycling up and down in concert across the RMS areas (Leavitt et al. 2015). It should be noted that unlike the occupancy study plots, the demography survey plots were non-randomly selected within areas known or suspected to support greater than average Flat-tailed Horned Lizard densities (Root 2010), which are required to obtain robust enough datasets for use in population estimation models. Therefore, extrapolation of density estimates to areas outside these survey plots cannot be legitimately undertaken. In spite of this caveat, this is an important dataset, which is lacking in many other imperiled cryptic species, that provides useful insights into how population abundance changes over time.

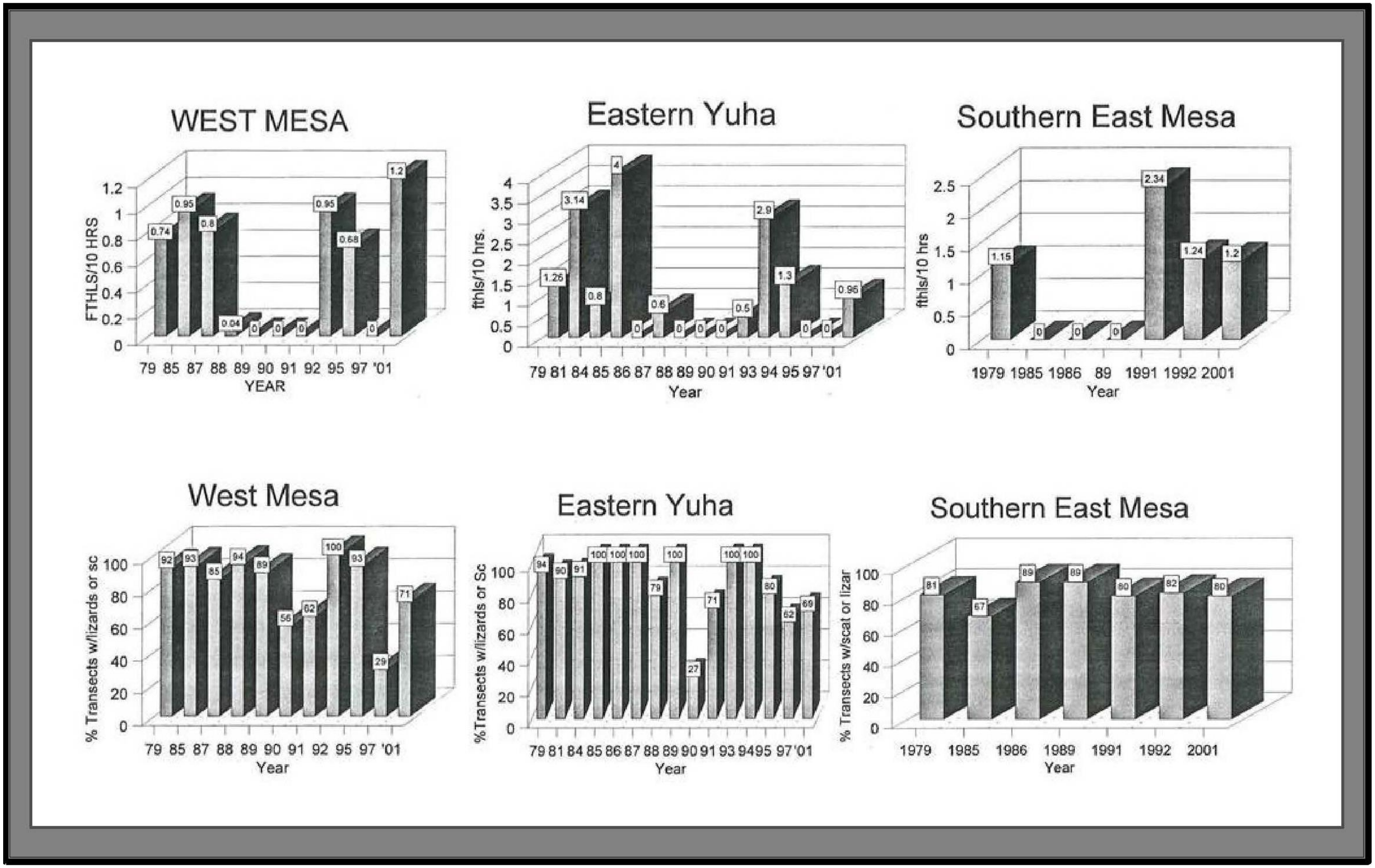


Figure 7. Indices of Trends in Abundance and Distribution between 1979 and 2001

Source: Wright (2002)

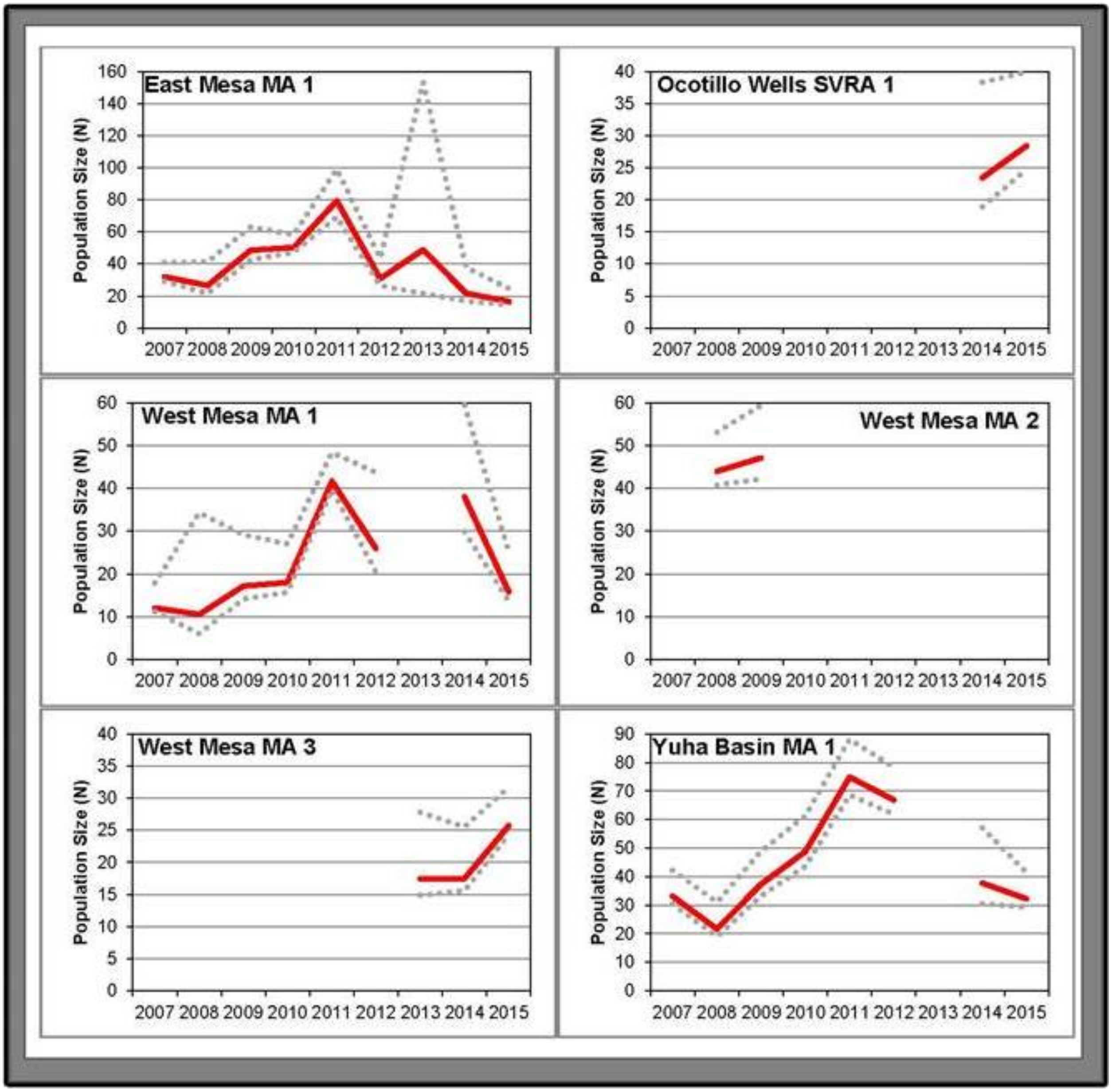
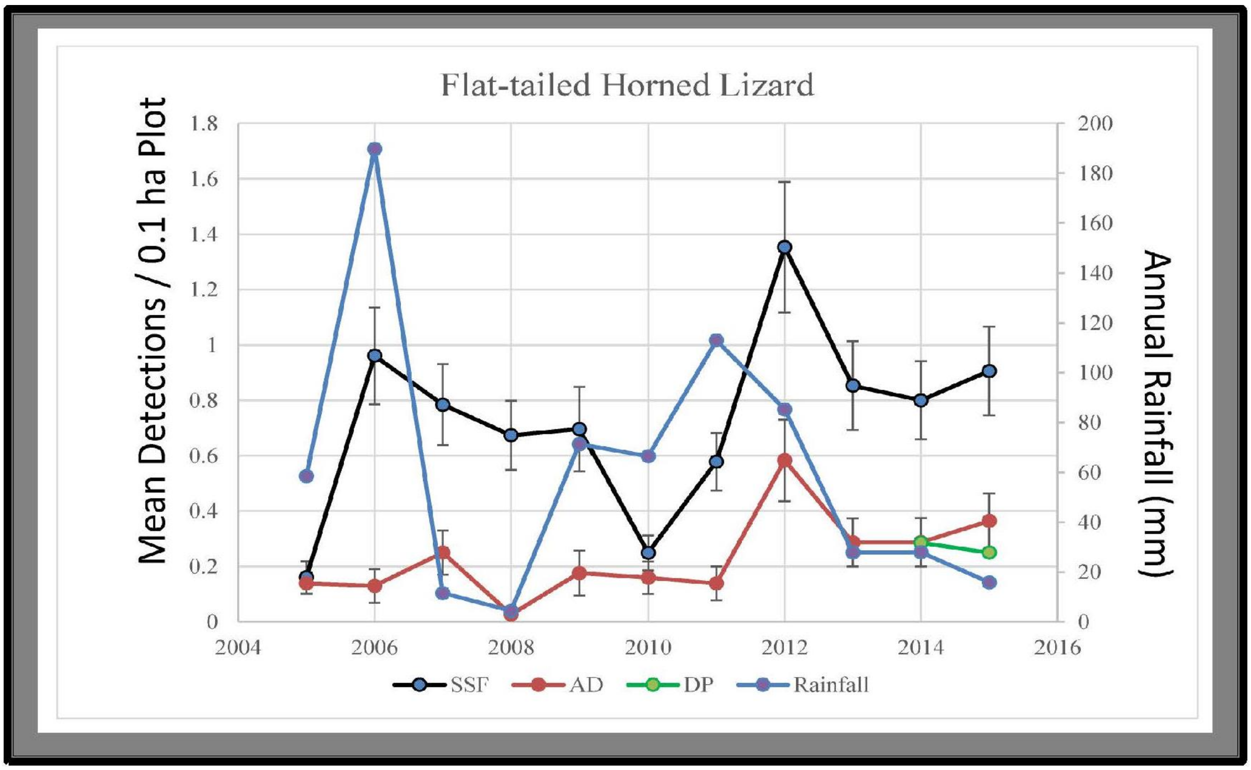


Figure 8. Annual Plot-level Flat-tailed Horned Lizard Population Estimates and Trends

Source: Grimsley and Leavitt (2016)

The nearly fourfold increases in abundance from 2008 to 2011 on the three MAs in California that were surveyed consistently over that time reflect how rapidly and dramatically Flat-tailed Horned Lizards can respond to favorable conditions, and the subsequent declines to near 2008 levels from 2011 to 2015 reflect how rapidly they can decline as well. These fluctuations are often attributed to differences in precipitation, but the relationship between rainfall and Flat-tailed Horned Lizard abundance is complex and not always positively correlated (Barrows and Allen 2009, Leavitt 2013a, Young and Young 2000). In wet years, predators as well as prey increase, as do non-native plants, which may limit the species' ability to rebound immediately

(Barrows and Allen 2009, Goode and Parker 2015, J. Rorabaugh pers. comm.). In the Coachella Valley, Flat-tailed Horned Lizard population fluctuations do not appear to be positively correlated with precipitation anymore due to the negative impact of Sahara mustard infestations during wet years on Flat-tailed Horned Lizard abundance (CVCC 2016). As reported in CVCC (2016), above average rainfall from 2009-2011was coincident with a decline in Flat-tailed Horned Lizards, and the subsequent drought resulted in a population increase (Figure 9).



SSF = stabilized sand fields of the Thousand Palms Conservation Area; AD = active dunes of the Thousand Palms Conservation Area; DP = stabilized sand fields of the south eastern Dos Palmas Conservation Area. Rainfall is off-set (forward) by one year to demonstrate reproductive recruitment and survivorship resulting from the previous year's precipitation levels. Error bars represent one standard error.

Figure 9. Coachella Valley Spatial and Temporal Population Trends

Source: CVCC (2016)

California is currently experiencing an extreme drought that began in 2011, which appears to be influencing Flat-tailed Horned Lizard densities across the species' range in the state (Figures 8 and 9). Predictions for a wetter 2015-2016 winter had not manifested as of August 31, 2016, and a vast majority of the Flat-tailed Horned Lizard's range in California is more than 50% below average precipitation for this water year to date (Figure 10). As a result, Flat-tailed Horned Lizard abundance is relatively low across most of its range; however, nearly 40 years of monitoring data demonstrate that the species can and has rebounded from recent multi-year droughts in spite of myriad other stressors.

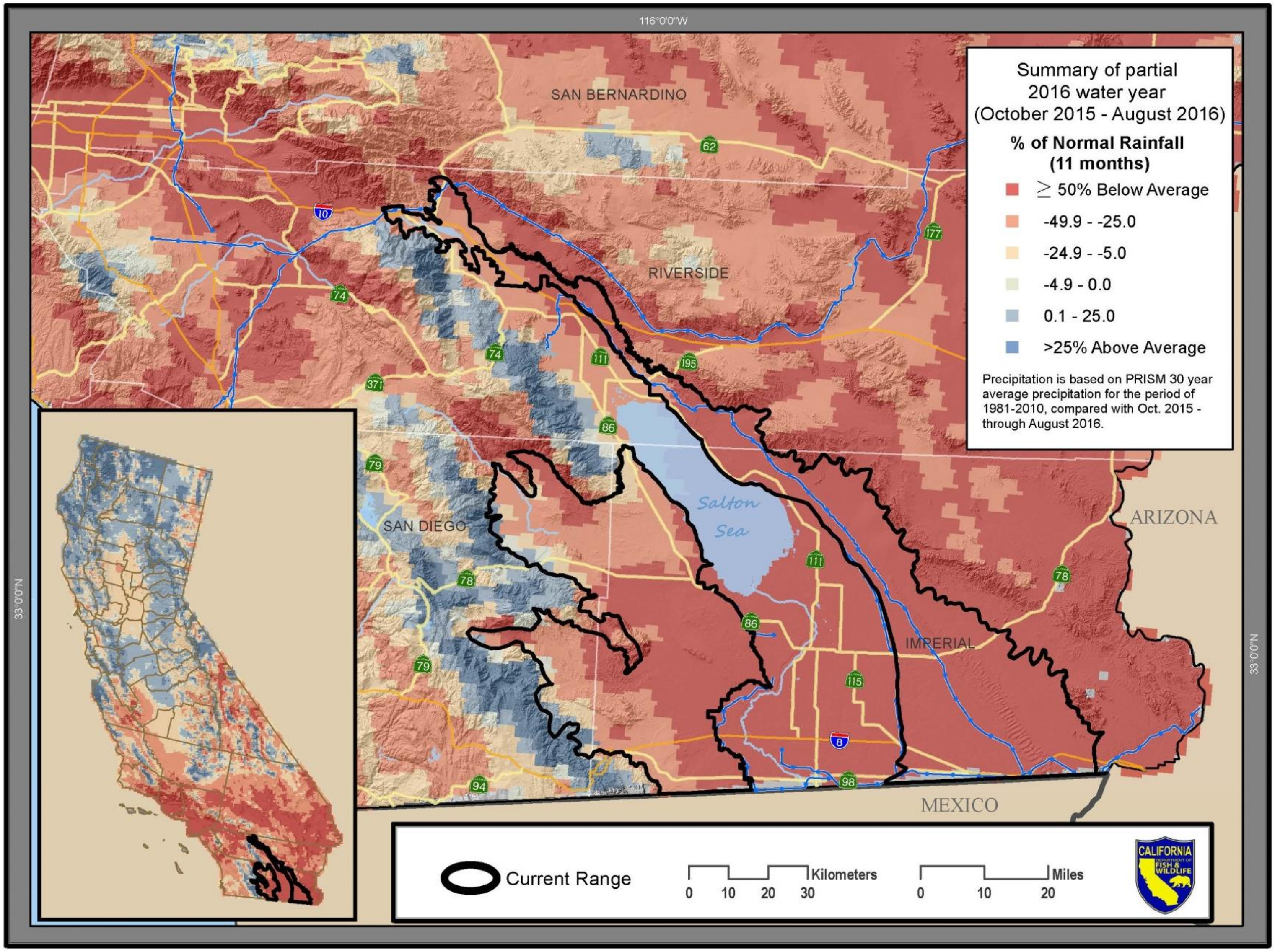


Figure 10. 2016 Water Year Statewide Precipitation Comparison to Average

Sources: CDFW GIS Library, NOAA Weather Service (2016)

EXISTING MANAGEMENT

Land Ownership within the California Range

Using the Department's current Flat-tailed Horned Lizard range in California, approximately 77% of the 666,916 ha (1,647,979 ac) are owned or managed by public agencies (Table 3, Figure 11), with nearly all the remaining land in private ownership. Of the public land, 99% is managed by RMS member agencies (in some cases the land is owned by a different agency than manages the land).

Table 3. Public Landownership within the Flat-tailed Horned Lizard's California Range[1]

Agency	Hectares	Acres	Group %	Unit %
Federal	*393,021*	*971,172*	*58.93%*	
U.S. Bureau of Land Management[2]	317,055	783,457		47.54%
U.S. Navy[2]	67,876	167,725		9.28%
U.S. Bureau of Reclamation[2]	12,335	38,480		1.85%
U.S. Fish and Wildlife Service[2]	1,524	3,766		0.23%
U.S. Forest Service	231	571		0.03%
State	*121,122*	*299,298*	*18.16%*	
California Department of Parks and Recreation[2]	116,099	286,886		17.41%
State Lands Commission	3,066	7,576		0.46%
California Department of Fish and Wildlife[2]	1,641	4,055		0.25%
Coachella Valley Mountains Conservancy	216	534		0.03%
California Wildlife Conservation Board	81	200		0.01%
University of California	20	49		0.00%
County	*362*	*895*	*0.05%*	
San Diego, County of	360	890		0.05%
Imperial, County of	2	5		0.00%
City	*49*	*121*	*0.01%*	
Palm Springs	37	91		0.01%
Cathedral City	9	22		0.00%
Palm Desert	2	5		0.00%
Indio	1	2		0.00%
Special District	*1,458*	*3,603*	*0.22%*	
Imperial Irrigation District	878	2,170		0.13%
Coachella Valley Water District	470	1,161		0.07%
Borrego Water District	64	158		0.01%
Desert Water Agency	31	77		0.00%
Palm Springs Unified School District	7	17		0.00%
Salton Community Services District	7	17		0.00%
Desert Recreation District	1	2		0.00%
Grand Total	**516,012**	**1,275,088**		**77.37%**

[1] CPAD (2015) [2] RMS Member Agency

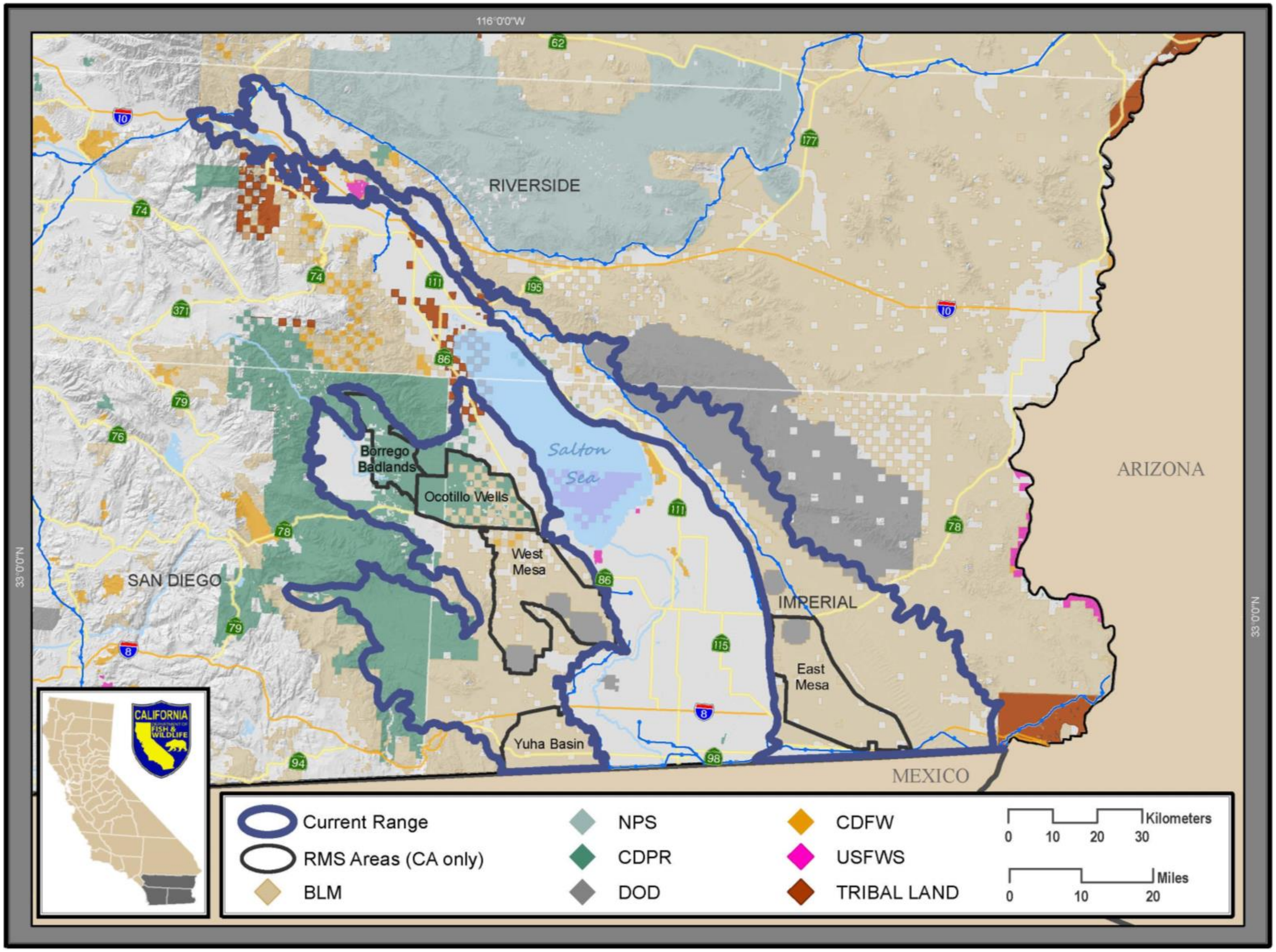


Figure 11. Main Land Ownership within the Flat-tailed Horned Lizard's California Range

Sources: CDFW GIS Library, FTHICC

Flat-tailed Horned Lizard Rangewide Management Strategy

In 1997, a voluntary long-term Interagency Conservation Agreement was signed by the Department, USFWS, BLM, U.S. Bureau of Reclamation, U.S. Marine Corps, U.S. Navy, Arizona Game and Fish Department, and the California Department of Parks and Recreation (California State Parks) to implement the Flat-tailed Horned Lizard Rangewide Management Strategy (RMS), which was subsequently revised in 2003 (FTHLICC 1997, 2003). The RMS is implemented by the Interagency Coordinating Committee (ICC) and the Management Oversight Group, both comprised of members of the signatory agencies. The overall goal of the RMS is to "maintain self-sustaining populations of Flat-tailed Horned Lizard in perpetuity" (FTHLICC 2003). As briefly discussed in the "Existing Regulatory Status" section, the RMS established five MAs, four in California and one in Arizona, and one RA in an active OHV park (FTHLICC 1997). MAs were designed to include as much high-quality Flat-tailed Horned Lizard habitat (identified in previous studies) and as large an area as possible, while avoiding extensive, existing, and predicted management conflicts such as OHV open riding areas (FTHLICC 2003). The RA was established to encourage research on the potential impacts of OHV use on Flat-tailed Horned Lizards, funded through the California State Parks' Off-Highway Motor Vehicle Recreation Division (OHMVRD) (FTHLICC 1997).

Management objectives for MAs include:

- Continue to secure and/or manage sufficient habitat to maintain self-sustaining Flat-tailed Horned Lizard populations in each of the five designated MAs;
- Maintain a "long-term stable" or increasing population of Flat-tailed Horned Lizards in all MAs (a population that is stable over the long term exhibits no downward population trend after the effects of natural demographic and environmental stochasticity are removed);
- Continue to support research that promotes conservation of the species;
- Within and outside of MAs, limit the loss of habitat and effects on Flat-tailed Horned Lizard populations through the application of effective mitigation and compensation; and
- Encourage and assist Mexico in the development and implementation of a Flat-tailed Horned Lizard conservation program (FTHLICC 2003).

Although entry into the Interagency Conservation Agreement and implementation of the RMS is voluntary and based on available funding, the BLM and the Department of Defense have formally adopted the RMS within some of their agencies' environmental planning documents. The BLM, through a California Desert Conservation Area Plan amendment, adopted the three California MAs as Areas of Critical Environmental Concern (ACEC) in 2005 (FTHLICC 2006). Under the Sikes Act, the Department of Defense adopted the RMS into the Integrated Natural Resources Management Plans (INRMPs) for their installations (Navy 2014, USAF and USMC 2013).

California State Parks, the third main landowner within the Flat-tailed Horned Lizard's California range, has not formally adopted the RMS into its planning documents. The Anza-Borrego Desert State Park Final General Plan and Environmental Impact Report (EIR) were approved by the State Parks and Recreation Commission in 2005. While they include goals and guidelines for conservation of significant and sensitive biota (CDPR 2005), they do not directly address

Flat-tailed Horned Lizards, which influences dedication of funding and staffing availability to implement the RMS. Management for the Flat-tailed Horned Lizard within the Ocotillo Wells State Vehicular Recreation Area (OWSVRA) falls under guidelines incorporated by California State Parks to evaluate and sustain park resources, but as an RA, OWSVRA is not subject to the same protections from disturbance in the RMS as the MAs are. OWSVRA is mandated to provide OHV recreation (e.g., free-play, racing, and touring) in a manner to sustain long-term use (FTHLICC 2003). The OHMVRD, in cooperation with the BLM, is preparing a General Plan/Recreation Area Management Plan/California Desert Conservation Area Land Use Plan Amendment (hereafter "OWSVRA Plan") and associated EIR/Environmental Impact Statement (EIS), which will update the current general plan that was developed in 1982 (CDPR 2015). The objective of the OWSVRA Plan is to create a comprehensive planning tool under both State and federal guidelines to effectively manage OWSVRA for high quality recreation, while protecting its resources in a sustainable manner (Ibid.).

Each MA is controlled by multiple agencies, and all MAs in California include private inholdings, which are targeted for acquisition to reduce the chance of development within the MA boundaries (FTHLICC 2003). Land management within the MAs is designed to avoid or reduce permanent surface disturbance and to promote reclamation of disturbed areas (e.g., duplicate roads that are no longer needed) (Ibid.). The RMS requires compensatory mitigation for long-term impacts to Flat-tailed Horned Lizard habitat at ratios anywhere from 3:1 to 6:1 within MAs and 1:1 outside of them. In addition, permanent surface disturbance cannot exceed 1% of the total area within the MAs (Ibid.). While this cap is a voluntary measure in areas where it has not been formally adopted (e.g., BLM lands outside ACECs), the RMS member agencies have not exceeded this threshold on any of the MAs.

The land area within the California MA boundaries totals 142,518 ha (352,168 ac), comprising approximately 21% of the Flat-tailed Horned Lizard's range in the state (using the Department's current estimated range map, Figure 1). Since 1997, impacts to 346 ha (855 ac) have been approved within the California MAs, and 6,811 ha (16,830 ac) of private lands have been acquired (FTHLICC 2015a). In 2014, authorized surface impacts increased in MAs as a result of solar energy development and military projects (Ibid). The RMS annual implementation progress report for 2014 concludes "there is some concern the 1% development cap may be reached, and exceeded, in some MAs due to utility-scale renewable energy development and Navy projects" (Ibid.); however, the member agencies are not considering revising the cap (R. Lovich pers. comm.).

As already described in the "Status and Trends in California" sections, RMS member agencies conduct occupancy and demography surveys to monitor Flat-tailed Horned Lizard trends on the RMS areas. Formal monitoring under the RMS began in 2002, and as techniques were refined, a Flat-tailed Horned Lizard Monitoring Plan was developed in 2008 to standardize monitoring methods, data collection, and related activities (FTHLICC 2008). The Monitoring Plan was further revised in 2011 "to improve the precision of occupancy estimates and detection probability" (FTHLICC 2015a). The demography and occupancy monitoring protocols were further standardized in 2015 (FTHLICC 2015b, FTHLICC 2015c). Despite some inconsistency in data collection across the RMS areas and the generally low detectability of Flat-tailed Horned Lizards, the member agencies have amassed a large and valuable dataset on abundance and distribution trends. Within the multiple planning actions in the RMS, monitoring Flat-tailed Horned Lizard populations remains a high priority, and the 2014 RMS implementation annual progress report concludes that “the majority of the tasks outlined by the [RMS] are being completed on schedule” (FTHLICC 2015a) . Only “provide public information and education” is ongoing but not on schedule, and “determine effects of natural barriers” has not been completed (Ibid). The latter is underway, as described above, in the form of a landscape genomics study, a habitat model, and a focused analysis on important corridors for the species.

In addition to population monitoring, numerous research studies have been completed since the inception of the RMS to better understand and conserve Flat-tailed Horned Lizards. These have been accomplished using compensation funds collected and administered by RMS member agency personnel. These include, but are not limited to, a detailed general ecology study (Young 2010), evaluating the potential for OHVs to crush Flat-tailed Horned Lizards during brumation (Grant and Doherty 2009), quantification of habitat disturbance (Fernandez et al. 2006, Villarreal 2014), effects of military base activities (Goode and Parker 2015), ecological associations with Flat-tailed Horned Lizard occupancy at OWSVRA (Beauchamp et al. 1998, Gardner 2005), OHV effects (McGrann et al. 2006, Nicolai and Lovich 2000, Wone et al. 1994, Young 1999), genetics (Culver and Dee 2008, Mulcahey et al. 2006), use of culverts (Painter and Ingraldi 2007), and effects of translocation (Goode and Parker 2015, Painter et al. 2008). In addition to the aforementioned research projects currently underway, two additional studies are in the course of being funded: anthropogenic influences on avian predation and climate change (FTHLICC 2016).

Coachella Valley Multiple Species Habitat Conservation Plan

The Coachella Valley Multiple Species Habitat Conservation Plan (CVMSHCP) is a multi-jurisdiction plan, adopted pursuant to ESA and the California Natural Communities Conservation Planning Act. It provides for the long-term conservation of ecological diversity within the Coachella Valley region of Riverside County, while streamlining the development application review process throughout the plan area. The Department and the USFWS issued permits for the 75-year term CVMSHCP in 2008. The CVMSCHP includes an area of approximately 445,000 ha (1,100,000 ac) that does not include tribal lands (CVCC 2016). The Flat-tailed Horned Lizard is a Covered Species under CVMSCHP.

Within the plan area there are 13,122 ha (32,426 ac) of predicted modeled habitat for the Flat-tailed Horned Lizard (where presence was expected based on recent observations) and 2,089 ha (5,161 ac) of modeled potential habitat (generally higher elevation areas where historical, but not recent, records exist) (CVMSHCP 2007). Modeled habitat overlaps 10 designated Conservation Areas (Figure 12). Approximately 1,679 ha (4,148 ac) of predicted habitat are identified as core habitat, all in the Thousand Palms area (Ibid.). Under full implementation, within the Conservation Areas, Flat-tailed Horned Lizard take would not be authorized on 1,661 ha (4,105 ac) or 98% of core, 5,628 ha (13,908 ac) or 94% of predicted, and 1,296 ha (3,203 ac) or 93% of potential habitat (Ibid.). Take of Flat-tailed Horned Lizards within the entire plan area was authorized for 7,107 ha (17,562 ac) or 54% of predicted and 696 ha (1,720 ac) or 33% of potential habitat (Ibid.). The vast majority of this habitat lies outside of the Conservation Areas and is already highly fragmented, surrounded by existing development, and has a compromised

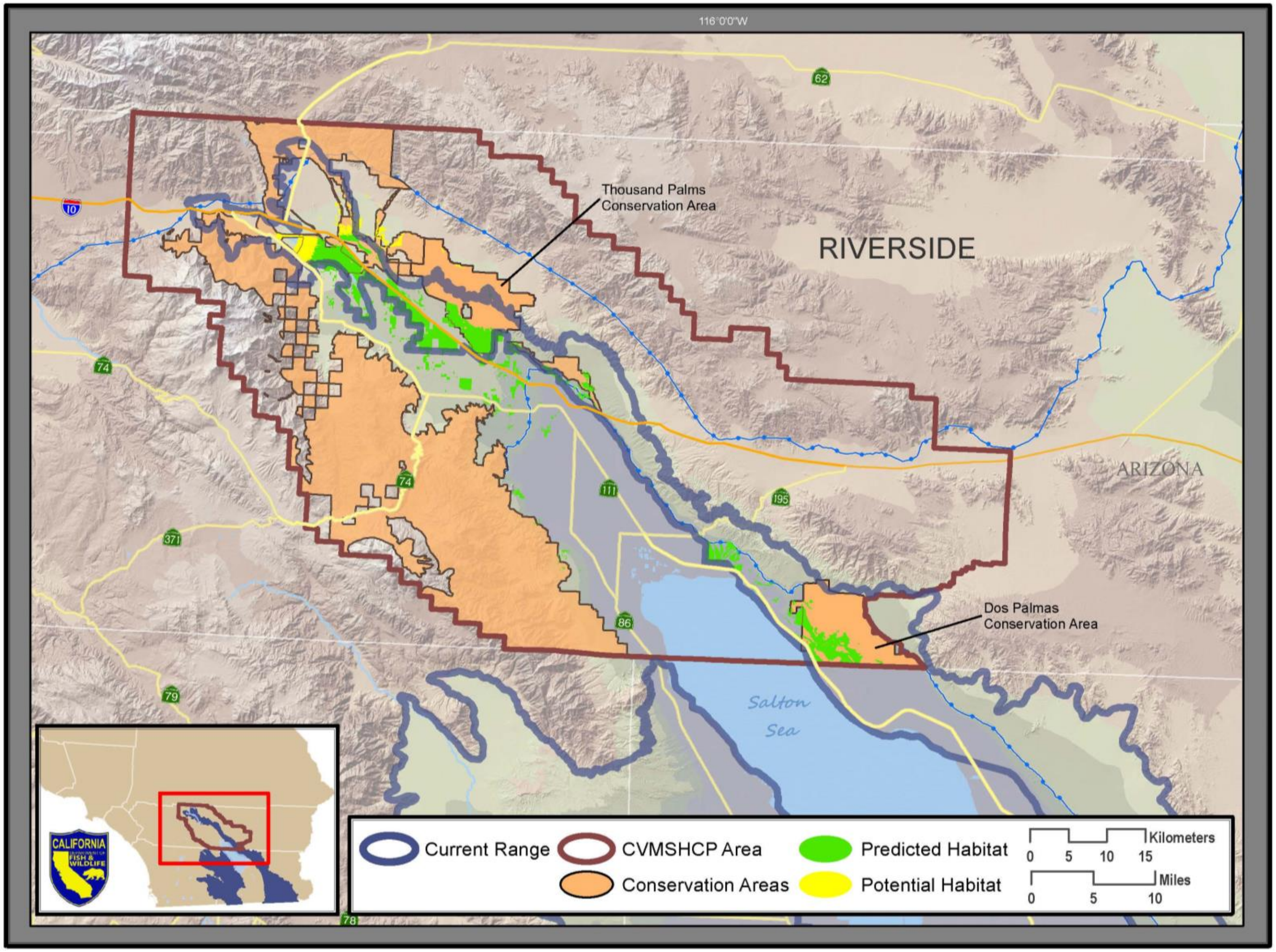


Figure 12. CVMSHCP Conservation Areas and Modeled Flat-tailed Horned Lizard Habitat

Sources: CDFW GIS Library, CVMSHCP

sand source/transport system (Ibid.). A Major Amendment to the CVMSHCP was approved in 2016 that increased the amount of habitat on which take of Flat-tailed Horned Lizards can occur by 1 ha (3 ac) of predicted habitat and 4 ha (10 ac) of potential habitat (CDFW 2016).

Prior to the CVMSHCP, some Flat-tailed Horned Lizard habitat had already been protected as a result of the Coachella Valley Fringe-toed Lizard Habitat Conservation Plan. The CVMSCHP conservation goals track the areas remaining for acquisition (CVCC 2016). As of 2016, 81% of the remaining Flat-tailed Horned Lizard habitat has been acquired within the Thousand Palms Conservation Area, while only 15% within the Dos Palmas Conservation Area, and 0% has been acquired in the East Indio Hills Conservation Area (Ibid.). In total, 511 ha (1,263 ac) of 2,035 ha (5,028 ac) or 25% of the Flat-tailed Horned Lizard-specific habitat acquisitions have been made since 1996 (Ibid.).

Although the CVMSHCP predicts there is suitable or potential habitat within a number of conservation areas throughout the plan area, as previously discussed, Flat-tailed Horned Lizards appear to have been extirpated from nearly all of the Coachella Valley with the exception of the Thousand Palms and the Dos Palmas conservation areas, sites separated by approximately 72 km (45 mi) of largely unsuitable habitat. While the CVMSHCP (2007) states that "[i]deally, three or more sites with discrete sand sources and of sufficient size to maintain a viable population should be preserved," it also recognizes that "[r]ealistically there are not three such sites remaining that are not already fragmented or otherwise compromised by Development."

Lower Colorado River Multi-Species Conservation Program

The 50-year Lower Colorado River Multi-Species Conservation Program (LCRMSCP) was signed by the Department of the Interior Secretary and representatives from agencies within Arizona, California, and Nevada in 2005. The LCRMSCP was created to balance the use of the Colorado River water resources with the conservation of native species and their habitats from Lake Mead to the southernmost border with Mexico (LCRMSCP 2016). The plan is implemented by the Bureau of Reclamation (Ibid.).

None of the LCRMSCP area falls within the Flat-tailed Horned Lizard's current range in California, but a small portion occurs between Imperial Dam and the Mexican border in Arizona (LCRMSCP 2015). There are two Flat-tailed Horned Lizard-specific conservation measures in the plan. The first is to acquire and protect 93 ha (230 ac) of unprotected occupied Flat-tailed Horned Lizard habitat, which was completed by purchasing two privately owned parcels totaling 97 ha (240 ac) adjacent to the Yuha Basin MA in 2012 (USFWS 2012). The second is to implement conservation measures to avoid or minimize take of Flat-tailed Horned Lizards including those described in the RMS (LCRMSCP 2015).

California Desert Conservation Area Plan

In 1976, the Federal Land Policy and Management Act authorized the BLM to conserve and manage public lands, and required the preparation of the California Desert Conservation Area Plan (CDCA). The BLM can designate ACECs through the CDCA. ACECs are defined as "areas within the public lands where special management attention is required… to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources or other natural systems or processes, or to protect life and safety from natural hazards" (DOI 2001). The goals of ACECs are to:

- Identify and protect the significant natural and cultural resources requiring special management attention found on the BLM-administered lands in the CDCA;
- Provide for other uses in the designated areas, compatible with the protection and enhancement of the significant natural and cultural resources; and
- Systematically monitor the preservation of the significant natural and cultural resources on BLM-administered lands, and the compatibility of other allowed uses with these resources (DOI 1980).

Portions of the three MAs administered by the BLM (East Mesa, Yuha Basin, and West Mesa) were designated as ACECs to protect the Flat-tailed Horned Lizard in 2005 (FTHLICC 2006). The Coachella Valley Fringe-toed Lizard and Dos Palmas ACECs in the Coachella Valley also provide protection for the Flat-tailed Horned Lizard (BLM 2016a). North Algodones Dunes, which supports Flat-tailed Horned Lizards at least along its vegetated edges, was an ACEC but was recently withdrawn because it is already designated Wilderness under the National Landscape Conservation System, rendering the ACEC designation unnecessary (BLM 2016b). The new 5,925 ha (14,640 ac) Ocotillo ACEC will be managed in part for the protection of Flat-tailed Horned Lizards (BLM 2016a). Management requirements vary by location but in general include controlling and erecting signs explaining vehicle access areas and routes, restricting mineral exploration/development, developing additional habitat/water sources, conducting intensive resource inventories, controlling exotic species and introducing native species, and stabilizing/rehabilitating/salvaging features (DOI 1980).

California Environmental Quality Act

The California Environmental Quality Act (CEQA) is a California law (Public Resources Code Section 21000 et seq.) that requires State and local agencies to publicly disclose, analyze, and potentially mitigate environmental impacts from projects over which they have discretionary approval power. In particular, CEQA requires that actions that may substantially reduce the habitat, decrease the number, or restrict the range of any species that can be considered rare, threatened, or endangered must be identified, disclosed, considered, and mitigated or justified. (Cal. Code Regs., tit. 14, §§ 15065(a)(1), 15380.)

CEQA compliance is not always thorough because the process can be very costly and time-consuming. Agencies may also determine projects are exempt (i.e., they do not need to go through the impact analysis, public disclosure, and mitigation process). Mitigation is required if a project is not CEQA-exempt and impacts would be potentially "significant." Mitigation must reduce impacts to below a level of significance or minimize unavoidable significant impacts, where feasible. The CEQA process generally incentivizes agencies and project applicants to implement mitigation thereby avoiding significant impacts.

Due to its SSC designation, impacts to Flat-tailed Horned Lizards are generally considered potentially significant if agencies determine on a project-specific basis that the species meets the CEQA criteria for rare, threatened, or endangered. However, agencies are not required to make this determination for Flat-tailed Horned Lizards and other species that are not listed under CESA or ESA. Even when they are considered in a CEQA analysis, lack of readily available information on which to base impact analyses and lack of understanding of the law may result in projects having an unknown significant impact on the species.

One measure that is often included in CEQA documents to minimize adverse impacts to sensitive species is translocation of encountered individuals a safe distance away from the disturbance area. However, translocation's utility in conserving species has been questioned (Germano and Bishop 2009, Germano et al. 2015). Two recent studies evaluated the efficacy of translocation for conserving Flat-tailed Horned Lizards (Goode and Parker 2015, Painter et al. 2008). While their methods were somewhat different, their results were similar. Both studies compared survival, persistence, behavior, and movement patterns using radio-telemetry on translocated and control group Flat-tailed Horned Lizards (Ibid.). In the months immediately following translocation (late summer/fall 2012), both translocated males and females had significantly larger home ranges than non-translocated individuals; however, after that, there was no significant difference between the two groups (Goode and Parker 2015). Painter et al. (2008) noted greater movements in translocated individuals up to 14 days post-release. Survival probabilities were lower for translocated Flat-tailed Horned Lizards, although the difference was not statistically significant (Goode and Parker 2015, Painter et al. 2008). This result indicates Flat-tailed Horned Lizards may have a period of acclimation following translocation as they adjust to their new locations (Ibid.). Goode and Parker (2015) observed translocated Flat-tailed Horned Lizards engaging in reproductive behavior and concluded that "[w]hile the results of this project certainly do not justify making translocation a commonly used mitigation measure for Flat-tailed Horned Lizards, there were some promising results that warrant further study."

In order for translocation to be effective in avoiding direct mortality within the disturbance area, exclusion fencing must be maintained, or the individual must be moved a great distance away. Goode and Parker (2015) observed telemetered Flat-tailed Horned Lizards climbing over the fence with some regularity; thirty individuals, both non-translocated and translocated, crossed the fence at least once. The fence used in this study "began falling into disrepair almost immediately after it was constructed, with sand drifts accumulating quickly and holes appearing after several weeks" (Ibid). Most, if not all, of these individuals were placed immediately outside the exclusion fencing, and given the relatively large home ranges of Flat-tailed Horned Lizards, it is not surprising that they would attempt to return to where they were captured. Painter et al. (2008) noted that while none of the translocated Flat-tailed Horned Lizards that were moved greater than 1.6 km (1 mi) away showed signs of homing behavior, individuals that were released 100 m (328 ft) away from their capture point did.

FACTORS AFFECTING ABILITY TO SURVIVE AND REPRODUCE

Fragmentation, Edge Effects, and Small Populations

It is well established that loss of habitat is the primary reason for a vast majority of species' declines and extinctions globally. However, declines can occur even in seemingly relatively undisturbed habitat when barriers to movement fragment once contiguous blocks into smaller areas and when adverse impacts from adjacent land uses extend into that habitat (i.e., edge effects). Depending on their severity, edge effects around habitat fragments can create perpetual population sinks (areas of negative population growth). Because the habitat is still intact, individuals will continue to move into the area where they may experience higher mortality risk than in the habitat block's core. Such sinks will have the greatest impact on overall population dynamics in small reserves with high perimeter-to-area ratios and in species that range widely and therefore come into frequent contact with edge more often (Woodroffe and Ginsberg 1998).

Fragmentation and edge effects can be particularly deleterious when they impact species with small populations or create smaller populations, which are more at risk of decline or localized extirpation due to random fluctuations in abundance and loss of genetic diversity through drift (Woodroffe and Ginsberg 1998). For example, Vandergast et al. (2016) discovered that genetic structure among Coachella Valley Fringe-toed Lizard (*Uma inornata*) populations increased, while genetic diversity and effective population sizes decreased between 1996 and 2008. They suggested this rapid differentiation was likely a synergistic effect of population declines during the historic drought of the late 1990s–early 2000s and habitat fragmentation that precluded post-drought genetic rescue (Ibid.). Flat-tailed Horned Lizard populations in the Coachella Valley are even smaller and more fragmented than the Coachella Valley Fringe-toed Lizard, apparently only persisting as potentially viable populations in two conservation areas (Barrows et al. 2008). Similarly, Culver and Dee (2008) observed that a small population of Flat-tailed Horned Lizards, separated from the rest of the species' range in Arizona by development and Interstate 8, was moderately genetically differentiated from those located south of the road. They posited this may have been due to a strong selective force north of the freeway, random genetic drift, or inbreeding due to the effects of isolation and small population size (Ibid.).

Edge effects, reported as reductions in Flat-tailed Horned Lizard detections, have been observed as great as 725 m (0.45 mi) away from a habitat edge and are primarily associated with increased predation by Round-tailed Ground Squirrels, Loggerhead Shrikes, and American Kestrels, and road mortality (Barrows et al. 2006, Goode and Parker 2015, Wright and Grant 2003, Young and Young 2005). In some cases, these edge effects appear to be able to shift Flat-tailed Horned Lizard population dynamics from a bottom-up process, where the lizard numbers are regulated by native ant abundance, to a top-down process, where the lizards are limited by predation and possibly road mortality, creating a population sink along the habitat boundary (Barrows et al. 2006).

The USFWS (2011) evaluated Flat-tailed Horned Lizard habitat fragmentation by major canals and highways, the international border, and several railways by multiplying the size of the habitat block by the density estimate they used to calculate rangewide abundance (see "Abundance" section). Because no one knows what the minimum viable population size is for Flat-tailed Horned Lizards, the USFWS used 7,000 individuals per population (based on Reed et al. 2003) to differentiate between habitat blocks that were likely large enough to avoid deleterious effects from small population sizes from those that weren't (Ibid.). Based on this calculation, which did not incorporate edge effects, neither occupied conservation area in the Coachella Valley appears large enough to support a "large enough" population, three of nine areas west of the Imperial Valley were large enough (comprising 83% of the total area), and two of eight areas east of the Imperial Valley were large enough (comprising 69% of the total area) (Ibid.).

Some species-specific evidence (Barrows et al. 2006, 2008; Culver and Dee 2008; Goode and Parker 2015; Young and Young 2005), as well as some analyses based on assumptions of minimum viable population size (USFWS 2011), and population dynamics theory (Woodroffe and Ginsberg 1998), support the contention that Flat-tailed Horned Lizards are susceptible to the adverse effects of habitat fragmentation, edge effects, and small population sizes.

Roads, Canals, and Railroads

Major highways, canals, and railroads can form large-scale near-complete barriers to Flat-tailed Horned Lizard movement, migration, and gene flow (Figure 13). Even where these features are permeable, they can fragment the habitat through demonstrable edge effects that increase mortality.

Several major highways bisect the species' range in California, as well as many minor ones. Flat-tailed Horned Lizards are frequently found on and around roads, and because they often freeze in the presence of threats, including vehicles, they're particularly susceptible to being killed on roads. Flat-tailed horned lizards were the most commonly encountered reptile (dead or alive) on paved roads within a military base in Arizona three out of four years under study (Goode and Parker 2015). Flat-tailed Horned Lizards accounted for 40.2% of all dead-on-road reptile observations at the base, which supports some of the highest population densities of the species in its U.S. range (Goode and Parker 2015, Leavitt et al. 2015). As previously described, the decline of Flat-tailed Horned Lizards along a stretch of Highway 78 was one of the reasons Flat-tailed Horned Lizards started receiving conservation attention in the 1970s (Altman et al. 1980, Turner and Medica 1982). Reports of proportions of dead vs. live Flat-tailed Horned Lizards on roads range from 3% - 27% (Goode and Parker 2015, Muth and Fisher 1992, Turner et al. 1980, Young and Young 2000) but do little to assess the impacts roads may be having at a population level. However, at least two studies (Barrows et al. 2006, Goode and Parker 2015) have addressed this population-level effect specifically on Flat-tailed Horned Lizards.

Using mark-recapture data, Goode and Parker (2015) reported no significant differences in population abundance estimates in plots adjacent to roads compared to control plots. In fact, two of the highest abundance estimates came from plots adjacent to roads. However, it should be noted that these were from plots without adjacent power poles (Ibid.), suggesting predation may be a primary driver in observed edge effects along roads (see "Predation" section below) at least in areas where traffic is substantially less than along major freeways. In a similar pattern, Barrows et al. (2006) reported a much greater and more abrupt reduction in Flat-tailed Horned Lizard detections near wider, well-traveled roads with curbs vs. narrower, less-traveled roads without curbs; however, they could not absolutely attribute this to road mortality because they simultaneously observed a high level of predation by American Kestrels using a palm tree planted across the wider road. Road mortality may be having a population-level effect in some areas, particularly wide heavily traveled roads. For example, Wright and Grant (2003) reported 87% fewer Flat-tailed Horned Lizards within 725 m (0.45 mi) of Highway 98 where it traverses the Yuha Basin MA. While at least some lizards undoubtedly successfully cross these roads, the depressed numbers observed adjacent to them could have serious effects on already small, fragmented populations.

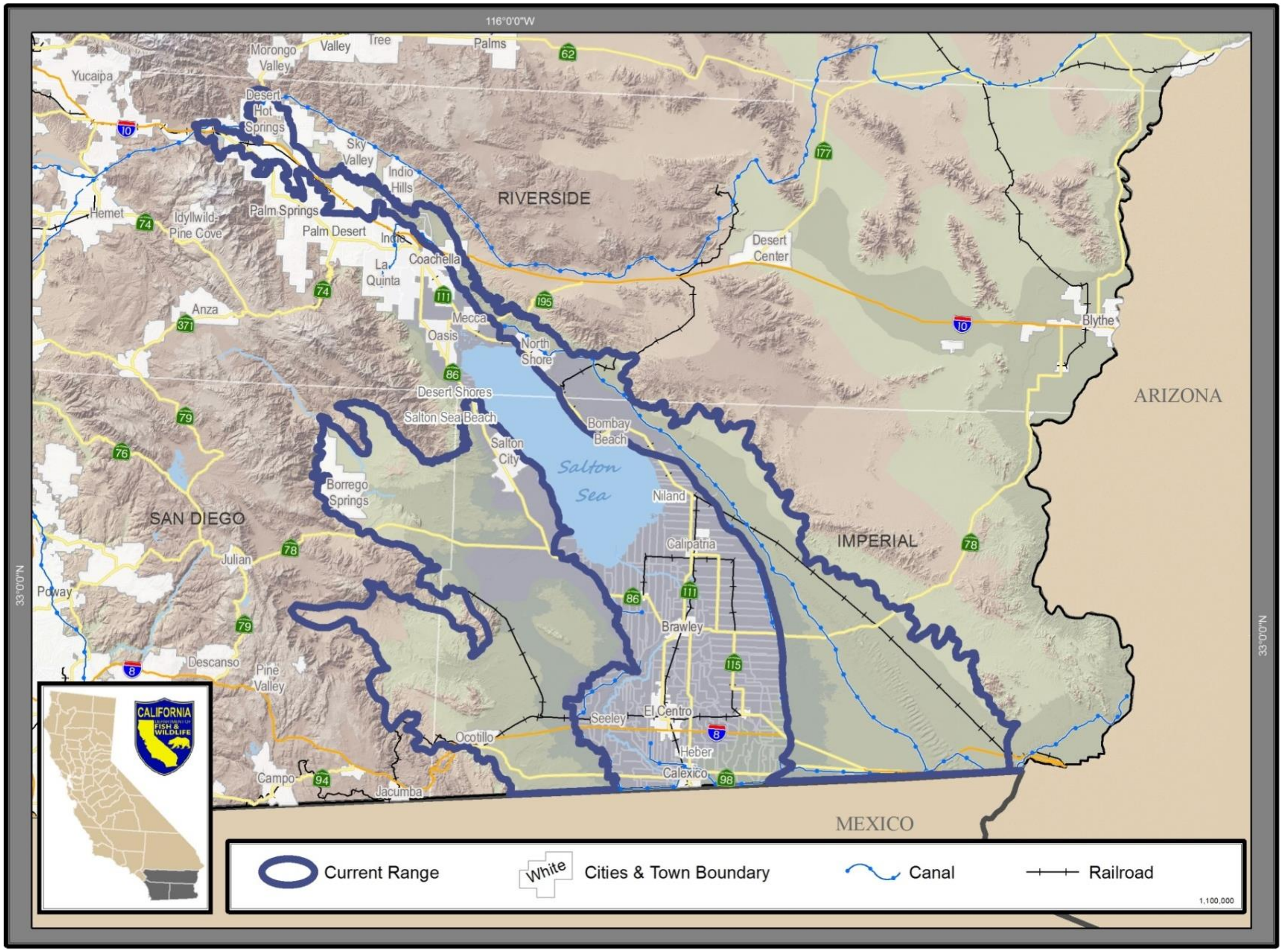


Figure 13. Potential Barriers and Sources of Fragmentation

Sources: CDFW GIS Library

Nearly all of the canals in the Flat-tailed Horned Lizard's range are located within the existing developed lands in the Imperial and Coachella valleys. Two major exceptions are the All American Canal along the southern border and the Coachella Canal, which travels from north to south along the east side of the Salton Sea (Figure 13). No studies have been conducted regarding the impact of canals on Flat-tailed Horned Lizards; however, it is clear that they present a barrier to movement with the possible exception of overcrossings. The Coachella Canal has several overcrossings to accommodate water and sediment transport down washes coming from the mountains to the east. In contrast, the All American Canal has very few crossings, all of which are narrow vehicle bridges. The canal effectively isolates the Flat-tailed Horned Lizards occurring in the small strip of land south of it and north of agricultural land in Mexico, called Andrade Mesa, from the rest of the species' range (FTHLICC 2003).

Canal maintenance or improvements and construction of any new facilities have the potential to injure or kill Flat-tailed Horned Lizards or destroy their habitat. However, failure to maintain facilities and repair leaks can lead to habitat degradation such as facilitating the spread of tamarisk (*Tamarix* spp.), which can support avian predators. Imperial Irrigation District is discussing potentially constructing an intake canal off the All American Canal heading north close to the East Highline Canal that would discharge into a reservoir (J. Lovecchio pers. comm.), which, if constructed, would likely adversely impact a relatively small area in the overall Flat-tailed Horned Lizard's range.

There are a few railroads that run through the Flat-tailed Horned Lizard's range in California (Figure 13), which could pose a barrier to movement over long distances. It is unclear whether Flat-tailed Horned Lizards would avoid the tracks and their platforms, or if they would be able to climb over the tracks if they do not avoid them. In some areas, the tracks run over culverts constructed over washes that would allow more unrestricted movement from one side to another, so some movement and gene flow is potentially still possible across these features.

Agricultural and Urban Development

As previously described in the "Distribution" section, the two primary sources of Flat-tailed Horned Lizard habitat loss over the past century have been agricultural and urban development in Imperial, Coachella, and Borrego Valleys. New agricultural development has slowed substantially due to reduced water deliveries from the Lower Colorado River, and some fields have been fallowed (USFWS 2011) and converted to solar farms. While these fallowed lands may be perceived as marginally suitable habitat, Flat-tailed Horned Lizards have been observed using them where they are adjacent to intact habitat (RECON 2010).

Most land within the California portion of the Flat-tailed Horned Lizard's range is owned by State or various federal agencies, so extensive urban development is unlikely (USFWS 2011), although the California Department of Finance (2014) projects Imperial County's population is likely to grow from 187,689 people in 2010 to 336,492 in 2060 (+79%). The majority of this growth in the near term (2021) will be directed to existing incorporated townsites, including Bombay Beach, Desert Shores, Heber, Niland, Ocotillo, Salton City, Salton Sea Beach, and Seeley (County of Imperial 2013) (Figure 13). Most private land holdings are relatively small and discontinuous throughout the species' range in California, although there are large aggregations around Borrego Springs and Ocotillo in San Diego County (USFWS 2011), suggesting development of private land is likely to have somewhat localized impacts in most potentially developable areas. In addition to limiting the cap on permanent surface disturbance to 1% of the MAs, the RMS member agencies use compensatory mitigation money from approved project disturbances to purchase private inholdings within and adjacent to the MA boundaries, reducing the likelihood urban (or other) development will fragment the habitat within these areas. Incidental take associated with nearly all future urban development in the Coachella Valley has been permitted through the CVMSHCP (see “Existing Management” section).

Renewable Energy Development

Unlike agricultural and urban development, renewable energy (solar, wind, geothermal) development within the Flat-tailed Horned Lizard’s range has increased dramatically in recent years. Lovich and Ennen (2011, 2013) synthesize the literature on potential impacts from utility scale renewable energy projects on desert ecosystems and wildlife. These include but are not limited to (1) creating a barrier to movement and fragmenting habitat; (2) increasing mortality on access roads and through increased avian predation along transmission lines; (3) opening up previously inaccessible areas to the public, facilitating illegal OHV use; (4) producing fugitive dust; (5) increasing soil erosion; (6) spreading invasive species; (7) increasing exposure to contaminants; (8) producing persistent loud noise and vibrations (wind); (9) increasing risk of fire; and (10) potentially altering local temperature, precipitation, and wind conditions (Ibid.).

There are no known studies investigating the specific impacts of renewable energy facilities and their associated infrastructure on Flat-tailed Horned Lizards, although some information from other studies provided above on the effects habitat fragmentation, road mortality, and increased predation could apply. In addition, Olech (1984) reported that localized declines in indexed Flat-tailed Horned Lizard detections (scat and lizards) within the Yuha Basin corresponded with increased public use of those sites via construction of access roads for transmission lines and San Diego Gas and Electric’s Imperial Valley Substation. Non-authorized OHV use was the most common “competing use” along all transects, and for transects where it was the only competing use of habitat, the temporal declines in observations were significant (Ibid.).

To date, renewable energy development in California has been permitted on a project-by-project basis. To facilitate permitting, the BLM has produced Programmatic Environmental Impact Statements (PEIS) for wind (BLM 2005), geothermal (BLM and USFS 2008), energy corridors (DOE and BLM 2008), and solar (BLM and DOE 2012). Wind resource potential is low throughout nearly all of the Flat-tailed Horned Lizard’s range in California with the exception of the area around Ocotillo (BLM 2005) near the southwestern edge of the species’ range, where the species appears to be sparsely distributed. The Ocotillo Wind Energy Facility was constructed in 2012 (BLM 2016d). Geothermal potential is greater, but its footprint is relatively small, and sites can typically be reclaimed and restored after extraction (BLM and USFS 2008).

The potential for solar energy facilities to impact a substantial amount of Flat-tailed Horned Lizard habitat is greater than that of wind or geothermal. Two Solar Energy Zones (SEZ) were identified in the PEIS, but only one is located within the Flat-tailed Horned Lizard’s range (BLM and DOE 2012). The 2,314 ha (5,718 ac) Imperial East SEZ is located immediately south of the East Mesa MA in a fragmented patch of habitat bordered by Interstate 8, Highway 98, and

Imperial Valley agriculture (Ibid.). An additional SEZ, the 4,354 ha (10,759 ac) West Chocolate Mountains SEZ, was subsequently established within the approximately 26,000 ha (64,247 ac) West Chocolate Mountains Renewable Energy Evaluation Area (REEA), located immediately south of Dos Palmas east of the Salton Sea (BLM 2012). The Final EIS for the West Chocolate Mountains REEA incorporated the RMS as its conservation measures for Flat-tailed Horned Lizards (Ibid.). There were no pending solar project applications within the Imperial East SEZ as of April 2015 (BLM 2015) or West Chocolate Mountains SEZs as of June 2014 (BLM 2014).

From January 2009-September 2015, the BLM approved right-of-way grants for six solar, one wind, and zero geothermal energy projects within the Flat-tailed Horned Lizard's range (BLM 2016d), although two of the proposed solar projects were subsequently withdrawn (F. Sirchia pers. comm.). Prior to 2009, the BLM had not approved any solar energy projects on public lands (BLM 2016d). The conservation, mitigation, and compensation measures in the RMS were incorporated into the environmental documents for these renewable energy projects, including minimizing impacts to Flat-tailed Horned Lizard habitat to the extent feasible, particularly within MAs, and purchasing compensation land or paying into a special fund for unavoidable impacts. For each approved project within a Flat-tailed Horned Lizard MA, the maximum (6:1) compensation ratio was applied.

Two energy corridors were identified that run roughly east to west through the Flat-tailed Horned Lizard's range in California, one in the far southern and one in the far northern parts of the range, overlapping portions of the East Mesa and Yuha Basin MAs as well as the Thousand Palms Conservation Area (DOE and BLM 2008). To date all of the solar projects with a BLM right-of-way grant have been located in the vicinity of the Imperial Valley Substation and Sunrise and Southwest Powerlinks (major transmission lines) in or around the Yuha Basin MA (BLM 2016d). Most of the solar facilities were constructed on private agricultural land, and disturbance to Flat-tailed Horned Lizard habitat was restricted to construction of transmission lines connecting the facilities with existing infrastructure (Figure 14).

Aside from solar projects on BLM lands, there are several other authorized or pending renewable energy projects within the Flat-tailed Horned Lizard's range in California. Wind energy facilities are concentrated in the two locations that possess moderate to high wind resource levels, each along the periphery of the species' range (BLM 2005). One area is located in the far northwestern extent of the species' presumptive range near Whitewater in Riverside County, and the other is located in a canyon west of Ocotillo along the Sunrise Powerlink corridor in Imperial County within approximately 8 km (5 mi) of the Yuha Basin MA. In addition to the already operational Ocotillo Express Wind Farm in the latter zone, approvals for testing in the same area have been issued to two other wind energy development companies (BLM 2016c). There are several dozen parcels with geothermal leases located in approximately four areas within the Flat-tailed Horned Lizard's range (BLM 2013). The East Mesa Geothermal Field lies partially within the East Mesa MA, the Truckhaven Geothermal Leasing Area is located within the Ocotillo Wells RA, and the West Chocolate Mountains Geothermal Leasing Area is within the West Chocolate Mountains REEA. The Truckhaven Geothermal Project recently completed a reconnaissance survey and subsequently decided not to proceed with any future development (M. Rodriguez pers. comm.). In addition, renewable energy facilities are being approved on county lands that are not requiring implementation of the RMS conservation

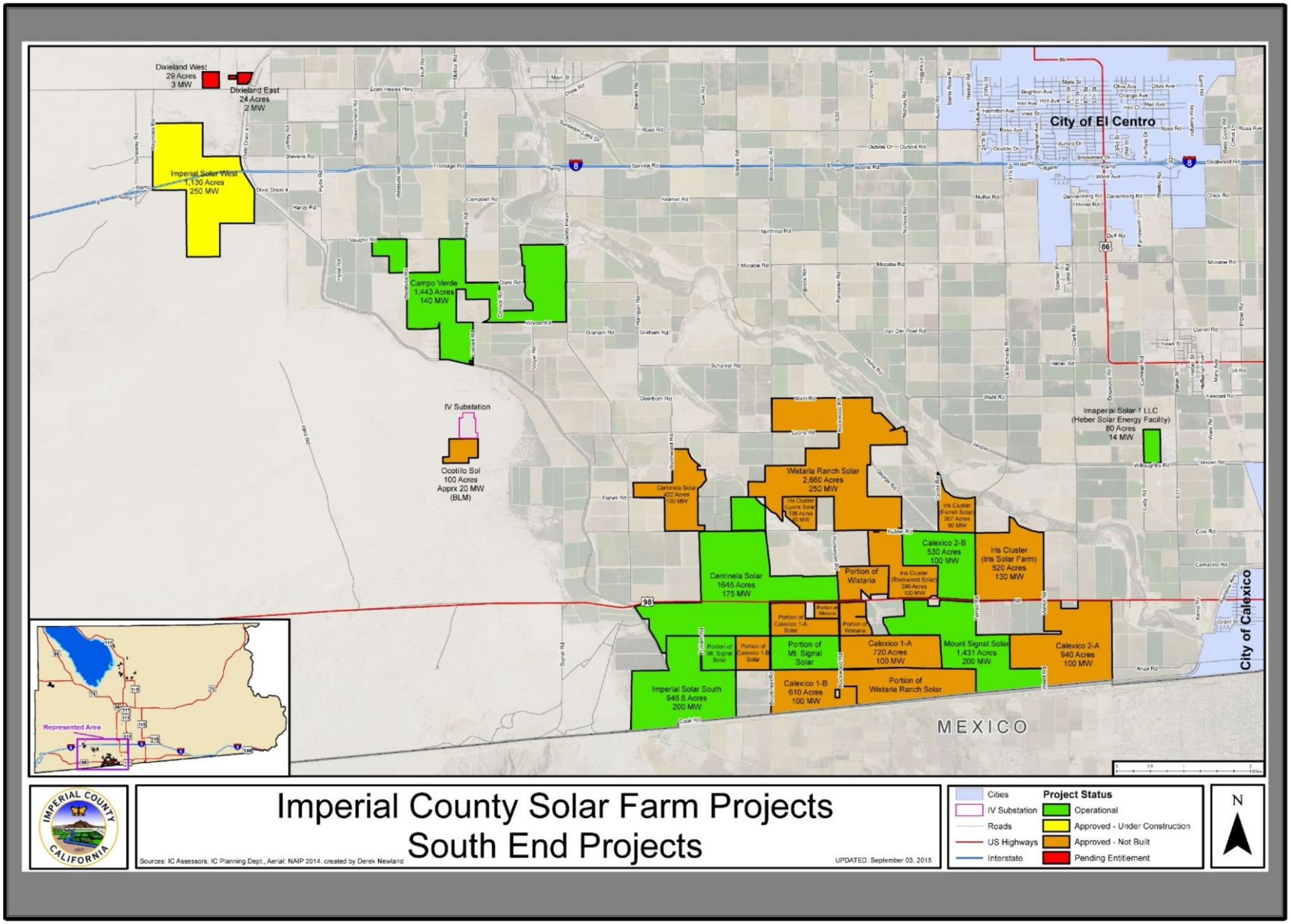


Figure 14. Solar Facility Footprints in Southwestern Imperial County

Source: Imperial County (2015)

measures, although renewable energy companies are expected to evaluate potential impacts to Flat-tailed Horned Lizards and mitigate to a less than significant level through CEQA compliance (see “Existing Management” section).

With so many different agencies involved in renewable energy development oversight and approval and such a high demand in California, State and federal agencies recognized the need for a comprehensive plan to guide development in appropriate areas while protecting sensitive resources. In 2008, the BLM, California Energy Commission, USFWS, and the Department began a collaborative effort to draft a Desert Renewable Energy Conservation Plan (DRECP) covering the Mojave and Colorado/Sonora desert region of California. The Draft DRECP EIR/EIS was released for public comment in September 2014 (DRECP 2014). As a result of feedback during this period, the agencies decided to implement the DRECP in a phased approach starting with just BLM-administered lands. In November 2015, the BLM-proposed Land Use Plan Amendment (LUPA) and the DRECP Final EIS were released for public comment (DRECP 2015). In March 2016, a notice describing the proposed ACEC updates was released for public comment (BLM 2016b). In addition to identifying Development Focus Areas (DFA) where renewable energy permitting would be streamlined, the LUPA proposes to designate 130 ACECs covering approximately 2,418,400 ha (5,975,973 ac), including 445,569 ha (112,603 ha) within Wildlife Study Areas and Wilderness Areas. It also and establishes Conservation and Management Actions and resource use limitations for management of those ACECs, including a detailed methodology for implementing and managing for ground disturbance caps in ACECs (DRECP 2015). Figure 15 depicts the DFAs in relation to the RMS areas and proposed ACEC expansion. A Record of Decision was signed, and the LUPA was formally approved, in September 2016 (BLM 2016a).

Within the LUPA area, there are approximately 216,100 ha (534,000 ac) of modeled Flat-tailed Horned Lizard habitat, nearly all of which occurs in the Imperial Borrego Valley Ecoregion Subarea (DRECP 2015). Approximately 173,690 ha (429,000 ac) of this area is within the DRECP area and available for development (excludes military lands, tribal lands, and BLM open OHV areas). The DFAs that overlap the Flat-tailed Horned Lizard’s range occur in the western foothills of the Chocolate Mountains, which include geothermal leasing areas studied in the 2008 Geothermal PEIS; lands along the western edge of East Mesa ACEC; and lands on the west side of the Salton Sea, which include the Truckhaven Geothermal Leasing Area within the Ocotillo Wells RA. Under the Preferred Alternative, approximately 6,880 ha (17,000 ac) of modeled Flat-tailed Horned Lizard habitat would be disturbed for renewable energy: 2,833 ha (7,000 ac) for solar, 8 ha (20 ac) for wind, 2,023 ha (5,000 ac) for geothermal, and 2,023 ha (5,000 ac) for transmission lines (Ibid.). This amounts to less than 4% of available modeled habitat within the LUPA and less than 2% of the modeled habitat (371,500 ha [918,000 ac]) throughout the entire DRECP area (Ibid.). The RMS conservation, mitigation, and compensation measures are incorporated into the LUPA (BLM 2016a). In addition, the Preferred Alternative would expand Flat-tailed Horned Lizard protections by increasing the size of some of the ACECs within the species’ range and restricting or reducing some incompatible uses (Table 4) (Ibid.). The amount of renewable energy development authorized by Imperial and San Diego counties is unknown, although their combined ownership within the Flat-tailed Horned Lizard’s range is only 0.05% (using the Department’s range map).

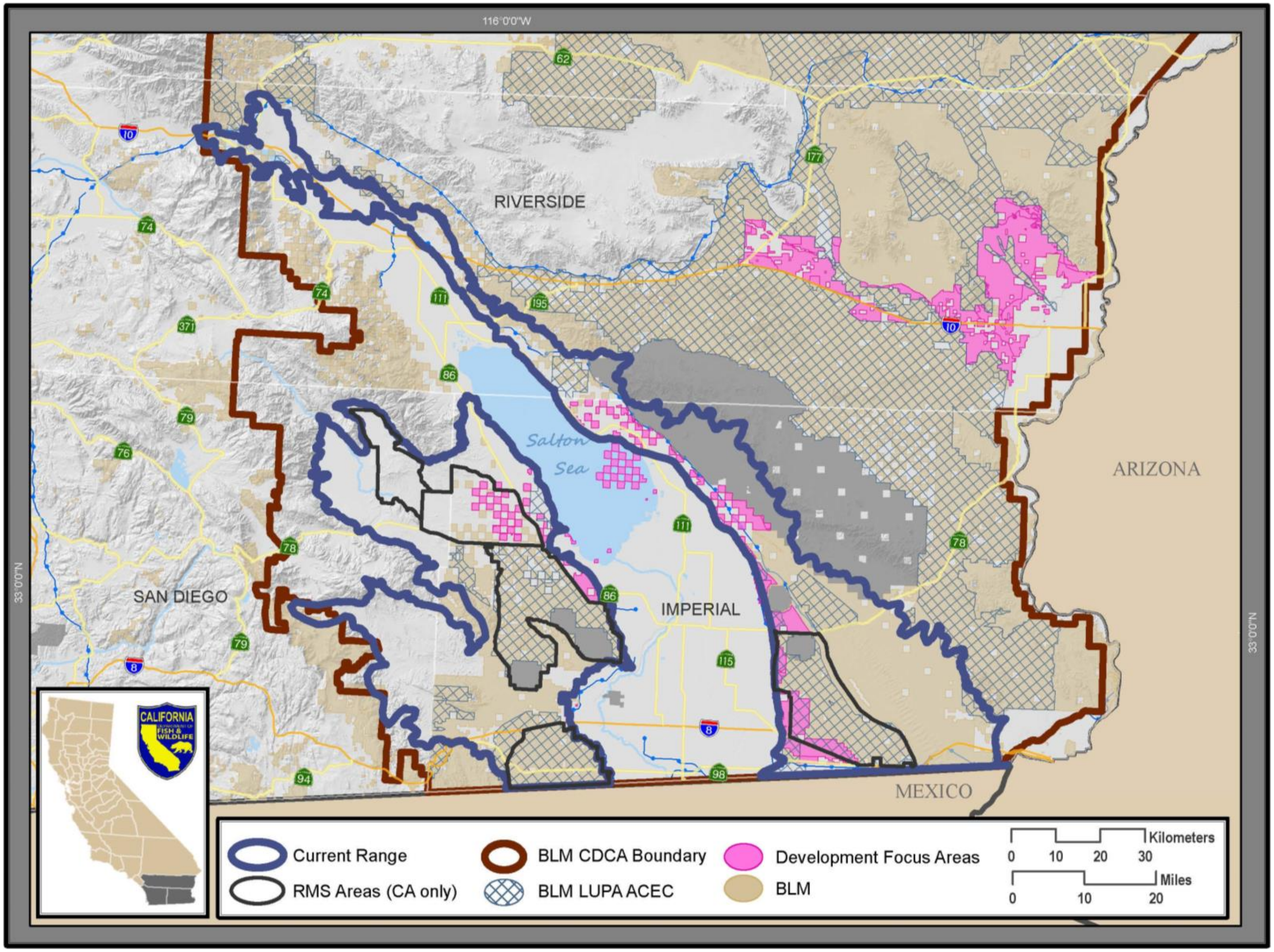


Figure 15. Land Use Designations under the BLM LUPA

Source: BLM, CDFW GIS Library

Table 4. ACECs within Flat-tailed Horned Lizard's Range (LUPA Preferred Alternative) [1, 2]

ACEC	Current Area in ha (ac)	Proposed Area in ha (ac)	Renewable Energy	Mining	OHV
Coachella Valley Fringe-toed Lizard Preserve	4,156 (10,270)	4,156 (10,270)	No	Yes[3,4]	No
Coyote Mountains Fossil Site	2,380 (5,880)	2,380 (5,880)	No	Yes[3,4]	No
Dos Palmas Preserve	3,371 (8,330)	3,371 (8,330)	No	Yes[4,5]	No
East Mesa	17,037 (42,100)	35,807 (88,480)	Geothermal[6]	Yes[4,7]	Yes
Lake Cahuilla	5,382 (13,300)	5,382 (13,300)	Geothermal[6]	Yes[4,7]	Yes
Ocotillo	0 (0)	5,925 (14,640)	No	Yes[3,4,5]	Yes
Salton Sea Hazardous	0 (0)	2,873 (7,100)	No	No	No
San Sebastian Marsh-San Felipe Creek	2,639 (6,520)	2,639 (6,520)	Geothermal (100% NSO)	Yes[3,4,5]	Yes
Shoreline	0 (0)	4,804 (11, 870)	Geothermal[6]	Yes[3,4,5,7]	Yes
West Mesa	8,215 (20,300)	33,415 (82,570)	Geothermal[6]	Yes[3,4,5]	Yes
Yuha Basin	27,641 (68,300)	31,282 (77,300)	No	Yes[4]	Yes

[1] Some ACECs only partially overlap the species' range. Those with minimal overlap are not included in the table.

[2] All ACECs have a 1% disturbance cap except Lake Cahuilla (None); Salton Sea Hazardous and Shoreline (0.1%).

[3] Locatable minerals = gold, silver, gems, limestone, etc.

[4] Mineral materials = sand, gravel, rock, etc.

[5] Non-energy leasables = phosphate, sodium, potassium, sulphur, etc.

[6] New leases are only allowed where they overlap a DFA and are subject to a "No Surface Occupancy" (NSO) stipulation (i.e., extraction only through directional drilling from outside the area).

[7] Oil and gas

Mining

The area of mining and mineral sites within the Flat-tailed Horned Lizard's range have not been mapped or quantified (BLM 2011), although Rado (1981) estimated 2,070 ha (5,115 ac) of active and intermittent sand and gravel quarries at the time of his study. Most mining activity within the Flat-tailed Horned Lizard's range is sand and gravel extraction, which has a relatively small physical footprint but can have a larger ecological footprint (BLM 2011, FTHLICC 2003). Like other types of development, mining activities remove and fragment habitat and can impact air quality, create erosion and substantial noise, promote invasive species, release contaminants, and result in increased mortality through roadkill and/or subsidizing predators (Ibid.). The Yuha Basin MA has been identified as a source of suitable sand and gravel (DRECP 2015), and there is an ongoing operation adjacent to and partially within East Mesa MA (BLM 2011). Among the few exemptions from the requirement to compensate for impacts to Flat-tailed Horned Lizard habitat in the RMS areas are sites that have previously been mined along the East Highline Canal, either inside or outside of the East Mesa MA, if the applicant will be reclaiming the site and no further mining would occur (FTHLICC 2003).

Oil and gas leases were issued throughout the Salton Trough in the early 1980s, but only one test well was drilled (FTHLICC 2003). The well was not profitable, no oil or gas resources have been identified, and all oil and gas leases within the Flat-tailed Horned Lizard's habitat had expired by the early 2000s (USFWS 1997, FTHLICC 2003).

Gold mining was listed as a potentially significant future threat to Flat-tailed Horned Lizards in the Department's 1989 status review due to numerous mining claims being staked in the area of OWSVRA (Bolster and Nicol 1989), but this threat did not manifest in subsequent years.

Off-highway Vehicles

Most Flat-tailed Horned Lizard habitat is available for OHV recreational opportunities to some degree. Closed areas are restricted to military lands, wilderness designations, and Anza-Borrego Desert State Park (BLM 2003), although the latter allows highway-legal vehicle use along established primitive roads. The BLM allows vehicles on established routes within the East Mesa, West Mesa, and Yuha Basin MAs (Ibid.). The adverse effects that OHVs can cause to desert ecosystems have been well documented, including (1) compacting soil and destroying soil crusts, which leads to erosion and limits plant germination, growth, and vigor; (2) damaging and destroying the plants themselves and crushing animal burrows, which reduces habitat availability and quality; (3) raising fugitive dust and emitting byproducts of combustion, which impacts air quality and plant growth; (4) spreading invasive species; (5) directly wounding or killing wildlife; and (6) producing excessive noise, which can alter animal behavior and physiology (Ouren et al. 2007).

The most recent estimate of OHV route proliferation and surface disturbance within the Flat-tailed Horned Lizard's range in California occurred in the early 2000s (USFWS 2003, Wright 2002), prior to adoption of the Western Colorado OHV Routes of Travel Designation Plan and construction of the border fence (BLM 2003, USCBP 2012a). It is impossible to differentiate recreational OHV activity from that undertaken by Border Patrol. Wright (2002) estimated the number of routes and graded roads increased by 387% within the West Mesa MA from 1985 to 2001, increased by 23% within the Yuha Basin MA from 1994 to 2001, and decreased 45% within the East Mesa MA from 1994 to 2001. Wright (2002) estimated 11.4% of the West Mesa MA had vehicle tracks in 2001, and the USFWS (2003) estimated that surface area disturbance in 2002 was 9.7% in the Yuha Basin MA and 7.8% in the East Mesa MA. The 45% drop in vehicle track coverage in one year was speculated to have been the result of a big sandstorm and change in Border Patrol activities (Wright and Grant 2003). This serves as a good example of why vehicle track coverage is an imperfect estimate of OHV impacts. Tracks disappear more quickly in sand than other surfaces, and a high number of tracks does not necessarily equate to frequent, or even recent, vehicle traffic since they can last for a long time in certain substrates

(Ibid.). Nevertheless, track coverage has been used as the metric of OHV pressure in the vast majority of studies on the activity's potential effects on Flat-tailed Horned Lizards.

There have been numerous attempts to study the impacts of OHVs on Flat-tailed Horned Lizards over the past three and a half decades, but complications associated with the low overall detectability of the species, variable detectability in different habitats, the unreliability of using scat as a surrogate index of abundance, and difficulty categorizing level or intensity of OHV use at a site have rendered the results somewhat equivocal.

Setser and Young (2000), studying radio-tracked Flat-tailed Horned Lizards in mudhill habitat within OWSVRA, found positive associations between Flat-tailed Horned Lizard habitat use and rocks and plants, and a negative association with OHV disturbance out to 10m (33 ft) from vehicle tracks (Ibid.). Hollenbeck (2004, 2006) found sand was the only significant variable associated with Flat-tailed Horned Lizard abundance on several plots across OWSVRA, track coverage was not. Wright and Grant (2003) reported that significantly fewer Flat-tailed Horned Lizards were found on plots with greater than 9% track coverage; however, there was no significant correlation between Flat-tailed Horned Lizard abundance and track coverage. Sand coverage was the only significant environmental variable that was positively correlated with Flat-tailed Horned Lizard abundance (Ibid.). Gardner (2005) also found that Flat-tailed Horned Lizards were positively associated with sand, as well as shrub abundance, even when the sandy plots were OHV routes in washes. McGrann et al. (2006) found that ant mound densities, mean adult Flat-tailed Horned Lizard mass, and mean juvenile Flat-tailed Horned Lizard mass were significantly greater on low impact plots (i.e., lower vehicle track %) than high impact plots, but overall density of Flat-tailed Horned Lizards was greater on the high impact plots at one site and lower on another. Because they controlled for sand and vegetation, they speculate the difference was regularity of OHV use (as opposed to simply track coverage), which was greater at the site with lower Flat-tailed Horned Lizard densities (Ibid.). Wright (2002) reported that surveys undertaken between 1979 and 2001 found significantly more Flat-tailed Horned Lizards in the Limited Use and Navy lands of West Mesa than in the adjacent Superstition Mountains and Plaster City Open Areas. However, he noted that 23% of the transects in the Open Areas were in areas impacted directly or indirectly (due to close proximity) by either mining, agriculture, or a dry lake bed, which were not detected on the transects in the Limited and Navy Lands, and may have accounted for some of the difference in lizard encounter rates between the vehicle use classes (Ibid.).

Some studies have sought to discover the direct impacts on Flat-tailed Horned Lizards from OHVs. Because the highest recreational OHV use occurs during cooler months when many Flat-tailed Horned Lizards are typically brumating, Grant and Doherty (2009) investigated the risk of them being crushed by OHVs while in burrows by simulating high and low impact riding intensities. Five of twelve Flat-tailed Horned Lizards were directly run over while in their burrows during the high impact treatment and three in the low, but none were injured or killed despite brumating at shallow depths (Ibid.). The authors noted that a higher proportion of lizards brumated under shrubs in OWSVRA (high use area) than in East Mesa (low use area) and that rainfall may have played a part in the results, speculating that OHVs may cut less deeply into wet soil because the water tension helps hold it together (Ibid.). Young (1999) investigated the difference in Flat-tailed Horned Lizard reaction to an OHV passing by vs. a person walking by and found none. Nicolai and Lovich (2000) radio-tracked three male Flat-tailed Horned Lizards before and after a race and found an overall reduced rate of movement after the race, although the biological significance of the difference was dubious since the mean activity areas after the race were variable (i.e., one lower, one nearly the same, and one higher than before the race). In a similar study, Flat-tailed Horned Lizards were radio-tracked in April 2014 during the Imperial Valley OHV S.C.O.R.E. race (R. Lovich pers. comm.). Preliminary results indicate that distances moved between consecutive translocations varied with no obvious pattern related to the race, and there were no mortalities despite the fact that nine of the lizards were located directly within the race path before, during, and after the event (Ibid.). Activity area size ranged from increased, same, and decreased among the nine Flat-tailed Horned Lizards on the race course (Ibid.).

Noise associated with OHVs (as well as military activities, construction equipment, transmission lines, power plants, and wind farms) has been speculated to adversely affect Flat-tailed Horned Lizards (Bolster and Nicol 1989, CBD 2014). The degree to which noise impacts Flat-tailed Horned Lizards is uncertain, although some evidence suggests it is likely negligible. Heffner and Heffner (1998) concluded that reptiles show few, if any, responses to sound, and it appears they do not make as wide a use of hearing as most other vertebrates. However, Bondello (1977) and Brattstrom and Bondello (1983) demonstrated prolonged acoustical sensitivity loss in Desert Iguanas (*Dipsosaurus dorsalis*) and Mohave Fringe-toed Lizards (*Uma scoparia*), respectively, after short duration exposure to OHV-level noises. These studies have been used to support the notion that similar impacts to Flat-tailed Horned Lizards are likely. However, Flat-tailed Horned Lizards have a different ear anatomy than these species. Flat-tailed Horned Lizards have no exterior ear opening, and Norris and Lowe (1951) concluded that the species' tympanum (eardrum) was so degenerate, it appears to have become functionless. The tympanum is covered with skin and encroached upon by bone, and the middle ear has been invaded by jaw bone, a condition that approximates that of snakes (Norris and Lowe 1951, Stebbins and McGinnis 2012). These changes have been noted in other lizard genera as well and are thought to be adaptations to burrowing (Ibid.). Christensen et al. (2012) concluded "that pythons, and possibly all snakes, lost effective pressure hearing with the complete reduction of a functional outer and middle ear, but have an acute vibration sensitivity that may be used for communication and detection of predators and prey." In addition, Wone et al. (1994) experimented with high frequency sounds to determine if they could elicit Flat-tailed Horned Lizards to run and thus be more easily detected; however, none of the Flat-tailed Horned Lizards exposed to the sounds reacted, remaining crouched and motionless whether the units were turned on at a distance or nearby.

Significant impacts from OHV activity on Flat-tailed Horned Lizards have been difficult to measure and appear to be confounded by other factors that may have a greater effect on abundance. They certainly are injured and killed on roads and trails, but the frequency and severity of this source of mortality and its impact on population dynamics are unknown. A very small proportion (two out of hundreds) of all the Flat-tailed Horned Lizards tracked with radio-transmitters was known to have been killed by OHVs (Goode and Parker 2015, Grant and Doherty 2009, Muth and Fisher 1992, Setser 2001). One reason for this low proportion may be that Flat-tailed Horned Lizards are selecting habitat features like rocks and shrubs that OHV riders tend to avoid (Gardner 2005). In addition, not all OHV activity is the same, and the risk to Flat-tailed Horned Lizards may vary dramatically depending on a number of factors, including habitat suitability, substrate, time of year, and available resources. For instance, as previously described, Grant and Doherty (2006) observed that lighter Flat-tailed Horned Lizards tended to enter brumation later in the year and speculated that they may need to stay active longer to put on fat reserves to last the winter. They also noted, as others have, that juveniles may not brumate at all. It is possible in lean years, Flat-tailed Horned Lizards may not brumate as long, and the longer they stay active, the more likely they are to be exposed to OHVs on the surface. In addition, Young and Young (2000) noted that it appeared Flat-tailed Horned Lizards are much more likely to flee from an approaching vehicle in a year with abundant resources than in a year of restricted resources, which may suggest that in times of physiological stress due to drought, the species could be more susceptible to being run over (Ibid.).

Where OHV use intensity is great enough that it substantially reduces shrubs or prey, particularly in areas where these habitat features may already be scarce, Flat-tailed Horned Lizard density and body condition are likely to suffer. Luckenbach and Bury (1983) observed marked declines in herbaceous and perennial plants, arthropods, lizards, and mammals in open OHV riding areas of the Algodones Dunes vs. closed/low use areas. The extent to which these changes in vegetation and prey have occurred as a result of OHV activity across the Flat-tailed Horned Lizard's range in California is unknown. Whether the vibrations from OHVs detected by Flat-tailed Horned Lizards impact their ability to respond to predators or other threats (like OHVs) is similarly unknown.

United States-Mexico Border Activities

In response to illegal immigration and narcotics smuggling, Border Patrol actively enforces the border and surrounding areas, using OHVs, pedestrian and vehicle fences, and surveillance cameras and towers (Cohn 2007, FTHLICC 2003, Lasky et al. 2011). Flat-tailed Horned Lizards may be adversely affected by both illegal activities and the efforts to halt them through habitat fragmentation caused by the border fence, increased predation facilitated by tall perches (fences and towers) and trash, on- and off-road mortality, and habitat degradation from cross-country driving and tire-dragging.

There is limited literature available specifically assessing border related impacts on the Flat-tailed Horned Lizard (Cohn 2007; Fernandez et al. 2006; Lasky et al. 2011; USCBP 2012a, 2012b; Villarreal et al. 2014). While Border Patrol has the authority to operate up to 161 km (100 mi) from the border, the USFWS (2011) estimated that border-related activities involved a zone of high impact within 1 km (0.6 mi) north of the border. In California, that would amount to heavy disturbance of approximately 2,318 ha (5,728 ac) or 0.7% and 5,012 ha (12,385 ac) or 3% of the Flat-tailed Horned Lizard's range west and east of the Imperial Valley, respectively. The construction of a border fence along the entire California range of the species is expected to dramatically reduce that impact (Ibid.). In Arizona after installation of the border fence in Yuma, reduced impacts to Flat-tailed Horned Lizard habitat associated with trans-border illegal immigration activities, OHV activity, drug smuggling, and ensuing law enforcement activities in Arizona has been observed (FTHLICC 2012, R. Lovich pers. comm., Rorabaugh 2010, USFWS 2011, K. Young pers. comm.).

The border fence is nearly continuous across the Flat-Tailed Horned Lizard's range in California (USCBP 2012a) and consists of four types (PV-1, P-2, PV-4, and VF-2) that appear to be at least semi-permeable to lizards (Figure 16) (Lasky et al. 2011, Rorabaugh 2010, USCBP 2012a). Given the relatively large home ranges of Flat-tailed Horned Lizards, at least some genetic exchange across the border seems possible, particularly if the benefits to Flat-tailed Horned Lizards and their habitat observed in Arizona also transpire in California. While most of the border fence in California is intended to prevent both foot and vehicle traffic, there is an approximately 2 km (1.2 mi) stretch of the border west of Calexico adjacent to the Yuha Basin MA where a pedestrian fence was only sporadically installed (USCBP 2012a) that could potentially concentrate illegal activity in this area (Lasky et al. 2011).

Figure 16. Border Fence Designs: (a) PV-1, (b) VF-2, (c) P-2, (d) PV-4

Source: USCBP

In addition to the fence, Border Patrol has installed remote video surveillance system (RVSS) towers to monitor illegal activities. There are approximately 20 of these towers within the Flat-tailed Horned Lizard's current range in California (J. Petrilla pers. comm.). These RVSS towers can monitor a much larger area than Border Patrol agents can cover by vehicle (USCBP 2012b) and may reduce the amount of road mortality associated with law enforcement activities.

The REAL ID Act of 2005 (Pub.L. 109–13, 119 Stat. 302) authorizes the Department of Homeland Security to waive all laws as necessary, including environmental review and mitigation, to “ensure expeditious construction of certain barriers and roads at the U.S border.” In spite of this, Border Patrol and personnel from the BLM-El Centro office participate in monthly meetings and coordinate regular Flat-tailed Horned Lizard orientation sessions to reduce Border Patrol impacts to the species’ habitat (FTHLICC 2012).

Military Activities

Military lands and activities occur within the Flat-tailed Horned Lizard’s California range. Naval Air Facility El Centro (NAFEC) has two bombing ranges, one containing 12,060 ha (29,800 ac) of land within the West Mesa MA (representing 22% of the MA), and a 3,440 ha (8,500 ac) range in the East Mesa MA (covering 7% of the MA) (FTHLICC 2003). Although most training is aircraft-related, ground-based activities that can cause surface disturbance include non-exploding bombing, training, various target activities that include maintenance and site clean-up, road travel, and other facility maintenance (FTHLICC 2003, USFWS 2011). These activities can adversely impact Flat-tailed Horned Lizards through direct mortality, habitat degradation, and increased risk of fire.

The military is a signatory of the Interagency Conservation Agreement and implements the conservation measures in the RMS through their INRMPs, which are required under the Sikes Act (Navy 2014, USAF and USMC 2013). “At NAFEC, any new or maintenance activities conducted within Flat-tailed Horned Lizard MAs are confined to previously disturbed areas. Work crews are trained in Flat-tailed Horned Lizard recognition and disturbance minimization. For projects which upgrade or install new infrastructure to targets, construction is limited to previously disturbed ground and a Flat-tailed Horned Lizard monitor is on site at all times to ensure that mortality is minimized” (R. Powell pers. comm., USFWS 2011). Main range roads and gates have posted Flat-tailed Horned Lizard notification signs, and NAFEC produced a printed document entitled “Environmental Handbook: NAF El Centro Range Complex in 2016” (R. Lovich pers. comm.). In addition, these lands are not open to the public, affording them greater protection from illegal OHV activity and vandalism (Muth and Fisher 1992). Furthermore, Young and Young (2000) observed that jets flying to and from the targets or dog fighting did not seem to bother the Flat-tailed Horned Lizards they were studying on the Barry M. Goldwater Range in Yuma, Arizona.

Overexploitation

Collecting Flat-tailed Horned Lizards for scientific, educational, and pet trade purposes may have impacted populations decades ago (Stewart 1971, Turner and Medica 1982), but these practices currently do not appear to be common. Horned lizards do not make good pets in general because they are difficult to keep alive in captivity (Sherbrooke 2003), and Flat-tailed Horned Lizards are no exception (Goode and Parker 2015). In addition, recreational and commercial collection of this species is illegal (Cal. Code Regs., tit. 14, §§ 5.60 & 43). A Scientific Collecting Permit issued by the Department is required to capture Flat-tailed Horned Lizards for scientific or educational purposes (Cal. Code Regs., tit. 14, § 650). Research on

Flat-tailed Horned Lizards may have some adverse effects. Goode and Parker (2015) observed that handling associated with attaching radio transmitters appears to affect predation rates of telemetered Flat-tailed Horned Lizards. Nearly half (48.4%) of predated Flat-tailed Horned Lizards were killed within the first week of handling, and 20.3% were killed within a day of handling, indicating that there is a period of increased vulnerability to predators after handing (Ibid.). They suspect scent from the adhesive used to attach the transmitters may have alerted predators like Kit Foxes with a keen sense of smell to the lizards, although effects from handling may also play a part (Ibid.). Setser and Young (2000) attributed two telemetered Flat-tailed Horned Lizard mortalities to research. One was impaled by a marker flag while in a burrow, and one apparently overheated when its transmitter got stuck in a pile of rocks (Ibid.).

Predation

As previously described, the largest natural cause of Flat-tailed Horned Lizard mortality is predation, accounting for as much as 40-50% of the observed mortality in certain years (Goode and Parker 2015, Muth and Fisher 1992, Young and Young 2000). Increased predation by American Kestrels, Loggerhead Shrikes, and Round-tailed Ground Squirrels near urban and agricultural development has been implicated in declines in Flat-tailed Horned Lizards as far as 450 m (0.3 mi) from the habitat edge (Barrows et al. 2006, Young and Young 2005). In addition, anthropogenic structures such as power poles, transmission lines, fences, ornamental or invasive tree species, and hedgerows, located in otherwise intact habitat act as perching or nesting platforms, which can augment the populations of avian predators and provide a better vantage point for hunting.

Goode and Parker (2015) recorded far fewer Flat-tailed Horned Lizards and far more avian predators along a stretch of road with power poles than one without them. They also reported that preliminary data suggested that minimally-traveled roads alone have little effect on the number of Flat-tailed Horned Lizard scat present, while roads with power lines and poles had significantly less scat within the 75 m (246 ft) nearest to the power line, and the power pole/road effect may extend even farther than 150 m (492 ft) (Ibid.). The mean of the abundance estimates from plots adjacent to roads with power poles was nearly three times lower than the mean from plots without them. Years earlier at the same site, Young and Young (2000) reported that Loggerhead Shrikes were commonly seen hunting from the power poles, and they found many remains of shrike-killed Flat-tailed Horned Lizards in the creosote bushes along this section of road, even though they rarely saw any live individuals there.

Competition

Flat-tailed Horned Lizards are not considered to be territorial (Muth and Fisher 1992), and individuals with overlapping home ranges generally ignore or avoid one another (Young 1999). As a result, intraspecific competition for resources does not seem to be a limiting factor. Other sympatric lizards also consume ants; however, their diets are much more diverse than the Flat-tailed Horned Lizard’s. While their diets and ranges overlap substantially in California, Desert Horned Lizards and Flat-tailed Horned Lizards rarely occur together because they prefer different soil types, the former being associated with coarser, more gravely and rocky substrates (Barrows and Allen 2009, Turner et al. 1980). There are no known reports of competition between Flat-tailed Horned Lizards and other types of animals.

Disease

There are few reports in the literature of parasites on Flat-tailed Horned Lizards, and none of naturally occurring diseases (Johnson and Spicer 1985). Helminth nematodes, particularly *Skrjabinoptera phrynosoma*, are well documented in horned lizards in general (Sherbrooke 2003) and Flat-tailed Horned Lizards specifically (Goldberg et al. 1993, Klauber 1939, Norris 1949). These parasites extract energy from their hosts, but their impact on Flat-tailed Horned Lizards is unknown. Norris (1949) noted that red mites were common ectoparasites on Flat-tailed Horned Lizards as well.

Contaminants

Although pesticides could kill harvester ants and other Flat-tailed Horned Lizard food sources, the use of aerial pesticides in the species' range is currently very limited (FTHLICC 2003, USFWS 2011). An aerial and ground-based Malathion spray program to control the curly top virus occurs roughly every three years, but it includes avoidance and minimization measures to limit potential effects on Flat-tailed Horned Lizards (USFWS 2011). No pesticide treatments are applied within the MAs, although use of targeted hand-applied herbicides (e.g., for tamarisk eradication projects) is allowed (FTHLICC 2003).

Invasive Species and Fire

Native plants provide seeds for harvester ants (Pianka and Parker 1975, Young and Young 2000), as well as shade and refuge from predators, and they trap the windblown sand substrate preferred by Flat-tailed Horned Lizards (Muth and Fisher 1992). Non-native plants, especially those that have become invasive, can alter landscapes and ecosystems. Several species of non-native, invasive plants are common in Flat-tailed Horned Lizard habitat, many of which are Mediterranean or Asian annual species that germinate in the winter or spring months such as Split grass (*Schismus barbatus*), Russian-thistle (*Salsola tragus*), and Sahara mustard (FTHLICC 2003). Many other non-native annual species may be present, particularly near agricultural areas and near streams or wetlands (Ibid.). Most are not adapted to the severe aridity of the Flat-tailed Horned Lizard's range and require years of heavy precipitation to rapidly proliferate (Barrows et al. 2009, Rao and Allen 2010). While these are typically temporary eruptions, more recently Sahara mustard is becoming the dominant annual plant in the Coachella Valley during non-drought years as well (CVCC 2013a).

Sahara mustard is a highly invasive annual plant that is locally abundant in some years throughout portions of the Flat-tailed Horned Lizard's California range. It is most common in wind-blown sand deposits and disturbed sites such as roadsides and abandoned fields (Minnich and Sanders 2000). It was first collected in North America in 1927 in the Coachella Valley (Ibid.), where its impacts on Flat-tailed Horned Lizards and other flora and fauna have been the focus of many studies (Barrows and Allen 2010, Barrows et al. 2009, CVCC 2013b, Hulton VanTassel et al. 2014). Minnich and Sanders (2000) speculate that Sahara mustard's rapid spread through the Sonoran Desert may be related to the fact that, during rains, a sticky gel forms over the species' seed case that adheres to animals as well as automobiles. In this way, on- and off-road vehicles may be accelerating the spread of this invasive species.

Sahara mustard cover appears to influence both community structure and the extent to which arthropods (including ants) inhabit multiple aeolian (wind-blown) sand habitats within the Coachella Valley (Hulton VanTassel et al. 2014). In the Coachella Valley, Sahara mustard has been found to retard Flat-tailed Horned Lizard population growth (CVCC 2013a). In dunes, Flat-tailed Horned Lizards prefer stabilized areas (Barrows and Allen 2009), but since the most recent explosive mustard growth event in 2005, they have been found more frequently on active sand dunes, a habitat type they typically rarely occupy, where mustard growth is limited (CVCC 2013b). Juvenile Flat-tailed Horned Lizards were found to be 10% smaller on stabilized sand fields as compared to active dunes, potentially due to limited food resources (primarily ants) in areas dominated by mustard (Ibid.). Possible other reasons for this include reduced mobility as a result of dense mustard growth and increased soil compaction due to mustard inhibiting aeolian sand movement (CVCC 2013b). Mustard has been implicated as the cause for a Flat-tailed Horned Lizard population response similar to one during drought conditions, despite recent years with average or above average rainfall (CVCC 2013b, 2016).

Creosote bush scrub habitat throughout the southern Californian desert has also been invaded and subsequently altered by nonnative annual grasses (Brown and Minnich 1986, Lovich and Bainbridge 1999, Rao and Allen 2010, Steers and Allen 2011). Invasive annual grasses are known to increase the extent, frequency, and severity of natural fire regimes throughout desert shrublands (Abatzglou and Kolden 2011; Brown and Minnich 1986; Rao and Allen 2010; Steers and Allen 2010, 2011). Though fire is rare in the Colorado Desert (Figures 17 and 18), the exception may be the very northwestern edge of the Flat-tailed Horned Lizard's range in the Coachella Valley, which is "a major wildland-urban interface area that has been significantly impacted by atmospheric nitrogen deposition concomitant with fuel alterations from invasive annual grasses and increased ignition frequencies from human activities" (Steers and Allen 2011). Post fire recovery of desert shrublands has been studied here, demonstrating that species composition shifts and that long-lived native species like creosote bush and white bursage, which are important to Flat-tailed Horned Lizards, struggle to recover (Steers and Allen 2011). In addition, while apparently not recorded in the fire dataset used in Figures 17 and 18, a non-native annual plant-fueled fire burned approximately 1,457 ha (3,600 ac) in northern East Mesa MA in 1992 (FTHLICC 2003). Large numbers of perennial shrubs, including creosote bush, were killed, and restoration of perennial cover has been slow (Ibid.).

In addition to non-native plants, non-native ants have been implicated as a potential threat to Flat-tailed Horned Lizards (CBD 2014). Native ants within the Flat-tailed Horned Lizard's range, primarily harvester ants, are adapted to desert conditions (Pianka and Parker 1975). The exotic vegetation, changes in soil condition, and extra moisture associated with the edges of human development (agriculture, irrigation canals, and urban areas) can facilitate invasion by Argentine ants (*Linepithema humile*) and other non-natives, resulting in displacement of native ants (Suarez et al. 1998). In California, red fire ants (*Solenopsis invicta*) frequently build mounds on irrigated turf or nest in places such as rotten logs, walls of buildings, under sidewalks, and in outdoor electric and water utility boxes (Greenberg and Kabashima 2013). Barrows and Allen (2009) reported that Argentine ants and red fire ants have invaded the Coachella Valley, but not Flat-tailed Horned Lizard habitat, which they presume is the result of a barrier created by hyper-arid conditions.

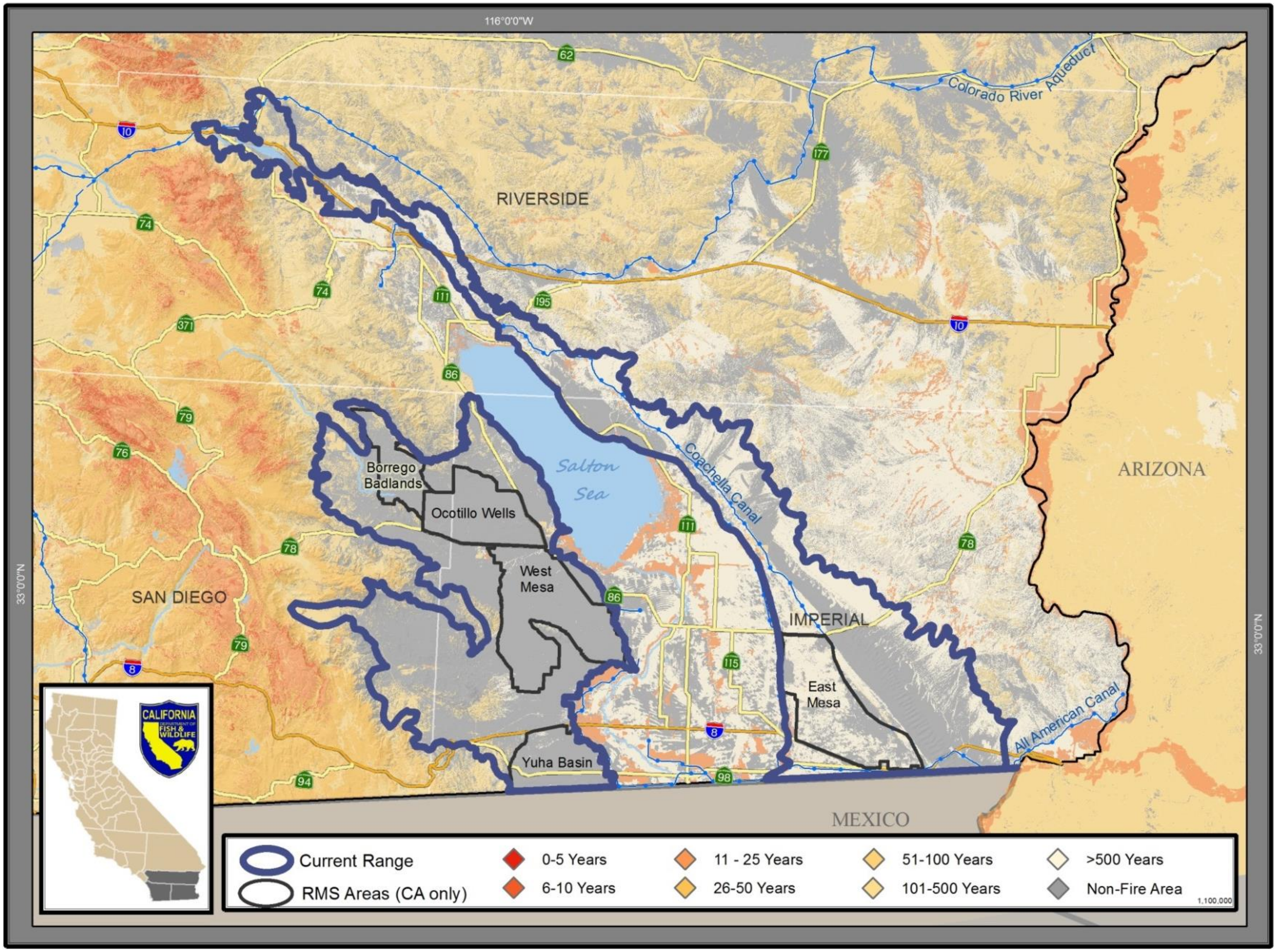


Figure 17. Mean Fire Return Interval

Sources: CDFW GIS Library, LANDFIRE

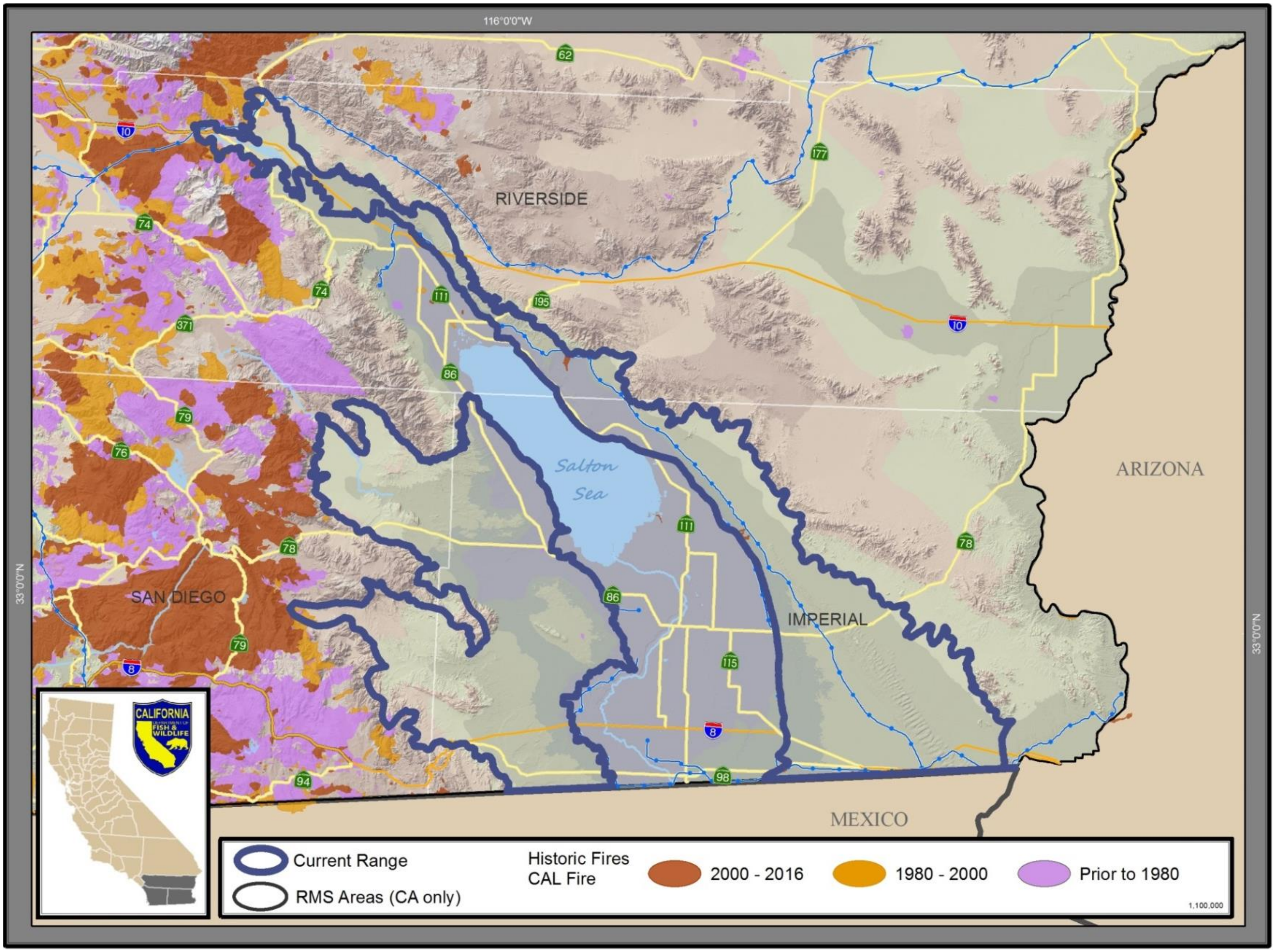


Figure 18. Historic Large Fires within the Flat-tailed Horned Lizard's California Range

Sources: CDFW GIS Library, LANDFIRE

Drought and Climate Change

California entered what has become a historic drought in 2011. A similarly severe event has not occurred in the last 1200 years (Griffin and Anchukaitis 2014). Seager et al. (2007) reported broad consensus among climate models that the transition to a more arid American Southwest is already underway, and that if the models are correct, droughts will become the new norm.

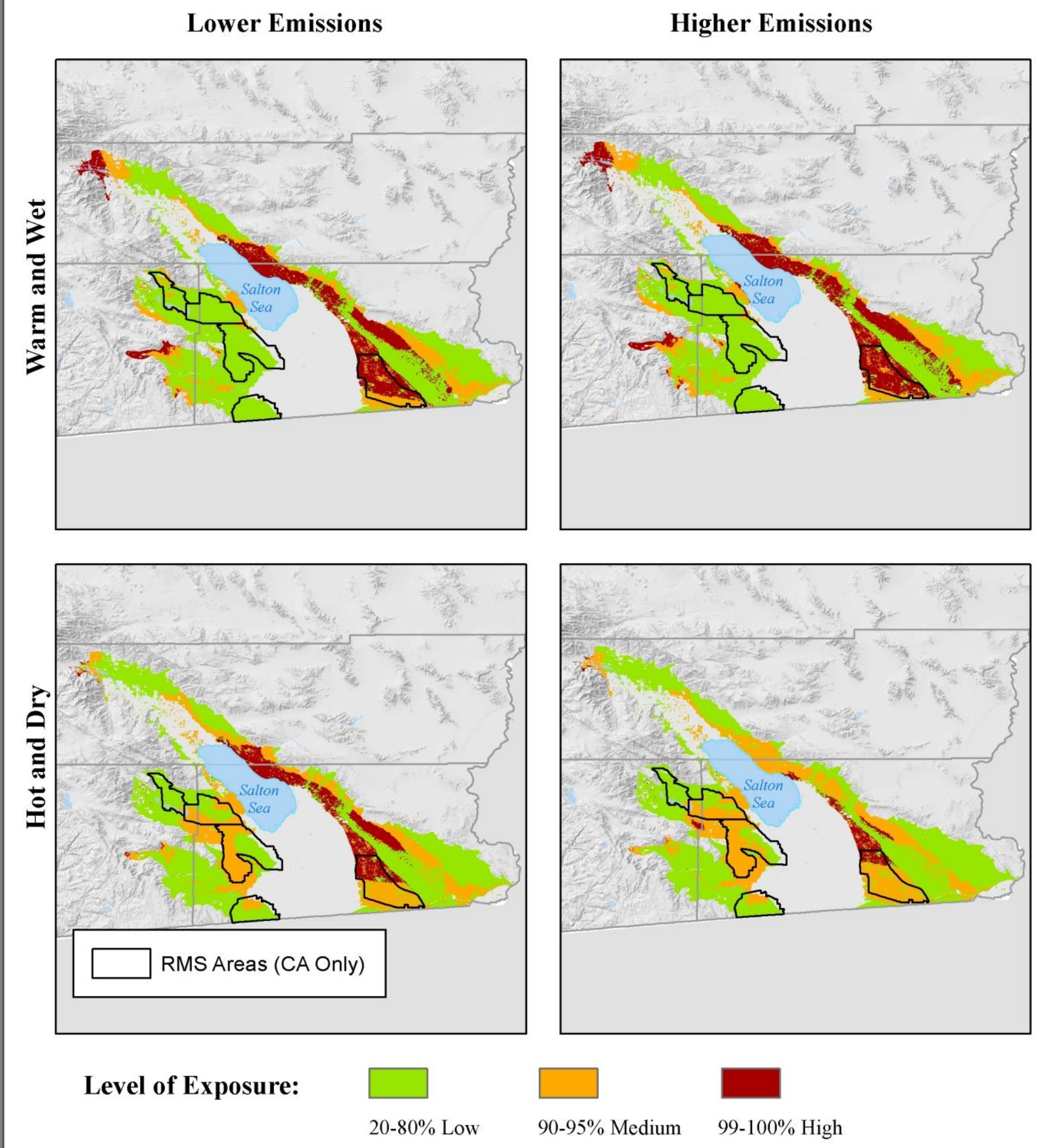
Empirical data over the last century confirm the Sonoran Desert warming trends in winter and spring, decreased frequency of freezing temperatures, lengthening of the freeze-free season, and increased minimum temperatures per winter year (Weiss and Overpeck 2005). In addition, variability in cool season rainfall (i.e., when the majority of precipitation within the Flat-tailed Horned Lizard's California range falls) is increasing (Abatzoglou and Kolden 2011). These changes in temperature and precipitation are already driving shifts in vegetation in the Sonoran Desert, including a decrease in creosote bush and increase in invasive grasses (Kimball et al. 2010, Munson et al. 2012, Weiss and Overpeck 2005).

While the Flat-tailed Horned Lizard is adapted to one of the most arid places in the country, it may be at greater than average risk of localized extinctions from prolonged droughts due to its small geographic range, specialized diet, low reproductive index, short lifespan, and increasing habitat fragmentation (USFWS 1993, Barrows and Allen 2009). The Flat-tailed Horned Lizard has the highest measured active body temperature of horned lizard species in the United States (Pianka and Parker 1975) and, like other desert-adapted reptiles, may already approach its physiological tolerances (Barrows 2011, Young and Young 2000), although this has not been experimentally tested for this species. There are two natural mechanisms for a species to persist in the face of climate change: dispersal to a more favorable thermal environment (typically north or higher elevation), which requires enough time and unobstructed ability to move, and behavioral and/or physiological adaption to new conditions (Sinervo et al. 2010).

Flat-tailed Horned Lizards in California are located at the northern extent of their range, and the populations in the Coachella Valley are already small and fragmented. The species' range boundary in California is surrounded by mountains and unsuitable habitat (i.e., rocky substrate). Even with a short generation time, given the predicted pace of climate change in the region, it is unlikely the species will be able to adapt to a different substrate and migrate up in elevation and latitude. Behavioral strategies to cope with rising temperatures include spending more time in the shade or in a burrow, which leaves less time available for foraging and mating (Sinervo et al. 2010). In addition to adult lizards being at greater risk of reaching a critical thermal maximum, embryos in the nest will be subjected to increasingly higher temperatures and may exceed their critical thermal maximum temperature more often (Levy et al. 2015). Flat-tailed Horned Lizards have been shown to dig nests to substantial depths (90 cm [35 in]) to reach the zone of soil moisture in drought situations (Young and Young 2000), so they may be able to adjust in that way, but the fate of eggs that are buried that far below the surface is unknown. They could also potentially lay nests in a greater amount of shade, but as climate change appears to be favoring invasive grasses over native shrubs (Abatzoglou and Kolden 2011, Munson et al. 2012), this may become a scarcer option.

Two studies on the potential climate change risk to Flat-tailed Horned Lizards have been undertaken. Thorne et al. (2016) modeled the relative environmental stress a vegetative community would undergo given different climate scenarios in the short-term (2039) and long-term (2099). The study used two global climate models (GCMs) that represent the two major trajectories that future climate models predict California's future climate could take: (1) hotter and drier (MIROC ESM) or (2) warmer and wetter (CNRM CM5) (Ibid.). Each of these was evaluated at two scenarios representing different levels of future greenhouse gas emissions: (1) low emissions (RCP 4.5) or (2) high emissions (RCP 8.5), to encompass a full range of potential future conditions in California (Ibid.). Typically, a vegetation community largely defines the composition and structure of species' habitat; therefore, stress on the vegetation community may result in changes to a species' habitat, although this may not be the case for Flat-tailed Horned Lizards where positive associations with vegetation density and composition vary. The Department evaluated the Thorne et al. (2016) vegetation stress results within the area of Flat-tailed Horned Lizard potential habitat in California (Figures 19 and 20). It appears that by 2099, large portions of the species' range will be under extreme climatic stress and may no longer support the current vegetation community. Under a warmer and wetter future climate, the future status of large portions of the vegetation composition within the species' range is considered to be uncertain. These "non-analog" areas are predicted to experience future climates that fall outside the range of conditions currently known in California, because the State does not currently have areas with such high levels of both heat and precipitation. According to Thorne et al. (2016), although increased precipitation in this scenario may be a cause for optimism, increased plant respiration requirements under higher temperatures may still result in a negative water balance and increased stress on vegetation. Wright et al. (2013) used an ecological niche model built with Flat-tailed Horned Lizard locality data (from California and Arizona, not Mexico) and several climate change scenarios to predict the potential changes to the species' distribution under several future climatic conditions in 2050. There was overwhelming consensus among the model outputs that predicted Flat-tailed Horned Lizard distribution would remain fairly stable to that date (Ibid.); however, this analysis did not take changes in habitat into account. This result mirrored the expert scoring for vulnerability to climate change (i.e., slight) in the recent SSC evaluation effort (Thomson et al. 2016).

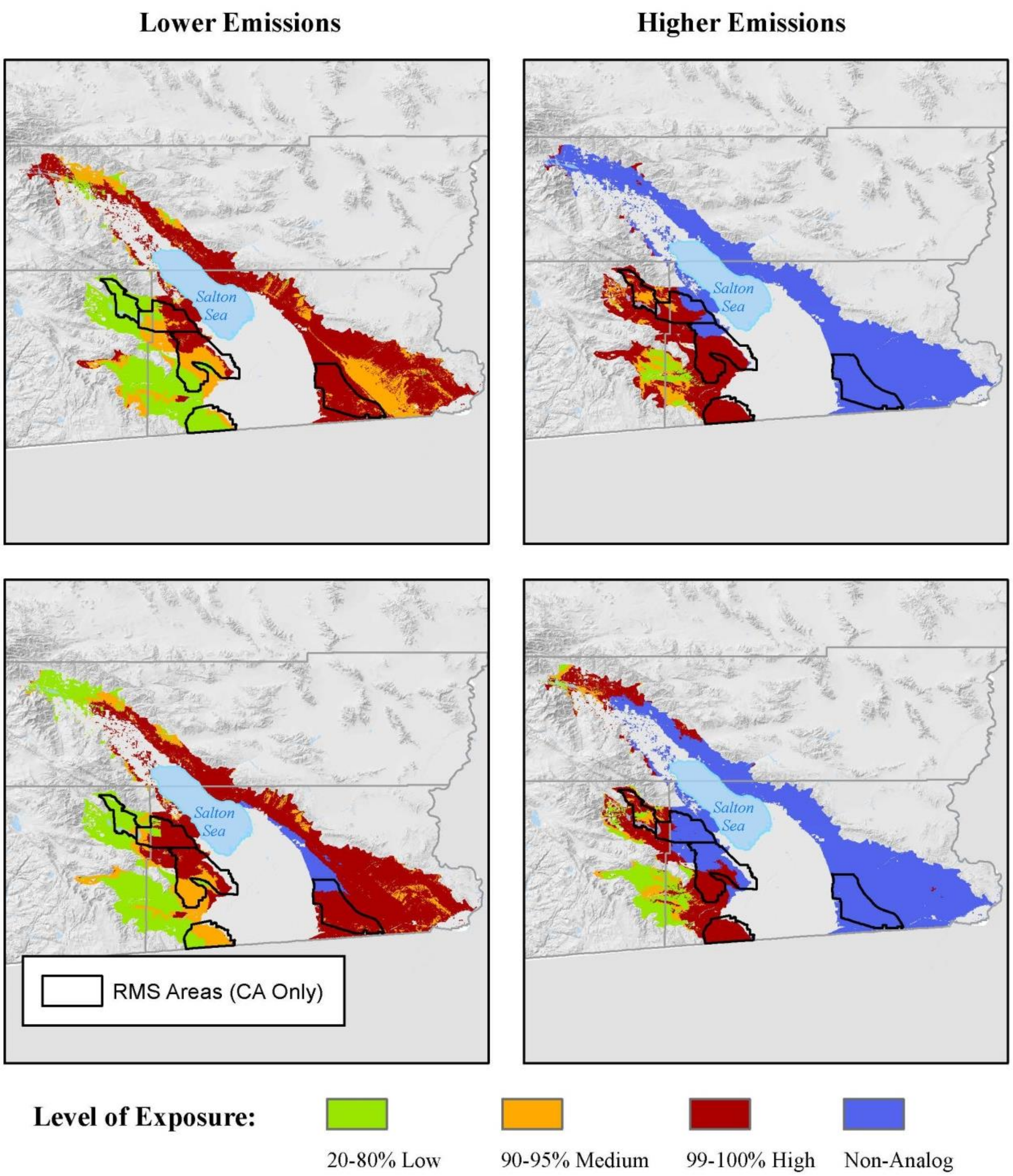
As previously discussed, Flat-tailed Horned Lizard populations can experience natural dramatic fluctuations in abundance over sometimes short periods of time, typically in response to rainfall and its effect on resource availability (CVCC 2016, Leavitt et al. 2015). Setser and Young (2000) observed Flat-tailed Horned Lizards putting on weight rapidly and engaging in courtship and mating almost immediately after a series of monsoonal rains that increased ant availability. Drought conditions reduce harvester ant abundance and activity, which reduces reproduction in a species with already very low reproductive output (Howard 1974, Young and Young 2000). In addition, drought effects may also place Flat-tailed Horned Lizards at greater risk from natural and anthropogenic sources of mortality since it appears Flat-tailed Horned Lizards with lower body mass stay active longer (Grant and Doherty 2006). With its short lifespan and low reproductive potential, prolonged droughts are expected to cause greater decreases in population size that, coupled with other threats, could amount to loss of genetic diversity that would otherwise aid in adapting to a rapidly warming environment. Alternatively, if the climate becomes wetter, Flat-tailed Horned Lizards may not suffer significant adverse effects, as long as the vegetation community still supports an abundance of their preferred prey.



Mapped Climate Exposure of FTHL Habitat Under Four Near-term (2039) Climate Projections. This image shows areas of suitable FTHL habitat within the species range based on California Wildlife Habitat Relationships (CWHR 2016) and a statewide best-available vegetation map (FVEG2015, FRAP 2015), and climate exposure scores for vegetation macrogroups from Thorne et al. (2015). High (>95% exposure) are highly stressed areas; Moderate (80-95% exposure) are stressed areas, and Low (<80% exposure) are areas expected to remain climatically suitable for the vegetation that currently occupies them. "Warm and Wet" = CNRM CM5, Hot and Dry" = MIROC ESM, Lower Emissions = RCP 4.5, and Higher Emissions = RCP 8.5.

Figure 19. Predicted Climate Change Impacts to Habitat in 2039

Sources: CDFW GIS Library, Thorne et al. (2016)



Mapped Climate Exposure of FTHL Habitat Under Four End-of-Century (2099) Climate Projections. This image shows areas of suitable FTHL habitat within the species range based on California Wildlife Habitat Relationships (CWHR 2016) and a statewide best-available vegetation map (FVEG2015, FRAP 2015), and climate exposure scores for vegetation macrogroups from Thorne et al. (2015). High (>95% exposure) and Non-Analog (outside the bounds of current California climate) are highly stressed areas; Moderate (80-95% exposure) are stressed areas, and Low (<80% exposure) are areas expected to remain climatically suitable for the vegetation that currently occupies them. "Warm and Wet" = CNRM CM5, Hot and Dry" = MIROC ESM, Lower Emissions = RCP 4.5, and Higher Emissions = RCP 8.5.

Figure 20. Predicted Climate Change Impacts to Habitat in 2099

Sources: CDFW GIS Library, Thorne et al. (2016)

PROTECTION AFFORDED BY LISTING

It is the policy of the State to conserve, protect, restore and enhance any endangered or any threatened species and its habitat. (Fish & G. Code, § 2052.) The conservation, protection, and enhancement of listed species and their habitat is of statewide concern. (Fish & G. Code, § 2051(c).) CESA defines “take” as hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill. (Fish & G. Code, § 86.) The Fish and Game Code provides the Department with related authority to allow “take” of species listed as threatened or endangered under certain circumstances through incidental take permits, memorandum of understandings, natural community conservation plans, or other plans or agreements approved by or entered into by the Department. (Fish & G. Code, §§ 2081, 2081.1, 2086, 2087 and 2835.)

If the Flat-tailed Horned Lizard were listed under CESA, impacts of take caused by activities authorized through incidental take permits must be minimized and fully mitigated according to State standards. These standards typically include protection of the land in perpetuity with an easement, development and implementation of a species-specific adaptive management plan, and funding through an endowment to pay for long-term monitoring and maintenance to ensure the mitigation land meets performance criteria. Obtaining an incidental take permit is voluntary. The Department cannot force compliance; however, any person violating the take prohibition may be punishable under State law.

Additional protection of Flat-tailed Horned Lizard following listing would be expected to occur through State and local agency environmental review under CEQA. CEQA requires that affected public agencies analyze and disclose project-related environmental effects, including potentially significant impacts on rare, threatened, and endangered species. In common practice, potential impacts to listed species are examined more closely in CEQA documents than potential impacts to unlisted species. Approximately 20% of the land within the Flat-tailed Horned Lizard’s range in California is managed by State or local agencies, and approximately 20% is in private ownership.

Under CEQA’s “substantive mandate,” State and local agencies in California must avoid or substantially lessen significant environmental effects to the extent feasible. (Pub. Resources Code, § 21080; Cal. Code Regs., tit.14., §§ 15002 & 15021.) With that mandate and the Department’s regulatory jurisdiction, the Department expects related CEQA review will likely result in increased information regarding the status of Flat-tailed Horned Lizard in California due to, among other things, updated occurrence and abundance information for individual projects subject to State and local discretion. Where significant impacts are identified under CEQA, the Department expects required project-specific avoidance, minimization, and mitigation measures will benefit the species. State listing, in this respect, and consultation with the Department during State and local agency environmental review under CEQA, would be expected to benefit the species in terms of reducing impacts from individual projects, which might otherwise occur absent listing.

Typically, increased consideration for a species that is listed under CESA would also be expected to occur under the National Environmental Policy Act (NEPA), the federal equivalent of CEQA; however, because the RMS member agencies manage nearly 100% of the federal lands within the Flat-tailed Horned Lizard’s California range, they are already implementing the

RMS measures during NEPA reviews as Lead, Responsible, and Trustee agencies. Federally managed land makes up approximately 60% of the species' range in California.

As previously described, implementation of the RMS includes, in most circumstances, requiring compensatory mitigation for long-term, unavoidable impacts to Flat-tailed Horned Lizard habitat within and outside of the MAs whether Flat-tailed Horned Lizards are detected during surveys or not. This compensatory mitigation is used to purchase private lands, which are turned over to the BLM, Bureau of Reclamation, or another appropriate agency for management. It is also used to fund ICC-approved actions related to the RMS such as the numerous research studies that have advanced understanding of this species. In addition, approximately one-fifth of the species' range in California has a 1% cap on permanent habitat loss under the RMS. While the RMS areas do not afford the same level of protection that a species-specific mitigation area would under CESA, they nevertheless represent large tracts of mostly intact habitat, unlike most CESA compensatory mitigation lands, which are generally small by comparison. However, because implementation of the RMS is voluntary over most of the land the member agencies manage, there is a possibility that some may opt out of the Interagency Conservation Agreement and divert their limited resources away from participation in implementation of the RMS to focus on CESA compliance.

A related potential challenge to implementing CESA protections for the Flat-tailed Horned Lizard is the scarcity of high quality habitat on private land within the species' range that could be used for mitigation. However, a recent option to use BLM land for CESA mitigation has become available through an agreement entered into by the Department and BLM in 2015, referred to as the Durability Agreement (BLM and CDFW 2015). If mutually agreeable between the two agencies, CESA compensatory mitigation actions could be implemented on BLM Conservation Lands (e.g., ACECs and Wilderness Areas) that include restoration of habitat and movement corridors, rehabilitation of closed roads, predator control, invasive plant species removal and control, and additional law enforcement (Ibid.).

For some species, CESA listing may prompt an increase interagency coordination and the likelihood that State and federal land and resource management agencies will allocate funds towards protection and recovery actions. However, in the case of the Flat-tailed Horned Lizard, the RMS member agencies already meet and coordinate regularly and fund RMS actions. As mentioned previously in the "Existing Management" section, the RMS has already been incorporated into the BLM's land use plans for the East Mesa, West Mesa, and Yuha Desert MAs through adoption of ACECs in the CDCA, as well as the Department of Defense's properties through their INRMPs, making these conservation measures mandatory.

Similarly, unlike other species that may benefit from CESA listing by having a greater likelihood of being incorporated into large-scale conservation and planning documents like Habitat Conservation Plans and Natural Community Conservation Plans (NCCP), the Flat-tailed Horned Lizard is already a Covered Species throughout most of its range in California for the vast majority of projected development impacts (i.e., urban and renewable energy in Coachella Valley under the CVMSHCP and renewable energy throughout much of the rest of its range under the DRECP/BLM LUPA). As a Covered Species in the CVMSHCP, the Department provides assurances that no additional mitigation measures shall be required for the 75-year life of the permit unless it determines that continued implementation would jeopardize the species' continued existence, and would therefore lead to NCCP Permit revocation or suspension. As previously discussed, the recently approved DRECP/BLM LUPA, requires implementation of the conservation measures in the RMS for any applicant requesting a right-of-way grant for renewable resources on BLM land.

CESA listing would be expected to improve protections for future development on State and local government and private lands in San Diego and Imperial counties, which could have significant localized impacts on the species, particularly along the east side of the Salton Sea where the connectivity between the East Mesa and Dos Palmas populations is tenuous.

SUMMARY OF LISTING FACTORS

CESA directs the Department to prepare this report regarding the status of the Flat-tailed Horned Lizard based upon the best scientific information available to the Department. CESA's implementing regulations identify key factors that are relevant to the Department's analyses. Specifically, a "species shall be listed as endangered or threatened ... if the Commission determines that its continued existence is in serious danger or is threatened by any one or any combination of the following factors: (1) present or threatened modification or destruction of its habitat; (2) overexploitation; (3) predation; (4) competition; (5) disease; or (6) other natural occurrences or human-related activities." (Cal. Code Regs., tit. 14, § 670.1, subd. (i)(1)(A).)

The definitions of endangered and threatened species in the Fish and G. Code provide key guidance to the Department's scientific determination. An endangered species under CESA is one "which is in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, over exploitation, predation, competition, or disease." (Fish & G. Code, § 2062.) A threatened species under CESA is one "that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of special protection and management efforts required by [CESA]." (Id., § 2067.)

The following summarizes the Department's determination regarding the factors to be considered by the Commission in making its decision on whether to list the Flat-tailed Horned Lizard. This summary is based on the best available scientific information, as presented in the foregoing sections of the report.

Present or Threatened Modification or Destruction of Habitat

<u>Agricultural and Urban Development</u>

While agricultural development has reduced and fragmented available habitat, this impact is fairly concentrated in the middle of the Flat-tailed Horned Lizard's range in California and is not expected to increase significantly in the future. Flat-tailed Horned Lizards have already disappeared from most historically occupied sites in the Coachella Valley over the past 30 years due to agricultural and urban development (CVCC 2013a), threatening the species' long-term persistence in this area. Another potential threat is posed by the projected future urban development in Imperial County (County of Imperial 2013), particularly on the east side of the Salton Sea. While this area is relatively small compared to the species' range, growth in this area could eliminate the only potential habitat corridor between the East Mesa and the Dos Palmas populations, if it has not already been lost.

Renewable Energy Development

Expansion of renewable energy development is expected to continue within the Flat-tailed Horned Lizard's range, and Phase I of the DRECP (i.e., the BLM LUPA) is expected to reduce impacts to the species by focusing most of the impacts on or near existing disturbed areas and existing transmission lines as opposed to relatively undisturbed open desert. However, the lack of county and city participation in the plan could compromise its efficacy if relatively undisturbed private and local government managed lands are developed.

Mining

Sand and gravel mining are the most common mining activities currently in operation within the Flat-tailed Horned Lizard's range, but the area available for mineral extraction in Imperial County is largely depleted (BLM 2011). In addition, oil, gas, and gold exploration have proven unprofitable. Therefore, the threat to Flat-tailed Horned Lizards posed by mining is considered relatively small.

Off-highway Vehicles

Few focused studies have found a demonstrable connection between OHV use and population-level adverse impacts on Flat-tailed Horned Lizards; however, the power to detect significant effects on this cryptic species is low. Occupancy surveys on the RMS areas suggests the species is still widespread within most of them, and population fluctuations track closely across the RMS areas, suggesting precipitation, and not localized disturbance is primarily driving abundance trends. Nevertheless, it is reasonable to expect that where OHV use substantially reduces native shrubs or prey, particularly in areas where these habitat features may be scarce, it may pose a threat to the species. The extent to which these changes in vegetation and prey have occurred as a result of OHV activity across the Flat-tailed Horned Lizard's range is unknown because widespread habitat disturbance monitoring has not been conducted.

United States-Mexico Border Activities

While there are likely adverse effects arising from road mortality and potentially increased avian predation within some distance from the border fence, as well as mortality and habitat degradation associated with cross-country travel by Border Patrol agents, there also appear to be some benefits to increased border security, including reduced habitat damage from illegal border crossings. Additionally, the fencing used in California does not appear to create an absolute barrier to movement or gene flow. Border activities, overall, do not appear to pose a serious threat to Flat-tailed Horned Lizards at this time.

Military Activities

Through the Sikes Act, the vast majority of Flat-tailed Horned Lizard habitat on military lands is protected and managed in a way to conserve the species, so military activities do not appear to pose a significant threat to the species at present.

Overexploitation

Collecting for the pet trade does not appear to be a current threat, although some evidence exists that the listing process alone can increase the likelihood of it becoming a threat due to the human disposition to place exaggerated value on rare or “off limits” species (Courchamp et al. 2006). Opportunity for illegal commercial or recreational collection of Flat-tailed Horned Lizards may be great in some areas due to their common use of, and highly visible on, roads compared to on native substrates, and their tendency to freeze instead of flee. However, horned lizards are notably difficulty to keep alive in captivity due to their specialized diet, which may negate this potential threat. While there may be increased mortality due to research activities, these take place over a very small portion of the species’ range, and the beneficial information derived from them outweighs the negligible threat they may pose to Flat-tailed Horned Lizard populations. There is no evidence to suggest Flat-tailed Horned Lizards are or will be substantially threatened by overexploitation.

Predation

Anthropogenic increases in predation pose a threat to Flat-tailed Horned Lizards, but the severity of the threat likely depends on the vulnerability of the Flat-tailed Horned Lizard population (e.g., small and isolated in Thousand Palms Conservation Area vs. large and intact in East Mesa MA) and the surrounding land use. For example, the effect of predation along the edge of urban or agricultural development appears to be greater than it is along a powerline in the middle of the desert because the former provides more subsidized resources. Given development is relatively concentrated within the Imperial, Coachella, and Borrego Valleys, this area of heightened predation comprises a small fraction of the Flat-tailed Horned Lizard’s range at this time.

Competition

There is no evidence to suggest that competition threatens Flat-tailed Horned Lizards.

Disease

There is no evidence to suggest that disease threatens Flat-tailed Horned Lizards.

Other Natural Events or Human-Related Activities

<u>Fragmentation, Edge Effects, and Small Populations</u>

Currently large expanses of relatively intact habitat remain within the Flat-tailed Horned Lizard’s range in California, outside of the Coachella Valley. While habitat fragmentation, edge effects, and small population sizes may pose threats to Flat-tailed Horned Lizards in some portions of their California range (e.g., Coachella Valley), the degree to which this would adversely impact the species as a whole is uncertain. How and where future development is constructed will affect the severity of this threat, but as long as the RMS is being implemented, a substantial portion of the species’ range in California will remain relatively undisturbed in the ACECs.

<u>Roads, Canals, and Railroads</u>

Major roads, canals, and railroads may pose a threat to Flat-tailed Horned Lizards through habitat fragmentation and/or edge effects. In addition, mortality associated with major roads could create a localized population sink on both sides of the road. Minor, lightly traveled roads (including OHV trails), especially those without associated power poles or other human-provided perches, contribute to some mortality. The degree to which Flat-tailed Horned Lizards are affected by these features is largely unknown throughout most of the species' range.

Contaminants

There is no evidence to suggest that herbicides, pesticides, or other contaminants pose a significant threat to Flat-tailed Horned Lizards.

Invasive Species and Fire

Invasive species like Sahara mustard appear to be playing a role in Flat-tailed Horned Lizard declines in portions of the species range (e.g., the Coachella Valley). The degree to which invasive plants are having widespread population-level impacts, either alone or in conjunction with other factors, throughout the species' range in California is unknown, although populations in the MAs appear stable over time. Invasive grasses increase the risk of fire, and while it is rare within most of the species' range to date, a non-native grass-fueled fire burned part of East Mesa in 1992 (an area with a historic fire return interval of 500 years). The Coachella Valley is at higher risk because it is located in a major wildland-urban interface area (Steers and Allen 2011). Here, the Flat-tailed Horned Lizard could be at risk of local extirpation due to the interaction of both invasive plant species and climate change (CVCC 2013a). Non-native ants do not appear to pose a threat to Flat-tailed Horned Lizards.

Drought and Climate Change

Flat-tailed Horned Lizards live in a highly arid environment and have evolved with drought. Large, healthy populations are expected to rebound, but droughts, particularly longer droughts, may threaten small, isolated populations like those in the Coachella Valley. The threat posed by climate change is somewhat equivocal, and the degree to which it will threaten the continued existence of the species is unknown.

LISTING RECOMMENDATION

CESA directs the Department to prepare this report regarding the status of the Flat-tailed Horned Lizard in California based upon the best scientific information. CESA also directs the Department based on its analysis to indicate in the status report whether the petitioned action is warranted. (Fish & G. Code, § 2074.6; Cal. Code Regs., tit. 14, § 670.1, subd. (f).) In addition to evaluating whether the petitioned action (i.e., listing as endangered) was warranted, the Department considered whether listing as threatened under CESA was warranted.

The Department includes and makes its recommendation in its status report as submitted to the Commission in an advisory capacity based on the best available science. In consideration of the scientific information contained herein, the Department has determined that listing the Flat-tailed Horned Lizard as threatened or endangered under CESA is not warranted at this time.

MANAGEMENT RECOMMENDATIONS

These management recommendations were developed by the Department in accordance with the requirements of Fish and Game Code, section 2074.6. The Department recommends these actions be implemented regardless of the Commission's decision on listing Flat-tailed Horned Lizard as threatened or endangered. This list includes recommendations for actions that could be undertaken by the Department as well as by other public agencies, non-governmental organizations, and private land owners.

Revisit Flat-tailed Horned Lizard Status in Three to Five Years

Several research and planning efforts are underway that are expected to provide additional insights into the status of the Flat-tailed Horned Lizard in California in the next three to five years. For example, in that time, at least preliminary results from the following RMS member agency-funded studies should be available: landscape genomics, population viability analysis, habitat connectivity along the east side of the Salton Sea, and the extent to which avian predation that is subsidized by anthropogenic features or actions is affecting Flat-tailed Horned Lizard mortality rates. Also in that time, it is likely the OWSVRA Plan will be prepared and potentially implemented. How the considerations and protections afforded to Flat-tailed Horned Lizards in that plan are carried out could affect the species' status. OWSVRA covers roughly 5% of the species' range in California and was recognized early on as an area of high density relative to many parts of the species' range (Klauber 1939, Turner and Medica 1982). Additionally, in that time, at least a few years of implementation of Phase I of the DRECP will be available to better determine to what degree the potential threats from renewable energy development, and benefits from increased ACECs to Flat-tailed Horned Lizards, are realized. In that time, it is possible Phase II of the DRECP (State and local lands) will also be developed. In addition, the species currently is experiencing what appears to be a widespread drought-related decline in abundance. The next three to five years will likely reveal whether the species can rebound from another prolonged drought in light of the current stresses it is facing. If the data indicate a change in status is warranted, the Department should prepare the appropriate document to address the newly acquired data.

Increase Department Participation in RMS Implementation

Like the other member agencies, the Department's contribution to Flat-tailed Horned Lizard conservation through implementation of the RMS is subject to funding, staffing availability, and management priority. The Department can strive to increase its participation in implementation of the RMS by identifying outside funding opportunities (e.g., State Wildlife Grants) and providing staff to assist with population monitoring, habitat restoration, education and outreach, and international coordination and collaboration.

Improve Population and Habitat Monitoring

Encourage annual budgeting by RMS member agencies to dedicate funding sufficient to fully implement the occupancy and demography survey protocols across all RMS lands. In addition, expand monitoring to sites outside of the RMS areas to obtain a better rangewide status assessment. Collect and analyze data on environmental covariates, such as habitat quality, predators and prey, and anthropogenic threats, which may be effecting distribution and abundance, so that an informed adaptive management strategy can be developed if population declines cannot be attributed primarily to weather.

Increase Habitat Quality and Quantity

Where feasible, restore areas degraded by OHVs, mining, or agriculture. Increase patrol of areas and cite illegal cross-country OHV or other public trespass in closed or limited use areas to minimize habitat degradation and mortality. Immediately obscure and/or restore any new unsanctioned trails. Where feasible and practical, close (permanently or temporarily) areas to OHV use that have become heavily degraded as a result of this activity. Decommission unnecessary powerlines or other anthropogenic structures that provide perches for avian predators. Remove or trim hedgerows along roads that attract avian predators and investigate perch deterrents. Clean up illegally dumped material as quickly as possible. To the extent feasible, remove or reduce the abundance and extent of non-native grasses, Sahara mustard, and other invasive species, particularly in highly imperiled areas like the Coachella Valley.

Reduce Habitat Fragmentation and its Effects

Investigate how barriers may be limiting gene flow across the species' range. Use this information to protect important habitat linkages and movement corridors such as Yuha Basin to West Mesa and East Mesa to Dos Palmas. Try to improve potentially broken linkages by creating effective road and canal crossings. Continue to purchase private inholdings within the larger public land matrix. Coordinate with and assist the Mexican government on Flat-tailed Horned Lizard conservation across the border. If necessary and prudent given the results of the landscape genomics study, consider developing a reintroduction strategy to address loss of diversity and local extirpations.

Reduce Habitat Loss and Edge Effects from Renewable Energy Projects

Encourage siting renewable energy development outside of the desert completely (see Hernandez et al. 2015) or, if within the Flat-tailed Horned Lizard's range, ensure it is located on compatible lands (e.g., near existing transmission line on agricultural lands or previously developed lands). Limit the amount of new transmission lines by encouraging construction of a single line with additional capacity for future expansion. Bury lines whenever possible.

Further Investigate the Impacts and Potential Uses of Translocation

To date, only one study has simultaneously investigated the effects to translocated and resident Flat-tailed Horned Lizards where translocations have occurred (Goode and Parker 2015). Large numbers of Flat-tailed Horned Lizards are translocated out of harm's way on construction projects, and their fate, as well as the fate of the recipient populations, is not well understood. Exclusion fencing may be somewhat useful in reducing mortality; however, it requires continuous maintenance that may limit its utility. Research in this area should develop translocation plans that take the recipient population's density and the habitat quality into account. Develop a reintroduction strategy, which is informed by landscape genomics, to translocate Flat-tailed Horned Lizards to restored or apparently suitable, but unoccupied, habitat, even if it is located relatively far from the project site to increase population redundancy and resiliency across the species' range. Monitor the results to determine if the reintroductions were successful.

ECONOMIC CONSIDERATIONS

The Department is charged in an advisory capacity in the present context to provide a written report and a related recommendation to the Commission based on the best scientific information available regarding the status of Flat-tailed Horned Lizard in California. The topic areas and related factors the Department is required to address as part of that effort are biological and not economic. (See Fish & G. Code, § 2074.6; Cal. Code Regs., tit. 14, § 670.1, subd. (f).)

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Personal Communications

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Barrows, C.[2] Electronic mail received August 16, 2016.

Lovecchio, J. Electronic mail received May 3, 2016.

Lovich, R. Status review comments received July 29, 2016.

Petrilla, J. Electronic mail received May 4, 2016.

Powell, R. Electronic mail received April 28, 2016.

Rodriguez, M. Electronic mail received June 15, 2016.

Rorabaugh, J. Status review comments received July 21, 2016.

Sirchia, F. Status review comments received July 29, 2016.

Young, K. Status review comments received July 15, 2016

APPENDIX 1. Flat-Tailed Horned Lizard Rangewide Management Strategy, 2003 Revision

Flat-tailed Horned Lizard Rangewide Management Strategy, 2003 Revision

An Arizona-California Conservation Strategy

Prepared and edited by the

Flat-tailed Horned Lizard Interagency Coordinating Committee
May 2003

EXECUTIVE SUMMARY

The Flat-tailed Horned Lizard Rangewide Management Strategy has been prepared to provide guidance for the conservation and management of sufficient habitat to maintain extant populations of flat-tailed horned lizards (FTHLs), *Phrynosoma mcallii,* in each of five Management Areas (MAs) in perpetuity. The species is found only in southwestern Arizona, southeastern California, and adjacent portions of Sonora and Baja California Norte, Mexico.

The USFWS proposed the species for listing as a threatened species on November 29, 1993. Human activities have resulted in the conversion of roughly 49% of the historic FTHL habitat to other uses, such as agriculture and urban development. Further evaluation of populations supported by remaining habitat is necessary. While initial evidence suggested that FTHL populations had declined in the Yuha Basin and northern East Mesa (Wright 1993; USFWS 1993), Wright (2002) recently found no significant trends in lizard encounter rates in Yuha Desert, East Mesa, or West Mesa from 1979-2001. The USFWS withdrew its proposed listing on January 3, 2003, based in part on protections offered by this Rangewide Management Strategy (RMS).

The 1997 edition of the RMS established five FTHL MAS — four in California and one in Arizona. Surface disturbing activities are limited in these areas. Although land alterations in FTHL habitat outside of the MAs are not limited, mitigation and compensation measures are applied. One research area (RA) was also established to support research in an active off-highway vehicle (OHV) recreation area. Conservation areas in the Coachella Valley were also established.

Wide-scale population estimates have, to date, been unreliable. While new techniques to estimate abundance continue to be evaluated, this revised document calls for monitoring changes in distribution over time in addition to monitoring changes in population size. Revised monitoring techniques have been established.

The RMS was prepared by representatives from federal, state, and local governments. Itis designed to be used as the basis for a conservation agreement among the agencies. Signatory agencies will incorporate measures in the RMS into their land management plans. Compliance with the National Environmental Policy Act (NEPA) and other applicable federal and state law will be achieved through these management plans or revisions. The planned actions in the RMS are organized in a step-down format used by the USFWS in recovery plans.

PREFACE

Dr. Larry D. Foreman and members of the Flat-tailed Horned Lizard Interagency Coordinating Committee (ICC) prepared the original *Flat-tailed Horned Lizard Rangewide Management Strategy* in 1997. Kevin V. Young[1] and Ty J. Gardner coordinated the 2003 revision (Arizona Game and Fish Department solicitation # QF02-040-S; funds made available by the U.S. Fish and Wildlife Service). The following members of the ICC and MOG (listed by agency) participated in writing and discussion until a consensus was reached:

Agency	**ICC Member**	**MOG Member**
Anza-Borrego State Park	Paul Jorgensen	Mark Jorgensen
Arizona Game and Fish, Yuma	Lin Piest	Larry Voyles
California Department of Fish and Game	Eddy Konno	Glenn Black
California State Parks, Ocotillo Wells	Eric Hollenbeck	Curt Itogawa
U.S. Bureau of Land Management, El Centro	Gavin Wright	Greg Thomsen
U.S. Bureau of Land Management, Palm Springs	Rachelle Huddleston-Lorton	Elena Misquez
U.S. Bureau of Land Management, Yuma	Fred Wong	Gail Acheson
U.S. Bureau of Reclamation, Yuma	Andrea Campbell	Cynthia Hoeft
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Cover Artwork: flat-tailed horned lizard in Sonora, Mexico. Courtesy of Jim Rorabaugh.

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LIST OF ACRONYMS

The following acronyms are used in this document:

ACEC	Area of Critical Environmental Concern
AGFD	Arizona Game and Fish Department
ABDSP	Anza-Borrego Desert State Park
BLM	United States Bureau of Land Management
BMGR	Barry M. Goldwater Range
BOR	United States Bureau of Reclamation
BP	Border Patrol
CDFG	California Department of Fish and Game
CNLM	Center for Natural Lands Management
CVMSHCP	Coachella Valley Multiple Species Habitat Conservation Plan and Natural Communities Conservation Plan
DOD	United States Department of Defense
EA	Environmental Assessment
FTHL	Flat-tailed horned lizard
GIS	Geographic Information System
ICC	Interagency Coordinating Committee
MA	Management Area
MCAS	Marine Corps Air Station, Yuma
MOG	Management Oversight Group
MOU	Memorandum of Understanding
NAF	Naval Air Facility
NEPA	National Environmental Policy Act
OHV	Off-highway vehicle
OWSVRA	Ocotillo Wells State Vehicular Recreation Area
RA	Research Area
ROW	Right of Way
SVL	Snout-Vent Length
USFWS	United States Fish and Wildlife Service

OVERVIEW

Species Description

Taxonomy

The flat-tailed horned lizard (FTHL), *Phrynosoma mcallii,* was first described by Hallowell in 1852 as *Anota mcallii* after U.S. Army Colonel George A. M'Call who collected the type specimen (Johnson and Spicer 1985). Due to the lack of external ear openings, the FTHL was initially placed in a separate genus (*Anota*) from other horned lizards (Johnson and Spicer 1985). Norris and Lowe (1951) decided that similarities of *mcallii* to other horned lizards were greater than its differences and placed it into the genus *Phrynosoma*. The FTHL is one of 14 currently recognized species of horned lizard (eight of which occur in the U.S.) (Zamudio and Parra Olea 2000). It is believed to be most closely related to the desert horned lizard, *P. platyrhinos* (Reeder and Montanucci 2001). No subspecies of FTHL have been described (Funk 1981).

Field Characters

The FTHL has the typical round, flattened body shape of horned lizards. It is distinguished from other species in its genus by its dark vertebral stripe; lack of external ear openings; long, broad and flattened tail; and comparatively long spines on the head (Funk 1981). The FTHL has two rows of fringed scales on each side of its body. The species is cryptic in color, ranging from pale gray to light rust brown dorsally, and white or cream (unspotted) ventrally with a prominent umbilical scar. The only apparent external difference between males and females is the presence of enlarged postanal scales in males, typical of Phrynosomatids. Maximum snout-vent length (SVL) for the species is 87 mm (Boundy and Balgooyen 1988), but 65-80 mm SVL is typical adult size (Young and Young 2000). Adult weight varies between 10 and 25 g. Hatchlings range from 30 to 38 mm and weigh about 1.5 g (Johnson and Spicer 1985; Young and Young 2000).

The only other horned lizard known to be sympatric with the FTHL is the desert horned lizard. The latter is distinguished from the FTHL by a combination of characters including absence of a dark vertebral stripe, an exposed tympanum, a spotted ventral surface in most individuals, a single row of fringed scales, and a narrower and less-flattened tail (Figure 1). Apparent hybrids between the two species, which exhibit a mix of morphological characteristics, have been observed near Ocotillo, California (Stebbins 1985) and on the BMGR near Yuma, AZ (Morrill, Young, pers. obs.). There has been at least one case of hybridization in captivity (Collet 2002).

Figure 1. Comparative views of *Phrynosoma mcallii (left)* and *P. platyrhinos* (right) adults and hatchlings.

Distribution and Habitat Status

The FTHL has the most limited distribution of any horned lizard species in the U.S. (Stebbins 1985). It is found in the extreme southwestern corner of Arizona, the southeastern corner of California, and adjoining portions of Sonora and Baja California, Mexico (Figure 2). In Arizona, the FTHL is found in southwestern Yuma County south of the Gila River and west of the Butler and Gila mountains. Estimates of historic habitat in Arizona range from 203,520 to 221,043 acres, and of current habitat from 135,900 to 176,000 acres (Johnson and Spicer 1985; Rorabaugh *et al*. 1987; Hodges 1995, 1997; Piest and Knowles 2002). Suitable habitat is found east and south of the city of Yuma outside of the Colorado and Gila River floodplains and adjoining croplands. Lands within the range of the FTHL in Arizona include federal lands administered by the Department of Defense (DOD) through Marine Corps Air Station at Yuma (MCAS-Yuma), the Bureau of Land Management (BLM), and the Bureau of Reclamation (BOR); state of Arizona lands; and private lands. The majority of the FTHL's range in Arizona is on the western Barry M. Goldwater Range (BMGR), managed by MCAS-Yuma. Records from Mexico Highway 2, just south of the International Boundary, suggest the species might be present in the area of Pinta Sands on the Cabeza Prieta National Wildlife Refuge, but searches in this area have only documented desert horned lizards (Rorabaugh 1996a, 1997).

The historical range of the FTHL in California encompasses approximately 1.8 to 2.2 million acres, primarily in Imperial County, but also in eastern San Diego County and central Riverside County (Turner *et al.* 1980; Rado 1981; Bolster and Nicol 1989; Hodges 1997). However, about 50% of the land within this range is now unsuitable, including the Salton Sea and urban and agricultural areas (Hodges 1997). Areas identified as especially important to the species in California encompass approximately 210,000 acres and are found primarily in four regions (Rado 1981; Turner *et al.* 1980). MAs were established in these areas and have been the focus of FTHL habitat conservation (see Management Areas, p. 49). The El Centro Resource Area (BLM, California Desert District) administers three of these areas: West Mesa MA, East Mesa MA, and Yuha Desert MA (the BLM and the U.S. Navy jointly manage portions of West Mesa and East Mesa). The California Department of Parks and Recreation (CDPR) manages Ocotillo Wells State Off-Highway Vehicle Area (OWSVRA) as a RA and a portion of Anza-Borrego Desert State Park (ABDSP) as the Borrego Badlands MA.

The northern margin of the species' range is in the Coachella Valley, an area where expansive agricultural and urban development has destroyed the vast majority of original FTHL habitat. The largest remaining, unfragmented habitat patch is approximately 3,900-4,200 acres in size, just 3-4% of the original habitat extent within the Coachella Valley (Barrows 2002). The Coachella Valley Multiple Species Habitat Conservation Plan and Natural Communities Conservation Plan (CVMSHCP) will protect approximately 44.5% of the remaining FTHL habitat in the valley.

Based on Figure 2, about half of the historical range of the FTHL is in Mexico, particularly in Sonora. In Baja California Norte, the range extends from the International Border west of Mexicali south to Laguna Salada. A specimen found south of Laguna Salada in 2001 (Rodriguez 2002) extended the known southern range limit in Baja by approximately 40 miles. It is unknown whether this population is connected to those to the north or is disjunctive. In Sonora, the species has been found in the sandy plains immediately south of and contiguous with habitat in Arizona, and east through the Pinacate Region to the sandy plains around Puerto Peñasco and Bahía de San Jorge (Johnson and Spicer 1985; Gonzáles-Romero and Álvarez-Cárdenas 1989; Rodríguez 2002). The FTHL is probably absent from the volcanic areas in the Pinacate Region and rare in the dune fields of the Gran Desierto (Rodríguez 2002).

Map Creation

The current and historical distribution map (Figure 2) is designed to provide graphic representation of the approximate current and historical FTHL range boundaries. This map is not based on a predictive model, with the exception of the current range in the Coachella Valley (see below), and should not be viewed as such. ArcView (ESRI 1998) shape files (.shp) for the current and historical distributions recognized in this document are on file with ICC member agencies.

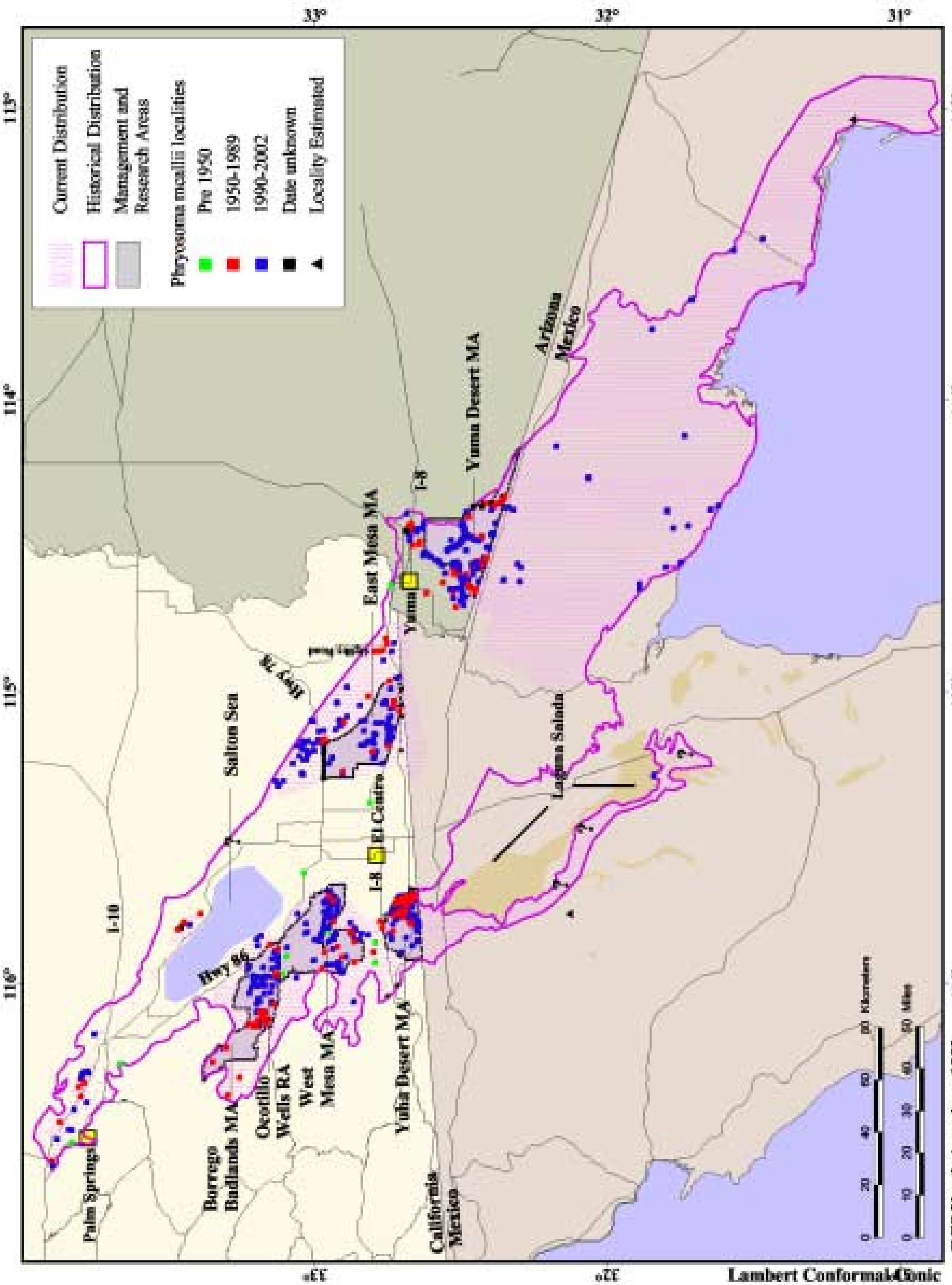
The historical distribution is based on a 750-foot contour interval across the majority of the range, particularly in the U.S. and the most northern portion of Mexico. There are several departures from this contour: 1) along the eastern boundary of the Algodones dune system the boundary is based on a microphyll/desert dry wash habitat (coverage provided by BLM-El Centro) because the habitats to the east of these are not likely to have been occupied by FTHLs at any time (contra Hodges 1997); 2) the boundary on the eastern side of the Yuma desert MA was defined as the edge of the rocky substrate, estimated as a fixed distance from the western slope of the Gila mountains, since this habitat is not occupied by FTHLs (Hodges 1995, Young and Young 2000); 3) much of the range in Sonora, Mexico is based on an ArcView coverage (obtained from http://data.geocomm.com) that delineates the boundaries between unconsolidated substrates (included) and inundated areas (excluded), but areas outside the unconsolidated substrates were included (e.g. mudhill habitat near El Golfo) where verified locality data were available (Rodríguez 2002); and 4) the distribution around Laguna Salada is based on the range map in Foreman (1997), recent localities (Rodríguez 2002) and mention of sightings on the eastern side where sand accumulates against the Sierra Cucapa (Lee Grismer, California State University San Diego, pers. comm.).

The current distribution (except the Palm Springs area) is a subset of the historical range map from which habitat that has been converted to urban, agricultural, or other such permanent disturbances has been removed. Data used to remove such areas include USGS maps, ArcView coverages of city streets, and aerial photographs of the East Mesa, West Mesa, and Yuha Desert MAs and surrounding areas (provided by BLM-El Centro). Features removed include, but are not limited to: Yuma, AZ; Ocotillo, Borrego Springs, and Salton City, California; the agricultural areas of the Imperial Valley, California and the Mexicali Valley, Baja Norte; and projects recognized on aerial photos in the Yuha Desert MA, north of the Yuha Desert MA, and near the Salton Sea Test Base.

The current distribution in the Coachella Valley area (Riverside Co., California) is the October 2002 draft (provided by the Coachella Valley Association of Governments) of the predicted portion of a FTHL habitat model produced for the CVMSHCP. This model includes habitat below the 700-foot contour interval. The model was refined by looking for vegetation community and soil type associations and deleting developed areas. The model includes habitat patches that are too small to maintain viable populations (Cameron Barrows, Center for Natural Lands Management (CNLM), pers. comm.). Further information is available through the Coachella Valley Association of Governments.

Further work is necessary to solidify the current distribution of the FTHL in the U.S. and Mexico. In particular, work is needed outside the MAs to firmly delineate the boundaries on the exterior portion of the range in the U.S. Such work, in conjunction with surveys within MAs, could help produce a habitat model that may more accurately describe the historical and current FTHL range. Areas of Mexico that remain uncertain and could benefit from further surveys and/or modeling include: 1) the southeast boundary in Sonora; 2) the extent of historical range in the Mexicali valley and the current range surrounding that area (including Mesa Andrade); 3) the extent of the current and historical ranges surrounding Laguna Salada; and 4) the degree of connectivity between portions of the current and historical ranges in Sonora, the Mexicali Valley, and surrounding Laguna Salada.

Figure 2. Approximate current and historical distribution of the flat-tailed horned lizard.



Habitat Use

Flat-tailed horned lizards occur entirely within the Lower Colorado River Valley Subdivision of Sonoran Desert Scrub (Turner and Brown 1982), the largest and most arid subdivision of the Sonoran Desert. Annual precipitation varies from 5.8 cm at El Centro, California to 13.5 cm at Palm Springs. Summer daytime temperatures range from 30 to 45°C.

Most records for FTHLS come from the creosote (*Larrea tridentata*)-white bursage (*Ambrosia dumosa*) series of Sonoran Desert Scrub (Turner and Brown 1982). It is this open community in association with sandy flats and valleys that is often described as FTHL habitat (Stebbins 1985; Turner and Medica 1982; Rorabaugh *et al.* 1987). Although most records for the species are from sandy flats or areas with a veneer of fine, windblown sand, the FTHL has also been collected or observed in areas with little or no windblown sand, such as badlands in the Yuha Basin and the Borrego Valley, and on saltbush flats at the northeastern end of the Salton Sea (Turner *et al.* 1980; Wone and Beauchamp 1995a). The species has also been recorded in the mixed scrub series within the Lower Colorado River Valley Subdivision of Sonoran Desert Scrub (Turner and Brown 1982), on gravelly soils in ABDSP, and in association with senita cactus (*Lophocereus schottii*) in Sonora. FTHLS apparently occur at low densities in parts of the Algodones dune fields (Luckenbach and Bury 1983; Wright, pers. obs.) and are probably rare in the unvegetated portions of other major dune systems (Luckenbach and Bury 1983; McCalvin 1993; Rodríguez 2002; Turner *et al.* 1980).

In California, the species has been recorded in a comparatively broad range of habitats, including sandy flats and hills, badlands, salt flats, and gravelly soils. In Arizona, the species is apparently restricted to sandy and hardpan flats. This may be due to habitat availability rather than FTHL habitat preferences. In Arizona, the presence of big galleta grass (*Pleuraphis rigida*) was correlated with FTHL abundance and may be an important vegetation component of its habitat (Rorabaugh *et al.* 1987). However, big galleta grass is not present in many high-density FTHL areas in California (Turner and Medica 1982; Rorabaugh *et al.* 1987). In California, Muth and Fisher (1992) found both white bursage (*Ambrosia dumosa*) and indigo bush (*Dalea emoryi*) were correlated with FTHLS, presumably because of their ability to trap wind-blown sand and provide shade for thermal cover. In the badlands habitat at OWSVRA, FTHL commonly use rocks as basking sites and for cover, primarily along the ridges of the hills (Setser 2001). In the Coachella Valley, FTHL are found in high densities in areas with saltbush (*Atriplex canescens* and *A. polycarpa*). The saltbush consistently produces seeds each fall, even in drought conditions, which may account for elevated ant populations and higher FTHL densities in this habitat (Cameron Barrows, CNLM, pers. comm.). A sampling of FTHL habitats is shown in Figure 3.

Although the desert horned lizard occurs sympatrically with the FTHL, subtle differences have been described in preferred microhabitat use by both species in close proximity. Rorabaugh *et al.* (1987) characterized desert horned lizard habitat as gently sloping alluvial terrain dominated by washes vegetated with small trees such as palo verde (*Parkinsonia microphylla*) and ironwood (*Olneya tesota*). FTHL habitat in the near proximity was described as consisting of finer sand, more level and unbroken terrain, and sparser creosotebush-bursage vegetation than the habitat of the desert horned lizard (Hodges 1995; Young and Young 2000).

Figure 3. Typical flat-tailed horned lizard habitat from various parts of its range.

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a) Yuma Desert MA

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b) Coachella Valley Preserve

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c) East Mesa MA

©T. Gardner

d) Ocotillo Wells RA

Food Habits

Ants constituted 97% of the prey items in FTHL stomachs examined by Pianka and Parker (1975) and scats examined by Turner and Medica (1982). The percentage of ants in their diet is greater than other horned lizards (Pianka and Parker 1975). Harvester ants (in the genera *Messor* and *Pogonomyrmex*) are far more important in the diet than smaller ant species (Turner and Medica 1982), and *Pogonomyrmex* are twice as common as *Messor* in the scats of FTHL on the Yuma Desert MA, AZ (Young and Young 2000). Studies in California (Turner and Medica 1982) and Arizona (Turner and Medica 1982; Rorabaugh *et al.* 1987) showed positive correlations between FTHL scat abundance and number of harvester ant nests.

While FTHLS feed almost exclusively on ants from day to day, occasional outbreaks of other insects may provide important feeding opportunities. For example, Mark Fisher (Boyd Deep Canyon Desert Research Center, pers. comm.) observed FTHLS gorging on sphinx moth larvae. Young (unpubl. data) examined the stomach of one road-killed FTHL and found it full of small beetles, which at the time were very abundant. Piest (pers. obs.) observed several instances in one morning where FTHLS were feeding at termite casings. While such feeding opportunities are short-lived, they may allow for quick building of fat reserves.

Like other carnivorous desert lizards, FTHLS primarily use preformed water (water found in their food) to maintain proper water balance (Schmidt-Nielsen 1964). Freestanding water is not usually available in FTHL habitat. Dew, which is used as a water source by lizards in other climates, is uncommon in southwestern deserts. It normally occurs at cool temperatures and evaporates before lizards become active enough to use it (Schmidt-Nielsen 1964). The use of free water by FTHLS is debatable. Mayhew (1968) states that FTHLS have never been seen drinking water in the wild or in captivity. However, Johnson and Spicer (1985) and Young (pers. obs.) witnessed captive FTHLS drinking water that was sprayed on their heads.

Reproduction

Flat-tailed horned lizards are oviparous (egg-laying) and early maturing, and they can produce multiple clutches (Howard 1974). Under favorable conditions, two cohorts of hatchlings may be produced in late July and in September (Muth and Fisher 1992), but in dry conditions only the late season clutch may be produced (Young and Young 2000). Hatchlings from the first cohort in July may reach sexual maturity after their first winter season, whereas hatchlings born later may require an additional growing season to mature (Howard 1974).

Compared to most other horned lizards, FTHLS produce relatively small clutches, ranging from 3 to 7 eggs with a mean clutch size of about 5 (Howard 1974; Pianka and Parker 1975). Howard (1974) developed a productivity index as a product of the number of egg clutches per year and the average number of eggs per clutch. The FTHL productivity ranked the lowest among the horned lizards studied, followed by the desert horned lizard. Howard (1974) suspected that very high temperatures and high aridity experienced by both species resulted in their lower reproductive potential. High aridity may also pose problems for nest construction. In 2000, two nest sites were found at OWSVRA, at depths of 14 cm and 26 cm, both times a few centimeters deeper than the point at which the substrate became visibly moist (Setser 2001). Two nest sites were also found on the Yuma Desert MA in drier weather conditions. One was at a depth of 90 cm and the other was at a depth of 80 cm. Again, the nest sites were a few centimeters below the level at which the sand became visibly moist (Young and Young 2000). An even sex ratio was documented in populations in California (Turner and Medica 1982; Muth and Fisher 1992).

Behavior

Unlike other iguanid lizards, which often flee when approached, FTHLS generally remain still (Wone and Beauchamp 1995a), or may bury themselves in loose sand (Norris 1949; Young and Young 2000). This reluctance to move when disturbed, together with cryptic coloration and flattening of the body, makes them very difficult to locate in the field and very susceptible to road mortality.

FTHLS studied by Muth and Fisher (1992) spent 54% of the day in some form of movement. Most activity occurred throughout the mid-day in spring and fall. As summer temperatures increase, FTHLS shift to two activity periods, morning and evening (Mayhew 1968).

During the active season, FTHLS most often spend the night exposed on the surface, but occasionally shuffle under the sand or enter a burrow (Klauber 1939; Smith 1946; Muth and Fisher 1992; Young and Young 2000). When daytime surface temperatures approach 120°F (50°C), individuals retreat into burrows, at least some of which are of their own making (Rorabaugh 1994), but do not exhibit summer dormancy, even during drought conditions (Young and Young 2000). In Arizona, these daytime burrows were found to be straight, 70-80 cm long, and 25-30 cm deep (Young and Young 2000). The availability of burrows, or soils friable enough for burrow construction, may be a necessary habitat component for FTHLS (Muth and Fisher 1992; Rorabaugh 1994).

Muth and Fisher (1992) reported winter dormancy for FTHLS from mid-November until mid-February, but Setser (2001) noted some animals becoming dormant in mid-October. Mayhew (1965) found the majority of adult FTHLS hibernated in burrows they had dug within 5 cm of the surface. All winter-dormant FTHLS found by Muth and Fisher (1992) were within 10 cm of the surface. According to Mayhew (1968), adult FTHLS are obligatory hibernators. He suspected that reduced food availability, as well as decreasing photoperiod and lower metabolic rate resulting from reduced temperature, is the hibernation triggering mechanism (Mayhew 1965). In his study of FTHL in the lab, adults ceased eating in the fall regardless of temperature and starved when prevented from hibernating. However, horned lizards are notoriously difficult to keep in captivity, and the starvation may have been unrelated to the need to hibernate. Hollenbeck (pers. obs.) has observed some adult FTHLS at OWSVRA active for several weeks at a time during the winter. Sherbrooke (1987) successfully raised regal horned lizards (*Phrynosoma solare*) without hibernation.

Juveniles have often been found to show winter activity in California (Muth and Fisher 1992; Cameron Barrows, CNLM, pers. comm.). Whereas adults may be able to make metabolic adjustments for hibernation, juveniles may have to remain active so their fat reserves can be supplemented throughout winter (Muth and Fisher 1992). The smaller body size of the juveniles would allow them to reach a preferred body temperature on warm winter days quicker than the larger adults (Schmidt-Nielsen 1964), and winter activity may allow juveniles to reach reproductive maturity at an earlier age (Howard 1974; Smith and Ballinger 1994).

FTHLS have unusually large home ranges for lizards their size. Allometric equations based on lizard mass would predict FTHL home ranges to be less than 0.5 acres. But at Muth and Fisher's

West Mesa study site, the mean home range size for all FTHLS with more than 18 recaptures was 6.7 acres. (Muth and Fisher 1992). At a site in the Yuha Desert, Turner and Medica (1982) estimated home ranges of 0.32 and 0.12 acres for male and female FTHLS, respectively. However, the small size of the Yuha Desert study plot (10.1 acres) combined with relatively few recaptures and a relatively short study period likely resulted in an underestimate of home range size. On the Yuma Desert MA, among 14 FTHLS that were each relocated at least 45 times over the course of the summer, the mean home range of male FTHLS was 8.8 acres. Females had a significantly smaller mean home range of 4.37 acres (Miller 1999). However, using only 10-15 locations of 45 FTHLS over 15-day time periods changed the mean home range estimate to only 0.84 acres (Miller 1999). This suggests that FTHLS in that population may not maintain distinct home ranges, but instead shift their area of use through time, thereby increasing the home range estimate with each additional location. Great variation in home range size was noted among individuals and between years (Miller 1999; Young and Young 2000). Young and Young (2000) found that in the Yuma Desert MA, FTHL home range size decreased in females during a wet year, presumably because they did not have to forage as widely to meet energetic demands. Conversely, males increased their movements in the wet year, presumably because the abundant resources allowed them to increase mate-seeking behavior. At OWSVRA, home ranges appear more stable than in the Yuma Desert MA (Setser 2001).

Population Dynamics

No definitive data exist on population dynamics. However, information from scat surveys (Rorabaugh 1994; Wright 2002) and life history studies (Muth and Fisher 1992; Young and Young 2000) suggest that densities fluctuate greatly between years and that these fluctuations may be associated with winter/spring precipitation and production of annual plants in the spring. This pattern is true for other desert lizards (see Mayhew 1967; Hoddenbach and Turner 1968; Parker and Pianka 1975). Because scat size and scat production are greatly affected by climatic conditions, scat counts may exaggerate true population dynamics (Young and Young 2000).

FTHL populations may fluctuate in response to prey availability. Harvester ant population sizes and activity fluctuate with the availability of seeds, which are correlated with the amount and timing of precipitation (Beatley 1967; Brown *et al.* 1979). Harvester ants rely on seed storage during periods of climatic stress, thus decreasing their availability as a food source for FTHLS during periods of low precipitation (Brown *et al.* 1979). In the Yuma Desert MA, it is uncommon for individual FTHLS to live more than four years, but a lifespan of at least six years has been recorded (Young, unpublished data). Mortality due to predation varies greatly from year to year (Young and Young 2000). Predation rates may also vary between habitat types, with higher yearly survivorship noted at OWSVRA than in the Yuma Desert MA (Setser 2001).

Population Viability Analysis

A FTHL Conservation Team conducted population viability analyses with the simulation models RAMAS and VORTEX (Fisher *et al.* 1998). The Team's work clarified research needs and provided some insight into the mechanisms of FTHL population dynamics. Population variables such as age-specific survivorship, fecundity, and population size; sex ratios; age at first reproduction; density dependence; stochasticity; and other variables were used in the analysis to generate information about population viability, especially extinction risk for specified time intervals.

Ideally, these analyses would define an initial population size and reserve size needed to support a viable population for a specified time interval, such as 100 or 500 years. Unfortunately, population demographics and stochasticity in possible reserves (MAs) are not adequately understood to provide this information. Generally for vertebrates, populations above 5,000 individuals are considered viable (Meffe and Carroll 1994). The goal of estimating minimum viable populations is not to maintain the *minimum* number, but to maintain populations well above that size. Each of the MAs is believed to contain viable FTHL populations.

The simulation models suggested that FTHL population viability is particularly sensitive to changes in mortality rates versus other factors. This likely explains the absence of FTHL near agricultural areas where the habitat appears good but there are increased predator densities (Young pers. obs.). Other important variables are fecundity and the effects of environmental stochasticity, such as drought and years with above average precipitation. Management practices intended to benefit FTHL have little effect on fecundity and precipitation. However, by reducing activities that result in mortality, directly or indirectly, management within reserves could increase the viability of FTHL populations. Thus, the population viability analyses suggest that actions that limit sources of mortality, versus other factors, will especially increase the chances that populations will persist into the future. Results also highlighted the need for accurate estimates of population variables, particularly age-specific clutch size and numbers of clutches produced per female annually; mortality rates, particularly for juvenile lizards; population density; and how population parameters vary over time and with precipitation or annual plant production. Better estimates of population variables would greatly enhance the value of population viability analyses in guiding the management of this species.

Threats

A variety of anthropogenic activities have altered or destroyed the landscape and native vegetation throughout much of the Sonoran Desert (Lovich and Bainbridge 1999). From the estimated historical range in the U.S. (Figure 2), the FTHL has lost approximately 49% of its original habitat (Hodges 1997). The Salton Basin had been subjected to frequent inundation from the Colorado River even prior to the accidental flooding from 1905 through 1907, and it is questionable whether this area can be considered historic habitat. If the 235,520 acres currently occupied by the Salton Sea are not considered historic habitat, the amount of habitat lost is approximately 43%. Rado (1981) estimated that about 315,000 acres of habitat in California had been lost to agricultural development and 83,000 additional acres for urban development (398,000 total acres lost). Hodges (1997) had much higher estimates, with 877,000 total acres lost to agricultural and urban development. She also noted that 24,000 acres in Arizona had been converted to agriculture and urban use. Additional unknown acreage has been degraded due to utility lines, geothermal development, sand and gravel mining, OHV use, waste disposal sites, military activities, Border Patrol (BP) activities, and roads. While initial evidence suggested that FTHL populations had declined in the Yuha Basin and northern East Mesa (Wright 1993; USFWS 1993), Wright (2002) recently found no significant trends in lizard encounter rates in Yuha Desert, East Mesa, or West Mesa from 1979-2001. Further evaluation of the status of these populations is necessary.

In Sonora, less than 20% of the habitat has been converted to agricultural, urban, or other uses. In Baja California Norte, considerable habitat loss has occurred in the Mexicali Valley where urban and agricultural development extends from Mexicali to the Colorado River (Johnson and Spicer 1985).

Several aspects of FTHL ecology and behavior contribute to the species' sensitivity to habitat loss and degradation. Among these are the following: 1) the FTHL is distributed over a relatively small area (Figure 2); 2) relatively low clutch size may limit the ability of FTHL populations to recover from declines; 3) the large home range of the FTHL means that surface-disturbing activities may affect populations for relatively great distances from project sites; 4) FTHLs often freeze in response to danger, which makes them susceptible to mortality on roads and in other areas of activity; 5) FTHLs are found in valleys and flats where the majority of residential and agricultural development typically occurs; 6) FTHLs are susceptible to a variety of predators, many of which occur at elevated levels near agriculture or urban areas; and 7) FTHLs inhabit the most arid portions of the Sonoran Desert, in which drought is likely an important factor in population dynamics.

Agricultural Development

Conversion to agriculture eliminates FTHL habitat. Agricultural development has occurred primarily in the Imperial, Coachella, Mexicali, Borrego, and Colorado River valleys and on Yuma Mesa. Portions of the Colorado and Imperial valleys were converted entirely to agriculture many decades ago. Limited new agricultural development is continuing northward in the Imperial Valley along the edges of the Salton Sea and on Yuma Mesa. Similarly, in the Coachella Valley, development of new lands for agriculture is continuing, especially around Indio and southward adjacent to the Salton Sea. The rate of new development is relatively slow due to limitations on irrigation water.

Densities of some predators are elevated at or near agricultural lands. Relatively high densities of predators (e.g., round-tailed ground squirrel, common raven, greater roadrunner, American kestrel, burrowing owl, and loggerhead shrike) appear to result in elevated predation on FTHLs in adjacent undeveloped lands (Piest, Wong, Young, pers. obs.).

Urbanization

Urban development results in a direct loss of habitat and habitat degradation resulting from a variety of human activities. Southeastern California and southwestern Arizona are experiencing dramatic growth in human population. Most of the new urban development is occurring on agricultural lands in the Imperial, Coachella, and Colorado River valleys. However, some urban development is occurring in FTHL habitat in the Coachella Valley and Borrego Valley, California, and on the Yuma Mesa near Yuma and San Luis, Arizona. Growth is also occurring in San Luis, Sonora, including development of an 8,000-acre industrial park in FTHL habitat on the eastern end of the city. Direct impacts on FTHL habitat come from activities such as construction of commercial and residential buildings, landscaping for yards, parks, and golf courses, and road construction. Indirect effects of urbanization on adjacent FTHL habitat include route proliferation, increased OHV use, spread of non-native vegetation, and trash accumulation. Predators, such as common ravens, American kestrels, and domestic dogs and cats, also increase in urban areas, resulting in increased predation rates on FTHLs in adjacent wildlands (Bolster and Nicol 1989; Cameron Barrows, CNLM, pers. comm.).

Off-highway Vehicle Use

Over the past 20 years, there have been numerous bibliographies (e.g., Webb and Wilshire 1983) and literature reviews (e.g., Berry 1996) on the effects of OHV activity. In 1983, Webb and Wilshire (1983) published a comprehensive analysis on the impacts and management of OHVs in arid regions.

Legal OHV use falls into four basic kinds: 1) use of existing routes and trails for access and touring; 2) use of existing routes and trails by motorcycles, four-wheel drive vehicles, and all-terrain cycles as a recreational activity; 3) use of existing routes and trails for competitive vehicle events; and 4) cross-country travel in OHV "open areas."

Illegal OHV activity occurs in some areas but is limited by law enforcement, signing, and public information and education. The U.S. BP conducts patrols and rescues near the International Border that sometimes involve cross-country travel. BP OHV activity in FTHL habitat has greatly increased from 1997 to 2002 (Rorabaugh pers. comm.), but new BP practices, such as reliance on remote cameras, may reduce the amount of OHV traffic in the future (Wright 2002).

Currently, California BLM permits competitive events in the Superstition Mountains Open Area and the Plaster City Open Area on the western side of the FTHL's range. In addition, cross-country travel (or "free-play") is allowed in the BLM's Plaster City Open Area, the BLM's Superstition Hills Open Area, and the OWSVRA. Portions of these open areas support FTHL populations of various densities. However, FTHL encounter rates in BLM open areas have historically been only ¼ of those in the adjacent limited areas, suggesting an OHV related effect (Wright 2002).

The nature and extent of impacts of OHV use depends upon the kind of activity (Webb and Wilshire 1978; Adams *et al.* 1982). Most desert soils are susceptible to compaction from vehicles. Important factors determining the intensity of compaction are soil moisture, vehicle type, and amount of vehicle activity (Davidson and Fox 1974; Webb *et al.* 1978; Adams and Endo 1980). Compaction results in increased water and wind erosion and decreased water infiltration and retention. Important factors in erosion of desert soils are slope, soil particle size, and size of disturbed area (Adams and Endo 1980). Compaction of soils may negatively affect burrowing of FTHLS or the construction of ant nests. Changes in soil characteristics may affect the ability of the soil to support vegetation, resulting in decreased density, diversity, and biomass of plant cover (Davidson and Fox 1974; Webb *et al.* 1978).

OHVs may impact vegetation by physically damaging roots, stems, or whole plants (Hall 1980). The resulting decrease in biomass and/or change in species diversity may result in a reduced or degraded food base for ant prey species. In addition, decreases in plant cover will decrease protection from predators, shelter from solar heating and wind, and may affect sand accumulation and retention.

The current state of knowledge of the impacts of OHV use on the FTHL is both incomplete and inconclusive. The results of work performed by Utah State University (Setser 2001) at the OWSVRA suggest that FTHLS are found less often in areas disturbed by OHVs than in areas that were randomly selected. However, FTHLS were found within 10 m of an impact area at a frequency similar to that of random locations, suggesting that vehicle impacts may be localized. Wright (2002) and Rorabaugh *et al.* (2002) found FTHLS persisting in areas of MAs that had the greatest levels of OHV disturbance observed in California and Arizona. Wright (2002) found no consistent relationship between vehicle impacts and flat-tailed horned lizard detection rates, but Wright and Grant (2002) noted that plots with less than 9% vehicle track coverage (n = 6) had 3.5 times more lizards than plots with greater than 9% track coverage (n= 6, p = 0.05). Substrate differences between plots was a confounding variable. These results must be interpreted cautiously since no well-controlled study has been conducted to determine effects of OHVs on FTHLs. The OWSVRA continues to support research addressing the impacts of OHV use on the FTHL.

In addition to the indirect effects noted above, FTHLs could be killed directly by being run over, either above ground or in burrows. FTHL winter burrows are shallow (average depth of 5.6 cm, range 2.6-10.0, n=6; Muth and Fisher 1992); thus, vehicles may crush burrows and lizards in burrows. Bury *et al.* (1977) found reduced biomass, density, and diversity of reptiles in heavily used areas of OHV open areas.

It has been shown that prolonged noise can adversely affect some lizards (e.g., desert iguana, Mojave fringe-toed lizard) (Bondello 1976; Brattstrom and Bondello 1983). However, it is not known whether or not vehicle noise at levels and durations anticipated in the desert negatively impact FTHLs. Effects are more likely where prolonged, loud noise occurs. A bibliography of literature on the effects of noise on animals can by found in Brattstrom (1978).

Off-road activity has increased dramatically over the last decade in the Yuma Desert, Yuha Desert, and West Mesa MAs (Wright 1993; Rorabaugh, pers. obs.). In the Yuha and southern half of the West Mesa MAs in 2001, 10.5 and 6%, respectively, of the surface area was covered by vehicle tracks (Wright 2002), which was a significant increase over 1994. Wright could not determine how much of this increase came from BP, smugglers, or recreationalists. Routes in the southern part of the East Mesa MA decreased by 45% from 1994 – 2001. In the Yuma Desert MA, off-road vehicle tracks covered 2.9% of the ground surface in the BMGR portion, and 3.4% of the surface in the 5-Mile Zone portion of the MA (Rorabaugh *et al*. 2002). The authors suspected that much of the off-road traffic was attributable to BP.

Highways, Canals, Railroads

Mobile species are commonly killed by vehicle traffic along well-traveled roads. Road mortality can significantly decrease amphibian and reptile densities along roads (Nicholson 1978a, b; Rosen and Lowe 1994; Carr and Fahrig 2001). Grant *et al.* (2001) found 87% fewer FTHLs within 0.45 mile of Highway 98 in Imperial County, California, as compared to areas farther from the road. Young and Young (2000) suggested FTHL populations would be affected within 0.3 mile of a road, with severe impacts within 0.15 mile. Such mortality could depress local populations and function as a partial barrier to movement. FTHLs are less likely to be run over on railroads, but the tracks may create a significant barrier to movements. Numerous roads and highways bisect remaining FTHL habitat. Within the Coachella Valley, I-10, a busy freeway, separates remaining populations, and smaller well-traveled roads fragment remaining habitat to the north and south of I-10. Further south in California, State Routes 86, 78, and 98, and Interstate 8 divide habitat areas. It is possible that some FTHL movement occurs across these roads, but they likely function as effective barriers to most FTHL movement. Numerous smaller roads exist throughout California that are likely to depress local populations but may allow more movement between populations than these major highways.

The Arizona Department of Transportation is developing a proposal to construct the Area Service Highway linking the Araby Road Exit on Interstate 8 and the planned commercial port of entry just east of San Luis, Arizona. The proposed route would pass through approximately 10 miles of previously undisturbed FTHL habitat and would upgrade and pave approximately 5 miles of an existing dirt road. The new commercial port of entry may facilitate urban and industrial development, which could cause further loss of habitat on both sides of the international border.

Canals probably function as nearly absolute barriers, with FTHLs able to cross only at bridges and siphons. Some may drown in large canals as well as small agricultural drains, but the significance is unknown. Barriers to movement can create small, local populations which are susceptible to stochastic events and extinction, and which cannot be recolonized from adjacent populations (Wilcox and Murphy 1985). For example, the Andrade Mesa, a small strip of FTHL habitat in California north of croplands in Mexico and south of the All-American Canal, is effectively isolated. Highways, canals, and railroads may also facilitate urban and agricultural development, which results in further loss, degradation, and fragmentation of habitat. Within California, the Coachella Canal and the All-American Canal bisect FTHL habitat and separate populations. This likely isolates the population to the east of the Coachella Canal (including animals found in the Algodones Dunes and to the east of the dunes) from the East Mesa population.

The BOR and cooperating water districts have proposed construction of a new, concrete-lined All-American Canal adjacent to the existing unlined canal, from 1 mile west of Pilot Knob to Drop 3 of the Canal in southeastern Imperial County, California (BOR and Imperial Irrigation District 1990). Construction would destroy a linear strip of desert scrub and dune habitat approximately 400 to 600 feet in width and 23 miles in length. Approximately 725 acres of FTHL habitat would be lost (Bransfield and Rorabaugh 1993). The project currently is postponed, but is likely to occur as water needs escalate in southern California.

Military Activities

The FTHL inhabits two military installations, Naval Air Facility (NAF) near El Centro, and the western BMGR administered by MCAS-Yuma. The FTHL also occurs at the former Salton Sea Test Base. MCAS-Yuma manages 114,800 acres within the Yuma Desert MA, and NAF-El Centro manages 29,800 acres within the West Mesa MA and 8,500 acres in the East Mesa MA.

At NAF-El Centro, Range 2510 intersects the West Mesa MA and Range 2512 intersects the East Mesa MA. The training ranges are used for aircraft familiarization, air-to-air refueling, tactical air control, inert (non-exploding) bombing, inert rocket/small arms firing, air combat maneuvering, air intercept, survey flights, search and rescue flights, and air defense exercises (NAF-El Centro 2001). Three target areas within FTHL habitat are used for high, intermediate, and low altitude inert bombing and inert rocket-firing exercises, and for special weapons and conventional delivery of inert ordnance. Each target has an impact radius of up to 1,500 feet. Other activities include target maintenance, clean up of target sites, road maintenance, mobile target activity, and target and run-in-line grading. Most activity is confined to previously disturbed areas such as existing roadways and designated staging areas, so very little off-road activity is required. However, unauthorized public OHV recreation occurs in these areas.

At the BMGR, the Yuma Desert MA intersects Range 2301W which includes two targets in FTHL habitat. The targets have an impact radius of up to 1,500 feet, and are used for inert air-to-ground rockets, bombs, and strafing. Other activities within FTHL habitat include the use of precision air-to-ground lasers, explosive ordnance disposal, rifle and pistol training, and tactical landing at Auxiliary Airfield 2. Other activities include target maintenance, clean up of target sites, and road maintenance. Most activity is confined to existing roadways and designated staging areas, so very little off-road activity occurs. The BMGR and Yuma Desert MA are immediately adjacent to the Mexican border, so undocumented alien traffic and U.S. BP off-road vehicle activity are common in the area. The BMGR portion of the Yuma Desert MA is closed to the public and patrolled by MCAS.

Most military activities result in small amounts of direct habitat disturbance, or occur in previously disturbed habitat, so effects on FTHLs and their habitat are likely to be small except where activities are concentrated. Some incendiary devices could start wildfires (see discussion of Fire as a threat on p. 19), although the Integrated Natural Resource Management Plans include measures for fire suppression. Explosion of ordnance and aircraft noise could potentially cause hearing loss in lizards at or near the noise sources (Brattstrom and Bondello 1983).

Utilities

Harm and harassment of FTHLs as well as direct habitat disturbance may result from installation and maintenance of utilities such as transmission lines, pipelines, and fiber optic cable lines. Habitat disturbance from transmission lines results primarily from installation of towers, construction and use of access routes to the tower sites, use of the tower site, use of line-pulling sites, and maintenance activities. Total direct disturbance is relatively small, usually less than 8 acres per mile. Vasek *et al.* (1975a) found in the Mojave Desert that the overall, long-term effects are a permanently devegetated maintenance road, enhanced vegetation along the road edge and between tower sites, and reduced vegetation cover under the towers, which recovered significantly but not completely in about 33 years. If crushing, rather than blading, is required, time to recovery of spur routes, tower sites, and pulling sites can be reduced. Although new access routes are usually required, sometimes transmission lines are placed along existing maintenance roads. An indirect but potentially large impact is that loggerhead shrikes and other avian predators can use the transmission lines and towers to more effectively prey upon FTHLs (Young and Young 2002).

Direct habitat disturbance from pipelines results from trenching, stockpiling of fill, refilling the trench, and moving vehicles along the corridor during construction and inspections. Total disturbance is also relatively small but greater than transmission lines (i.e., usually less than 16 acres per mile). Natural habitat restoration in the construction zone requires many decades and perhaps centuries (Vasek *et al*. 1975b).

Direct habitat disturbance from burying fiber-optic cable results primarily from the crushing of vegetation where the tracked vehicle lays the cable. The disturbed area is usually narrow (< 4 m), resulting in a small disturbance overall (usually less than 1.5 acres per mile).

Pipelines, transmission lines, or fiber-optic cables are not likely to function as barriers to movements. However, roads constructed to build or maintain these utilities may cause a proliferation of new access roads into previously undisturbed areas, resulting in off-site habitat disturbance.

Predation

Round-tailed ground squirrels (*Spermophilus tereticaudus*) appear to be the chief predator of FTHLs. They were responsible for 50% of known mortalities of transmittered FTHL on West Mesa MA in 1990-1992 (Muth and Fisher 1992), and they killed 30% of all transmittered FTHLs in 1996 and 10% of transmittered FTHLs in 1998 in the Yuma Desert MA (Young and Young 2000). However, at OWSVRA ground squirrels were uncommon and did not prey upon transmittered FTHLs (Setser 2001). Loggerhead shrikes are also important predators of FTHL (Duncan *et al.* 1994; Muth and Fisher 1992; Young and Young 2000). Other documented predators include American kestrel (*Falco sparverius*) (Duncan *et al.* 1994; Cameron Barrows, CNLM, pers. comm.), common raven (*Corvus corax*) (Duncan *et al.* 1994), burrowing owl (*Athene cunicularia*) (Duncan *et al.* 1994), sidewinder (*Crotalus cerastes*) (Funk 1965; Muth and Fisher 1992), coachwhip (*Masticophis flagellum*) (Young and Young 2000), kit fox (*Vulpes macrotis*) (Duncan *et al.* 1994; Muth and Fisher 1992; Young and Young 2000), and leopard lizard (*Gambelia wislizenii*) (Carlson and Mayhew 1988; Young 1999). Other likely predators of FTHLs include the greater roadrunner (*Geococcyx californianus*), thrashers (*Toxostoma* spp.), patch-nosed snakes (*Salvadora hexalepis*), glossy snakes (*Arizona elegans*) (Muth and Fisher 1992), and large scorpions (*Hadrurus arizonensis*) (Turner and Rorabaugh 1998). Muth and Fisher also suspected the leaf-nosed snake (*Phyllorhyncus decurtatus*) was a possible predator, but recent evidence (S. Gardner 2002) suggests this is unlikely. Predator densities are often elevated near human development (Bryant 1911). For example, data from the Breeding Bird Survey show that populations of common raven have increased 4.7-fold in the Colorado Desert between 1969 and 1988 (BLM *et al.* 1989). Cameron Barrows (CNLM, pers. comm.) documented high predation rates from a kestrel pair nesting in a palm tree just outside the Coachella Valley Preserve. He also noted severely depressed FTHL populations within 0.1 mile of a road in the Coachella Valley, a result of predation by kestrels and shrikes that nested in nearby housing areas and golf courses and hunted from power poles along the roads. Round-tailed ground squirrels and roadrunners occur at elevated densities near agricultural areas and may explain absence of FTHLs in some areas of apparently suitable habitat adjacent to agriculture (Wong & Young, pers. obs.). Elevated predation may contribute to a cumulative set of adverse effects that result in population declines in some areas.

Energy and Mineral Extraction

Mining and Mineral Material Extraction

Mining and mineral extraction activities cause habitat loss and degradation because of long-term loss of vegetation cover and removal of topsoil. Associated activities, such as truck and light vehicle traffic, can result in direct mortality within the project area as well as outside of the project site along access roads. Even though most mineral material sites (e.g., sand and gravel) are small, their cumulative effect can be significant. The acreage of mining and mineral sites within FTHL MAs has not been mapped and quantified.

Geothermal Power Development

Geothermal power development is occurring in the Imperial and Mexicali valleys, particularly in agricultural lands, but also in adjacent desert lands. Much geothermal development has occurred in FTHL habitat in the southwestern portion of East Mesa. Power plant construction, wells, pipelines, transmission lines, and service roads cause habitat loss and degradation. Currently, geothermal energy companies believe that the geothermal resource is exploited at or near capacity (Rob Waiwood, Geologist, BLM California Desert District, pers. comm.). No additional power plants are proposed for East Mesa. Some additional disturbance will occur from replacement wells and associated facilities (e.g., pipelines).

Oil and Gas Development

Extensive leasing by the federal government of oil and gas rights occurred in the early 1980's in the Salton Sea Trough. Some leasing also occurred in the Yuma Desert south of Yuma. These leases were highly speculative. Only one test well was drilled in California, and two test wells were drilled in Arizona. None of these wells were profitable, and no oil or gas resources have been identified. At present there are no active federal leases for oil and gas within the range of the FTHL in the U.S.

Potentially, portions of public land within the range of the FTHL could be offered for lease in the future. Leasing, which is discretionary, would not take place unless interest had been expressed by the oil and gas industry. Any leasing would be required to adhere to regulatory standards (43 CFR 3100 et seq.). Oil and gas leases may be issued with standard stipulations as well as additional stipulations for sensitive areas, including stipulations requiring no surface occupancy.

The development of an oil and gas field would result in loss or degradation of habitat from well pads, pipelines, and service roads. Some direct mortality could occur on roads used by trucks and other vehicles. Under current regulations the amount and location of disturbance on federal lands would be subject to strong controls.

Wind Turbines

Wind turbines cover about 317 acres of FTHL habitat in the northwestern portion of the Coachella Valley. Some habitat is lost where turbine platforms are built, and there may be some road mortality on the dirt maintenance roads. However, the turbines have mainly been built on gravel floodplains and foothill slopes, where FTHLS are unlikely to occur. Furthermore, there may be an indirect positive effect in that the presence of wind turbines keeps the habitat from being converted to urban use, which is the primary cause of habitat loss in the Coachella Valley. The turbines may also reduce densities of avian predators.

Landfills

In recent years there have been increasing attempts to place large, regional landfills serving distant urban centers in remote areas, such as the Colorado Desert. The proposals range from 2,000 to 20,000 acres in size. Large landfills in FTHL habitat would result in a permanent loss of habitat. Additional degradation of habitat as well as direct mortality and population fragmentation would occur from trash transportation, such as railroads and roads, and ancillary facilities. Although strongly stipulated to limit the effect, landfills may increase populations of predators (e.g., ravens, roadrunners) that potentially could prey on FTHLS many miles from the landfill.

In the past, the federal government issued leases to cities and counties for landfills serving local areas. Currently, federal agencies are disposing of, primarily through exchange or sale, lands proposed for landfills. Local agencies may still develop new sites on private lands in wildland areas. Even though relatively small in size (10-200 acres), these landfills would result in negative effects on FTHLS similar to large, regional landfills.

BOR sold 640 acres of land south of Yuma to the city of Yuma for a regional landfill prior to the Conservation Agreement. The land is located just east of the Arizona state prison along County 23rd Street. It is currently undeveloped and occupied by FTHLS. This landfill will replace the existing Yuma County landfill located east of Somerton, when that landfill reaches capacity.

Exotic Plants

Many species of introduced, non-native plants occur in FTHL habitat. Most are Mediterranean or Asian annual species that germinate in the winter or spring months. Split grass (*Schismus barbatus*) is common throughout the range of the FTHL and locally abundant. Sahara mustard (*Brassica tournefortii*) and Russian thistle (*Salsola tragus*) are locally abundant. Sahara mustard appears to be spreading rapidly in some areas. Many other non-native annual species may be present, especially species in the families Gramineae (grasses), Chenopodiaceae (goosefoots), Cruciferae (mustards), and Compositae (sunflowers), particularly near agricultural areas and near streams or wetlands. Density, diversity, and productivity of both native and non-native annual plants vary greatly from year to year. In years with abundant winter and spring rainfall, densities and diversity of annual plants are often relatively high (Tevis 1958; Inouye 1991; Rorabaugh 1994).

The effects of non-native annual plants on the FTHL are unknown. However, their abundance in FTHL habitat is of concern for several reasons. In portions of East Mesa, the Coachella Valley, and habitat in Sonora, densities of Russian thistle and/or Sahara mustard are very great in some years, with stem or culm densities perhaps great enough to impede movement by FTHLs, which are relatively wide-bodied and active. As discussed in the following section on fire, high productivity of non-native annuals can fuel fires that destroy native perennial shrubs and facilitate changes in plant composition.

Where non-native annuals have significantly changed plant communities, the types of food available to harvester ants have also been altered. Relationships among species of harvester ants and between ant populations and environmental variables are complex (Ryti and Case 1988; Mackay 1991). Changes in annual plant communities may trigger changes in ant communities that could, in turn, affect predators of ants, including FTHLs.

In addition to non-native annual plants, saltcedar (*Tamarix ramosissima*), a non-native perennial shrub or tree, has invaded areas of shallow groundwater in FTHL habitat on the west side of West Mesa, in the Yuha Basin (Wright 1993), and along portions of the All-American and Coachella Canals. FTHLs have been recorded in saltcedar communities (Kim Nicol and Betsy Bolster, CDFG, pers. comm.), but dense stands of saltcedar are likely unsuitable for them.

Fire

In the summer of 1992, a dense, dried stand of non-native annual plants fueled a fire in northern East Mesa that burned approximately 3,600 acres. Although the effects of the fire have not been quantified, large numbers of perennial shrubs, particularly creosote, were killed. Restoration of perennial cover after the fire has been very slow. Dried, non-native plants in the Coachella Valley have also fueled several small fires of less than ten acres. Habitat in portions of the Coachella Valley, on East Mesa, and in Sonora support dense stands of non-native annuals and, as a result, is particularly susceptible to fire. Presumed ignition sources of fires within habitats occupied by FTHLs include: lightning strikes, campfires, highway and railroad sources, catalytic converters on OHVs, military activities (particularly use of flares and bombing), and other activities. Fires are more frequent near towns and roads (Tracy 1994) and are likely to occur after annual plants cure in the spring and before late summer or winter rains reduce the fire hazard.

The effects of fire on FTHL habitat have not been studied. However, many species of perennial shrubs in desert scrub habitats are generally poorly adapted to fire (Brown and Minnich 1986; Minnich 1994). Fire in desert scrub communities causes vegetational conversion to communities that are more fire tolerant (Minnich 1994). Recovery of pre-fire cover and biomass of desert shrubs is achieved only after several decades (Minnich 1994). Creosote and white bursage, which are often dominant perennial shrubs in FTHL habitat, typically experience high mortality during fires. Big galleta grass, also an important perennial in some areas, resprouts vigorously after fire (Minnich 1994). Although fire suppression activities are needed to control the size of fires, off-highway access during fires and creation of fire lines can result in habitat damage (Duck *et al*. 1994).

If fire occurs when FTHLs are on or near the surface, individuals could be killed directly by the fire. The effects of vegetation community conversion on FTHLs are unknown, but decreased shrub cover could make individuals more susceptible to predation and environmental extremes. Changes in plant community composition could also facilitate changes in substrates and ant populations that could adversely affect FTHLs. Additional study is needed to quantify the effects of fire on this species and its habitat.

Pesticide Use

Agricultural fields in the range of the FTHL are sprayed aerially with insecticides to control various insect pests. These pesticides may drift onto adjacent wildlands and kill ants, the primary prey of FTHLs (BLM 1990). Pesticide drift is less likely to be concentrated sufficiently to kill FTHLs directly, but dosages may become lethal if accumulated in the tissues by consuming contaminated prey. Sublethal effects on lizards are poorly studied and pesticide tolerances of FTHLs are unknown (Johnson 1989). Drift of herbicides from croplands may also injure or kill plants in adjacent FTHL habitat.

Since 1943, the California Department of Food and Agriculture has conducted a control program for the exotic sugar beet leafhopper (*Circulifer tenellus*), a carrier of curly top virus, which damages crops. The program has entailed aerial application of insecticides (DDT from 1956-1965 and malathion since 1965) in areas known to harbor the insect. In the past this has included portions of East Mesa, West Mesa, and Yuha Basin in California (Calif. Dept. of Food and Agric. 1991). Historically, treatments in the Imperial Valley have occurred in about one out of every three years with aerial treatment acreage varying between 3,000 and 27,000 acres. The last two aerial treatments in Imperial County were in 1992 and 1998, with treatment acreages of 7,143 and 5,900 respectively (Calif. Dept. of Food and Agric. 2002).

Effects of malathion on the FTHL have not been studied; however, studies on other lizards have shown no direct effects at applications many times higher than planned here (Peterle and Giles 1964; Giles 1970; Hall and Clark 1982). Harvester ants, which are the primary prey of FTHLs, are killed by the insecticide treatments (Bolster and Nicol 1989). Proposed treatment protocols call for application during night or early morning hours in the winter or spring. Since most ants in a colony are underground during these cool periods, few ants should be killed directly (Calif. Dept. of Food and Agriculture 1995). Monitoring efforts have shown that, although foraging individuals may be killed in significant numbers, ant colonies recover quickly following malathion spraying (Peterson 1991; Calif. Dept. of Food and Agric. 2002). However, no rigorous studies have investigated the effects of malathion spraying on harvester ant populations within the range of the

FTHL, therefore the conclusions of these monitoring efforts are as yet unsupported. Spraying, if necessary, typically would occur at or near the time of emergence of hibernating FTHLs. This would likely affect populations in sprayed areas, because food resources (ants) would be temporarily reduced. Therefore, malathion spraying is considered inconsistent with FTHL conservation in FTHL MAs.

Despite mitigation measures, the overall effects of the program are uncertain. Effects of applying broad-spectrum insecticide over many years to desert scrub communities are potentially many and complex. For instance, changes in invertebrate communities may include changes in pollinator and herbivore populations, which may in turn alter plant communities. Changes in plant communities could precipitate further changes in invertebrate communities and create altered conditions for vertebrates, as well. The effects of this program need further study. The USFWS has issued a biological/conference opinion, and a recent update, on the beet leafhopper control program (USFWS 1996b; USFWS 2001). The terms and conditions stipulate that no treatments may occur in FTHL MAs, and that aerial treatments in habitats elsewhere that support high densities of FTHLs should be restricted to the fall and winter months to the extent possible. The most recent decision of the BLM California State Director (March 11, 2002) in authorizing a beet leafhopper malathion control program on public lands in California includes the following terms and conditions:

“9. No treatments shall be applied in designated flat-tailed horned lizard management areas, as set forth in the Flat-tailed Horned Lizard Rangewide Management Strategy (Twedt 2001). Treatments within other flat-tailed horned lizard habitats shall be limited to not more than one application in a given area per year.

10. Harvester ant monitoring shall be conducted in association with any treatments that occur in flat-tailed horned lizard habitat in the Imperial Valley.”

Land Disposal

Lands that are removed from federal or state ownership are available for agricultural development, urban development, landfills, or other surface disturbing activities consistent with local zoning regulations. These activities result in varying degrees of habitat loss and adverse effects to FTHL populations.

The Arizona State Land Department is disposing of land occupied by FTHLs in two areas: 1) near Fortuna Road east of Yuma and south of Interstate 8 and 2) near the town of San Luis. The parcels of state lands that are currently being sold are immediately adjacent to residential and commercial development and have reached what the State Land Department feels is their peak value. It is expected that these lands will be developed as housing or commercial property soon after their sale and thus will no longer be useable as habitat for FTHLs. The State Land Department is currently denying land sale applications for other state land parcels in FTHL habitat because these lands have not yet reached their highest potential value. Recently, however, they have leased significant parcels of habitat for agricultural development.

Cattle Grazing

Historically, portions of FTHL habitat in the U.S. were grazed (e.g. East Mesa) as ephemeral pasturelands; however, we are not aware of any grazing currently occurring in the U.S. range of the species. Cattle grazing occurs at least seasonally in some portions of Sonora where FTHLs are found. In dry periods, cattle congregate around water sources and corrals, such as at Pozo Nuevo, Sonora. During wet winters and springs when annual plants are abundant, cattle may stray far from water and ranchers often truck in additional stock to take advantage of abundant forage. Areas in the immediate vicinity of water are often heavily trampled and denuded of vegetation. The effects of livestock grazing on the FTHL are unknown; however, grazing can reduce populations of other lizards (Jones 1981; Bock *et al.* 1990; Mitchell 1999). Heavy grazing is widely recognized as having serious deleterious effects on desert soils, vegetation communities, and fauna; however, effects of light to moderate grazing are not as well documented (see review in Lovich and Bainbridge 1999).

Other Activities

Various specialized projects and facilities have been constructed or proposed for desert areas that provide habitat for the FTHL. As habitat is lost to these projects, populations of FTHLs are reduced accordingly. Examples of such projects are the Arizona state prison in the Yuma Desert, which occupies about 640 acres of former FTHL habitat, and the nearby A-22 site that BOR had developed prior to the Conservation Agreement for disposal of salt sludge produced by the Yuma Desalting Plant. Development at the A-22 site currently occupies about 160 acres but would be expanded to as large as 960 acres if or when the desalting plant began full-scale operation.

Listing History

In California, the FTHL was designated a sensitive species by the BLM in 1980 (BLM 1980). The purpose of the designation was to provide increased management attention to prevent population declines and habitat loss or degradation that might result in federal or state listing as endangered or threatened. The designation raises the level of concern for FTHLs in the environmental review process and in land use planning. No specific habitat or population protection measure or review process is required or prohibited by the sensitive species designation. By present BLM policy, species designated sensitive are, at a minimum, afforded the protection provided candidate species (BLM 1988). This includes direction to 1) determine distribution, abundance, and population status, 2) develop a habitat management program, and 3) coordinate with the USFWS (BLM 1988).

On January 25, 1988, the California Department of Fish and Game (CDFG) Commission received a petition requesting listing of the FTHL as an endangered species. On May 13, 1988, the Commission accepted the petition and designated the FTHL a candidate species (Carlson and Mayhew 1988). The CDFG reviewed the petition and other information and recommended in its review (Bolster and Nicol 1989) that the species be listed as threatened. On June 22, 1989, the Commission voted against the proposed listing.

The Arizona Game and Fish Department (AGFD) currently includes the FTHL on its draft list of wildlife of special concern (AGFD in prep). This designation affords no legal protection to the species, but is used in planning to encourage habitat conservation and management consideration. Collecting or killing FTHLs is prohibited in both Arizona and California, except by special permit.

The USFWS included the FTHL as a Category 2 candidate for listing as a threatened or endangered species in its original "Review of Vertebrate Wildlife" published in the *Federal Register*, December 10, 1982 (USFWS 1982). Category 2 candidate species were those for which data in the USFWS possession indicate that listing may be appropriate, but additional information is needed to support a proposed rule. In a 1985 revision of the candidate list, the species was retained as a Category 2 candidate (USFWS 1985). Due to new data (especially Rorabaugh *et al*. 1987, Carlson and Mayhew 1988, and Olech undated), the USFWS elevated the FTHL to a Category 1 candidate in its revised list issued on January 6, 1989 (USFWS 1989). Category 1 candidate species were those for which the USFWS had sufficient information to support a proposal to list them as threatened or endangered.

On November 29, 1993, the USFWS published a proposed rule to list the FTHL as a threatened species (USFWS 1993). The USFWS cited "documented and anticipated population declines associated with widespread habitat loss, fragmentation, and degradation due to human activities such as agricultural developments, urban expansion, OHV use, energy developments, and military activities" as the primary bases for the proposed listing. The USFWS could not determine critical habitat at that time. A public meeting was held in El Centro on March 22, 1994, to gather public comment. The passage of Public Law No. 104–6, 109 Stat. 73 in April 1995 delayed consideration of listing the FTHL until an executive waiver, signed by President Clinton on April 26, 1996, allowed the Secretary of the Interior to again list species for protection under the Endangered Species Act.

In response to a lawsuit brought by the Defenders of Wildlife and others, the Secretary of the Interior was ordered by the district court in Arizona on May 16, 1997 to, within 60 days, issue a final decision on the listing of the FTHL. On July 15, 1997 the Secretary of the Interior issued a notice to withdraw the proposal to list the FTHL based on three primary factors: 1) population trend data did not conclusively demonstrate significant population declines; 2) some of the threats to the habitats occupied by FTHLs had become less serious since the proposed rule was issued; and 3) the 1997 Conservation Agreement and RMS would ensure a further decrease in threats to the FTHL and its habitat (USFWS 1997). The Defenders of Wildlife and others again filed suit against the Secretary of the Interior in district court. On June 16, 1999, the district court for the Southern District of California issued a summary judgment upholding the Secretary of the Interior's decision not to list the FTHL.

The Defenders of Wildlife and others appealed the case to the Ninth Circuit Court of Appeals, which on July 31, 2001 reversed the district court's ruling and asserted that the Secretary of Interior's decision to withdraw the FTHL from consideration for listing was "arbitrary and capricious". The primary reasoning for this decision was that the Secretary of the Interior did not adequately address the meaning of the phrase, "in danger of extinction throughout … a significant portion of its range" and how an adequate interpretation of this phrase applies to the status of the FTHL. Furthermore, the court expressed concern about the incomplete implementation of the 1997 Conservation Agreement. On October 24, 2001, the district court ordered the Secretary of the Interior to reinstate the 1993 proposed rule to list the FTHL. The proposed rule was reinstated December 26, 2001 (USFWS 2001).

On January 3, 2003, the USFWS withdrew the proposed rule to list the FTHL as a threatened species (USFWS 2003). They determined that listing was not warranted because threats to the species as identified in the proposed rule were not as significant as earlier believed, and current available data did not indicate that the threats to the species and its habitat are likely to endanger the species in the foreseeable future throughout all or a significant portion of its range.

The Mexican Government has designated the FTHL a threatened species. As such, the species is protected from collection, sale, and commerce, and its habitat is afforded special protection

(Secretaría de Medio Ambiente y Recursos Naturales 2002). An international consortium selected the FTHL and portions of its habitat as conservation priorities in an ecosystem-wide analysis (Marshall *et al.* 2000).

MANAGEMENT PROGRAM

Overall Goal

MAINTAIN SELF-SUSTAINING POPULATIONS OF FLAT-TAILED HORNED LIZARDS IN PERPETUITY.

Management Objectives

- Continue to secure and/or manage sufficient habitat to maintain self-sustaining FTHL populations in each of the five designated MAS (Yuma Desert, East Mesa, West Mesa, Yuha Desert, and Borrego Badlands MAS) and in areas designated by the CVMSHCP.
- Maintain a "long-term stable" or increasing population of FTHLS in all MAS. A population that is stable over the long term exhibits no downward population trend after the effects of natural demographic and environmental stochasticity are removed.
- Continue to support research that promotes conservation of the species at OWSVRA and elsewhere throughout the range of the species.
- Within and outside of MAS, limit the loss of habitat and effects on FTHL populations through the application of effective mitigation and compensation.
- Encourage and assist Mexico in the development and implementation of a FTHL conservation program.

Overview and Purpose

In 1994, the USFWS, BLM, BOR, DOD, and several other agencies signed a MOU "...on Implementation of the Endangered Species Act" that established a general framework for cooperation and participation among cooperators in the conservation of species tending toward federal listing as threatened or endangered under the Endangered Species Act. The MOU identified the development of conservation agreements as a valuable process for achieving conservation of species through voluntary cooperation. A conservation agreement is a formal, written document agreed to by the USFWS and other cooperators that identifies specific actions and responsibilities for which each party agrees to be accountable. The objective of a conservation agreement is to reduce threats to a candidate species or its habitat, possibly lowering the listing priority or eliminating the need to list the species.

This strategy formed the basis of a conservation agreement among the cooperators for management of FTHLS (Foreman 1997). The conservation agreement that was signed is included as Appendix 1. Although the USFWS determined that the conservation agreement was effective and that listing the FTHL was unnecessary, it retains the ability to reconsider the effectiveness of the agreement. Lack of compliance among the cooperators, a change of circumstances, or other reasons may alter the expected result of this strategy. If threats to the FTHL or its habitat are not reduced, the USFWS may proceed with another proposed or an emergency listing.

The purpose of this strategy is to provide a framework for securing and managing sufficient habitat to maintain several self-sustaining populations of the FTHL throughout the species' range in the U.S. (see Habitat Management, p. 49). A major step towards that objective was the establishment of five MAS encompassing large blocks of habitat where surface disturbing and mortality causing activities are minimized. Prior to the RMS, management of federal lands within FTHL habitat was guided by several management plans, as discussed in Appendix 2. These plans cover federal lands both within and outside the MAs. When the MAs were established, this document became the standard for management and conservation of FTHL habitat. Signatory agencies have incorporated measures in the RMS into their land management plans to comply with the NEPA and state counterparts.

Outside of these MAs, FTHL habitat receives a degree of protection through mitigation and compensation and through the previously established habitat management plans that affect public lands outside of MAs (Appendix 2). Specifically, signatories to the conservation agreement ensure that adverse effects of projects they authorize outside of MAs are mitigated and that residual effects are compensated in accordance with a standard formula (see Mitigation and Compensation). The funds obtained through compensation are used to consolidate land ownership within the MAs or to enhance habitat.

As part of its adaptive management approach, programs for monitoring FTHL population, distribution, and habitat disturbance have been established (see Monitoring Program, p. 66 and Appendix 4 and Appendix 5). If population or distribution declines occur, the ICC shall investigate potential causes. If causes are anthropogenic in nature, the ICC shall make recommendations to the MOG for reversing the trend.

This document is the first revision of the 1997 RMS (Foreman 1997). Because the Implementation Schedule will expire in 2008, it is expected that the schedule will be revised at that time. Concurrently, the need for a revision of the entire document will be evaluated.

Planning Actions

The following Planning Actions have been developed as recommendations to signatory agencies to ensure that the goal of maintaining a “long-term stable” population within each MA is achieved. The original Planning Actions from the 1997 RMS are repeated here, though some of these actions have been completed. Actions that have been identified since 1997 have been added. It is understood that implementation of these actions is subject to availability of funds and compliance with all applicable regulations. It is anticipated that specific actions may be modified based on information obtained from future monitoring, research, and evaluations of the effectiveness of this strategy. Annual evaluations and proposed modifications of this strategy shall be coordinated through the FTHL ICC. The MOG will meet as necessary to review recommendations of the ICC and may make corresponding modifications to Planning Actions in the RMS.

1. **Delineate and designate five FTHL MAs and one FTHL RA. See Table 3 for a summary of land ownership within each MA. Boundary descriptions and geographic information system (GIS) maps are on file with land management agencies.**

   1.1. Designate the Yuma Desert FTHL MA as shown in Figure 4. If the proposed Area Service Highway is constructed along a portion of the boundary of the MA, the east and south side of the ROW will be the new western and northern boundary of the MA, as appropriate.

   1.2. Designate and complete NEPA process for the East Mesa FTHL MA as shown in Figure 5.

1.3. Designate and complete NEPA process for the West Mesa FTHL MA as shown in Figure 6.

1.4. Designate and complete NEPA process for the Yuha Desert FTHL MA as shown in Figure 7.

1.5. Designate and complete California Environmental Quality Act process for the Borrego Badlands FTHL MA as shown in Figure 8.

1.6. Designate the OWSVRA as the Ocotillo Wells FTHL RA as shown in Figure 9.

1.7. Continue to manage areas in the Coachella Valley that are capable of sustaining viable populations of FTHL by working with other agencies and organizations in finalizing a CVMSHCP (see Figure 10).

2. Define and implement management actions necessary to minimize loss or degradation of habitat.

2.1. Mitigate and compensate, as needed (Appendix 6), project impacts on FTHLS and their habitat both within and outside of MAS and the RA through humane and cost-effective measures.

2.1.1 Apply mitigation measures as appropriate, based on the nature of the anticipated impacts (see Mitigation section).

2.1.2 Require compensation for residual impacts remaining after application of other on-site mitigation measures (see Compensation section).

2.2. Limit land use authorizations that would cause surface disturbance within the MAS.

2.2.1 Land use applications will continue to be reviewed on a case-by-case basis for impacts on FTHLS and their habitat. Every attempt shall be made to locate projects outside of MAS. New ROWS may be permitted only along the boundaries of MAS and only if impacts can be mitigated to avoid long-term effects on FTHLS in the MA. Where discretionary, other new authorizations may be permitted if the habitat disturbance does not pose a significant barrier to lizard movements. Disturbance shall be limited to 10 acres or less per authorization, if possible. If individual disturbances over 10 acres are necessary, the ICC and the MOG shall be contacted to provide suggestions for minimizing potential impacts to FTHLS. The cumulative new disturbance per MA since 1997 may not exceed 1% of the total acreage on federal land. The 1% cap on new surface disturbance within MAS will remain in effect for 5 years, after which the 1% cap will be reviewed by the MOG and amended, if necessary, based on more recent information. Each agency may permit disturbances of up to 1% of the land that the agency manages within the MA. Additions to the 242 Well Field by the BOR and existing, on-going activities at DOD facilities (for MCAS-Yuma, these activities are described in the EIS for the Yuma Training Range Complex) do not count towards this 1%. If disturbance greater than the 1% cap is desired, the agency may request use of the 1% disturbance allowance of other signatory agencies in the MA. All authorizations must be conducted in accordance with applicable mitigation and compensation.

2.2.2 All federally owned lands in the MAs shall be retained in federal ownership (except the patenting of mining claims pursuant to the General Mining Law of 1872). Lands in MAs owned by the state of California and managed as preserves, refuges, or parks shall be retained in state ownership.

2.2.3 Maintenance of all existing ROW facilities may continue within MAs.

2.2.4 The proposed Area Service Highway and its ROW are outside of the Yuma Desert MA. This and other new road construction along the boundary of the Yuma Desert MA shall require fencing to reduce access to the MA and lizard exclusion fencing (Appendix 7) to reduce lizard mortality.

2.3. Limit and/or reduce surface disturbance in MAs from discretionary minerals actions.

2.3.1 Allowable activities are the following: 1) leasing under the mineral leasing laws with no surface occupancy; 2) development and production in existing mineral material extraction sites in accordance with local, state, and federal laws and land-use plans, and subject to applicable mitigation; 3) new leases and permits for geothermal energy with stipulations of no surface occupancy (in California MAs only); and other mining and exploration activities authorized under the General Mining Law of 1872. Replacement wells and operation and maintenance of facilities shall be allowed on existing leases. The activities listed above shall be subject to applicable Mitigation (p. 60) and Compensation (p. 62).

2.4. Limit vehicle access and limit route proliferation within MAs.

2.4.1 Reduce new road construction to a minimum by coordinating access needs and avoiding conflicts and replication in road use, development, and management. Allow maintenance of roads on a case-by-case basis, recognizing that maintenance of some roads may be necessary to prevent proliferation of parallel routes. Any new surface disturbance associated with road maintenance shall require mitigation.

2.4.2 All routes shall be designated either "closed" to motorized vehicles, "open" for general public use by all types of vehicles, or "limited" to a specific season, user, or vehicle type or number. Vehicle use shall be restricted to designated open and limited routes. Routes in MAs shall be given a high priority for signing. Routes shall be considered “closed” unless signed as “opened” or “limited”.

2.4.3 Reduce open and limited route density in MAs, particularly in portions of MAs where route density is high.

2.4.4 Participating land managers shall coordinate with the U.S. BP to ensure cooperation with and enforcement of vehicle regulations in MAs and the RA to the maximum extent possible. Coordination shall include regularly scheduled meetings among signatory agencies and U.S. BP in the Yuma and El Centro Sectors to discuss management issues and ways to resolve those issues.

2.5. Limit the impacts of recreational activities within MAs.

2.5.1 All types of vehicle-oriented recreation in compliance with current regulations may occur within the RA.

2.5.2 Permit no competitive motorized vehicle recreational events within MAS. A competitive event is any event where speed or elements of competition (i.e., winning) are present in any form. Non-competitive events may be allowed on routes designated open for public use during the FTHL season of hibernation. Other types of vehicle-based recreation except camping (see action 2.5.4) in compliance with current regulations may occur within MAS.

2.5.3 Allow currently authorized non-motorized recreational activities, such as rock hounding, hiking, backpacking, non-vehicle based camping, picnicking, bicycling, horseback-riding, hunting, bird watching, and nature study, in all MAS and the RA in accordance with existing regulations. Development of new recreational facilities, such as visitor centers, campgrounds, mountain bike trails, equestrian trails, shall not be allowed within MAS, if these would create new surface disturbance in excess of 1%. Installation of interpretive signing and informational kiosks is allowed.

2.5.4 Allow vehicle-based camping only in developed campgrounds, designated camping areas, or within 50 feet from centerline of a designated open route within MAS. More restrictive measures may apply in certain areas. Non-vehicle camping may occur anywhere.

2.5.5 No long-term camping areas shall be designated or developed in MAS.

2.6. Authorize limited use of plants in MAS.

2.6.1 Make no sales and allow no commercial collecting of native plant products (including whole plants, plant parts, flowers, and seeds) within MAS, except as needed for rehabilitation projects within the MAS.

2.6.2 Authorize no livestock grazing in the MAS.

2.7. Within the MAS, allow off-road military maneuvers and encampments only in designated sites. Allow other military activities on previously disturbed lands managed by DOD agencies consistent with normal operations and functions. Marine Corps activities on the BMGR shall be governed by Conference Opinion 2-21-95-F-114, dated April 17, 1996 (USFWS 1996a), as amended, whether or not the species is listed. This Conference Opinion is consistent with the goal and management objectives set forth in this RMS.

2.8. Suppress fires in MAS and the BLM-administered lands in the RA using a mix of the following methods: 1) aerial attack with fire retardants, 2) crews using hand tools to create fire breaks, and 3) mobile attack engines limited to public roads, designated open routes, and routes authorized for limited-use. Do not allow earth-moving equipment (such as bulldozers) except in critical situations to protect life, property, or resources. Post-suppression mitigation shall include rehabilitation of firebreaks and other ground disturbances using hand tools.

2.9. No pesticide treatments shall be applied within MAS. Use of specifically targeted, hand-applied herbicides (e.g. for tamarisk eradication projects) is allowed.

2.10. Within MAs, other discretionary land uses and activities not consistent or compatible with the above restrictions and the general RMS shall not be approved by the authorizing agency.

3. Within the MAs, rehabilitate damaged and degraded habitat, including closed routes and other small areas of past intense activity. Methods to be used may include, but are not limited to, a) ripping or scarifying compacted soils, b) recontouring the surface, c) pitting or imprinting the surface, d) seeding with native plants, e) planting seedlings, f) irrigating, and g) barricading. See Habitat Rehabilitation on page 69 for additional information.

4. Attempt to acquire through exchange, donation, or purchase from willing sellers all private lands within MAs.

4.1. Establish and maintain with approval of the MOG (see Planning Action 6.1.1) a prioritized list of parcels or screening criteria for acquisition within each MA and habitat corridor.

4.2. Seek funding to acquire key parcels within MAs.

4.3. Using compensation and other funds, acquire land within MAs in accordance with established priorities and/or criteria.

4.4. Participate in exchanges where opportunities arise to acquire key parcels within MAs.

5. Maintain or establish effective habitat corridors between naturally adjacent populations.

5.1. Activities in potential habitat corridors between MAs and the RA shall be regulated or mitigated so that at least occasional interchange of FTHLs occurs among adjacent populations. Potential habitat corridors include lands between West Mesa and Yuha Desert MAs and between West Mesa MA and Ocotillo Wells RA (see Corridors). In addition, activities in the Yuha Desert and Yuma Desert MAs that would prevent interchange of FTHLs across the International Border shall be prohibited.

5.2. Coordinate conservation efforts with Mexico and the Immigration and Naturalization Service to ensure continued movement of FTHLs across the International Border in the Yuha Desert and Yuma Desert MAs.

6. Coordinate activities and funding among the participating agencies and Mexican agencies.

6.1. Maintain information exchange and coordination of monitoring, management activities, and research.

6.1.1 Maintain a FTHL MOG consisting of management representatives from agencies participating in the conservation agreement (see Planning Action 6.2). The FTHL MOG shall provide management-level leadership, coordination, and oversight in the implementation of this RMS. The FTHL MOG shall review progress in implementing the conservation agreement, approve amendments to the RMS, set priorities, and recommend measures to resolve management issues relevant to implementation of the RMS. The FTHL MOG shall provide overall policy guidance and coordination among the cooperators for the use of compensation funds.

6.1.2 Hold semi-annual meetings of the ICC. Each of the participating agencies shall designate a representative(s) to the ICC. Representatives from other agencies, organizations, and groups with special interests or knowledge of the FTHL may also be invited to ICC meetings. The ICC shall function as a forum for exchange of information on research results and proposals and for discussion of technical and management issues. The ICC may be assigned specific duties and responsibilities by the FTHL MOG.

6.1.3 Develop a forum for discussions with agencies and individual counterparts in Mexico to coordinate activities, provide information exchange, and promote and assist in development of a FTHL conservation program in Mexico.

6.2. Confirm commitment of agencies participating in this RMS through development and signing of a conservation agreement.

6.3. Incorporate management actions from this RMS when developing multi-agency, multi-species ecosystem plans for the ecoregions in the range of the FTHL incorporating management actions from this RMS.

6.3.1 Incorporate actions in the development of the Western Colorado Desert Coordinated Management Plan (including the Yuha Desert, West Mesa, East Mesa, and Borrego Badlands MAs and Ocotillo Wells RA).

6.3.2 Incorporate actions in the development of the CVMSHCP.

6.3.3 Incorporate actions in the development of the Western Colorado Desert Route Designation.

6.4. Coordinate with the BP in developing mutual agreements for the conservation of natural resources.

6.4.1 Encourage use of techniques that minimize BP OHV activity, such as remote cameras and vehicle barriers.

6.4.2 Prepare an educational presentation for briefing BP agents.

7. Promote the purposes of the strategy through law enforcement and public education.

7.1. Provide law enforcement in MAs and the Coachella Valley FTHL conservation areas sufficient to ensure compliance with OHV and other regulations as described in the planned actions.

7.2. Public information and education about the MAs and RA, including but not limited to interpretive signs and brochures, shall be made available to the public at the offices and interpretive centers of the participating agencies. Information provided shall describe the purposes of the MAs, the RA, and conservation areas within the Coachella Valley, and shall list all pertinent regulations.

8. Encourage and support research that will promote the conservation of FTHLs or desert ecosystems and will provide information needed to effectively define and implement necessary management actions. Research should be encouraged both

within and outside of MAs and the RA. Planning actions 8.3 and 8.4 shall be emphasized, as recommended by the ICC.

8.1. All research shall be conducted under permit from the land management agency. Permits from the state game and fish agency may also be required, and from the USFWS if the species is listed.

8.2. The OWSVRA shall continue to budget for research for at least 5 years. A team of scientists and managers will recommend research designs. Results shall be distributed to other land management agencies.

8.3. Continue to refine cost-effective techniques for assessing FTHL abundance.

8.3.1 Test trapping webs and other techniques to enumerate FTHLs directly.

8.3.2 Determine effectiveness of relative enumeration techniques as an index of relative abundance using test plots of known density.

8.4. Determine the following life history and demographic parameters and how they vary with environmental conditions:

- Age-specific mortality
- Longevity
- Clutch size
- Age-specific number of clutches per year
- Hatching success
- Recruitment
- Diet
- Home range size

8.5. Determine effects of the following activities and factors on FTHL demographics and habitat:

- Paved roads and highways
- OHV use and associated activities
- Geothermal development
- Pesticide Use
- Predation
- Non-native plants
- Fire
- Wind turbines

8.6. Determine genetic variation among populations and the effects of barriers on movements.

8.6.1 Determine genetic variation in populations in the different MAs.

8.6.2 Determine effects of human-created barriers such as railroads, canals, paved roads, agricultural fields, and extensively denuded areas.

8.6.3 Determine effects of natural barriers, such as the Colorado River.

8.7. Determine the effectiveness of the proposed mitigation measures.

9. Continue inventory and monitoring.

9.1. Continue to inventory lands within the range of FTHLS to clarify current range and habitat use.

9.2. Monitor habitat quality and population trends in five MAS, and additional MAS as designated, to determine progress toward overall management goal.

9.2.1 The ICC shall monitor implementation of this strategy.

9.2.2 Land management agencies shall monitor regional population trends using standardized techniques (see Appendix 4 and Appendix 5). Each MA shall be monitored using mark-recapture technique to estimate FTHL population size and determine a confidence interval, at least once every three years.

9.2.3 Land management agencies shall document habitat disturbance and loss; recording cumulative totals for percent and acreage of habitat lost. Land management agencies shall document a running total of compensation funds collected to date.

9.2.3.1 Signatory agencies shall conduct aerial reconnaissance and analysis of surface disturbance on the five MAS every five years.

9.2.4 The ICC shall prepare an annual report of monitoring results and progress on implementation of this RMS. The annual report shall be presented to the MOG for review and approval by the end of February each year and shall document implementation of Planning Actions in the previous calendar year. The report shall include a schedule of activities to be accomplished in the current calendar year, budget needs for the next fiscal year, and outyear budget needs for major projects. The report shall also include a summary of monitoring results and a discussion of the likely causes of any noted declines. Recommendations for reversing anthropogenic declines shall be made.

9.2.5 New inventory, monitoring, and research data shall be used in evaluations of the RMS and in assessing proposed changes to the RMS.

Summary of Management Strategy Implementation, 1997-2002

This section summarizes the implementation of Planning Actions identified in the 1997 edition of the RMS. It covers the period from May 1997 through June 2002. Details of items listed in this section can be found in the ICC annual reports that were completed during this period.

1. Delineate and designate flat-tailed horned lizard MAS and a RA.

1.1-1.6. Five MAS and one RA were mapped and precise boundary descriptions completed (see Figure 4 through Figure 9 and Appendix 3). Measures identified in the RMS were implemented within areas mapped as MAS. BLM-El Centro and BLM-Yuma drafted a document to implement the RMS: *The Proposed Amendment to the California Desert Conservation Area Plan and the Yuma District Resource Management Plan to Expand the East Mesa* ACEC*, West Mesa* ACEC*, and Gran Desierto Dunes* ACEC *Boundaries and to Implement the Flat-tailed Horned Lizard*

Rangewide Management Strategy in Imperial County, California and Yuma County, Arizona. A draft EA is attached to the Proposed Amendment (EA No. CA-067-EA-1998-023). Public scoping meetings concerning this proposed amendment were held. Work is in progress to finalize the EA, complete the NEPA process, and legally designate the MAs.

1.7. Encourage development of a MA in the Coachella Valley. The ICC developed a map with recommended boundaries for a MA in the Coachella Valley. The map was submitted to the Science Advisory Committee to be considered for incorporation into the CVMSHCP (see 6.3.2). Areas designated for management of FTHL in the Coachella Valley would take into account habitat connectivity, current levels of degradation, and manageability. Rather than designate a separate FTHL MA in the Coachella Valley, signatories decided to support creation and management of the CVMSHCP **.**

2. Define and implement management actions necessary to minimize loss or degradation of habitat.

2.1. Mitigate and compensate project impacts through humane and cost-effective measures.

2.1.1. Apply mitigation measures. Appropriate mitigation measures were enforced for all authorized projects that impacted FTHLs or their habitat.

2.1.2. Require compensation for residual impacts. Compensation funds were required for most projects that had residual impacts to FTHL habitat. Funds collected totaled $9742 in 1997/98, $5262 in 1998/91, $45,372 in 1999/01, and $246,880 in 2001/02 (the last figure is for BLM-Yuma only). Some projects were not charged compensation. This occurred where mitigation measures eliminated residual effects, and in cases of unauthorized BP project impacts on FTHL.

2.2. Limit authorizations that would cause surface disturbance in MAs.

2.2.1. Attempt to locate projects outside MAs; limit discretionary land use authorizations and ROWs to 10 acres and 1% total per MA. Four projects in excess of 10 acres were authorized; these were 75.7, 31.4, 16.1, and 11.6 acres in size. Acreage and percent of the MA authorized for disturbance were 2.7 and 0.002 % in the Yuma Desert, 20.2 and 0.018 % in the East Mesa, 107.1 and 0.079 % in the West Mesa, 20.2 and 0.036 % in the Yuha Desert, and 0.0 and 0.000 % in the Borrego Badlands.

2.2.2. Federally owned lands in the MAs shall be retained in federal ownership. No disposal of **federal** lands within MAs occurred.

2.2.3. Maintenance in existing ROWs may continue. No action required.

2.2.4. Require fencing along Yuma Desert MA boundary road. Signatory agencies coordinated with Yuma Mesa Irrigation and Drainage District and Yuma County on plans to fence the south side of County 14th Street from Avenue 6E east to Avenue 16E. The fence would be along the northern boundary of the Yuma Desert MA, and is planned to consist of barbed wire and hardware cloth. Fencing will be required along the Area Service Highway.

2.3. Limit surface disturbance in MAs from minerals actions.

2.3.1. Allow approved minerals actions while applying applicable mitigation and compensation. In 1998, 10 acres were adversely affected. In 2001, an additional 8.17 acres were affected by mining in previously existing claims.

2.4. Limit vehicle access and route proliferation in MAs.

2.4.1. Reduce new roads to a minimum in MAs. No new roads were authorized in MAs. However, numerous roads have developed in some MAs through repeated unauthorized use by BP, OHV recreationalists, and/or smugglers.

2.4.2. Designate routes "open", "closed", or "limited". Give route signing a priority. Some closed routes have been signed as such on the boundary of the Yuma Desert MA. The only paved road in the Yuma Desert MA was posted with a 25-mph speed limit to reduce the chance of FTHL mortality. BLM-El Centro signed vehicle routes several times, but overall signing of the route network was incomplete. NAF-El Centro signed routes on their ranges to reduce FTHL mortality. [In January 2003, BLM-El Centro completed route designation for the Western Colorado Desert. All vehicle routes on BLM managed lands in Imperial County were designated as open, closed, or limited. BLM is actively seeking congressional and grant dollars to implement this designation through signing and enforcing open and limited routes and closing and rehabilitating closed routes.]

2.4.3 Reduce route density in MAs. No action. Route densities in some areas increased because of smuggler and BP traffic.

2.4.4. Coordinate with US BP to ensure cooperation and enforcement of vehicle regulations. ICC members held several FTHL orientation sessions with BP agents in the Yuma and El Centro sectors to reduce impacts to FTHL habitat along the International Border. These briefings were designed to familiarize BP agents with FTHL natural history, habitat requirements, and the importance of minimizing vehicular traffic off of designated patrol routes/roads. These briefings were well received by BP personnel. BLM-El Centro implemented an aggressive education strategy with BP to reduce impacts to FTHL habitat. This education included Detailer and Post Academy Orientation in which detailers and new employees assigned to the El Centro sector were given a 1-2 hour presentation on the location of MAs, desert ecology, sensitive species, and how FTHL habitat is affected by off-route travel, including information relating to prey, ecology, and habits of the FTHL. BP representatives attended several MOG meetings, during which the issue of off-road travel was discussed. BLM-El Centro and BP held monthly coordination meetings.

2.5. Limit impacts of recreational activities in MAs.

2.5.1. Allow vehicle-oriented recreation in RA. No action required.

2.5.2. Permit no competitive recreation events in MAs. Competitive races have not been permitted in MAs. Prior to 1997, 6-12 races per year had been held in the West Mesa and Yuha Desert MAs.

2.5.3. Allow non-motorized recreational activities in MAs, but no new recreational facilities. No new recreational facilities were allowed in MAs.

2.5.4. Limit camping in MAs. A camping closure was implemented and enforced as mitigation in the East Mesa MA. This closure was signed and monitored and uses interpretive kiosks to educate the recreational community on FTHL habitat. No camping (or other public access) is allowed in the BMGR portion of the Yuma Desert MA.

2.5.5. No long-term camping areas shall be developed in MAs. None were developed.

2.6. Allow no sales or commercial collecting of plant products in MAs. No plant sales or commercial collecting were allowed.

2.7. Allow military maneuvers and encampments only in designated sites in MAs. Accomplished. A military staging area in the Yuma Desert MA was fenced to identify its location and limits so that adjacent areas would not be impacted.

2.8. Suppress fires in MAs and BLM lands in the RA using allowable methods. No fires occurred.

2.9. No pesticide treatments shall be applied within MAs. No pesticide treatments occurred.

2.10. Within MAs, other activities not consistent with the RMS shall not be approved. None were approved.

3. **Rehabilitate damaged and degraded habitat in MAs.** BLM-El Centro closed and rehabilitated several unauthorized vehicle tracks. Many of these received further vehicle impacts after being closed.

4. **Attempt to acquire all private lands within MAs.**

4.1 Maintain prioritized list of parcels for acquisitions. Lists prioritizing parcels for acquisition were maintained by the California OHV Division office headquarters in Sacramento and by BLM-El Centro. BLM-El Centro contacted all landowners within the East Mesa MA to advise them of BLM's desire to acquire their lands through purchase or exchange.

4.2 Seek funding to acquire key parcels in MAs. Compensation funds collected in California were banked for habitat acquisition.

4.3. Using compensation and other funds, acquire key lands in MAs. Acreage of habitat acquired in MAs and the RA is summarized in Table 1. DOD acquired approximately 15,500 acres of Arizona state land within the Yuma Desert MA, with DOD funding. All lands within this MA are now managed by signatory agencies. Private lands totaling 740 acres within and adjacent to the Borrego Badlands MA were acquired. BLM acquired 320 acres in the East Mesa and West Mesa MAs. Acquisitions of private lands totaling 8,936 acres were added to the OWSVRA RA.

4.4. Participate in exchanges to acquire key parcels in MAs. No opportunities for exchange arose.

Table 1. Private and state land acquired in MAs and the RA.

Agency	Acres	Location
Department of Defense	15,500	Yuma Desert Management Area
Ocotillo Wells District	8,936	Ocotillo Wells Research Area
Anza-Borrego State Park	740	Borrego Badlands Management Area
BLM El Centro	240	East Mesa Management Area
BLM El Centro	80	West Mesa Management Area
Total	**25,496**	

5. Maintain or establish effective habitat corridors between naturally adjacent populations.

5.1. Limit or mitigate activities in movement corridors. No projects were considered that would block movement across existing corridors between MAs.

5.2. Coordinate with Mexico and INS to ensure movement across the border. All corridors are currently intact to the best of our knowledge. No projects were considered that would block movement across the International Border.

6. Coordinate activities and funding among the participating agencies and Mexican agencies.

6.1.1. Establish a FTHL MOG. The MOG met three times per year to coordinate implementation of the conservation agreement in response to recommendations from the ICC. Meeting minutes were provided to all MOG and ICC members to facilitate effective coordination.

6.1.2. Hold semi-annual meetings of the ICC. The ICC met quarterly to discuss implementation of Planning Actions under the RMS and issues and challenges regarding implementation of the Planning Actions. In addition to ICC meetings, subgroups of the ICC met on occasion to discuss specific issues.

6.1.3. Develop a forum for discussions with agencies and individuals in Mexico. Directors of the Reserva de la Biósfera Alto Golfo de California y Delta del Río Colorado and the Reserva de la Biósfera el Pinacate y Gran Desierto de Altar cooperated with the ICC in furthering the knowledge and conservation efforts of the FTHL and its habitat. The Alto Golfo director hosted a meeting of the ICC at the Reserve’s field station near El Golfo de Santa Clara, Sonora, and participated in one meeting in the U.S. A study, funded by BLM-Yuma and BOR was completed which investigated the status of FTHL in Sonora and Baja California del Norte (Rodríguez 2002), and developed interpretive materials (see 7.2 and 9.1).

6.2 Develop a conservation agreement. The conservation agreement was developed and was signed in June 1997. Signatories were AGFD; California Department of Parks and Recreation; NAF-El Centro; MCAS-Yuma; BLM, California and Arizona state offices; BOR, Lower Colorado Region; and USFWS, Region 1 and Region 2. The CDFG signed in July 1998.

6.3.1. Incorporate actions in Western Colorado Desert ecosystem plan. [BLM-El Centro designated all routes in the Western Colorado Desert as open, closed or limited in January 2003]

6.3.2. Incorporate actions into the CVMSHCP. BLM-Palm Springs participated in the development of the CVMSHCP. [This planning effort was ongoing as of January 2003. In addition, BLM-Palm Springs completed an amendment to the California Desert Conservation Area Plan in December 2002. Actions described in the RMS were incorporated into that planning decision and will be implemented on federal land in the Coachella Valley.]

6.4. Coordinate with U.S. BP to develop mutual agreements. In addition to the education efforts described in 2.4.4, coordination with BP occurred at multiple levels, and BP was represented at several MOG meetings.

7. Promote the purposes of the strategy through law enforcement and public education.

7.1. Provide sufficient law enforcement. AGFD, BLM, and MCAS-Yuma participated in off-road vehicle patrols in the Yuma Desert. Two MCAS-Yuma law enforcement positions were filled in April 2001 for the west side of the BMGR to help prevent illegal off-highway activity. ABDSP law enforcement rangers enforced regulations in the Borrego Badlands MA. Insufficient law enforcement was available to prevent illegal OHV traffic and illegal dumping in the West Mesa, Yuha Desert, East Mesa MAs, and the BOR portion of the Yuma Desert MA. [As of January 2003, BLM-El Centro was filling vacant law enforcement positions and applying for grants to add two additional rangers.]

7.2. Provide public information and education about the MAs and RA. FTHL signs were placed along roads within the East Mesa MA as compensation for a pipeline project. FTHL signs were posted at most access points into the Yuma Desert MA; however, most were subsequently stolen. BOR conducted information workshops and survey training for maintenance staff and other interested parties. Information brochures addressing the FTHL were prepared by staff from OWSVRA, printed in both English and Spanish, and were distributed to other agencies, their staffs, and the public. Funding for these brochures was provided by BOR and BLM. MCAS-Yuma developed a wallet-sized photo information card addressing the FTHL and distributed the card to key personnel working on BMGR. All users of BMGR received a briefing that included information on the FTHL, slides, pictures and/or descriptions. BLM-El Centro completed a range-user brochure and wallet cards to educate all range users of the presence of FTHL and correct procedures to avoid impacting lizards or to report any accidental impacts to lizards. The brochures and wallet cards were distributed to all range users. NAF-El Centro also produced brochures and wallet cards. During the 2001 and 2002 Yuma Birding and Nature Festivals, an ICC member presented one-hour seminars on the biology and conservation of the FTHL and hosted field trips to the Yuma Desert MA. FTHL ecology and habitat, the conservation agreement, and cooperative efforts of the participating agencies were highlighted during the seminars and field trips, all of which were well attended and well received by the public. Rorabaugh *et al.* (2000) presented a paper at a symposium entitled Creative Cooperation in

Resource Management in which they described the multi-agency conservation agreement to implement the RMS for the FTHL. AGFD and USFWS met with the Tucson Herpetological Society and other plaintiffs in a suit against USFWS regarding their 1997 decision to not list the FTHL. This meeting provided an opportunity to better explain the position of AGFD and USFWS regarding the status of the FTHL and the decision to not list it. Preservation of FTHL habitat was a priority issue in discussions with the Yuma Mesa Irrigation and Drainage District, BOR, BLM-Yuma, MCAS-Yuma, and the city of Yuma regarding development in the Foothills and the inclusion of this area into the water district. AGFD coordinated with Yuma city and county planners in the Growing Smarter and open spaces initiatives in Arizona. Discussions included the funding of habitat enhancement/acquisition and the potential for creating FTHL reserves outside the MA. With funding provided by BOR and BLM, Centro Intercultural de Estudios de Desiertos y Océanos worked with the education departments of the Alto Golfo and Pinacate Reserves to develop a brochure that informed visitors about the FTHL, biological features of the Gran Desierto de Altar, and the habitats and potential threats to FTHLs in Mexico (Rodríguez 2002). In addition, the brochure included specific information on regulations and recommendations for people to help protect FTHLs. Signs were developed to place in strategic areas in the reserves and along their borders, particularly areas close to railroad routes, roads frequented by locals, and roads accessing ejido lands.

8. Encourage and support research to promote conservation of FTHL and desert ecosystems.

8.1. Require permits for research. AGFD and CDFG continued to require a scientific collecting permit for any person who handled a FTHL. The AGFD issued 21 permits during this reporting period and CDFG issued seven through June 2001.

8.2. OWSVRA shall continue to budget for research. OWSVRA funded four studies (Young 1999; Setser and Young 2000; Setser 2001; T. Gardner 2002) to collect information on demographics, habitat use, and effects of OHV activity (see 8.4 and 8.5). The Ocotillo Wells District funded genetic and relative abundance studies by Utah State University researchers during the 2002 field season.

8.3. Develop a cost-effective technique for assessing FTHL abundance.

8.3.1. Test trapping and other techniques to enumerate FTHLs directly. ICC members consulted with Dr. David Anderson, a statistician from Colorado State University, regarding the practicality of monitoring FTHL population trends. Colorado State University statisticians developed a proposal for a trapping web design, which uses 97 pit fall traps arranged along 8 lines radiating from a central point. The theory is based on distance sampling, and the statistics of importance are the distances from the center of the web to the traps containing FTHL. Based on capture rates of FTHLs in pit fall traps reported by other studies, the authors recommended establishing 10-15 webs in each MA to achieve desirable sample sizes. ICC members established a trial trapping web in the Yuma Desert MA to test methods and materials, and to help evaluate whether this technique could produce the minimum of five captures per web calculated to be required to estimate densities and trends. The web was operated in May and September of 2000, 2001, and 2002. Total captures were four, five, five, and four, respectively. A proposal to implement a full-scale trapping web was prepared by the ICC for submittal to funding sources. Young and Young (2000) used intensive tracking techniques to estimate densities in the Yuma Desert MA. Their estimates ranged from 0.5 lizards per hectare during drought conditions to 5.1 lizards per hectare in a good year. They believed that this variability, resulting from variable weather patterns, would be problematic for use in trends analysis. They estimated a minimum population of 28,000 FTHLs on the BMGR in 1996. A proposal to evaluate detection by dogs was drafted and is being finalized. A survey that uses mark/recapture methodology to estimate populations was developed and implemented by BLM-El Centro (Grant *et al.* 2001). It yielded a crude abundance estimate of 1.9 lizards per hectare (95% CI: 1.08 to 3.91 lizards/ha). [In the summer of 2002, the protocol was modified to provide a more robust estimate. This effort resulted in the best MA population estimate to date. The population of FTHLs in the Yuha Basin MA was estimated at 18,494 adults (95% CI = 14,596-22,391) and 8,685 juveniles (95% CI =6,860-10,510). "Adults" included all individuals over 60 mm SVL, while juveniles included all individuals less than 60 mm SVL (Wright and Grant 2002). This method is presented in Appendix 4.]. A presence/absence survey protocol was developed for determining distribution in Mexico (Gardner *et al.* 2001), and a modified version of that protocol is proposed for monitoring distribution in MAs (Appendix 5).

8.3.2. Determine effectiveness of direct enumeration techniques and scat counts as an index of relative abundance. Young and Young (2000) tested pitfall traps, walking surveys, driving surveys, and tracking for their effectiveness in surveying FTHL. Tracking and driving were the most successful.

8.4. Determine life history and demographic data. Young and Young (2000) captured 499 individual FTHLs in Arizona, and fitted 80 with radio transmitters to track movements and habitat use. They made comparisons between FTHLs and desert horned lizards, and between drought years and a wet year. Growth, longevity, predation, home range, habitat use, and behavior were investigated. Setser and Young (2000) caught, measured and marked 95 FTHLs at OWSVRA. They compared growth rates between years and with FTHLs captured in Arizona. They attached transmitters to 58 FTHLs to obtain home range and microhabitat use data. Comparisons were made between males, females, juveniles, and with Arizona FTHLs. They analyzed associations between FTHL habitat use and habitat features. Setser (2001) caught, measured and marked 121 FTHLs at OWSVRA. They compared the length, weight, and condition index between areas and between FTHLs caught in 1999 and 1998. They attached transmitters to 65 FTHLs to obtain home range and microhabitat use data. Comparisons were made between males and females. Gardner *et al.* (2001) x-rayed several gravid FTHLs for reproductive analysis. Gardner and Foley (2001) conducted a research study at NAF-El Centro to quantify availability and use of FTHL habitat at target areas. Weights were tracked through the course of the season and thread bobbins were used to evaluate use of different substrates by FTHLs and desert horned lizards. T. Gardner (2002) captured a total of 82 individual FTHLS at OWSVRA in 2001 and placed transmitters on 49. Body condition and movements were monitored.

8.5. Determine effects of conflicting activities. A study at the Coachella Valley Preserve compared the invertebrate and reptile communities in an old vineyard and an undisturbed area (Cameron Barrows, CNLM, pers. comm.). Four FTHLS were caught in a regenerating vineyard, indicating their ability to use rehabilitated habitats. Nicolai and Lovich (2000) found that FTHL movements declined after an OHV race in the Yuha Desert. Setser and Young (2000) and Setser (2001) found a negative association between OHV disturbance and FTHL habitat use at OWSVRA. Based on qualitative observations, T. Gardner (2002) did not suggest that any differences in OHV activity had influenced the FTHLS at his study sites at OWSVRA. He did, however, recognize that some habitat factors (vegetation, sand availability) that appeared to differ between the sites may have been influenced by OHV activity. In addition, at OWSVRA, the district ecologist outfitted some individual lizards with radio-telemetry as part of a limited, ongoing study of the effects of OHVS on movement and home ranges. Wright and Grant (2002) determined that neither vehicle track coverage nor number of vehicle routes or roads were significantly correlated with FTHL numbers. However, plots with less than 9% vehicle track coverage had 3.5 times more FTHLS than plots with greater than 9% track coverage. Plots with a route or road on them did not have a significantly different number of FTHLS than plots without a route or road. They suggested that substrate characteristics played a greater role in affecting numbers of FTHLS than did vehicle traffic.

8.6. Determine genetic variation among populations and effects of barriers.

8.6.1. Determine genetic variation in MAS. Tissue samples (toe clips from live animals, plus liver and muscle from sacrificed animals) were obtained from FTHLS in the Yuma Desert MA in Arizona (Gardner *et al.* 2001) and several populations in California, including OWSVRA (Setser 2001; T. Gardner 2002), Yuha Desert (Dan Mulcahy, Utah State University, unpubl. data), East Mesa MA (Dan Mulcahy, unpubl. data; Gardner & Foley 2001), West Mesa MA (Gardner & Foley 2001), and Coachella Valley (Tanya Trepanier, unpubl. data). Tissues from scattered localities in Baja California del Norte and Sonora, Mexico were also obtained (Rodríguez 2002). Dan Mulcahy is conducting the analyses and anticipates completion of the findings in 2003 (pers. comm.)

8.6.2. Determine effects of human-created barriers. This was not investigated.

8.6.3. Determine effects of natural barriers. The genetic analyses described under 8.6.1 will allow an evaluation of the effects of the Colorado River and the Salton Sea Trough as potential natural barriers.

8.7. Determine effectiveness of mitigation measures. BLM-Yuma tested ¼- and ½-inch mesh fencing to determine its durability for potential use in excluding FTHLS from roads. They found that both sizes withstood burial from drifting sand, but the ½-inch mesh resulted in ensnarement and mortality of zebra-tailed lizards. Utah State University researchers installed test enclosures and found that FTHL are not likely to climb fences of either size mesh. Gardner *et al.* (2001) found that ¼-inch mesh barrier fences were effective in reducing the number of FTHL entering the Auxiliary 2 road in the Yuma Desert MA. These findings were incorporated into a fencing protocol (Appendix 7).

9. **Continue Inventory and Monitoring**

9.1. **Continue inventories.** The area between I-10 and Dos Palmas was surveyed to determine if a corridor for FTHL existed there. Only desert horned lizards were found. The substrate was apparently too rocky and coarse for FTHL. Historic FTHL habitat in this area appeared to have been lost to agriculture. BLM-Yuma and AGFD completed a project to test Landsat imagery to predict FTHL occurrence. They found that the imagery could be used to predict with moderate accuracy areas of high to moderate lizard density. Areas with few or no FTHL could not be predicted with any accuracy, however. BLM-Palm Springs surveyed the area between the east end of Indio Hills and the Coachella Valley Preserve for FTHL and found none. These two populations were probably genetically isolated from one another. Due to the small area the Indio Hills population occupies (1,800 acres), its heavily impacted nature, and low population density, it is not believed to be viable in the long term. Surveys were conducted along fringe areas of the Borrego Badlands MA in the area of Clark Dry Lake, Font's Wash, and the western Borrego Badlands. These surveys added to our knowledge of documented FTHL range. FTHL were monitored for presence/absence on a provisional basis (pending the establishment of an effective protocol) at OWSVRA. With funding from BOR and BLM, an important study to investigate the distribution of FTHL in Sonora and Baja California del Norte was conducted. The Centro Intercultural de Estudios de Desiertos y Océanos, a binational non-governmental organization in Puerto Peñasco, Sonora, was contracted to conduct this study. The principal investigator worked closely with ICC members to develop a survey protocol, conduct surveys, and analyze the results. Cooperators in this project included the Reserva de la Biósfera Alto Golfo de California y Delta del Río Colorado, the Reserva de la Biósfera el Pinacate y Gran Desierto de Altar, and several ICC agencies. ICC members made several trips, totaling 43 person-days of effort, to assist with this project. New distributional records were obtained in Baja California, the Gran Desierto, and Alto Golfo. A database was developed in conjunction with these surveys for storing locality records of FTHL in Mexico, morphometric and habitat data, and time and date of encounters. An interim report was completed during this reporting period, and a final report was completed in July 2002 (Rodríguez 2002).

9.2. Monitor habitat quality and population trends in the MAs.

9.2.1. **Monitor implementation of the RMS.** Implementation has been monitored through the compilation of annual reports as required by 9.2.4 (ICC 1998; Henry 1999; Twedt and Wright 2002).

9.2.2. **Monitor population trends.** Trends in encounter rates for FTHL and their scat were analyzed using data collected from 1979 to 2001 on three MAs in California (Wright 2002). Each year from 1979 to 2001 (except 1981), sample sites were drawn at random or systematically from three areas in the eastern Yuha Desert, West Mesa, and southern East Mesa MAs. Analysis of these data showed no significant trends in encounter rates of FTHL or their scat. However, given the potential observer and sampling biases, a minor trend (upward or downward) could not be ruled out. Extension of this work into 2002 in the eastern Yuha Desert showed a similar non-significant trend (Wright and Grant 2002). Observations of FTHL during the course of biannual reptile surveys at OWSVRA were recorded as part of regular monitoring. FTHL observations by staff during archeology surveys, ranger patrol, or in the course of maintenance duties were noted. MCAS-Yuma continued its long-term surveys of the Auxiliary 2 road to assess the number of road kills and to monitor population trends.

9.2.3. Document habitat disturbance and loss. Data forms were developed to facilitate standardized assessment and documentation of habitat disturbance and loss. The habitat impacts that were authorized are shown in Table 2. Narratives describing these impacts and significant impacts on state or private lands may be found within the ICC annual reports. The Navy contracted Tierra Data Systems to aerial photograph and digitally map the 5 MAs and the RA to document habitat loss and disturbance. This effort provided a baseline with which to compare future analyses of habitat condition. BLM-El Centro began to quantify the level of vehicular impacts to FTHL habitat in their resource area using a step-point method. This consisted of walking 2.5-mile triangular transects within randomly chosen sections and tabulating what was found at the point of the surveyor's toe every 20th step along the transect. Variables measured included plants, vehicular tracks, organic litter, human footprints, water bottles, piles of clothes, and campfires. These surveys were conducted in 2001 in southeastern and southern portions of the Yuha and East Mesa MAs, respectively. Approximately 10.5% of the southeastern portion of the Yuha Desert MA was found to be covered with vehicle tracks. About 4.8% of the southern half of the East Mesa MA was covered with vehicle tracks (Wright 2002). The number of vehicle routes crossed by 12 transects in the Yuha Desert MA declined by 45% from 2001 to 2002, probably due to unusually strong spring sandstorms and changes in BP practices (Wright and Grant 2002). A similar effort was conducted in the Yuma Desert MA, where vehicle tracks were found to cover 2.9% of the ground surface in the BMGR portion of the MA and 3.4% of the surface in the 5-Mile Zone portion (Rorabaugh *et al.* 2002).

9.2.4. **Prepare an annual report of monitoring results and implementation progress.** Two annual reports (ICC 1998; Henry 1999) and a biannual report (Twedt and Wright 2002) were produced that summarized monitoring and RMS implementation from July 1997 through June 2001. The 2001/2002 report was in preparation.

9.2.5. New data shall be used in evaluations of the RMS and in assessing proposed changes. The new information described in the planning actions above was relied upon heavily during the revision of this RMS.

Table 2. Acres of FTHL habitat authorized for impact on lands managed by signatory agencies.

Agency	Inside MA	Outside MA	Total[1]
Palm Springs BLM	0	40.6	40.6[2]
El Centro BLM	146.5	240.8	387.3
Yuma BLM	0	81.3	81.3
Naval Air Facility - El Centro	1	0	1
Marine Corps Air Station-Yuma	2.5	0	2.5
Anza-Borrego Desert State Park	0	0	0
Ocotillo Wells SVRA	0	0	0
Bureau of Reclamation	0.2	391	391.2
Total Acres	150.3	753.7	904.0

[1]Figures exclude impacts from casual OHV use, BP activity, and OHV racing.

[2]Disturbance was considered temporary on 38.6 acres and permanent on 2 acres.

Management Implementation Schedule, 2003-2007

Table Description

The following table displays the priority, responsible agency, estimated cost, and schedule for completing each Planning Action. Initiation of these actions is subject to availability of funds. Actions in the table are explained further in the corresponding Planning Actions.

The priorities indicated in the table are assigned the following definitions:

Priority 1: An action that must be taken in the near term to conserve the species and prevent irreversible population declines.

Priority 2: An action that must be taken to prevent significant declines in population or habitat quality.

Priority 3: All other actions necessary to meet the goals and objectives of this Strategy.

The following abbreviations and symbols are used in the implementation schedule:

ABDSP.....................Anza-Borrego Desert State Park

AGFD ....Arizona Game and Fish Department

BLM ....Bureau of Land Management

BOR..........................Bureau of Reclamation

ICC...........................Interagency Coordinating Committee

CDFG........................California Department of Fish and Game

OWSVRA..................Ocotillo Wells State Vehicular Recreation Area

USFWS.....................U.S. Fish and Wildlife Service

USMC.......................U.S. Marine Corps

USN .........................U.S. Navy

☑...........................Task completed since 1997

☐...........................Task not completed

⇨,↻......................Task ongoing

Management Strategy Implementation Schedule, 2003-2007

Status	Priority	Action number	Planned action	Duration (yrs)	Resp agency	Total cost ($000)	Cost estimates ($000) FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
		1.	**Delineate and designate FTHL MAs**								
☑	1	1.1	Designate Yuma Desert MA	2	BLM BOR USMC	0					
☑	1	1.2	Designate East Mesa MA	2	BLM USN	0					
☑	1	1.3	Designate West Mesa MA	2	BLM USN	0					
☑	1	1.4	Designate Yuha Desert MA	2	BLM	0					
☑	1	1.5	Designate Borrego Badlands MA	2	ABDSP	0					
☑	3	1.6	Designate Ocotillo Wells RA	1	BLM OWSVRA ABDSP	0					
☑	1	1.7	Designate conservation areas in Coachella Valley	2	BLM USFWS CDFG	0					
		2.	**Define and implement actions necessary to minimize loss or degradation of habitat**								
⇨	1	2.1.1	Apply mitigation measures	↻	ALL	0					
⇨	1	2.1.2	Require compensation	↻	ALL	25	5	5	5	5	5
⇨	1	2.2.1	Limit discretionary land uses authorizations and rows to 10 acres and 1% total per MA	↻	ALL	0					
⇨	1	2.2.2	Do not dispose of lands in MAs	↻	ALL	0					
⇨	3	2.2.3	Continue maintenance in existing ROWs	↻	ALL	0					
⇨	2	2.2.4	Require fencing along Yuma Desert MA boundary road	↻	ALL	0					
⇨	2	2.3.1	Limit surface disturbance from mineral activities in MAs	↻	ALL	0					
☑	2	2.4.1	Reduce new roads to a minimum in MA s	2	ALL	0					
☐	1	2.4.2	Designate routes "open," "closed, or limited." Give route signing a priority	2	BLM	200	50	90	20	20	20
☐	1	2.4.3	Reduce route density in MAs		See 2.4.2						
⇨	1	2.4.4	Coordinate with U.S.BP	↻	ALL	20	4	4	4	4	4
⇨	3	2.5.1	Allow OHV recreation in RA	↻	OWSVRA	0					
⇨	1	2.5.2	No competitive recreational events in MAs	↻	ALL	0					
⇨	2	2.5.3	Allow non-motorized recreational activities in MAs, but no new recreational facilities	↻	ALL	0					
⇨	2	2.5.4	Limit camping in MAs	↻	BLM	20	10	10			

Status	Priority	Action number	Planned action	Duration (yrs)	Resp agency	Total cost ($000)	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
			Management Strategy Implementation Schedule, 2003-2007								
⇨	2	2.5.5	No new long-term visitor areas in MAs	↻	ALL	0					
⇨	3	2.6	Authorize limited use of flora in MAs	↻	ALL	0					
⇨	1	2.7	Allow military maneuvers and encampments only in designated sites in MAS	↻	USN USMC	0					
⇨	3	2.8	Suppress fires in MAS using limited fire suppression methods in MAs	↻	ALL	0					
⇨	1	2.9	Prohibit pesticide treatments in MAS	↻	ALL	0					
⇨	3	2.10	Limit other activities consistent with above	↻	ALL	0					
		3.	**Rehabilitate damaged and degraded habitat**								
⇨	2	3	Rehabilitate damaged and degraded habitat in MAs	↻	BLM BOR ABDSP USMC USN	200	40	40	40	40	40
		4.	**Bring all lands within MAs into public management**								
☑	3	4.1	Maintain prioritized list of parcels for acquisitions; and respect private rights	1	ALL	0					
☐	3	4.2	Procure funds for land acquisitions in MA s (37,600 acres of private lands acres in California MAs at $250 per acre)	↻	BLM CDFG ABDSP OWSVRA	9,400					
⇨	3	4.3	Use compensation funds to acquire key lands in MAs	↻	BLM CDFG ABDSP OWSVRA	20	4	4	4	4	4
⇨	3	4.4	Exchange lands opportunistically	↻	BLM	20	4	4	4	4	4
		5.	**Maintain or establish effective habitat corridors between naturally adjacent populations**								
⇨	2	5.1	Limit or mitigate activities in movement corridors	↻	ALL	25	5	5	5	5	5
⇨	3	5.2	Coordinate with Mexico and INS	↻	ALL	10	2	2	2	2	2
		6.	**Coordinate activities and funding among the participating agencies and Mexican agencies**								
☑	2	6.1.1	Establish FTHL MOG	↻	ALL	5	1	1	1	1	1
⇨	2	6.1.2	Hold semi-annual ICC meetings	↻	ALL	5	1	1	1	1	1
⇨	3	6.1.3	Establish forum for discussions with agencies and individuals in Mexico	↻	ALL	5	1	1	1	1	1

Management Strategy Implementation Schedule, 2003-2007

Status	Priority	Action number	Planned action	Duratio n (yrs)	Resp agency	Total cost ($000)	Cost estimates ($000)				
							FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
☑	1	6.2	Develop Conservation Agreement	1	ALL	0					
☐	2	6.3.1	Incorporate actions in Western Colorado Desert ecosystem plan (Note: other state and local agencies will fill key roles)	3	ALL	750	20	300	250	200	
☑	2	6.3.2	Incorporate actions in CVMSHCP (Note: other state and local agencies will fill key roles)	3	BLM CDFG USFWS	600	300	200	100		
☐	2	6.3.3	Incorporate actions in Western Colorado Desert Route Designation	3	BLM						
⇨	1	6.4	Coordinate with U.S. BP and develop mutual agreements	2	BLM BOR	6	3	3			
⇨	2	6.4.1	Encourage use of techniques to minimize BP OHV activity	↻	BLM BOR	5	1	1	1	1	1
☐	2	6.4.2	Prepare educational briefing for BP agents	1	BLM BOR	5					
		7.	**Promote the purposes of the strategy through law enforcement and public education**								
⇨	1	7.1	Provide adequate law enforcement	↻	BLM CDFG AGFD	750	150	150	150	150	150
⇨	3	7.2	Provide public information and education	↻	ALL	25	5	5	5	5	5
		8.	**Conduct research necessary to effectively define and implement necessary management actions**								
⇨	3	8.1	Require permits for research	↻	ALL	5	1	1	1	1	1
⇨	2	8.2	OWSVRA shall continue to fund research	↻	OWSVRA	200	40	40	40	40	40
☐	2	8.3.1	Test trapping as a population census technique	2	ALL	170					
☐	2	8.3.2	Test direct counting methods	2	ALL		Included in 8.2 and 8.3.1				
☐	2	8.4	Determine life history and demographic data	2	ALL		Also included in 8.2 and 8.3.1				
☐	2	8.5	Determine effects of conflicting activities	5	ALL	300					
☐	3	8.6.1	Determine genetic variation in population	5	ALL	30					
☐	3	8.6.2	Determine effects of non-natural barriers	5	ALL	30					
☐	3	8.6.3	Determine effects of natural barriers	5	ALL	15					
☐	3	8.7	Determine effectiveness of mitigation measures	5	ALL	20					
		9.	**Continue inventory and monitoring**								

Status	Priority	Action number	Planned action	Duration (yrs)	Resp agency	Total cost ($000)	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
			Management Strategy Implementation Schedule, 2003-2007				**Cost estimates ($000)**				
⇨	2	9.1	Continue inventories	↻	ALL	125	25	25	25	25	25
⇨	2	9.2.1	Monitor implementation	↻	ICC	40	8	8	8	8	8
⇨	2	9.2.2	Monitor population trends	↻	ALL (MCAS)	320 (70)	70	105 (35)	70	105 (70)	70
⇨	1	9.2.3	Document habitat disturbance and loss	↻	ALL	40	8	8	8	8	8
⇨	1	9.2.3.1	Conduct aerial reconnaissance and analysis of surface disturbance on the five MAs every five years	↻	ALL	50					
⇨	2	9.2.4	Prepare annual monitoring/implementation report	↻	ICC	20	4	4	4	4	4
⇨	1	9.2.5	Use new inventory, monitoring, and research data in evaluations and proposed changes	↻	ALL	0					

Habitat Management

Management Areas

Each MA is controlled by multiple agencies and may include private inholdings (Table 3). MAs were designed to include most FTHL habitat identified as key areas in previous studies, even though the absolute densities of FTHLs within the MAs were not known. MAs were proposed based upon accepted principles of good preserve design, utilizing the best information available at the time. MAs included as large an area as possible, but avoided extensive, existing and predicted management conflicts (e.g., OHV open areas). Conflicts that are localized in nature (e.g., sand and gravel mines, military bombing targets) were accepted within some of the MAs. The MAs are the core areas for maintaining self-sustaining populations of FTHLs in perpetuity. Legal descriptions of the MAs and the RA are provided in Appendix 3, and maps (Figure 4 to Figure 10) are provided below. Maps do not show existing OHV trails, which are extensive in some MAs, except for major trails at OWSVRA.

The prescriptions that guide the management of lands within the MAs (see Planning Action 2, pg 27) were designed primarily to reduce surface disturbance and to promote reclamation of areas, such as duplicate roads that are no longer needed.

Table 3. Overview of Acreage and Ownership of Management Areas.

Management Area[1]	Federal Non-military[2]	Federal Military	State[3]	Private	Total
Yuma Desert[4] (Figure 4)	16,200	114,800[5]	0	0	131,000
East Mesa (Figure 5)	99,900	8,500	0	6,900	115,300

West Mesa (Figure 6)	83,200	29,800	1,300	21,800	136,100
Yuha Basin (Figure 7)	57,200	0	0	3,000	60,200
Borrego Badlands (Figure 8)	0	0	36,500	5,900	42,400
Total	256,500	153,100	37,800	37,600	**485,000**

1 The existing Coachella Valley Preserve and Dos Palmas ACEC (not included in table) includes about 17,076 and 14,400 acres, respectively, administered by federal and state agencies and private organizations.

2 Includes lands administered by the BLM and BOR.

3 Includes lands administered by California Department of Parks and Recreation and California State Lands Commission

4 Pending designation of the proposed Area Service Highway. A portion of the Yuma Desert MA boundary will be formed by the Area Service Highway, if and when constructed (see Figure 4).

5 Lands administered by MCAS-Yuma

Other Lands

Ocotillo Wells State Vehicular Recreation Area

A RA was established in California (Figure 9) where FTHL research is encouraged and funded by the California Department of Parks and Recreation's Division of Off-Highway Motor Vehicle Recreation (Foreman 1997). The RA is about 77,000 acres in size. About 47,000 acres of the RA are owned by the state and 22,000 acres are owned by BLM, all of which are managed as OWSVRA. The State has applied to BLM under the Recreation and Public Purposes Act for transfer and patenting of all 22,000 acres of BLM land to OWSVRA. The State is also actively acquiring the remaining private lands (8,000 acres) within the RA.

OWSVRA is mandated to provide OHV recreation (free-play, racing, and touring) in a manner to sustain long-term use. Soil removal, artifact collecting, hunting, and shooting are prohibited within OWSVRA. No collecting of reptiles is allowed except under a scientific collecting permit issued by CDFG and approved by OWSVRA.

In 1991, an extensive wildlife survey and habitat protection plan (Kutilek *et al*. 1991; Wone *et al.* 1991) was completed in OWSVRA. The presence of FTHLS and the possibility of listing precipitated a study in 1994 (Wone *et al*. 1994) to develop methods for monitoring population trends in OWSVRA. In these studies, methods of monitoring FTHL population trends on permanent plots in OWSVRA and on control plots were assessed (Wone and Beauchamp 1995b; Wone *et al.* 1997). OWSVRA has since funded several studies (Young 1999; Setser and Young 2000; Setser 2001; T. Gardner 2002; Gardner in prep) investigating topics such as: demographics, habitat use (including investigation of the mud hills habitat type), movement patterns, and the effects of OHV activity on FTHLS and their habitat. OWSVRA has made a commitment to continue to support FTHL research through 2007.

Anza-Borrego Desert State Park

Lands within ABDSP are managed to conserve native plant and animal communities. Mining, soil removal, grazing, rock hounding, artifact collection, hunting, shooting, and other activities that could cause surface disturbances are prohibited in the park. FTHLS occur on an estimated 30,000 to 40,000 acres of the Park.

Within the 600,000-acre park, there is a system of primitive roadways about 500 miles in length. No vehicular activity is allowed off these roadways. Patrol rangers cite violators; the park's patrol aircraft provides backup. Designated roads that might impact sensitive natural or cultural resources can be closed seasonally or permanently by order of the District Superintendent. OHVs are prohibited from park roads unless they are licensed for use on highways. This rule essentially excludes use of all-terrain vehicles, quad-runners, high performance two-cycle motorcycles, and most dune buggies.

All animal and plant life within ABDSP is protected. No collection of reptiles is allowed, with the exception of those taken under a scientific collecting permit issued by the park office. Reptile poaching takes place on paved roadways, but usually does not include FTHLs (ABDSP files; Mark Jorgensen, pers. comm.)

Coachella Valley

Upon completion, the CVMSHCP will protect approximately 44.5% of the remaining FTHL habitat in the valley. This plan has been in preparation approximately 7-8 years, and will likely be signed in 2003. The FTHL is a covered species in this plan. An earlier HCP, implemented in 1986 to provide protection for the Coachella Valley fringe-toed lizard, also provides protection for FTHL habitat in the valley. Several hundred acres of privately owned and currently occupied habitat remains adjacent and connected to protected habitat. These lands are currently at risk for development, but will be protected if there are willing sellers and funds available to purchase through the CVMSHCP (Barrows 2002). In addition to protections via the CVMSHCP, habitat for FTHL within Dos Palmas ACEC and other BLM-managed public lands in eastern Riverside County, are already in conservation status and will remain so.

In the mid 1980's, the Coachella Valley Preserve System was established primarily for conservation of the Coachella Valley fringe-toed lizard (*Uma inornata*). The BLM, USFWS, CDFG, California Department of Parks and Recreation, and The Nature Conservancy acquired major portions of the preserve system. The System consists of three units totaling about 20,114 acres (Coachella Valley Preserve - 17,076 acres; Willow Hole-Edom Hill Preserve - 1,863; and Indian Avenue Preserve - 1,175 acres). About 6,000 acres of the System contain suitable FTHL habitat (Figure 10). The USFWS holdings were designated the Coachella Valley National Wildlife Refuge System. BLM-administered lands were designated an ACEC in 1993. The CDFG lands were designated an Ecological Reserve. The CDPR manages the adjacent Indio Hills State Park in a manner consistent with the Preserve goals. An interim plan was prepared in 1986 by The Nature Conservancy; it was replaced by an updated, interagency management plan in 1995 (BLM *et al*. 1995). A preserve management team meets quarterly to discuss management activities. No vehicular traffic is allowed.

Dos Palmas ACEC

The Dos Palmas ACEC is located north of the Salton Sea community of North Shore and encompasses about 14,400 acres of federal, state, and private lands. Surveys for FTHL in the southern part of the ACEC in the late 1970’s resulted in the discovery of FTHL near Bat Cave Buttes. No additional surveys have been conducted since the 1970’s. The ACEC is managed cooperatively by an interagency management committee, consisting of representatives from BLM, CDFG, California Department of Parks and Recreation, CNLM, and USFWS, which meets quarterly to discuss management issues and directions. In 1998, BLM prepared an Ecosystem Management Plan for the ACEC and continues to implement that today. Vehicular traffic is limited to existing, designated routes. BLM-Palm Springs has requested funding in Fiscal Years 2004 and 2005 to conduct surveys at Dos Palmas and east toward the East Mesa MA in Imperial County.

Arizona Lands outside the Yuma Desert MA

On BLM and BOR FTHL habitat outside BMGR, OHV use is limited to existing roads and trails. Because BLM and BOR are signatories to this document, surface-disturbing projects are subject to mitigation and compensation as described in this document. The Arizona State Land Department has not developed a plan for the management of state of Arizona lands within FTHL habitat. The State Land Department is processing land purchase applications for state of Arizona lands east of Yuma and near San Luis.

Mexican Habitat

Although this strategy currently addresses habitat in the U.S. only, there are objectives and planned actions for establishing and maintaining contacts with appropriate agencies and personnel in Mexico to promote the conservation of FTHL habitat within Mexico. Agencies that have the authority to work with Mexico, including the AGFD, CDFG, USFWS, BOR, and BLM, have developed partnerships with agencies, researchers, and non-governmental organizations in Sonora, and will work to develop similar contacts in Baja California Norte. It is hoped that through these contacts and exchanges of ideas a similar management strategy will be adopted in Mexico. This program may include corridors between MAs in the U.S. and Mexico.

Lands in El Parque Nacional del Pinacate Cerro Pinto and the Sierra del Rosario in Sonora and near the delta of the Colorado River in Sonora and Baja California are in core protection zones of biosphere reserves (Reserva de la Biósfera de El Pinacate y Gran Desierto de Altar and Reserva de la Biósfera del Alto Golfo de California y Delta del Río Colorado). El Parque Nacional del Pinacate is an area administered by the Mexican government with use restrictions similar to a national park in the U.S. However, the boundaries are not well established, and enforcement of regulations is minimal. The Pinacate area is primarily a volcanic zone within which FTHL habitat is probably limited to the sandy perimeters of Volcán Pinacate. Reserva de la Biósfera Alto Golfo includes FTHL habitat in Sonora in the vicinity of the Colorado River Delta and the Gran Desierto.

Figure 4. Yuma Desert Management Area.

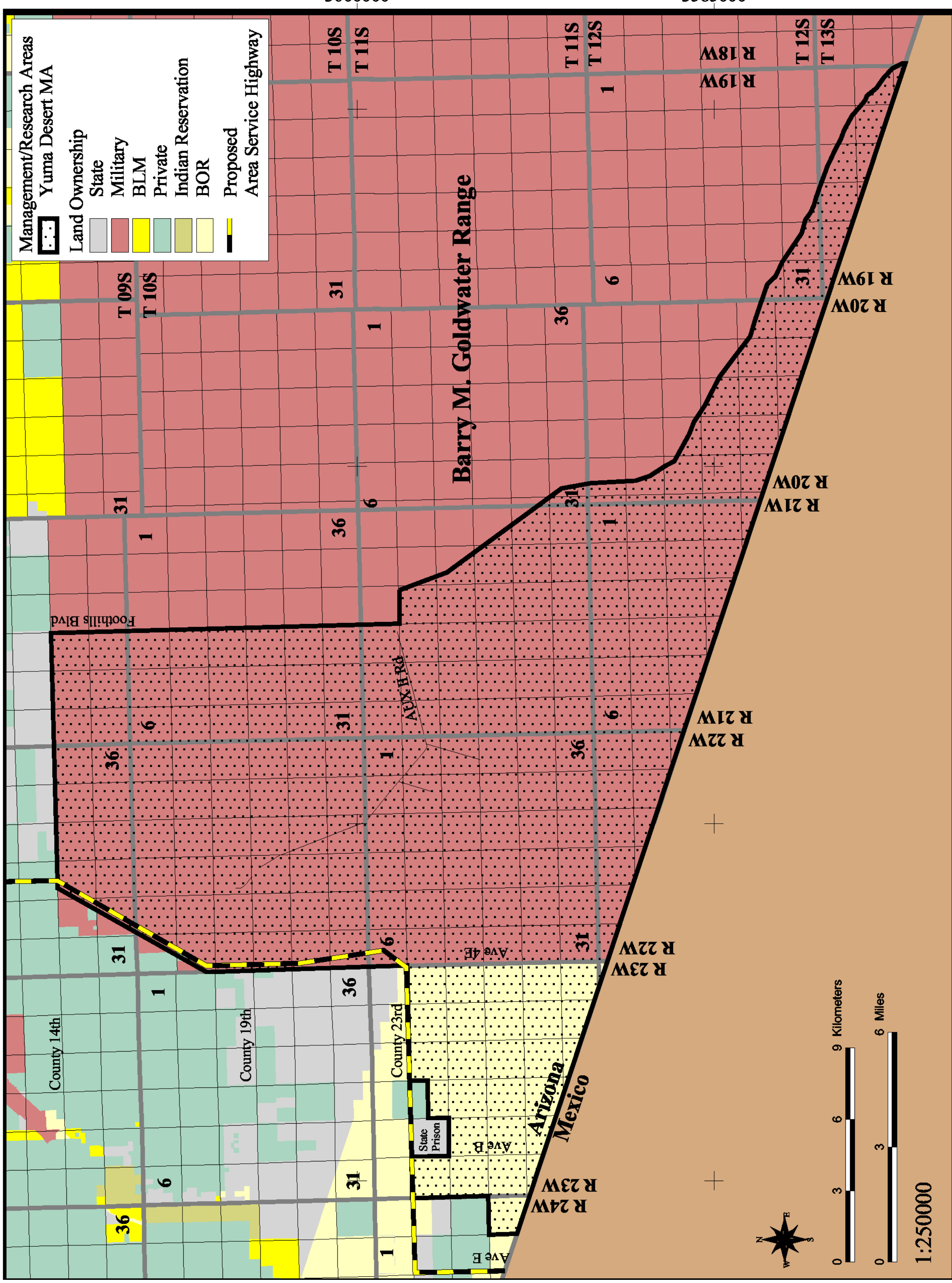


Figure 5. East Mesa Management Area.

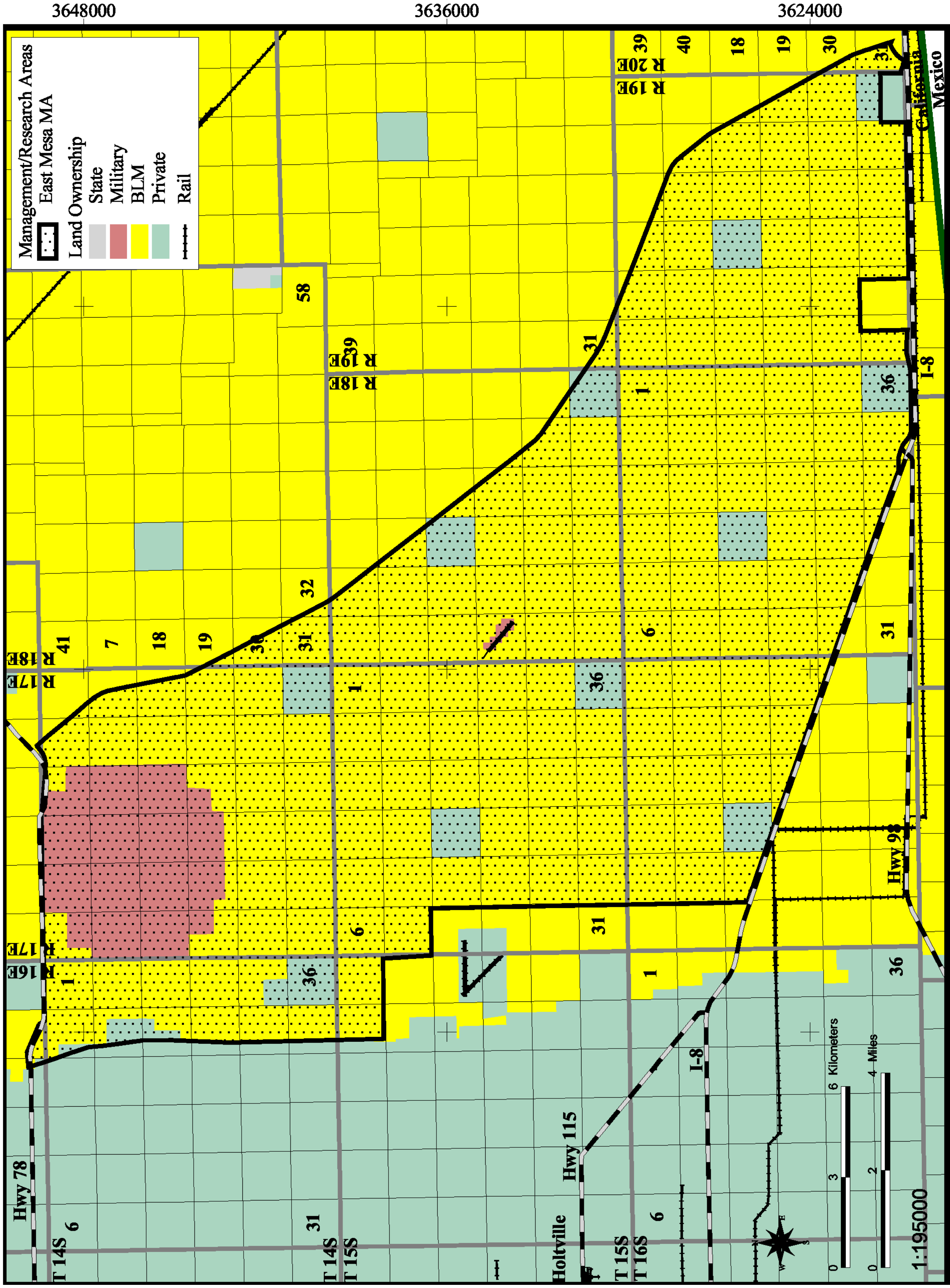


Figure 6. West Mesa Management Area.

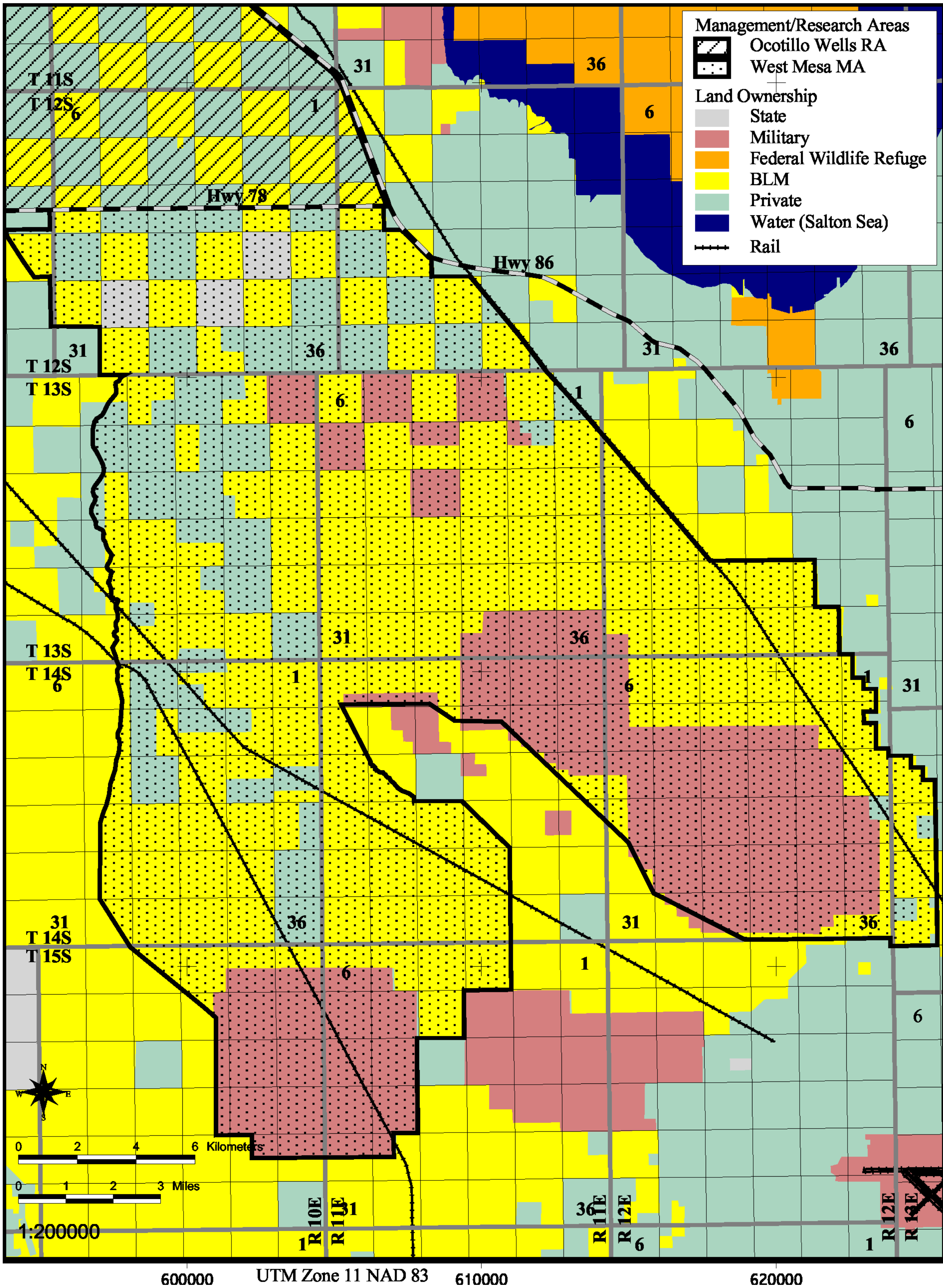


Figure 7. Yuha Desert Management Area.

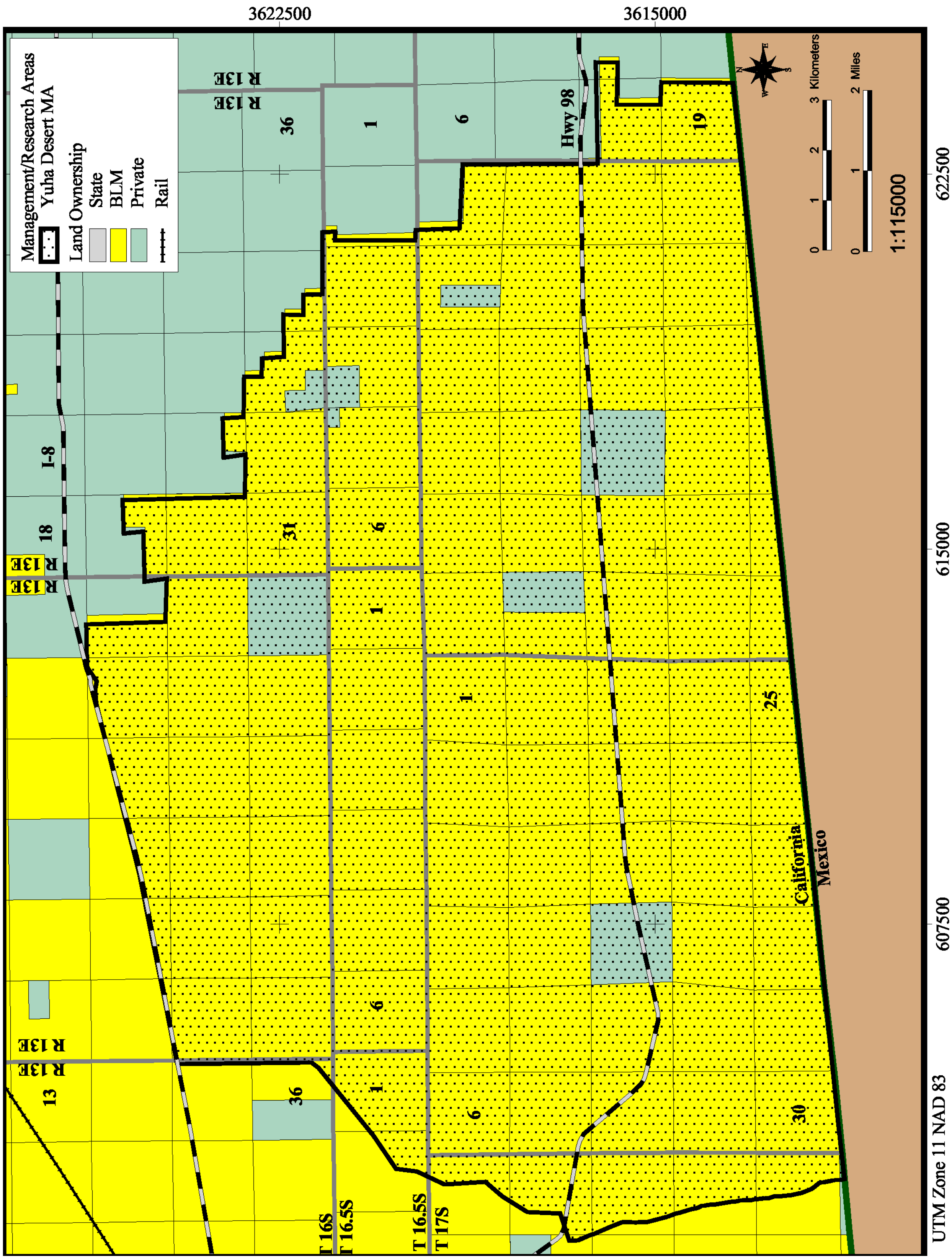


Figure 8. Borrego Badlands Management Area.

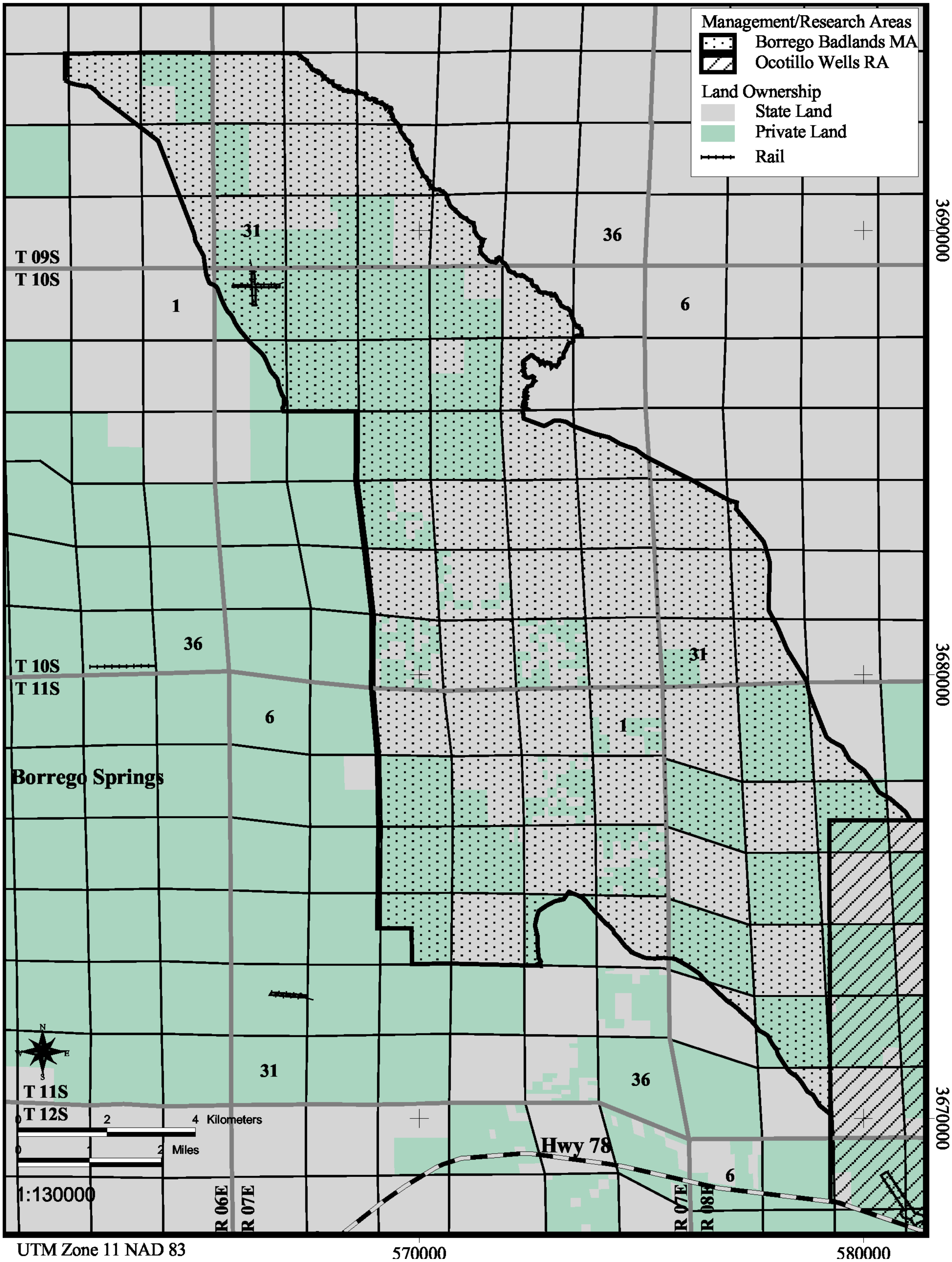


Figure 9. Ocotillo Wells State Vehicular Recreation Area Research Area.

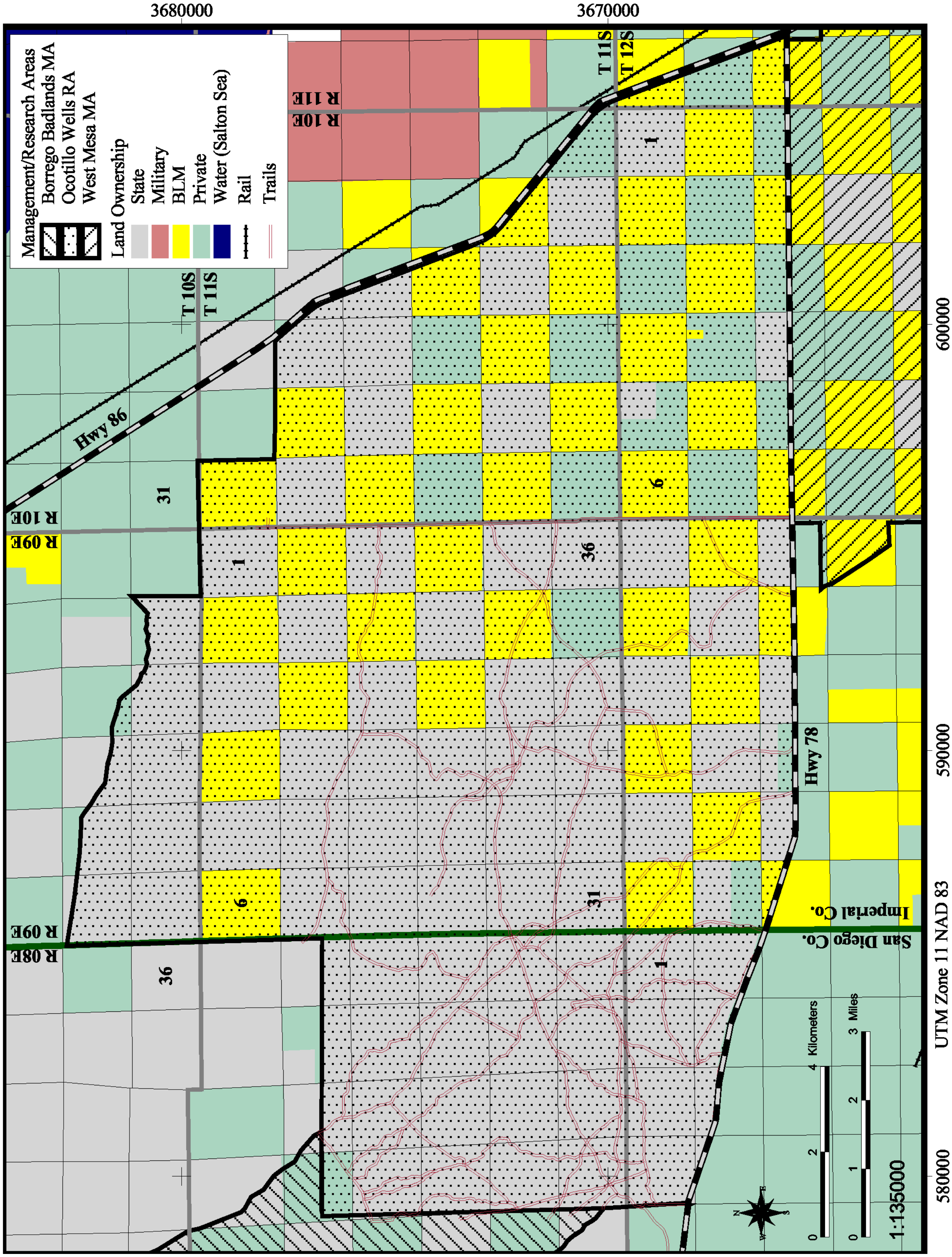
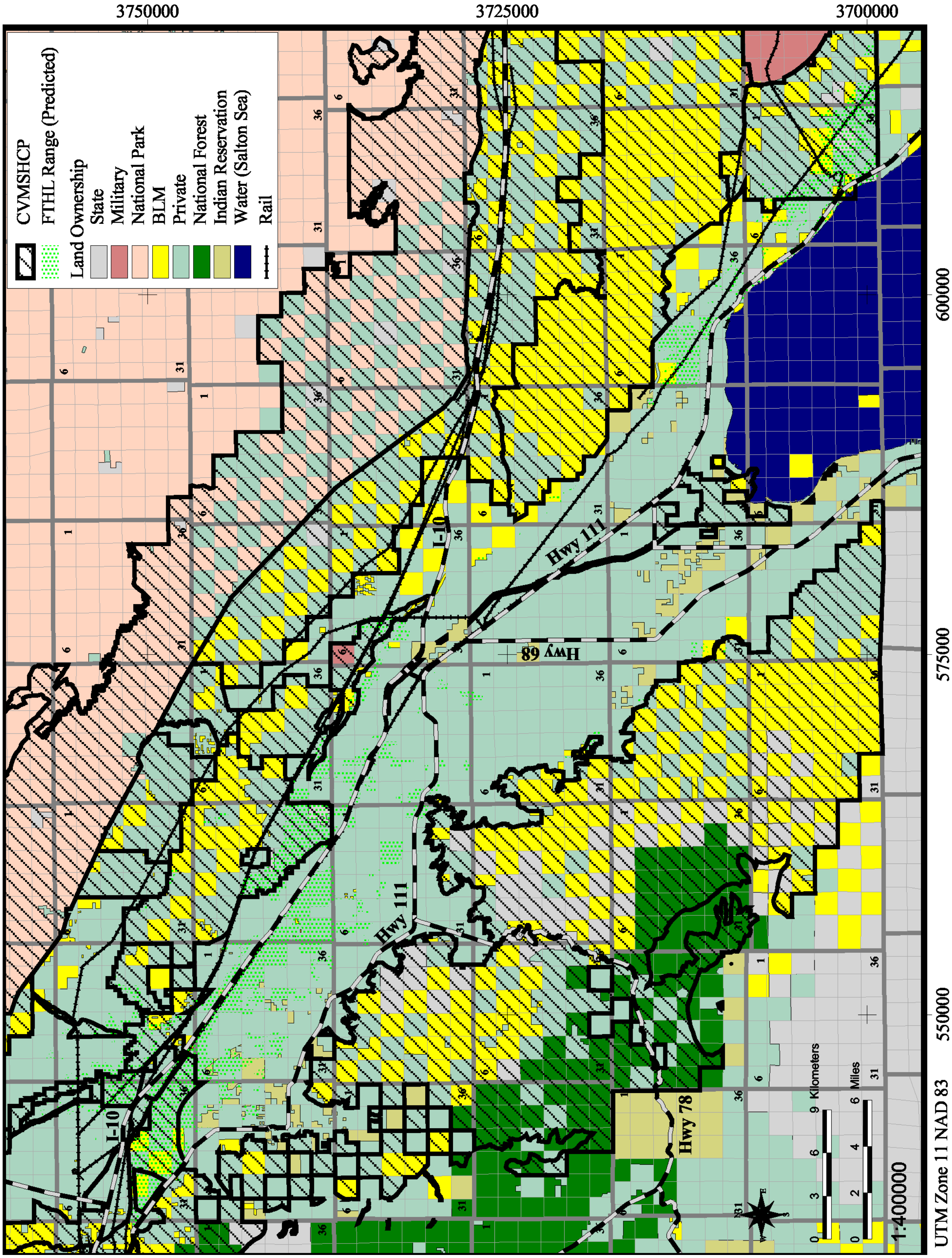


Figure 10. Coachella Valley Preserve System.



Mitigation

In accordance with Planning Action 2.1.1, the following mitigation measures shall be incorporated into all projects where applicable based on the Project Evaluation Protocol in Appendix 6. The measures are to be modified to conform to the nature of the project.

1. To the extent possible, surface-disturbing projects shall be located outside of FTHL MAS and the RA, and shall be timed to minimize mortality. If a project must be located within a MA or RA, effort shall be made to locate the project in a previously disturbed area or in an area where habitat quality is poor. A survey of the project site shall be conducted prior to construction in order to assist in locating the project.

2. Prior to project initiation, an individual shall be designated as a field contact representative. The field contact representative shall have the authority to ensure compliance with protective measures for the FTHL and will be the primary agency contact dealing with these measures. The field contact representative shall have the authority and responsibility to halt activities that are in violation of these terms and conditions.

3. All project work areas shall be clearly flagged or similarly marked at the outer boundaries to define the limit of work activities. All construction and restoration workers shall restrict their activities and vehicles to areas that have been flagged to eliminate adverse impacts to the FTHL and its habitat. All workers shall be instructed that their activities are restricted to flagged and cleared areas.

4. Within FTHL habitat, the area of disturbance of vegetation and soils shall be the minimum required for the project. [If possible, specify a maximum disturbance allowable based on the specifics of the project.] Clearing of vegetation and grading shall be minimized. Wherever possible, rather than clearing vegetation and grading the ROW, equipment and vehicles shall use existing surfaces or previously disturbed areas. Where grading is necessary, surface soils shall be stockpiled and replaced following construction to facilitate habitat restoration. To the extent possible, disturbance of shrubs and surface soils due to stockpiling shall be minimized.

5. Existing roads shall be used for travel and equipment storage whenever possible.

6. Where feasible and desirable, in the judgment of the lead agency, newly created access routes shall be restricted by constructing barricades, erecting fences with locked gates at road intersections, and/or by posting signs. In these cases, the project proponent shall maintain, including monitoring, all control structures and facilities for the life of the project and until habitat restoration is completed.

7. A biological monitor shall be present in each area of active surface disturbance throughout the work day from initial clearing through habitat restoration, except where the project is completely fenced and cleared of FTHLS by a biologist (see Measure 8). The biological monitors shall meet the requirements set in Appendix 6. The monitor(s) shall perform the following functions:

   a) Develop and implement a worker education program. Wallet-cards summarizing this information shall be provided to all construction and maintenance personnel. The education program shall include the following aspects at a minimum:

- biology and status of the FTHL,
- protection measures designed to reduce potential impacts to the species,
- function of flagging designating authorized work areas,
- reporting procedures to be used if a FTHL is encountered in the field, and
- importance of exercising care when commuting to and from the project area to reduce mortality of FTHLs on roads.

b) Ensure that all project-related activities comply with these measures. The biological monitor shall have the authority and responsibility to halt activities that are in violation of these terms and conditions.

c) Examine areas of active surface disturbance periodically (at least hourly when surface temperatures exceed 85ºF) for the presence of FTHLs. In addition, all hazardous sites (e.g., open pipeline trenches, holes, or other deep excavations) shall be inspected for the presence of FTHLs prior to backfilling.

d) Work with the project supervisor to take steps, as necessary, to avoid disturbance to FTHLs and their habitat. If avoiding disturbance to a FTHL is not possible or if a FTHL is found trapped in an excavation, the affected lizard shall be captured by hand and relocated.

8. Sites of permanent or long-term (greater than one year) projects in MAs where continuing activities are planned and where FTHL mortality could occur, may be enclosed with FTHL barrier fencing to prevent lizards from wandering onto the project site where they may be subject to collection, death, or injury. Barrier fencing should be in accordance with the standards outlined in Appendix 7. After clearing the area of FTHLs (also see Appendix 7), no on-site monitor is required (see Measure 7).

9. The project proponent shall develop a project-specific habitat restoration plan under approval by the lead agency. The plan shall consider and include as appropriate the following methods: replacement of topsoil, seedbed preparation, fertilization, seeding of species native to the project area, noxious weed control, and additional erosion control (see Habitat Rehabilitation, p. 69). Generally, the restoration objective shall be to return the disturbed area to a condition that will perpetuate previous land use. The project proponent shall conduct periodic inspection of the restored area. Restoration shall include eliminating any hazards to FTHLs created by construction, such as holes and trenches in which lizards might become entrapped. Disturbance of existing perennial shrubs during restoration shall be minimized, even if such shrubs have been crushed by construction activities.

10. Construction of new paved roads shall include a lizard barrier fence on each side of the road that is exposed to occupied FTHL habitat. Exceptions may occur in accordance with the following evaluation, to be applied separately to each side of the road. This prescription may also be applied to canals or other fragmenting projects.

Side is made nonviable for FTHLs even if connected to the other side:

- Compensate for the entirety of the fragmented parcel.

Side is viable only if connected to the other side:

- Compensate for the entirety of the fragmented parcel, or
- Provide fencing and effective culverts or underpasses that will maintain connectivity.

Side is viable even if not connected to the other side:

- Provide fencing (no culverts)

Specifications for barrier fences are provided in Appendix 7. The FTHL ICC will make the determination of FTHL population viability based on the size, configuration, and habitat condition of the isolated parcel, threats from adjacent lands, and existing scientific evidence of edge effects on FTHL. Culvert design will be provided by the FTHL ICC.

Compensation

Pursuant to Title 43 Code of Federal Regulations and the Federal Land Policy and Management Act of 1976, federal land management agencies may permit actions that result in FTHL habitat loss on their lands. To mitigate such losses both within and outside MAs, compensation is charged if residual effects would occur after all reasonable on-site mitigation has been applied. Signatories may use compensation funds to acquire, protect, or restore FTHL habitat both within and contiguous with MAs (with MOG approval). These actions will help ensure the existence of FTHLs and their habitat in the future.

Determining Whether Compensation Is Required

When compensation is required

If adverse effects remain after the project proponent has taken all reasonable on-site mitigation measures, a project proponent must compensate for the remaining (residual) on-site effects. To evaluate whether it is appropriate to collect compensation, agency biologists must consider whether the impacted area can potentially support FTHLs based on habitat factors favorable to FTHLs (Appendix 6). If agency biologists determine that the project area can potentially support FTHLs, then compensation shall be required. Negative FTHL survey results in the project area shall be irrelevant in the determination of whether to charge compensation because FTHLs can re-occupy the suitable FTHL habitat in the future, or FTHLs were present but not detected due to their cryptic nature.

When compensation is not required

Situations when compensation is not required include the following. First, a project proponent does not need to compensate if the proposed disturbance would not occur in suitable FTHL habitat (e.g., compacted ground, small lots surrounded by urban development, or riparian areas). However, if the project area contains both suitable and unsuitable habitat, agency biologists may base compensation on the entire project area because FTHLs may use unsuitable habitat (e.g., paved or dirt roads or fringes of agricultural fields) adjacent to suitable habitat.

Second, a project proponent does not need to compensate if the agency biologist has determined that mitigation measures have eliminated all adverse, on-site effects (i.e., there are no residual effects).

Third, a project proponent does not need to compensate for disturbances if the signatory authorized the project (e.g., a lease or ROW) before June 1997 (when the signatory signed the conservation agreement), and no longer maintains regulatory discretion to impose compensation. For example, if a signatory granted a ROW to a proponent before June 1997, and the proponent disturbs land within their ROW, the proponent does not need to pay compensation. However, if the signatory renews a permit or ROW authorization, the signatory should require proponents to follow the RMS under the renewed agreement.

Last, signatories to the RMS do not need to compensate for their own disturbances because they are already contributing significant resources towards FTHL conservation. However, if a signatory disturbs over 1% of a FTHL MA (see Planning Action 2.2.1 for details), the signatory must pay compensation based on the compensation formula described below for that exceeded disturbance.

Compensation Determination

Compensation basis

The goal of compensation is to prevent the net loss of FTHL habitat and make the net effect of a project neutral or positive to FTHLS by maintaining a habitat base for FTHLS. To achieve this goal, compensation will be based on the acreage of FTHL habitat lost to a project proponent's impacts on signatory land after all reasonable on-site mitigation has been applied. Compensation for habitat lost outside a FTHL MA will be charged at a 1:1 ratio. When a project proponent's impacts are inside a FTHL MA, a multiplying factor ranging from three to six will be applied to the affected acreage to obtain an adjusted compensation acreage.

This multiplying factor **(M)** for disturbances inside FTHL MAS will be determined by the following formula:

$$M = 3 + A + G + E + D$$

where the factors are evaluated as shown below:

A Adjacent habitat impacts:

a) Adjacent lands will not be affected. 0

b) Adjacent habitat will receive direct or
indirect deleterious impacts. 0.5

G Growth inducing effects within flat-tailed horned lizard habitat:

a) The project will have no growth inducing effects. 0

b) The project will have growth inducing effects. 0.5

E Existing disturbance on site:

a) There is moderate to heavy existing habitat disturbance...........0

b) There is little or no existing habitat disturbance. 1

D Duration of effect:

a) The effects of the project are expected to be short term

(< 10 years). 0
b) The effects of the project are expected to be long term
(> 10 years). 1

Signatories should require project proponents to replace the acreage or adjusted acreage lost to the project proponent's impacts. However, signatories may convert either the compensation acreage or adjusted compensation acreage to a monetary equivalent (including administrative costs) that is required to replace the acreage or adjusted acreage. The per acre dollar figure for compensation fees shall be based on the cost of acquiring lands prioritized for acquisition by signatory agencies.

If signatories cannot replace the land disturbed by proponents because lands within FTHL MAs haven't been appraised or there are no more lands available for acquisition (Yuma Desert MA), signatories can charge fair market value of the impacted land and any costs associated with appraising the impacted land. Minimum compensation shall be $200.

Unique Compensation Circumstances

Some land actions have unique circumstances or impacts to FTHLs, and therefore determining the acreage of impact often will depend on the circumstance. Some examples of unique circumstances in common land actions are listed below.

Land disposal

Federal regulation provides for public lands to be made available for disposal via the Recreation and Public Purposes Act. Such land leases and patents are discretionary actions that require both NEPA and Endangered Species Act compliance. Federal land management agencies endeavor to retain ownership of land that provides habitat for sensitive species. However, if a case arises where public lands within FTHL habitat are to be disposed, the signatory disposing the land will collect compensation for the entire acreage regardless if the proponent intends to disturb only a portion of the land because there is no guarantee that the undisturbed portion will remain habitat for FTHLS.

Indirect effects

A project's indirect effects on FTHLs should be considered when determining compensation. For example, ROW grants for aboveground structures such as roads, pipelines, towers, or similar facilities can have adverse impacts to FTHLs beyond the areas that are proposed to be disturbed. First, such disturbances have been shown to attract FTHL predators. For example, roads may attract round-tailed ground squirrels (Garland and Bradley 1984), and towers can provide perching areas for loggerhead shrikes and American kestrels. Second, construction vehicles can introduce invasive weeds that degrade FTHL habitat. Last, vehicles from increased authorized and unauthorized traffic on maintenance roads can cause FTHL mortality. If these and other adverse indirect effects (e.g., habitat fragmentation, decreased FTHL density near roads) cannot be mitigated (with FTHL barriers or corridors, for e.g.), compensation for indirect effects will be required.

Boundaries of MAs

In areas where a MA boundary is defined by a road, the road ROW (not the road itself) will be considered to be the boundary for the MA. Consequently, compensation for residual effects within the ROW will be 1:1.

Recovered FTHL Habitat

Over time, disturbed habitat may recover from a project's residual effects and again become suitable FTHL habitat. If a subsequent project disturbs the recovered area again, the proponent (regardless of whether they were the original proponent) will still be required to pay compensation for residual effects.

Reopening of Mines along the East Highline Canal

For sites that have previously been mined along the East Highline Canal, either inside or outside of the East Mesa MA, compensation shall be charged at a 1:1 ratio if the applicant is not intending to fully mine and complete final reclamation of the site. Compensation shall not be charged if the applicant will be reclaiming the site and no further mining would occur.

Compensation Fund Accounts

Each of the signatories shall maintain an accounting of all compensation funds paid and collected. These accountings shall be incorporated into the annual monitoring report. The BLM shall act as a clearinghouse for all compensation funds and accounting data. Project proponents will pay the BLM through the signatory that authorizes the project. The signatory should give the check to the BLM field office (El Centro or Yuma) that manages the nearest FTHL MA. In addition, the signatory should also provide the secretary of the ICC a completed pre-project and post-project (if appropriate) reporting form for projects/activities that disturb FTHL habitat. The forms are provided in Appendix 8.

Use Of Funds

The agency to receive the compensation land or fee shall be determined through coordination among the permitting agencies. Typically, the compensation fee or land will go to the agency that predominantly manages the nearest MA. Pre-authorized and unauthorized uses are listed below. This list is not exclusive and the MOG, in consultation with the ICC, will ultimately decide how to use compensation funds for unlisted uses.

Pre-authorized uses of funds

Signatories can fund a variety of actions with compensation funds, but funds must directly benefit FTHLS or their habitat within or contiguous with FTHL MAS.

There are several approved uses of compensation funds, but the top priority shall be acquisition of inholdings within the nearest MA (see Planning Action 4). If opportunities for acquisition have been exhausted, examples of activities that could be carried-out with compensation funds include the following:

- Transfer funds to other MAs to purchase FTHL habitat, especially FTHL habitat within or contiguous with MAs that are threatened with imminent impacts.
- Construct and maintain fences and signs around MAs to prevent OHVs from entering and degrading FTHL habitat (see Planning Action 2.4.2). In addition, these fences could be designed to physically prevent FTHLS from leaving the MAs and encountering nearby roads (Appendix 7).
- Educate people and organizations about the effects of OHV use (see Planning Action 7.2). Educators should target those audiences most likely to travel off-road, such as

the public, BP, and utility companies.

- Restore degraded FTHL habitat within or contiguous with MAS (see Planning Action 3).
- Fund other management actions deemed necessary by the ICC and MOG.

Essentially, funds that cannot be used to purchase FTHL habitat within or contiguous with MAS can be used to accelerate implementation of actions identified in the implementation schedule (e.g., expending $100,000 in FY03 for habitat rehabilitation, instead of $40,000 as currently scheduled).

Unauthorized uses of funds

Funds should not be used in place of other agency funding that is obligated or programmed to carryout planning actions listed in the implementation schedule. For example, signatories shall not fund law enforcement and FTHL research/monitoring with compensation funds because signatories to this document have agreed to implement monitoring and law enforcement activities with their own funds.

Monitoring Program

In accordance with the first objective of this RMS (to "maintain a 'long-term stable' or increasing population of FTHLS in all MAS"), a population monitoring program has been implemented to learn how FTHL populations are changing over time. Determining whether there is a trend means obtaining accurate measurements of the populations over time, then removing "the effects of natural demographic and environmental stochasticity." Such effects are currently unknown; hence the monitoring also has a goal to document the variability in FTHL populations in response to natural processes (such as drought cycles).

Monitoring cannot reveal the actual causes of a population trend (Elzinga *et al.* 1998). However, by monitoring habitat disturbance in addition to population and distribution, correlations can be made between population change and one potential cause for decline. Even without conclusive proof of its cause, if a population or distribution decline of >30% is noted within any MA, and factors other than climate are the potential cause, the ICC will draft management prescriptions to reverse the trend. If declines are correlated with increased habitat disturbance from OHV use (documented either through ground surveys or aerial monitoring), signatory agencies will take measures to limit OHV traffic. If statistical proof of causal relationships is deemed necessary, the costs of implementing a research program with replicated controls and treatments will be evaluated.

The foundation for an inventory and monitoring program was laid in 1978 with surveys conducted on East Mesa, West Mesa, and Yuha Basin (Turner *et al.* 1978). Some monitoring has been conducted every year since then except 1980, 1982, and 1983. Distribution and relative abundance of FTHLS were estimated through much of the range of the species in California and Arizona by use of standardized 3-mile triangular transects in which numbers of FTHLS and their scat were counted and used as an index to relative abundance (Turner and Medica 1982; Rorabaugh *et al*. 1987; Olech undated; BLM and CDFG 1990; Wright 1993). Scat transect methods were standardized in 1990 (BLM and CDFG 1990). Trends on BLM-administered lands have been analyzed periodically (Olech 1986; Wright 1993, 2002). In addition to BLM-administered lands, inventories of the Navy target areas (Dames & Moore 1995; Rorabaugh 1996b), Salton Sea Naval Base (Muth and Fisher 1989; Rorabaugh 1996c) and OWSVRA (Wone *et al*. 1994; Wone *et al*. 1995; Wone and Beauchamp 1995a, 1995b) have been conducted.

Two critical assumptions of the scat transect survey method are 1) FTHL scat is readily distinguishable from other lizard's scat, and 2) scat and lizard counts are correlated with FTHL density.

The first assumption is largely met by not counting scat less than 5.5 mm in diameter (Muth and Fisher 1992) and not using scat counts to estimate relative density in areas where desert horned lizards occur (desert horned lizard scat is indistinguishable from FTHL scat) (Turner and Medica 1982).

The second assumption has been problematic. The relationship between scat counts and horned lizard density has been difficult to examine due to the problems associated with obtaining true FTHL density estimates. But several reports suggest that if scat is correlated with lizard density, the relationship may be weak (Muth and Fisher 1992; Rorabaugh 1994; Beauchamp *et al.* 1998). Wright (1993) found a correlation between FTHL counts and scat; however, the relationship between lizard counts and relative abundance is unknown. Use of lizard count data to estimate relative density is suspect due to the infrequency with which FTHLs are observed on triangular scat transects (on average less than one animal per 10 hours of searching) (Turner and Medica 1982; Rorabaugh *et al*. 1987) and because environmental conditions are likely to influence FTHL activity and detectability. Scat counts in the same area may fluctuate greatly from year to year (Wright 1993; Rorabaugh 1994), but there are factors other than lizard density that affect numbers of scat that are produced and visible (Muth and Fisher 1992; Rorabaugh 1994; Young 2002). Beauchamp *et al.* (1998) note that the presence of several scat in an area suggests two indistinguishable alternatives: either a single individual used the area repeatedly and the scat persisted, or multiple individuals have used the area over a shorter time span.

Due to the animal’s cryptic nature, monitoring efforts typically yield highly variable, low encounter rates, making analysis of monitoring data problematic. In a recent analysis of 1979-2001 FTHL monitoring data, no population trends were detected despite increases in habitat disturbance (Wright 2002). It was noted that inconsistencies between observers and changes in monitoring protocols added to the difficulties of detecting trends. Because of known problems with scat surveys and lizards encountered on line transects, new monitoring methods were called for (Foreman 1997).

Two new monitoring techniques are being implemented as part of this first revision. Implementation of these revised monitoring methods should increase sensitivity to detecting future trends. The first is an improved mark/recapture population monitoring technique developed by Wright and Grant (2002) (see Appendix 4). Using this technique, they estimated a population of about 30,000 FTHLs (95% CI: 21,500 – 33,000) in the Yuha Desert MA during the summer of 2002, with an average density of 1.3 lizards per hectare (0.5 per acre). Percent sand coverage was the only variable significantly correlated with population size. This technique has yielded the best wide-scale population estimate to date.

Pronounced natural fluctuations and potentially large confidence intervals may still mask detection of long-term population trends. Additionally, the small number of mark/recapture plots may be insufficient for detecting localized population declines, such as on the edges of MAs. In addressing these problems, the ICC felt that monitoring changes in FTHL distribution and changes in habitat disturbance could supplement monitoring population trends, to provide a more sensitive indicator of unnatural population declines. Distribution may be monitored by gathering presence/absence data (Appendix 5). These data, in conjunction with GIS overlays, can be used to create a predictive spatial model using StatMod (Garrard 2002), which will aid in detecting declines in distribution and may serve to tighten the population estimates obtained from the mark/recapture surveys.

The protocols for monitoring population and distribution both include measuring disturbance at the sample sites. In addition to those measures, wide-scale (aerial) monitoring of surface disturbance will occur every five years (see Planning Action 9.2.3.1).

It is anticipated that a population estimate from mark/recapture will be obtained from each MA during the next five years, which will allow for evaluation of this technique as a long-term monitoring tool. The distribution monitoring protocol is yet untested. It is recommended that it be implemented on a trial basis (e.g. in one MA for two years) and evaluated by the ICC to determine whether to expand the sampling. Following these new protocols over the next five years will establish baseline estimates against which future comparisons can be made. It is anticipated that during the 2007 revision of this document, the baseline data will be carefully reviewed and the ICC will determine whether or not they can set population and distribution thresholds which, if reached, would act as a stimulus for more drastic management efforts.

Restorative Measures

The following restorative measures are prescribed in the Planning Actions and are explained in more detail in this section. A discussion of how these measures were implemented can be found in the Summary of Management Strategy Implementation, 1997-2002, under actions 2, 3, and 5.

Route Closures

To reduce direct mortality from vehicles and to limit the increase in surface disturbance from the proliferation of routes, each discretionary, designated route in a MA shall require justification for the necessity of the route. Designated routes shall be prioritized in terms of importance to FTHLs and to the OHV community and other public and private route users. Redundant, low priority, and non-essential routes in MAs shall be closed and restored.

The following process will be utilized to reduce route density in MAs:

Step 1 - A small, interdisciplinary team shall be formed. The team should include, at a minimum, biological and recreation staff from the land management agency and representatives of USFWS, the state wildlife agency, the state OHV recreation agency, and important user groups. Other management agency staff, such as surface protection specialist or realty specialist, may be added as desirable.

Step 2 - The team shall identify non-discretionary routes (e.g., routes with existing ROWs) and discretionary routes (i.e., routes that can be closed at the discretion of the land management agency).

Step 3 - Representatives of users of routes shall assign an importance priority to each discretionary route. A written justification for each desired open route shall be prepared.

The team shall evaluate route densities and priorities, FTHL population density and trend data, FTHL home range size, and habitat disturbance attributed to routes to determine the level of route closures needed to ensure viable populations of FTHLS. Areas within MAS that support high levels of vehicular use and that are particularly important for the FTHL shall be identified as high priority areas for route closure.

Step 4 - Within areas identified for route closure, the team shall identify discretionary routes needing closure. Any discretionary route that serves no identifiable purpose, parallel routes, routes with no identifiable destination, and routes with high resource damage shall also be recommended for closure. Routes along utility corridors and canals and routes used by agencies (e.g., BP access) shall be evaluated for closure except to specific, authorized users.

Step 5 - All necessary federal and state environmental reviews shall be completed.

Step 6 - Closed routes shall be signed, as necessary, and restored.

Habitat Rehabilitation

Damaged and degraded areas in the desert may take centuries to recover their original appearance and ecosystem function without intervention. Preparation of the ground surface and replanting of vegetation may speed the restoration of the native flora, the rebuilding of the soil structure, and the reestablishment of native wildlife. Available techniques are reviewed in Lovich (1993).

Lovich and Bainbridge (1999) estimate low-intensive restoration efforts can cost $30,000 to $62,000 per acre. Besides being expensive, plants often die after re-vegetation efforts because of unknown, unpredictable, or uncontrollable environmental factors (e.g., drought or unsuitable soil conditions). Given the cost, recovery time, and the low to moderate probability of long-term success of restoration efforts, it is more effective to limit the extent and intensity of the initial impacts to the land (Lovich and Bainbridge 1999). Nonetheless, there are times when habitat rehabilitation is worthwhile. When a decision has been reached to restore a degraded area within an MA, and the underlying causes of habitat degradation have been removed (such as closing routes of travel), the most effective rehabilitation techniques known must be used. Since little is known about the habitat factors that benefit FTHL, initial rehabilitation efforts should be planned in an experimental fashion and the results of various treatments should be well documented so they can be improved upon over time.

Corridors

It is recognized that the Colorado River has been a long-term, natural barrier between populations in Arizona and California, and that this may have resulted in genetic divergence (see Figure 2). During the past century, the populations in East Mesa were effectively isolated from those to the west and south by the Salton Sea, extensive agricultural development, canals, and highways. However, managed areas to the west (i.e., Yuha Desert, West Mesa, Ocotillo Wells, and Borrego Badlands) lie relatively close to one another, and some movement between MAS may occur. Populations in the Coachella Valley are probably currently disjunct from those in the Imperial and

Borrego valleys. Planned actions provide guidance for managers to maintain sufficient habitat to provide for interchange of FTHLs between MAs, where habitat corridors persist. In this way, those naturally adjoining populations of FTHLs will be able to interbreed, helping to maintain genetic vigor, and natural recolonization could occur in the case of extirpation from local populations.

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APPENDICES

Appendix 1. 1997 Conservation Agreement

CONSERVATION AGREEMENT
PHRYNOSOMA MCALLII, FLAT-TAILED HORNED LIZARD

1. PURPOSE AND NEED

The flat-tailed horned lizard is a small, phrynosomatid lizard inhabiting sandy flats and valleys from the Coachella Valley, California, south and east through the Borrego and Imperial valleys, California, Southwestern Yuma County, Arizona, and adjacent portions of Baja California Norte and Sonora, Mexico. Approximately 34 percent of flat-tailed horned lizard habitat has been converted to urban or agricultural uses, or was inundated by the Salton Sea early in this century and is no longer occupied by the species. Six key habitat areas remain in the United States, including the Ocotillo Wells area, Borrego Badlands, West Mesa, Yuha Desert, and East Mesa in California, and the Yuma Desert in Arizona. These areas are subject to a variety of activities that degrade habitat, including agricultural, residential, and industrial development, off-highway vehicle use, geothermal development, sand and gravel operations, military activities, fire, and construction of roads, canals, and utilities. Although population trends are difficult to monitor, evidence suggests populations may have declined in two key areas, including northern East Mesa and the Yuha Desert. The Fish and Wildlife Service proposed the flat-tailed horned lizard as a threatened species in a November 29, 1993 Federal Register Notice. Collection of the species is prohibited by state law in Arizona and California. Further information on the status, distribution, taxonomy, and threats facing this species can be found in the Rangewide Management Strategy (Appendix 1), which serves as a Conservation Assessment and Conservation Strategy.

Occupied habitat is under the jurisdiction of a variety of federal, state, local government, and private entities. The primary land owners or managers of flat-tailed horned lizard habitat in California include; the Bureau of Land Management, Department of the Navy, California Department of Parks and Recreation (Ocotillo Wells State Recreational Vehicle Area and Anza Borrego Desert State Park), Bureau of Reclamation, and private individuals. In Arizona, the primary land owners or managers are; Marine Corps Air Station Yuma, Bureau of Reclamation, Bureau of Land Management, Arizona State Land Department, and private individuals. In both states, the U.S. Border Patrol is empowered with broad law enforcement authority and conducts many activities in flat-tailed horned lizard habitat, particularly within 25 miles of the international boundary. Local governments, including cities and counties, affect location and types of development, and may affect rates of growth within their jurisdiction. The six key habitat areas are managed primarily by the parties to this agreement.

This Conservation Agreement has been initiated to conserve the flat-tailed horned lizard by reducing threats to the species, stabilizing the species' populations, and maintaining its ecosystem. The document's primary purpose is to conserve the flat-tailed horned lizard through conservation measures under the Endangered Species Act of 1973, as amended.

The Conservation Agreement establishes a general framework for cooperation and participation among signatories. The signatories will provide support to the program as needed, and will provide input on current and future program needs. The Agreement is made and entered into to meet the following objective: 1) Implement the Flat-tailed Horned Lizard Rangewide Management Strategy (Appendix 1), thus establishing an open process by which to identify and carry out such actions as will conserve the species through voluntary participation of public and private partners.

II. INVOLVED PARTIES

In order to meet the present and/or future needs of this conservation effort, this Agreement may be modified or amended at any time by mutual written concurrence of the cooperating agencies to facilitate additional cooperators. The parties below are currently involved in this agreement.

Ecological Services - Carlsbad Field Office
U.S. Fish and Wildlife Service
2730 Loker Avenue West
Carlsbad, California 92008

Ecological Services Phoenix Field Office
U.S. Fish and Wildlife Service
2321 West Royal Palm Road, Suite 103
Phoenix, Arizona 85021-4951

U.S. Bureau of Land Management
California Desert District
6221 Box Springs Boulevard
Riverside, California 92507

U. S. Bureau of Land Management
Yuma District
2555 Gila Ridge Road
Yuma, Arizona 85365

U.S. Bureau of Reclamation
Yuma Area Office
P.O. Box D
Yuma, Arizona 85356

Marine Corps Air Station - Yuma
Box 99220
Yuma, Arizona 85369-9220

U.S. Navy
El Centro Naval Air Facility
El Centro, California 92243-5001

Arizona Game and Fish Department
2221 West Greenway Road
Phoenix, Arizona 85023-4399

California Department of Fish and Game
330 Golden Shore, Suite 50
Long Beach, California 90802

California Department of Parks and Recreation
Off-Highway Motor Vehicle Division
Ocotillo Wells State Recreational Vehicle Area
P.O. Box 320
Borrego Springs, California 92004

California Department of Parks and Recreation
Anza Borrego Desert State Park
P.O. Box 299
Borrego Springs, California 92004

III. AUTHORITIES

The authorities for the involved parties to participate in this Conservation Agreement are derived from the following legislation:

U.S. FISH AND WILDLIFE SERVICE:

Endangered Species Act of 1973, as amended
Fish and Wildlife Act of 1956, as amended
Fish and Wildlife Coordination Act of 1934, as amended
Sikes Act of 1960, as amended

U.S. BUREAU OF LAND MANAGEMENT

Endangered Species Act of 1973, as amended
Federal Land Policy Management Act
Sikes Act of 1960, as amended

U.S. BUREAU OF RECLAMATION

Endangered Species Act of 1973, as amended
Fish and Wildlife Coordination Act of 1934, as amended

MARINE CORPS AIR STATION - YUMA

Endangered Species Act of 1973, as amended
Sikes Act of 1960, as amended

U. S. NAVY EL CENTRO NAVAL AIR FACILITY

Endangered Species Act of 1973, as amended
Sikes Act of 1960, as amended

ARIZONA GAME AND FISH DEPARTMENT

Arizona Revised Statute 17-231.B-7
Endangered Species Act of 1973, as amended
Sikes Act of 1960, as amended

CALIFORNIA DEPARTMENT OF FISH AND GAME

Endangered Species Act of 1973, as amended
Sikes Act of 1960, as amended
California Fish and Game Code section 1802
California Fish and Game sections 3450 et seq.

CALIFORNIA DEPARTMENT OF PARKS AND RECREATION

Endangered Species Act of 1973, as amended

In addition to the above-listed legislative authorities, the following interagency agreements provide a framework for cooperation and participation among involved parties in the conservation of species tending towards listing: a Memorandum of Understanding signed by the U.S. Fish and Wildlife Service, the U.S. Bureau of Land Management, the U.S. Forest Service, the National Park Service, the National Marine Fisheries Service, and the International Association of Fish and Wildlife Agencies, issued on January 25, 1994 and amended on March 20, 1994 (Appendix 2); and a Memorandum of Understanding signed by 14 federal agencies, including among others, the U.S. Fish and Wildlife Service, the U.S. Bureau of Land Management, U.S. Bureau of Reclamation, and Department of Defense on September 28, 1994 (Appendix 3).

IV. IMPLEMENTATION OF CONSERVATION ACTIONS

Conservation actions necessary to ensure the long-term persistence of the flat-tailed horned lizard are identified in the Flat-tailed Horned Lizard Management Plan implementation schedule. Subject to availability of funds and compliance with all applicable regulations, the involved parties agree to implement actions according to scheduled completion dates and by responsible parties, as shown in the implementation schedule. If threats have been removed to a degree that the flat-tailed horned lizard does not meet the definition of a threatened species, pursuant to the Act, the Fish and Wildlife Service may withdraw the proposed rule to list the flat-tailed horned lizard as threatened. If the species is withdrawn and it becomes known that there are threats to the survival of the species that are not or cannot be resolved through this or any Conservation Agreement, the species will be re-assigned to candidate status and an appropriate listing priority assigned.

NOW THEREFORE, in consideration of the above premises, the cooperators enter into this Agreement as full and equal partners to accomplish its purpose and objectives.

All cooperators agree to:

1. Further develop and implement the objectives, strategies, and tasks of the Flat-tailed Horned Lizard Rangewide Management Strategy

2. As needed for this conservation effort, and as available, provide program personnel with facilities, equipment, logistical support, and access to lands under their control.

3. Participate regularly in ICC and MOG meetings to enhance communication and cooperation, and to help develop annual or other work plans and reports.

4. Develop and distribute public information and educational materials on this conservation effort.

5. Provide ongoing review of, and feedback on, this conservation effort.

6. Cooperate in development of major media releases and media projects.

7. Keep local governments, communities, the conservation community, citizens, and other interested and affected parties informed on the status of this conservation effort, and solicit their input on issues and actions of concern or interest to them.

8. Whenever possible, develop voluntary opportunities and incentives for local communities and private landowners to participate in this conservation effort.

9. Assist in generating the funds necessary to implement this conservation effort.

V. FLAT-TAILED HORNED LIZARD INTERAGENCY COORDINATING COMMITTEE

1. The involved parties shall designate a representative to serve on the Flat-tailed Horned Lizard Interagency Coordinating Committee (ICC). The ICC shall monitor the implementation of the Rangewide Management Strategy and provide a forum for exchange of information on the species. The ICC shall also be responsible for specific tasks as set forth in the implementation schedule. Through mutual agreement among designated representatives of all involved parties, the ICC may recommend changes in the tasks and scheduling of task implementation to the MOG, as described in the implementation schedule of the

Rangewide Management Strategy. The ICC shall in no way make recommendations to or serve as an advisory group to a federal agency.

Designated representatives shall attend at least two meetings of the ICC annually for the life of this Agreement to review progress and coordinate work priorities and schedules.

VI. FLAT-TAILED HORNED LIZARD MANAGEMENT OVERSIGHT GROUP

The involved parties shall designate a management-level representative to serve on the Flat-tailed Horned Lizard Management Oversight Group (FTHL MOG). The FTHL MOG will perform management-level duties, as described in the Rangewide Management Strategy and as identified by the ICC. The FTHL MOG shall meet semi-annually, or as needed. Members of the FTHL MOG have been selected by each signatory agency, and are listed below.

Bureau of Land Management, California	El Centro Resource Area Manager
Bureau of Land Management, Arizona	Yuma Field Office Manager
Bureau of Reclamation, Yuma	Yuma Area Manager
U.S. Fish and Wildlife Service, Region 1	Assistant Field Supervisor, Carlsbad
U.S. Fish and Wildlife Service, Region 2	Field Supervisor, Phoenix
Arizona Game and Fish Department	Yuma Region Supervisor
California Department of Parks and Recreation	Ocotillo Wells SVRA Superintendent
Anza Borrego Desert State Park	Superintendent
El Centro Naval Air Station	Resource Management Officer
Barry Goldwater Range	Range Management Officer
California Department of Fish and Game	Regional Manager

VII. ADMINISTRATIVE CLAUSES

1. Nothing herein shall be construed as obligating the parties to expend or as involving the parties in any contract or other obligation for the payment of money in excess of appropriations authorized by law and administratively allocated to work described herein.

2. This agreement is not a fund obligating document, and each party shall carry out its separate activities in a coordinated and mutually beneficial manner. Any activity that may create an exchange of funds will be conducted outside the scope of this agreement as authorized by law or regulations of each party.

3. All parties are hereby put on notice that the Arizona Game and Fish Department's participation in this agreement is subject to cancellation by the Governor of Arizona pursuant to A.R.S. 38-511 if any person is significantly involved in initiating, negotiating, securing, drafting, or creating a contract on behalf of the state of Arizona or any of its departments or agencies at any time while the contract or any extension of the contract is in effect, or is an employee of any other party to the contract in any capacity or a consultant to any other part of the contract with respect to the subject matter of the contract.

4. This Agreement will not be effective with respect to the Arizona Game and Fish Department until the fully executed Agreement is filed with the Arizona Secretary of State.

5. Pursuant to the laws of Arizona (A.R.S. 35-124 and 35-215, and section 41-1179.04, as amended), California, and the United States, all jointly maintained books, accounts, reports, files, and other records relating to this Agreement shall be subject at all reasonable times to inspection and audit by the state of Arizona, the state of California, and the federal government for five

years after completion of the Agreement. Such records shall be reproduced as designated by the state of Arizona, the state of California, and the federal government.

6. Any contracts entered into as a result of this Agreement shall comply with all state and federal contracting laws, including all applicable laws prohibiting discriminatory employment practices by contractors. Contracts entered into by the state of Arizona shall incorporate the Arizona Governor's Executive Order No. 75-5 entitled "Prohibition of Discrimination in State Contracts - Non-discrimination in Employment by Government Contractors and Subcontractors".

7. To the extent required or permitted by the laws of Arizona (Arizona Revised Statutes section 12-1518 and any successor statutes), California, and the United States, the cooperators agree to use arbitration, after exhausting all applicable administrative remedies, to resolve any dispute arising out of this agreement, where not in conflict with federal law or laws of the state of California. Any arbitration with respect to real property shall occur in the state where the real property is located or, if the real property is owned by the United States, shall be conducted pursuant to federal law.

IT IS MUTUALLY AGREED AND UNDERSTOOD BY AND BETWEEN THE COOPERATORS THAT:

1. Specific work projects or activities that involve transfer of funds services, or property among cooperators to this Agreement may require execution of separate agreements or contracts.

2. Specific proposed project actions or changes in management activities may require amendments to existing land use plans and further environmental analysis before implementation.

3. Conflicts between or among cooperators concerning procedures or actions under this Agreement that cannot be resolved at the operational level (i.e. by cooperator representatives to the MOG or ICC) will be referred to the next higher level within each cooperator, as necessary, for resolution.

VIII. DURATION OF AGREEMENT

The term of this Agreement shall begin on the date the Agreement is filed with the Secretary of State, after signed by all parties, and end after all tasks identified in the implementation schedule are completed, or until terminated by mutual concurrence of all the parties. The involved parties shall review the Conservation Agreement and its effectiveness annually to determine whether it should be revised. Within a year of completing the tasks identified in the implementation schedule, the Conservation Agreement shall be reviewed by the involved parties and either modified, renewed, or terminated. This Agreement may, at any time, be amended, extended, modified, supplemented, or terminated by mutual concurrence. Any party may withdraw from this Agreement by providing 60 days notice to the other parties in writing.

IX. SIGNATURES

[The original, signed signature pages are not included]

IN WITNESS WHEREOF:

The cooperators hereto have executed this Agreement as of the last written date below.

For the **U.S. DEPARTMENT OF INTERIOR, FISH AND WILDLIFE SERVICE, REGION 1**
Michael Spear, Regional Director

For the **U.S. DEPARTMENT OF INTERIOR, FISH AND WILDLIFE SERVICE, REGION 2**
Nancy Kaufman, Regional Director

For the **U.S. DEPARTMENT OF INTERIOR, BUREAU OF LAND MANAGEMENT, CALIFORNIA STATE OFFICE**
Edward Hastey, State Director

For the **U.S. DEPARTMENT OF INTERIOR, BUREAU OF LAND MANAGEMENT, ARIZONA STATE OFFICE**
Denise Meridith, State Director

For the **U.S. DEPARTMENT OF INTERIOR, BUREAU OF RECLAMATION, LOWER COLORADO REGION**
Robert Johnson, Regional Director

For the **U.S. DEPARTMENT OF DEFENSE, MARINE CORPS AIR STATION - YUMA**
C. J. Turner, Commanding Officer

For the **U.S. DEPARTMENT OF DEFENSE, EL CENTRO NAVAL AIR FACILITY**
Captain P. T. Madison, Commanding Officer

For the **ARIZONA GAME AND FISH DEPARTMENT**
Duane Shroufe, Director

For the **CALIFORNIA DEPARTMENT OF FISH AND GAME**
Jacqueline E. Schafer, Director

For the **CALIFORNIA DEPARTMENT OF PARKS AND RECREATION**
Donald Murphy, Director

Appendix 2. Federal Plans Affecting Flat-tailed Horned Lizard Habitat

Bureau of Land Management lands

In 1980, the Secretary of the Interior signed the California Desert Conservation Area Plan (BLM 1980) prescribing land uses on BLM-administered lands in California. The existing network of designated routes is illustrated on BLM's Desert Access Guides (maps). The Desert Plan established two ACECs to conserve the FTHL - the Yuha Basin (40,622 acres) and East Mesa ACECs (40,712 acres). The Desert Plan also directed that habitat management plans be written for lands adjacent to these ACECs. Although not designated specifically for the FTHL, the San Sebastian Marsh/San Felipe Creek ACEC (6,337 acres) and Dos Palmas ACEC (14,400 acres) also contain habitat for the FTHL.

In 1990, the BLM and CDFG signed the "Management Strategy for the Flat-tailed Horned Lizard on Bureau of Land Management Administered Lands within the California Desert Conservation Area" (BLM and CDFG 1990). Habitat categories were defined, and a category map was developed in the plan. A policy and formula were instituted for projects to compensate for lost or degraded habitat. Other management activities to reduce habitat degradation and loss were implemented. Measures implemented through various plans were brought into a species rangewide (California only) context. Among these were the research program, the inventory and monitoring program, interagency coordination, and habitat compensation.

California

Yuha Basin ACEC

In 1981, a combined plan was prepared for the Yuha Basin ACEC (BLM 1981). Specific actions in the plan were designed to protect sensitive cultural and wildlife resources while allowing for mineral material sales, geothermal development, and motorized vehicle competitive events. In 1983, a habitat management plan was prepared for the adjacent Yuha Desert area (BLM 1983). Measures were similar to the Yuha Basin ACEC Plan with additional measures dealing with monitoring of FTHL population trends, exchanges and acquisitions, and formation of an interagency coordinating committee. In response to indications of declining FTHL populations and increasing damage to cultural resources due to route proliferation and cross-country vehicle travel in Yuha Basin, the "Yuha Desert Management Plan" (BLM 1985) was prepared. This plan covers both of the previous areas plus several adjacent ACECs and Natural Areas. The plan tightened controls on, but did not eliminate OHV competitive events. Routes of travel were reduced in number. Camping was restricted to a 25-foot corridor along routes of travel. Law enforcement was increased. Other actions dealing with interagency coordination and monitoring of population trends were strengthened. In 1985, the Yuha Basin ACEC was expanded to 63,000 acres.

East Mesa ACEC

In 1982, the "Southern East Mesa ACEC Management Plan" (BLM 1982a) and "East Mesa Wildlife Habitat Management Plan" (BLM 1982b) were completed. The two plans covered adjacent areas and included similar measures. Although not previously conducted in East Mesa, competitive events were formally prohibited, but oil and gas leasing and geothermal energy development were allowed. The ACEC is closed to mineral material sales. Inventory and monitoring of FTHL populations were given a high priority.

San Sebastian Marsh/San Felipe Creek ACEC

In 1986, the "San Sebastian Marsh/San Felipe Creek [ACEC] Management Plan" (BLM 1986a) was signed. Based on scat counts, FTHLs are locally abundant in this ACEC (BLM 1986a). Most measures in the plan were aimed at protecting and enhancing the aquatic and riparian resources. The ACEC is closed to vehicle entry. The ACEC encompasses about 5,100 acres administered by the BLM and about 1,250 acres administered by the CDFG.

Dos Palmas ACEC

Limited FTHL habitat is found in the Dos Palmas ACEC along the northeastern side of the Salton Sea. This area encompasses about 14,400 acres of federal, state, and private lands. Dos Palmas ACEC originated in 1980 as the Salt Creek ACEC, at the time about 2,500 acres to protect Yuma clapper rail, desert pupfish, and other sensitive biological resources, including the FTHL. In 1998, BLM prepared an Ecosystem Management Plan for the ACEC and continues to implement that today.

West Mesa

The West Mesa ACEC was officially designated in 1986 to protect habitat of the FTHL, rare plants, and cultural resources. No plan has been written at this time. The ACEC encompasses more than 20,300 acres, including about 1,600 acres of private land.

Algodones Dunes

A habitat management plan for the Algodones Dunes was prepared in 1987 (BLM 1987b). Based on scat counts, FTHLs are present in small numbers, mostly around the periphery of the dunes. The plan focuses on general enhancement and protection of the flora and fauna of the dunes. Most of the dunes north of Highway 78 is designated wilderness; the dune area south of Highway 78 is open to vehicular cross-country travel.

Arizona

BLM Yuma Field Office manages approximately 900 acres of potential FTHL habitat. These 19 land parcels range in area from 1.6 to 335 acres with an average area of 46 acres. Most of the potential FTHL habitat is poor quality because parcels are typically small, fragmented, and disturbed.

BLM manages lands within the Yuma Field Office under the Yuma District Resource Management Plan (BLM 1987a) and the Lower Gila South Resource Management Plan (BLM 1998). In addition, amendments have been developed for the Yuma Resource Management Plan. They are the: Lower Gila South Resource Management Plan – Goldwater Amendment (BLM 1990), Yuma District Resource Management Plan Amendment (BLM 1992), Yuma District (Bill Williams) Resource Management Plan Amendment (BLM 1994), Yuma District (Havasu) Resource Management Plan Amendment (BLM 1994), Yuma District (Lands) Resource Management Plan Amendment, and Lechuguilla-Mohawk Habitat Management Plan (BLM 1997).

Currently, the FTHL RMS is addressed in the Lechuguilla-Mohawk Habitat Management Plan, and BLM-Yuma has been following the RMS since its inception. BLM-Yuma plans to incorporate the RMS in its upcoming resource management plan.

Department of Defense Lands

California

The Congress has withdrawn two military ranges in California, R-2510 (West Mesa) and R-2512 (East Mesa). The ranges have been withdrawn from all forms of appropriation under public land laws and are reserved for use by the Secretary of the Navy for defense-related purposes. This withdrawal became effective on October 1, 1996, and is in effect for 25 years. FTHLS occur throughout both of these ranges. Although the ranges are withdrawn from entry for non-military uses, R-2510 is adjacent to an OHV open area, and trespass OHV activity occurs. R-2512 also has some OHV use but to a lesser extent. Land management strategies and responsibilities will be developed through a new memorandum of understanding between BLM and the Department of the Navy.

Arizona

The passage of the Military Lands Withdrawal Act of 1986 (Public law 99-606) transferred land management responsibilities on the BMGR to the BLM. However in 2001, land management responsibilities transferred back to the DOD under the Military Lands Withdrawal Act of 1999 (Public law 106-65). DOD will manage the BMGR under the Integrated Natural Resources Management Plan, which is in preparation as of this writing.

On the BMGR, FTHL habitat occurs in portions of three special areas: 1) the Gran Desierto Dunes ACEC; 2) the Yuma Desert and Sand Dunes Habitat Management Area; and 3) the extreme western portion of the Tinajas Altas Mountains ACEC. In these areas, OHV use, camping, new ROWS, and other land use authorizations are limited. For safety reasons, MCAS-Yuma issues range passes for visitors to the BMGR. Visitors are restricted to driving street-legal vehicles, which further inhibits off-road travel.

For military activities on the BMGR, the USFWS has prepared a conference opinion (USFWS 1996a) that provides guidance for activities affecting the FTHL.

Bureau of Reclamation lands

About 600,000 acres, mostly in Imperial County, California, were withdrawn by Secretarial orders dating back to the early 1900's for use by the BOR in development of the All-American Canal, Boulder Canyon, Colorado River Storage, and Yuma Reclamation projects. Lands were withdrawn from settlement, sales, location under the mining laws, and entry. Withdrawn lands are managed by the BLM under an agreement with the BOR signed in 1978. The Federal Land Policy and Management Act of 1976 directed agencies holding withdrawals to work with the BLM to determine which withdrawals were obsolete and should be terminated; agency recommendations were to be submitted to the Department of the Interior for review and approval. In January 1992, recommendations reflecting the coordinated efforts of the BOR, BLM, and the Imperial and Coachella Valley Irrigation Districts were submitted to the Department of the Interior. It was recommended that 133,712 acres continue under withdrawal and that withdrawals be terminated on 444,781. The California Desert Conservation Area Plan (BLM 1980) will cover lands released from withdrawal. Unless within the boundaries of the 1964 Lower Colorado River Land Use Plan, lands continuing under withdrawal and covered under the earlier agreements will be managed by BOR.

Appendix 3. Legal Description of Management and Research Areas

Description of Yuma Desert Flat-tailed Horned Lizard Management Area

Beginning in the northwest corner of the area, the northern boundary of the MA is approximately 50 feet south of the BMGR boundary to accommodate County 14th Street and its right-of-way. On the eastern side of the MA, the boundary follows Foothills Boulevard south to the Auxiliary 2 service road. East and south along the Auxiliary 2 road to its end in Sec. 23 in T.11S., R.21W. The boundary then follows a southeasterly direction to the International Boundary. The southern boundary of the MA follows the International Boundary to Avenue D. The boundary includes federally administered lands in the Five-Mile Zone east of Avenue D and south of County 23rd Street, excluding the State Prison and the Yuma City Landfill. Along County 23rd Street and the western side of the BMGR, the boundary follows the proposed Area Service Highway route, excluding the proposed highway and its ROW.

In the interim period until a full analysis of alternative corridors is completed, federally administered lands within the BMGR west of the proposed route of the Area Service Highway and in the Five-Mile Zone north of the proposed route will be managed in accordance with prescriptions that apply to MAs.

QUAD SHEETS:

East boundary – Butler Mountains, Vopoki Ridge SE, Vopoki Ridge, W. of Vopoki Ridge, Fortuna SW, Fortuna

North boundary – Fortuna, Yuma East

West boundary – Yuma East, Yuma SE, S.E. of Somerton, S. of Somerton

South boundary – S. of Somerton, S.E. of Somerton, W. of Vopoki Ridge, Vopoki Ridge SW, Vopoki Ridge SE, Butler Mountains

Description of East Mesa Flat-tailed Horned Lizard Management Area

All are San Bernardino Meridian.

[East boundary] Beginning in Sec. 31 in T.16S., R.20E. at the intersection of Frontage Road and West Levee Road on the north side of the All-American Canal, then northwest along the West Levee Road (on west levee of Coachella Canal) to Highway 78 (Glamis Highway) in Sec. 35 in T.13S., R.17E;

[North boundary] then west on Highway 78 to the intersection with an unnamed dirt road in NW¼NE¼NE¼ Sec. 2 in T.14S., R.16E.;

[West boundary] then south on this dirt road to the intersection with BLM Route A181 in Sec. 23 in T.14S., R.16E., then south on BLM Route A181 to BLM Route A3410 in Sec. 11 in T.15S., R.16E., then eastward and southward on BLM Route A3410 to BLM Route A357 in Sec. 18 in T.15S., R.17E, then east on BLM Route A357 for about 0.3 miles to the west side of Sec. 17 in T.15S., R.17E., then south on the west side of Sec. 17, 20, 29, 32 in T.15S., R.17E. and Sec. 5, 8, and 17 in T.16S., R.17E to the Frontage Road on the north side of Interstate Highway 8 in Sec. 17 in T.16S., R.17E.;

[South boundary] then east on Interstate 8 Frontage Road to the west side of E½E½ Sec. 31 in T.16S., R.19E., then due north to the northern side of Sec. 31, then east 1.0 miles to the west side of E½E½ Sec. 32 in T.16S., R.19E., then due south to the Frontage Road, then east to the west side of Sec. 36 in T.16S., R.19E., then north to the N½ Sec. 36, then due east 1 mile to the east side of Sec. 36, then south to Frontage Road, then east on Frontage Road to the West Levee Road.

QUAD SHEETS:

East boundary - Grays Well, Cactus, Glamis SE, Glamis SW, Glamis NW.

North boundary - Glamis NW, Holtville NE.

West boundary - Holtville NE, Holtville East, Glamis SW.

South boundary - Glamis SW, Midway Well NW, Midway Well, Grays Well.

Description of West Mesa Flat-tailed Horned Lizard Management Area

All are San Bernardino Meridian.

[East boundary] Beginning in southeast corner of Sec. 30 in T.14S., R.13E. and north along the east side of Sec. 30, 19, 18, and 7 to the south side of N½ of Sec. 7, then west and north around SW¼NE¼ Sec. 7, then west and north around NW¼NE¼ Sec. 7, then west along the north side of N½ Sec. 7, then north about 0.15 miles along the east side of Sec. 13 in T.14S., R.12E. to the southeast corner of Sec. 12, then in Sec. 12, west and north around E½SE¼, then west and north and east around SW¼NE¼, then north along the west side of NE¼NE¼, then in Sec. 1 in T.15S, R.12E., north along the west side of SW¼SW¼, then west and north around NW¼SE¼, then west and north around E½NW¼, then west to the southeast corner of Sec. 35 in T.13S., R.12E., then north along the west side of Sec. 35 to the northeast corner of Sec. 35, then west and north around E½ of Sec. 26, then west along the northern side of Sec. 26 W½, 27, and 28 to the intersection with BLM Route SF291 (transmission power line service road), then northwest on BLM Route SF291 to the northern side of Sec. 28 in T.12S., R.11E., then west on the north side of Sec. 28 to the southeast corner of Sec. 20, then north on the east side of Sec. 20 to Highway 86, then northwest on Highway 86 to the northern side of Sec. 20, then west on the northern side of Sec. 20 to the southeast corner of Sec. 18 in T.12S., R.11E., then north along the east side of Sec. 18 to Highway 78;

[North boundary] then west on Highway 78 to the west side of Sec. 18 in T.12S., R.10E.;

[West boundary] then south on the west side of Sec. 18 in T.12S., R.10E., then west on the north side of Sec. 24 in T.12S., R.9E. to the west side of Tarantula Wash, then southeast along the west side of Tarantula Wash to the south side of Sec. 24, then east to the northwest corner of Sec. 30 in T.12S., R.10E., then south along the west side of Sec. 30 and east along the south side of Sec. 30, then south on the west side of Sec. 32 and east along the south side of Sec. 32 to Carrizo Wash near the northeast corner of Sec. 5 in T.13S., R.10E., then south along the west side of Carrizo Wash through Sec. 5, 8, 17, 20, 29, and 32 in T.13S., R.10E., and then south through Sec. 5, 8, 17, 20, 29, and 32 in T.14S., R.10E. to the intersection with BLM Route SF397 in NW¼ Sec. 32 in T.14S., R.10E., then southeast on BLM Route SF397 to an unnamed, east-west route along the northern side of the SW¼SE¼ Sec. 15 in T.15S, R.10E., then west about .25 miles to the boundary of the U.S. Navy Target 103 at about the northwest corner of SE¼SE¼ Sec. 15, then south along the boundary of Target 103 (approximately west side of SE¼SE¼ Sec. 15 and E½E½ Sec. 22 to the south side of Sec. 22 in T.15S, R.10E., [South boundary] then (along the boundary of Target 103) east on the south side of Sec. 22 and east and south around NW¼ of Sec. 26 in T.15S, R.10E., then east along the south side of NE¼ of Sec. 26 and N½ Sec. 25, in T.15S., R.10E., and N½ Sec. 30 and NW¼ Sec. 19, in T.15S., R.11E., then north along the east side of NW¼ Sec. 19, then north and east around the S½SW¼ Sec. 20, then north along the east side of Sec. 20 and 17, then east along the south side of Sec. 9, then north along the east side of Sec. 9, then east along the north side of Sec. 10, then north along the east side of Sec. 3, in T.15S., R.11E and along the east side of Sec. 34 and 27 in T.14S., R.11E, then diagonally from the southeast corner to the northwest corner across Sec. 22, the west along the north side of Sec. 21, then north on the east side of Sec. 17 to the 120-ft. contour line, then northwest on this contour line to the intersection with BLM Route SF274 in Sec. 17 T.14S., R.11E., then northwest on BLM Route SF274 to the intersection with BLM Route SF391 in Sec. 6 T.14S., R.11E., then southwest on BLM Route SF391 to the boundary of U.S. Navy Target 101 in Sec. 32 T.14S., R.12E., then southeast along the boundary of Target 101 to the southwest corner of Sec. 34 in T.14S., R.12E., then west on the south side of Sec. 34, 35, and 36 in T.14S., R.12E., then south along the west side of Sec. 30 in T.14S., R. 13E., then along the south side of Sec. 30 to the southeast corner of Sec. 30.

QUAD SHEETS:

East boundary - Brawley NW, Calipatria SW, Kane Spring, Kane Spring NE.

North boundary - Kane Spring NE, Kane Spring NW.

West boundary - Kane Spring NW, Harpers Well, Plaster City NW, Painted Gorge.

South boundary - Painted Gorge, Plaster City, Superstition Mountain, Brawley NW.

Description of Yuha Desert Flat-tailed Horned Lizard Management Area

All are San Bernardino Meridian.

[East boundary] Beginning at the International Boundary Road on the east side of Sec. 19 in T.17S., R.13E., then north along the eastern edge of public lands lying west of the Westside Main Canal Service Road in T.17S., R.13E.; T.17S., R.12E.; and T.16½S., R.12E. to Interstate Highway 8;

[North boundary] then east along the south side of Interstate Highway 8 to the west side of Sec. 30 in T.16S., R.11E.;

[West boundary] then south along the west side of Sec. 30 and 31 (T.16S., R.11E.) about 1.5 miles to the intersection with BLM Route Y1929, then south on BLM Route Y1929 to BLM Route 2716 in Sec. 12 in T.17S, R.10E., then south on BLM Route Y2716, to BLM Route Y2722 in Sec. 11 in T.17S, R.10E., then south to the International Boundary Road;

[South boundary] then east along the International Boundary Road to the east side of Sec. 19 in T.17S., R.13E.

QUAD SHEETS:

East boundary - Mount Signal, Yuha Basin, Plaster City.

North boundary - Plaster City, Painted Gorge.

West boundary - Painted Gorge, Coyote Wells.

South boundary - Coyote Wells, Yuha Basin, Mount Signal.

Description of Borrego Badlands Flat-tailed Horned Lizard Management Area

All are San Bernardino Meridian.

[East boundary] Beginning at the road near the northeast corner of the SE¼ of Sec. 32 (unsurveyed) in T.11S., R.8E., then north along the east side of Sec. 32, 29, 20, and 17 (unsurveyed), then east on the south side of Sec. 9 and 10 in T.11S., R.8E. to the east side of the east fork of Palo Verde Wash in Sec. 10, then northwest and north along the east side of Palo Verde Wash to Borrego Springs Highway, then northwest along Borrego Springs Highway to the intersection with Truckhaven Trail in NE¼SW¼ Sec. 13 in T.10S., R.7E., then west on Truckhaven Trail to the 800-ft. contour line in NE¼NW¼ Sec. 14, then north and northwest along the 800-ft. contour line through Sec. 14, 11, 12, 1, and 2 in T.10S, R7E and Sec. 35, 34, 27, 28, 21, and 20 in T.9S., R.7E. to the northern side of Sec. 20 in T.9S., R.7E;

[North boundary] then west along the northern side of Sec. 20 and 19 in T.9S., R.7E. and the northern side of Sec. 24 and 23 in T.9S., R.6E. to the northwest corner of Sec. 23;

[West boundary] then south on the west side of Sec. 23 in T.9S., R.6E. to the intersection with the Rockhouse Trail in ¼SW¼NW Sec. 23, then southeast on Rockhouse Trail (west fork in Sec. 36, 1, 6, 7) through Sec. 23, 26, 25, and 36 in T.9S., R.6E. and Sec. 1 in T.10S., R.6E. and Sec. 6 and 7 in T.10S., R.7E. to the northwest corner of Sec. 17 in T.10S., R.7E., then east along the northern side of Sec. 17, then south along the eastern side of Sec. 16, 21, 28, and 33 in Sec. T.10S., R.7E. and the eastern side of Sec. 4, 9, 16, and NW¼ Sec. 21 in T.11S., R.7E. to the southwest corner of NW¼ Sec. 16;

[South boundary] then west on the south side of NW¼ of Sec. 21 then south on the south side of E½ Sec. 21, then east on the south side of Sec. 21, 22, and 23 to the Borrego Mountain Wash Jeep Trail in Sec. 23 in T.11S., R.7E., then north along the Borrego Mountain Wash Jeep Trail to the intersection with the San Felipe Creek Road in SW¼SE¼ Sec. 14, then west along the San Felipe Creek Road to the east side of Sec. 32 (unsurveyed) in T.11S., R.8E.

QUAD SHEETS:

East boundary - Borrego Mountain, Fonts Point, Clark Lake, Clark Lake NE.

North boundary - Clark Lake NE.

West boundary - Clark Lake NE, Clark Lake, Borrego Sink

South boundary - Borrego Sink, Borrego Mountain

Description of Ocotillo Wells Flat-tailed Horned Lizard Research Area

All are San Bernardino Meridian.

East boundary Beginning at the intersection of Highway 86 and Highway 78 in Sec. 17 in T.12S, R.11E., then north along Highway 86 to the north side of Sec. 9 in T.11S., R.10E.;

North boundary then west on the northern side of Sec. 9, 8, and 7 in T.11S., R.10E., then north on the east side of Sec. 1 in T.11S., R.9E to the intersection with the northern fork of Arroyo Salada Wash in ¼NE¼NE¼NE of Sec. 1., then northwest along this wash through Sec. 36 in T.10S., R.9E. and east through N½N½ Sec. 35 and 34 to the intersection with Truckhaven Trail in NE¼NE¼, then west on Truckhaven Trail to the west side of Sec. 30 (Imperial/San Diego County Line);

West boundary then south on the west side Sec. 30 and 31 in T.10S., R.9E. and the west side of Sec. 6 and 7 in T.11S., R.9E to a point about 0.6 miles south of the northwest corner of Sec. 7, then due west 4 miles, then due south along the west side of Sec. 16, 21, 28, and 33 in T.11S., R.8E. and the west side of Sec. 4 in T.12S., R.8E. to Highway 78;

South boundary then east on Highway 78 to the intersection with Highway 86.

QUAD SHEETS:

East boundary - Kane Spring NE, Kane Spring NW.

North boundary - Kane Spring NW, Truckhaven, Seventeen Palms.

West boundary - Seventeen Palms, Shell Reef, Borrego Mountain.

South boundary - Borrego Mountain, Kane Spring NW, Kane Spring NE.

Appendix 4. Population Monitoring Protocol

Introduction

This protocol describes how to establish and survey 12 plots on a MA and is based on Wright and Grant's (2002) surveys of the Yuha Desert MA.

Plot selection

The MA can be stratified based on coarse habitat differences (three strata were defined based on substrate in the Yuha Desert MA). The 12 plots should be divided between strata. Plots should be randomly selected from within the strata. Each plot should measure 200 x 200 m (4 ha; 10 acres). Divide the plot into 20, 10 m-wide north/south lanes using pin flags (this takes 400 pin flags and about a day of work).

Disturbance surveying

Data on substrate and disturbance should be collected for each plot in a separate procedure (usually after flagging the plot on the first day). Each of the three technicians walks the flag lines (one beginning at each end and one beginning in the middle), and records the substrate and disturbance category at the tip of his/her toe on every tenth step until each technician has recorded 100 point observations (see data sheet in Appendix 8). A vehicle track is recorded if the point was in a vehicle track of any kind of any age. Two digital photos should also be taken at each plot, from the middle of the north and south sides, facing into the plot.

Lizard surveying

All surveys shall be conducted from April through September when air temperatures are between 25 and 37 °C (75 and 100 °F) (Young and Young 2000). Each plot is to be surveyed by three technicians looking for lizards while walking side by side in each lane, taking care to search the whole plot thoroughly. Technicians should begin searching 20 minutes before sunrise. The entire plot should be searched in a morning before temperatures get too hot for the lizards to be on the surface (it generally takes three people two to four hours per plot). Each plot should be surveyed for five consecutive days.

When a FTHL is found, all data on the Horned Lizard Observation Data Sheet (see Appendix 8) should be filled in completely. Additional data to be collected while walking the plot includes number of horned lizard scat seen and other lizard species observed.

To minimize survey variance, always use the same number of people each day on a plot and use the same people on a plot for all survey days. Try to search for the same amount of time each day, and only search all areas and lanes of the plot once a day, giving equal effort to each area of the plot. Rotate where you start the plot each day from one side to the other and then from the center in either direction, thus ensuring that each portion of the plot is searched under the ideal temperature regime.

Data analysis

Capture histories are to be analyzed using the computer program MARK (Otis *et al.* 1978; White and Burnham 1999), which gives an estimate of the population using the plot. Population estimates for adults and juveniles (<60 mm SVL) should be obtained separately. The most appropriate model, as determined by MARK's model selection procedure (using Akaike's Criterion and M(0) as a baseline), should be used for abundance estimates, although models determined to have unrealistic assumptions (i.e., regarding individual capture heterogeneity, capture response, or temporal variability) may be disregarded. The population calculated by MARK can't simply be divided by 4 ha to get a density estimate (Otis *et al.* 1978). More lizards use the plot over time than are on the plot at any single time. Many home ranges are only partially in the plot. To calculate density, the mean maximum distance moved (MMDM) method of Wilson and Anderson (1985) should be used. This method adds a boundary strip around the plot using the observed recapture distances during the survey as an index of home range size for that site/year. This method is more appropriate than using a set boundary based on home range averages because FTHL home range size varies according to habitat, gender, size, density of lizards, how wet the year is and how long you follow the lizard (Young and Young 2000; Setser 2001; Young, pers. obs.; Kirk Setser, pers. comm.).

Appendix 5. Distribution Monitoring Protocol

Distribution shall be monitored through one-hour presence/absence surveys at one-hectare (100 x 100 m) [2.5 acre (330 x 330 ft.)] sample points. All surveys shall be conducted from April through September when air temperatures are between 25 and 37 °C (75 and 100 °F) (Young and Young 2000). Surveys should be conducted by personnel who have demonstrated competence at locating FTHLs. The distribution monitoring datasheet in Appendix 8 should be used for data collection. Each sample point should be surveyed by only one person, but it is recommended that researchers work in pairs (drive together to the general area and split up to survey nearby sample points).

Key Areas

Within each MA, two permanent key areas will be selected for long-term monitoring. These key areas will serve as an early warning system where localized population declines can be detected before becoming widespread. Hence, key areas should be selected in areas of known or suspected habitat decline, most likely on the margins of the MA. Key areas can be of any shape, but should be four square miles (10.4 km^2) in total area. A control area, also four square miles, should be selected in the interior of the MA away from disturbances, to serve as a control against which changes in distribution within key areas can be compared. Within each area, 30 permanent one-hectare sample points should be randomly selected. Thirty additional sample points should be randomly selected from outside the control and key areas. These last 30 points are for refining the predictive distribution model over time and should not be permanent. Choose all sample points ahead of time and assign an identifying number to each. Vary which area you sample from week to week to avoid a seasonal bias. Sample each point only once each year. In subsequent years, resample the permanent points in the control and key areas, but select new random points for model refinement.

Monitoring Protocol at Sample Points

To survey, navigate to a sample point with a GPS unit, put down a tall pin flag to mark the position (the center of the hectare), note the starting time, then take a digital photo from the middle point, facing whichever direction you feel best represents the average habitat of that hectare. Spend up to one hour searching carefully within a 50-meter radius of the flag. Measure disturbance and other variables of interest during your initial search by collecting 50 “toe point” samples. This is done by walking north/south transects spaced 10-20 m apart and recording whether there is a vehicle track (of any size or age) or other variable of interest (e.g. galleta grass) within two m (6.5 ft) of every 10th footstep (if you encounter a horned lizard track while doing toe point samples, pause the sampling and follow the track—you can finish your sampling later). If you encountered a FTHL while measuring disturbance, no additional searching is needed. If you did not encounter a FTHL, continue surveying in any fashion that gives good coverage of the hectare and maximizes the chance of encountering a FTHL (tracking is encouraged when conditions allow). Note presence of scat, but focus on finding a lizard. The survey ends after one hour, or as soon as a FTHL is found and disturbance data have been gathered. Note end time, check that all data are filled out and then (if conditions permit) navigate to the next sample point (with a goal of completing two or three samples per person each morning).

Data analysis

The presence or absence of FTHLs (represented as a 1 or 0 respectively) at each location serves as the dependent variable to be used in conjunction with GIS overlays that represent various habitat features (the independent variables) in a logistic regression model. Using a recently developed ArcView extension, StatMod (Garrard, 2002), the goal is to create a predictive spatial model of FTHL occurrence within the MA and surrounding area. Such a model predicts probability of presence, and should indicate areas of high and low importance to the lizard. Proximity to roads and agriculture, as well as disturbance from OHV activity (if available as GIS overlays) can also be used as predictor variables, thus allowing assessment of their effects upon FTHL occurrence.

StatMod samples the independent variables at each survey point, and the resulting data set is used to create the model. The user has great flexibility in model creation (e.g. selecting which independent variables will be used in the model through either backward elimination, forward selection, stepwise selection, no selection, or specifying certain variables that must be included). Careful thought should be given to the choice of independent variables and to the settings for model parameters. Either categorical or continuous predictor variables may be used. It is recommended that Chris Garrard (Utah State University), or another statistician familiar with spatial modeling, be consulted prior to undertaking any analyses. The StatMod extension and a user's guide are available (at no cost) at http://bioweb.usu.edu/gistools/statmod/ but to run the logistic regression model requires ArcView 3.2 and SAS statistical software. The model can be refined as additional survey data are collected.

Appendix 6. Project Evaluation Protocol

Introduction

The objective of this protocol is to provide an assessment of FTHL presence or absence at proposed project sites within FTHL habitat on federal lands outside of MAs, to determine whether mitigation may be required (mitigation and compensation are automatically required on MAs, and compensation is required on all historic FTHL habitat on signatory lands outside of MAs). If the results indicate the species is present in a proposed project area, that project will be subject to appropriate mitigation and compensation. Surveys to determine presence or absence of the species are only required in areas of unknown occurrence (mitigation and compensation are automatically required in areas of known occurrence). However, a project proponent can forego these surveys by assuming the species is present and applying appropriate mitigation and compensation. If less than 20 acres of continuous potential habitat remain on and adjacent to the project site, no surveys or mitigation will be required (but compensation will still be required).

Areas of Known Occurrence

Resource and land management agencies have mapped areas of known FTHL occurrence (Figure 2). Within the historical range, assume the species is present if:

1. There is a locality record within two miles; and
2. the habitat is continuous (i.e., not divided by impermeable barriers such as a canal) and suitable between the locality and the project site; and
3. major habitat alteration or conversion has not taken place since the species was detected.

Areas of Unknown Occurrence

In areas of potentially suitable habitat within or on the edge of the species' range (Figure 2) in which presence is not assumed, surveys must be conducted to determine the presence or absence of FTHLs at project sites prior to project initiation. If the surveys indicate FTHLs are present at the project site, then mitigation and compensation will be required. If all survey requirements are met and the species is deemed absent, then mitigation is not required.

Required Authorizations and Qualifications

Only persons authorized by AGFD (in Arizona) or CDFG (in California) shall conduct surveys and handle FTHLs. Investigators shall have experience in surveying for FTHLs, including ability to recognize and follow FTHL tracks, or shall obtain training from an experienced investigator. Prior to any survey effort, a survey proposal shall be developed and approved by AGFD (in Arizona), CDFG (in California), and/or by the state or federal agency that manages the lands to be surveyed.

Survey Protocol

Although investigators shall focus on finding horned lizards, both scat and horned lizards shall be noted. All surveys shall be conducted from April through September when air temperatures are between 25 and 37 ^{o}C (75 and 100 ^{o}F) (Young and Young 2000). For projects that will impact less than nine hectares (22 acres), surveys should cover an area of at least nine hectares, centered on the proposed project site (unless one or more edges of the project site are unsuitable habitat, in which case the surveys would be conducted in adjacent suitable habitat). A minimum of four one-hour presence/absence surveys (Appendix 5) shall be conducted in this area, with one of the surveys centered on the project site.

For larger projects the number of one-hour presence/absence surveys will increase in the following manner:

Project impact size (ha)	Number of one-hour presence/absence surveys
10-25	4
26-50	6
51-100	8
100-260 (1 section)	10
> 260	10 per section

Road Surveys

FTHLS are often easier to detect on roadways than during walking surveys. Thus, road surveys shall also be conducted and shall consist of driving all roads at least twice in or near the survey area and recording any horned lizards observed. Workers should drive very slowly (no more than 10 miles per hour on unpaved roads) to allow detection of lizards. Road surveys should be conducted from April through September primarily in the morning when air temperatures range from 25 to 37 ^{o}C (Young and Young 2000).

Data Records

The location of transects, and each FTHL, desert horned lizard, and horned lizard scat found during walking or road surveys shall be recorded on maps of scale no less than 1:24,000. Date and time observed, and (if captured) sex and snout-vent length shall be recorded for each horned lizard observed. A 35-mm color photograph with the lizard filling at least half of the frame shall be taken of each horned lizard. A sample of horned lizard scat shall be collected. A qualitative assessment of the habitat should be conducted, including listing dominant perennial and annual plants, substrate types, and level of disturbance (note roads, OHV tracks, vegetation removal, etc.) Photographs can be used to document habitat characteristics. Survey dates, and beginning and ending times and surface temperatures of each survey shall be recorded. Any blocks of time not actually spent conducting the survey shall be subtracted from the total survey time. Data collected during walking surveys shall be recorded on the attached sample survey form. Survey results shall be detailed in a report to which all survey forms and data on lizards, including photographs and maps, shall be appended.

Interpretation of Survey Results

The following criteria shall be used to derive presence or absence of the FTHL from the survey results:

Species present if:

1. FTHLs are found; or
2. Horned lizard scat is found and the desert horned lizard is unlikely to occur at the project site; or, as noted previously,
3. No FTHLs are found; but
    a) FTHLs have been found within two miles of the project site, and
    b) The habitat is continuous or suitable between the locality and the project site.

Species absent if:

1. No scat or horned lizards are found; and
    a) No FTHLs have been found within two miles of the project site; or
    b) FTHL locality record(s) exist within two miles, but the habitat is not continuous or suitable between the locality and project site; or
2. Scat is found, no FTHLs are found, but desert horned lizards occur within two miles of the project site; and
    a) No FTHL locality record(s) exist within two miles of the project site; or
    b) FTHL locality record(s) exist within two miles, but the habitat is not continuous or suitable between the locality and project site.

If, based on the above analysis, FTHLs are deemed present, locality records, scat occurrence, and descriptions of habitat shall be sent to the ICC secretary to update the distribution map.

Appendix 7. Fencing and Removal Survey Protocols

In accordance with Measure 8 of the Mitigation section, sites of permanent or long-term (greater than one year) projects in MAs where continuing activities are planned and where FTHL mortality could occur may be enclosed with FTHL barrier fencing. After clearing the enclosed area of horned lizards following the protocol described in this appendix, no on-site monitor is required (see Measure 7 of the Mitigation section). Fencing for the purpose of producing a FTHL barrier along roads (see Mitigation Measure 10) shall also follow these protocols as applicable. Prior to any fencing or removal survey, a proposal shall be developed and approved by AGFD (in Arizona), CDFG (in California), and/or by the state or federal agency that manages the lands to be surveyed.

Fencing Protocol

Barrier fences for the exclusion of FTHLs shall follow these specifications:

1) The barrier fence shall be constructed along the entire perimeter of the project and be inset sufficiently from the perimeter of the parcel to allow for construction and maintenance.
2) Barrier material shall be 0.25” mesh hardware cloth and 36” in height
3) Barrier material shall be buried 6” deep, providing 30” above the surface.
4) Barrier material shall be securely attached to t-posts or fence posts and barbed wire strung at heights of 15” and 30” (A third barbed wire shall be strung above the FTHL proof fencing), using metal clips or wire.
5) Additional t-posts or fence posts shall be placed at any junctions between rolls of hardware cloth to discourage the formation of gaps.
6) An experienced biological monitor shall oversee the construction of the barrier fence and be on-site to search for and remove FTHLs during surface-disturbing activities.
7) The entire fence shall be maintained in perpetuity, including but not limited to the repair of gaps under or in the fence, and accumulation of plant debris or sand on the outside of the fence.
8) Biological monitors shall conduct a removal survey, following the protocol below, only after the fence construction is completed.

Removal Survey Protocol

Removal surveys shall be conducted after barrier fence completion and prior to construction activities. Surveys shall follow these guidelines:

1) Surveys shall be conducted by experienced biological monitors as described in Appendix 6.
2) Surveys shall occur only during appropriate survey conditions as described in Appendix 6
3) Projects < 4 acres (1.6 ha) in size require four hours of survey effort. For larger projects, minimum survey effort shall be 0.5 hour per acre. The land managing agency may require a greater survey effort.

4) Survey methods shall be designed to achieve a maximal capture rate and shall include but not be limited to the following: strip transects, tracking, and raking around shrubs.
5) Survey methods shall incorporate a systematic component to ensure that the entire fenced project site is surveyed. A modification of the Population Monitoring Protocol (Appendix 7) may be used.

Appendix 8. Forms and Data Sheets

Population Monitoring Data Sheet

MA: _____ Plot#: ____ Technicians: ____

Corner locations (NAD 27 projection, UTM Zone _____) NW _____________ , _____________SW ___________, ___________

NE __________ , __________ SE ___________ , ____________ Photo ID #’s _____ ,______ Dominant Vegetation _____________

Habitat Inventory (report totals from 300 point obs here): OHV trails _ Fine sand (< 0.5 mm):______Coarse sand (0.5 – 1.0 mm):______Gravel (> 1 – 30 mm):____ Rock (> 30 mm): ___

5 DAY CAPTURE HISTORY TABLE

	DAY 1		DAY 2		DAY 3		DAY 4		DAY 5		Start Date:
Start/End times											
Start/End temps											**End Date:**
Start corner											

Record UTM (NAD 27) of capture for each day caught (or mark ‘0’ if not seen). Record full capture data of each lizard’s initial capture on the Horned Lizard Observation data sheet

ID	SEX[1]	AGE[2]	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	CAP. HIST.[3]
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15[4]								

[1]Sex categories: 0 = female, 1 = male. [2]Age categories: 0 = hatchling = < 40 mm; 1 = juvenile = 40-60 mm; 2 = adult = > 60 mm. [3]Series of five 0’s and 1’s where 1 = caught, 0 = not seen. Compile capture histories for each animal at the end of the 5 survey days. [4]If more than 15 individuals are captured on a plot, use an additional data sheet.

Distribution Monitoring Data Sheet

Sheet #______________

(Time should be recorded in 24:00 clock)

Use NAD27 projection and **specify UTM Zone________**

Observer	Date	Start time	End time	Easting (UTM)	Northing (UTM)	Plot #	Photo #
NOTES:							

FTHL	DHL	Scat	GrSq	Ztail	<500 m from development?	Disturbance	Ggrass
Record these as 1 = present; 0 = absent. Record FTHL measurements on FTHL observation data sheet.					If yes, specify type (road, ag, housing)	Values between 0 and 50 from toe-point samples	

Observer	Date	Start time	End time	Easting (UTM)	Northing (UTM)	Plot #	Photo #
NOTES:							

FTHL	DHL	Scat	GrSq	Ztail	<500 m from development?	Disturbance	Ggrass
Record these as 1 = present; 0 = absent. Record FTHL measurements on FTHL observation data sheet.					If yes, specify type (road, ag, housing)	Values between 0 and 50 from toe-point samples	

Observer	Date	Start time	End time	Easting (UTM)	Northing (UTM)	Plot #	Photo #
NOTES:							

FTHL	DHL	Scat	GrSq	Ztail	<500 m from development?	Disturbance	Ggrass
Record these as 1 = present; 0 = absent. Record FTHL measurements on FTHL observation data sheet.					If yes, specify type (road, ag, housing)	Values between 0 and 50 from toe-point samples	

Horned Lizard Observation Data Sheet

Sheet #______________

(Time should be recorded in 24:00 clock)

Use NAD27 projection and **specify UTM Zone________**

Observer	Date	Time	Easting (UTM)	Northing (UTM)	Plot #	I.D. #	Photo #

Species		Sex		SVL (mm)	Weight (g)	Notes:
FTHL	DHL	M	F			

Observer	Date	Time	Easting (UTM)	Northing (UTM)	Plot #	I.D. #	Photo #

Species		Sex		SVL (mm)	Weight (g)	Notes:
FTHL	DHL	M	F			

Observer	Date	Time	Easting (UTM)	Northing (UTM)	Plot #	I.D. #	Photo #

Species		Sex		SVL (mm)	Weight (g)	Notes:
FTHL	DHL	M	F			

Observer	Date	Time	Easting (UTM)	Northing (UTM)	Plot #	I.D. #	Photo #

Species		Sex		SVL (mm)	Weight (g)	Notes:
FTHL	DHL	M	F			

Observer	Date	Time	Easting (UTM)	Northing (UTM)	Plot #	I.D. #	Photo #

Species		Sex		SVL (mm)	Weight (g)	Notes:
FTHL	DHL	M	F			

Observer	Date	Time	Easting (UTM)	Northing (UTM)	Plot #	I.D. #	Photo #

Species		Sex		SVL (mm)	Weight (g)	Notes:
FTHL	DHL	M	F			

Observer	Date	Time	Easting (UTM)	Northing (UTM)	Plot #	I.D. #	Photo #

Species		Sex		SVL (mm)	Weight (g)	Notes:
FTHL	DHL	M	F			

Project Reporting Form

for Projects or Activities that Disturb Flat-tailed Horned Lizard Habitat

*This form is to be filled out before project initiation **and** after project completion.*

If this form is used for reporting unauthorized disturbances (within or outside of MAs*), document all information sources, preferably with publicly available documents. In all cases, respect private property rights.*

PROJECT DESCRIPTION/LOCATION:
Project Number:__________Authorizing Agency:__________Field Contact Rep:____________________
Project name/description:____
Project proponent:____ Authorized:___ Unauthorized:___

Project type: Construction___ Military Maneuver___ Land Disposal___ Maintenance of Existing Project___ Intrusive Research___ Recreation/Interpretive Development___ Mining (includes sand and gravel)___
Other (describe)____

Project location: (attach map showing location and footprint of project)
Within MA___ (indicate which MA)______________
Outside MA___Township_____ Range_____ Section_____ 1/4 Section_____

EFFECTS OF THE PROJECT:
Growth inducing effects: Yes___ No___ **Previously disturbed:** Yes___ No___ Partly___
Duration of effect: Short term (<10 yrs)___ Long term (≥10 yrs)___ **New access:** Yes___ No___
Acres lost as habitat:_____ Acres degraded:_____
Lands outside project footprint: Not affected_____ Adversely affected_____

MITIGATION/COMPENSATION:
Mitigation required: Yes___ No___ **Mitigation plan:** Yes___ No___ **Mitigation type:** Construction limited to 11/15-2/15___ Worker education___ Location altered___ FCR___ Define and limit work areas___ Biological monitor___ Preconstruction surveys___ Perimeter lizard fence___ Restoration___ Post-project monitoring___Other____

Compensation required: Yes___ No___ **Compensation type:** $(amount)________ Lands(acres):_______
If compensation is lands: Lands transferred to:_______________________
Location of lands:____

*FTHL **OBSERVATIONS***:
FTHL Observed on Project Site: Yes___ No___ **If Yes, fill out the FTHL Observation Data Sheet**
#FTHLs relocated_____ #FTHLs killed_____ #FTHLs injured_____

COMMENTS:____(continue other side if needed)

Preparer (print):____ Title:______________________________

Signature:____ Date:__________

Mail a copy of this form and any additional data to the Secretary of the Interagency Coordinating Committee

APPENDIX 2. List of Acronyms and Abbreviations

ac	acre
ACEC	Area of Critical Environmental Concern
BLM	United States Bureau of Land Management
C	Celsius
CBD	Center for Biological Diversity
CDCA	California Desert Conservation Area Plan
CDFG	California Department of Fish and Game (now CDFW)
CDFW	California Department of Fish and Wildlife
CDPR	California Department of Parks and Recreation
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
cm	centimeter
CNDDB	California Natural Diversity Database
Commission	California Fish and Game Commission
CPAD	California Protected Areas Data Portal
CVCC	Coachella Valley Conservation Commission
CVMSHCP	Coachella Valley Multiple Species Habitat Conservation Plan
CWHR	California Wildlife Habitat Relationships
Department	California Department of Fish and Wildlife
DFA	Development Focus Areas
DOD	Department of Defense
DOE	Department of Energy
DOI	Department of the Interior
DRECP	Desert Renewable Energy Conservation Plan
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ESA	Endangered Species Act (federal)
F	Fahrenheit
FGC	Fish and Game Commission
ft	feet
FTHLICC	Flat-tailed Horned Lizard Interagency Coordinating Committee

GCM	Global Climate Model
GIS	Geographic Information System
ha	hectare
H.E.R.P.	Herpetological Education & Research Project
ICC	Interagency Coordinating Committee
in	inch
INRMP	Integrated Natural Resources Management Plan
km	kilometer
LCRMSCP	Lower Colorado River Multi-species Conservation Program
LUPA	Land Use Plan Amendment
m	meter
MA	Flat-tailed Horned Lizard Management Area
mi	mile
mm	millimeter
NAFEC	Naval Air Facility El Centro
NCCP	Natural Community Conservation Plan
NEPA	National Environmental Policy Act
NOAA	National Ocean and Atmospheric Administration
NPS	National Park Service
NSO	No Surface Occupancy
OHMVRD	Off-highway Motor Vehicle Recreation Division
OHV	Off-highway Vehicle
OWSVRA	Ocotillo Wells State Vehicular Recreation Area
PEIS	Programmatic Environmental Impact Statement
PVA	Population Viability Analysis
RA	Flat-tailed Horned Lizard Research Area
REEA	Renewable Energy Evaluation Area
RMS	Flat-tailed Horned Lizard Rangewide Management Strategy
RMS areas	Borrego Badlands MA, West Mesa MA, East Mesa MA, Yuha Desert MA, and Ocotillo Wells State Vehicular Recreation Area RA
RVSS	Remote Video Surveillance System
SEZ	Solar Energy Zone

SSC	Species of Special Concern
USAF	United States Air Force
USFWS	United States Fish and Wildlife Service
USMC	United States Marine Corps

APPENDIX 3. Public Notice

PUBLIC NOTICE

August 14, 2015

TO WHOM IT MAY CONCERN:

NOTICE IS HEREBY GIVEN that the California Department of Fish and Wildlife has initiated a status review of the flat-tailed horned lizard (*Phrynosoma mcallii*) pursuant to Fish and Game Code section 2074.6, and is providing this notice pursuant to Fish and Game Code section 2074.4 to solicit data and comments on the petitioned action from interested and affected parties.

The Department has initiated status review following related action by the Fish and Game Commission. Having provided notice, the flat-tailed horned lizard is now a candidate species under the California Endangered Species Act (Cal. Reg. Notice Reg. 2013, No. 52-Z, pp. 2085-2092; see also Fish & G. Code, §§ 2074.2, 2085).

The Department has 12 months to review the petition, evaluate the available information, and report back to the Commission whether or not the petitioned action is warranted (Fish & G. Code, § 2074.6). The Department's recommendation must be based on the best scientific information available to the Department.

Therefore, **NOTICE IS FURTHER GIVEN** that anyone with data or comments on the species' ecology, genetics, life history, distribution, abundance, habitat, the degree and immediacy of threats to reproduction or survival, adequacy of existing management, and recommendations for management of the species, is hereby requested to provide such data or comments to:

California Department of Fish and Wildlife
Nongame Wildlife Program
Attn: Laura Patterson
1812 9th Street
Sacramento, California 95811

Please submit two hard copies if submitting by surface mail.
Comments may also be sent via email to: wildlifemgt@wildlife.ca.gov. If submitting by email, please include "flat-tailed horned lizard" in the subject heading.

Responses and information received by **September 14, 2015** will be evaluated for possible incorporation in the Department's final report to the Fish and Game Commission. The Department's written report will indicate, based on the best scientific information available, whether the Department concludes that the petitioned action is warranted or not warranted. Receipt of the report will be placed on the agenda for the next available meeting of the Commission after delivery. The report will be made available to the public at that time. Following receipt of the Department's report, the Commission will allow a 30-day public comment period prior to taking any action on the Department's recommendation.

If you have any questions, please contact Laura Patterson at 916-341-6981 or the Department via email at wildlifemgt@wildlife.ca.gov or at the address above.

As a candidate species, the flat-tailed horned lizard receives the same legal protection afforded to an endangered or threatened species (Fish & G. Code, § 2085). Research on flat-tailed horned lizard requires appropriate permits issued pursuant to Fish and Game Code Section 2081(a). Interested researchers should contact Laura Patterson at Laura.Patterson@wildlife.ca.gov for more information. Detection information on flat-tailed horned lizard should be sent to the California Natural Diversity Data Base http://www.dfg.ca.gov/biogeodata/cnddb/ .

APPENDIX 4. Public Comments

The attached comments were received during the public solicitation for information period. Two commenters requested a time extension and were granted it but provided no additional information. Two commenters submitted attachments, including papers already utilized in the status review, other reports, GIS files, and photographs. Those are not attached here because of their excessive size; however, they are available upon request.

From:	Joshua Pierce
To:	Wildlife Management
Subject:	Flat-Tail Horned Lizard
Date:	Thursday, August 13, 2015 9:52:58 AM

Hello,

To who it may concern, a news source claiming to be affiliated with the CDFW made a call for information regarding Flat-Tail Horned Lizards (*Phrynosoma mcalli*). I worked as project lead for the Flat-Tail Horned Lizard (FTHL) monitoring project back in 2012. It should be noted the Bureau of Land Management (BLM) El Centro office has detailed, long-term records of population dynamics of FTHL in Southern California. It would be advisable to examine their records.

If you are looking for general information about their life histories; a simple google search would suffice. From experience, they eat almost exclusively harvester ants; their feces are elongated cylinders measuring between .75-2cm in length and approximately .5cm in diameter. This is important for two reasons. Firstly, you can be certain it is feces from FTHL because of the way it falls apart (the indigestible components and lack of water to bind them in the scat is indicative of FTHL). Secondly, you can monitor populations, activity, and simply track individuals by the presence of this scat. They are most active between 4:30 Am and 11:00 Am and most easily visible at this time. Later you may find them buried in the sand or underneath the abundant creosote bushes. Almost exclusively found on sandy substrate with a tendency to avoid rocky or hard substrates with the exception of feeding on harvester ants at those sites. Lizards will bury themselves up to their head in sand and do so by quick lateral undulations which flick sand around the sides of their body. The relatively flat profile of the lizard results in little shadow being cast when on top of the sand. Occasionally, lizards have been found standing entirely erect, for reasons unknown (perhaps to thermoregulate or display). Young lizards may be found in latter parts of summer with mating seasons in late spring through June. Males approach females and can often be found together at this time. While normally reclusive and uninclined to move, lizards during this time will frequently run away. Additionally, females have been observed being visually defensive and almost aggressive while pregnant. Adult lizards measure from 70mm-120mm with rare instances of greater than 120mm.

If you would like more life history information, I would be happy to oblige.

In 2012 there was a stark drop in the population with very few lizards being observed. Interobserver variance was accounted for by having teams of observers walking in line at arm length. Plots were walked every day for 10 days before switching to new plots and with high detection for lizard detection. As a very experienced herpetologist, these lizards are very cryptic and the eye must be trained to see them.

Though I was merely a technician, one cannot help but observe the influence of anthropocentric drivers in the area. Whether it be OHV's, human traffic, industrial development, improper water usage, unsustainable farming practices, housing developments, illegal harvesting, harvester ant decline, or climatic variance, I would recommend these lizards be protected so as their habitat can be properly conserved. I may also suggest an examination of harvester ant densities.

Cheers,
Joshua Pierce

From:	Smilie Face
To:	Wildlife Management
Subject:	flat tailed horned lizard
Date:	Thursday, August 13, 2015 2:48:26 PM

I've seen horned toads in my area.

I've seen them on the firebreak ridge above Placerita Canyon Nature Center in Newhall, CA

En route to Towsley Peak at Rivendale Park aka Towsley Park of the Santa Monica Mountains (in Santa Clarita, CA)

Fish Canyon trail, off Templin Highway.

I didn't know there were different species of horned lizards. These are all located in Northern Los Angeles County. If this is of interest, I will try to locate one of the photos I took of a friend holding the horned lizard and then releasing where he found it.

I've been a docent at Placerita Nature Center for many years and put your post on our facebook page. I hope that was the right thing to do.

Helen Sweany

From:	annetteuthe
To:	Wildlife Management
Cc:	lovetheplants@gmail.com
Subject:	FlatTailed Lizard
Date:	Friday, August 14, 2015 2:52:26 PM

Hello, I was asked to forward this picture taken on May 5, 2015 while hiking in the hills on the Oak Flat Trail, north east of Templin Highway, south of Vista Del Lago, in what I believe may be the Castaic area of California.

From:	tom harrington
To:	Wildlife Management
Cc:	editor@ss-offroadmagazine.com
Subject:	lizard
Date:	Thursday, August 20, 2015 11:45:26 AM

Thanks for the invitation to comment,
All lizards are easy to propagate. 10 eggs, twice a season. The revenue, time and energy spent justifying the existence of the committee Monitoring Flat-tailed Horned Lizards could have been used to hatch literally millions of lizards and other semi-endangered animals. Shame on you for manipulating this situation to give reason for your careers. Do the right thing. How about we Fund the Breeding and distribution of endangered animals. Duh.

Tom Harrington
Resident, Ocotillo Wells

From:	Julie Andersen
To:	Wildlife Management
Subject:	flat-tailed horned lizard
Date:	Tuesday, August 25, 2015 11:04:22 AM

Hello,

When I worked as a consultant in Arizona, we had a large project with potential impacts to FTHL. I have provided a link to the FONSI for the project, which has valuable information that may be of interest to CDFW in your review of FTHL.

http://azdot.gov/docs/default-source/environmental-planning-library/sr195_fonsi_main_text.pdf?sfvrsn=2

I hope this is helpful.

-Julie

El Centro
Chamber of Commerce®
& VISITORS BUREAU

1095 South 4th Street
Post Office Box 3006
El Centro, CA 92244 - 3006
(760) 352-3681
Fax (760) 352-3246

September 10, 2015

California Department of Fish and Wildlife
Nongame Wildlife Program
Attn: Laura Patterson
812 9th Street
Sacramento, CA 95811
wildlifemgt@wildlife.ca.gov

RE: Request Extension of Comment Period on Proposed Listing of Flat Tailed Horned Lizard

Dear Ms. Patterson,

As a group of renewable energy developers and responsible off road enthusiasts, we have serious concerns about the California Department of Fish and Wildlife Commission's proposed listing of the flat tailed horned lizard (FTHL) as an endangered species and plan to file comments. However, we are concerned that the comment period ending Sept. 14 does not provide sufficient time to assess and prepare the meaningful responses appropriate for an issue that would significantly impact renewable energy development, recreational use of the desert and the economy of the Imperial County.

A substantial record of environmental data has been compiled over the years that renewable energy development and off road recreational use have coexisted with the FTHL on state and federal desert land in Imperial County. We believe including such data and more recently completed documentation in our responses will help inform the Commission's ultimate decision. However, our responses cannot be completed by the current comment period deadline.

In the interest of good government, broad public participation and stakeholder input, we urge you to extend the comment period for an additional 30 days.

We appreciate your consideration of this request and look forward to your prompt response. Please contact us if you have any questions.

Sincerely,

Chamber President

California Department of Fish and Wildlife
Nongame Wildlife Program
Attn: Laura Patterson
812 9th Street
Sacramento, CA 95811
wildlifemgt@wildlife.ca.gov

RE: Request Extension of Comment Period on Proposed Listing of Flat Tailed Horned Lizard

Dear Ms. Patterson,

The Coalition of Labor, Agriculture, and Business (COLAB) has serious concerns about the California Department of Fish and Game Commission's proposed listing of the flat tailed horned lizard (FTHL) as an endangered species and plan to file comments. However, we are concerned that the comment period ending Sept. 14 does not provide sufficient time to assess and prepare the meaningful responses appropriate for an issue could significantly impact the economy of the Imperial County.

A substantial record of environmental data has been compiled over the years that development, as well as off recreational use have coexisted with the FTHL on federal and nonfederal desert land in Imperial County. We believe including such data and more recently completed documentation in our responses will help inform the Commission's ultimate decision. However, the responses of the County and interested parties cannot be completed by the current comment period deadline.

In the interest of good government, broad public participation and stakeholder input, we urge you to extend the comment period for an additional 30 days.
We appreciate your consideration of this request and look forward to your prompt response. Please contact us if you have any questions.

Sincerely,

Kay Day Pricola
Executive Director

California Department of Fish and Wildlife
Nongame Wildlife Program
Attn: Laura Patterson
812 9th Street
Sacramento, CA 95811
wildlifemgt@wildlife.ca.gov

RE: Request Extension of Comment Period on Proposed Listing of Flat Tailed Horned Lizard

Dear Ms. Patterson,

As a group of agri-business, renewable energy developers, responsible off road enthusiasts and biologists, we have serious concerns about the California Department of Fish and Game Commission's proposed listing of the flat tailed horned lizard (FTHL) as an endangered species and plan to file comments. However, we are concerned that the comment period ending Sept. 14 does not provide sufficient time to assess and prepare the meaningful responses appropriate for an issue that would significantly impact Imperial County's vast agriculture, renewable energy development, recreational use of the desert and the overall economy of the County.

A substantial record of environmental data has been compiled over the years that renewable energy development and off road recreational use have coexisted with the FTHL on federal and nonfederal desert land in Imperial County. We believe including such data and more recently completed documentation in our responses will help inform the Commission's ultimate decision. However, our responses cannot be completed by the current comment period deadline.

In the interest of good government, broad public participation and stakeholder input, we urge you to extend the comment period for an additional 30 days.
We appreciate your consideration of this request and look forward to your prompt response. Please contact us if you have any questions.

Sincerely,

Charla D. Teeters

Charla Teeters
United Desert Gateway

Nicole Nicholas Gilles
Executive Director
American Sand Association

Glenna

Glenna Barrett
Wildlife Biologist
Barrett Enterprises

Tim Kelley
President & CEO
Imperial Valley Economic Development Corp.

Bob Ham
California Off-Road Vehicle Association
American Sand Association

Marie S. Barrett

Marie Barrett
Barrett Biological Surveys

Edward Stoven
San Diego Off-Road Coalition
Friends of Ocotillo Wells

From:	Ed Stovin
To:	Wildlife Management
Subject:	Flat Tailed Horned Lizard
Date:	Sunday, September 13, 2015 11:34:24 PM
Attachments:	1.1 - 2015_Leavitt_etal_FTHL Monitoring.docx 2013 Leavitt_etal_FTHL Monitoring.docx FTHL - Annual report 2011 final OW cmmts 4-11-13.docx FTHL - Interp Potential impacts.wps FTHL Annual report 2013 final.docx FTHL Monitoring Manuscript draft_no photos_TJG AR comments.docx FTHL Annual report 2013 final.docx

Dear CDFW, attached are files I received from a California Public Records Act request to California State Parks regarding the flat tailed horned lizard. While I am interested in the survival of the species, I am also interested in keeping this species off the endangered species list. I was frankly shocked at how much work, how many stipulations and how many agencies are currently working on preserving this species. This was most apparent when I read in the "FTHL Annual Report 2013 Final" Appendix B: 2014 Annual Work Plan for the Flat-tailed Horned Lizard Interagency Coordinating Committee, all the step and contingencies being followed to help the species. I understand that within the management areas, surface disturbances of more than 1% are not allowed.. This is currently the case within the MA. I also understand that a threshold of population decline of 30% could trigger the need to list the lizard. The studies show that while declines at times have been noted (and closely correlate with precipitation) the 30% threshold has not been crossed. It is interesting to note that one of the areas with the most FTHLs is in the open OHV area Ocotillo Wells SVRA.

I, and the people I represent, are very worried about the economic and recreational impacts this potential listing would have. After reviewing the data attached (and volumes more I omitted) I believe the FTHL is being protected by a formidable association of agencies and is doing fine. I truly hope you will recommend to the California Fish and Wildlife Commission that this species is doing fine and listing it is unnecessary.

Ed Stovin

Director, California Off-Road Vehicle Association

President, San Diego Off-Road Coalition

Vice President, Friends of Ocotillo Wells

Vice Chair, BLM Imperial Sand Dunes Recreation Area Desert Advisory Council Subgroup

From: Joe
To: Wildlife Management
Subject: Flat-tailed Horned Lizard
Date: Monday, September 14, 2015 9:24:49 AM

To Whom It May Concern:

Listing the flat-tailed horned lizard (FTHL) is an important step in conserving and preserving this species. I worked for nine years at the two state parks that are strongholds of the FTHL on state lands. Without listing, the administration at those parks have no urgency or imperative to support study and management for the species.

At Ocotillo Wells there was a flawed, but extensive study for the FTHL. As soon as the federal listing attempt was rejected, the program was decimated. It went from 480 surveys on 80 proportionally distributed plots throughout the park to 90 surveys on the easy-to-reach plots near the headquarters. Their surveys have been increased again because of this fear of listing. (The issue of the flaws in the work at OW was addressed in my note sent before the Commission vote. The Interagency Coordinating Committee for FTHL Management (ICC) keeps changing protocols so that a scientifically valid set can never be obtained.)

I am now at Anza-Borrego Desert State Park (ABDSP) which had long ignored the FTHL, seldom participating even in the ICC meetings even though it was a signatory to the group's foundation, let alone doing any survey work. When I got there, a new employee had laid the foundation for a program in accordance with the ICC. It was getting up to speed with two years of solid work, although still a bit shy of enough to be complete. When the new superintendent comes in, he pulls the plug on the surveys because he felt district resources should be expended elsewhere. Although arguing strenuously, I could not convince him of the importance of building our effort--not even continuing it. It was not a listed species and therefore the district had no more responsibility to this species than any other even though ABDSP is a valuable and unique control area because so much of FTHL habitat in California is being ridden on by off-roaders (OW) or targeted for development (BLM lands).

As I wrote you earlier, the efforts of the ICC are inadequate because it is voluntary. OW cannot be sanctioned for damaging habitat with open riding and camping, items specified as detrimental in the ICC's Rangewide Management Strategy (RMS). OW did return to a higher level of survey because the USFWS person on the ICC threatened it. ABDSP cannot be forced to live up to its commitment made when it signed the Conservation Agreement. These state entities need the legal framework of listing to keep them doing what they should. Otherwise, any conservation work depends on the vagaries of individuals and how they see the priorities of resource expenditure, money, personnel, and time.

This species needs real protection. I hope the Commission will vote for listing so that happens.

Joe Hopkins
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Borrego Springs, California 92004
760-332-9802
dsrtjoe@Hotmail.com

September 14, 2015

By U.S. and Electronic Mail

California Department of Fish and Wildlife
Nongame Wildlife Program
Attn: Laura Patterson
1812 9th Street
Sacramento, CA 95811
email: wildlifemgt@wildlife.ca.gov

Re: Comments on the Petition to List the Flat-Tailed Horned Lizard (Phrynosoma mcallii) as Endangered under the California Endangered Species Act

Dear Ms. Patterson:

We represent Ecologic Partners, Inc., a consortium of family-oriented recreational groups that are committed to protecting public access to key recreational areas in the western United States.[1] We appreciate the opportunity to provide comments to the California Department of Fish and Wildlife (DFW) in connection with DFW's status review of the Flat-Tailed Horned Lizard (*Phrynosoma mcallii*) (FTHL) under Fish and Game Code section 2074.6 in response to a Petition to list the FTHL under the California Endangered Species Act (CESA).

The DFW should not recommend to the Fish and Game Commission that the FTHL be listed under CESA. As made clear by the Petition history, the Petition does not contain sufficient information to indicate that listing may be warranted. The Petition should not be evaluated in a vacuum — the DFW and the Commission have the benefit of years of extensive study and analysis performed at the federal level by the U.S. Fish and Wildlife Service (Service). This letter is intended as a brief overview of the Service's determinations with respect to the FTHL.

As shown below, since at least 1993, the Service has exhaustively examined issues surrounding the FTHL, and repeatedly determined that listing the FTHL as threatened under the federal Endangered Species Act is not warranted. The instant Petition is a "repackage" of unsuccessful attempts to list the FTHL under the federal Endangered Species Act. However, the Petition does

[1] EcoLogic's charter members include the American Sand Association, the San Diego Off-Road Coalition, the American Motorcyclists Association District 37, and the Off-Road Business Association. EcoLogic provides this comment letter on behalf of itself, and on behalf of these four organizations and their respective members.

not overcome the Service's repeated findings that there is insufficient cause to listing the FTHL as a threatened species. Accordingly, the Petition does not present sufficient scientific information indicating that listing may be warranted under California's Endangered Species Act.

THE 1997 WITHDRAWAL OF THE FTHL PROPOSED LISTING

As background, on November 29, 1993, the Service published a proposed rule to list the FTHL as a threatened species under the federal Act. (58 FR 62624.) On June 15, 1997, the Service issued a final decision to withdraw the FTHL proposed listing. (62 FR 37852.)

The Service determined that the FTHL did not meet the required criteria to warrant listing as threatened under the ESA for three primary reasons. First, the Service found that the best available scientific data was inadequate to show that the FTHL was suffering from a population decline. Second, the Service found that a number of the threats to the FTHL identified in the proposed rule had been eliminated or reduced. Finally, the Service determined that the Range wide Management Strategy and the implementing Conservation Agreement, covering a significant part of the species' extant habitat, would further reduce threats to the species and its habitat. Therefore, the Service concluded, analysis of the five listing factors set forth in 16 U.S.C. §1533(a)(1) demonstrated that listing the FTHL as a threatened species was not warranted. In addition, as in the proposed rule, the Service's final determination found that overutilization (Listing Factor B) and disease or predation (Listing Factor C) do not threaten the FTHL with extinction.[2] The Secretary's ultimate conclusion also turned on her determination that, however serious the threats to the lizard on private land, "[l]arge blocks of habitat with few anticipated impacts exist on public lands throughout the range of this species." (62 FR 37860; *Defenders of Wildlife v. Norton* (9th Cir. 2001) 258 F.3d 1136, 1140.)

The 1997 decision to withdraw the FTHL proposed listing was challenged in the U.S. District Court for the Southern District California. On June 16, 1999, the District Court upheld the Service's decision of withdrawal. However, the decision was appealed and on July 31, 2001, the Ninth Circuit Court of Appeals vacated the District Court's ruling and remanded back to the Secretary. (*Defenders of Wildlife*, *supra*, 258 F.3d at p. 1136.) In accordance with the Court of Appeal's ruling, the Service reinstated the 1993 proposed rule. (66 FR 66384.)

THE 2003 WITHDRAWAL OF THE FTHL PROPOSED LISTING

On January 3, 2003, the Service published a decision to withdraw the 1993 proposed rule to list the FTHL under the federal Endangered Species Act. (68 FR 331.) The Service determined that

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[2] *Defenders of Wildlife, et al. v. Babbitt, et al.*, Brief for Defendants-Appellees, 2000 WL 33980128, at pp. 13–14.

listing the FTHL as threatened was not warranted "because threats to the species as identified in the proposed rule are not as significant as earlier believed, and current available data do not indicate that the threats to the species and its habitat, as analyzed under the five listing factors described in section 4(a)(1) of the Act, are likely to endanger the species in the foreseeable future throughout all or a significant portion of its range." (*Ibid.*) The Service found the lizard to be "in danger of extirpation in the Coachella Valley" (68 FR 348); however, it determined that the Coachella Valley is not a significant portion of the species' range. Accordingly, the Service concluded in the 2003 withdrawal that the FTHL populations on either side of the Imperial Valley-Salton Sea and in Arizona were not likely to become endangered in the foreseeable future.

The 2003 withdrawal was challenged in the U.S. District Court for the District of Arizona. On August 30, 2005, the District Court found that the Service's withdrawal of the proposed rule violated the federal Endangered Species Act and the Ninth Circuit's remand order by failing to evaluate the lizard's lost habitat and whether that habitat was a significant portion of the range. The Court upheld all other aspects of the 2003 withdrawal decision, concluding that the Secretary's assessment of threats to the lizard's current range was reasonable and supported by the evidence in the administrative record. (*Tucson Herpetological Soc. v. Salazar* (9th Cir. 2009) 566 F.3d 870, 875.)

The District Court ordered the Service to make a new listing decision, stating that the agency need only address the matters on which the Court's August 30, 2005 Order found the withdrawal unlawful, *i.e.*, generally, whether the lizard's lost historical habitat renders the species in danger of extinction in a significant portion of its range.

THE 2006 WITHDRAWAL OF THE FTHL PROPOSED LISTING

The Service did not appeal the District Court's Order; instead, pursuant to the order, the Service cancelled the 2003 withdrawal and restored the lizard to proposed listing status. The Service re-examined the lost historical habitat of the FTHL in relation to the 2003 withdrawal, and determined that the lost historical habitat is not a significant portion of the species' range, and its loss does not result in the species likely becoming endangered in the foreseeable future throughout all or a significant portion of its range. (71 FR 36745.) Accordingly, on June 28, 2006, the Service again withdrew the 1993 proposed rule.

To comply with the District Court's 2005 limited remand order, the 2006 withdrawal quantified the lizard's lost range, explained why that range is not "significant" within the meaning of the Endangered Species Act, and incorporated the findings in the 2003 withdrawal by reference. (*Tucson Herpetological Soc. v. Salazar* (9th Cir. 2009) 566 F.3d 870, 875.) Specifically, the 2006 withdrawal offered a set of reasons for discounting the significance of the lizard's lost historical range (approximately 23% of the species' baseline range). The Service explained that:

(1) lizard populations persist across most of the species' current range despite habitat loss and fragmentation; (2) much of the lizard's lost habitat was converted to agricultural, commercial, and residential development long ago; (3) the lost portions of the lizard's range do not carry any special biological or genetic importance for the species as a whole; and (4) lost historical habitat represents a relatively small portion of the lizard's baseline range. (*Tucson Herpetological Soc.*, *supra*, 566 F.3d at p. 877; See 71 FR 36751.)

The 2006 withdrawal was also challenged in the U.S. District Court for the District of Arizona. The District Court granted summary judgment in favor of the Service. (*Tuscon Hermetological Society v. Kempthorne*, 04-CV-00075-PHX-NVW.) However, this ruling was challenged in the Ninth Circuit Court of Appeals, which reversed the District Court's ruling. The Ninth Circuit determined that, in the analysis of whether the lizard's lost historical range constituted a significant portion of the species' range, the administrative record did not support what the Court viewed as the Service's conclusion that FTHL populations were stable and viable throughout most of its current range.

THE 2011 WITHDRAWAL OF THE FTHL PROPOSED LISTING

Accordingly, on November 3, 2009, the District Court remanded the 2006 withdrawal to the Service for further consideration and reinstated the 1993 proposal to list the species. And, after further detailed analysis, on March 15, 2011, the Service withdrew the 1993 proposed rule for the fourth and final time. (76 FR 14210.) The Service made the determination to withdraw because threats to the species as identified in the 1993 proposed rule are not as significant as earlier believed, and available data do not indicate that the threats to the species and its habitat, as analyzed under the five listing factors described in section 4(a)(1) of the Act, are likely to endanger the species in the foreseeable future throughout all or a significant portion of its range. The Service published its 2011 decision to withdraw in a detailed 58-page opinion. (76 FR 14210.) The Service's decision, which is summarized below, was not challenged and is now considered the Service's final opinion on the matter.

The Service's Background Findings

As to management and populations, the Service found three notable management mechanisms are in place within the U.S. portion of the FTHL range: (1) the Interagency Conservation Agreement, which includes the Flat-tailed Horned Lizard Rangewide Management Strategy (Rangewide Management Strategy); (2) the Coachella Valley Multiple Species Habitat Conservation Plan (Coachella Valley MSHCP); and (3) the Lower Colorado River Multi-Species Conservation Plan (Lower Colorado MSCP). (76 FR 14215.) The Service found that implementation of the Interagency Conservation Agreement has had a positive effect on the FTHL populations in the United States and will continue to do so. The Coachella Valley

MSHCP is a regional habitat conservation plan (HCP) developed under section 10 of the Act that covers the FTHL in the Coachella Valley. The Lower Colorado MSCP is also an HCP that addresses the FTHL. (*Ibid.*)

As to population dynamics, the Service noted the history of FTHL monitoring and the shortcomings of the techniques used. (76 FR 14219.) However, the Service noted that monitoring using more rigorous data collection and analytical methodologies has been conducted as part of the implementation of the Rangewide Management Strategy. (*Ibid.*) The Service found that:

> "Although there are no comparable historical data with which to provide context, our analysis suggests that the level of occupancy of flat-tailed horned lizards within the surveyed areas seemed relatively high at all sites. For example, visual-and-scat survey results show that flat-tailed horned lizards occupied at least 80 percent of the Management Areas in the years surveyed, except in the West Mesa Management Area in 2005, which had a low level of survey effort that year. Additionally, results from the 53-plot subset with multi-year data from 2006 to 2009 suggested that the level of flat-tailed horned lizard occupancy stayed about the same or may have even increased slightly over time."

(*Ibid.*) Accordingly, the Service stated: "we conclude from the above results that the level of occupancy within the survey areas is not low, and that there is no indication of a decline." (*Ibid.*) In short, although recognizing certain caveats, the Service concluded that FTHL populations in the Management Areas "are not low and have not declined since 2007, and probably not declined since 1997." (76 FR 14220.)

The Service's Findings on the Five Factors Affecting the FTHL

The federal Endangered Species Act provides that a species may be determined to be endangered or threatened due to one or more of the five factors described in section 4(a)(1) of the Act. (16 U.S.C. §1533(a)(1).) The Service evaluated threats to the FTHL under the five listing factors in the 1993 proposed rule; and, the subsequent documents in 1997 and 2003 withdrawing the proposed rule included additional evaluations. (76 FR 14223.) At the time of the 2011 withdrawal, the 2003 withdrawal document was the most comprehensive and the most recent five-factor analysis. (*Ibid.*) In addition, the 2011 document used the best scientific and commercial data available to evaluate current potential threats to FTHL and its habitat rangewide per the five listing factors. (*Ibid.*)

For the first listing factor, the Service evaluated the present (current) or threatened (anticipated) impacts that may be affecting the habitat or range of the FTHL. (76 FR 14223.) Under this factor, the Service extensively analyzed "fragmentation"[3] and past habitat loss; agricultural and urban development; development associated with energy production projects; the effects of invasive, nonnative plants; off-highway vehicles; and military training activities. The Service concluded that current or anticipated future urban, agricultural, or energy development throughout the species' range is not currently a substantial threat to the FTHL, nor does the Service expect it to become a substantial threat in the foreseeable future. Further, the Service did not consider the potential threats of invasive, nonnative plants, frequent OHV activity, or military training activities to be substantial threats to the FTHL, either individually or in combination. Therefore, based on its review of the best available scientific and commercial information, the Service found the FTHL is not threatened by the present or threatened destruction, modification, or curtailment of its habitat or range, either now or in the foreseeable future. (76 FR 14231.)

For the second listing factor, the Service analyzed overutilization — *i.e.*, the capture or collection of individuals of a species — of the FTHL for commercial, recreational, scientific, or educational purposes. The Service concluded that the available information does not suggest that the amount of utilization has significantly affected the status of the FTHL; therefore, the Service concluded based on the best scientific and commercial information, that overutilization for any purpose is not a threat to the FTHL, now or in the foreseeable future. (76 FR 14232.)

For the third listing factor, the Service analyzed disease and predation. The Service stated it is not aware of any reports of disease in the FTHL. The Service also found that predation likely occurs in some human-altered areas at higher than typical rates; however, compared to the distribution of the species, relatively few flat-tailed horned lizards are likely subjected to increased predation. Therefore, based on its review of the best scientific and commercial information, the Service found the FTHL is not threatened by disease or predation, now or in the foreseeable future. (76 FR 14232.)

For the fourth listing factor, the Service analyzed existing regulatory mechanisms. The Service noted that in its analyses under the other four listing factors, all of the threats presented are of low magnitude, are non-imminent, and/or cover very small portions of the species' range. (76 FR 14233.) The Service found that with the withdrawal of the proposal to list the FTHL, the only change in regulatory protections would be the removal of the conference requirement under section 7(a)(4) of the federal Endangered Species Act. Because a conference opinion is only advisory in nature, the Service does not expect this change to have any significant effect on the status of the FTHL. (76 FR 14235.) The Service analyzed regulatory mechanisms under Federal

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3 The Service noted that the term "fragmentation," as it has been used in the past, is ambiguous. (76 FR 14224.) However, "fragmentation" has generally been defined as the breaking up of a habitat or ecosystem into smaller parcels. (76 FR 14223.)

laws, California state laws, Arizona state laws, and Mexican federal law. The Service found that these regulatory mechanisms will remain in place and will continue to provide benefits to the FTHL and its habitat. (*Ibid.*) This includes several laws or mechanisms that reduce potential threats, such as State laws that restrict collection of FTHLs, and planning documents that incorporate measures from the Rangewide Management Strategy. Therefore, the Service concluded that the existing regulatory mechanisms are not inadequate and do not threaten the species throughout all or a significant portion of its range, now or in the foreseeable future. (76 FR 14235.)

As to the fifth listing factor, the Service assessed the natural or manmade threats to the species that were not addressed under the previous four factors. The Service analyzed the potential effects associated with "fragmentation" on the species and its habitat. Specifically, the Service assessed the effects of barriers and small populations and edge effects. (76 FR 14236.) The Service also considered the potential effects of pesticide spraying, OHV use, prolonged drought, and global climate change under this factor, although several of these factors were also identified elsewhere. (*Ibid.*) As to fragmentation, the Service noted that the distribution of the FTHL is divided into four discrete populations; accordingly, the Service assessed the "fragmentation" threat on each of the individual populations, instead of on the population-as-a-whole. (76 FR 14237.) In short, after detailed analysis, the Service concluded that the vast majority of the current distribution of the FTHL occurs in blocks of habitat large enough to support populations greater than 7,000 adults; therefore, small population size is not a threat to the FTHL and the species is not habitat-limited. (76 FR 14251.) The Service also concluded that the various other potential threats assessed under this factor, *i.e.*, pesticide spraying, *etc.*, are not substantial, either individually or in combination. Accordingly, based on its review of the best available scientific and commercial information, the Service found that the FTHL is not threatened by natural or manmade factors affecting its continued existence, either now or in the foreseeable future. (*Ibid.*)

Overview of the Service's 2011 Findings

The FTHL monitoring data on which the Service relied in 2011 is more robust than the data it relied on in its 1993 proposed rule and its earlier withdrawal documents. (76 FR 14251.) This enabled the Service to conclude with increased confidence that FTHL populations in the Management Areas are not low in abundance or declining. Its analysis suggests that occupancy of FTHLs within survey areas is relatively high. (*Ibid.*) The Service's interpretation is that the available population data does not support a conclusion that the species is in danger of extinction, or is likely to become endangered within the foreseeable future. (*Ibid.*) Instead, the Service concluded that the FTHL populations are not small and the species is not habitat-limited in the United States or Mexico at this time, nor does it expect the species to suffer from the deleterious effects of small population size in the foreseeable future. (76 FR 14253.)

The Service also concluded that the effects to the species associated with the implied meaning of fragmentation — that is, the division of the species' populations into smaller populations by the introduction of manmade barriers and the subsequent deleterious effects that may be associated with small population size — are not likely to constitute a substantial threat to the species now or in within the foreseeable future. (76 FR 14252.)

In addition, the Service concluded that within the United States, most of the area occupied by the species is under Federal or State control and overseen by agencies that are signatories to the Interagency Conservation Agreement and associated Rangewide Management Strategy. Although the agreement is voluntary, several signatories — including the BLM — have incorporated aspects of the Rangewide Management Strategy into their planning documents, thus making them less voluntary. (*Ibid.*) Thus, the conservation efforts implemented by signatories of the Interagency Conservation Agreement and associated Rangewide Management Strategy reduce the impact of existing threats in the United States and promote actions that benefit the FTHL throughout its range, including Mexico. (*Ibid.*)

The Service also found that threats to FTHLs associated with development activities are reduced or limited by the Interagency Conservation Agreement and the Rangewide Management Strategy, and by the limited amount of water available in this arid region and the remoteness of much of the habitat.

Finally, the Service considered the species' status relative to the five factors described in the federal Endangered Species Act. The Service carefully assessed the best scientific and commercial data available regarding the past, present, and reasonably anticipated future threats faced by the FTHL. The analysis did not identify threats of imminence, intensity, or magnitude, either individually or in combination, to the extent that the species requires the protection of the Act throughout its range. Further, there is no information to suggest that the FTHL population is declining or is in danger of becoming an endangered species in the foreseeable future. Therefore, the Service concluded that the species is not in danger of extinction or likely to become so within the foreseeable future and is not in need of the protections afforded by the federal Endangered Species Act. (76 FR 14253.)

THE FTHL RANGEWIDE MANAGEMENT STRATEGY IS WORKING

As you know, the Flat-tailed Horned Lizard Interagency Coordinating Committee (FTHL ICC) prepared the Flat-tailed Horned Lizard Rangewide Management Strategy (RMS) in 1997, which was subsequently revised in 2003. The purpose of the RMS (as revised) was to secure and manage sufficient habitat to maintain self-sustaining populations of the FTHL in habitat areas. (RMS, at pp. 24 and 47.) The FTHL ICC also became responsible for implementing conservation and management strategies for the FTHL and maintaining extant populations of the

FTHL in perpetuity. As a result, five management areas (MAs) and one research area (RA) were established to protect the species and to serve as long-term monitoring sites. The El Centro Resource Area administers three of these areas: West Mesa MA, East Mesa MA, and Yuha Desert MA. The California Department of Parks and Recreation manages the Octotillo Wells State Off-Highway Vehicle Area (OWSVRA) as an RA and the Borrego Badlands MA. Outside the MAs, the FTHL habitat is protected through previously established habitat management plans.

The FTHL ICC created a population and monitoring program to learn how FTHL populations change (if at all) over time. According to the RMS, determining whether there is a trend requires accurate measurements of populations, then removing "the effects of natural demographic and environmental stochasticity." (RMS, at p. 64.) The RMS states that if a population or distribution decline greater than 30% is detected within any MA, the FTHL ICC would prepare management prescriptions to reverse the trend. That was the "trigger point" established by the FTHL ICC to determine when action was needed.

Multiyear Monitoring (2007-2013) Report on the FTHLs Report No Decline

In June 2015, the Herpetological Conservation & Biology published results of a multiyear study conducted between 2007 and 2013 on the FTHL population within the MAs and RA. The research was obtained by a consortium of individuals, including individuals from the DFW, State Parks, U.S. Fish and Wildlife Service, California Desert District, and the U.S. Bureau of Land Management and can be found on the Internet at the following website address: http://www.herpconbio.org/Volume_10/Issue_1/Leavitt_etal_2015.pdf . For your convenience, a hardcopy is attached for your review and consideration. The primary author of the study is Daniel J. Leavitt, from the Arizona Game and Fish Department (the Leavitt Report).

The FTHL ICC established a monitoring plan to evaluate both demography and occupancy of the FTHL, using the same methods for consistency across in the MAs and RA. The research team selected occupancy plots randomly from several MAs and sampled those plots multiple times during the active season for the FTHL between 2011 and 2013. (Leavitt, at p. 191.) Leavitt's team sampled 100-200 plots per MA six times each summer. For demographic measurements, the research team selected a series of 9 hectare plots based on perceived habitat quality between 2008 and 2013. The demographic plots were surveyed every week-day for two weeks, 10 times per year. The team followed FTHL tracks and other signs of FTHL presence. They marked captured FTHLs measuring 45 millimeters in length and tagged fully grown adults with Passive Integrated Transponders. (Leavitt, at p. 193.) From the data collected the research team developed multiple-season occupancy and demographic models to estimate, among other things, occupancy probability, immigration, emigration, births, and deaths. (Leavitt, at pp. 193-194.)

Between 2007 and 2013, the research team captured 715 FTHL and found no evidence of a population decline greater than 30% during the monitoring period after accounting for natural and stochastic population fluctuations. In addition, the team found less than 1% of the land in the management areas had been disturbed since the creation of the RMS in 1997. (Leavitt, at p. 191.) Most important, the highest occupancy was at the OWSVRA, which suggests that the resource management regime at this park is effective and maintains sufficient "separation" between OHV users and FTHLs. (Leavitt, at p. 197.)

In short, under the applicable candidacy standards, the available data, of which there is plenty, do not support listing the FTHL under the CESA. Given the extensive analysis already conducted under the federal Act, which has been fully vetted by both district courts and the Ninth Circuit Court of Appeals, the Department and the Commission should deny the petition to list the FTHL as threatened or endangered under California law.

Thank you for your consideration.

Very truly yours,

David P. Hubbard
of
Gatzke Dillon & Ballance LLP

From: Heatwole, Nicholas (Nick)
To: Wildlife Management; Julian DeSantiago; John Swett; Laura (Beth) Sabin
Subject: "flat-tailed horned lizard" status review comment
Date: Monday, September 14, 2015 4:39:19 PM

California Department of Fish and Wildlife

Nongame Wildlife Program

Attn: Ms. Laura Patterson

1812 9th Street

Sacramento, CA 95811

Subject: Status review of the flat-tailed horned lizard (*Phrynosoma mcallii*) comment response

Dear Ms. Patterson,

We have received the Public Notice dated August 14, 2015. On behalf of the Bureau of Reclamation, Yuma Area Office, I would like to provide some input regarding the petitioned action related to the flat-tailed horned lizard (*Phrynosoma mcallii* or FTHL) as Endangered under California's Endangered Species Act (CESA). Basically, we are against the petitioned action.

As you are probably already aware, Reclamation is a signer of the Range-wide Management Strategy (RMS) for FTHLs. Reclamation has participated in this effort since conception and is well rehearsed in the management aspects of the RMS. We actively participate in the Management Oversight Group and Interagency Coordinating Committee. We are satisfied with the conservation measures currently in place to protect FTHL and its habitat both in Arizona and in California. Reclamation would prefer that the RMS be the primary source of protection for the FTHL. We believe in the voluntary model of compliance versus the compulsory model. We believe under the compulsory model that more resources will be used.

We also would like to advocate on behalf of one of our largest customers, the Imperial Irrigation District. Under the proposed listing, significant changes to current agreements, plans, and other efforts would need to take place, placing an undue burden on their staff and resources to come into compliance with California's law. We firmly believe that this additional burden will provide no real benefit to the conservation of the lizard, but may have the opposite effect of using resources to comply with the law rather than using those resources to directly benefit conservation.

We have been partners with the Arizona Game and Fish Department (Department) to collect monitoring data. We defer to the Department to provide the data and reports so that we are not duplicating the effort or adding confusion.

If you have any questions regarding our perspective or if you still need the monitoring data that Reclamation has participated in collecting at the Yuma Desert Management Area in Arizona, please contact Mr. Nicholas (Nick) Heatwole by electronic mail at nheatwole@usbr.gov or by telephone at (928-343-8111). Thank you for the opportunity to provide our input.

Sincerely,

Julian DeSantiago, Manager

Environmental Planning and Compliance

Group

--
Nicholas (Nick) Heatwole
Environmental Protection Specialist
United States Bureau of Reclamation
Yuma Area Office
928-343-8111
nheatwole@usbr.gov

September, 14, 2015

California Department of Fish and Wildlife (CDFW)
Nongame Wildlife Program
Attn: Laura Patterson
1812 9th Street
Sacramento, CA 95811

Dear Ms. Patterson

I am writing to provide you with an update to the recent conversations that our staff has had with CDFW staff regarding the Flat-tailed Horned Lizard (FTHL) monitoring at Ocotillo Wells State Vehicular Recreation Area (OWSVRA). It is our understanding that all the monitoring data submitted to the Interagency Coordinating Committee (ICC) as well as the past Tyler Grant (2005) and Ty Gardinar (2005) studies are in the possession of CDFW and that we do not need to submit them.

Although not yet submitted, OWSVRA has completed the 2015 ICC occupancy plots and has not noted any substantial changes in the preliminary data, although this data is still subject to review and analysis by the ICC. We anticipate completing two demographic plots by September 25, 2015 and request to submit the preliminary results of this data to CDFW as part of the information to be evaluated by CDFW staff on September 28, 2015. Therefore we request an extension of the September 14, 2015 deadline by two weeks.

Additionally, the Off-Highway Motor Vehicle Recreation (OHMVR) Division at California State Parks is currently preparing a state and federal planning document (the OWSVRA Plan) and EIS/EIR and will prepare subsequent Trail Management Plans that would address future mitigation that may be required if the FTHL is listed as endangered and will address mitigation and strategies for monitoring FTHL occupancy and viability regardless of whether or not the species is listed. Mitigation in this plan update would be a major component of any future incidental take permit requirement but it is not scheduled to be completed and approved until mid or late 2016.

OWSVRA is an ongoing operation of over 85,000 acres that operates under the OHMVR Act of 2003 and the existing General Plan, written in 1982. Legislative mandates in the OHMVR Act include PRC 5090.35 which requires monitoring and adaptive management to ensure a sustainable habitat and wildlife populations, and PRC 5090.43 which requires provision and enhancement of off-highway vehicle recreation. Approximately 500,000 visitors recreate at OWSVRA annually and visitation has been as high as 1,300,000. Most of our users are families seeking outdoor recreation. It is against the law per Title 14, California Code of Regulations to damage any native plant or harass or injure any animal and our award winning interpretation department works to educate park users about the wildlife present in the park and the need to sustain the desert ecosystems, reaching over 50,000 annually. Since 2011, we have instituted an active restoration program and developed a native plant nursery to enhance the restoration areas.

OWSVRA has a staff of 9 rangers and receives assistance from Cal-Fire and desert lifeguards during the busy season for public safety and emergency services. Emergency personnel and park maintenance help to ensure necessary health and safety services to the park visitors. The Resources Department currently has 2 Environmental Scientists, 2 biologist Environmental Services Interns, three senior parks aides helping with biological surveys, a resources maintenance team, and a cultural resource team. We anticipate hiring another Environmental Scientist in the next month as well. With our active resources team and monitoring program, we have been studying the FTHL in OWSVRA since 2005 and intend to continue to do so into the future, allowing us to note and react to a significant decline, if it should occur.

Please let us know if we can provide you with any additional information and contact Craig Fischer by email (craig.fischer@parks.ca.gov) or phone (760) 767-1084 if you have any additional questions.

Thank you for your attention to this information and we anticipate a continued positive relationship and coordination with CDFW staff.

Sincerely,

Tina Robinson

Tina Robinson, Senior Park and Recreation Specialist
Ocotillo Wells District
Off-Highway Motor Vehicle Recreation Division
California State Parks
5172 Highway 78, Box 10
Borrego Springs, CA 92004

cc: Garratt Aitchison, District Superintendent Ocotillo Wells District
Rick LeFlore, Environmental Program Manager, OHMVR Division

The Bureau of Reclamation - Lower Colorado River Multi-Species Conservation Program Comments in Response to the Status Review of the Flat-Tailed Horned Lizard (*Phrynosoma mcallii*)

As stated in the California Department of Fish and Wildlife Public Notice, dated August 15, 2015, the California Department of Fish and Wildlife is proposing to initiate a status review pursuant to Fish and Game Code section 2074.6 and is soliciting comments on the petitioned action to list the species under the California Endangered Species Act. The species is found within the Lower Colorado River Basin and is a covered species of the Lower Colorado River Multi-Species Conservation Program (LCR MSCP 2004). In accordance with the LCR MSCP, Reclamation has provided protection and benefits to this species since 2005.

The Lower Colorado River Multi-Species Conservation Program (LCR MSCP) has reviewed our records for information regarding the ecology, genetics, life history, distribution, abundance, habitat, the degree and immediacy of threats to reproduction or survival, adequacy of existing management, and recommendations for management for the flat-tailed horned lizard. Below you will find the original request in bold, followed by our response in regular print.

Ecology, Genetics and Life History Information

The LCR MSCP does not have any information to provide on ecology, genetics of life history of the species.

Distribution, Abundance and Habitat Information

Distribution of the flat-tailed horned lizard within the Lower Colorado River Multi-Species Conservation Program (LCR MSCP) planning area.
Only a small portion of the current range of the flat-tailed horned lizard is found in the LCR MSCP planning area in the northeast part of the Lower Colorado River floodplain in Reach 7. Reach 7 encompasses the historic flood plain of the lower Colorado River (LCR) from the Northerly International Boundary south to the Southerly International Boundary (SIB).

The historic range of the flat-tailed horned lizard covers all of Reach 7 within Arizona and a small portion of Reach 6 within California and Arizona. Reach 6 encompasses the historic flood plain of the LCR from Imperial Dam south to the Northerly International Boundary. The Yuma Desert Management Area is the closest management area to the LCR MSCP planning area and is just southeast of the LCR MSCP planning area in Arizona. The other flat-tailed horned lizard management areas are in California well outside the LCR MSCP planning area.

Abundance and Habitat of the flat-tailed horned lizard within the Lower Colorado River Multi-Species Conservation Program (LCR MSCP) conservation areas
The LCR MSCP conducted presence/absence surveys to confirmed flat-tailed horned lizard occupancy at the private properties in California in the Yuha Basin flat-tailed

horned lizard management area and the BLM Yuha Basin Area of Critical Environmental Concern. Data and reports are provided on the enclosed CD. The surveys informed acquisition of 240 acres of land to be conserved for the species.

The Degree and Immediacy of Threats to Reproduction or Survival

The following is a summary of LCR MSCP covered activities and their impacts as assessed in the *Lower Colorado River Multi-Species Conservation Program, Volume I: Programmatic Environmental Impact Statement/Environmental Impact Report (LCR MSCP 2005).*

LCR MSCP covered activities within California:

The Lower Colorado River Multi-Species Conservation Program (LCR MSCP) is a partnership of Federal and non-Federal stakeholders that was created to respond to the need to balance the use of lower Colorado River (LCR) water resources and the conservation of native species and their habitats in compliance with the Endangered Species Act (ESA). This is a long-term (50-year) plan to conserve at least 26 species along the LCR from Lake Mead to the Southerly International Boundary with Mexico through implementation of a Habitat Conservation Plan (HCP), including the flat-tailed horned lizard.

Under this long-term program, current water diversions and power production within the historic floodplain of the Colorado River will be accommodated, and opportunities for future water and power development will be optimized to the extent consistent with the law. This includes Delivery and Diversion of 9 million acre feet of water per year, moving of 1.574 million acre feet of additional water per year, and maintenance of the infrastructure to manage the river and deliver water and power.

The comprehensive program addresses future Federal agency consultation needs under Section 7 of the ESA and non-Federal agency needs for endangered species incidental take authorization under Section 10 of the ESA. The program also allows California agencies to meet their obligations under California State law for the California Endangered Species Act (CESA).

Implementing the LCR MSCP will create at least 8,132 acres of new habitat (5,940 acres of cottonwood-willow, 1,320 acres of honey mesquite, 512 acres of marsh, and 360 acres of backwater) and produce 660,000 subadult razorback suckers and 620,000 bonytail to augment the existing populations of these fish in the LCR. LCR MSCP staff may also participate in the recovery programs for these fish by funding other appropriate activities in lieu of stocking. In addition, there is a substantial research and monitoring component to the program. Under the program, a $25 million fund was established to support projects implemented by land use managers to protect and maintain existing habitat for covered species.

For more detailed information on the LCR MSCP and covered activities please refer to the LCR MSCP EIS/EIR (LCR MSCP 2004a), LCR MSCP Habitat Conservation Plan (LCR MSCP 2004b), and the LCR MSCP Biological Assessment (LCR MSCP 2004c).

> http://www.lcrmscp.gov/publications/hcp_volii_dec04.pdf
> http://www.lcrmscp.gov/publications/voliii_biol_assessment.pdf
> http://www.lcrmscp.gov/publications/voli_env_impact_st_dec04.pdf

Impacts of Flow-related Covered Activities:
Flow-related activities are unlikely to result in take of the flat-tailed horned lizard as they will not affect the desert scrub communities inhabited by the flat-tailed horned lizard.

Impacts of Non-flow Covered Activities:
Non-flow Covered Activities in California are not anticipated in flat-tailed horned lizard habitat.

Activities in Arizona associated with maintaining the 242 Well Field and Lateral near the SIB may directly and indirectly affect the species. Activities to maintain the 242 well fields include controlling weeds, cleaning the lateral, grading and graveling access roads, and repairing or replacing infrastructure. Operation of vehicles and other equipment to implement these activities could result in direct mortality or harassment of individual lizards. Operation of equipment can crush lizards in underground burrows or on the surface in locations where maintenance activities are undertaken, or lizards present along roadways may be struck by vehicles.

Other maintenance activities, restoration activities, and replacement of facilities and infrastructure in Arizona flat-tailed horned lizard habitat may result in harassment and mortality of individuals and removal of small amounts of suitable habitat. These activities are expected to result in low level take over the term of the LCR MSCP.

Non-flow related activities may result in conversion of lands to agriculture in Reaches 6 and 7 in Arizona. Conversion of lands to agriculture would remove habitat, and operation of equipment necessary to convert lands and farm fields would result in harassment and the mortality of the individuals. This species inhabits sites that support sparsely vegetated fine sands. The extent of habitat loss is estimated to be up to 10 percent of the total extent of desert scrub and riparian land cover types that would be converted to agricultural uses in Reaches 6 and 7. Up to 1,280 acres of desert scrub and riparian land cover could be converted to agricultural uses; therefore, based on this assumption, up to 128 acres of flat-tailed horned lizard habitat could be removed by these activities.

Impacts LCR MSCP Implementation activities:

Activities associated with establishing and managing LCR MSCP created covered species habitat may result in take of flat-tailed horned lizard. To the extent practicable, construction of new infrastructure that may be required to establish and maintain conservation areas in Reaches 6 and 7 would be designed to avoid flat-tailed horned lizard habitat. However, harassment and mortality of individuals could be associated with habitat establishment and maintenance activities (e.g., operation of vehicles and equipment). These activities, therefore, could result in a low level take.

Adequacy of Existing Management:

Conservation Measures for the flat-tailed horned lizard

The LCR MSCP programmatic biological opinion and Section 10 permit cover the impacts of LCR MSCP actions and activities on 7 listed and 19 unlisted covered species and 5 evaluation species for a 50 year period (2005-2055). The flat-tailed horned lizard was included as a covered species. Covered species have been treated in the LCR MSCP Habitat Conservation Plan as if they are listed species. Impacts were assessed and conservation measures identified and implemented.

There are two LCR MSCP conservation measures associated with the flat-tailed horned lizard.

FTHL1. Consistent with the mitigation measures identified in the *Flat-tailed Horned Lizard Rangewide Management Strategy* the LCR MSCP will acquire and protect 230 acres of unprotected occupied flat-tailed horned lizard habitat. The acquired habitat will be transferred to an appropriated management agency for permanent protection of habitat for this species.

This conservation measure is complete. Reclamation purchased two privately owned parcels totaling 240 acres adjacent to the Yuha Basin flat-tailed horned lizard management area and within the BLM Yuha Basin Area of Critical Environmental Concern. Land ownership was transferred to the BLM. Presence-absence surveys for the flat-tailed horned lizard were conducted within the entire area to determine occupancy. Three adult flat-tailed horned lizards were documented during the surveys. Photos were taken and identification to species was confirmed by the flat-tailed horned lizard interagency coordinating committee.

FTHL 2. Reclamation will continue to implement measures to avoid or minimize taken of flat-tailed horned lizard. These measures will include worker education programs and other procedures as described in the 1997 biological opinion to for Reclamation’s operation of the lower Colorado River and are in accordance with the 2003 Flat-tailed Horned lizard Interagency Coordinating Committee recommendations for the species.

When conducting activities covered by the LCR MSCP; Reclamation and its partners follow minimization measures and worker education program recommended in the 1997 and 2003 *Flat-tailed Horned Lizard Rangewide Management Strategy*.

Recommendations:

The LCR MSCP recommends that the worker education minimization measure in the *Flat-tailed Horned Lizard Rangewide Management Strategy* continue to be implemented within the LCR MSCP planning area. Since the conservation measures to offset the impacts of LCR MSCP covered activities have already been implemented, we do not recommend additional management actions within the LCR MSCP planning area.

Enclosed Documents

Attached to this email are the following documents associated with Reclamation's purchase of the two privately owned parcels near the Yuha Basin Flat-tailed Horned Lizard Management Area and the presence/absence surveys that confirmed flat-tailed horned lizard occupancy.

- The final report for the LCR MSCP flat-tailed horned lizard presence/absence surveys
- Data sheets for the presence/absence surveys
- Tables of raw data for the presence/absence surveys
- GIS data and associated meta data for the presence/absence surveys
- Photos of the three flat-tailed horned lizards detected during the presence/absence surveys
- The United States Fish and Wildlife Service Concurrence letter that the LCR MSCP completed conservation measure FTHL1

Literature Cited

Additional information regarding LCR MSCP habitat creation accomplishments and assessment of impacts is available at **www.lcrmscp.gov**.

Flat-tailed Horned Lizard Interagency Coordinating Committee. 2003. *Flat-tailed Horned Lizard Rangewide Management Strategy, 2003 revision*. 80 pp. plus appendices.

Lower Colorado River Multi-Species Conservation Program. 2004a. *Lower Colorado River Multi-Species Conservation Program, Volume I: Programmatic Environmental Impact Statement/Environmental Impact Report.* December 17. (J&S 00450.00.) Sacramento, CA.

Lower Colorado River Multi-Species Conservation Program. 2004b. *Lower Colorado River Multi-Species Conservation Program, Volume II: Habitat Conservation Plan.* Final. December 17. (J&S 00450.00.) Sacramento, CA

Lower Colorado River Multi-Species Conservation Program. 2004c. *Lower Colorado River Multi-Species Conservation Program, Volume III. Biological Assessment.* Final. December 17. (J&S 00450.00.) Sacramento, CA.

APPENDIX 5. External Peer Review Solicitation Letters

State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Wildlife Branch
1812 Ninth Street
Sacramento, CA 95814
www.wildlife.ca.gov

EDMUND G. BROWN JR., Governor
CHARLTON H. BONHAM, Director

June 22, 2016

Cameron Barrows
University of California Riverside
Center for Conservation Biology
Room 228
75-080 Frank Sinatra Dr.
Palm Desert, CA 92211
Cameron.Barrows@unr.edu

Dear Cameron Barrows:

SUBJECT: FLAT-TAILED HORNED LIZARD (PHRYNOSOMA MCALLII); DEPARTMENT OF FISH AND WILDLIFE, PEER REVIEW STATUS REPORT

Thank you for agreeing to serve as a scientific peer reviewer for the Department of Fish and Wildlife's (Department) Draft Status Review of the Flat-tailed Horned Lizard (*Phrynosoma mcallii*). A copy of this report, dated June 21, 2016, is enclosed for your use in that review. The Department seeks your expert analysis regarding the scientific validity of the report and its assessment of the status of Flat-tailed Horned Lizards in California. **The Department would appreciate receiving your peer review input on or before July 22, 2016.**

The Department seeks your review as part of formal proceedings pending before the California Fish and Game Commission (Commission) under the California Endangered Species Act (CESA). As you may know, the Commission, as a constitutionally established entity distinct from the Department, exercises exclusive statutory authority under CESA to add species to the state lists of endangered and threatened species (Fish & G. Code, § 2070). The Department serves in an advisory capacity during listing proceedings, charged by the Fish and Game Code to use the best scientific information available to make related recommendations to the Commission (Fish & G. Code, § 2074.6).

The Commission first received the petition to list the Flat-tailed Horned Lizard as endangered on June 10, 2014. (Cal. Reg. Notice Register 2014, No. 28-Z, p. 1238). The Commission published notice of its acceptance of the petition for further consideration and formal designation of the Flat-tailed Horned Lizard as a candidate species on March 6, 2015. (Cal. Reg. Notice Register 2015, No. 10–Z, p. 410).

The draft report forwarded to you today reflects the Department's effort to identify and analyze the scientific information available regarding the status of the Flat-tailed Horned Lizard in California. At this time, the Department believes the available science indicates that listing the Flat-tailed Horned Lizard as endangered under CESA (i.e., the petitioned action) is not warranted; however, it remains undecided whether the species meets the definition of threatened. An endangered species is defined as " a native species or subspecies...which is in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, overexploitation, predation, competition, or disease" (Fish and G. Code, § 2062). A threatened species is defined as "a native species or subspecies...that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of the special protection and management efforts required by [CESA]" (Fish and G. Code, § 2067). We underscore that scientific peer review plays a critical role in the Department's effort to develop and finalize its listing recommendation to the Commission as required by the Fish and Game Code.

Because of the importance of your effort, we ask you to focus your review on the scientific information available regarding the status of Flat-tailed Horned Lizard in California. As with our own effort to date, your peer review of the science and analysis regarding each of the listing factors prescribed in CESA (Cal. Code Regs., Tit. 14, § 670.1(i)(1)(A)) (i.e., present or threatened habitat modification, overexploitation, predation, competition, disease, and other natural occurrences or human-related activities that could affect the species) is particularly important.

Please note that the Department releases this peer review report to you solely as part of the peer review process, and it is not yet public.

For ease of review, I invite you to use "Track Changes" in Microsoft Word, or provide comments in list form by page number, section header, and paragraph. Please submit your comments electronically to Laura Patterson at Laura.Patterson@wildlife.ca.gov, or at the address in the letterhead above. If you have any questions, you may reach her by telephone at (916) 341-6981.

If there is anything the Department can do to facilitate your review, please let me know. Thank you again for your contribution to the status review effort and the important input it provides during the Commission's related proceedings.

Sincerely,

Kari Lewis, Acting Chief,
Wildlife Branch
Wildlife and Fisheries Division

Enclosure

ec: Department of Fish and Wildlife

Karen Miner, Nongame Wildlife Program Manager
Wildlife Branch
Wildlife and Fisheries Division
Karen.Miner@wildlife.ca.gov

Laura Patterson, Senior Environmental Scientist (Specialist)
Wildlife Branch
Wildlife and Fisheries Division
Laura.Patterson@wildlife.ca.gov

State of California – Natural Resources Agency
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EDMUND G. BROWN JR., Governor
CHARLTON H. BONHAM, Director

June 22, 2016

Rob Lovich
Naval Facilities Engineering Command SW
Desert Integrated Product Team
1220 Pacific Highway
San Diego, CA 92132
Robert.Lovich@navy.mil

Dear Rob Lovich:

SUBJECT: FLAT-TAILED HORNED LIZARD (PHRYNOSOMA MCALLII); DEPARTMENT OF FISH AND WILDLIFE, PEER REVIEW STATUS REPORT

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Sincerely,

Kari Lewis

Kari Lewis, Acting Chief
Wildlife Branch
Wildlife and Fisheries Division

Enclosure

ec: Department of Fish and Wildlife

Karen Miner, Nongame Wildlife Program Manager
Wildlife Branch
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Laura Patterson, Senior Environmental Scientist (Specialist)
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June 22, 2016

Jim Rorabaugh
P.O. Box 31
Saint David, AZ 85630
jrorabaugh@hotmail.com

Dear Jim Rorabaugh:

SUBJECT: FLAT-TAILED HORNED LIZARD (PHRYNOSOMA MCALLII); DEPARTMENT OF FISH AND WILDLIFE, PEER REVIEW STATUS REPORT

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Sincerely,

Kari Lewis

Kari Lewis, Acting Chief
Wildlife Branch
Wildlife and Fisheries Division

Enclosure

ec: Department of Fish and Wildlife

Karen Miner, Nongame Wildlife Program Manager
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EDMUND G. BROWN JR., Governor
CHARLTON H. BONHAM, Director

June 22, 2016

Kevin Young
Biology Department
Sul Ross State University
205 Wildcat Drive
Del Rio, TX 78840
flattail@gmail.com

Dear Kevin Young:

SUBJECT: FLAT-TAILED HORNED LIZARD (PHRYNOSOMA MCALLII); DEPARTMENT OF FISH AND WILDLIFE, PEER REVIEW STATUS REPORT

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Please note that the Department releases this peer review report to you solely as part of the peer review process, and it is not yet public.

For ease of review, I invite you to use "Track Changes" in Microsoft Word, or provide comments in list form by page number, section header, and paragraph. Please submit your comments electronically to Laura Patterson at Laura.Patterson@wildlife.ca.gov, or at the address in the letterhead above. If you have any questions, you may reach her by telephone at (916) 341-6981.

If there is anything the Department can do to facilitate your review, please let me know. Thank you again for your contribution to the status review effort and the important input it provides during the Commission's related proceedings.

Sincerely,

Kari Lewis, Acting Chief
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Enclosure

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APPENDIX 6. External Peer Review Comments

External peer review comments to the June 2016 draft of the document are presented in the order they were received.

Cameron Barrows: July 1, 2016

Kevin Young: July 15, 2016

Jim Rorabaugh: July 22, 2016

Flat-tailed Horned Lizard MOG/ICC: July 29, 2016

STATE OF CALIFORNIA
NATURAL RESOURCES AGENCY
DEPARTMENT OF FISH AND WILDLIFE

REPORT TO THE FISH AND GAME COMMISSION
A STATUS REVIEW OF THE
FLAT-TAILED HORNED LIZARD
(*PHRYNOSOMA MCALLII*) IN CALIFORNIA

CHARLTON H. BONHAM, DIRECTOR
CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

September 2016

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[Note to readers: This section will be completed after external peer review.]

EXECUTIVE SUMMARY

[Note to readers: This section will be completed after external peer review.]

REGULATORY FRAMEWORK

Petition Evaluation Process

"A Petition to List the Flat-tailed Horned Lizard (*Phrynosoma mcallii*) as Endangered ~~Under~~ under the California Endangered Species Act" (Petition) was submitted to the Fish and Game Commission (Commission) on June 10, 2014 by the Center for Biological Diversity. Commission staff transmitted the Petition to the Department of Fish and Wildlife (Department) pursuant to Fish and Game Code section 2073 on June 12, 2014, and published a formal notice of receipt of the Petition on July 11, 2014 (Cal. Reg. Notice Register 2014, No. 28-Z, p. 1238). The Department's charge and focus in its advisory capacity to the Commission is scientific. A Petition to list or delist a species under the California Endangered Species Act (CESA) must include "information regarding the population trend, range, distribution, abundance, and life history of a species, the factors affecting the ability of the population to survive and reproduce, the degree and immediacy of the threat, the impact of existing management efforts, suggestions for future management, and the availability and sources of information. The Petition shall also include information regarding the kind of habitat necessary for species survival, a detailed distribution map, and other factors the Petitioner deems relevant." (Fish & G. Code, § 2072.3.)

On September 30, 2014, the Department provided the Commission with its evaluation of the Petition, "Evaluation of the Petition from the Center for Biological Diversity to List the Flat-Tailed Horned Lizard (*Phrynosoma mcallii*) as Endangered Under the California Endangered Species Act" (Evaluation), to assist the Commission in making a determination as to whether the petitioned action may be warranted based on the sufficiency of scientific information. (Fish & G. Code, §§ 2073.5 & 2074.2; Cal. Code Regs., tit. 14, § 670.1, subds. (d) & (e).) Focusing on the information available to it relating to each of the relevant categories, the Department recommended to the Commission that the Petition be accepted.

At its scheduled public meeting on February 12, 2015, in Sacramento, California, the Commission considered the Petition, the Department's Evaluation and recommendation, and comments received. The Commission found that sufficient information existed to indicate the petitioned action may be warranted and accepted the Petition for Consideration. Upon publication of the Commission's notice of its findings, Flat-tailed Horned Lizard was designated a candidate species on March 6, 2015 (Cal. Reg. Notice Register 2015, No. 10-Z, p. 410).

Status Review Overview

The Commission's action designating the Flat-Tailed Horned Lizard as a candidate species triggered the Department's process for conducting a status review to inform the Commission's decision on whether to list the species. At its scheduled public meeting on February 11, 2016, in Sacramento, California, the Commission granted the Department a six-month extension to facilitate external peer review.

This written status review report, based upon the best scientific information available and including independent peer review of the draft report by scientists with expertise relevant to Flat-tailed Horned Lizard, is intended to provide the Commission with the most current information available on the Flat-tailed Horned Lizard and to serve as the basis for the Department's recommendation to the Commission on whether the petitioned action is warranted. The status

review report also presents preliminary identification of habitat that may be essential to the continued existence of the species and provides management recommendations for recovery of the species. (Fish & G. Code, § 2074.6.). Receipt of this report is to be placed on the agenda for the next available meeting of the Commission after delivery. At that time, the report will be made available to the public for a 30-day public comment period prior to the Commission taking any action on the Department's recommendation.

Existing Regulatory Status

The Flat-tailed Horned Lizard was the subject of a previous CESA listing petition. Dr. Wilbur Mayhew and Ms. Barbara Carlson of the University of California at Riverside petitioned the Commission to list the Flat-tailed Horned Lizard as an endangered species under CESA on January 25, 1988. Consistent with the Department's recommendation, the Commission designated the Flat-tailed Horned Lizard as a candidate species for CESA listing on May 13, 1988. After completing the status review, the Department recommended listing the species as threatened; however, on June 22, 1989, the Commission voted against the proposed listing, citing insufficient scientific information on population densities.

The Flat-tailed Horned Lizard also has a listing history under the federal Endangered Species Act (ESA). The United States Fish and Wildlife Service (USFWS) initially proposed to list the species as threatened under the ESA in 1993 (USFWS 1993); however, its determination was delayed in part due to Public Law No. 104-6, 109 Stat. 73, enacted in 1995, which placed a moratorium on new species' listings and critical habitat designations under the ESA. The moratorium was lifted in 1996. In 1997, the Department of the Interior Secretary was sued to compel the USFWS to make a listing determination within 60 days, at which point the USFWS withdrew its proposed listing (USFWS 1997). That decision sparked numerous additional court cases, the primary issue of each centered on whether or not the USFWS sufficiently analyzed Flat-tailed Horned Lizard population viability across its entire range. After multiple court-ordered re-evaluations, the USFWS withdrew its proposed rule to list, most recently in 2011 (USFWS 2003, 2006, 2011). One of the contributing factors in the USFWS's decisions not to list the Flat-tailed Horned Lizard was the development of an Interagency Conservation Agreement, signed by multiple federal and state agencies tasked with managing most of the species' habitat in the U.S., and the creation and implementation of a Rangewide Management Strategy (RMS) for the species.

The Flat-tailed Horned Lizard is listed as a Species of Special Concern (SSC) by the Department and as a Sensitive Species by the U.S. Bureau of Land Management (BLM). The Department's SSC designation is administrative and is intended to alert biologists, land managers, and others to a species' declining or at-risk status, to encourage additional management considerations for these species to ensure population viability, and to preclude the need for listing under CESA. SSCs are defined as species, subspecies, or distinct populations of an animal native to California that currently satisfies one or more of the following (not necessarily mutually exclusive) criteria: is extirpated from the State within the recent past; is listed under ESA (but not CESA) as threatened or endangered or meets the State's definition of threatened or endangered but has not been formally listed; is experiencing, or formerly experienced, serious (noncyclical) population declines or range retractions (that have not been reversed), which if continued or resumed, could qualify it for threatened or endangered status

under CESA; has naturally small populations and/or range size and exhibits high susceptibility to risk from any factor(s) that, if realized, could lead to declines that would qualify it for threatened or endangered status (Thomson et al. 2016).

Neither of these administrative designations provides the species with formal regulatory status like the ESA or CESA (see Existing Management section); however, the RMS requires conservation measures, including compensatory mitigation, for surface disturbance within the five Flat-tailed Horned Lizard Management Areas (MA) established through the RMS (Figure 1). There are four MAs within California (Borrego Badlands, West Mesa, Yuha Basin, and East Mesa) that comprise approximately 21% of the species' range in the State (using the Department's range map), as well as one Research Area (RA; Ocotillo Wells State Vehicular Recreation Area). Collectively, the MAs and RA will be referred to as the "RMS areas" in this status review. More information on the protections afforded and efforts aimed at conserving the Flat-tailed Horned Lizard, including monitoring the species' distribution through occupancy studies and its trends in abundance through demography surveys, is provided in the Status and Trends in California and Existing Management sections.

BIOLOGY AND ECOLOGY

Species Description

The Flat-tailed Horned Lizard, like all horned lizards in the genus *Phrynosoma*, has a dorsoventrally flattened body with spiny scales, including head spines or "horns," and cryptic coloration, ranging from pale gray to light rust brown, which closely matches the substrate on which it lives. The Flat-tailed Horned Lizard has multiple diagnostic traits that distinguish it from other *Phrynosomids*, including a distinctive dark dorsal stripe down its midline with a ~~serious~~ series of dark spots on either side; long, sharp occipital horns; a prominent umbilical scar on an otherwise unspotted white or cream venter; and, as its name suggests, a relatively long broad flattened tail (Funk 1981, Muth and Fisher 1992, Sherbrooke 2003, Young and Young 2000). Flat-tailed horned lizards also possess two lateral fringe scale rows and lack external ear openings (Funk 1981, Johnson and Spicer 1985). Adults typically range in size from 57-84 mm (2.2-3.3 in) snout-to-vent length (i.e., excluding tail length), while hatchlings are about 35-38 mm (1.4-1.5 in) (Howard 1974).

Taxonomy

Flat-tailed Horned Lizards (Class Reptilia, Order Squamata) belong to the Family Phrynosomatidae, a large and diverse group that, in addition to horned lizards, includes zebra-tailed, earless, rock, spiny, fringe-toed, tree, brush, and side-blotched lizards. Hallowell (1852) classified the species as *Anota m'callii*, but the current species classification is *Phrynosoma mcallii* (Crother et al. 2012). The genus *Phrynosoma* consists of a unique group of lizards known commonly as horned lizards or colloquially as horned toads (in Greek *phrynos* = toad and *soma* = body). This group, compared to other lizards, is characterized by strongly dorsoventrally flattened bodies; sharp spines; a reluctance to run when approached; long activity period; more variable body temperatures; a specialized, often ant-rich, diet; and specialized dentition that facilitates ant-eating (Pianka and Parker 1975).

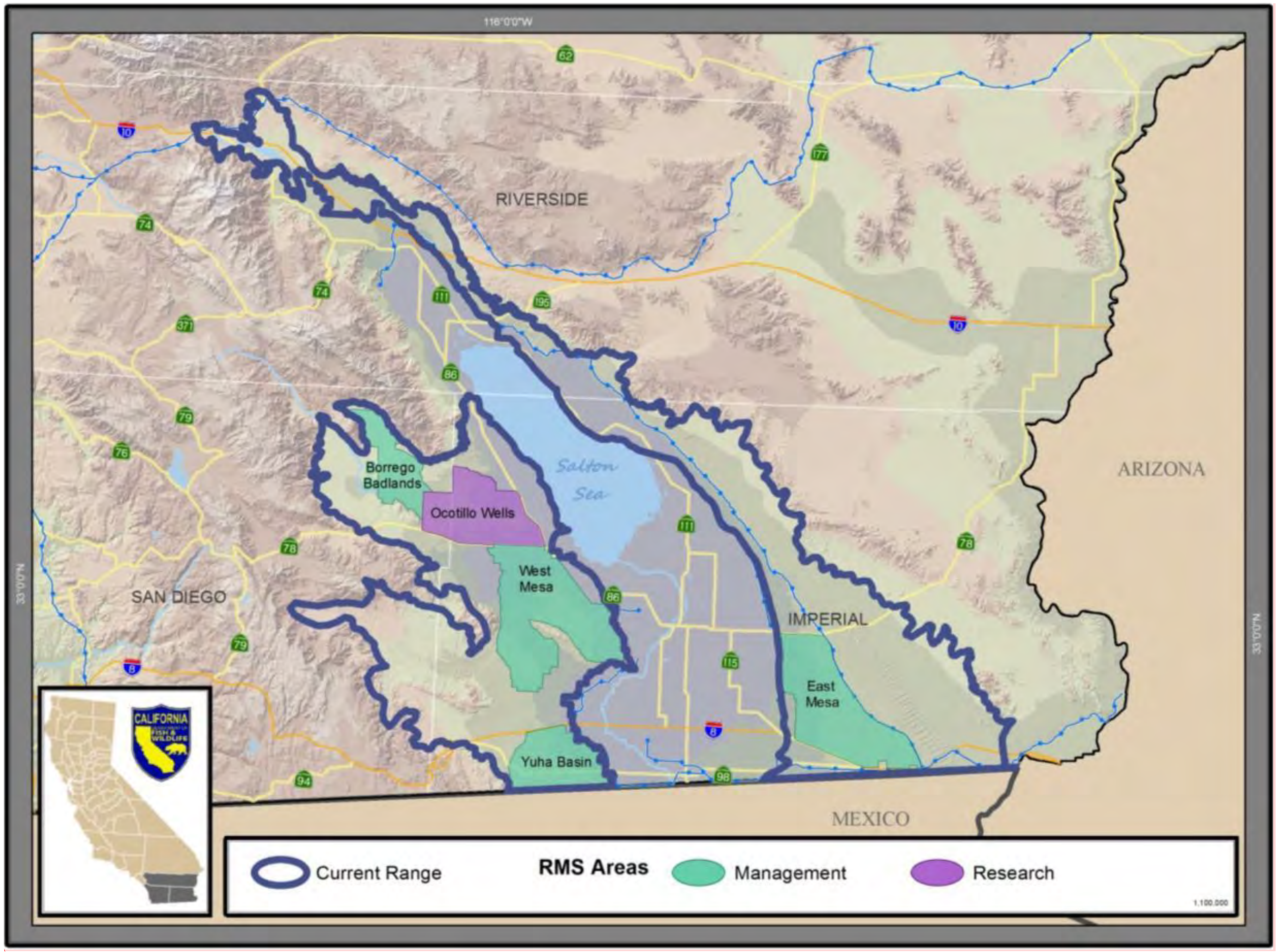


Figure 1. Flat-tailed Horned Lizard RMS Areas in California

Comment [CB1]: For each of the maps I've seen so far the delineated current range is not correct, it's a range that was likely true in the 1970-1980s but certainly not for today. Whichever direction the Commission goes on this decision, they need accurate information. Ideally what should be shown is 1) a historic range, which based on the genetics work to date must have been continuous until the recent past; 2) a range that reflects the agricultural development of the 1900s and a moderate level of city development – essentially the "current range" map you show here, and then 3) what is more likely a truer representation of the current range. The clusters of points in Figure 3 are a much more accurate depiction of the current range, with the large areas with no points either no longer supporting flat-tails, or at low, arguably unsustainable levels, or at least potentially no longer occupied. It would be disingenuous to indicate that there hasn't been significant habitat loss and continued habitat loss over the past decades. At least for the northern distribution (north of San Diego-Imperial Counties) I can assure you that the habitat loss has been upwards of >95% since the 1970s. Losses have occurred in the south as well, and will continue as renewable energy development expands. As I stated before the current map reflects that 1970s condition. Good, accurate maps are what the Commission will depend upon for making their decision.

Genetics

Phylogenetic relationships of *Phrynosomids* are not well understood (Leaché and McGuire 2006, Mulcahy et al. 2006). There are no recognized subspecies of Flat-tailed Horned Lizards (Crother et al. 2012), but two major clades east and west of the Colorado River have been revealed through genetic analyses (Culver and Dee 2008, Mulcahy et al. 2006). The western clade is predominantly located in California and shows signs of genetic differentiation among regions when mitochondrial DNA is used (Mulcahy et al. 2006); however, there was no evidence of genetic differentiation among the California populations using microsatellite data (Culver and Dee 2008). Mulcahy et al. (2006) determined that the populations east and west of the Imperial Valley, currently separated by urban and agricultural development, are significantly differentiated, although the data suggest that gene flow was limited prior to this anthropogenic change in landscape. While the Coachella Valley population and the population west of the Imperial Valley are also separated by urban and agricultural development, they are not significantly genetically differentiated from each other (Ibid.). Hybrids with morphological characters that are intermediate between Flat-tailed Horned Lizards and Desert Horned Lizards (*P. platyrhinos*) have been reported from near Ocotillo, California (Stebbins 2003) and between Flat-tailed Horned Lizards and Goode's Horned Lizards (*P. goodei*) from near Yuma, Arizona (Mulcahy et al. 2006).

Comment [CB2]: This divergence in findings between Mulcahy, and Culver and Dee, regarding the level of genetic differentiation on each side of the Imperial County agricultural lands is critical. I am no geneticist, but I believe micro-satellite evidence should reveal finer-scale differences if they exist. A recent paper by Vandergast et al. (I am a co-author) found very rapid (10 year) genetic separation in the now fragmented populations of Coachella Valley fringe-toed lizards – using micro-satellites. If Culver and Dee found none for the flat-tails in Imperial County, then either there isn't any, or there were methodological errors. Assuming no errors – it is a peer reviewed paper – then I would assume that there has been little if any genetic differentiation despite the historic habitat fragmentation. Regardless, until this is resolved I don't think one could ignore Culver and Dee and use only Mulcahy to support a pre agricultural development separation of the two flat-tailed populations. It then follows that the agricultural lands and associated hyper salinity of the regions to the north and south of the Salton Sea represent anthropogenic habitat losses for this species.

Geographic Range and Distribution

The Flat-tailed Horned Lizard has the smallest range of any horned lizard found within the United States and has among the smallest ranges of all horned lizards (Sherbrooke 2003). The species is restricted to southeastern California, the extreme southwestern portion of Arizona, and the adjacent portions of northeastern Baja California Norte and northwestern Sonora, Mexico (Funk 1981). The majority of the species' range is within Mexico, while the majority of the U.S. range is within California (USFWS 2011). In California, Flat-tailed Horned Lizards are distributed throughout much of the Salton Trough, in sections of eastern San Diego County, central Riverside County, and western and south-central Imperial County. Flat-tailed Horned Lizards are most frequently found below 230 m (750 ft) in elevation, although they have been reported up to 520 m (1,700 ft) above sea level (Turner et al. 1980). Figure 2 shows the Department's approximation of the Flat-tailed Horned Lizard's current range (referred to as "Current CDFW Range" in map legends), based on aerial imagery interpretation of disturbed lands (e.g., urban and agricultural areas), soil types, elevation, and slope compared to the historical range boundary from the RMS (FTHLICC 2003). Figure 3 shows the distribution of Flat-tailed Horned Lizard observations, categorized by date.

Growth, Reproduction, and Survival

Flat-tailed horned lizards have relatively long active periods, on average 277 days/year, without any prolonged periods of inactivity or aestivation (Muth and Fisher 1992), providing them plenty of time to grow and seek mates when conditions are favorable. Hibernation usually begins on average in mid-November but can range from October through December (Grant and Doherty 2009, Muth and Fisher 1992, Wone and Beauchamp 2003), although some individuals, particularly juveniles, remain active in the winter (Muth and Fisher 1992). Muth and Fisher (1992) speculate that juveniles may not have the fat reserves to get through winter without

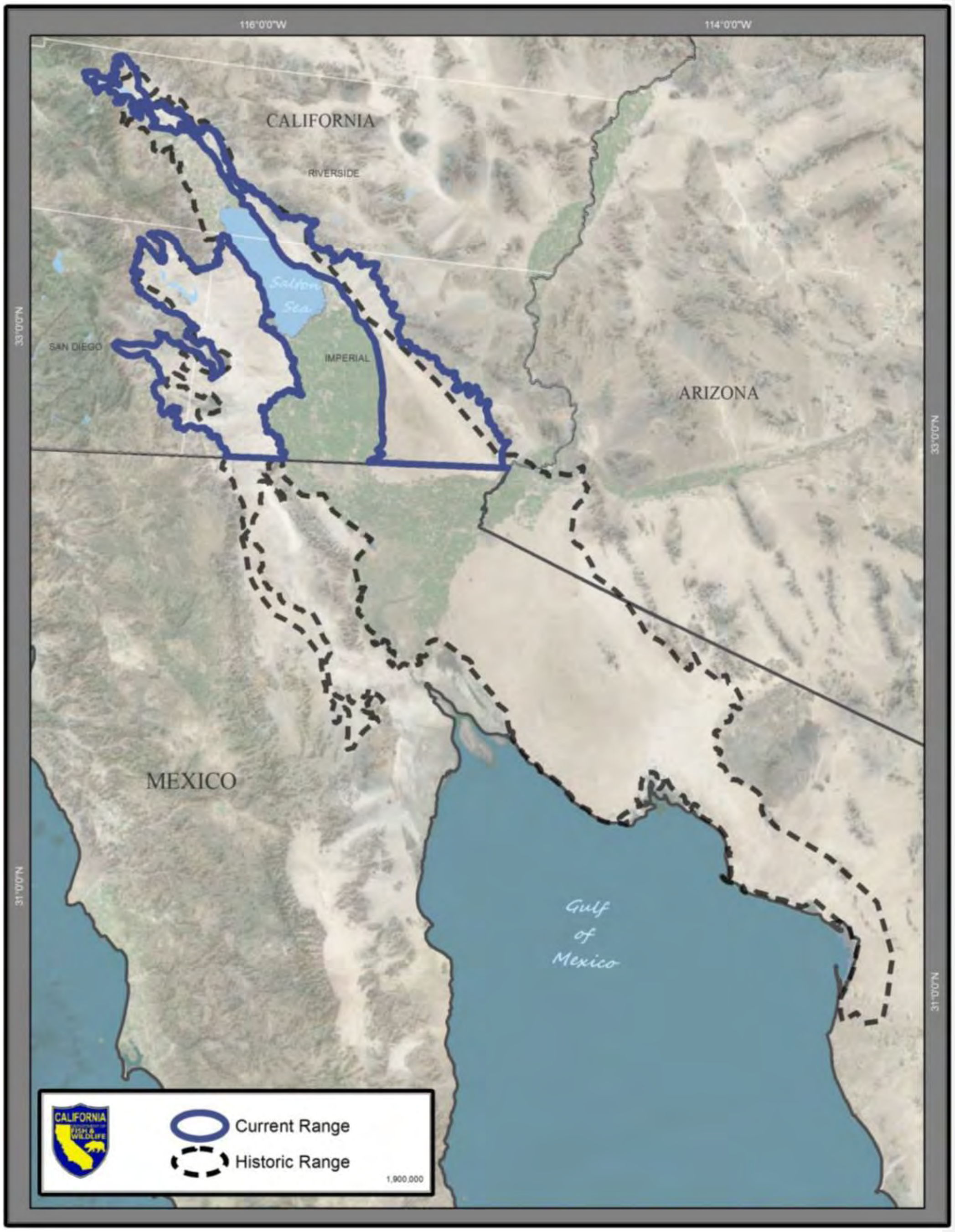


Figure 2. Flat-tailed Horned Lizard Current and Historic Range

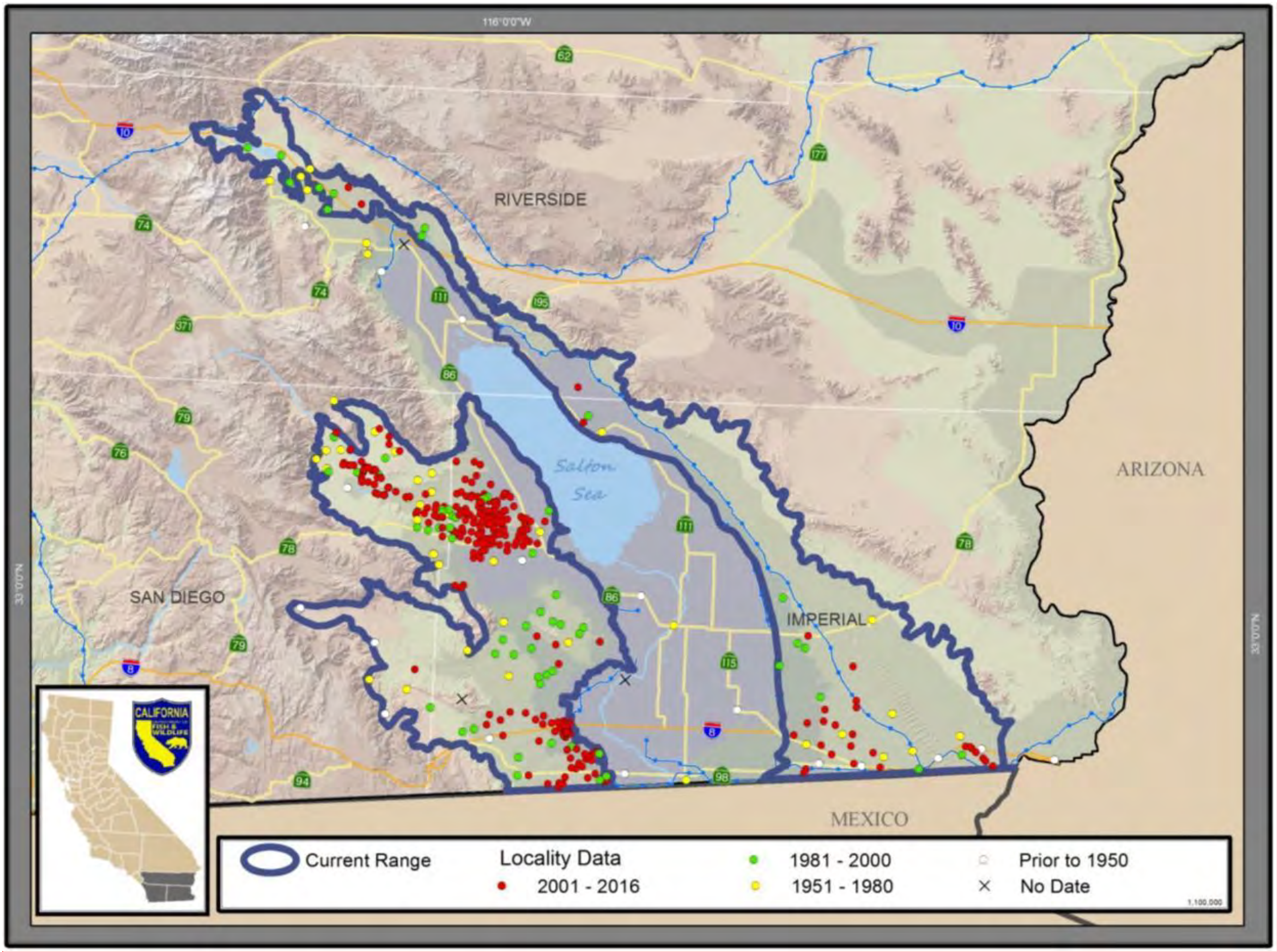


Figure 3. Flat-tailed Horned Lizard Observations in California

Comment [CB3]: Unless there are known biases for these location points, they may represent the best available knowledge for the current flat-tailed horned lizard distribution in California. The concentration of points around Ocotillo Wells indicates a sampling bias, but the other points appear to have a more random, less biased distribution. The white, pre-1950 points may have some location errors, but taken at face value they clearly show occupancy in areas that are no longer suitable and/or are not currently occupied, including current agriculture and areas of current too saline habitats. I would be tempted to draw polygons around the point clusters, making the assumption that the lizards are not occupying new habitats. So white+yellow+green+red would give an approximation of a historic distribution. Yellow+green+red would be a 1950s-1970s distribution, green+red would be a 1980s-1990s distribution, and red would be a 2000's distribution. The large gaps between points should be assumed to be no longer occupied unless the habitat is fully intact (it's not in Riverside County). Isolated points Such as those in Riverside County and southeastern San Diego County might be buffered by perhaps a km and assumed to be isolated fragmented populations until shown otherwise. Those in Riverside County are most definitely isolated and fragmented populations. Those polygons would then represent hypotheses of habitat loss and presented as hypotheses, not as absolute truth – until validated or refuted. Such a map would catalyze more searching in areas presumed to be no longer occupied (due to the lack of recent records) and so over time an increasingly accurate distribution map would emerge.

Beyond informing the Commission, such a map could guide energy development – hopefully away from occupied flat-tail habitat.

feeding, or they may remain active to attain the minimum reproductive size (60-66 mm, 2.4-2.6 in) (Howard 1974, Root 2010) as quickly as possible. Time of emergence is variable and can range from December to April, but averages in February (Mayhew 1965, Wone and Beauchamp 2003). When surface temperatures reach 50°C (122ºF), most Flat-tailed Horned Lizards will retreat into rodent or self-constructed burrows, although Young and Young (2000) observed them at surface temperatures of 55°C (131ºF).

Flat-tailed Horned Lizards are oviparous (egg-laying) and early maturing (FTHLICC 2003). They are generally capable of mating upon emergence from hibernation, and females may be able to produce two separate clutches of eggs (Howard 1974, Muth and Fisher 1992, Turner and Medica 1982). Several researchers report that the first hatchlings appear mid to late July, while a second set appears from late August through October (Ibid.). In dry years, females may only produce a single clutch that does not hatch until late August or September (Setser 2001, Young and Young 2000). It is also possible that females do not lay multiple clutches, but rather different individuals lay at distinct times throughout the active period (Young and Young 2000).

Gravid females deposit their eggs in deep burrows over a period of two to four days (Young and Young 2000). Nests depths are variable depending on substrate and weather conditions (observed range: 14-90 cm, 5.5-35.4 in) but are deep enough to ensure that the eggs are laid in moist soil (Setser 2001, Young and Young 2000). Eggs are incubated for approximately 52 days before hatching (Ibid.). Flat-tailed Horned Lizards produce small clutches (averaging 4.7-5.4 eggs) and have the lowest productivity index (i.e., average clutch size x frequency) of the seven southwest *Phrynosomids* studied by Howard (1974).

Juveniles grow quickly, but growth rate appears to be dependent on when and where hatchlings were born and resource availability. Under favorable conditions, hatchlings born in the first cohort are able to reach adult size prior to hibernation and thus are able to breed at the beginning of the next year's active season, while hatchlings from a second cohort may not mature until the middle of the following summer, delaying breeding until their second year (Muth and Fisher 1992, Young and Young 2000). Drought may also delay sexual maturity, since growth rates slow under these conditions (Young and Young 2000).

Most Flat-tailed Horned Lizards live to three years in age, but individuals can live four or even six years (FTHLICC 2003, Leavitt 2013b, Young and Young 2000). Muth and Fisher (1992) estimated the mean annual survival rate at approximately 53%, noting the lowest survival rates occurred in spring and summer. During hibernation, survival is typically 100% (Grant and Doherty 2009, Muth and Fisher 1992). Annual survival estimates from demography surveys on East Mesa and West Mesa MAs between 2007 and 2013 varied substantially, ranging from 27%-70% and 4%-59%, respectively (Leavitt 2013b). Leavitt (2013b) noted that these estimates suggest low annual survival is the norm. Juvenile survivorship is not clear, but the annual juvenile survival rate for Desert Horned Lizards is significantly lower than adult survivorship (Pianka and Parker 1975).

Comment [CB4]: This statement is not supported by the subsequent data presented in this paragraph. At a 53% annual mortality (likely higher for juveniles) just 47% of a given cohort will survive their first year; 25% will survive their second year, and just 13% will reach the ripe old age of 3 years old. Hardly "most" live to three years in age. Barrows and Allen (2009) provided real data on this topic measuring survivorship for the first year being 75-55%, the second year 19-2% and the third year just 2%. Second and third year survivorship was far less than the generalized estimate of 53%. Not sure why the Barrows and Allen (2009) paper is being ignored here. What this means is that it is critically important for first year individuals to breed to achieve positive or stable population growth. It also underlines this species' sensitivity to mortality factors and how they then impact population growth.

The largest natural cause of Flat-tailed Horned Lizard mortality is predation, which, based on telemetry data, has been recorded as high as 40-50% of the population in certain years (Goode and Parker 2015, Muth and Fisher 1992, Young and Young 2000). Primary predators of Flat-tailed Horned Lizards are Loggerhead Shrikes (*Lanius ludovicianus*) and Round-tailed Ground

Squirrels (*Xerospermophilus tereticaudus*), but they are also preyed upon by a number of other reptiles, birds, and mammals, including Sidewinders (*Crotalus cerastes*), Coachwhips (*Coluber flagellum*), American Kestrels (*Falco sparverius*), Common Ravens (*Corvus corax*), and Kit Foxes (*Vulpes macrotis*) (Barrows et al. 2006, Duncan et al. 1994,Goode and Parker 2015, Muth and Fisher 1992, Young and Young 2000). Predation by some species, particularly birds and squirrels, increases near human development due to the availability of subsidized resources such as water and artificial perches (Barrows et al. 2006, Young and Young 2005).

To avoid predation, Flat-tailed Horned Lizards rely on their cryptic coloration and typically freeze instead of fleeing (Wone and Beauchamp 1995b). This can make them especially vulnerable to road mortality, which has also been suggested as a substantial source of mortality (Muth and Fisher 1992, Turner et al. 1980, Young and Young 2000). A population viability analysis suggested that Flat-tailed Horned Lizard persistence is particularly sensitive to changes in mortality versus other factors such as reproductive output or growth (Fisher et al. 1998, FTHLICC 2003).

Diet and Food Habits

According to Johnson and Spicer (1985), although the Flat-tailed Horned Lizard is remarkably swift compared to other horned lizards, it is basically a "sit and wait" predator. Ants comprise 97% of the Flat-tailed Horned Lizard's diet, higher than any other *Phrynosomid* (Pianka and Parker 1975). Flat-tailed Horned Lizards primarily eat native harvester ants (genera *Messor* and *Pogonomyrmex*) but are known to eat smaller ants and other invertebrates opportunistically as well (FTHLICC 2003, Turner and Medica 1982, Young and Young 2000). During a severe drought in 1997, Young and Young (2000) measured scat contents and found less than half the number of ants were present in scat collected during wetter years, and they observed that Flat-tailed Horned Lizards lost weight during drought conditions. In drought years, annual vegetation is depressed, resulting in decreased seed abundance, which in turn negatively affects the harvester ants that feed primarily on seeds (Barrows and Allen 2009). Freestanding water and dew are not commonly available in Flat-tailed Horned Lizard habitat, so the species primarily relies on preformed water (water found within their food) to maintain proper water balance (FTHLICC 2003).

Home Range and Territoriality

Compared to their size, Flat-tailed Horned Lizards have very large home ranges and do not appear to be territorial (Muth and Fisher 1992). Young (1999) investigated interactions among Flat-tailed Horned Lizards with overlapping home ranges and found that lizards were actively avoiding each other. Home range sizes among individual Flat-tailed Horned Lizards can vary widely even in the same area, but method of data collection and analysis, location, season, sex, climatic conditions, and density dependence may all be influential. Goode and Parker (2015) measured male home ranges from 0.04-6.8 ha, and female home ranges from 0.02-14.5 ha. These ranges overlap the lowest and highest mean home range sizes observed by other researchers (Muth and Fisher 1992, Setser 2001, Setser and Young 2000, Turner and Medica 1982, Young and Young 2000). Males appear to have larger home ranges than females, at least in spring and early summer, which can likely be attributed to searching for mates (Goode and Parker 2015, Setser and Young 2000, Turner and Medica 1982, Young 1999). Some gravid

females will leave their home range, traveling as far as 1,647 m to deposit their eggs before returning to their original home range site (Setser 2001, Young and Young 2000). Climatic conditions, specifically drought, are presumed to reduce home range size and activity (Young and Young 2000).

Habitat that May be Essential for the Species' Continued Existence in California

Flat-tailed Horned Lizard habitat is characterized by hot summers ranging from 30-45^{0}C and generally mild winters in the very low 20s ^{0}C (FTHLICC 2003, Johnson and Spicer 1985). Annual rainfall is typically low and varies spatially and temporally (Ibid.). Within the California portion of the species' range, rainfall averages approximately 5.8 cm in El Centro and 13.5 cm in Palm Springs (FTHLICC 2003) and predominantly falls during winter, while the Arizona portion of the species' range generally receives summer rains (Johnson and Spicer 1985). Flat-tailed Horned Lizard habitat is subjected to frequent drought conditions (Johnson and Spicer 1985) and flash floods during periods of heavy rain (Turner and Medica 1982). Although it is sympatric with the Desert Horned Lizard in some parts of its range, the Flat-tailed Horned Lizard occupies hotter, drier, and more severe habitats than any other *Phrynosomid* (Johnson and Spicer 1985).

According to Turner et al. (1980), the best habitats for Flat-tailed Horned Lizards generally exhibit "surface soils of fine packed sand, or pavement, overlain intermittently with loose, fine sand." Most records of Flat-tailed Horned Lizards come from the creosote bush (*Larrea tridentata*)-white bursage (*Ambrosia dumosa*) assemblage, and occasionally saltbush (*Atriplex* spp.) (FTHLICC 2003, Turner et al. 1980). However, the species has been recorded in a broad range of habitats in California compared to Arizona, including sandy flats and hills, badlands, salt flats, and gravelly soils (FTHLICC 2003). Flat-tailed Horned Lizards have also been found on the rocky slopes at lower elevations, along the vegetated edges of active sand dunes, on stabilized sand fields, and less frequently, within active dunes themselves (Barrows and Allen 2009, Luckenbach and Bury 1983, Turner et al. 1980). The species has even been found in fallowed agricultural fields dominated by non-native weedy species (RECON 2010).

There are five habitats associated with Flat-tailed Horned Lizards in the California Wildlife Habitat Relationships System (CWHR) (Figure 4). CWHR is a state-of-the-art information system for California's wildlife that contains life history, geographic range, habitat relationships, and management information on 712 species of amphibians, reptiles, birds, and mammals known to occur in the state. Desert Scrub, Desert Wash, and Barren are considered high quality habitat, while Alkali Desert Scrub and Desert Succulent Scrub are considered marginal (CDFW 2014). Desert Scrub habitats typically are open, scattered assemblages of broadleaved evergreen or deciduous microphyll shrubs, usually between 0.5 and 2 m in height; canopy cover is generally less than 50%, usually much less; bare ground is often between plants; and creosote bush is often considered a dominant species (CDFG 1988). Barren is considered any habitat with <2% total vegetation cover by herbaceous, desert, or non-wildland species and <10% cover by tree or shrub species (Ibid.). Desert Wash habitats are characterized by the presence of arborescent, often spiny, shrubs generally associated with intermittent streams (washes) or drier bajadas (alluvial deposits adjacent to washes), especially in the Sonoran Desert (Ibid.).

Comment [CB5]: There is nothing in error with what has been written here, but I believe that it misses the focus of what is important to the flat-tails. Yes they can occur in all the habitats listed here, but the critical habitat component is loose, fine, friable soils; loose enough for easy digging, but cohesive enough to allow for burrows to not collapse over days, weeks or more of re-use. That is most typically a matrix or patchwork of aeolian sands with patches of more silty layers or crusts. The relative abundance of aeolian sand and silt/clay crusts can vary from site to site but in most cases both are present. When they are both present the flat-tail abundance is usually at its highest. Perennial, scattered vegetation is important for cover and thermoregulation, but the species composition isn't as much. And of course if the soils are too salty for vegetation or for some reason vegetation is absent, then so are ants, so are microclimate refugia, and so are flat-tails.

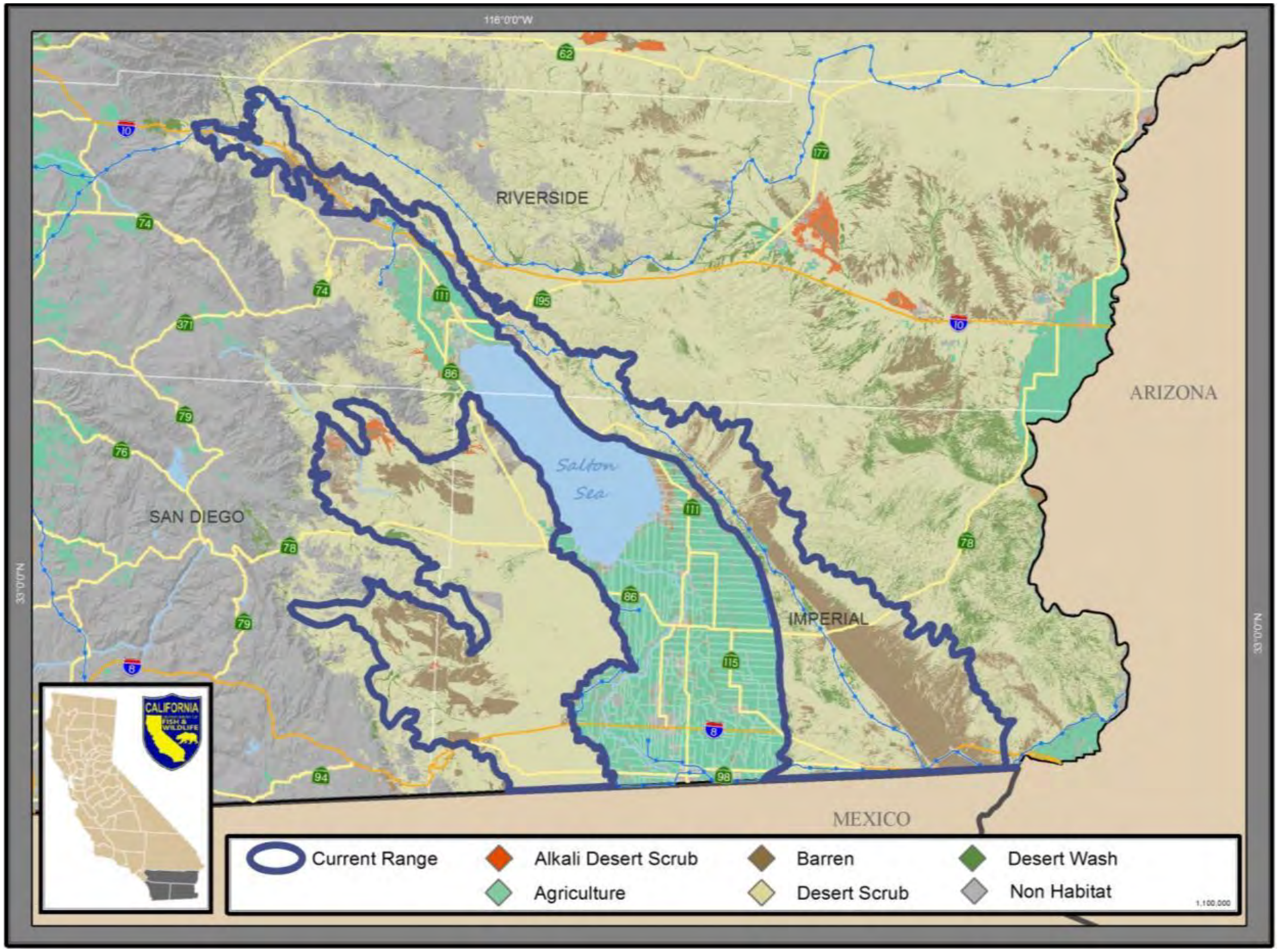


Figure 4. Flat-tailed Horned Lizard Habitat Associations

A number of studies have attempted to identify habitat characteristics that are significantly correlated with presence and abundance of Flat-tailed Horned Lizards, but their results have varied. In most cases, there is a positive correlation between Flat-tailed Horned Lizard abundance and perennial plant density (Altman et al. 1980, Barrows and Allen 2009, Muth and Fisher 1992, Turner and Medica 1982). However, it should be noted that typical Flat-tailed Horned Lizard habitat is sparsely-vegetated, so maximum coverage of perennial plant density is likely never very high at any of the sites. Positive correlations have also been reported between Flat-tailed Horned Lizards and the abundance of sand (Gardner 2005, Hollenbeck 2004, Wright and Grant 2003), as well as harvester ant nests (Barrows and Allen 2009, Rorabaugh et al. 1987, Turner and Medica 1982). Barrows and Allen (2009) found that soil compaction was significantly correlated with Flat-tailed Horned Lizard abundance in opposite directions on stabilized sand fields (negative) and active dunes (positive), suggesting that the "availability of moderately compacted sands may be important to horned lizards for digging burrows that are used for thermoregulation and nesting."

STATUS AND TRENDS IN CALIFORNIA

Range

Uncertainty exists regarding what constituted historically suitable habitat available for the Flat-tailed Horned Lizard in California due to periodic Colorado River flooding of the Salton Trough (FTHLICC 2003, USFWS 2011). This uncertainty affects estimates of losses in the species' range and distribution because the vast majority of land converted to agriculture and urban development occurs within this area of historical flooding. A detailed description of the geologic and hydrologic history is provided in the Setting and Habitat section of the USFWS's (2011) withdrawal of the proposed rule to list the Flat-Tailed Horned Lizard as threatened. Based on evidence of its ephemeral persistence and marginal suitability, the USFWS did not consider habitat within the historic Lake Cahuilla lakebed (Figure 5) as part of the species' historical range (USFWS 2006). Barrows et al. (2008) also did not consider this area as potential habitat when modeling changes in Flat-tailed Horned Lizard distribution in the Coachella Valley pre- and post-development.

Alternatively, Hodges (1997), while omitting areas of unsuitable habitat containing marshes, obvious rocky mountains, new alluvial deposits, and the main body of the Algodones Dunes, included the Salton Trough in her estimate of historic habitat due to the existence of Flat-tailed Horned Lizard records from areas within the Imperial Valley and around the Salton Sea. Based on this, she concluded that the total possible inhabitable area of historic Flat-tailed Horned Lizard habitat in California was as large as 899,000 ha (Ibid.). Flooding of the Salton Sea, agricultural development, and urbanization were the primary sources of habitat loss, leading to a reduction in range of approximately 51% in Imperial County, 58% in Riverside County, and 9% in San Diego County (Ibid.). Hodges (1997) considered the Riverside County estimate to be very conservative, and more recently, Barrows et al. (2008) reported that an estimated 83-92% of suitable Flat-tailed Horned Lizard habitat has been lost in the Coachella Valley. Conversely, the Imperial Valley estimate is likely inflated based on the periodic historic flooding that rendered much of the area unsuitable for extended periods. While at least some of the habitat

Comment [CB6]: Hopefully this report will not make the same error – or reflect an existing bias. Obviously when flooded the basin was not habitat, but it was dry as much as it was flooded, and the shorelines were likely not nearly as salty as they are today, So it is as reasonable to postulate that during the dry periods, before the hyper salinity of the shorelines, that the habitat was pretty good. In the Barrows et al. 2008 report, those habitats were excluded due to their hyper salinity, but prior to recent historic agricultural practices it was likely much less saline. An example is the Dos Palmas ACEC (BLM) just east of the north end of the Salton Sea in Riverside County. Early descriptions of that landscape revealed a creosote bush scrub – burro bush association – species that do not tolerate high salinity. Today most of that same landscape has been replaced with salt cedar, salt bush and pickle weed – because of land use practices and leakage along the Coachella canal that brought salt to the surface. Again, the genetics are not unequivocal in supporting a long period of separation between the east and western portions of the flat-tail's range.

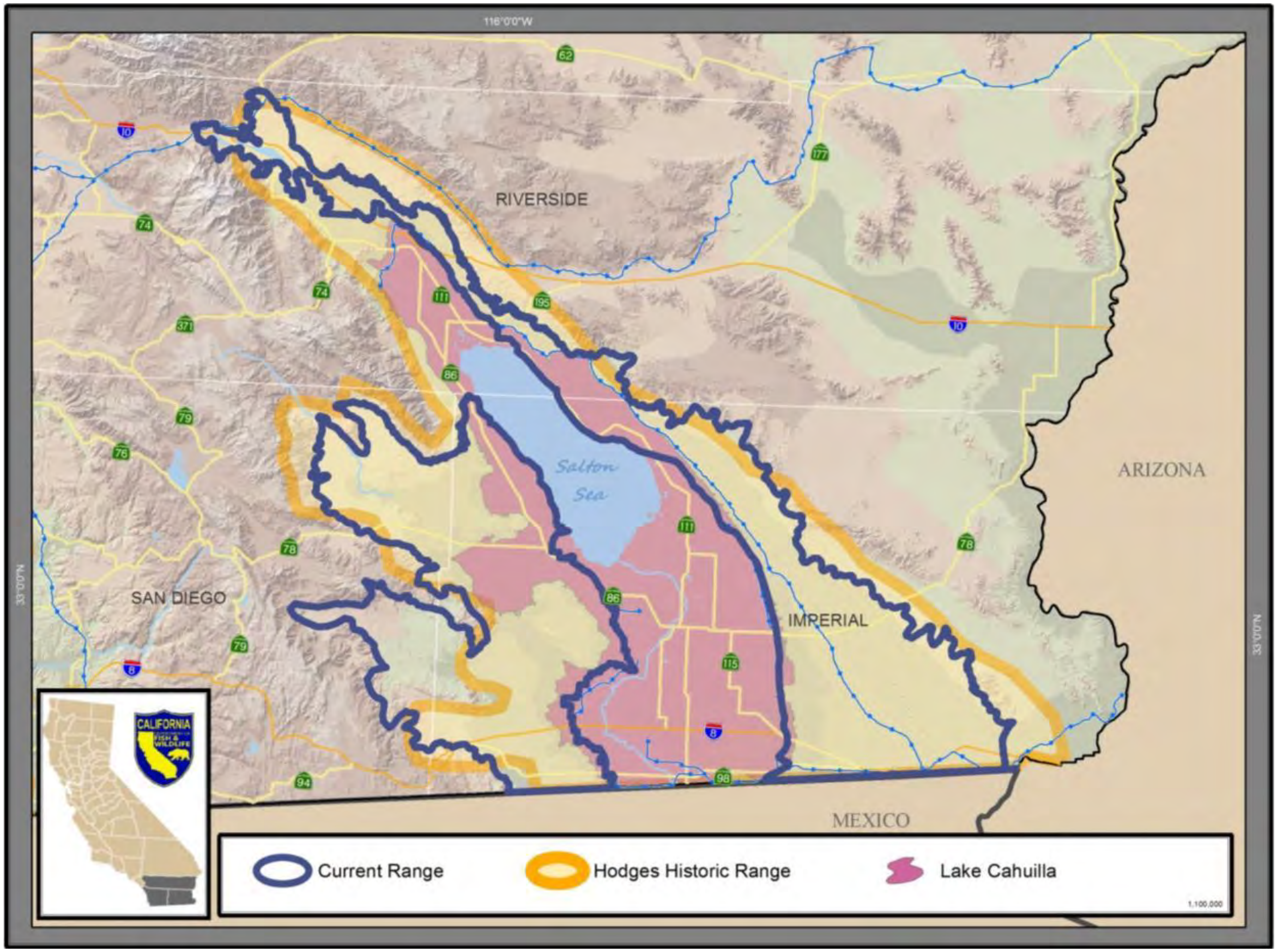


Figure 5. Historical Range Boundary Estimates Compared to Current Range Estimate

appears to have been suitable as recently as the end of the 19th century based on collections from the area (Hodges 1997), genetic data reveal that gene flow across the Imperial Valley was limited centuries before agricultural development began and the current Salton Sea flooded in the early 1900s (Mulcahy et al. 2006).

Regardless of the exact amount of loss, it is clear that the current Flat-tailed Horned Lizard range has been reduced from its historical extent due to agricultural and urban development. As a result, connectivity, even if historically infrequent, between the populations east and west of the Imperial Valley has been lost, and connectivity between the Coachella Valley and these populations ~~may have~~has been lost as well.

Distribution

With the exception of the Coachella Valley, the Flat-tailed Horned Lizard's distribution within its species' California range appears to have remained fairly stable in the areas for which data are available. As recently as the early 1980s, Flat-tailed Horned Lizards had a broader distribution in the Coachella Valley, occurring on what is now the Whitewater Floodplain Preserve, on the southern flanks of Edom Hill, and at the eastern end of the Indio Hills (CVCC 2013a). Currently, the only presumed remaining populations are on the Thousand Palms Preserve and further south within the Dos Palmas Preserve (Ibid). If they do inhabit the other areas, it is at a density below detection levels (Ibid.).

The distribution of Flat-tailed Horned Lizards within the RMS Areas (Figure 1) has been monitored using survey methods that incorporate the species' low detection probability into estimates of occupancy and local colonization and extinction rates (i.e., occupancy surveys in the RMS). Until recently, these methods included the use of sign (e.g., scat or tracks), which provide a much greater power to detect changes from survey period to survey period than visual confirmation of a Flat-tailed Horned Lizard (Root 2010) but are also problematic. Several studies have demonstrated that Flat-tailed Horned Lizard sign is not always positively correlated with current presence or abundance (Beauchamp et al. 1998, Muth and Fisher 1992, Rorabaugh 1994, Rorabaugh et al. 1987, Turner and Medica 1982, Wone and Beauchamp 1995a, Wright 2002, Young and Young 2000). This is due to any number of reasons, including (1) the fact that substrate and weather (e.g., wind, rain) can affect scat detectability and persistence (minutes to months) of scat or tracks in the environment (Beauchamp et al. 1998, Rorabaugh 1994); (2) it is impossible to distinguish the difference between multiple scats per lizard vs. several lizards defecating once (Beauchamp et al. 1998); (3) lizards produce fewer and smaller scats during times of low resource availability like drought (Rorabaugh 1994, Young and Young 2000); (4) Flat-tailed Horned Lizard scat are indistinguishable from Desert and Goode's Horned Lizards where they are sympatric (Root 2010, Rorabaugh et al. 1987, Young and Young 2000); and (5) surveyors who concentrate on finding scat invariably find fewer lizards (Wone et al. 1994). At best, scat can serve as an indication that the area was at least used by a Flat-tailed Horned Lizards, even if only as the species passed through it (Root 2010). Table 1 depicts the estimated likelihood that a Flat-tailed Horned Lizard will be present at a random spot within the RMS areas, based solely on lizard observations (i.e., not scat).

Table 1. Occupancy Probability Estimates for RMS Areas (California only)[1]

	East Mesa	West Mesa	Yuha Basin	Borrego Badlands	Ocotillo Wells
2005		0.06			
2006	0.44				1.00
2007					1.00
2008			0.56		0.66
2009		0.86			0.86
2010	0.75				0.85
2011				0.42	0.91
2012				0.20	0.84
2013				0.10	0.78

[1] 2005-2010 data from Frary (2011); 2011-2013 data from Leavitt (2013b)

Occupancy probabilities were generally high across the RMS areas, particularly Ocotillo Wells, where extinction (0.07 ± 0.07) and colonization rates (0.00 ± 0.00) were estimated to be low (Leavitt 2013b). Despite being relatively close to Ocotillo Wells, occupancy probability and colonization rate estimates (0.01 ± 0.04) at Borrego Badlands were relatively low, and local extinction rates (0.54 ± 0.19) were predicted to be very high (Ibid.). Leavitt (2013b) posited that indications of a steady decline at Borrego Badlands are likely due to irregular sampling at that location and that this trend is an artifact of a poor sampling regime. Unfortunately, the relatively low power to detect changes from visual-only surveys, coupled with irregular and inconsistent monitoring on the MAs since 2005, has led in some cases to large standard errors and the inability to estimate population parameters (Grimsley and Leavitt 2016). Properly executed occupancy studies have far greater power to detect long-term changes in distribution when plots are sampled more frequently (i.e., annually vs. biennially or triennially) and all survey passes (days/plot) within the survey year are completed (Leavitt 2013b, Zylstra et al. 2010).

With the exception of the Coachella Valley, there are no distribution data on Flat-tailed Horned Lizards outside of the RMS areas. It should be noted that the MAs were chosen because they were thought to represent some of the highest quality contiguous habitat available to the species, and there are limits on disturbance within them. Therefore, extrapolation of these occupancy estimates to the rest of the species' range may not be prudent because areas of presumably lower quality and greater disturbance would be expected to have a lower likelihood of occupancy by Flat-tailed Horned Lizards.

Abundance

Obtaining reliable rangewide abundance or density estimates for Flat-tailed Horned Lizards is complicated due to the species' relatively low detectability and large home range size, as well as researchers' use of un-standardized, and in some cases, inappropriate survey methods (e.g., scat detection rates as an index of abundance). The Petition (Table 2, page 23 in CBD 2014) provides a list of abundance estimates based on scat and lizard observations per hour of survey effort using results of studies ranging from 1979-2001. Due to the unreliability of these estimates and no clear correlation with Flat-tailed Horned Lizard abundance, they are not reproduced here.

Since then, only three studies have used solely lizard observations and an appropriate sampling design to estimate abundance of adult Flat-tailed Horned Lizards across the RMS areas (Table 2). Some sites (West Mesa 2003 and Yuha Basin 2004) suffered from sparse data (Grant and Doherty 2007), and their 95% confidence intervals (C.I.) reflect that. Hollenbeck (2006) estimated the abundance of juveniles, in addition to adults, because they were encountered throughout the duration of the study and accounted for a majority of the individual Flat-tailed Horned Lizards captured and recaptured.

Table 2. Abundance and Density Estimates from RMS Areas (California only)

RMS Area	Abundance	Lower C.I.	Upper C.I.	Lizards/ha	(Lizards/ac)
Yuha Basin 2002[1]	25,514	12,761	38,790	1.05	(0.42)
East Mesa 2003[1]	42,619	19,704	67,639	0.91	(0.37)
West Mesa 2003[1]	10,849	3,213	23,486	0.20	(0.08)
Ocotillo Wells 2003[2]	19,222	18,870	26,752	0.61	(0.25)
Yuha Basin 2004[1]	73,017	4,837	163,635	3.00	(1.21)
Ocotillo Wells 2005[3,4]	24,345	14,329	69,922	0.78	(0.32)
Ocotillo Wells 2005[3,5]	37,085	22,166	74,812	1.19	(0.48)

[1] Grant and Doherty (2007), [2] Hollenbeck (2004), [3] Hollenbeck (2006), [4] adults, [5] juveniles

There has only been one attempt at estimating the number of Flat-tailed Horned Lizards across the species' range. The USFWS (2011) used a density of 0.3 lizards/ha (0.1 lizards/ac) and its estimate of the Flat-tailed Horned Lizard's remaining range to make that calculation. The density USFWS used was the smallest estimate derived by Root (2010) from data obtained between 2007 and 2009 on the MAs. Within California, this amounted to approximately 73,000 individuals west of the Imperial Valley; 44,000 east of it; and 1,100 in the Coachella Valley. The USFWS (2011) acknowledged that there were numerous assumptions in its calculations that limited accuracy of the extrapolated population sizes, but it concluded that, even using the most conservative density estimate, the populations east and west of the Imperial Valley were large enough that any threats associated with small populations would be unlikely to occur. The minimum viable population size for Flat-tailed Horned Lizards is unknown, and the USFWS (2011) also acknowledged that within these coarse-scale populations, barriers to movement fragment the habitat into various patches, which could result in deleterious effects from small population sizes (see Fragmentation, Edge Effects, and Small Populations below).

Not surprisingly, an increased level of survey effort (i.e., number of surveyors and amount of time looking specifically for lizards) appears to increase the likelihood of detecting Flat-tailed Horned Lizards. For example, surveys by biological monitors and incidental observations by construction personnel trained to look out for Flat-tailed Horned Lizards can sometimes find unexpectedly high densities when compared to the RMS area demography survey results. For example, prior to and during construction of the Imperial Solar Energy Center West's (CSolar)

transmission line within the Yuha Basin MA in 2014, 152 Flat-tailed Horned Lizards were located along the 6.6 ha (16.3 ac) right-of-way that was dominated by creosote bush and white bursage, resulting in an estimated density of 23.0 lizards/ha (9.3 lizards/ac) (UltraSystems 2015) (Figure 6). To put this density into context, using the RMS demography survey data from the Yuha Basin MA, the highest plot-level density estimate between 2007 and 2015 was 4.9 lizards/ha (2.0 lizards/ac) in 2011, and the 2014 estimate (i.e., the same year as the construction surveys as well as the third consecutive year of drought) was 2.5 lizards/ha (1.0 lizards/ac). These estimates were derived from abundance data in Grimsley and Leavitt (2016), which were then divided by 15.2 ha (37.6 ac), the estimated effective survey area, based on a 45 m (147 ft) movement buffer around the survey plot as suggested for standardization with other surveys by Root (2010). The solar facility portion of the CSolar project was located on 457 ha (1,130 ac) of abandoned agricultural fields that were considered barren or in the early seral stages of desert scrub in 2015 (Ultrasystems 2015) but were dominated by non-native weeds such as Sahara mustard (*Brassica tournefortii*) and London rocket (*Sisymbrium irio*) five years prior (RECON 2010). In this degraded habitat, another 95 Flat-tailed Horned Lizards were found, or approximately 0.21 lizards/ha (0.08 lizards/ac) (Dudek 2016).

Population Trend

Flat-tailed Horned Lizard populations appear to be highly sensitive to environmental fluctuations, which can result in high variability in abundance over short periods of time (Young and Young 2000). For example, within stabilized sand fields in the Coachella Valley, Barrows and Allen (2009) recorded the Flat-tailed Horned Lizard population decline by approximately 50% per year from 2002 to 2005, with a >90% decline overall; however, it was able to recover with no management action. This high level of variability coupled with the species' low detectability make accurate estimates of population trends exceedingly challenging, and comparisons in abundance or rate of detection from a small number of time periods should be viewed with caution.

Until fairly recently, evidence of population trends were limited to anecdotal accounts, primarily of seemingly precipitous localized declines (Altman 1980, Turner et al. 1980) that may have at least partially been attributable to wet vs. dry years (Turner and Medica 1982), and use of Flat-tailed Horned Lizard sign (e.g., scat and tracks) as well as individual lizards, which as previously mentioned is often unreliable. As an example, Wright (2002) analyzed scat and lizard detection rate data from 1979 to 2001 across a number of BLM properties and found no significant population trend over that period, but he cautioned that the survey methodology was inconsistently conducted throughout this. In addition to the complications associated with making assumptions about correlations between scat detection and lizard abundance, in all years except one, the survey effort was less than the estimated minimum necessary to have an 80% probability of being within 50% of the true mean sighting rate (Ibid.). However, when the data from the Yuha Basin, West Mesa, and East Mesa were combined, they met or exceeded this threshold, and the detection rate per 10 hr of surveying was 1.1 lizards in 1979, 1.0 lizards in 1985, 0.0 lizards in 1989, 1.2 lizards in 1991, and 1.1 lizards in 2001 (Ibid.).

Standardized demography survey protocols using solely mark-recapture Flat-tailed Horned Lizard data are a relatively recent development. Consequently, dataset with the longest duration on population trends using this method only spans 2007-2015. Grimsley and Leavitt (2016)

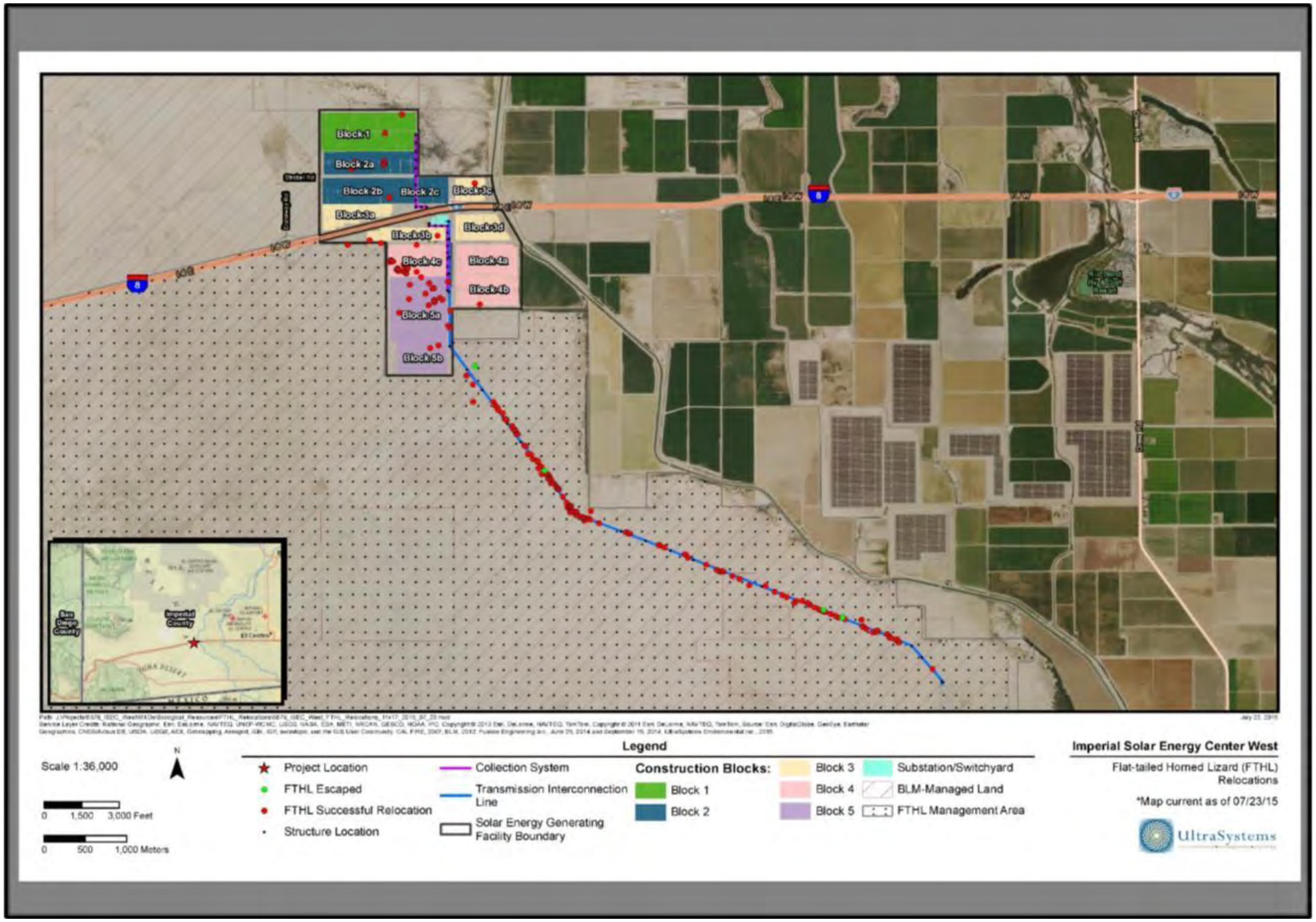


Figure 6. Flat-tailed Horned Lizard Observations (Relocations) within a Solar Project Footprint

calculated and plotted Flat-tailed Horned Lizard abundance estimates from Demography surveys on 9-ha plots within the RMS areas over that period of time (Figure 7). Demography surveys only began at Ocotillo Wells in 2014, and they have never been conducted on Borrego Badlands. As with the occupancy surveys, inconsistencies in demography survey data collection (e.g., number of surveyors and/or survey days) have led to large standard errors and the inability to estimate population parameters in some cases (Grimsley and Leavitt 2016). Nevertheless, the populations generally appear to be cycling up and down in concert (Leavitt et al. 2015). It should be noted that unlike the occupancy study plots, the demography survey plots were non-randomly selected within areas known or suspected to support greater than average Flat-tailed Horned Lizard densities, which are required in order to obtain robust enough datasets for use in population estimation models. Therefore, extrapolation of density estimates to areas outside of the high-quality survey plots cannot be legitimately undertaken. Nevertheless, these data do provide meaningful population trend data.

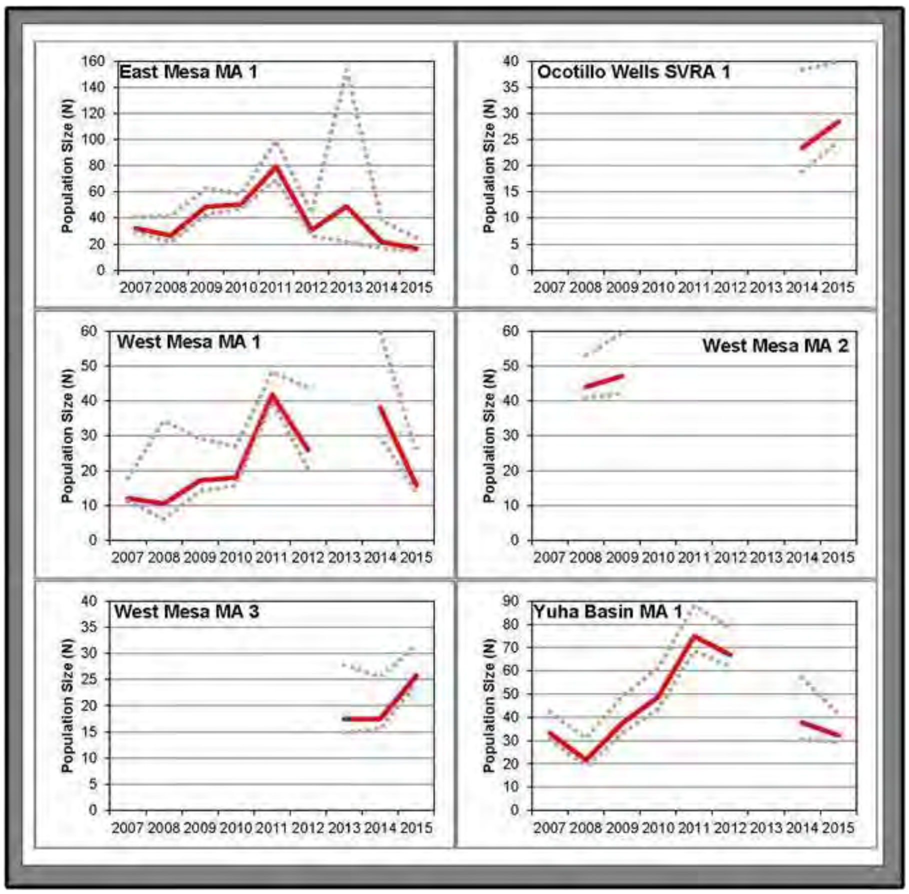


Figure 7. Annual Plot-level Flat-tailed Horned Lizard Population Estimates and Trends

The nearly fourfold increases in abundance from 2008 to 2011 on the three MAs in California that were surveyed consistently over that time reflect how rapidly and dramatically Flat-tailed Horned Lizards can respond to favorable conditions, and the subsequent declines to near 2008 levels from 2011 to 2015 reflect how rapidly they can decline as well. These fluctuations are often attributed to differences in precipitation, but the relationship between rainfall and Flat-tailed Horned Lizard abundance is complex and not always positively correlated (Barrows and Allen 2009, Leavitt 2013a, Young and Young 2000). California is currently experiencing an extreme drought that began in 2011. Predictions for a wetter 2015-2016 winter have not manifested as of March 31, 2016, and a vast majority of the Flat-tailed Horned Lizard's range in California is more than 50% below average precipitation for this water year to date (Figure 8).

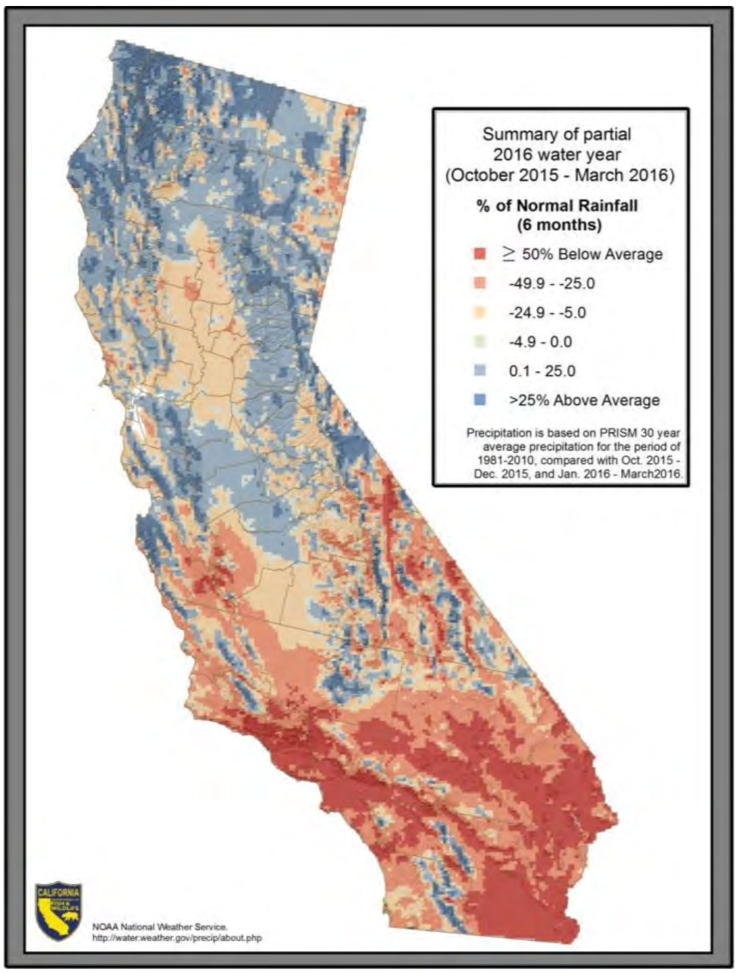


Figure 8. 2016 Water Year Statewide Precipitation Comparison to Average

EXISTING MANAGEMENT

Land Ownership within the California Range

Using the Department's current Flat-tailed Horned Lizard range in California, approximately 77% of the 666,916 ha (1,647,979 ac) are owned or managed by public agencies (Table 3, Figure 9). Of that land, 99% is managed by RMS participating agencies.

Table 3. Public Landownership within the Flat-tailed Horned Lizard's California Range[1]

Agency	Hectares	Acres	Group %	Unit %
Federal	*393,021*	*971,172*	*58.93%*	
U.S. Bureau of Land Management[2]	317,055	783,457		47.54%
U.S. Navy and Marine Corps[2]	67,876	167,725		9.28%
U.S. Bureau of Reclamation[2]	12,335	38,480		1.85%
U.S. Fish and Wildlife Service[2]	1,524	3,766		0.23%
U.S. Forest Service	231	571		0.03%
State	*121,122*	*299,298*	*18.16%*	
California Department of Parks and Recreation[2]	116,099	286,886		17.41%
State Lands Commission	3,066	7,576		0.46%
California Department of Fish and Wildlife[2]	1,641	4,055		0.25%
Coachella Valley Mountains Conservancy	216	534		0.03%
California Wildlife Conservation Board	81	200		0.01%
University of California	20	49		0.00%
County	*362*	*895*	*0.05%*	
San Diego, County of	360	890		0.05%
Imperial, County of	2	5		0.00%
City	*49*	*121*	*0.01%*	
Palm Springs	37	91		0.01%
Cathedral City	9	22		0.00%
Palm Desert	2	5		0.00%
Indio	1	2		0.00%
Special District	*1,458*	*3,603*	*0.22%*	
Imperial Irrigation District	878	2,170		0.13%
Coachella Valley Water District	470	1,161		0.07%
Borrego Water District	64	158		0.01%
Desert Water Agency	31	77		0.00%
Palm Springs Unified School District	7	17		0.00%
Salton Community Services District	7	17		0.00%
Desert Recreation District	1	2		0.00%
Grand Total	**516,012**	**1,275,088**		**77.37%**

[1] California Protected Areas Database (CPAD) 2015 [2] RMS Participating Agency

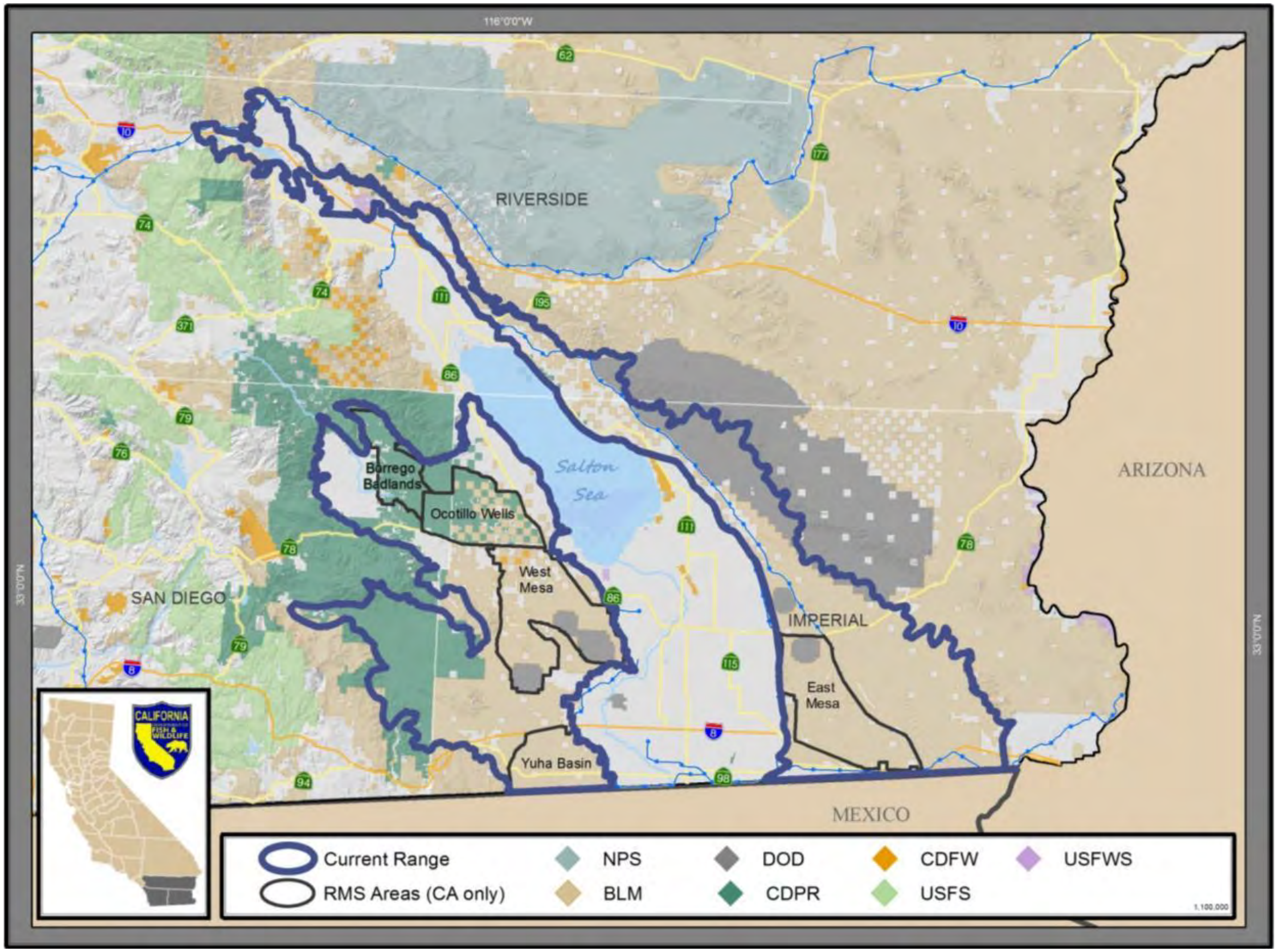


Figure 9. Main Land Ownership within the Flat-tailed Horned Lizard's California Range

Flat-tailed Horned Lizard Rangewide Management Strategy

In 1997, a voluntary long-term Interagency Conservation Agreement (ICA) was signed by the Department, USFWS, BLM, U.S. Bureau of Reclamation, U.S. Marine Corps, U.S. Navy, Arizona Game and Fish Department, and the California Department of Parks and Recreation (California State Parks) to implement the Flat-tailed Horned Lizard Rangewide Management Strategy (RMS), which was subsequently revised in 2003 (FTHLICC 2003, Foreman 1997). The RMS is implemented by the Interagency Coordinating Committee (ICC) and the Management Oversight Group (MOG), both comprised of members of the signatory agencies. The overall goal of the RMS is to "maintain self-sustaining populations of Flat-tailed Horned Lizard in perpetuity" (FTHLICC 2003). As briefly discussed in the Existing Regulatory Status section, the RMS established five Management Areas (MA), four in California and one in Arizona, and one Research Area (RA) in an active off-highway vehicle (OHV) park (Foreman 1997). MAs were designed to as much high-quality Flat-tailed Horned Lizard habitat (as identified in previous studies) and as large an area as possible, while avoiding extensive, existing, and predicted management conflicts such as OHV open riding areas (FTHLICC 2003). The RA was established to encourage research on the potential impacts of OHV use on Flat-tailed Horned Lizards, funded through the California Department of Parks and Recreation's Off-Highway Motor Vehicle Recreation Division (OHMVRD) (Foreman 1997).

Management objectives for MAs include:

- Continue to secure and/or manage sufficient habitat to maintain self-sustaining Flat-tailed Horned Lizard populations in each of the five designated MAs;
- Maintain a "long-term stable" or increasing population of Flat-tailed Horned Lizards in all MAs (a population that is stable over the long term exhibits no downward population trend after the effects of natural demographic and environmental stochasticity are removed);
- Continue to support research that promotes conservation of the species;
- Within and outside of MAs, limit the loss of habitat and effects on Flat-tailed Horned Lizard populations through the application of effective mitigation and compensation; and
- Encourage and assist Mexico in the development and implementation of a Flat-tailed Horned Lizard conservation program (FTHLICC 2003).

Although entry into the ICA and implementation of the RMS is voluntary and based on available funding, BLM and the Department of Defense have formally adopted the RMS within some of their agencies' environmental planning documents. The BLM, through a California Desert Conservation Area Plan amendment, adopted the three California MAs as Areas of Critical Environmental Concern (ACEC) in 2005 (FTHLICC 2013). Under the Sikes Act, the Department of Defense has codified the RMS into the Integrated Natural Resources Management Plans (INRMPs) for their installations (Navy 2014, USAF and USMC 2013).

California State Parks, the third main landowner within the Flat-tailed Horned Lizard's California range, has not formally adopted the RMS into its planning documents. The Anza-Borrego Desert State Park Final General Plan and Environmental Impact Report (EIR) were approved by the State Parks and Recreation Commission in 2005. While they include goals and guidelines for conservation of significant and sensitive biota (CDPR 2005), they do not directly address

Flat-tailed Horned Lizard, which affects dedication of funding and staffing availability to implement the RMS. Management for the Flat-tailed Horned Lizard within the Ocotillo Wells State Vehicular Recreation Area (OWSVRA) falls under guidelines incorporated by California State Parks to evaluate and sustain park resources, but as an RA, OWSVRA is not subject to the same protections from disturbance in the RMS as the MAs are. OWSVRA is mandated to provide OHV recreation (e.g., free-play, racing, and touring) in a manner to sustain long-term use (FTHLICC 2003). The OHMVRD, in cooperation with the BLM, is preparing a General Plan/Recreation Area Management Plan/California Desert Conservation Area Land Use Plan Amendment ("Ocotillo Wells SVRA Plan") and associated EIR/Environmental Impact Statement (EIS), which will update the current general plan that was developed in 1982 (CDPR 2015). The objective of the Ocotillo Wells SVRA Plan is to create a comprehensive planning tool under both state and federal guidelines to effectively manage Ocotillo Wells SVRA for high quality recreation, while protecting its resources in a sustainable manner (Ibid.).

Each MA is controlled by multiple agencies, and all MAs in California include private inholdings, which are targeted for acquisition to reduce the chance of development within the MA boundaries (Ibid.). Land management within the MAs is designed to avoid or reduce permanent surface disturbance and to promote reclamation of disturbed areas (e.g., duplicate roads that are no longer needed) (Ibid.). The RMS requires compensatory mitigation for long-term impacts to Flat-tailed Horned Lizard habitat at ratios anywhere from 3:1 to 6:1 within MAs and 1:1 outside of them, and surface disturbance cannot exceed 1% of the total area within the MAs (Ibid.). While there is no indication the participating agencies will increase this disturbance cap in the future, it is a voluntary measure in areas where it has not been formally adopted (i.e., outside the ACECs).

The land area within the California MA boundaries totals 142,518 ha, approximately 21% of the Flat-tailed Horned Lizard's range in the state (using the Department's current estimated range map, Figure 1). Since 1997, impacts to 346 ha have been approved within the California MAs, and 6,811 ha of private lands have been acquired (FTHLICC 2015). In 2014, authorized surface impacts increased in MAs as a result of solar energy development and military projects (Ibid). The most recent RMS implementation progress report concludes "there is some concern the 1% development cap may be reached, and exceeded, in some MAs due to utility-scale renewable energy development and Navy projects" (Ibid.).

As already described in the Status and Trends in California sections, participating agencies conduct occupancy and demography surveys to monitor Flat-tailed Horned Lizard trends on the RMS areas. Formal monitoring under the RMS began in 2002, and as techniques were refined, a Flat-tailed Horned Lizard Monitoring Plan was developed in 2008 to standardize data collection (Ibid.). The Monitoring Plan was further revised in 2011 "to improve the precision of occupancy estimates and detection probability" (Ibid). The general inconsistency of data collection over the years has made population trend analysis somewhat challenging (Grimsley and Leavitt 2016), and the participating agencies admit that full population monitoring efforts needed to quantify critical population indices and detect trends suffer from funding and staffing constraints over most of the areas managed in California (FTHLICC 2015). Aside from that, the most recent RMS implementation progress report concludes that "the majority of the tasks outlined by the [RMS] are being completed on schedule" (only "provide public information and

education” is ongoing but not on schedule, and “determine effects of natural barriers” has not been completed) (Ibid).

In addition to conducting population monitoring, the participating agencies have supported and are currently supporting several research projects since the inception of the RMS through direct funding and personnel. These include, but are not limited to, evaluating the potential for OHVs to crush Flat-tailed Horned Lizards during hibernation (Grant and Doherty 2009), ecological associations with Flat-tailed Horned Lizard occupancy at OWSVRA (Beauchamp et al. 1998, Gardner 2005), OHV effects (McGrann et al. 2006, Wone et al. 1994, Young 1999), genetics (Culver and Dee 2008), landscape genomics (FTHLICC 2016), use of culverts (Painter and Ingraldi 2007), effects of translocation (Goode and Parker 2015, Painter et al. 2008), road mortality (Goode and Parker 2015), efficacy of barrier fencing along roads (Gardner et al. 2001), habitat suitability modeling (FTHLICC 2016), population viability analyses (Fisher et al. 1998, FTHLICC 2016), potential eastern Salton Trough movement corridor (FTHLICC 2016), anthropogenic influences on avian predation (Ibid.), and climate change (Ibid.).

Coachella Valley Multiple Species Habitat Conservation Plan

The Coachella Valley Multiple Species Habitat Conservation Plan (CVMSHCP) is a multi-agency plan, adopted pursuant to the federal Endangered Species Act and the California Natural Communities Conservation Planning Act. It provides for the long-term conservation of ecological diversity within the Coachella Valley region of Riverside County, while streamlining the development application review process throughout the plan area. The Department and the USFWS issued permits for the 75-year term CVMSCHP in 2008. The CVMSCHP includes an area of approximately 445,000 ha that do not include Indian Reservation Lands (CVCC 2015).

Within the plan area there are 13,122 ha of predicted modeled habitat for the Flat-tailed Horned Lizard of which 1,678 ha are identified as core habitat (CVMSHCP 2007). The CVMSHCP conserves 98% of the core habitat and 93% of other habitat beneficial to the conservation of the species (Ibid.). Outside of the conservation areas, 52% of predicted modeled habitat and 29% of potential habitat are authorized for take of Flat-tailed Horned Lizards (Ibid.). These areas are already highly fragmented, surrounded by existing development, and have a compromised sand source/transport system (Ibid.).

Although the CVMSHCP predicts there is suitable or potential habitat within a number of conservation areas, Flat-tailed Horned Lizards appear to have been extirpated from nearly all of the Coachella Valley with the exception of the Thousand Palms Preserve and possibly Dos Palmas. While the CVMSCHP (2007) states that “[i]deally, three or more sites with discrete sand sources and of sufficient size to maintain a viable population should be preserved,” it also recognizes that “[r]ealistically there are not three such sites remaining that are not already fragmented or otherwise compromised by Development.” Only Thousand Palms is considered “core habitat,” meaning it is presumably large enough to sustain a population, although see the Fragmentation, Edge Effects, and Small Populations section below (Ibid.). Nevertheless, the CVMSCHP (2007) concludes that the Conservation Areas benefit the FTHL “by securing the long-term sand source-sand transport systems for their preferred habitat in the dune areas of the western and central Coachella Valley and by securing the unprotected habitat …throughout the plan area” (Ibid).

As of 2015, 81% of the Flat-tailed Horned Lizard Habitat to be conserved within the Thousand Palms Conservation Area has been acquired (CVCC 2015), although the vast majority of it was already conserved prior to the plan. Only 15% of the Flat-tailed Horned Lizard habitat to be conserved in the Dos Palmas Conservation Area, and none of the East Indio Hills Conservation Area has been acquired from 2006-2014 (Ibid.).

Lower Colorado River Multi-Species Conservation Program

The 50-year Lower Colorado River Multi-Species Conservation Program (LCR MSCP) was signed by the Department of the Interior Secretary and representatives from agencies within Arizona, California, and Nevada in 2005. The LCR MSCP was created to balance the use of the Colorado River water resources with the conservation of native species and their habitats from Lake Mead to the southernmost border of Mexico (LCR MSCP 2016). The plan is implemented by the Bureau of Reclamation (Ibid.).

None of the LCR MSCP area falls within the Flat-tailed Horned Lizard's range in California, but a small portion occurs between Imperial Dam and the Mexican border in Arizona (LCR MSCP 2015). There are two Flat-tailed Horned Lizard-specific conservation measures in the plan. The first is to acquire and protect 230 acres of unprotected occupied Flat-tailed Horned Lizard habitat, which was completed by purchasing two privately owned parcels totaling 240 acres adjacent to the Yuha Basin MA in 2012 (C. Ronning pers. comm.). The second is to implement conservation measures to avoid or minimize take of Flat-tailed Horned Lizards including those described in the RMS (LCR MSCP 2015).

California Desert Conservation Area Plan

In 1976, the Federal Land Policy and Management Act (FLPMA) authorized the BLM to conserve and manage public lands, and required the preparation of the California Desert Conservation Area Plan (CDCA). The BLM can designate ACECs through the CDCA. ACECs are defined as "areas within the public lands where special management attention is required (when such areas are developed or used or where no development is required) to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources or other natural systems or processes, or to protect life and safety from natural hazards" (DOI 2001). The goals of ACECs are to:

Identify and protect the significant natural and cultural resources requiring special management attention found on the BLM-administered lands in the CDCA;

Provide for other uses in the designated areas, compatible with the protection and enhancement of the significant natural and cultural resources; and

Systematically monitor the preservation of the significant natural and cultural resources on BLM-administered lands, and the compatibility of other allowed uses with these resources (DOI 1980).

Portions of the three MAs administered by the BLM (East Mesa, Yuha Basin, and West Mesa) were designated as ACECs to protect the Flat-tailed Horned Lizard in 2005 (BLM 2016c, FTHLICC 2006). The Coachella Valley Fringe-toed Lizard and Dos Palmas ACECs in the Coachella Valley also provide protection for the Flat-tailed Horned Lizard (BLM 2016c). North

Algodones Dunes, which supports Flat-tailed Horned Lizards along its vegetated edges, was an ACEC but was recently withdrawn because it is already designated wilderness under the National Landscape Conservation System and the ACEC designation was unnecessary (BLM 2016c). Management requirements vary by location but in general include controlling and erecting signs explaining vehicle access areas and routes, restricting mineral exploration/development, developing additional habitat/water sources, conducting intensive resource inventories, controlling exotic and introducing native species, and stabilizing/rehabilitating/salvaging features (DOI 1980).

California Environmental Quality Act

Flat-tailed Horned Lizards are designated as a SSC by the Department, and as such the California Environmental Quality Act (CEQA) provides the species with certain protections from projects undertaken or approved by public agencies. CEQA is a California law (Public Resources Code Section 21000 et seq.) that requires state and local agencies to publicly disclose, analyze, and potentially mitigate environmental impacts from projects over which they have discretionary approval power. In particular, CEQA requires that actions that may substantially reduce the habitat, decrease the number, or restrict the range of any species that can be considered rare, threatened, or endangered must be identified, disclosed, considered, and mitigated or justified. (Cal. Code Regs., tit. 14, §§ 15065(a)(1), 15380.)

CEQA compliance is not always thorough because the process can be very costly and time-consuming. Agencies may also determine projects are exempt (i.e., they do not need to go through the impact analysis, public disclosure, and mitigation process). Mitigation is required if a project is not CEQA-exempt and impacts would be potentially “significant.” Mitigation must reduce impacts to below a level of significance or minimize unavoidable significant impacts, where feasible. The CEQA process generally incentivizes agencies and project applicants to implement mitigation thereby avoiding significant impacts.

Impacts on Flat-tailed Horned Lizards are generally considered potentially significant if agencies determine on a project-specific basis that the species meets the CEQA criteria for endangered, rare, or threatened. However, agencies are not required to make this determination for Flat-tailed Horned Lizards and other species that are not listed under the California or federal Endangered Species Acts. Even when they are considered in a CEQA analysis, lack of readily available information on which to base impact analyses and lack of understanding of the law may result in projects having an unknown significant impact on the species.

One measure that is often used to minimize adverse impacts to sensitive species is translocation of encountered individuals a safe distance away from the construction site. However, its utility in conserving species has been questioned (Germano and Bishop 2009, Germano et al. 2015). Two recent studies evaluated the efficacy of translocation for conserving Flat-tailed Horned Lizards (Goode and Parker 2015, Painter et al. 2008). While their methods were somewhat different, their results were quite similar. Both studies compared survival, persistence, behavior, and movement patterns using radio-telemetry on translocated and control Flat-tailed Horned Lizards (Ibid.). In the months immediately following translocation (late summer/fall 2012), both translocated males and females had significantly larger home ranges than non-translocated individuals; however, after that, there was no significant difference

between the two groups (Goode and Parker 2015). Survival probabilities were lower for translocated Flat-tailed Horned Lizards, although the difference was not statistically significant (Goode and Parker 2015, Painter et al. 2008). This result indicates Flat-tailed Horned Lizards may have a period of acclimation following translocation as they adjust to their new locations (Ibid.). Painter et al. (2008) noted greater movements in translocated individuals up to 14 days post-release. Goode and Parker (2015) did observed translocated Flat-tailed Horned Lizards engaging in reproductive behavior and concluded that "[w]hile the results of this project certainly do not justify making translocation a commonly used mitigation measure for Flat-tailed Horned Lizards, there were some promising results that warrant further study."

In order for translocation to be effective, exclusion fencing must be maintained. Goode and Parker (2015) observed telemetered Flat-tailed Horned Lizards crossing the fence with some regularity; thirty individuals, both non-translocated and translocated, crossed the fence at least once. The fence used in this study "began falling into disrepair almost immediately after it was constructed, with sand drifts accumulating quickly and holes appearing after several weeks" (Ibid). Most, if not all, of these individuals were placed immediately outside the exclusion fencing, and given the relatively large home ranges of Flat-tailed Horned Lizards, it is not surprising that they would attempt to re-enter. Painter et al. (2008) noted that while none of the translocated Flat-tailed Horned Lizards that were moved greater than 1.6 km (1 mi) away showed signs of homing behavior, control individuals that were released 100 m (328 ft) away from their capture point did.

FACTORS AFFECTING ABILITY TO SURVIVE AND REPRODUCE

Fragmentation, Edge Effects, and Small Populations

It is well established that loss of habitat is the primary reason for a vast majority of species' declines and extinctions globally; however, declines can occur even in seemingly relatively undisturbed habitat when barriers to movement fragment once contiguous blocks into smaller areas and when adverse impacts from adjacent land uses extend into that habitat (i.e., edge effects). Depending on their severity, edge effects around habitat fragments can create perpetual population sinks (areas of negative population growth) because the habitat is still intact, so individuals will continue to move into it where they can experience high mortality risk than in the habitat block's core. Such sinks will have the greatest impact on overall population dynamics in small reserves with high perimeter-to-area ratios and in species that range widely and therefore come into frequent contact with edge more often (Woodroffe and Ginsberg 1998).

Fragmentation and edge effects can be particularly deleterious when they impact species with small populations or create smaller populations, which are more at risk of decline or localized extinctions from random fluctuations in abundance and loss of genetic diversity through drift (Woodroffe and Ginsberg 1998). For example, Vandergast et al. (2016) discovered that genetic structure among Coachella Valley Fringe-toed Lizard (*Uma inornata*) populations increased, while genetic diversity and effective population sizes decreased between 1996 and 2008. They suggested this rapid differentiation was likely a synergistic effect of population declines during the historic drought of the late 1990s–early 2000s and habitat fragmentation that precluded

post-drought genetic rescue (Ibid.). Flat-tailed Horned Lizard populations in the Coachella Valley are even smaller and more fragmented than the Coachella Valley Fringe-toed Lizard, apparently only persisting in two preserves (Barrows et al. 2008). Similarly, Culver and Dee (2008) discovered that a small population of Flat-tailed Horned Lizards, separated from the rest of the species' range in Arizona by development and Interstate 8, was moderately genetically differentiated from those located south of the road. Their observation of a disproportionately high frequency of an allele that was otherwise rare in all other populations suggested evidence of either a strong selective force north of the freeway or random genetic drift or inbreeding due to the effects of isolation and small population size (Ibid.).

Edge effects, reported as reductions in Flat-tailed Horned Lizard detections, have been observed as great as 450 m away from a habitat edge and are primarily associated with increased predation by round-tailed ground squirrels, loggerhead shrikes, and American kestrels, as well as road mortality (Barrows et al. 2006, Goode and Parker 2015, Young and Young 2005). In some cases, these edge effects appear to be able to shift Flat-tailed Horned Lizard population dynamics from a bottom-up process, where the lizard numbers are regulated by native ant abundance, to a top-down process, where the lizards are limited by predation and possibly road mortality, creating a population sink along the habitat boundary (Barrows et al. 2006).

The USFWS (2011) evaluated Flat-tailed Horned Lizard habitat fragmentation by major canals and highways, the international border, and several railways by multiplying the size of the habitat fragment by the density estimate they used to calculate rangewide abundance (see Abundance above). Because no one knows what the minimum viable population size is for Flat-tailed Horned Lizards, the USFWS used 7,000 individuals per population (based on Reed et al. 2003) to differentiate between habitat fragments that were likely large enough to avoid deleterious effects from small population sizes from those that weren't (Ibid.). Based on this calculation, which did not incorporate edge effects, neither occupied preserve in the Coachella Valley appears large enough to support a "large enough" population, only three of nine areas west of the Imperial Valley were large enough (83% of the total area), and only two of eight areas east of the Imperial Valley were large enough (69% of the total area) (Ibid.).

Some species-specific evidence (Barrows et al. 2006, 2008; Culver and Dee 2008; Goode and Parker 2015; Young and Young 2005), as well as some speculation (USFWS 2011) and population dynamics theory (Woodroffe and Ginsberg 1998), support the contention that Flat-tailed Horned Lizards are susceptible to the adverse effects of habitat fragmentation, edge effects, and small population sizes.

Roads, Canals, and Railroads

Major highways, irrigation canals, and railroads form large-scale near-complete barriers to Flat-tailed Horned Lizard movement, migration, and gene flow (Figure 10). These linear features fragment the habitat and can have demonstrable edge effects through increased mortality. The permeability (i.e., likelihood Flat-tailed Horned Lizards can cross the barrier) of these features differs somewhat across the species' range.

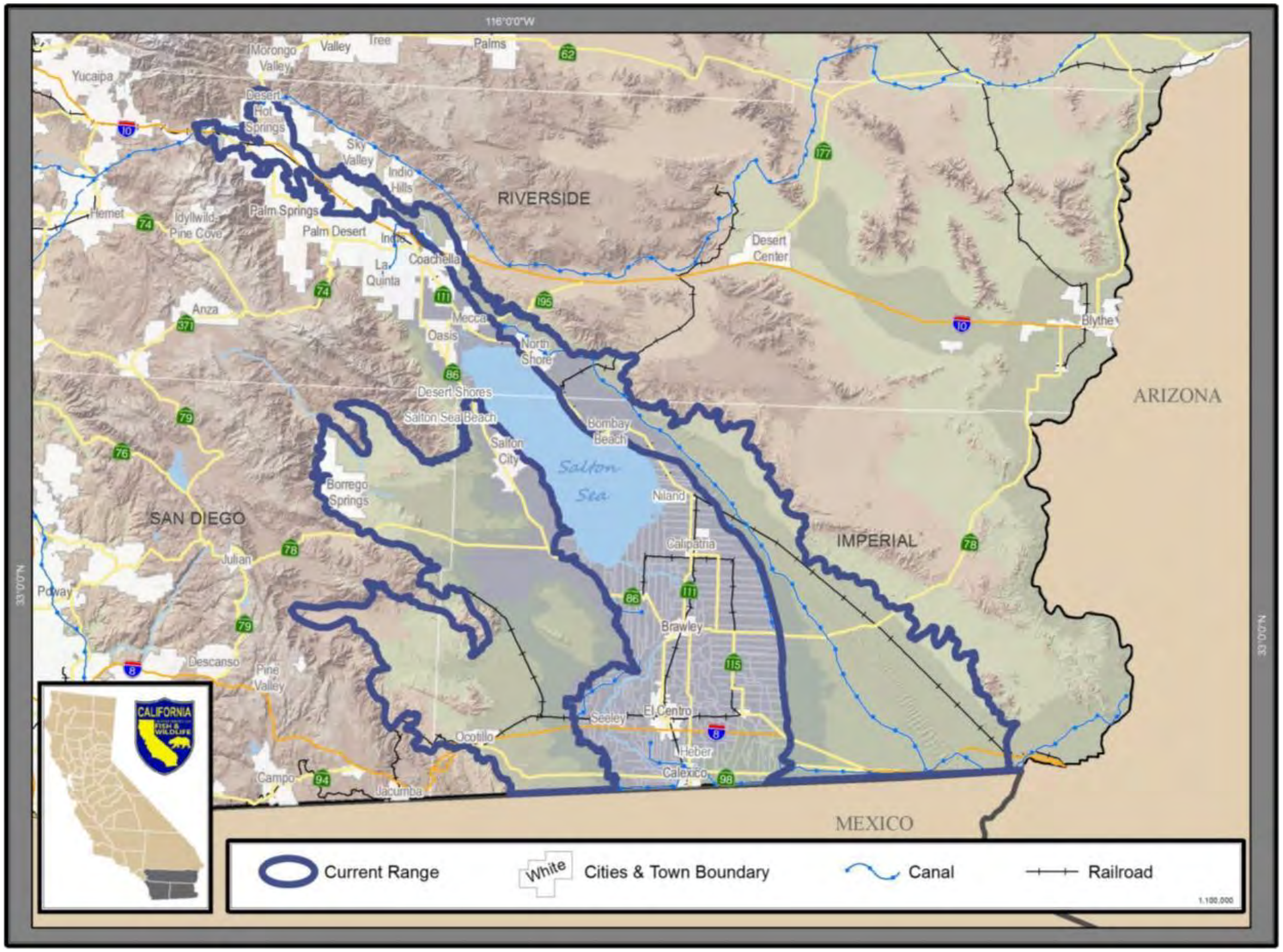


Figure 10. Major Barriers to Movement with the Flat-tailed Horned Lizard's California Range

Several major highways bisect the species' range in California. Flat-tailed Horned Lizards are frequently found on and around roads, and because they often freeze in the presence of threats, including vehicles, they're particularly susceptible to being killed on roads. Flat-tailed horned lizards were the most commonly encountered reptile (dead or alive) on paved roads within a military base in Arizona during three years out of a four-year study (Goode and Parker 2015). They accounted for 40.2% of all dead-on-road reptile observations, although only 3/353 (0.8%) of radio-telemetered Flat-tailed Horned Lizard deaths were known road kills, and individuals were frequently tracked moving across roads (Ibid.). Reports of proportions of dead vs. live Flat-tailed Horned Lizards on roads range from 3% - 27% (Goode and Parker 2015, Muth and Fisher 1992, Turner et al. 1980, Young and Young 2000) but do little to assess the impacts roads may be having at a population level. At least two studies (Barrows et al. 2006, Goode and Parker 2015) have studied this population-level effect specifically on Flat-tailed Horned Lizards.

Using mark-recapture data, Goode and Parker (2015) reported no significant differences in population abundance estimates in plots adjacent to roads compared to control plots. In fact, two of the highest abundance estimates came from plots adjacent to roads. However, it should be noted that these were from plots without adjacent power poles (Ibid.), suggesting predation may be the primary driver of the observed edge effect, not road mortality (see Predation below). In a similar pattern, Barrows et al. (2006) reported a much greater and more abrupt reduction in Flat-tailed Horned Lizard detections near wider, well-traveled roads with curbs vs. narrower, less-traveled roads without curbs; however, they could not absolutely attribute this to road mortality because they simultaneously observed a high level of predation by American Kestrels using a palm tree planted across the wider road. While road mortality may be having a population-level effect in some areas, the sparse data available do not strongly validate this assertion.

Nearly all of the irrigation canals in the Flat-tailed Horned Lizard's range are located within the existing developed lands in the Imperial and Coachella valleys. Two major exceptions are the All American Canal and the Coachella Canal (Figure 9). No studies have been conducted regarding the impact of canals on Flat-tailed Horned Lizards; however, it is clear that they present a complete barrier to movement with the possible exception of overcrossings. The Coachella Canal has several overcrossings to accommodate water and sediment transport down washes coming from the mountains to the east. In contrast, the All American Canal has very few crossings, all of which are narrow vehicle bridges.

Canal maintenance or improvements and construction of any new facilities have the potential to injure or kill Flat-tailed Horned Lizards or destroy their habitat. Imperial Irrigation District is discussing potentially constructing an intake canal off the All American Canal heading north close to the East Highline Canal that would discharge into a reservoir (J. Lovecchio pers. comm.), which if constructed would likely adversely impact a relatively small area in the overall Flat-tailed Horned Lizard's range.

There are several railroad tracks that run through the Flat-tailed Horned Lizard's range in California that pose a barrier to movement over long distances. It is unclear whether Flat-tailed Horned Lizards would avoid the trestles. In some areas, there are bridges constructed over

washes that would allow more unrestricted movement from one side to another, so even if they do avoid the trestles and tracks, some movement and gene flow is still possible.

Agricultural and Urban Development

As previously described in the Distribution section, the two primary sources of Flat-tailed Horned Lizard habitat loss over the past century have been agricultural and urban development in Coachella, Borrego, and Imperial valleys. New agricultural development has slowed substantially due to reduced water deliveries from the Lower Colorado River, and some fields have been fallowed (USFWS 2011) and converted to solar farms. Although the fallow fields may only be marginally suitable, Flat-tailed Horned Lizards have been observed using them (RECON 2010).

Most land within the California portion of the Flat-tailed Horned Lizard's range is owned by the State or various federal agencies, so extensive urban development is unlikely (USFWS 2011), although the California Department of Finance (2014) projects Imperial County's population is likely to grow from 187,689 in 2010 to 336,492 in 2060 (79%). The majority of this growth in the near term (2021) will be directed to existing incorporated townsites, including Bombay Beach, Desert Shores, Heber, Niland, Ocotillo, Salton City, Salton Sea Beach, and Seeley (County of Imperial 2013) (Figure 10). Private land holdings are relatively small and discontinuous throughout the range (USFWS 2011), indicating development of private land is likely to have small, localized impacts. Additionally, the Flat-tailed Horned Lizard ICC has been using compensatory mitigation money from approved project disturbances to purchase private inholdings within the MA boundaries, reducing the likelihood urban (or other) development will fragment the habitat within these areas. Future urban development in the Coachella Valley has been permitted through the CVMSHCP, which authorizes development in approximately 50% of the modeled suitable Flat-tailed Horned Lizard habitat, although nearly all of it is already fragmented and surrounded by existing development, so it would not likely support the species anyway (CVMSHCP 2007). Within the conservation areas, under the worst case scenario, take would occur within 2% (39 ha) of core habitat (i.e., able to sustain a population), 6% (336 ha) of modeled suitable habitat, and 7% (100 ha) of potentially suitable habitat (Ibid.).

Renewable Energy Development

Unlike agricultural and urban development, renewable energy (solar, wind, geothermal) development within the Flat-tailed Horned Lizard's range has increased dramatically in recent years. Lovich and Ennen (2011, 2013) synthesize the literature on potential impacts from utility scale renewable energy projects on desert ecosystems and wildlife. These include but are not limited to (1) creating a barrier to movement and fragmenting habitat; (2) increasing mortality on access roads and through increased avian predation along transmission lines; (3) opening up previously inaccessible areas to the public, facilitating illegal OHV use; (4) producing fugitive dust; (5) increasing soil erosion; (6) spreading invasive species; (7) increasing exposure to contaminants; (8) producing persistent loud noise and vibrations (wind); (9) increasing risk of fire; and (10) potentially altering local temperature, precipitation, and wind conditions (Ibid.).

There are no known studies investigating the specific impacts of renewable energy facilities and their associated infrastructure on Flat-tailed Horned Lizards, although some information from

other studies provided above on the effects habitat fragmentation, road mortality, and increased predation could apply. In addition, Olech (1984) reported that localized declines in indexed Flat-tailed Horned Lizard detections (scat and lizards) within the Yuha Basin corresponded with increased public use of those sites via construction of access roads for transmission lines and San Diego Gas and Electric's Imperial Valley Substation. Non-authorized OHV use was the most common "competing use" along all transects, and for transects where it was the only competing use of habitat, the temporal declines in observations were significant (Ibid.).

To date, renewable energy development in California has been permitted on a project-by-project basis. To facilitate this, the BLM has produced Programmatic Environmental Impact Statements (PEIS) for wind (BLM 2005), geothermal (BLM and USFS 2008), energy corridors (DOE and BLM 2008), and solar (BLM and DOE 2012). Wind resource potential is low throughout nearly all of the Flat-tailed Horned Lizard's range in California with the exception of the area around Ocotillo (BLM 2005) near the southwestern edge of the species' range, where the Ocotillo Wind Energy Facility was constructed in 2012 (BLM 2016a). Geothermal potential is greater, but its footprint is relatively small, and sites can typically be reclaimed and restored after extraction (BLM and USFS 2008).

The potential for solar energy facilities to impact a substantial amount of Flat-tailed Horned Lizard habitat is greater than that of wind or geothermal. Two Solar Energy Zones (SEZ) were identified in the PEIS, but only one is located within the Flat-tailed Horned Lizard's range (BLM and DOE 2012). The 2,314 ha Imperial East SEZ is located immediately south of the East Mesa MA in a fragmented patch of habitat bordered by Interstate 8, Highway 98, and Imperial Valley agriculture (Ibid.). An additional SEZ, the 4,354 ha West Chocolate Mountains SEZ, was subsequently established within the approximately 26,000 ha West Chocolate Mountains Renewable Energy Evaluation Area (REEA), located immediately south of Dos Palmas east of the Salton Sea (BLM 2012). The Final EIS for the West Chocolate Mountains REEA incorporated the RMS as its conservation measures for Flat-tailed Horned Lizards (Ibid.). There were no pending solar project applications within the Imperial East SEZ as of April 2015 (BLM 2015) or West Chocolate Mountains SEZs as of June 2014 (BLM 2014).

From January 2009-September 2015, the BLM approved right-of-way grants for five solar, one wind, and zero geothermal energy projects within the Flat-tailed Horned Lizard's range (BLM 2016a). Prior to 2009, the BLM had not approved any solar energy projects on public lands (Ibid.). The conservation, mitigation, and compensation measures in the RMS were incorporated into the environmental documents for these renewable energy projects, including minimizing impacts to Flat-tailed Horned Lizard habitat to the extent feasible, particularly within MAs, and purchasing compensation land or paying into a special fund for unavoidable impacts. For each approved project within a Flat-tailed Horned Lizard MA, the maximum (6:1) compensation ratio was applied.

Comment [CB7]: From my view, this description/case study underlines the short comings of a status quo for flat-tails. Despite the range-wide management plan in place there appears to be an on-going erosion, albeit slowed, of flat-tail habitat. Mitigating habitat losses with additional private lands acquired and put into public ownership is still habitat loss. Unless those lands are placed into fully protected designations, those mitigation lands are still "available" for future energy development. If flat-tail MAs are not fully protected, and managed toward sustainable flat-tail populations (Sahara mustard control, limits on OHV free play, no energy development, etc) then they are akin to what are often referred to as "paper parks" in third world countries – protection designations with no teeth. In the Coachella Valley the one site with what appears to be able to sustain a flat-tail population is fully protected and managed for the benefit of flat-tails and other species. This is because the multiple species plan manages all its covered species as if they are threatened/endangered regardless of their state or federal designation.

Two energy corridors were identified that run roughly east to west through the Flat-tailed Horned Lizard's range in California, one in the far southern and one in the far northern parts of the range, overlapping portions of the East Mesa and Yuha Basin MAs as well as the Thousand Palms Preserve (DOE and BLM 2008). To date all of the solar projects with a BLM right-of-way grant have been located in the vicinity of the Imperial Valley Substation and Sunrise and Southwest Powerlinks (major transmission lines) in or around the Yuha Basin MA (BLM 2016a).

Most of the solar facilities were constructed on private agricultural land, and disturbance to Flat-tailed Horned Lizard habitat was restricted to construction of transmission lines connecting the facilities with existing infrastructure (Figure 11).

Aside from solar projects on BLM lands, there are several other authorized or pending renewable energy projects within the Flat-tailed Horned Lizard's range in California. Wind energy facilities are concentrated in the two locations that possess moderate to high wind resource levels, each along the periphery of the species' range (BLM 2005). One area is located in the far northwestern extent of the species' presumptive range near Whitewater in Riverside County, and the other is located in a canyon west of Ocotillo along the Sunrise Powerlink corridor in Imperial County within approximately 8 km of the Yuha Basin MA. In addition to the already operational Ocotillo Express Wind Farm in the latter zone, approvals for testing in the same area have been issued to two other wind energy development companies (BLM 2016b). There are several dozen parcels with geothermal leases located in approximately four areas within the Flat-tailed Horned Lizard's range (BLM 2013). The East Mesa Geothermal Field lies partially within the East Mesa MA, the Truckhaven Geothermal Leasing Area is located within the Ocotillo Wells RA, and the West Chocolate Mountains Geothermal Leasing Area is within the West Chocolate Mountains REEA. The Truckhaven Geothermal Project recently completed a reconnaissance survey and subsequently decided not to proceed with any future development (M. Rodriguez pers. comm.). In addition, renewable energy facilities are being approved on county lands that are not requiring implementation of the RMS conservation measures, although renewable energy companies are expected to evaluate potential impacts to Flat-tailed Horned Lizards and mitigate to a less than significant level through CEQA compliance (see Existing Management section above).

With so many different agencies involved in renewable energy development oversight and approval and such a high demand in California, state and federal agencies recognized the need for a comprehensive plan to guide development in appropriate areas while protecting sensitive resources. In 2008, the BLM, California Energy Commission, USFWS, and the Department began a collaborative effort to draft a Desert Renewable Energy Conservation Plan (DRECP) covering the Mojave and Colorado/Sonora desert region of California. The Draft DRECP EIR/EIS was released for public comment in September 2014. As a result of feedback, the agencies decided to implement the DRECP in a phased approach starting with just BLM-administered lands. In November 2015, the BLM proposed Land Use Plan Amendment (LUPA) and DRECP Final EIS were released for public comment. In March 2016, the notice describing the proposed updates to the Areas of Critical Environmental Concern in the LUPA was published. The latter document proposes to designate 130 ACECs covering approximately 2,418,400 ha (including 445,569 ha within Wildlife Study Areas and Wilderness Areas) and includes Conservation and Management Actions (CMAs) and resource use limitations to manage those ACECs, including a detailed methodology for implementing and managing for ground disturbance caps in ACECs (DRECP 2015). Figure 12 depicts the Development Focus Areas (DFAs) in relation to the RMS areas and proposed expansion of protected areas.

Within the LUPA area there are approximately 173,610 ha of Flat-tailed Horned Lizard habitat located on BLM-managed lands primarily in the Imperial Borrego Valley Ecoregion Subarea (DRECP 2015). Impacts would occur in three BLM managed areas: the western foothills of the

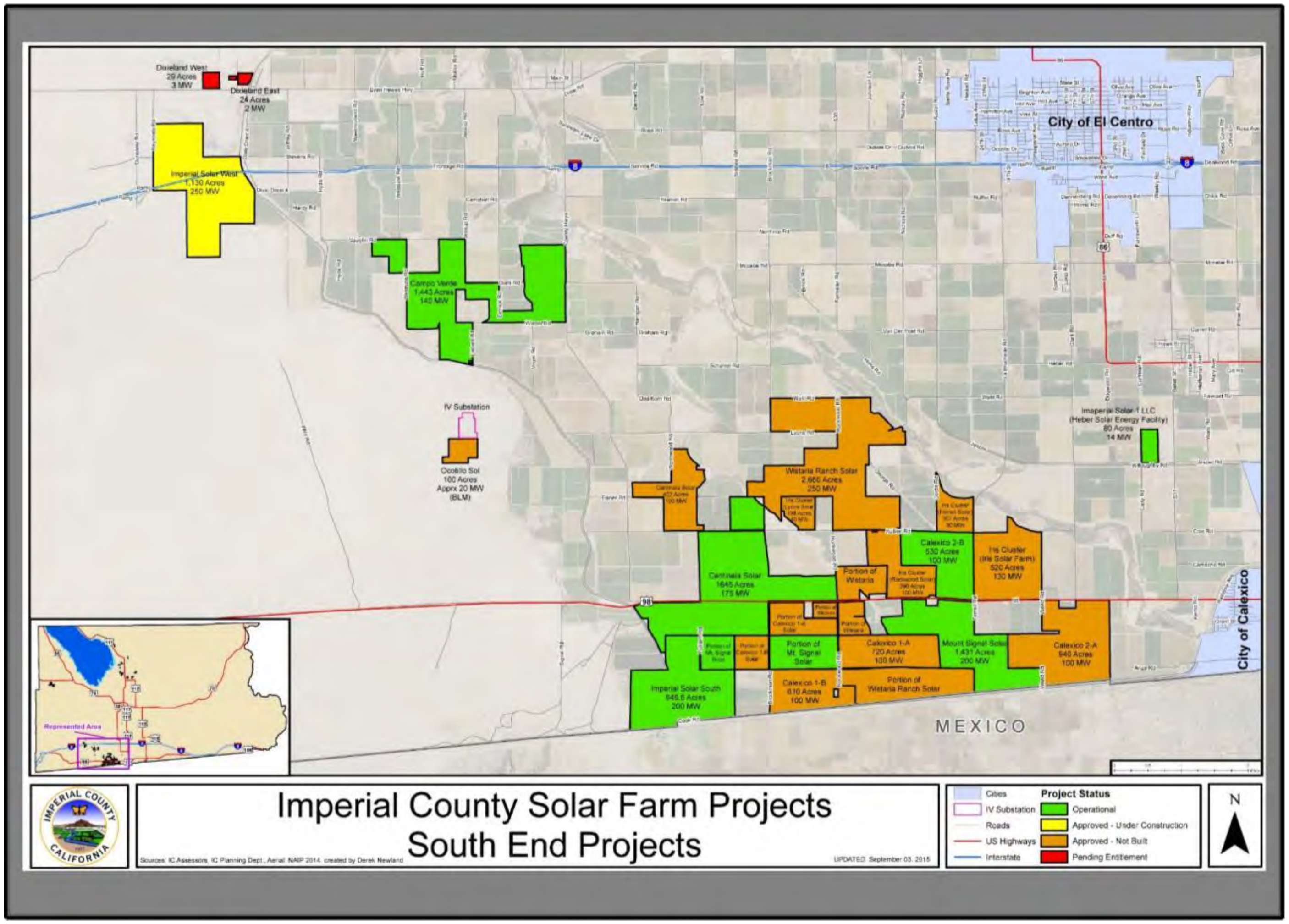


Figure 11. Solar Facility Footprints in Southwestern Imperial County

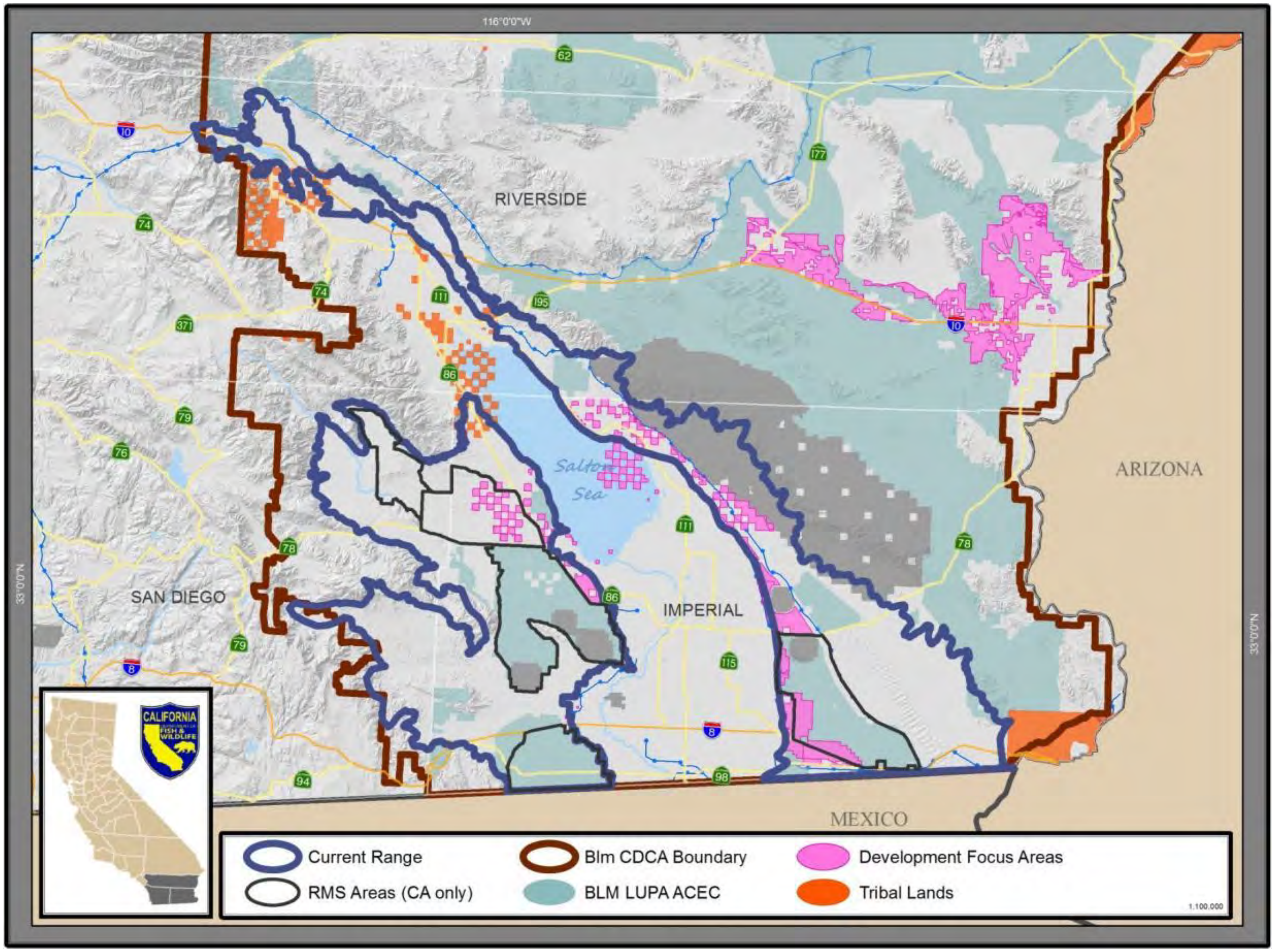


Figure 12. Land Use Designations under the Proposed BLM LUPA

Chocolate Mountains that include geothermal leasing areas studied in the 2008 Geothermal PEIS; BLM land along the western edge of East Mesa ACEC; and in BLM managed lands on the west side of the Salton Sea that include the Truckhaven Geothermal Leasing Area within the Ocotillo Wells RA. Under the Preferred Alternative, approximately 2,833 ha of solar, 8 ha of wind, 2,023 ha of geothermal, and 2,023 ha of transmission (includes BLM and non-BLM land) development would be permitted, slightly less than 4% of the total available (Ibid.). The RMS conservation, mitigation, and compensation measures are incorporated into the LUPA (Ibid.). In addition, the Preferred Alternative would expand Flat-tailed Horned Lizard protections by increasing the size of some of the ACECs within the species' range and restrict the type of uses (Table 4) (Ibid.). The Record of Decision has not yet been published for DRECP Phase I. Consequently, these amounts are subject to change, and it is unknown how much renewable energy development will be authorized by Imperial, Riverside, and San Diego counties.

Table 4. ACECs within Flat-tailed Horned Lizard's Range (LUPA Preferred Alternative)

ACEC	Current Area (ha)	Proposed Area (ha)	Renewable Energy	Mining	OHV
Coachella Valley Fringe-toed Lizard Preserve	4,151	4,158	No	No	No
Dos Palmas Preserve	3,371	3,371	No	Mineral Materials[1]	No
East Mesa	34,064	35,808	Geothermal[2]	Oil and Gas	Yes
Lake Cahuilla[3]	2,139	3,486	Geothermal[2]	Mineral Materials[4], Oil and Gas	Yes
Ocotillo	5,030	5,924	No	All Types	Yes
San Sebastian Marsh-San Felipe Creek	2,630	2,630	Geothermal (all NSO)	Locatable[5] Minerals, Mineral Materials	Yes
West Mesa	33,075	33,424	Geothermal	Mineral Materials	Yes
Yuha Basin	29,758	31,283	Geothermal	Mineral Materials	Yes

[1] Mineral materials = sand, gravel, rock, etc.

[2] New leases are subject to a "No Surface Occupancy" (NSO) stipulation (i.e., no surface disturbance, extraction only through directional drilling from outside the area)

[3] No disturbance cap (all others are 1%)

[4] Limited to historic operations only

[5] Locatable minerals = gold, silver, gems, limestone, etc.

Mining

The area of mining and mineral sites within the Flat-tailed Horned Lizard's range have not been mapped or quantified (BLM 2011), although Rado (1981) estimated 2,070 ha of active and intermittent sand and gravel quarries at the time of his study. Most mining activity within the Flat-tailed Horned Lizard's range is sand and gravel extraction, which has a relatively small physical footprint but can have a larger ecological footprint (BLM 2011, FTHLICC 2003). Like other types of development, mining activities remove and fragment, habitat, can impact air quality, create erosion and substantial noise, promote invasive species, release contaminants, and result in increased mortality along roads or through subsidizing predators (Ibid.). The Yuha Basin MA has been identified as a source of suitable sand and gravel (DRECP 2015), and there is an ongoing operation adjacent to and partially within East Mesa MA (BLM 2011). Among the few exemptions from the requirement to compensate for impacts to Flat-tailed Horned Lizards in the RMS are sites that have previously been mined along the East Highline Canal, either inside or outside of the East Mesa MA, if the applicant will be reclaiming the site and no further mining would occur (FTHLICC 2003).

Oil and gas leases were issued throughout the Salton Trough in the early 1980s, but only one test well was drilled (FTHLICC 2003). The well was not profitable, no oil or gas resources have been identified, and all oil and gas leases within the Flat-tailed Horned Lizard's habitat have expired (USFWS 1997, FTHLICC 2003).

Gold mining was listed as a potential future threat to Flat-tailed Horned Lizards in the Department's previous status review due to numerous mining claims being staked in the area of OWSVRA (Bolster and Nicol 1989); however, this threat never manifested.

Off-highway Vehicles

Most Flat-tailed Horned Lizard habitat is available for OHV recreational opportunities to some degree; closed areas are restricted to military lands, wilderness designations, and Anza-Borrego Desert State Park (BLM 2003). The BLM allows trail-only riding within the East Mesa, West Mesa, and Yuha Basin MAs (Ibid.). The adverse effects that OHVs can cause to desert ecosystems have been well documented, including compacting soil and destroying soil crusts, which leads to erosion and limits plant germination, growth, and vigor; damaging and destroying the plants themselves and crushing animal burrows, which reduces habitat availability and quality; raising fugitive dust and emitting byproducts of combustion, which impacts air quality and plant growth; spreading invasive species; directly wounding or killing wildlife; and producing excessive noise, which can alter animal behavior and physiology (Ouren et al. 2007).

The most recent estimate of OHV route proliferation and surface disturbance within the Flat-tailed Horned Lizard's range in California occurred in the early 2000s (USFWS 2003, Wright 2002), prior to adoption of the Western Colorado OHV Routes of Travel Designation Plan and construction of the border fence (BLM 2003, USCBP 2012a). Wright (2002) estimated the number of routes and graded roads increased by 387% within the West Mesa MA from 1985 to 2001, increased by 23% within the Yuha Basin MA from 1994 to 2001, and decreased 45% within the East Mesa MA from 1994 to 2001. Wright (2002) estimated 11.4% of the West Mesa MA had vehicle tracks in 2001, and the USFWS (USFWS 2003) estimated that 9.7% and 7.8% of the surface area was disturbed in 2002 within the Yuha Basin and East Mesa MAs,

respectively. Wright and Grant (2003) noted a 45% drop in vehicle track coverage in one year, speculating it could be the result of a big sandstorm and change in Border Patrol activities. This serves as a good example of why vehicle track coverage is an imperfect estimate of OHV impacts. Tracks disappear more quickly in sand than other surfaces, and a high number of tracks does not necessarily equate to frequent, or even recent, vehicle traffic since they can last for a long time in certain substrates (Ibid.). Nevertheless, it has been used as the metric of OHV use in nearly all studies of potential impacts to Flat-tailed Horned Lizards.

There have been numerous attempts to study the impacts of OHVs on Flat-tailed Horned Lizards over the past three and a half decades, but complications associated with the low detectability of the species and variable detectability in different habitats, the unreliability of using scat as a surrogate index of abundance, and difficulty categorizing level or intensity of OHV use at a site have rendered the results equivocal. There have only been a few rigorously designed studies undertaken.

Setser and Young (2000), studying radiotracked Flat-tailed Horned Lizards in mudhill habitat within OWSVRA, found positive associations between Flat-tailed Horned Lizard habitat use and rocks and plants, but a negative association with OHV disturbance; however, this avoidance was only detectable out to 10m from tracks. Hollenbeck (2004, 2006) found sand was the only significant variable associated with Flat-tailed Horned Lizard abundance on several plots across OWSVRA, track coverage was not. Gardner (2005) found that Flat-tailed Horned Lizards were positively associated with sand and shrub abundance, even when the sandy plots were within an OHV route within a wash. McGrann et al. (2006) found that ant mound densities, mean adult mass, and mean juvenile mass were significantly greater on low impact plots (i.e., lower vehicle track %) than high impact plots, but overall density was greater on the high impact plots at one site and lower on another. Because they controlled for sand and vegetation, they speculate the difference was regularity of OHV use, which was greater at the site with lower densities (Ibid.). Because the OHV season occurs largely during the Flat-tailed Horned Lizard's hibernation period, Grant and Doherty (2009) investigated the risk of being crushed by OHVs during this time by simulating high and low impact riding intensities. Five of twelve Flat-tailed Horned Lizards were directly run over during the high impact treatment and three in the low, but none were injured or killed despite hibernating at shallow depths (Ibid.). They noted that a higher proportion of lizards hibernated under shrubs in OWSVRA (high use area) than East Mesa (low use area) and that rainfall may have played a part in the results, speculating that OHVs may cut less deeply into wet soil because the water tension helps hold it together (Ibid.). Nicolai and Lovich (2000) radio-tracked three male Flat-tailed Horned Lizards before and after a race and found a reduced rate of movement after the race, although the biological significance of the difference was dubious since the mean activity areas after the race were variable (i.e., one lower, one nearly the same, and one higher than before the race). Young (1999) did not find a difference in Flat-tailed Horned Lizard reaction to an OHV passing by vs. a person walking by.

Comment [CB8]: I have found hatchling and juvenile flat-tailed horned lizards active every winter month. Larger, first clutch hatchlings will hibernate but second clutches may not. Adults and larger juveniles can be active in March (Barrows and Allen 2009). The point is there is no season or month when at least some flat-tails are not active on the surface and so susceptible to being impacted by OHVs.

Noise associated with OHVs (as well as military activities, construction equipment, transmission lines, power plants, and wind farms) has been speculated to adversely affect Flat-tailed Horned Lizards (Bolster and Nichol 1989, CBD 2014). The degree to which noise impacts Flat-tailed Horned Lizards is uncertain, although it is likely very little. Heffner and Heffner (1998) concluded that reptiles show few, if any, responses to sound, and it appears they do not make as wide a use of hearing as most other vertebrates. Bondello (1976) and Brattstrom and Bondello (1983) demonstrated prolonged acoustical sensitivity loss in Desert Iguanas (*Dipsosaurus dorsalis*) and Mohave Fringe-toed Lizards (*Uma scoparia*), respectively, after short duration exposure to OHV-level noises. These studies have been used to support the notion that similar impacts to Flat-tailed Horned Lizards are likely (Bolster and Nichol 1989). However, Flat-tailed Horned Lizards have a different ear anatomy than these species. Flat-tailed Horned Lizards have no exterior ear opening, and Norris and Lowe (1951) concluded that the species' tympanum (i.e., eardrum) was so degenerate, it appears to have become functionless. The tympanum is covered with skin and encroached upon by bone, and the middle ear has been invaded by jaw bone, a condition that approximates that of snakes (Norris and Lowe 1951, Stebbins and McGinnis 2012). These changes have been noted in other lizard genera as well and are thought to be adaptations to burrowing (Ibid.). Christensen et al. (2012) concluded "that pythons, and possibly all snakes, lost effective pressure hearing with the complete reduction of a functional outer and middle ear, but have an acute vibration sensitivity that may be used for communication and detection of predators and prey." In addition, Wone et al. (1994) experimented with high frequency sounds to determine if they could elicit Flat-tailed Horned Lizards to run and thus be more easily detected; however, none of the Flat-tailed Horned Lizards exposed to the sounds reacted, remaining crouched and motionless whether the units were turned on at a distance or nearby.

It is difficult to find any conclusive evidence of significantly detrimental effects of OHVs on Flat-tailed Horned Lizards. They certainly are injured and killed on roads and trails, but the frequency of this source of mortality and its impact on population dynamics are unknown. A very small proportion (two out of hundreds) of all the Flat-tailed Horned Lizards tracked with radio-transmitters was known to be killed by OHVs (Goode and Parker 2015, Grant and Doherty 2009, Muth and Fisher 1992, Setser 2001). This could be explained if Flat-tailed Horned Lizards are selecting habitat features like rocks and shrubs that OHV riders tend to avoid (Gardner 2005). In addition, not all OHV activity is the same, and the risk to Flat-tailed Horned Lizards likely varies dramatically depending on a number of factors that go into habitat suitability, time of year, and available resources. For instance, Grant and Doherty (2006) observed that lighter Flat-tailed Horned Lizards tended to enter hibernation later in the year and speculated that they may need to stay active longer to put on fat reserves to last the winter. They also noted, as others have, that juveniles may not hibernate at all. It is possible in lean years, Flat-tailed Horned Lizards may not hibernate as long, and the longer they stay active, the more likely they are to be exposed to OHVs on the surface.

Where OHV use intensity is so great that it substantially reduces shrubs or prey, particularly in areas where these habitat features may already be scarce, Flat-tailed Horned Lizard density and body condition are likely to suffer. Luckenbach and Bury (1983) observed marked declines in herbaceous and perennial plants, arthropods, lizards, and mammals in open OHV riding areas of the Algodones Dunes vs. closed/low use areas. The extent to which these changes in vegetation and prey have occurred as a result of OHV activity across the Flat-tailed Horned Lizard's range is unknown. Whether the vibrations from OHVs detected by Flat-tailed Horned Lizards impact their ability to respond to predators or other threats (like OHVs) is similarly unknown.

United States-Mexico Border Activities

In response to illegal immigration and narcotics smuggling, U.S. Customs and Border Patrol (BP) actively patrols the border and surrounding areas, using OHVs, pedestrian and vehicle (PV) fences, and surveillance cameras and towers (Cohn 2007, FTHLICC 2003, Lasky et al. 2011). Flat-tailed Horned Lizards may be adversely affected by both illegal activities and the efforts to halt them through habitat fragmentation caused by the border fence, increased predation facilitated by tall perches (fences and towers) and trash, road mortality, and habitat degradation from cross-country driving.

There is limited literature available specifically assessing border related impacts on the Flat-tailed Horned Lizard and other species (Cohn 2007; Lasky et al. 2011; USCBP 2012a, 2012b). The USFWS estimated that if border-related activities involved a zone of high impact 1 km north of the border, that would amount to disturbance of approximately 2,318 ha (0.7%) and 5,012 ha (3%) of the Flat-tailed Horned Lizard's range west and east of the Imperial Valley, respectively (USFWS 2011). The actual area of disturbance is probably less in the eastern section since the All American Canal runs the length of the border less than 1 km north of it (Ibid.). The construction of a border fence along the entire California range of the species is expected to dramatically reduce that impact (Ibid.). While vehicle-related mortality associated with the main access road along the border fence undoubtedly occurs, evidence suggests the PV fencing in Arizona has resulted in reduced impacts to Flat-tailed Horned Lizard habitat associated with trans-border illegal immigration activities, OHV activity, drug smuggling, and ensuing law enforcement activities (USFWS 2011, FTHLICC 2012, Rorabaugh 2010).

The border fence is nearly continuous across the Flat-Tailed Horned Lizard's range in California (USCBP 2012a) and consists of four types (PV-1, P-2, PV-4, and VF-2) that are at least semi-permeable to lizards (Figure 13) (Lasky et al. 2011, Rorabaugh 2010, USCBP 2012a). Given the relatively large home ranges of Flat-tailed Horned Lizards, it is likely that at least some genetic exchange is still occurring in spite of the fence and increased mortality adjacent to it from road mortality and potentially increased predation. The VF-2 fence, which is only a deterrent to vehicle traffic, was only sporadically constructed along approximately 2 km of the border west of Calexico adjacent to the Yuha Basin MA (USCBP 2012a), which could potentially concentrate illegal activity in this area (Lasky et al. 2011).

Comment [CB9]: Maybe, but without data I'd be uncomfortable making this assertion

In addition to the fence, BP has installed remote video surveillance system (RVSS) towers to monitor illegal activities. There are approximately 20 of these towers within the Flat-tailed Horned Lizard's current range in California (J. Petrilla pers. comm.). These RVSS towers can monitor a much larger area than border patrol agents can cover by vehicle (USCBP 2012b) and may reduce the amount of road mortality associated with law enforcement activities.

The REAL ID Act of 2005 (Pub.L. 109–13, 119 Stat. 302) authorizes the Department of Homeland Security to waive all laws as necessary, including environmental review and mitigation, to "ensure expeditious construction of certain barriers and roads at the U.S border." In spite of this, BP and personnel from the BLM-El Centro office participate in monthly meetings and coordinate regular Flat-tailed Horned Lizard orientation sessions to reduce BP impacts to the species' habitat (FTHLICC 2012).

Figure 13. Border Fence Designs: (a) PV-1, (b) VF-2, (c) P-2, (d) PV-4

Military Activities

Military lands and activities occur within the Flat-tailed Horned Lizard's California range. Naval Air Facility El Centro (NAFEC) has two bombing ranges, one containing 12,060 ha of land within the West Mesa MA (representing 22% of the MA), and a 3,440 ha range in the East Mesa MA (covering 7% of the MA) (FTHLICC 2003). Although most training is aircraft-related, ground-based activities that can cause surface disturbance include non-exploding bombing, training, various target activities that include maintenance and site clean-up, road travel, and maintenance (FTHLICC 2003, USFWS 2011). These activities can adversely impact Flat-tailed Horned Lizards through direct mortality, habitat degradation, increased risk of fire, and potential noise effects.

The military is a participant in the Flat-tailed Horned Lizard ICC and implements the conservation measures in the RMS through their INRMPs (Navy 2014, USAF and USMC 2013). "At NAFEC, any new or maintenance activities conducted within Flat-tailed Horned Lizard MAs are confined to previously disturbed areas. Work crews are trained in Flat-tailed Horned Lizard recognition and disturbance minimization. For projects which upgrade or install new infrastructure to targets, construction is limited to previously disturbed ground and a Flat-tailed Horned Lizard monitor is on site at all times to ensure that mortality is minimized" (R. Powell pers. comm., USFWS 2011). In addition, main range roads and gates have posted Flat-tailed Horned Lizard notification signs, and NAFEC is producing a Range Training Handbook that highlights Flat-tailed Horned Lizard and all natural resource concerns for those who come to train, work on, or utilize their facilities (R. Lovich pers. comm.). In addition, these lands are not open to the public, affording them greater protection from illegal OHV activity and vandalism (Muth and Fisher 1992). Furthermore, Young and Young (2000) observed that jets flying to and from the targets or dog fighting did not seem to bother the Flat-tailed Horned Lizards they were studying in at the Barry M. Goldwater Reserve in Yuma.

Overexploitation

Collecting Flat-tailed Horned Lizards for scientific and educational purposes or herpetoculture (pet trade) may have impacted populations decades ago (Stewart 1971, Turner and Medica 1982), but these practices currently are not common. Horned lizards do not make good pets in general because they are difficult to keep alive in captivity (Sherbrooke 2003), and Flat-tailed Horned Lizards are no exception (Goode and Parker 2015). In addition, sport collection of this species is illegal (Cal. Code Regs., tit. 14, § 5.60). A Scientific Collecting Permit issued by the Department is required to capture Flat-tailed Horned Lizards for scientific or educational purposes (Cal. Code Regs., tit. 14, § 650). Research on Flat-tailed Horned Lizards may have some adverse effects. Goode and Parker (2015) observed that handling associated with attaching radio transmitters appears to affect predation rates of telemetered Flat-tailed Horned Lizards. Nearly half (48.4%) of predated Flat-tailed Horned Lizards were killed within the first week of handling, and 20.3% were killed within a day of handling, indicating that there is a period of increased vulnerability to predators after handing (Ibid.). They suspect scent from the adhesive used to attach the transmitters may have alerted predators like Kit Foxes with a keen sense of smell to the lizards, although effects from handling may also play a part (Ibid.). Setser and Young (2000) attributed two telemetered Flat-tailed Horned Lizard mortalities to research. One was impaled by a marker flag while in a burrow, and one apparently overheated when its transmitter got stuck in a pile of rocks (Ibid.).

Predation

As previously described, the largest natural cause of Flat-tailed Horned Lizard mortality is predation, accounting for as much as 40-50% of the observed mortality in certain years (Goode and Parker 2015, Muth and Fisher 1992, Young and Young 2000). Increased predation by American Kestrels, Loggerhead Shrikes, and Round-tailed Ground Squirrels near urban and agricultural development has been implicated in declines in Flat-tailed Horned Lizards as far as 450 m from the habitat edge (Barrows et al. 2006, Young and Young 2005). In addition, anthropogenic structures such as power poles, transmission lines, fences, ornamental or invasive tree species, and hedgerows, located in otherwise intact habitat act as perching or nesting platforms, which can augment the populations of avian predators and provide a better vantage point for hunting.

Goode and Parker (2015) recorded far fewer Flat-tailed Horned Lizards and far more avian predators along a stretch of road with power poles than one without one. They also reported that preliminary data suggested that minimally-traveled roads alone have minimal effects on the number of Flat-tailed Horned Lizard scat present, while roads with power lines and poles had significantly less scat within the 75 m nearest to the power line, and the power pole/road effect may extend even further than 150 m (Ibid.). The mean of the abundance estimates from plots adjacent to roads with power poles was nearly three times lower than the mean from plots without them. Years earlier at the same site, Young and Young (2000) reported that shrikes were commonly seen hunting from the power poles, and they found many remains of shrike-killed Flat-tailed Horned Lizards in the creosote bushes along this section of road, even though they rarely saw any live individuals there.

Flat-tailed Horned Lizards are relatively short-lived; have a low reproductive index; their populations experience wide fluctuations in abundance in response to resource availability; and they are particularly sensitive to predation (Barrows and Allen 2009, Fisher 1998, FTHLICC 2003, Grimsley and Leavitt 2016, Howard 1974, Young and Young 2000).

Competition

Flat-tailed Horned Lizards are not considered to be territorial (Muth and Fisher 1992), and individuals with overlapping home ranges generally ignore or avoid one another (Young 1999). As a result, intraspecific competition for resources does not seem to be a limiting factor. Other sympatric lizards also consume ants; however, their diets are much more diverse than the Flat-tailed Horned Lizard's. While their diets and ranges overlap substantially in California, Desert Horned Lizards and Flat-tailed Horned Lizards rarely occur together because they prefer different soil types, the former being associated with coarser, more gravely and rocky substrates (Barrows and Allen 2009). There are no known reports of competition between Flat-tailed Horned Lizards and other types of animals.

Disease

There are few reports in the literature of parasites on Flat-tailed Horned Lizards, and none of naturally occurring diseases (Johnson and Spicer 1985). Klauber (1939) and Norris (1949) found nematodes in Flat-tailed Horned Lizards, and the latter also noted that red mites were common ectoparasites on them as well.

Contaminants

Although pesticides could kill harvester ants and other Flat-tailed Horned Lizard food sources, the use of aerial pesticides in the species' range is currently very limited (FTHLICC 2003, USFWS 2011). An aerial and ground-based malathion spray program to control the curly top virus occurs roughly every three years, but includes avoidance and minimization measures to limit potential effects on Flat-tailed Horned Lizards (USFWS 2011). No pesticide treatments are applied within the MAs, although use of targeted hand-applied herbicides (e.g., for tamarisk eradication projects) is allowed (FTHLICC 2003).

Invasive Species and Fire

Native plants provide seeds for harvester ants (Pianka and Parker 1975, Young and Young 2000), as well as shade and refuge from predators, and they trap the windblown sand substrate preferred by Flat-tailed Horned Lizards (Muth and Fisher 1992). Non-native plants, especially those that have become invasive, can alter landscapes and ecosystems. Several species of non-native, invasive plants are common in Flat-tailed Horned Lizard habitat, many of which are Mediterranean or Asian annual species that germinate in the winter or spring months such as Split grass (*Schismus barbatus*), Russian-thistle (*Salsola tragus*), and Sahara mustard (FTHLICC 2003). Many other non-native annual species may be present, particularly near agricultural areas and near streams or wetlands (Ibid.). Most are not adapted to the severe aridity of the Flat-tailed Horned Lizard's range and require years of heavy precipitation to rapidly proliferate (Barrows et al. 2009, Rao and Allen 2010). While these are typically temporary eruptions, more recently Sahara mustard is becoming the dominant annual plant in the Coachella Valley during non-drought years as well (CVCC 2013a).

Sahara mustard is a highly invasive annual plant that is locally abundant in some years throughout portions of the Flat-tailed Horned Lizard's California range. It is most common in wind-blown sand deposits and disturbed sites such as roadsides and abandoned fields (Minnich and Sanders 2000). It was first collected in North America in 1927 in the Coachella Valley (Ibid.), where its impacts on Flat-tailed Horned Lizards and other flora and fauna have been the focus of many studies (Barrows and Allen 2010, Barrows et al. 2009, CVCC 2013b, Hulton VanTassel et al. 2014). Minnich and Sanders (2000) speculate that Sahara mustard's rapid spread through the Sonoran Desert may be related to the fact that, during rains, a sticky gel forms over the species' seed case that adheres to animals as well as automobiles. In this way, on- and off-road vehicles may be accelerating the spread of this invasive species.

Sahara mustard cover appears to influence both community structure and the extent to which arthropods (including ants) inhabit multiple aeolian (wind-blown) sand habitats within the Coachella Valley (Hulton VanTassel et al. 2014). In the Coachella Valley, Sahara mustard has been found to retard Flat-tailed Horned Lizard population growth (CVCC 2013a). Flat-tailed Horned Lizards prefer stabilized sand dune habitats (Barrows and Allen 2009), but since the most recent explosive mustard growth event in 2005, they have been found more frequently on active sand dunes, a habitat type they typically rarely occupy, where mustard growth is limited (CVCC 2013b). Juvenile Flat-tailed Horned Lizards were found to be 10% smaller on stabilized sand fields as compared to active dunes, potentially due to limited food resources (primarily ants) in areas dominated by mustard (Ibid.). Possible other reasons for this include reduced mobility as a result of dense mustard growth and increased soil compaction due to mustard inhibiting aeolian sand movement (CVCC 2013b). Mustard has been implicated as the cause for a Flat-tailed Horned Lizard population response similar to one during drought conditions, despite recent years with average or above average rainfall (CVCC 2013b).

Creosote bush scrub habitat throughout the southern Californian desert has also been invaded and subsequently altered by nonnative annual grasses (Brown and Minnich 1986, Lovich and Bainbridge 1999, Rao and Allen 2010, Steers and Allen 2011). Invasive annual grasses are known to increase the extent, frequency, and severity of natural fire regimes throughout desert shrublands (Abatzglou and Kolden 2011; Brown and Minnich 1986; Rao and Allen 2010; Steers and Allen 2010, 2011). Though fire is rare in the Colorado Desert (Figures 14 and 15), the exception may be the very northwestern edge of the Flat-tailed Horned Lizard's range in the Coachella Valley, which is "a major wildland-urban interface area that has been significantly impacted by atmospheric nitrogen deposition concomitant with fuel alterations from invasive annual grasses and increased ignition frequencies from human activities" (Steers and Allen 2011). Post fire recovery of desert shrublands has been studied here, demonstrating that species composition shifts, and long-lived native species like creosote bush and white bursage that are important to Flat-tailed Horned Lizards struggle to recover (Steers and Allen 2011).

In addition to non-native plants, non-native ants have been implicated as a potential threat to Flat-tailed Horned Lizards. Native ants within the Flat-tailed Horned Lizard's range, primarily harvester ants, are adapted to desert conditions (Pianka and Parker 1975). The exotic vegetation, changes in soil condition, and extra moisture associated with the edges of human development (agriculture, irrigation canals, and urban areas) can facilitate invasion by Argentine ants (*Linepithema humile*) and other non-natives, resulting in displacement of native ants (Suarez et al. 1998). In California, red fire ants (*Solenopsis invicta*) frequently build mounds on irrigated turf or nest in places such as rotten logs, walls of buildings, under sidewalks, and in outdoor electric and water utility boxes (Greenberg and Kabashima 2013). Barrows and Allen (2009) reported that Argentine ants and red fire ants have invaded the Coachella Valley, but not Flat-tailed Horned Lizard habitat, which they presume is the result of a barrier created by hyper-arid conditions.

Drought and Climate Change

California entered what has become an historic drought in 2011. A similarly severe event has not occurred in the last 1200 years (Griffin and Anchukaitis 2014). Seager et al. (2007) reported broad consensus among climate models that the transition to a more arid American Southwest is already underway, and that if the models are correct, droughts will become the new norm. Empirical data over the last century confirm the Sonoran Desert warming trends in winter and spring, decreased frequency of freezing temperatures, lengthening of the freeze-free season, and increased minimum temperatures per winter year (Weiss and Overpeck 2005). In addition, variability in cool season rainfall (i.e., when the majority of precipitation within the Flat-tailed Horned Lizard's California range falls) is increasing (Abatzoglou and Kolden 2011). These changes in temperature and precipitation are already driving shifts in vegetation in the Sonoran Desert, including a decrease in creosotebush and increase in invasive grasses (Kimball et al. 2010, Munson et al. 2012, Weiss and Overpeck 2005).

While the Flat-tailed Horned Lizard is adapted to one of the most arid places in the country, it may nevertheless be at greater than average risk of localized extinctions from prolonged droughts due to its small geographic range, specialized diet, low reproductive index, short lifespan, and increasing habitat fragmentation (USFWS 1993, Barrows and Allen 2009). Populations of Coachella Valley Fringe-toed Lizards have already lost substantial genetic diversity since the last drought (Vandergast et al. 2016). The Flat-tailed Horned Lizard has the highest measured active body temperature of *Phrynosomids* in the United States (Pianka and Parker 1975) and, like other desert-adapted reptiles, may already approach its physiological tolerances (Barrows 2011). There are only two mechanisms for a species to persist in the face of climate change: given enough time and unobstructed ability to move, dispersal to a more favorable thermal environment (typically north or higher elevation) may be possible; otherwise, it will have to behaviorally and/or physiologically adapt (Sinervo et al. 2010).

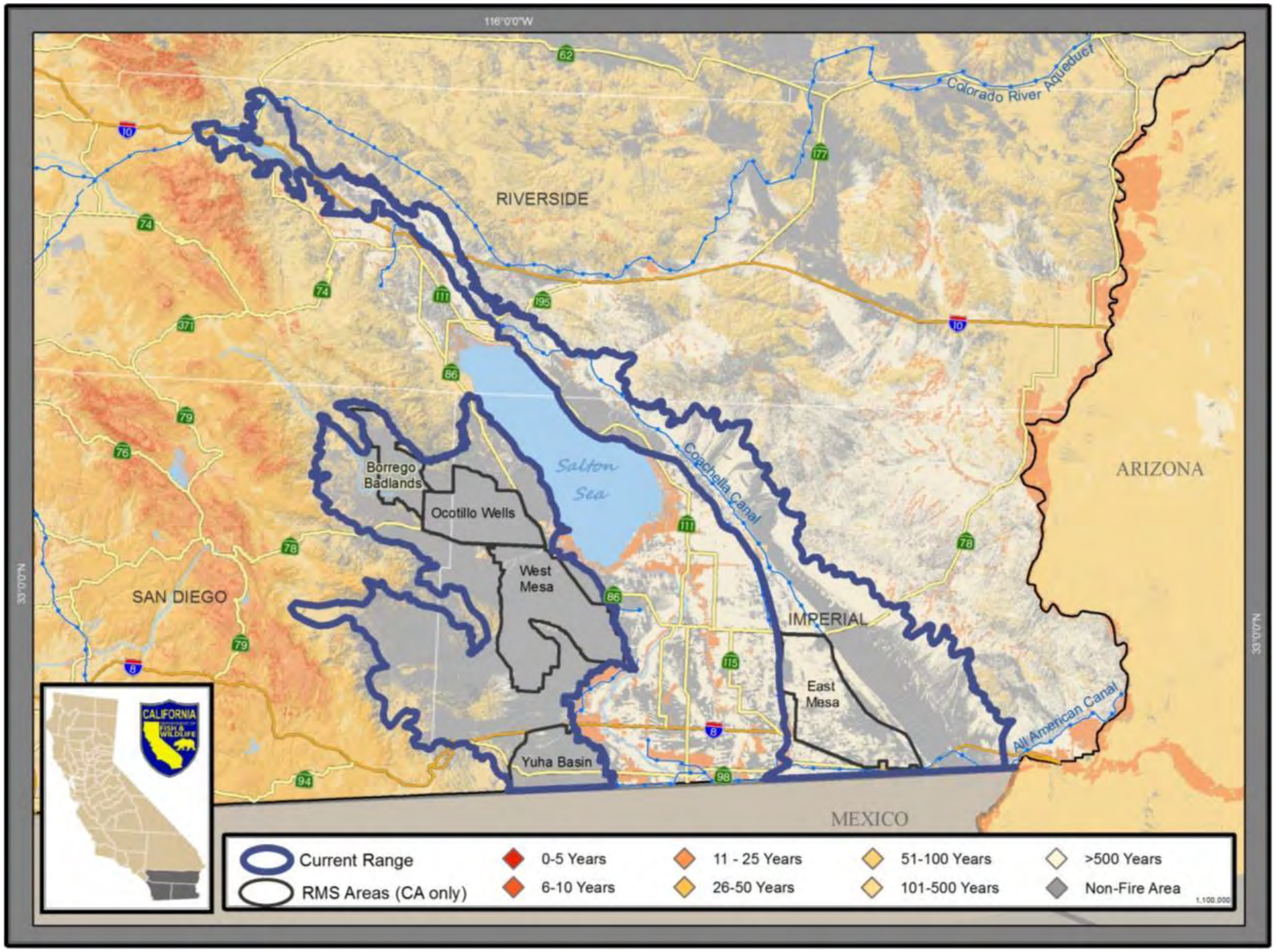


Figure 14. Mean Fire Return Interval within and around the Flat-tailed Horned Lizard's California Range

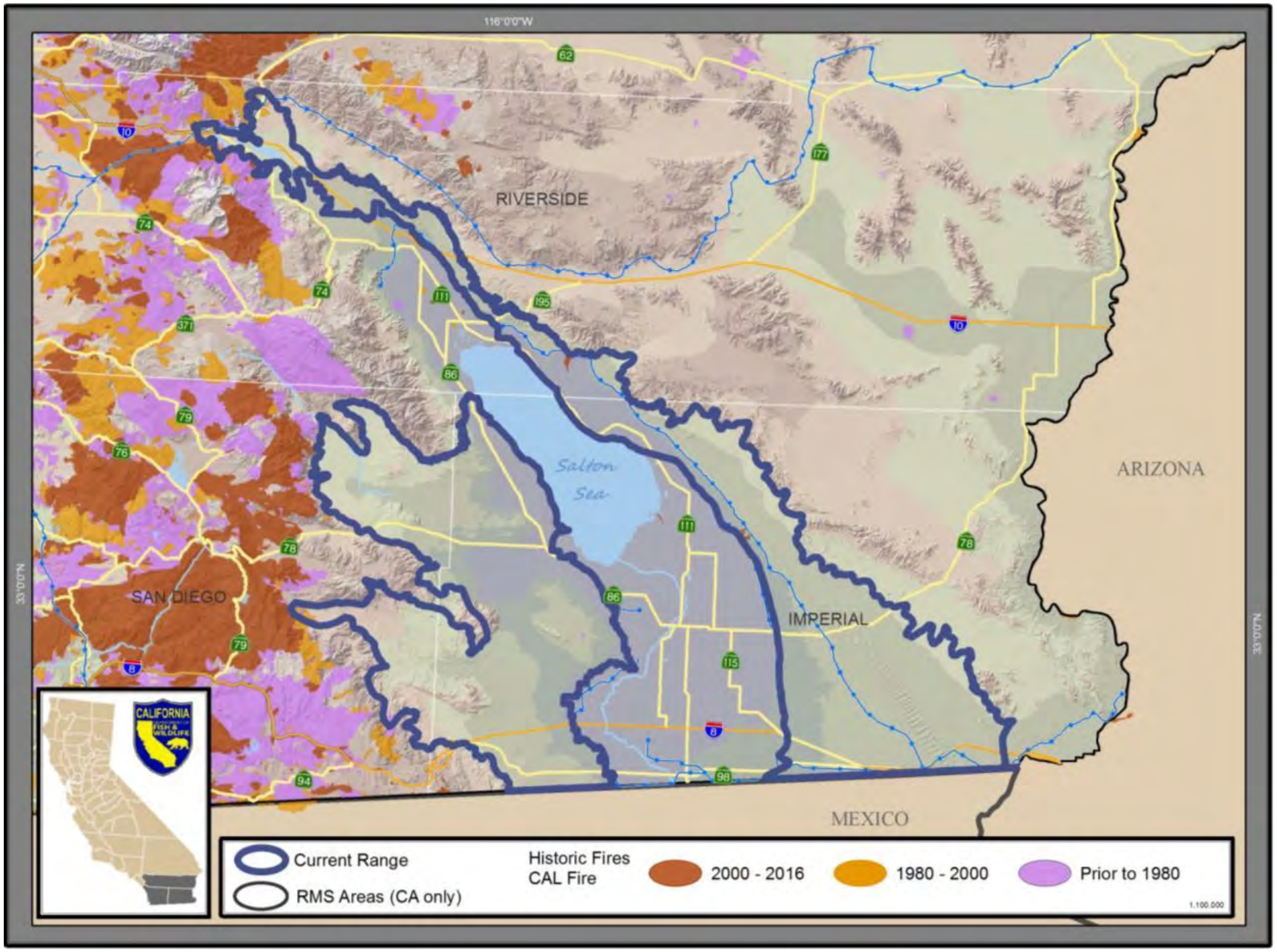
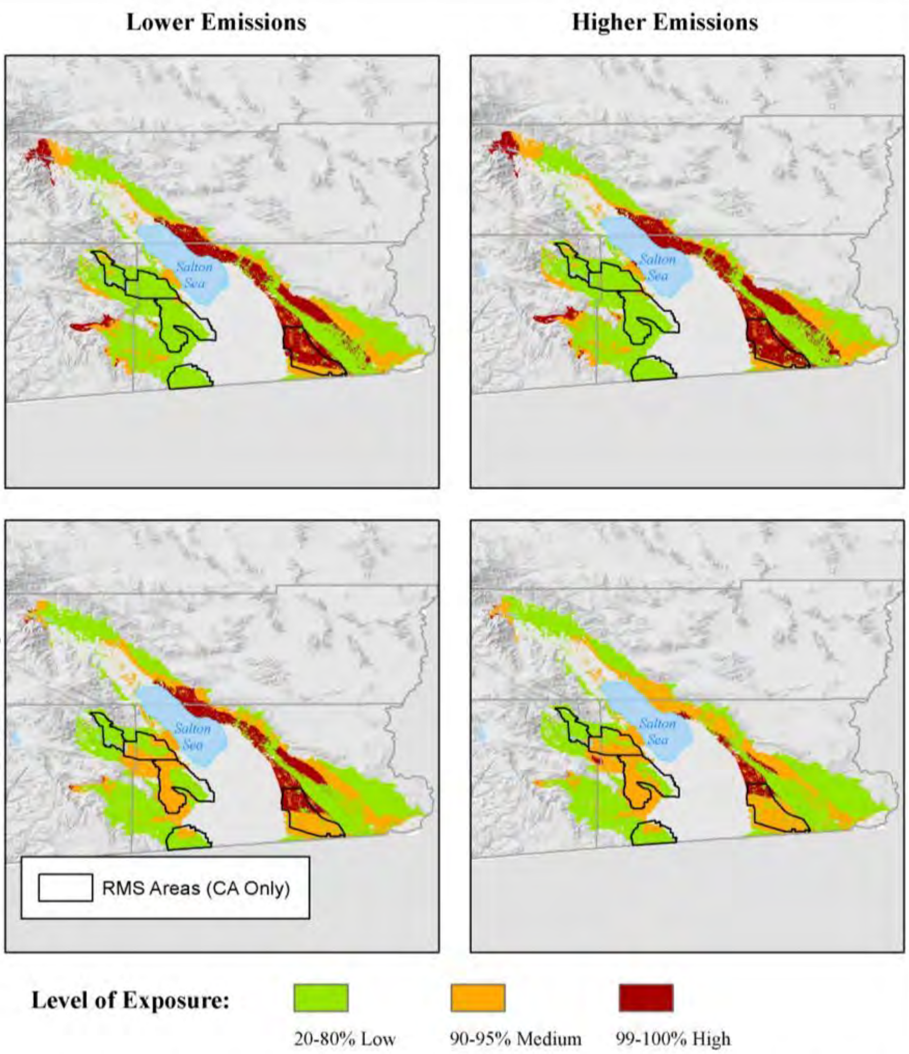


Figure 15. Historic Large Fires within and near the Flat-tailed Horned Lizard's California Range

Flat-tailed Horned Lizards in California are located at the farthest northern extent of their range, and the populations in the Coachella Valley are already extremely small and fragmented. The species' range boundary in California is surrounded by mountains and unsuitable habitat (i.e., rocky substrate). Even with a relatively short generation time, given the predicted pace of climate change in the region, it is unlikely the species will be able to migrate upwards and adapt to a different substrate and vegetative community in time. Behavioral strategies to cope with rising temperatures include spending more time in the shade or in a burrow, which leaves less time available for foraging and mating (Sinervo et al. 2010). In addition to adult lizards being at greater risk of reaching a critical thermal maximum, embryos in the nest will be subjected to increasingly higher temperatures and may exceed their critical thermal maximum temperature more often (Levy et al. 2015). Flat-tailed Horned Lizards have been shown to burrow substantial depths (90 cm) to reach the zone of soil moisture in drought situations (Young and Young 2000), so they may be able to adjust in that way, but the fate of hatchlings that are buried that far below the surface is unknown. They could also potentially lay nests in a greater amount of shade, but as climate change appears to be favoring invasive grasses over native shrubs (Abatzoglou and Kolden 2011, Munson et al. 2012), this may become a scarcer option.

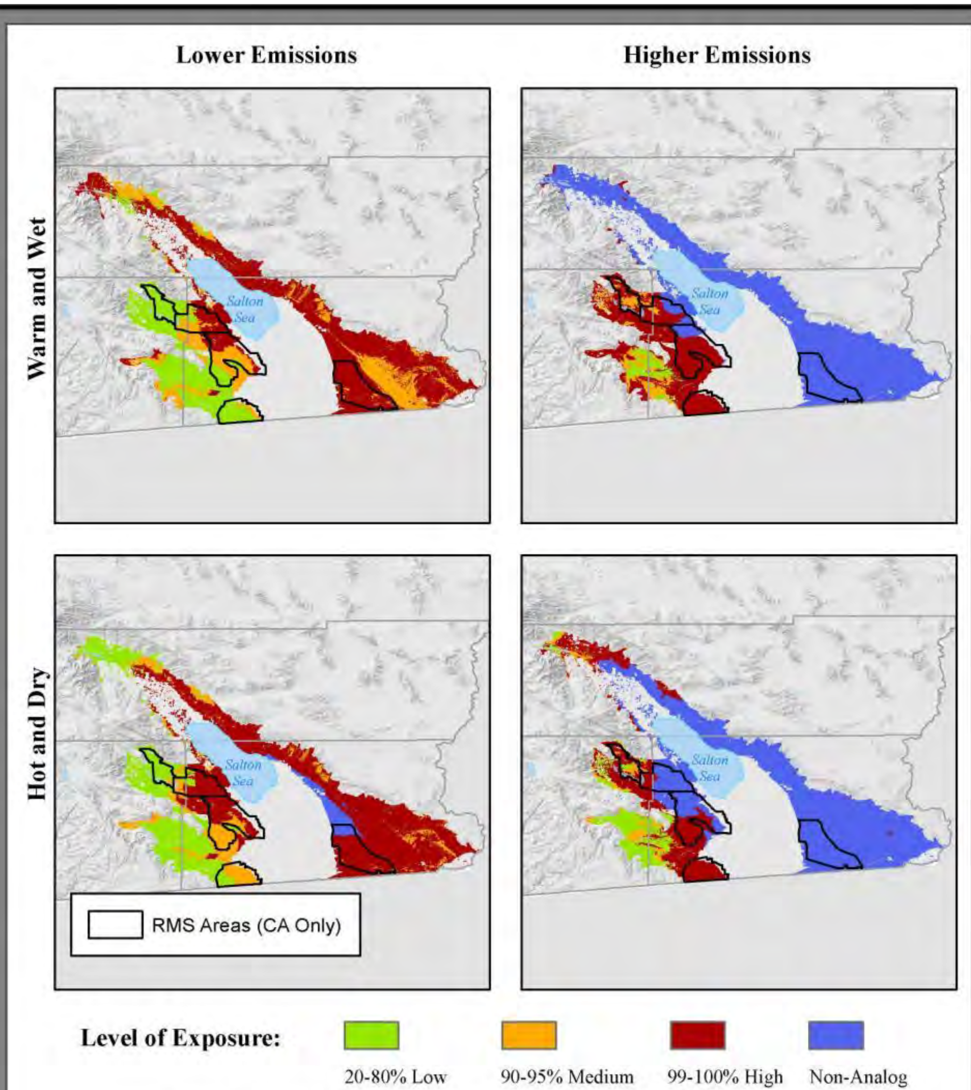
Two studies of potential climate change risk to Flat-tailed Horned Lizards have been undertaken. Wright et al. (2013) used an ecological niche model built with Flat-tailed Horned Lizard locality data (from California and Arizona, not Mexico) and several climate change scenarios to predict the climatic suitability of the species' range at 2050. There was overwhelming consensus among the models that predicted Flat-tailed Horned Lizard habitat remaining fairly stable to that date (Ibid.); however, this analysis did not take changes in habitat into account. The Department modeled the relative environmental stress a vegetative community would undergo given different climate scenarios in the short-term (2039) and long-term (2099) (Figures 16 and 17). It appears in the short-term, if the climate is hot and dry, Flat-tailed Horned Lizard habitat will undergo less stress than a warm and wet climate (Figure 16), but by 2099, large portions of the species' range will be under extreme stress and may no longer support the viable habitat (Figure 17).

Climate change is likely to adversely impact most native species over time. Flat-tailed Horned Lizard populations already experience dramatic fluctuations over time, typically in response to rainfall and its effect on resource availability. Setser and Young (2000) observed Flat-tailed Horned Lizards putting on weight rapidly and engaging in courtship and mating almost immediately after a series of monsoonal rains that increased ant availability. Drought conditions reduce harvester ant abundance, which reduces reproduction in a species with already very low reproductive output (Howard 1974, Young and Young 2000). In addition, drought effects may also place Flat-tailed Horned Lizards at greater risk from OHV-related mortality since it appears Flat-tailed Horned Lizards with lower body mass enter hibernation later in the year (Grant and Doherty 2009). Given its short lifespan and already low reproductive potential, prolonged droughts are very likely to cause decreases in population size that amount to loss of genetic diversity, the same diversity necessary to adapt to a rapidly warming environment.



Mapped Climate Exposure of FTHL Habitat Under Four Near-term (2039) Climate Projections. This image shows areas of suitable FTHL habitat within the species range based on California Wildlife Habitat Relationships (CWHR 2016) and a statewide best-available vegetation map (FVEG2015, FRAP 2015), and climate exposure scores for vegetation macrogroups from Thorne et al. (2015). High (>95% exposure) are highly stressed areas; Moderate (80-95% exposure) are stressed areas, and Low (<80% exposure) are areas expected to remain climatically suitable for the vegetation that currently occupies them. "Warm and Wet" = CNRM CM5, Hot and Dry" = MIROC ESM, Lower Emissions = RCP 4.5, and Higher Emissions = RCP 8.5.

Figure 16. Predicted Climate Change Impacts to Habitat in 2039



Mapped Climate Exposure of FTHL Habitat Under Four End-of-Century (2099) Climate Projections. This image shows areas of suitable FTHL habitat within the species range based on California Wildlife Habitat Relationships (CWHR 2016) and a statewide best-available vegetation map (FVEG2015, FRAP 2015), and climate exposure scores for vegetation macrogroups from Thorne et al. (2015). High (>95% exposure) and Non-Analog (outside the bounds of current California climate) are highly stressed areas; Moderate (80-95% exposure) are stressed areas, and Low (<80% exposure) are areas expected to remain climatically suitable for the vegetation that currently occupies them. "Warm and Wet" = CNRM CM5, Hot and Dry" = MIROC ESM, Lower Emissions = RCP 4.5, and Higher Emissions = RCP 8.5.

Figure 17. Predicted Climate Change Impacts to Habitat in 2099

PROTECTION AFFORDED BY LISTING

It is the policy of the state to conserve, protect, restore and enhance any endangered or any threatened species and its habitat. (Fish & G. Code, § 2052) The conservation, protection, and enhancement of listed species and their habitat is of statewide concern (Fish & G. Code, § 2051(c).) CESA defines "take" as hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill. (Fish & G. Code, § 86.) The Fish and Game Code provides the Department with related authority to authorize "take" under certain circumstances through incidental take permits, memorandum of understandings, natural community conservation plans, or other plans or agreements approved by or entered into by the Department. (Fish & G. Code, §§ 2081, 2081.1, 2086, 2087 and 2835.) Any person violating the take prohibition would be punishable under State law.

Approximately 77% of the Flat-tailed Horned Lizard's range is owned or managed by the RMS participating agencies. Implementation of the RMS includes, in most circumstances, requiring compensatory mitigation for long-term, unavoidable impacts to Flat-tailed Horned Lizard habitat within MAs whether the site is occupied or not. This compensatory mitigation is used to purchase private lands, which are turned over to the BLM for management, or it is used to fund RMS activities like habitat restoration.

If the Flat-tailed Horned Lizard were listed under CESA, impacts of take caused by activities authorized through incidental take permits must be minimized and fully mitigated according to state standards. These standards include protection of the land in perpetuity with an easement, development and implementation of a species-specific adaptive management plan, and funding through an endowment to pay for long-term monitoring and maintenance to ensure the mitigation land meets performance criteria. Because the RMS is voluntary, the participating agencies often struggle with funding and staffing to carry out the RMS activities in spite of the compensatory mitigation funding received. Additionally, the lands within it continue to be multiple-use under the BLM's management. However, mitigation lands required under CESA would be expected to guarantee protection and level of habitat quality for a longer time.

Additional protection of Flat-tailed Horned Lizard following listing would occur with required public agency environmental review under CEQA and its federal counterpart, the National Environmental Policy Act (NEPA). CEQA and NEPA both require affected public agencies to analyze and disclose project-related environmental effects, including potentially significant impacts on endangered, rare, and threatened special status species. In common practice, potential impacts to listed species are examined more closely in CEQA and NEPA documents than potential impacts to unlisted species.

Under CEQA's "substantive mandate," state and local agencies in California must avoid or substantially lessen significant environmental effects to the extent feasible. (Pub. Resources Code, § 21080; Cal. Code Regs., tit.14., §§ 15002 & 15021). With that mandate and the Department's regulatory jurisdiction, the Department expects related CEQA and NEPA review will likely result in increased information regarding the status of Flat-tailed Horned Lizard in California due to, among other things, updated occurrence and abundance information for individual projects. Where significant impacts are identified under CEQA, the Department expects required project-specific avoidance, minimization, and mitigation measures will benefit the species. State listing, in this respect, and required consultation with the Department during state and local agency environmental review under CEQA, would also be expected to benefit the species in terms of related impacts for individual project that might otherwise occur absent listing.

Unlike many other species whose listing under CESA may increase interagency coordination and the likelihood that State and federal land and resource management agencies will allocate funds towards protection and recovery actions, the participating agencies already meet and coordinate regularly to strategize how best to implement the RMS. When sufficient funding and staffing are available, these actions include monitoring, specific research studies, acquisition of private inholdings, and habitat restoration (among other things). As mentioned previously in Existing Management, the RMS has already been codified into the BLM's land use plans for the East Mesa, West Mesa, and Yuha Desert MAs through adoption of ACECs in the CDCA, as well as the Department of Defense's properties through their INRMPs, making these conservation measures mandatory. In other areas, if the Flat-tailed Horned Lizard is listed under CESA, it is possible some, or all, aspects of RMS implementation will be abandoned or reduced in priority to focus limited funding and staffing on mandatory CESA-compliance.

Also, unlike other species that may benefit from CESA listing by having a greater likelihood of being incorporated into large-scale conservation and planning documents like Habitat Conservation Plans and Natural Community Conservation Plans, the Flat-tailed Horned Lizard is already a covered species (or proposed to be covered as an "individual focal species" in the case of the DRECP/BLM LUPA) throughout its entire range in California for the vast majority of projected development impacts (i.e., urban and agricultural in Coachella Valley and renewable energy throughout the rest of the range). The exceptions would be any future development on local government and private lands in San Diego and Imperial counties, which while not amounting to a large proportion of the Flat-tailed Horned Lizard's range, could have large impacts on the species' connectivity to the limited remaining habitat in the north if the areas along the Salton Sea are developed. The DRECP does not provide CESA take coverage but does implement the RMS, which contains measures on BLM lands that extend beyond mitigation for projects that would result in take of Flat-tailed Horned Lizards.

A further potential challenge to implementing CESA protections for the Flat-tailed Horned Lizard is the scarcity of private land within the species' range that could be used for mitigation. A recent option to use BLM land for CESA mitigation has become available through an agreement entered into by the Department and BLM in 2015, referred to as the Durability Agreement (BLM and CDFW 2015). If mutually agreeable between the two agencies, CESA compensatory mitigation actions could be implemented on BLM Conservation Lands (e.g., ACECs and Wilderness Areas), including restoration of habitat and movement corridors, rehabilitation of closed roads, predator control, invasive plant species removal and control, and additional law enforcement (Ibid.).

SUMMARY OF LISTING FACTORS

CESA directs the Department to prepare this report regarding the status of Flat-tailed Horned Lizard based upon the best scientific information available to the Department. CESA's implementing regulations identify key factors that are relevant to the Department's analyses. Specifically, a "species shall be listed as endangered or threatened ... if the Commission determines that its continued existence is in serious danger or is threatened by any one or any combination of the following factors: (1) present or threatened modification or destruction of its habitat; (2) overexploitation; (3) predation; (4) competition; (5) disease; or (6) other natural occurrences or human-related activities." (Cal. Code Regs., tit. 14, § 670.1, subd. (i)(1)(A).)

The definitions of endangered and threatened species in the Fish and G. Code provide key guidance to the Department's scientific determination. An endangered species under CESA is one "which is in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, over exploitation, predation, competition, or disease." (Fish & G. Code, § 2062.) A threatened species under CESA is one "that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of special protection and management efforts required by [CESA]." (Id., § 2067.)

The following summarizes the Department's determination regarding the factors to be considered by the Commission in making its decision on whether to list the Flat-tailed Horned Lizard. This summary is based on the best available scientific information, as presented in the foregoing sections of the report.

Present or Threatened Modification or Destruction of Habitat

Agricultural and Urban Development

While agricultural development has reduced and fragmented available habitat, this impact is fairly concentrated down the middle of the Flat-tailed Horned Lizard's range in California and is not expected to increase in any significant way in the future. Flat-tailed Horned Lizards have already disappeared from most historically occupied sites in the Coachella Valley over the past 30 years due to agricultural and urban development (CVCC 2013a), threatening the species' long-term persistence in this area. Another threat is posed by the proposed future urban development in Imperial County (County of Imperial 2013) along the shores of the Salton Sea, particularly on the east side, which could eliminate the only habitat corridor between the population east of the Imperial Valley and the Dos Palmas population.

Renewable Energy Development

Expansion of renewable energy development is expected to continue within the Flat-tailed Horned Lizard's range, and Phase I of the DRECP (i.e., the BLM LUPA), if implemented, is expected to reduce impacts to the species by focusing most of the impacts on or near existing disturbed areas and existing transmission lines as opposed to relatively undisturbed open desert. However, the lack of county and city participation in the plan could compromise its efficacy if relatively undisturbed private and local government managed lands are developed.

Mining

It appears that sand and gravel mining are the most common mining activities currently in operation within the Flat-tailed Horned Lizard's range, but the area available for mineral extraction in Imperial County is largely depleted (BLM 2011). In addition, oil, gas, and gold exploration have proven unprofitable. Therefore, the threat to Flat-tailed Horned Lizards posed by mining is considered relatively small.

Off-highway Vehicles

Where OHV use intensity is so great that it substantially reduces shrubs or prey, particularly in areas where these habitat features may already be scarce, Flat-tailed Horned Lizard, it may pose a threat to the species. The extent to which these changes in vegetation and prey have occurred as a result of OHV activity across the Flat-tailed Horned Lizard's range is unknown since very few focused surveys have detected a demonstrable connection between OHV activity and Flat-tailed Horned Lizard abundance.

United States-Mexico Border Activities

While there are likely some adverse effects arising from road mortality and increased avian predation within a short distance from the border fence, there also appear to be some benefits from it including reduced habitat damage from illegal border crossing. Additionally, the fencing used in California does not appear to create a barrier to movement or gene flow. Border activities do not appear to pose a serious threat to Flat-tailed Horned Lizards.

Military Activities

The vast majority of Flat-tailed Horned Lizard habitat on military lands is protected and managed in a way to conserve the species, so military activities do not appear to pose a threat to them.

Overexploitation

Collecting for the pet trade does not appear to be a current threat, although some evidence exists that the listing process alone can increase the likelihood of it becoming a threat due to the human disposition to place exaggerated value on rare or "off limits" species (Courchamp et al. 2006). Illegal commercial collection of Flat-tailed Horned Lizards likely would not be very difficult due to the common observation among researchers that they frequently use, and are highly visible on, roads compared to on native substrates, and tend to freeze instead of flee. However, their renowned difficulty to keep alive in captivity may negate this potential threat. While there may be increased mortality due to research activities, these take place over a very small portion of the species' range, and the beneficial information derived from them outweighs the minimal threat they may pose to Flat-tailed Horned Lizard populations. There is no evidence to suggest Flat-tailed Horned Lizards are or will be substantially threatened by overexploitation.

Predation

Anthropogenic increases in predation pose a threat to Flat-tailed Horned Lizards, but the severity of the threat likely depends on the vulnerability of the Flat-tailed Horned Lizard population (e.g., small and isolated in Thousand Palms, Coachella Valley vs. large and intact in East Mesa MA) and the surrounding land use. For example, the effect of predation along the edge of urban or agricultural development appears to be greater than it is along a powerline in the middle of the desert because the former provides more subsidized resources. Given development is relatively concentrated within the Coachella and Imperial Valleys, this area of heightened predation comprises a small fraction of the Flat-tailed Horned Lizard's range.

Competition

There is no evidence to suggest that competition threatens Flat-tailed Horned Lizards.

Disease

There is no evidence to suggest that disease threatens Flat-tailed Horned Lizards.

Other Natural Events or Human-Related Activities

Fragmentation, Edge Effects, and Small Populations

Currently large expanses of relatively intact habitat remain within the Flat-tailed Horned Lizard's range in California. While habitat fragmentation, edge effects, and small population sizes may pose serious threats to Flat-tailed Horned Lizards in portions of their California range, the degree to which this would significantly adversely impact the species as a whole is uncertain. How and where future development is constructed will affect the severity of this threat.

Roads, Canals, and Railroads

Major roads, canals, and railroads may pose a serious threat to Flat-tailed Horned Lizards through habitat fragmentation and/or edge effects. In addition, mortality associated with major roads could create a localized sink on both sides of the road. Minor, lightly travelled roads (including OHV trails), especially those without associated power poles or other human-provided perches, likely contribute to some mortality but also likely do not pose a serious threat to Flat-tailed Horned Lizards.

Contaminants

There is no evidence to suggest that herbicides, pesticides, or other contaminants pose a significant threat to Flat-tailed Horned Lizards.

Invasive Species and Fire

Invasive species like Sahara mustard appear to be playing a role in Flat-tailed Horned Lizard declines in portions of the species range (e.g., the Coachella Valley). The degree to which invasive plants are having population-level impacts, either alone or in conjunction with other factors, throughout other parts of the species' range in California is unknown. While invasive grasses increase the risk of fire, this threat has not been observed within the Flat-tailed Horned Lizard's range with the exception of the Coachella Valley, which is located in a major wildland-urban interface area (Steers and Allen 2011). In the Coachella Valley, the Flat-tailed Horned Lizard could be at risk of local extinction due to the interaction of both invasive plant species and climate change (CVCC 2013a). Non-native ants do not appear to pose a threat to Flat-tailed Horned Lizards.

Drought and Climate Change

Drought, in combination with other factors such as habitat fragmentation and degradation, and climate change appear to pose a serious threat to Flat-tailed Horned Lizards.

LISTING RECOMMENDATION

[Note to readers: This section will be completed after external peer review.]

MANAGEMENT RECOMMENDATIONS

These recommendations were developed by the Department in accordance with the requirements of Fish and Game Code, section 2074.6. The Department recommends these actions be implemented regardless of the Commission's decision on listing Flat-tailed Horned Lizard as threatened or endangered. This list includes recommendations for actions that could be undertaken by the Department as well as by other public agencies, non-governmental organizations, and private land owners.

Revisit Flat-tailed Horned Lizard Status in Three to Five Years

Several research and planning efforts are in progress that are expected to provide additional insights into the status of the Flat-tailed Horned Lizard in California in the next three to five years. For example, in that time, at least preliminary results from the following studies should be available: landscape genomics, population viability analysis, habitat connectivity along the east side of the Salton Sea, and the extent to which avian predation that is subsidized by anthropogenic features or actions is affecting Flat-tailed Horned Lizard mortality rates. In that time, it is likely the OWSVRA General Plan will be prepared and potentially implemented. The degree to which Flat-tailed Horned Lizards are addressed and afforded protection in that plan is expected to contribute to either the conservation or decline of the species into the future. Additionally, in that time, a Record of Decision on the BLM LUPA should have been published, so at least a few years of implementation of its measures will be available to better determine to what degree the potential threats and benefits to Flat-tailed Horned Lizards are realized. In addition, the species currently is experiencing what appears to be a widespread drought-related decline in abundance. The next three to five years will likely reveal whether the species can rebound from prolonged drought or not. If the data indicate a change in status is warranted, the Department should prepare the appropriate document to address that change.

Increase Department Participation in RMS Implementation

Like the other participating agencies, the Department's contribution to Flat-tailed Horned Lizard conservation through implementation of the RMS is subject to funding and staffing availability.. The Department should increase its participation in implementation of the RMS, including working with partners to identify outside funding opportunities (e.g., State Wildlife Grants) and providing staff to assist with population monitoring, habitat restoration, education and outreach, and international coordination and collaboration.

Improve Population Monitoring Methods

Investigate the use of scent detection dogs in Occupancy and Demography surveys to increase detectability, which may greatly reduce duration and number of personnel necessary to achieve reliable estimates of distribution and abundance. Encourage annual budgeting by participating agencies to fully fund population monitoring efforts on the MAs and RA and expand them to other parts of the range for comparison. In addition to collecting data on Flat-tailed Horned

Lizards, data on environmental covariates should also be collected such as habitat quality, predators and prey, and anthropogenic threats, so that an informed adaptive management strategy can be developed. Investigate whether stressor monitoring may be more cost-effective and better able to inform management decisions.

Increase Habitat Quality and Quantity

Restore areas degraded by OHVs and mining. Increase patrol of areas and cite illegal cross-country OHV or other public trespass in closed or limited use areas. Immediately obscure and/or restore any new unsanctioned trails. Decommission powerlines or other anthropogenic structures that provide perches for avian predators. Remove or trim hedgerows along roads that attract avian predators. To the extent feasible, remove or reduce the abundance and extent of non-native grasses, Sahara mustard, and other invasive species. Clean up illegally dumped material as quickly as possible.

Reduce Habitat Fragmentation and its Effects

Investigate how barriers may be limiting gene flow across the species' range. Use this information to protect important habitat linkages and movement corridors such as Yuha Basin to West Mesa and East Mesa to Dos Palmas. Try to improve seemingly broken linkages, such as by creating effective road and canal crossings. Continue to purchase private inholdings within the larger public land matrix. Coordinate with and assist the Mexican government on Flat-tailed Horned Lizard conservation across the border. Implementers of the RMS and CVMSHCP should coordinate on reestablishing connectivity. If necessary, develop an assisted migration and or repatriation strategy to address loss of diversity and local extirpations.

Reduce Habitat Loss and Edge Effects from Renewable Energy Projects

Encourage siting renewable energy development outside of the desert completely (see Hernandez et al. 2015) or if within the Flat-tailed Horned Lizard's range, make sure it is located on compatible lands (e.g., near existing transmission line on agricultural lands). Limit the amount of new transmission lines by encouraging construction of a single line with additional capacity for future expansion. Bury lines whenever possible. Close (permanently or temporarily) areas to OHVs that are losing shrub cover.

Further Investigate the Impacts of Relocation

To date, only one study has simultaneously investigated the effects to relocated and resident Flat-tailed Horned Lizards where relocations have occurred (Goode and Parker 2015). Large numbers of Flat-tailed Horned Lizards are relocated out of harm's way on construction projects, and their fate, as well as the fate of the recipient populations, is not well understood. Exclusion fencing may be somewhat useful in reducing mortality; however, it requires continuous maintenance that may limit its utility. Research in this area should develop relocation plans that take the recipient population's density and the habitat quality into account. Develop a strategy that is informed by landscape-level genetics, to relocate Flat-tailed Horned Lizards to restored or apparently suitable, but unoccupied, habitat, even if it is located relatively far from the project site and monitor the results.

Modify the Mitigation and Compensation Strategy

Purchase and/or set aside lands specifically for Flat-tailed Horned Lizard conservation in high quality habitat, whereas few threats as possible exist (i.e., closed to OHV, far from human development, roads, and power lines). Use compensation funds to create an endowment, or higher interest earning account, that pays for routine management, maintenance, and monitoring of these sites and their populations.

ECONOMIC CONSIDERATIONS

The Department is charged in an advisory capacity in the present context to provide a written report and a related recommendation to the Commission based on the best scientific information available regarding the status of Flat-tailed Horned Lizard in California. The topic areas and related factors the Department is required to address as part of that effort are biological and not economic. (See Fish & G. Code, § 2074.6; Cal. Code Regs., tit. 14, § 670.1, subd. (f).)

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Lovich, R. Electronic mail received April 28, 2016.

Petrilla, J. Electronic mail received May 4, 2016.

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Rodriguez, M. Electronic mail received June 15, 2016.

Ronning, C. Electronic mail received April 26, 2016.

APPENDIX 1. Flat-Tailed Horned Lizard Rangewide Management Strategy, 2003 Revision

[In the final version, the entire document will be inserted, but since this is Word, not PDF, I'm just providing this page. Use the link within the narrative to download the 2003 RMS: https://www.wildlife.ca.gov/Regions/6/Flat-Tailed-Horned-Lizard-Copy]

APPENDIX 2. List of Acronyms and Abbreviations

ac	acre
ACEC	Area of Critical Environmental Concern
BLM	United States Bureau of Land Management
C	Celsius
CDCA	California Desert Conservation Act
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
cm	centimeter
CMA	Conservation and Management
CNDDB	California Natural Diversity Database
Commission	California Fish and Game Commission
CVMSHCP	Coachella Valley Multiple Species Habitat Conservation Plan
CWHR	California Wildlife Habitat Relationships
Department	California Department of Fish and Wildlife
DFA	Development Focus Areas
DRECP	Desert Renewable Energy Conservation Plan
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ESA	Endangered Species Act (federal)
F	Fahrenheit
FLPMA	Federal Land Policy and Management Act
ft	feet
hr	hour
ha	hectare
HCP	Habitat Conservation Plan
ICA	Interagency Conservation Agreement
in	inch
INRMP	Integrated Natural Resources Management Plan
km	kilometer
LCR MSCP	Lower Colorado River Multi-species Conservation Program

LUPA	Land Use Plan Amendment
m	meter
MA	Flat-tailed Horned Lizard Management Area
mi	mile
NCCP	Natural Communities Conservation Plan
OHMVRD	Off-highway Motor Vehicle Recreation Division
OHV	Off-highway Vehicle
OWSVRA	Ocotillo Wells State Vehicular Recreation Area
RA	Flat-tailed Horned Lizard Research Area
RMS	Flat-tailed Horned Lizard Rangewide Management Strategy
RMS Areas	Borrego Badlands MA, West Mesa MA, East Mesa MA, Yuha Desert MA, and Ocotillo Wells State Vehicular Recreation Area RA
SSC	Species of Special Concern
USFWS	United States Fish and Wildlife Service

APPENDIX 3. Public Notice

APPENDIX 4. External Peer Review Solicitation Letters

APPENDIX 5. External Peer Review Comments

APPENDIX 6. Public Comments

STATE OF CALIFORNIA
NATURAL RESOURCES AGENCY
DEPARTMENT OF FISH AND WILDLIFE

REPORT TO THE FISH AND GAME COMMISSION
A STATUS REVIEW OF THE
FLAT-TAILED HORNED LIZARD
(*PHRYNOSOMA MCALLII*) IN CALIFORNIA

Photo by Bruce Edley

CHARLTON H. BONHAM, DIRECTOR
CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

September 2016

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ACKOWLEDGMENTS

[Note to readers: This section will be completed after external peer review.]

EXECUTIVE SUMMARY

[Note to readers: This section will be completed after external peer review.]

REGULATORY FRAMEWORK

Petition Evaluation Process

"A Petition to List the Flat-tailed Horned Lizard (*Phrynosoma mcallii*) as Endangered Under the California Endangered Species Act" (Petition) was submitted to the Fish and Game Commission (Commission) on June 10, 2014 by the Center for Biological Diversity. Commission staff transmitted the Petition to the Department of Fish and Wildlife (Department) pursuant to Fish and Game Code section 2073 on June 12, 2014, and published a formal notice of receipt of the Petition on July 11, 2014 (Cal. Reg. Notice Register 2014, No. 28-Z, p. 1238). The Department's charge and focus in its advisory capacity to the Commission is scientific. A Petition to list or delist a species under the California Endangered Species Act (CESA) must include "information regarding the population trend, range, distribution, abundance, and life history of a species, the factors affecting the ability of the population to survive and reproduce, the degree and immediacy of the threat, the impact of existing management efforts, suggestions for future management, and the availability and sources of information. The Petition shall also include information regarding the kind of habitat necessary for species survival, a detailed distribution map, and other factors the Petitioner deems relevant." (Fish & G. Code, § 2072.3.)

On September 30, 2014, the Department provided the Commission with its evaluation of the Petition, "Evaluation of the Petition from the Center for Biological Diversity to List the Flat-Tailed Horned Lizard (*Phrynosoma mcallii*) as Endangered Under the California Endangered Species Act" (Evaluation), to assist the Commission in making a determination as to whether the petitioned action may be warranted based on the sufficiency of scientific information. (Fish & G. Code, §§ 2073.5 & 2074.2; Cal. Code Regs., tit. 14, § 670.1, subds. (d) & (e).) Focusing on the information available to it relating to each of the relevant categories, the Department recommended to the Commission that the Petition be accepted.

At its scheduled public meeting on February 12, 2015, in Sacramento, California, the Commission considered the Petition, the Department's Evaluation and recommendation, and comments received. The Commission found that sufficient information existed to indicate the petitioned action may be warranted and accepted the Petition for Consideration. Upon publication of the Commission's notice of its findings, Flat-tailed Horned Lizard was designated a candidate species on March 6, 2015 (Cal. Reg. Notice Register 2015, No. 10-Z, p. 410).

Status Review Overview

The Commission's action designating the Flat-Tailed Horned Lizard as a candidate species triggered the Department's process for conducting a status review to inform the Commission's decision on whether to list the species. At its scheduled public meeting on February 11, 2016, in Sacramento, California, the Commission granted the Department a six-month extension to facilitate external peer review.

This written status review report, based upon the best scientific information available and including independent peer review of the draft report by scientists with expertise relevant to Flat-tailed Horned Lizard, is intended to provide the Commission with the most current information available on the Flat-tailed Horned Lizard and to serve as the basis for the Department's recommendation to the Commission on whether the petitioned action is warranted. The status review report also presents preliminary identification of habitat that may be essential to the continued existence of the species and provides management recommendations for recovery of the species. (Fish & G. Code, § 2074.6.). Receipt of this report is to be placed on the agenda for the next available meeting of the Commission after delivery. At that time, the report will be made available to the public for a 30-day public comment period prior to the Commission taking any action on the Department's recommendation.

Existing Regulatory Status

The Flat-tailed Horned Lizard was the subject of a previous CESA listing petition. Dr. Wilbur Mayhew and Ms. Barbara Carlson of the University of California at Riverside petitioned the Commission to list the Flat-tailed Horned Lizard as an endangered species under CESA on January 25, 1988. Consistent with the Department's recommendation, the Commission designated the Flat-tailed Horned Lizard as a candidate species for CESA listing on May 13, 1988. After completing the status review, the Department recommended listing the species as threatened; however, on June 22, 1989, the Commission voted against the proposed listing, citing insufficient scientific information on population densities.

The Flat-tailed Horned Lizard also has a listing history under the federal Endangered Species Act (ESA). The United States Fish and Wildlife Service (USFWS) initially proposed to list the species as threatened under the ESA in 1993 (USFWS 1993); however, its determination was delayed in part due to Public Law No. 104-6, 109 Stat. 73, enacted in 1995, which placed a moratorium on new species' listings and critical habitat designations under the ESA. The moratorium was lifted in 1996. In 1997, the Department of the Interior Secretary was sued to compel the USFWS to make a listing determination within 60 days, at which point the USFWS withdrew its proposed listing (USFWS 1997). That decision sparked numerous additional court cases, the primary issue of each centered on whether or not the USFWS sufficiently analyzed Flat-tailed Horned Lizard population viability across its entire range. After multiple court-ordered re-evaluations, the USFWS withdrew its proposed rule to list, most recently in 2011 (USFWS 2003, 2006, 2011). One of the contributing factors in the USFWS's decisions not to list the Flat-tailed Horned Lizard was the development of an Interagency Conservation Agreement, signed by multiple federal and state agencies tasked with managing most of the species' habitat in the U.S., and the creation and implementation of a Rangewide Management Strategy (RMS) for the species.

The Flat-tailed Horned Lizard is listed as a Species of Special Concern (SSC) by the Department and as a Sensitive Species by the U.S. Bureau of Land Management (BLM). The Department's SSC designation is administrative and is intended to alert biologists, land managers, and others to a species' declining or at-risk status, to encourage additional management considerations for these species to ensure population viability, and to preclude the need for listing under CESA. SSCs are defined as species, subspecies, or distinct populations of an animal native to California that currently satisfies one or more of the following (not necessarily mutually exclusive) criteria: is extirpated from the State within the recent past; is listed under ESA (but not CESA) as threatened or endangered or meets the State's definition of threatened or endangered but has not been formally listed; is experiencing, or formerly experienced, serious (noncyclical) population declines or range retractions (that have not been reversed), which if continued or resumed, could qualify it for threatened or endangered status under CESA; has naturally small populations and/or range size and exhibits high susceptibility to risk from any factor(s) that, if realized, could lead to declines that would qualify it for threatened or endangered status (Thomson et al. 2016).

Neither of these administrative designations provides the species with formal regulatory status like the ESA or CESA (see Existing Management section); however, the RMS requires conservation measures, including compensatory mitigation, for surface disturbance within the five Flat-tailed Horned Lizard Management Areas (MA) established through the RMS (Figure 1). There are four MAs within California (Borrego Badlands, West Mesa, Yuha Basin, and East Mesa) that comprise approximately 21% of the species' range in the State (using the Department's range map), as well as one Research Area (RA; Ocotillo Wells State Vehicular Recreation Area). Collectively, the MAs and RA will be referred to as the "RMS areas" in this status review. More information on the protections afforded and efforts aimed at conserving the Flat-tailed Horned Lizard, including monitoring the species' distribution through occupancy studies and its trends in abundance through demography surveys, is provided in the Status and Trends in California and Existing Management sections.

BIOLOGY AND ECOLOGY

Species Description

The Flat-tailed Horned Lizard, like all horned lizards in the genus *Phrynosoma*, has a dorsoventrally flattened body with spiny scales, including head spines or "horns," and cryptic coloration, ranging from pale gray to light rust brown, which closely matches the substrate on which it lives. The Flat-tailed Horned Lizard has multiple diagnostic traits that distinguish it from other *Phrynosomids*, including a distinctive dark mid-dorsal stripe ~~down its midline~~ with a ~~serious~~ series of dark spots on either side; long, sharp occipital horns; enlarged laterally protruding temporal horns; a prominent umbilical scar on an otherwise unspotted white or cream venter; and, as its name suggests, a relatively long broad flattened tail (Funk 1981, Muth and Fisher 1992, Sherbrooke 2003, Young and Young 2000). Flat-tailed horned lizards also possess two lateral fringe scale rows and lack external ear openings (Funk 1981, Johnson and Spicer 1985). Adults typically range in size from 57-84 mm (2.2-3.3 in) snout-to-vent length (i.e., excluding tail length), while hatchlings are about 35-38 mm (1.4-1.5 in) (Howard 1974).

Taxonomy

Flat-tailed Horned Lizards (Class Reptilia, Order Squamata) belong to the Family Phrynosomatidae, a large and diverse group that, in addition to horned lizards, includes zebra-tailed, earless, rock, spiny, fringe-toed, tree, brush, and side-blotched lizards. Hallowell (1852) classified the species as *Anota m'callii*, but the current species classification is *Phrynosoma mcallii* (Crother et al. 2012). The genus *Phrynosoma* consists of a unique group of lizards known commonly as horned lizards or colloquially as horned toads (in Greek *phrynos* = toad and *soma* = body). This group, compared to other lizards, is characterized by strongly dorsoventrally flattened bodies; sharp spines; a reluctance to run when approached; long

activity period; more variable body temperatures; a specialized, often ant-rich, diet; and specialized dentition that facilitates ant-eating (Pianka and Parker 1975).

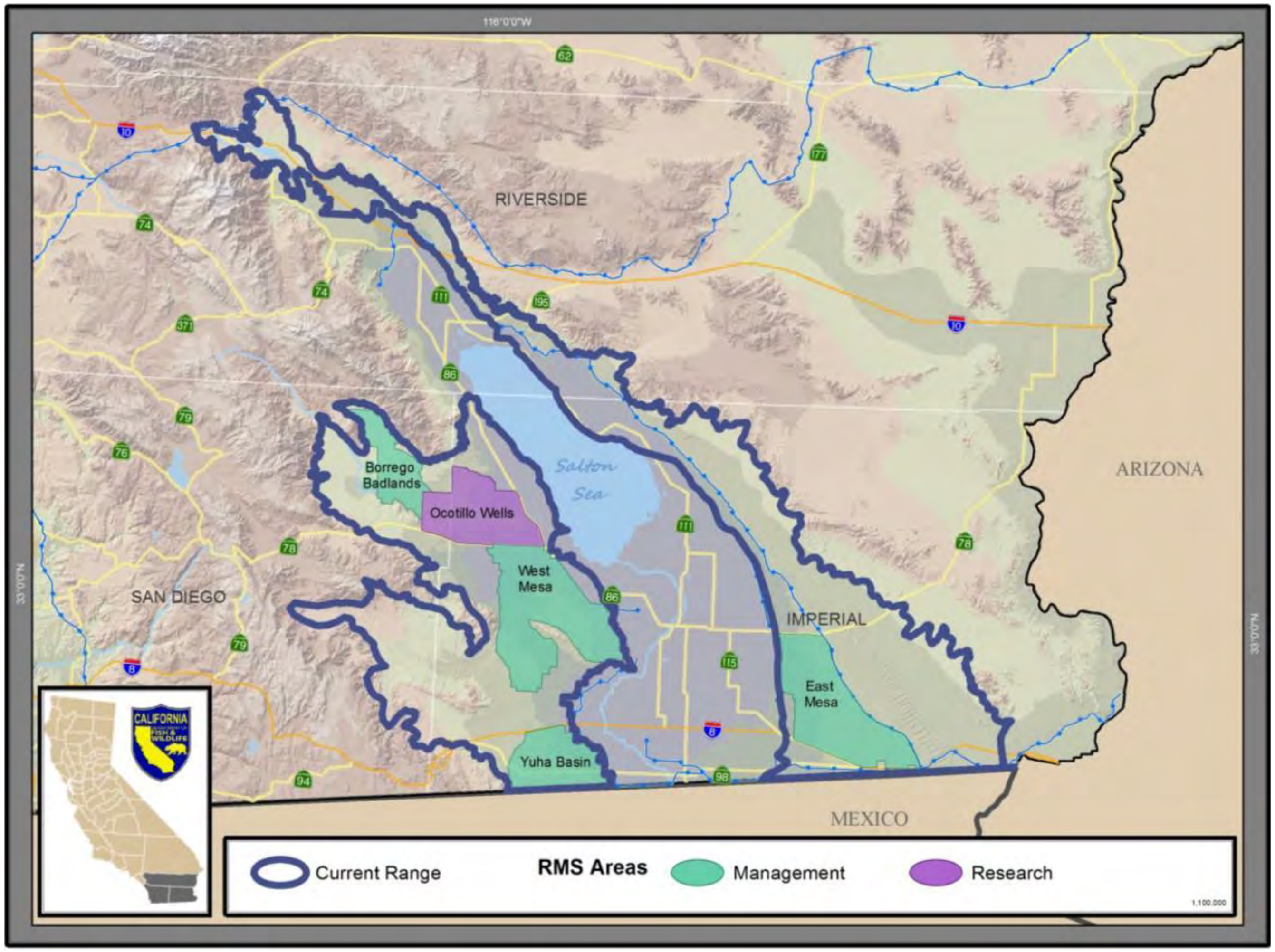

Figure 1. Flat-tailed Horned Lizard RMS Areas in California

Genetics

Phylogenetic relationships of *Phrynosomids* are not well understood (Leaché and McGuire 2006, Mulcahy et al. 2006). There are no recognized subspecies of Flat-tailed Horned Lizards (Crother et al. 2012), but two major clades east and west of the Colorado River have been revealed through genetic analyses (Culver and Dee 2008, Mulcahy et al. 2006). The western clade is predominantly located in California and shows signs of genetic differentiation among regions when mitochondrial DNA is used (Mulcahy et al. 2006); however, there was no evidence of genetic differentiation among the California populations using microsatellite data (Culver and Dee 2008). Mulcahy et al. (2006) determined that the populations east and west of the Imperial Valley, currently separated by urban and agricultural development, are significantly differentiated, although the data suggest that gene flow was limited prior to this anthropogenic change in landscape. While the Coachella Valley population and the population west of the Imperial Valley are also separated by urban and agricultural development, they are not significantly genetically differentiated from each other (Ibid.). Hybrids with morphological characters that are intermediate between Flat-tailed Horned Lizards and Desert Horned Lizards (*P. platyrhinos*) have been reported from near Ocotillo, California (Stebbins 2003) and between Flat-tailed Horned Lizards and Goode's Horned Lizards (*P. goodei*) from near Yuma, Arizona (Mulcahy et al. 2006).

Comment [K&A1]: I don't know if that is really the conclusion. I think there is strong support for the overall relationships, but some disagreement between mitochondrial and nuclear DNA analyses.

Comment [K&A2]: I should get a copy of this report. I have not read it.

Comment [K&A3]: FYI, I communicated with Mulcahy. He and a grad student are working on a more thorough (nuclear DNA) analysis of FTHL populations, but it will still be a year before they get their results.

Geographic Range and Distribution

The Flat-tailed Horned Lizard has the smallest range of any horned lizard found within the United States and has among the smallest ranges of all horned lizards (Sherbrooke 2003). The species is restricted to southeastern California, the extreme southwestern portion of Arizona, and the adjacent portions of northeastern Baja California Norte and northwestern Sonora, Mexico (Funk 1981). The majority of the species' range is within Mexico, while the majority of the U.S. range is within California (USFWS 2011). In California, Flat-tailed Horned Lizards are distributed throughout much of the Salton Trough, in sections of eastern San Diego County, central Riverside County, and western and south-central Imperial County. Flat-tailed Horned Lizards are most frequently found below 230 m (750 ft) in elevation, although they have been reported up to 520 m (1,700 ft) above sea level (Turner et al. 1980). Figure 2 shows the Department's approximation of the Flat-tailed Horned Lizard's current range (referred to as "Current CDFW Range" in map legends), based on aerial imagery interpretation of disturbed lands (e.g., urban and agricultural areas), soil types, elevation, and slope compared to the historical range boundary from the RMS (FTHLICC 2003). Figure 3 shows the distribution of Flat-tailed Horned Lizard observations, categorized by date.

Comment [K&A4]: I believe a new predictive map is underway (check with Rob Lovich). Cameron Barrow's map was restricted to Palm Springs area but indicated that there was less suitable habitat than suggested by the Current CDFW range.

Growth, Reproduction, and Survival

Flat-tailed horned lizards have relatively long active periods, on average 277 days/year, without any prolonged periods of inactivity or aestivation (Muth and Fisher 1992), providing them plenty of time to grow and seek mates when conditions are favorable. Hibernation usually begins on average in mid-November but can range from October through December (Grant and Doherty 2009, Muth and Fisher 1992, Wone and Beauchamp 2003), although some individuals, particularly juveniles, remain active in the winter (Muth and Fisher 1992). Muth and Fisher (1992) speculate that juveniles may not have the fat reserves to get through winter without

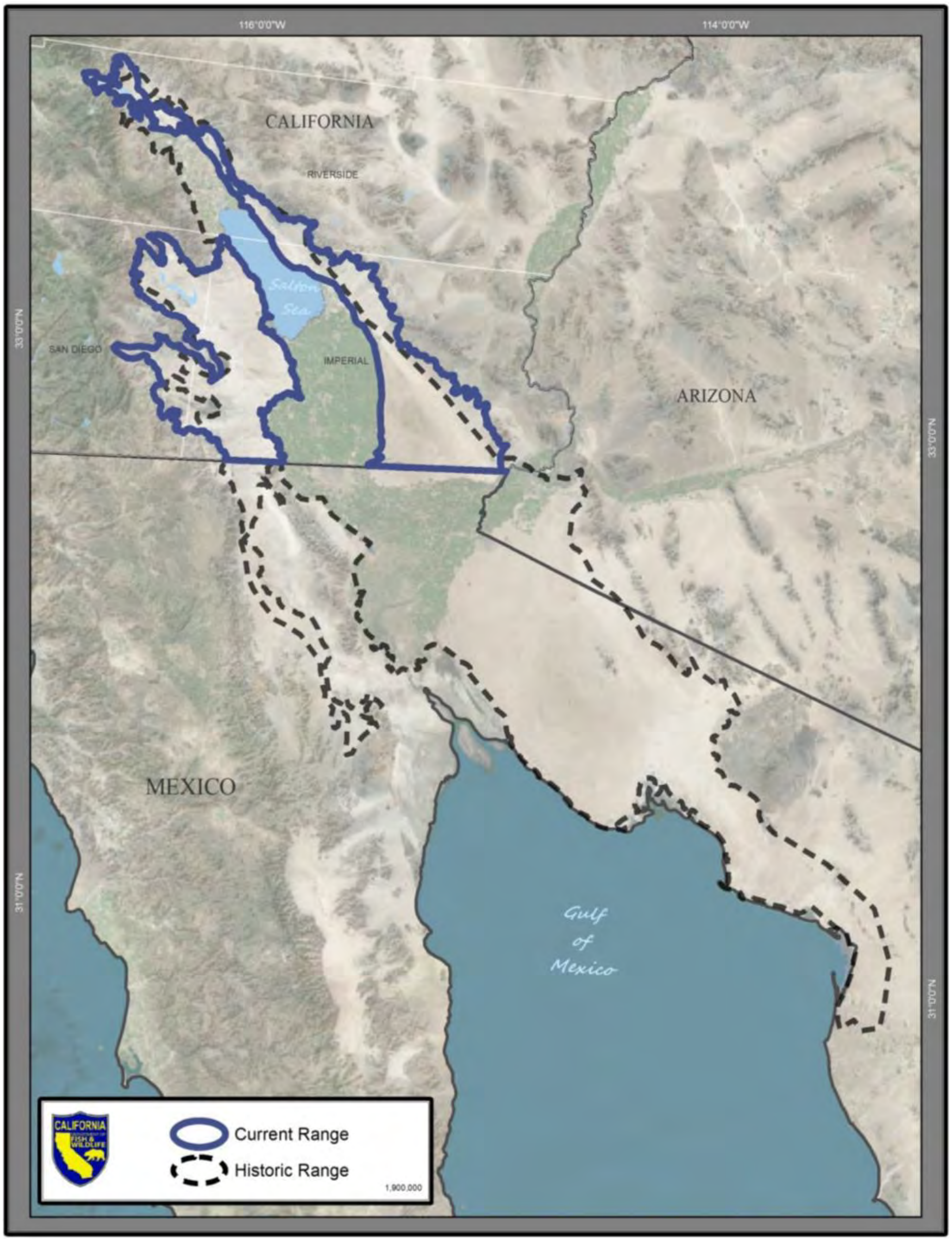

Figure 2. Flat-tailed Horned Lizard Current and Historic Range

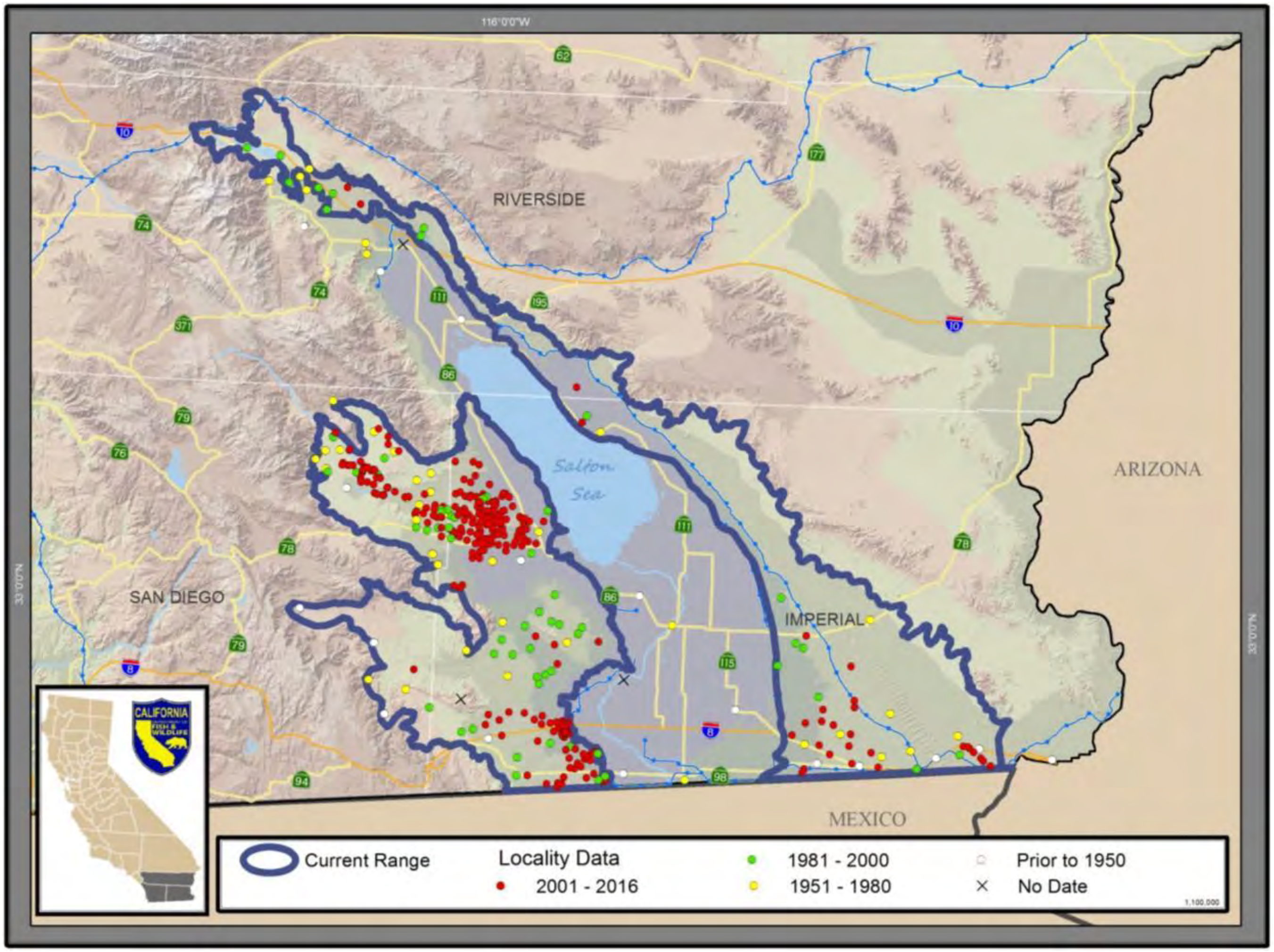

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Figure 3. Flat-tailed Horned Lizard Observations in California

feeding, or they may remain active to attain the minimum reproductive size (60-66 mm, 2.4-2.6 in) (Howard 1974, Root 2010) as quickly as possible. Time of emergence is variable and can range from December to April, but averages in February (Mayhew 1965, Wone and Beauchamp 2003). When surface temperatures reach 50°C (122ºF), most Flat-tailed Horned Lizards will retreat into rodent or self-constructed burrows, although Young and Young (2000) observed them at surface temperatures of 55°C (131ºF).

Comment [K&A5]: Very rare for them to go into a rodent burrow, even when being chased. I have never observed one use a rodent burrow to escape the heat. Being able to construct a burrow seems a crucial feature of the habitat.

Flat-tailed Horned Lizards are oviparous (egg-laying) and early maturing (FTHLICC 2003). They are generally capable of mating upon emergence from hibernation, and females may be able to produce two separate clutches of eggs (Howard 1974, Muth and Fisher 1992, Turner and Medica 1982). Several researchers report that the first hatchlings appear mid to late July, while a second set appears from late August through October (Ibid.). In dry years, females may only produce a single clutch that does not hatch until late August or September (Setser 2001, Young and Young 2000). It is also possible that females do not lay multiple clutches, but rather different individuals lay at distinct times throughout the active period (Young and Young 2000).

Gravid females deposit their eggs in deep burrows over a period of two to four days (Young and Young 2000). Nests depths are variable depending on substrate and weather conditions (observed range: 14-90 cm, 5.5-35.4 in) but are deep enough to ensure that the eggs are laid in moist soil (Setser 2001, Young and Young 2000). Eggs are incubated for approximately 52 days before hatching (Ibid.). Flat-tailed Horned Lizards produce small clutches (averaging 4.7-5.4 eggs) and have the lowest productivity index (i.e., average clutch size x frequency) of the seven southwest *Phrynosomids* studied by Howard (1974).

Juveniles grow quickly, but growth rate appears to be dependent on when and where hatchlings were born and resource availability. Under favorable conditions, hatchlings born in the first cohort are able to reach adult size prior to hibernation and thus are able to breed at the beginning of the next year's active season, while hatchlings from a second cohort may not mature until the middle of the following summer, delaying breeding until their second year (Muth and Fisher 1992, Young and Young 2000). Drought may also delay sexual maturity, since growth rates slow under these conditions (Young and Young 2000).

Most Flat-tailed Horned Lizards live to three years in age, but individuals can live four or even six years (FTHLICC 2003, Leavitt 2013b, Young and Young 2000). Muth and Fisher (1992) estimated the mean annual survival rate at approximately 53%, noting the lowest survival rates occurred in spring and summer. During hibernation, survival is typically 100% (Grant and Doherty 2009, Muth and Fisher 1992). Annual survival estimates from demography surveys on East Mesa and West Mesa MAs between 2007 and 2013 varied substantially, ranging from 27%-70% and 4%-59%, respectively (Leavitt 2013b). Leavitt (2013b) noted that these estimates suggest low annual survival is the norm. Juvenile survivorship is not clear, but the annual juvenile survival rate for Desert Horned Lizards is significantly lower than adult survivorship (Pianka and Parker 1975).

The largest natural cause of Flat-tailed Horned Lizard mortality is predation, which, based on telemetry data, has been recorded as high as 40-50% of the population in certain years (Goode and Parker 2015, Muth and Fisher 1992, Young and Young 2000). Primary predators of Flat-tailed Horned Lizards are Loggerhead Shrikes (*Lanius ludovicianus*) and Round-tailed Ground

Squirrels (*Xerospermophilus tereticaudus*), but they are also preyed upon by a number of other reptiles, birds, and mammals, including Sidewinders (*Crotalus cerastes*), Coachwhips (*Coluber flagellum*), American Kestrels (*Falco sparverius*), Common Ravens (*Corvus corax*), and Kit Foxes (*Vulpes macrotis*) (Barrows et al. 2006, Duncan et al. 1994,Goode and Parker 2015, Muth and Fisher 1992, Young and Young 2000). Predation by some species, particularly birds and squirrels, increases near human development due to the availability of subsidized resources such as water and artificial perches (Barrows et al. 2006, Young and Young 2005).

To avoid predation, Flat-tailed Horned Lizards rely on their cryptic coloration and typically freeze instead of fleeing (Wone and Beauchamp 1995b). This can make them especially vulnerable to road mortality, which has also been suggested as a substantial source of mortality (Muth and Fisher 1992, Turner et al. 1980, Young and Young 2000). A population viability analysis suggested that Flat-tailed Horned Lizard persistence is particularly sensitive to changes in mortality versus other factors such as reproductive output or growth (Fisher et al. 1998, FTHLICC 2003).

Diet and Food Habits

According to Johnson and Spicer (1985), although the Flat-tailed Horned Lizard is remarkably swift compared to other horned lizards, it is basically a “sit and wait” predator. Ants comprise 97% of the Flat-tailed Horned Lizard’s diet, higher than any other *Phrynosomid* (Pianka and Parker 1975). Flat-tailed Horned Lizards primarily eat native harvester ants (genera *Messor* and *Pogonomyrmex*) but are known to eat smaller ants and other invertebrates opportunistically as well (FTHLICC 2003, Turner and Medica 1982, Young and Young 2000). During a severe drought in 1997, Young and Young (2000) ~~measured scat contents and~~ found less than half the number of ants per scat ~~were present~~compared to ~~in~~ scat collected during wetter years, and they observed that Flat-tailed Horned Lizards lost weight during drought conditions. In drought years, annual vegetation is depressed, resulting in decreased seed abundance, which in turn negatively affects the harvester ants that feed primarily on seeds (Barrows and Allen 2009). Freestanding water and dew are not commonly available in Flat-tailed Horned Lizard habitat, so the species primarily relies on preformed water (water found within their food) to maintain proper water balance (FTHLICC 2003).

Comment [K&A6]: It was confusing as written. Here is one possible rewrite of that sentence.

Home Range and Territoriality

Compared to their size, Flat-tailed Horned Lizards have very large home ranges and do not appear to be territorial (Muth and Fisher 1992). Young (1999) investigated interactions among Flat-tailed Horned Lizards with overlapping home ranges and found that lizards were actively avoiding each other. Home range sizes among individual Flat-tailed Horned Lizards can vary widely even in the same area, but method of data collection and analysis, location, season, sex, climatic conditions, and density dependence may all be influential. Goode and Parker (2015) measured male home ranges from 0.04-6.8 ha, and female home ranges from 0.02-14.5 ha. These ranges overlap the lowest and highest mean home range sizes observed by other researchers (Muth and Fisher 1992, Setser 2001, Setser and Young 2000, Turner and Medica 1982, Young and Young 2000). Males appear to have larger home ranges than females, at least in spring and early summer, which can likely be attributed to searching for mates (Goode and Parker 2015, Setser and Young 2000, Turner and Medica 1982, Young 1999). Some gravid

females will leave their home range, traveling as far as 1,647 m to deposit their eggs before returning to their original home range site (Setser 2001, Young and Young 2000). Climatic conditions, specifically drought, are presumed to reduce home range size and activity (Young and Young 2000).

Habitat that May be Essential for the Species' Continued Existence in California

Flat-tailed Horned Lizard habitat is characterized by hot summers ranging from 30-45^{0}C and generally mild winters in the very low 20s ^{0}C (FTHLICC 2003, Johnson and Spicer 1985). Annual rainfall is typically low and varies spatially and temporally (Ibid.). Within the California portion of the species' range, rainfall averages approximately 5.8 cm in El Centro and 13.5 cm in Palm Springs (FTHLICC 2003) and predominantly falls during winter, while the Arizona portion of the species' range generally receives summer rains (Johnson and Spicer 1985). Flat-tailed Horned Lizard habitat is subjected to frequent drought conditions (Johnson and Spicer 1985) and flash floods during periods of heavy rain (Turner and Medica 1982). Although it is sympatric with the Desert Horned Lizard in some parts of its range, the Flat-tailed Horned Lizard occupies hotter, drier, and more severe habitats than any other *Phrynosomid* (Johnson and Spicer 1985).

Comment [K&A7]: Something weird happened with formatting here.

According to Turner et al. (1980), the best habitats for Flat-tailed Horned Lizards generally exhibit "surface soils of fine packed sand, or pavement, overlain intermittently with loose, fine sand." Most records of Flat-tailed Horned Lizards come from the creosote bush (*Larrea tridentata*)-white bursage (*Ambrosia dumosa*) assemblage, and occasionally saltbush (*Atriplex* spp.) (FTHLICC 2003, Turner et al. 1980). However, the species has been recorded in a broad range of habitats in California compared to Arizona, including sandy flats and hills, badlands, salt flats, and gravelly soils (FTHLICC 2003). Flat-tailed Horned Lizards have also been found on the rocky slopes at lower elevations, along the vegetated edges of active sand dunes, on stabilized sand fields, and less frequently, within active dunes themselves (Barrows and Allen 2009, Luckenbach and Bury 1983, Turner et al. 1980). The species has even been found in fallowed agricultural fields dominated by non-native weedy species (RECON 2010).

There are five habitats associated with Flat-tailed Horned Lizards in the California Wildlife Habitat Relationships System (CWHR) (Figure 4). CWHR is a state-of-the-art information system for California's wildlife that contains life history, geographic range, habitat relationships, and management information on 712 species of amphibians, reptiles, birds, and mammals known to occur in the state. Desert Scrub, Desert Wash, and Barren are considered high quality habitat, while Alkali Desert Scrub and Desert Succulent Scrub are considered marginal (CDFW 2014). Desert Scrub habitats typically are open, scattered assemblages of broadleaved evergreen or deciduous microphyll shrubs, usually between 0.5 and 2 m in height; canopy cover is generally less than 50%, usually much less; bare ground is often between plants; and creosote bush is often considered a dominant species (CDFG 1988). Barren is considered any habitat with <2% total vegetation cover by herbaceous, desert, or non-wildland species and <10% cover by tree or shrub species (Ibid.). Desert Wash habitats are characterized by the presence of arborescent, often spiny, shrubs generally associated with intermittent streams (washes) or drier bajadas (alluvial deposits adjacent to washes), especially in the Sonoran Desert (Ibid.).

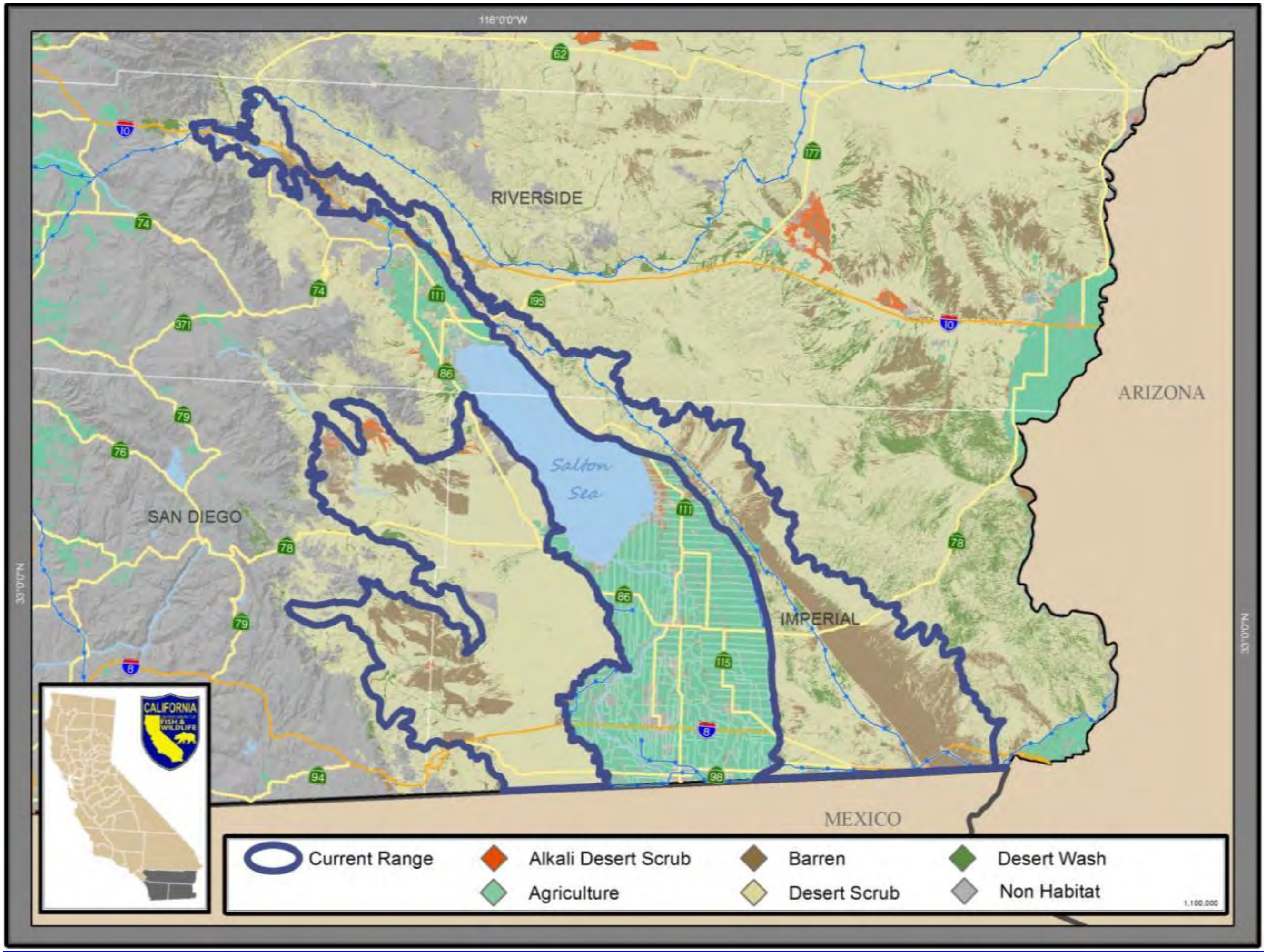


Figure 4. Flat-tailed Horned Lizard Habitat Associations

A number of studies have attempted to identify habitat characteristics that are significantly correlated with presence and abundance of Flat-tailed Horned Lizards, but their results have varied. In most cases, there is a positive correlation between Flat-tailed Horned Lizard abundance and perennial plant density (Altman et al. 1980, Barrows and Allen 2009, Muth and Fisher 1992, Turner and Medica 1982). However, it should be noted that typical Flat-tailed Horned Lizard habitat is sparsely-vegetated, so maximum coverage of perennial plant density is likely never very high at any of the sites. Positive correlations have also been reported between Flat-tailed Horned Lizards and the abundance of sand (Gardner 2005, Hollenbeck 2004, Wright and Grant 2003), as well as harvester ant nests (Barrows and Allen 2009, Rorabaugh et al. 1987, Turner and Medica 1982). Barrows and Allen (2009) found that soil compaction was significantly correlated with Flat-tailed Horned Lizard abundance in opposite directions on stabilized sand fields (negative) and active dunes (positive), suggesting that the "availability of moderately compacted sands may be important to horned lizards for digging burrows that are used for thermoregulation and nesting."

STATUS AND TRENDS IN CALIFORNIA

Range

Uncertainty exists regarding what constituted historically suitable habitat available for the Flat-tailed Horned Lizard in California due to periodic Colorado River flooding of the Salton Trough (FTHLICC 2003, USFWS 2011). This uncertainty affects estimates of losses in the species' range and distribution because the vast majority of land converted to agriculture and urban development occurs within this area of historical flooding. A detailed description of the geologic and hydrologic history is provided in the Setting and Habitat section of the USFWS's (2011) withdrawal of the proposed rule to list the Flat-Tailed Horned Lizard as threatened. Based on evidence of its ephemeral persistence and marginal suitability, the USFWS did not consider habitat within the historic Lake Cahuilla lakebed (Figure 5) as part of the species' historical range (USFWS 2006). Barrows et al. (2008) also did not consider this area as potential habitat when modeling changes in Flat-tailed Horned Lizard distribution in the Coachella Valley pre- and post-development.

Alternatively, Hodges (1997), while omitting areas of unsuitable habitat containing marshes, obvious rocky mountains, new alluvial deposits, and the main body of the Algodones Dunes, included the Salton Trough in her estimate of historic habitat due to the existence of Flat-tailed Horned Lizard records from areas within the Imperial Valley and around the Salton Sea. Based on this, she concluded that the total possible inhabitable area of historic Flat-tailed Horned Lizard habitat in California was as large as 899,000 ha (Ibid.). Flooding of the Salton Sea, agricultural development, and urbanization were the primary sources of habitat loss, leading to a reduction in range of approximately 51% in Imperial County, 58% in Riverside County, and 9% in San Diego County (Ibid.). Hodges (1997) considered the Riverside County estimate to be very conservative, and more recently, Barrows et al. (2008) reported that an estimated 83-92% of suitable Flat-tailed Horned Lizard habitat has been lost in the Coachella Valley. Conversely, the Imperial Valley estimate is likely inflated based on the periodic historic flooding that rendered much of the area unsuitable for extended periods. While at least some of the habitat

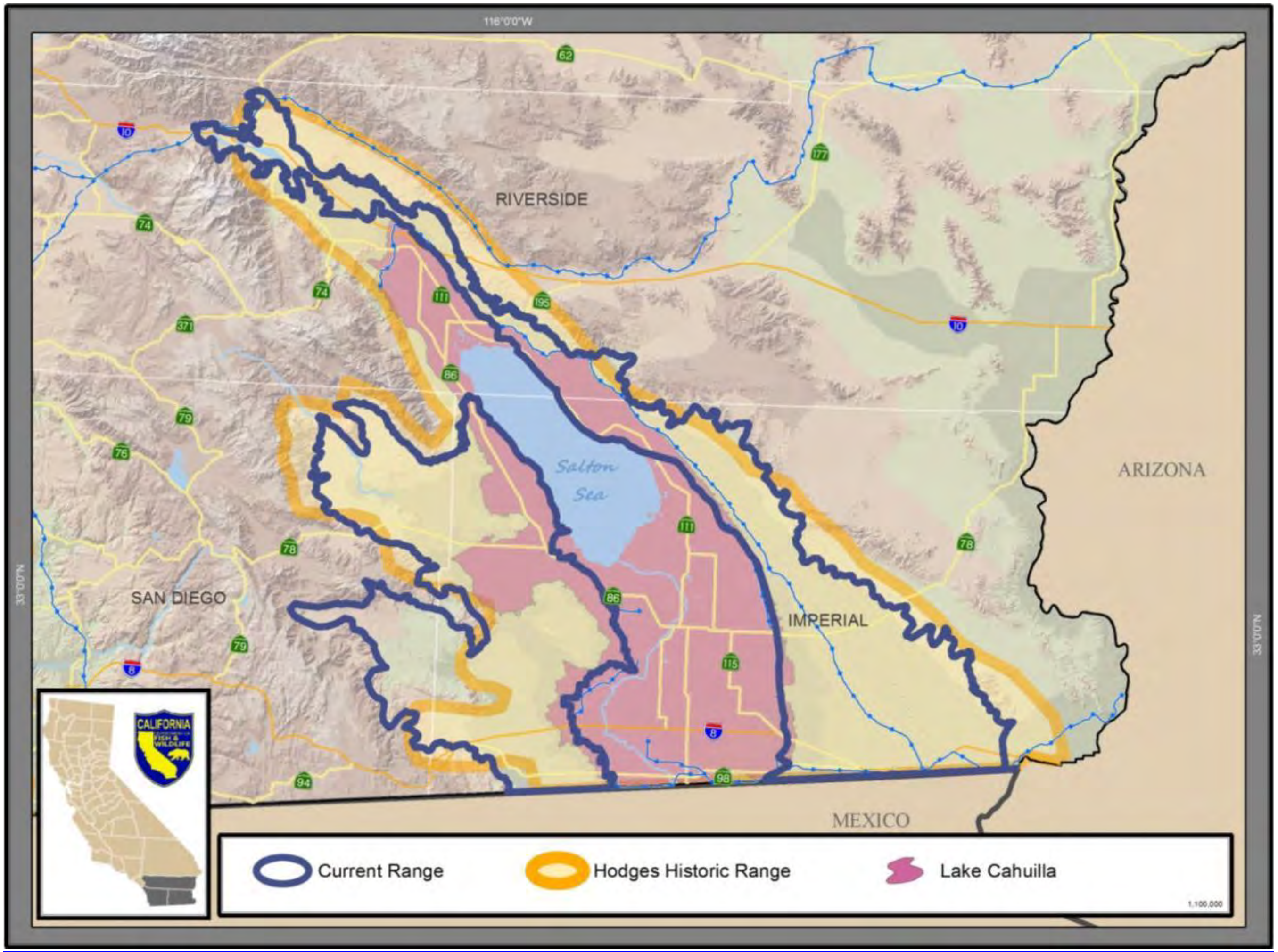


Figure 5. Historical Range Boundary Estimates Compared to Current Range Estimate

appears to have been suitable as recently as the end of the 19th century based on collections from the area (Hodges 1997), genetic data reveal that gene flow across the Imperial Valley was limited centuries before agricultural development began and the current Salton Sea flooded in the early 1900s (Mulcahy et al. 2006).

Regardless of the exact amount of loss, it is clear that the current Flat-tailed Horned Lizard range has been reduced from its historical extent due to agricultural and urban development. As a result, connectivity, even if historically infrequent, between the populations east and west of the Imperial Valley has been lost, and connectivity between the Coachella Valley and these populations may have been lost as well.

Distribution

With the exception of the Coachella Valley, the Flat-tailed Horned Lizard's distribution within its species' California range appears to have remained fairly stable in the areas for which data are available. As recently as the early 1980s, Flat-tailed Horned Lizards had a broader distribution in the Coachella Valley, occurring on what is now the Whitewater Floodplain Preserve, on the southern flanks of Edom Hill, and at the eastern end of the Indio Hills (CVCC 2013a). Currently, the only presumed remaining populations are on the Thousand Palms Preserve and further south within the Dos Palmas Preserve (Ibid). If they do inhabit the other areas, it is at a density below detection levels (Ibid.).

The distribution of Flat-tailed Horned Lizards within the RMS Areas (Figure 1) has been monitored using survey methods that incorporate the species' low detection probability into estimates of occupancy and local colonization and extinction rates (i.e., occupancy surveys in the RMS). Until recently, these methods included the use of sign (e.g., scat or tracks), which provide a much greater power to detect changes from survey period to survey period than visual confirmation of a Flat-tailed Horned Lizard (Root 2010) but are also problematic. Several studies have demonstrated that Flat-tailed Horned Lizard sign is not always positively correlated with current presence or abundance (Beauchamp et al. 1998, Muth and Fisher 1992, Rorabaugh 1994, Rorabaugh et al. 1987, Turner and Medica 1982, Wone and Beauchamp 1995a, Wright 2002, Young and Young 2000). This is due to any number of reasons, including (1) the fact that substrate and weather (e.g., wind, rain) can affect scat detectability and persistence (minutes to months) of scat or tracks in the environment (Beauchamp et al. 1998, Rorabaugh 1994); (2) it is impossible to distinguish the difference between multiple scats per lizard vs. several lizards defecating once (Beauchamp et al. 1998); (3) lizards produce fewer and smaller scats during times of low resource availability like drought (Rorabaugh 1994, Young and Young 2000); (4) Flat-tailed Horned Lizard scat are indistinguishable from Desert and Goode's Horned Lizards where they are sympatric (Root 2010, Rorabaugh et al. 1987, Young and Young 2000); and (5) surveyors who concentrate on finding scat invariably find fewer lizards (Wone et al. 1994). At best, scat can serve as an indication that the area was at least used by a Flat-tailed Horned Lizards, even if only as the species passed through it (Root 2010). Table 1 depicts the estimated likelihood that a Flat-tailed Horned Lizard will be present at a random spot within the RMS areas, based solely on lizard observations (i.e., not scat).

Table 1. Occupancy Probability Estimates for RMS Areas (California only)[1]

	East Mesa	West Mesa	Yuha Basin	Borrego Badlands	Ocotillo Wells
2005		0.06			
2006	0.44				1.00
2007					1.00
2008			0.56		0.66
2009		0.86			0.86
2010	0.75				0.85
2011				0.42	0.91
2012				0.20	0.84
2013				0.10	0.78

[1] 2005-2010 data from Frary (2011); 2011-2013 data from Leavitt (2013b)

Comment [K&A8]: Remarkable that the prior estimate for West Mesa was 0.06 and this one is 0.86. Who is doing the sampling, how much sampling effort, choice of sampling locations all make such a difference in the results, plus there are the effects of weather. . .

Occupancy probabilities were generally high across the RMS areas, particularly Ocotillo Wells, where extinction (0.07 ± 0.07) and colonization rates (0.00 ± 0.00) were estimated to be low (Leavitt 2013b). Despite being relatively close to Ocotillo Wells, occupancy probability and colonization rate estimates (0.01 ± 0.04) at Borrego Badlands were relatively low, and local extinction rates (0.54 ± 0.19) were predicted to be very high (Ibid.). Leavitt (2013b) posited that indications of a steady decline at Borrego Badlands are likely due to irregular sampling at that location and that this trend is an artifact of a poor sampling regime. Unfortunately, the relatively low power to detect changes from visual-only surveys, coupled with irregular and inconsistent monitoring on the MAs since 2005, has led in some cases to large standard errors and the inability to estimate population parameters (Grimsley and Leavitt 2016). Properly executed occupancy studies have far greater power to detect long-term changes in distribution when plots are sampled more frequently (i.e., annually vs. biennially or triennially) and all survey passes (days/plot) within the survey year are completed (Leavitt 2013b, Zylstra et al. 2010).

With the exception of the Coachella Valley, there are no distribution data on Flat-tailed Horned Lizards outside of the RMS areas. It should be noted that the MAs were chosen because they were thought to represent some of the highest quality contiguous habitat available to the species, and there are limits on disturbance within them. Therefore, extrapolation of these occupancy estimates to the rest of the species' range may not be prudent because areas of presumably lower quality and greater disturbance would be expected to have a lower likelihood of occupancy by Flat-tailed Horned Lizards.

Comment [K&A9]: I feel this is a real weakness—I would love to see a bigger sampling effort outside the RMS areas.

Comment [K&A10]: On the other hand, there could be areas of high quality habitat that have simply been overlooked.

Abundance

Obtaining reliable rangewide abundance or density estimates for Flat-tailed Horned Lizards is complicated due to the species' relatively low detectability and large home range size, as well as researchers' use of un-standardized, and in some cases, inappropriate survey methods (e.g., scat detection rates as an index of abundance). The Petition (Table 2, page 23 in CBD 2014) provides a list of abundance estimates based on scat and lizard observations per hour of survey effort using results of studies ranging from 1979-2001. Due to the unreliability of these estimates and no clear correlation with Flat-tailed Horned Lizard abundance, they are not reproduced here.

Since then, only three studies have used solely lizard observations and an appropriate sampling design to estimate abundance of adult Flat-tailed Horned Lizards across the RMS areas (Table 2). Some sites (West Mesa 2003 and Yuha Basin 2004) suffered from sparse data (Grant and Doherty 2007), and their 95% confidence intervals (C.I.) reflect that. Hollenbeck (2006) estimated the abundance of juveniles, in addition to adults, because they were encountered throughout the duration of the study and accounted for a majority of the individual Flat-tailed Horned Lizards captured and recaptured.

Table 2. Abundance and Density Estimates from RMS Areas (California only)

RMS Area	Abundance	Lower C.I.	Upper C.I.	Lizards/ha	(Lizards/ac)
Yuha Basin 2002[1]	25,514	12,761	38,790	1.05	(0.42)
East Mesa 2003[1]	42,619	19,704	67,639	0.91	(0.37)
West Mesa 2003[1]	10,849	3,213	23,486	0.20	(0.08)
Ocotillo Wells 2003[2]	19,222	18,870	26,752	0.61	(0.25)
Yuha Basin 2004[1]	73,017	4,837	163,635	3.00	(1.21)
Ocotillo Wells 2005[3,4]	24,345	14,329	69,922	0.78	(0.32)
Ocotillo Wells 2005[3,5]	37,085	22,166	74,812	1.19	(0.48)

[1] Grant and Doherty (2007), [2] Hollenbeck (2004), [3] Hollenbeck (2006), [4] adults, [5] juveniles

There has only been one attempt at estimating the number of Flat-tailed Horned Lizards across the species' range. The USFWS (2011) used a density of 0.3 lizards/ha (0.1 lizards/ac) and its estimate of the Flat-tailed Horned Lizard's remaining range to make that calculation. The density USFWS used was the smallest estimate derived by Root (2010) from data obtained between 2007 and 2009 on the MAs. Within California, this amounted to approximately 73,000 individuals west of the Imperial Valley; 44,000 east of it; and 1,100 in the Coachella Valley. The USFWS (2011) acknowledged that there were numerous assumptions in its calculations that limited accuracy of the extrapolated population sizes, but it concluded that, even using the most conservative density estimate, the populations east and west of the Imperial Valley were large enough that any threats associated with small populations would be unlikely to occur. The minimum viable population size for Flat-tailed Horned Lizards is unknown, and the USFWS (2011) also acknowledged that within these coarse-scale populations, barriers to movement fragment the habitat into various patches, which could result in deleterious effects from small population sizes (see Fragmentation, Edge Effects, and Small Populations below).

Not surprisingly, an increased level of survey effort (i.e., number of surveyors and amount of time looking specifically for lizards) appears to increase the likelihood of detecting Flat-tailed Horned Lizards. For example, surveys by biological monitors and incidental observations by construction personnel trained to look out for Flat-tailed Horned Lizards can sometimes find unexpectedly high densities when compared to the RMS area demography survey results. For example, prior to and during construction of the Imperial Solar Energy Center West's (CSolar)

transmission line within the Yuha Basin MA in 2014, 152 Flat-tailed Horned Lizards were located along the 6.6 ha (16.3 ac) right-of-way that was dominated by creosote bush and white bursage, resulting in an estimated density of 23.0 lizards/ha (9.3 lizards/ac) (UltraSystems 2015) (Figure 6). To put this density into context, using the RMS demography survey data from the Yuha Basin MA, the highest plot-level density estimate between 2007 and 2015 was 4.9 lizards/ha (2.0 lizards/ac) in 2011, and the 2014 estimate (i.e., the same year as the construction surveys as well as the third consecutive year of drought) was 2.5 lizards/ha (1.0 lizards/ac). These estimates were derived from abundance data in Grimsley and Leavitt (2016), which were then divided by 15.2 ha (37.6 ac), the estimated effective survey area, based on a 45 m (147 ft) movement buffer around the survey plot as suggested for standardization with other surveys by Root (2010). The solar facility portion of the CSolar project was located on 457 ha (1,130 ac) of abandoned agricultural fields that were considered barren or in the early seral stages of desert scrub in 2015 (Ultrasystems 2015) but were dominated by non-native weeds such as Sahara mustard (*Brassica tournefortii*) and London rocket (*Sisymbrium irio*) five years prior (RECON 2010). In this degraded habitat, another 95 Flat-tailed Horned Lizards were found, or approximately 0.21 lizards/ha (0.08 lizards/ac) (Dudek 2016).

Comment [K&A11]: Isn't that crazy? Did this density estimate put any sort of buffer around the right of way, or did it include just the right of way? Adding a 45 m buffer on either side of the road would make it more directly comparable to the survey estimates.

Population Trend

Flat-tailed Horned Lizard populations appear to be highly sensitive to environmental fluctuations, which can result in high variability in abundance over short periods of time (Young and Young 2000). For example, within stabilized sand fields in the Coachella Valley, Barrows and Allen (2009) recorded the Flat-tailed Horned Lizard population decline by approximately 50% per year from 2002 to 2005, with a >90% decline overall; however, it was able to recover with no management action. This high level of variability coupled with the species' low detectability make accurate estimates of population trends exceedingly challenging, and comparisons in abundance or rate of detection from a small number of time periods should be viewed with caution.

Comment [K&A12]: In my mind this paragraph summarizes the biggest problem with trying to manage this species. Nicely written! We would all love to have accurate population estimates over long periods of time, but that is unrealistic. Even if we could have those estimates we would see such high variability over time that it would be impossible to tease out anthropogenic impacts from the natural fluctuations.

Until fairly recently, evidence of population trends were limited to anecdotal accounts, primarily of seemingly precipitous localized declines (Altman 1980, Turner et al. 1980) that may have at least partially been attributable to wet vs. dry years (Turner and Medica 1982), and use of Flat-tailed Horned Lizard sign (e.g., scat and tracks) as well as individual lizards, which as previously mentioned is often unreliable. As an example, Wright (2002) analyzed scat and lizard detection rate data from 1979 to 2001 across a number of BLM properties and found no significant population trend over that period, but he cautioned that the survey methodology was inconsistently conducted throughout this. In addition to the complications associated with making assumptions about correlations between scat detection and lizard abundance, in all years except one, the survey effort was less than the estimated minimum necessary to have an 80% probability of being within 50% of the true mean sighting rate (Ibid.). However, when the data from the Yuha Basin, West Mesa, and East Mesa were combined, they met or exceeded this threshold, and the detection rate per 10 hr of surveying was 1.1 lizards in 1979, 1.0 lizards in 1985, 0.0 lizards in 1989, 1.2 lizards in 1991, and 1.1 lizards in 2001 (Ibid.).

Standardized demography survey protocols using solely mark-recapture Flat-tailed Horned Lizard data are a relatively recent development. Consequently, dataset with the longest duration on population trends using this method only spans 2007-2015. Grimsley and Leavitt (2016)

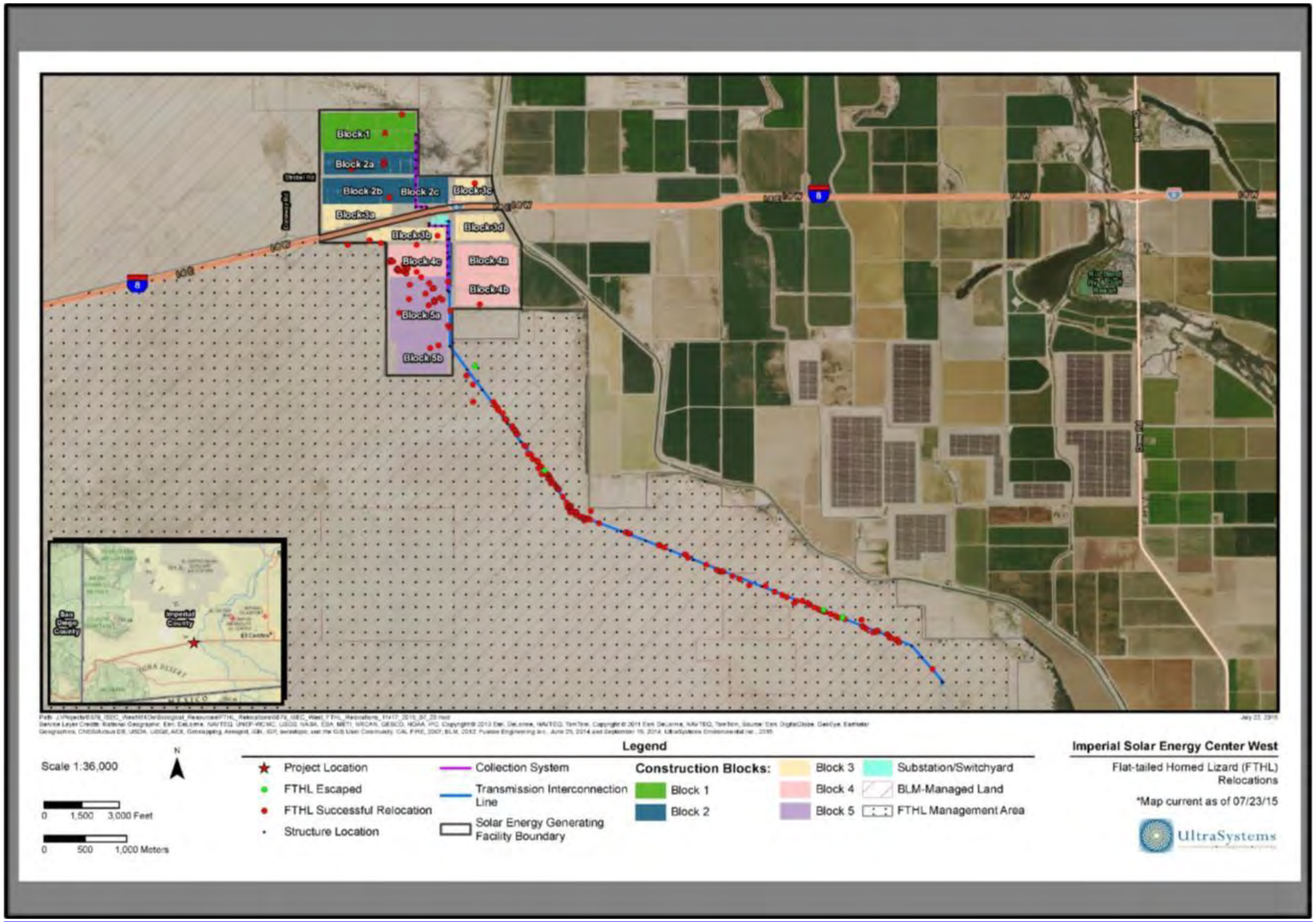


Figure 6. Flat-tailed Horned Lizard Observations (Relocations) within a Solar Project Footprint

calculated and plotted Flat-tailed Horned Lizard abundance estimates from Demography surveys on 9-ha plots within the RMS areas over that period of time (Figure 7). Demography surveys only began at Ocotillo Wells in 2014, and they have never been conducted on Borrego Badlands. As with the occupancy surveys, inconsistencies in demography survey data collection (e.g., number of surveyors and/or survey days) have led to large standard errors and the inability to estimate population parameters in some cases (Grimsley and Leavitt 2016). Nevertheless, the populations generally appear to be cycling up and down in concert (Leavitt et al. 2015). It should be noted that unlike the occupancy study plots, the demography survey plots were non-randomly selected within areas known or suspected to support greater than average Flat-tailed Horned Lizard densities, which are required in order to obtain robust enough datasets for use in population estimation models. Therefore, extrapolation of density estimates to areas outside of the high-quality survey plots cannot be legitimately undertaken. Nevertheless, these data do provide meaningful population trend data.

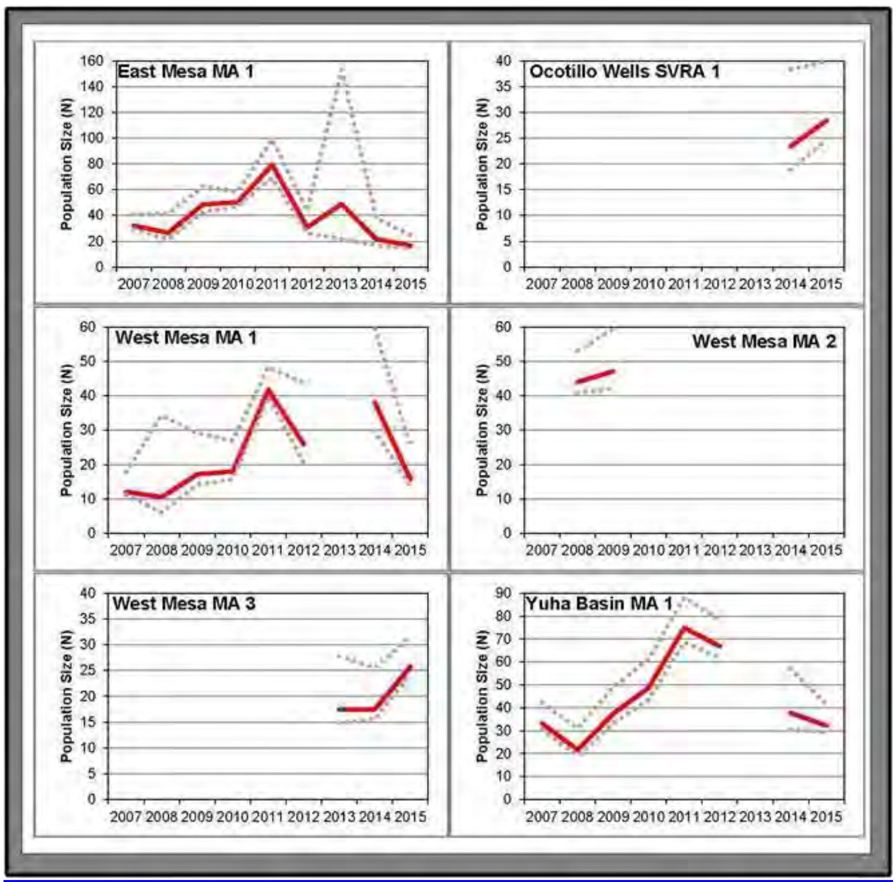


Figure 7. Annual Plot-level Flat-tailed Horned Lizard Population Estimates and Trends

The nearly fourfold increases in abundance from 2008 to 2011 on the three MAs in California that were surveyed consistently over that time reflect how rapidly and dramatically Flat-tailed Horned Lizards can respond to favorable conditions, and the subsequent declines to near 2008 levels from 2011 to 2015 reflect how rapidly they can decline as well. These fluctuations are often attributed to differences in precipitation, but the relationship between rainfall and Flat-tailed Horned Lizard abundance is complex and not always positively correlated (Barrows and Allen 2009, Leavitt 2013a, Young and Young 2000). California is currently experiencing an extreme drought that began in 2011. Predictions for a wetter 2015-2016 winter have not manifested as of March 31, 2016, and a vast majority of the Flat-tailed Horned Lizard's range in California is more than 50% below average precipitation for this water year to date (Figure 8).

Comment [K&A13]: Sorry to hear this. Hope things change soon!

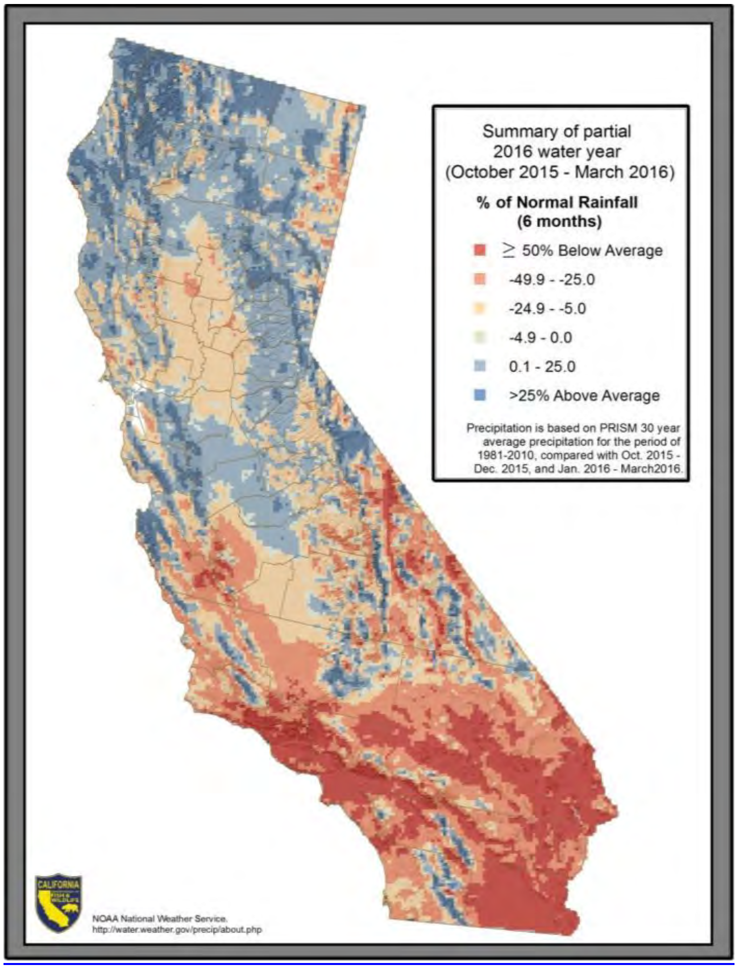


Figure 8. 2016 Water Year Statewide Precipitation Comparison to Average

EXISTING MANAGEMENT

Land Ownership within the California Range

Using the Department's current Flat-tailed Horned Lizard range in California, approximately 77% of the 666,916 ha (1,647,979 ac) are owned or managed by public agencies (Table 3, Figure 9). Of that land, 99% is managed by RMS participating agencies.

Table 3. Public Landownership within the Flat-tailed Horned Lizard's California Range[1]

Agency	Hectares	Acres	Group %	Unit %
Federal	*393,021*	*971,172*	*58.93%*	
U.S. Bureau of Land Management[2]	317,055	783,457		47.54%
U.S. Navy and Marine Corps[2]	67,876	167,725		9.28%
U.S. Bureau of Reclamation[2]	12,335	38,480		1.85%
U.S. Fish and Wildlife Service[2]	1,524	3,766		0.23%
U.S. Forest Service	231	571		0.03%
State	*121,122*	*299,298*	*18.16%*	
California Department of Parks and Recreation[2]	116,099	286,886		17.41%
State Lands Commission	3,066	7,576		0.46%
California Department of Fish and Wildlife[2]	1,641	4,055		0.25%
Coachella Valley Mountains Conservancy	216	534		0.03%
California Wildlife Conservation Board	81	200		0.01%
University of California	20	49		0.00%
County	*362*	*895*	*0.05%*	
San Diego, County of	360	890		0.05%
Imperial, County of	2	5		0.00%
City	*49*	*121*	*0.01%*	
Palm Springs	37	91		0.01%
Cathedral City	9	22		0.00%
Palm Desert	2	5		0.00%
Indio	1	2		0.00%
Special District	*1,458*	*3,603*	*0.22%*	
Imperial Irrigation District	878	2,170		0.13%
Coachella Valley Water District	470	1,161		0.07%
Borrego Water District	64	158		0.01%
Desert Water Agency	31	77		0.00%
Palm Springs Unified School District	7	17		0.00%
Salton Community Services District	7	17		0.00%
Desert Recreation District	1	2		0.00%
Grand Total	**516,012**	**1,275,088**		**77.37%**

[1] California Protected Areas Database (CPAD) 2015 [2] RMS Participating Agency

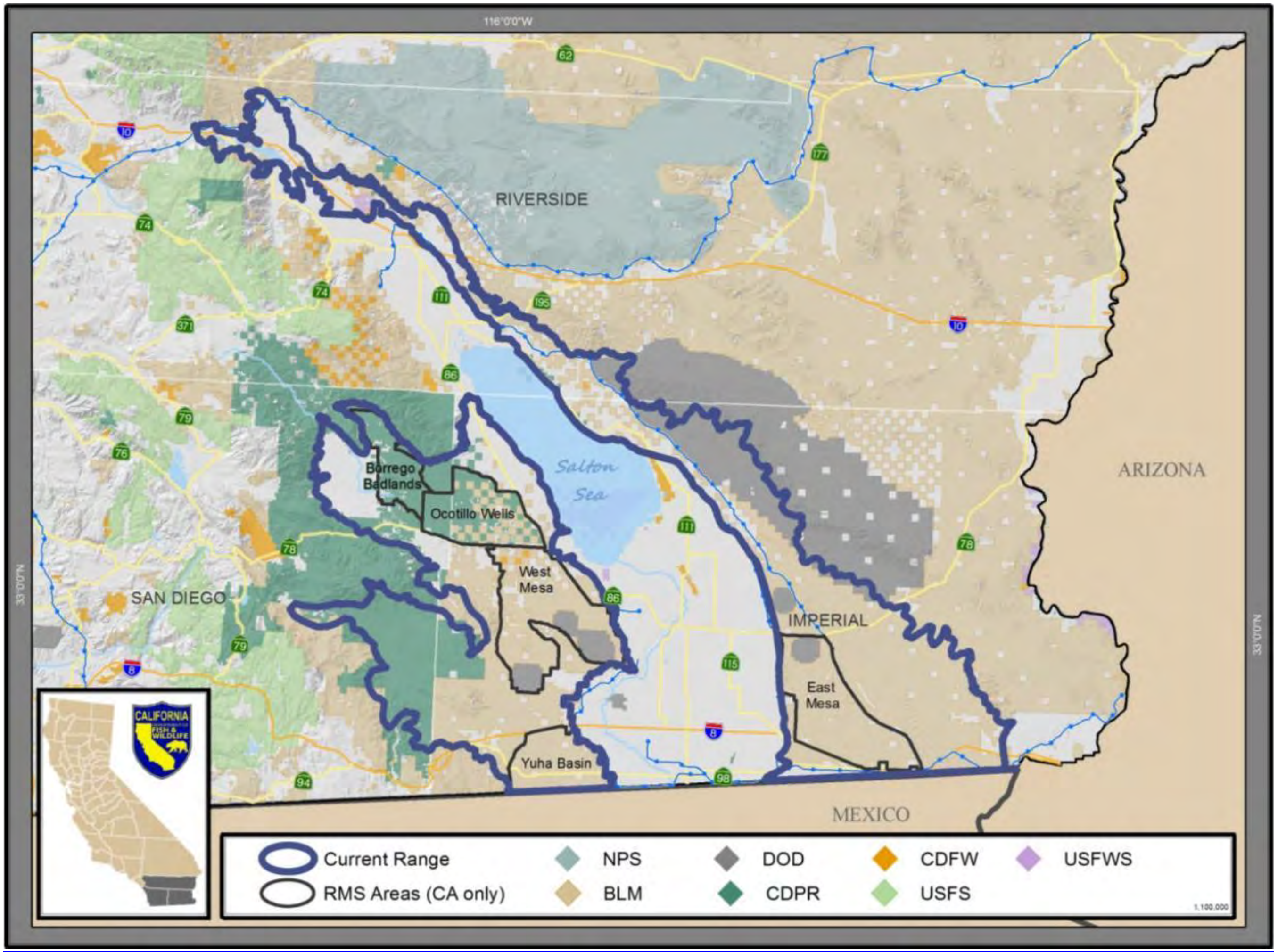


Figure 9. Main Land Ownership within the Flat-tailed Horned Lizard's California Range

Flat-tailed Horned Lizard Rangewide Management Strategy

In 1997, a voluntary long-term Interagency Conservation Agreement (ICA) was signed by the Department, USFWS, BLM, U.S. Bureau of Reclamation, U.S. Marine Corps, U.S. Navy, Arizona Game and Fish Department, and the California Department of Parks and Recreation (California State Parks) to implement the Flat-tailed Horned Lizard Rangewide Management Strategy (RMS), which was subsequently revised in 2003 (FTHLICC 2003, Foreman 1997). The RMS is implemented by the Interagency Coordinating Committee (ICC) and the Management Oversight Group (MOG), both comprised of members of the signatory agencies. The overall goal of the RMS is to "maintain self-sustaining populations of Flat-tailed Horned Lizard in perpetuity" (FTHLICC 2003). As briefly discussed in the Existing Regulatory Status section, the RMS established five Management Areas (MA), four in California and one in Arizona, and one Research Area (RA) in an active off-highway vehicle (OHV) park (Foreman 1997). MAs were designed to as much high-quality Flat-tailed Horned Lizard habitat (as identified in previous studies) and as large an area as possible, while avoiding extensive, existing, and predicted management conflicts such as OHV open riding areas (FTHLICC 2003). The RA was established to encourage research on the potential impacts of OHV use on Flat-tailed Horned Lizards, funded through the California Department of Parks and Recreation's Off-Highway Motor Vehicle Recreation Division (OHMVRD) (Foreman 1997).

Management objectives for MAs include:

- Continue to secure and/or manage sufficient habitat to maintain self-sustaining Flat-tailed Horned Lizard populations in each of the five designated MAs;
- Maintain a "long-term stable" or increasing population of Flat-tailed Horned Lizards in all MAs (a population that is stable over the long term exhibits no downward population trend after the effects of natural demographic and environmental stochasticity are removed);
- Continue to support research that promotes conservation of the species;
- Within and outside of MAs, limit the loss of habitat and effects on Flat-tailed Horned Lizard populations through the application of effective mitigation and compensation; and
- Encourage and assist Mexico in the development and implementation of a Flat-tailed Horned Lizard conservation program (FTHLICC 2003).

Although entry into the ICA and implementation of the RMS is voluntary and based on available funding, BLM and the Department of Defense have formally adopted the RMS within some of their agencies' environmental planning documents. The BLM, through a California Desert Conservation Area Plan amendment, adopted the three California MAs as Areas of Critical Environmental Concern (ACEC) in 2005 (FTHLICC 2013). Under the Sikes Act, the Department of Defense has codified the RMS into the Integrated Natural Resources Management Plans (INRMPs) for their installations (Navy 2014, USAF and USMC 2013).

California State Parks, the third main landowner within the Flat-tailed Horned Lizard's California range, has not formally adopted the RMS into its planning documents. The Anza-Borrego Desert State Park Final General Plan and Environmental Impact Report (EIR) were approved by the State Parks and Recreation Commission in 2005. While they include goals and guidelines for conservation of significant and sensitive biota (CDPR 2005), they do not directly address

Flat-tailed Horned Lizard, which affects dedication of funding and staffing availability to implement the RMS. Management for the Flat-tailed Horned Lizard within the Ocotillo Wells State Vehicular Recreation Area (OWSVRA) falls under guidelines incorporated by California State Parks to evaluate and sustain park resources, but as an RA, OWSVRA is not subject to the same protections from disturbance in the RMS as the MAs are. OWSVRA is mandated to provide OHV recreation (e.g., free-play, racing, and touring) in a manner to sustain long-term use (FTHLICC 2003). The OHMVRD, in cooperation with the BLM, is preparing a General Plan/Recreation Area Management Plan/California Desert Conservation Area Land Use Plan Amendment ("Ocotillo Wells SVRA Plan") and associated EIR/Environmental Impact Statement (EIS), which will update the current general plan that was developed in 1982 (CDPR 2015). The objective of the Ocotillo Wells SVRA Plan is to create a comprehensive planning tool under both state and federal guidelines to effectively manage Ocotillo Wells SVRA for high quality recreation, while protecting its resources in a sustainable manner (Ibid.).

Each MA is controlled by multiple agencies, and all MAs in California include private inholdings, which are targeted for acquisition to reduce the chance of development within the MA boundaries (Ibid.). Land management within the MAs is designed to avoid or reduce permanent surface disturbance and to promote reclamation of disturbed areas (e.g., duplicate roads that are no longer needed) (Ibid.). The RMS requires compensatory mitigation for long-term impacts to Flat-tailed Horned Lizard habitat at ratios anywhere from 3:1 to 6:1 within MAs and 1:1 outside of them, and surface disturbance cannot exceed 1% of the total area within the MAs (Ibid.). While there is no indication the participating agencies will increase this disturbance cap in the future, it is a voluntary measure in areas where it has not been formally adopted (i.e., outside the ACECs).

The land area within the California MA boundaries totals 142,518 ha, approximately 21% of the Flat-tailed Horned Lizard's range in the state (using the Department's current estimated range map, Figure 1). Since 1997, impacts to 346 ha have been approved within the California MAs, and 6,811 ha of private lands have been acquired (FTHLICC 2015). In 2014, authorized surface impacts increased in MAs as a result of solar energy development and military projects (Ibid). The most recent RMS implementation progress report concludes "there is some concern the 1% development cap may be reached, and exceeded, in some MAs due to utility-scale renewable energy development and Navy projects" (Ibid.).

As already described in the Status and Trends in California sections, participating agencies conduct occupancy and demography surveys to monitor Flat-tailed Horned Lizard trends on the RMS areas. Formal monitoring under the RMS began in 2002, and as techniques were refined, a Flat-tailed Horned Lizard Monitoring Plan was developed in 2008 to standardize data collection (Ibid.). The Monitoring Plan was further revised in 2011 "to improve the precision of occupancy estimates and detection probability" (Ibid). The general inconsistency of data collection over the years has made population trend analysis somewhat challenging (Grimsley and Leavitt 2016), and the participating agencies admit that full population monitoring efforts needed to quantify critical population indices and detect trends suffer from funding and staffing constraints over most of the areas managed in California (FTHLICC 2015). Aside from that, the most recent RMS implementation progress report concludes that "the majority of the tasks outlined by the [RMS] are being completed on schedule" (only "provide public information and

education" is ongoing but not on schedule, and "determine effects of natural barriers" has not been completed) (Ibid).

In addition to conducting population monitoring, the participating agencies have supported and are currently supporting several research projects since the inception of the RMS through direct funding and personnel. These include, but are not limited to, evaluating the potential for OHVs to crush Flat-tailed Horned Lizards during hibernation (Grant and Doherty 2009), ecological associations with Flat-tailed Horned Lizard occupancy at OWSVRA (Beauchamp et al. 1998, Gardner 2005), OHV effects (McGrann et al. 2006, Wone et al. 1994, Young 1999), genetics (Culver and Dee 2008), landscape genomics (FTHLICC 2016), use of culverts (Painter and Ingraldi 2007), effects of translocation (Goode and Parker 2015, Painter et al. 2008), road mortality (Goode and Parker 2015), efficacy of barrier fencing along roads (Gardner et al. 2001), habitat suitability modeling (FTHLICC 2016), population viability analyses (Fisher et al. 1998, FTHLICC 2016), potential eastern Salton Trough movement corridor (FTHLICC 2016), anthropogenic influences on avian predation (Ibid.), and climate change (Ibid.).

Coachella Valley Multiple Species Habitat Conservation Plan

The Coachella Valley Multiple Species Habitat Conservation Plan (CVMSHCP) is a multi-agency plan, adopted pursuant to the federal Endangered Species Act and the California Natural Communities Conservation Planning Act. It provides for the long-term conservation of ecological diversity within the Coachella Valley region of Riverside County, while streamlining the development application review process throughout the plan area. The Department and the USFWS issued permits for the 75-year term CVMSCHP in 2008. The CVMSCHP includes an area of approximately 445,000 ha that do not include Indian Reservation Lands (CVCC 2015).

Within the plan area there are 13,122 ha of predicted modeled habitat for the Flat-tailed Horned Lizard of which 1,678 ha are identified as core habitat (CVMSHCP 2007). The CVMSHCP conserves 98% of the core habitat and 93% of other habitat beneficial to the conservation of the species (Ibid.). Outside of the conservation areas, 52% of predicted modeled habitat and 29% of potential habitat are authorized for take of Flat-tailed Horned Lizards (Ibid.). These areas are already highly fragmented, surrounded by existing development, and have a compromised sand source/transport system (Ibid.).

Although the CVMSHCP predicts there is suitable or potential habitat within a number of conservation areas, Flat-tailed Horned Lizards appear to have been extirpated from nearly all of the Coachella Valley with the exception of the Thousand Palms Preserve and possibly Dos Palmas. While the CVMSCHP (2007) states that "[i]deally, three or more sites with discrete sand sources and of sufficient size to maintain a viable population should be preserved," it also recognizes that "[r]ealistically there are not three such sites remaining that are not already fragmented or otherwise compromised by Development." Only Thousand Palms is considered "core habitat," meaning it is presumably large enough to sustain a population, although see the Fragmentation, Edge Effects, and Small Populations section below (Ibid.). Nevertheless, the CVMSCHP (2007) concludes that the Conservation Areas benefit the FTHL "by securing the long-term sand source-sand transport systems for their preferred habitat in the dune areas of the western and central Coachella Valley and by securing the unprotected habitat …throughout the plan area" (Ibid).

As of 2015, 81% of the Flat-tailed Horned Lizard Habitat to be conserved within the Thousand Palms Conservation Area has been acquired (CVCC 2015), although the vast majority of it was already conserved prior to the plan. Only 15% of the Flat-tailed Horned Lizard habitat to be conserved in the Dos Palmas Conservation Area, and none of the East Indio Hills Conservation Area has been acquired from 2006-2014 (Ibid.).

Lower Colorado River Multi-Species Conservation Program

The 50-year Lower Colorado River Multi-Species Conservation Program (LCR MSCP) was signed by the Department of the Interior Secretary and representatives from agencies within Arizona, California, and Nevada in 2005. The LCR MSCP was created to balance the use of the Colorado River water resources with the conservation of native species and their habitats from Lake Mead to the southernmost border of Mexico (LCR MSCP 2016). The plan is implemented by the Bureau of Reclamation (Ibid.).

None of the LCR MSCP area falls within the Flat-tailed Horned Lizard's range in California, but a small portion occurs between Imperial Dam and the Mexican border in Arizona (LCR MSCP 2015). There are two Flat-tailed Horned Lizard-specific conservation measures in the plan. The first is to acquire and protect 230 acres of unprotected occupied Flat-tailed Horned Lizard habitat, which was completed by purchasing two privately owned parcels totaling 240 acres adjacent to the Yuha Basin MA in 2012 (C. Ronning pers. comm.). The second is to implement conservation measures to avoid or minimize take of Flat-tailed Horned Lizards including those described in the RMS (LCR MSCP 2015).

California Desert Conservation Area Plan

In 1976, the Federal Land Policy and Management Act (FLPMA) authorized the BLM to conserve and manage public lands, and required the preparation of the California Desert Conservation Area Plan (CDCA). The BLM can designate ACECs through the CDCA. ACECs are defined as "areas within the public lands where special management attention is required (when such areas are developed or used or where no development is required) to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources or other natural systems or processes, or to protect life and safety from natural hazards" (DOI 2001). The goals of ACECs are to:

Identify and protect the significant natural and cultural resources requiring special management attention found on the BLM-administered lands in the CDCA;

Provide for other uses in the designated areas, compatible with the protection and enhancement of the significant natural and cultural resources; and

Systematically monitor the preservation of the significant natural and cultural resources on BLM-administered lands, and the compatibility of other allowed uses with these resources (DOI 1980).

Portions of the three MAs administered by the BLM (East Mesa, Yuha Basin, and West Mesa) were designated as ACECs to protect the Flat-tailed Horned Lizard in 2005 (BLM 2016c, FTHLICC 2006). The Coachella Valley Fringe-toed Lizard and Dos Palmas ACECs in the Coachella Valley also provide protection for the Flat-tailed Horned Lizard (BLM 2016c). North

Algodones Dunes, which supports Flat-tailed Horned Lizards along its vegetated edges, was an ACEC but was recently withdrawn because it is already designated wilderness under the National Landscape Conservation System and the ACEC designation was unnecessary (BLM 2016c). Management requirements vary by location but in general include controlling and erecting signs explaining vehicle access areas and routes, restricting mineral exploration/development, developing additional habitat/water sources, conducting intensive resource inventories, controlling exotic and introducing native species, and stabilizing/rehabilitating/salvaging features (DOI 1980).

California Environmental Quality Act

Flat-tailed Horned Lizards are designated as a SSC by the Department, and as such the California Environmental Quality Act (CEQA) provides the species with certain protections from projects undertaken or approved by public agencies. CEQA is a California law (Public Resources Code Section 21000 et seq.) that requires state and local agencies to publicly disclose, analyze, and potentially mitigate environmental impacts from projects over which they have discretionary approval power. In particular, CEQA requires that actions that may substantially reduce the habitat, decrease the number, or restrict the range of any species that can be considered rare, threatened, or endangered must be identified, disclosed, considered, and mitigated or justified. (Cal. Code Regs., tit. 14, §§ 15065(a)(1), 15380.)

CEQA compliance is not always thorough because the process can be very costly and time-consuming. Agencies may also determine projects are exempt (i.e., they do not need to go through the impact analysis, public disclosure, and mitigation process). Mitigation is required if a project is not CEQA-exempt and impacts would be potentially “significant.” Mitigation must reduce impacts to below a level of significance or minimize unavoidable significant impacts, where feasible. The CEQA process generally incentivizes agencies and project applicants to implement mitigation thereby avoiding significant impacts.

Impacts on Flat-tailed Horned Lizards are generally considered potentially significant if agencies determine on a project-specific basis that the species meets the CEQA criteria for endangered, rare, or threatened. However, agencies are not required to make this determination for Flat-tailed Horned Lizards and other species that are not listed under the California or federal Endangered Species Acts. Even when they are considered in a CEQA analysis, lack of readily available information on which to base impact analyses and lack of understanding of the law may result in projects having an unknown significant impact on the species.

One measure that is often used to minimize adverse impacts to sensitive species is translocation of encountered individuals a safe distance away from the construction site. However, its utility in conserving species has been questioned (Germano and Bishop 2009, Germano et al. 2015). Two recent studies evaluated the efficacy of translocation for conserving Flat-tailed Horned Lizards (Goode and Parker 2015, Painter et al. 2008). While their methods were somewhat different, their results were quite similar. Both studies compared survival, persistence, behavior, and movement patterns using radio-telemetry on translocated and control Flat-tailed Horned Lizards (Ibid.). In the months immediately following translocation (late summer/fall 2012), both translocated males and females had significantly larger home ranges than non-translocated individuals; however, after that, there was no significant difference

between the two groups (Goode and Parker 2015). Survival probabilities were lower for translocated Flat-tailed Horned Lizards, although the difference was not statistically significant (Goode and Parker 2015, Painter et al. 2008). This result indicates Flat-tailed Horned Lizards may have a period of acclimation following translocation as they adjust to their new locations (Ibid.). Painter et al. (2008) noted greater movements in translocated individuals up to 14 days post-release. Goode and Parker (2015) did observed translocated Flat-tailed Horned Lizards engaging in reproductive behavior and concluded that "[w]hile the results of this project certainly do not justify making translocation a commonly used mitigation measure for Flat-tailed Horned Lizards, there were some promising results that warrant further study."

In order for translocation to be effective, exclusion fencing must be maintained. Goode and Parker (2015) observed telemetered Flat-tailed Horned Lizards crossing the fence with some regularity; thirty individuals, both non-translocated and translocated, crossed the fence at least once. The fence used in this study "began falling into disrepair almost immediately after it was constructed, with sand drifts accumulating quickly and holes appearing after several weeks" (Ibid). Most, if not all, of these individuals were placed immediately outside the exclusion fencing, and given the relatively large home ranges of Flat-tailed Horned Lizards, it is not surprising that they would attempt to re-enter. Painter et al. (2008) noted that while none of the translocated Flat-tailed Horned Lizards that were moved greater than 1.6 km (1 mi) away showed signs of homing behavior, control individuals that were released 100 m (328 ft) away from their capture point did.

FACTORS AFFECTING ABILITY TO SURVIVE AND REPRODUCE

Fragmentation, Edge Effects, and Small Populations

It is well established that loss of habitat is the primary reason for a vast majority of species' declines and extinctions globally; however, declines can occur even in seemingly relatively undisturbed habitat when barriers to movement fragment once contiguous blocks into smaller areas and when adverse impacts from adjacent land uses extend into that habitat (i.e., edge effects). Depending on their severity, edge effects around habitat fragments can create perpetual population sinks (areas of negative population growth) because the habitat is still intact, so individuals will continue to move into it where they can experience higher mortality risk than in the habitat block's core. Such sinks will have the greatest impact on overall population dynamics in small reserves with high perimeter-to-area ratios and in species that range widely and therefore come into frequent contact with edge more often (Woodroffe and Ginsberg 1998).

Fragmentation and edge effects can be particularly deleterious when they impact species with small populations or create smaller populations, which are more at risk of decline or localized extinctions from random fluctuations in abundance and loss of genetic diversity through drift (Woodroffe and Ginsberg 1998). For example, Vandergast et al. (2016) discovered that genetic structure among Coachella Valley Fringe-toed Lizard (*Uma inornata*) populations increased, while genetic diversity and effective population sizes decreased between 1996 and 2008. They suggested this rapid differentiation was likely a synergistic effect of population declines during the historic drought of the late 1990s–early 2000s and habitat fragmentation that precluded

post-drought genetic rescue (Ibid.). Flat-tailed Horned Lizard populations in the Coachella Valley are even smaller and more fragmented than the Coachella Valley Fringe-toed Lizard, apparently only persisting in two preserves (Barrows et al. 2008). Similarly, Culver and Dee (2008) discovered that a small population of Flat-tailed Horned Lizards, separated from the rest of the species' range in Arizona by development and Interstate 8, was moderately genetically differentiated from those located south of the road. Their observation of a disproportionately high frequency of an allele that was otherwise rare in all other populations suggested evidence of either a strong selective force north of the freeway or random genetic drift or inbreeding due to the effects of isolation and small population size (Ibid.).

Edge effects, reported as reductions in Flat-tailed Horned Lizard detections, have been observed as great as 450 m away from a habitat edge and are primarily associated with increased predation by round-tailed ground squirrels, loggerhead shrikes, and American kestrels, as well as road mortality (Barrows et al. 2006, Goode and Parker 2015, Young and Young 2005). In some cases, these edge effects appear to be able to shift Flat-tailed Horned Lizard population dynamics from a bottom-up process, where the lizard numbers are regulated by native ant abundance, to a top-down process, where the lizards are limited by predation and possibly road mortality, creating a population sink along the habitat boundary (Barrows et al. 2006).

Comment [K&A14]: I agree that edge effects are particularly problematic in Coachella Valley, as Barrows et al. have shown.

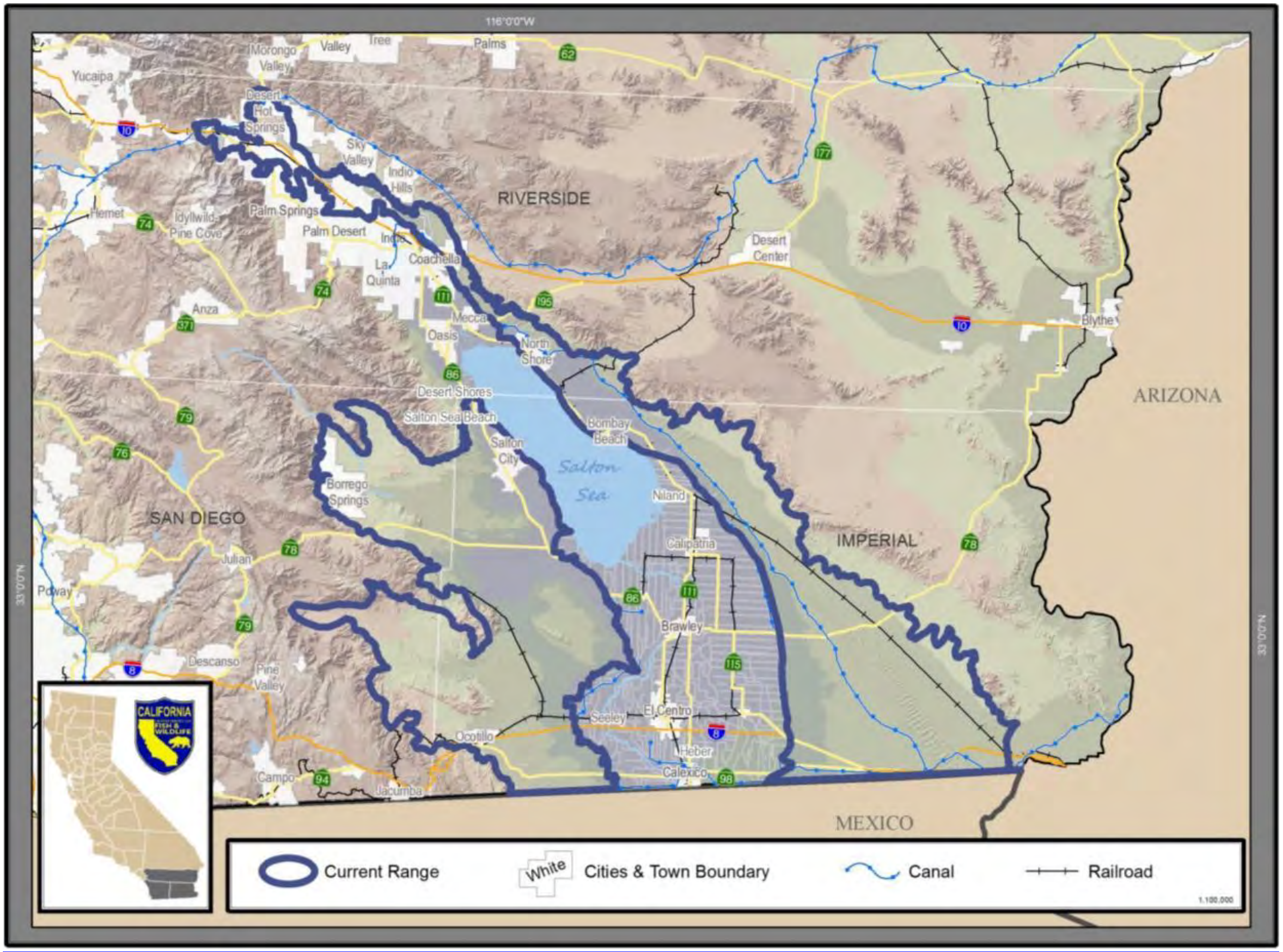
The USFWS (2011) evaluated Flat-tailed Horned Lizard habitat fragmentation by major canals and highways, the international border, and several railways by multiplying the size of the habitat fragment by the density estimate they used to calculate rangewide abundance (see Abundance above). Because no one knows what the minimum viable population size is for Flat-tailed Horned Lizards, the USFWS used 7,000 individuals per population (based on Reed et al. 2003) to differentiate between habitat fragments that were likely large enough to avoid deleterious effects from small population sizes from those that weren't (Ibid.). Based on this calculation, which did not incorporate edge effects, neither occupied preserve in the Coachella Valley appears large enough to support a "large enough" population, only three of nine areas west of the Imperial Valley were large enough (83% of the total area), and only two of eight areas east of the Imperial Valley were large enough (69% of the total area) (Ibid.).

Comment [K&A15]: This is a big conservation concern! Especially since they have low reproduction and high mortality.

Some species-specific evidence (Barrows et al. 2006, 2008; Culver and Dee 2008; Goode and Parker 2015; Young and Young 2005), as well as some speculation (USFWS 2011) and population dynamics theory (Woodroffe and Ginsberg 1998), support the contention that Flat-tailed Horned Lizards are susceptible to the adverse effects of habitat fragmentation, edge effects, and small population sizes.

Roads, Canals, and Railroads

Major highways, irrigation canals, and railroads form large-scale near-complete barriers to Flat-tailed Horned Lizard movement, migration, and gene flow (Figure 10). These linear features fragment the habitat and can have demonstrable edge effects through increased mortality. The permeability (i.e., likelihood Flat-tailed Horned Lizards can cross the barrier) of these features differs somewhat across the species' range.



RIVERSIDE
IMPERIAL
SAN DIEGO
ARIZONA
MEXICO
Salton Sea
Desert Hot Springs
Palm Springs
Palm Desert
Indio
Coachella
La Quinta
Mecca
Oasis
North Shore
Desert Shores
Salton Sea Beach
Salton City
Bombay Beach
Niland
Calipatria
Brawley
El Centro
Seeley
Heber
Calexico
Ocotillo
Borrego Springs
Julian
Descanso
Campo
Jacumba
Poway
Hemet
Idyllwild Pine Cove
Anza
Yucaipa
Sky Valley
Indio Hills
Desert Center
Blythe
Morongo Valley
Pine Valley
Current Range
White
Cities & Town Boundary
Canal
Railroad

Figure 10. Major Barriers to Movement with the Flat-tailed Horned Lizard's California Range

Several major highways bisect the species' range in California. Flat-tailed Horned Lizards are frequently found on and around roads, and because they often freeze in the presence of threats, including vehicles, they're particularly susceptible to being killed on roads. Flat-tailed horned lizards were the most commonly encountered reptile (dead or alive) on paved roads within a military base in Arizona during three years out of a four-year study (Goode and Parker 2015). They accounted for 40.2% of all dead-on-road reptile observations, although only 3/353 (0.8%) of radio-telemetered Flat-tailed Horned Lizard deaths were known road kills, and individuals were frequently tracked moving across roads (Ibid.). Reports of proportions of dead vs. live Flat-tailed Horned Lizards on roads range from 3% - 27% (Goode and Parker 2015, Muth and Fisher 1992, Turner et al. 1980, Young and Young 2000) but do little to assess the impacts roads may be having at a population level. At least two studies (Barrows et al. 2006, Goode and Parker 2015) have studied this population-level effect specifically on Flat-tailed Horned Lizards.

Comment [K&A16]: They had 353 deaths among transmittered animals??? How many survived having a transmitter on them? Not that we can measure it very well, but putting a transmitter on a FTHL seems to increase mortality rates.

Using mark-recapture data, Goode and Parker (2015) reported no significant differences in population abundance estimates in plots adjacent to roads compared to control plots. In fact, two of the highest abundance estimates came from plots adjacent to roads. However, it should be noted that these were from plots without adjacent power poles (Ibid.), suggesting predation may be the primary driver of the observed edge effect, not road mortality (see Predation below). In a similar pattern, Barrows et al. (2006) reported a much greater and more abrupt reduction in Flat-tailed Horned Lizard detections near wider, well-traveled roads with curbs vs. narrower, less-traveled roads without curbs; however, they could not absolutely attribute this to road mortality because they simultaneously observed a high level of predation by American Kestrels using a palm tree planted across the wider road. While road mortality may be having a population-level effect in some areas, the sparse data available do not strongly validate this assertion.

Comment [K&A17]: But at this study site there is very little traffic, as the road is closed to the public.

Comment [K&A18]: Sounds like an opportunity to study populations near and far from I-10.

Nearly all of the irrigation canals in the Flat-tailed Horned Lizard's range are located within the existing developed lands in the Imperial and Coachella valleys. Two major exceptions are the All American Canal and the Coachella Canal (Figure 9). No studies have been conducted regarding the impact of canals on Flat-tailed Horned Lizards; however, it is clear that they present a complete barrier to movement with the possible exception of overcrossings. The Coachella Canal has several overcrossings to accommodate water and sediment transport down washes coming from the mountains to the east. In contrast, the All American Canal has very few crossings, all of which are narrow vehicle bridges.

Canal maintenance or improvements and construction of any new facilities have the potential to injure or kill Flat-tailed Horned Lizards or destroy their habitat. Imperial Irrigation District is discussing potentially constructing an intake canal off the All American Canal heading north close to the East Highline Canal that would discharge into a reservoir (J. Lovecchio pers. comm.), which if constructed would likely adversely impact a relatively small area in the overall Flat-tailed Horned Lizard's range.

There are several railroad tracks that run through the Flat-tailed Horned Lizard's range in California that pose a barrier to movement over long distances. It is unclear whether Flat-tailed Horned Lizards would avoid the trestles. In some areas, there are bridges constructed over

washes that would allow more unrestricted movement from one side to another, so even if they do avoid the trestles and tracks, some movement and gene flow is still possible.

Agricultural and Urban Development

As previously described in the Distribution section, the two primary sources of Flat-tailed Horned Lizard habitat loss over the past century have been agricultural and urban development in Coachella, Borrego, and Imperial valleys. New agricultural development has slowed substantially due to reduced water deliveries from the Lower Colorado River, and some fields have been fallowed (USFWS 2011) and converted to solar farms. Although the fallow fields may only be marginally suitable, Flat-tailed Horned Lizards have been observed using them (RECON 2010).

Most land within the California portion of the Flat-tailed Horned Lizard's range is owned by the State or various federal agencies, so extensive urban development is unlikely (USFWS 2011), although the California Department of Finance (2014) projects Imperial County's population is likely to grow from 187,689 in 2010 to 336,492 in 2060 (79%). The majority of this growth in the near term (2021) will be directed to existing incorporated townsites, including Bombay Beach, Desert Shores, Heber, Niland, Ocotillo, Salton City, Salton Sea Beach, and Seeley (County of Imperial 2013) (Figure 10). Private land holdings are relatively small and discontinuous throughout the range (USFWS 2011), indicating development of private land is likely to have small, localized impacts. Additionally, the Flat-tailed Horned Lizard ICC has been using compensatory mitigation money from approved project disturbances to purchase private inholdings within the MA boundaries, reducing the likelihood urban (or other) development will fragment the habitat within these areas. Future urban development in the Coachella Valley has been permitted through the CVMSHCP, which authorizes development in approximately 50% of the modeled suitable Flat-tailed Horned Lizard habitat, although nearly all of it is already fragmented and surrounded by existing development, so it would not likely support the species anyway (CVMSHCP 2007). Within the conservation areas, under the worst case scenario, take would occur within 2% (39 ha) of core habitat (i.e., able to sustain a population), 6% (336 ha) of modeled suitable habitat, and 7% (100 ha) of potentially suitable habitat (Ibid.).

Renewable Energy Development

Unlike agricultural and urban development, renewable energy (solar, wind, geothermal) development within the Flat-tailed Horned Lizard's range has increased dramatically in recent years. Lovich and Ennen (2011, 2013) synthesize the literature on potential impacts from utility scale renewable energy projects on desert ecosystems and wildlife. These include but are not limited to (1) creating a barrier to movement and fragmenting habitat; (2) increasing mortality on access roads and through increased avian predation along transmission lines; (3) opening up previously inaccessible areas to the public, facilitating illegal OHV use; (4) producing fugitive dust; (5) increasing soil erosion; (6) spreading invasive species; (7) increasing exposure to contaminants; (8) producing persistent loud noise and vibrations (wind); (9) increasing risk of fire; and (10) potentially altering local temperature, precipitation, and wind conditions (Ibid.).

There are no known studies investigating the specific impacts of renewable energy facilities and their associated infrastructure on Flat-tailed Horned Lizards, although some information from

other studies provided above on the effects habitat fragmentation, road mortality, and increased predation could apply. In addition, Olech (1984) reported that localized declines in indexed Flat-tailed Horned Lizard detections (scat and lizards) within the Yuha Basin corresponded with increased public use of those sites via construction of access roads for transmission lines and San Diego Gas and Electric's Imperial Valley Substation. Non-authorized OHV use was the most common "competing use" along all transects, and for transects where it was the only competing use of habitat, the temporal declines in observations were significant (Ibid.).

To date, renewable energy development in California has been permitted on a project-by-project basis. To facilitate this, the BLM has produced Programmatic Environmental Impact Statements (PEIS) for wind (BLM 2005), geothermal (BLM and USFS 2008), energy corridors (DOE and BLM 2008), and solar (BLM and DOE 2012). Wind resource potential is low throughout nearly all of the Flat-tailed Horned Lizard's range in California with the exception of the area around Ocotillo (BLM 2005) near the southwestern edge of the species' range, where the Ocotillo Wind Energy Facility was constructed in 2012 (BLM 2016a). Geothermal potential is greater, but its footprint is relatively small, and sites can typically be reclaimed and restored after extraction (BLM and USFS 2008).

The potential for solar energy facilities to impact a substantial amount of Flat-tailed Horned Lizard habitat is greater than that of wind or geothermal. Two Solar Energy Zones (SEZ) were identified in the PEIS, but only one is located within the Flat-tailed Horned Lizard's range (BLM and DOE 2012). The 2,314 ha Imperial East SEZ is located immediately south of the East Mesa MA in a fragmented patch of habitat bordered by Interstate 8, Highway 98, and Imperial Valley agriculture (Ibid.). An additional SEZ, the 4,354 ha West Chocolate Mountains SEZ, was subsequently established within the approximately 26,000 ha West Chocolate Mountains Renewable Energy Evaluation Area (REEA), located immediately south of Dos Palmas east of the Salton Sea (BLM 2012). The Final EIS for the West Chocolate Mountains REEA incorporated the RMS as its conservation measures for Flat-tailed Horned Lizards (Ibid.). There were no pending solar project applications within the Imperial East SEZ as of April 2015 (BLM 2015) or West Chocolate Mountains SEZs as of June 2014 (BLM 2014).

From January 2009-September 2015, the BLM approved right-of-way grants for five solar, one wind, and zero geothermal energy projects within the Flat-tailed Horned Lizard's range (BLM 2016a). Prior to 2009, the BLM had not approved any solar energy projects on public lands (Ibid.). The conservation, mitigation, and compensation measures in the RMS were incorporated into the environmental documents for these renewable energy projects, including minimizing impacts to Flat-tailed Horned Lizard habitat to the extent feasible, particularly within MAs, and purchasing compensation land or paying into a special fund for unavoidable impacts. For each approved project within a Flat-tailed Horned Lizard MA, the maximum (6:1) compensation ratio was applied.

Two energy corridors were identified that run roughly east to west through the Flat-tailed Horned Lizard's range in California, one in the far southern and one in the far northern parts of the range, overlapping portions of the East Mesa and Yuha Basin MAs as well as the Thousand Palms Preserve (DOE and BLM 2008). To date all of the solar projects with a BLM right-of-way grant have been located in the vicinity of the Imperial Valley Substation and Sunrise and Southwest Powerlinks (major transmission lines) in or around the Yuha Basin MA (BLM 2016a).

Most of the solar facilities were constructed on private agricultural land, and disturbance to Flat-tailed Horned Lizard habitat was restricted to construction of transmission lines connecting the facilities with existing infrastructure (Figure 11).

Aside from solar projects on BLM lands, there are several other authorized or pending renewable energy projects within the Flat-tailed Horned Lizard's range in California. Wind energy facilities are concentrated in the two locations that possess moderate to high wind resource levels, each along the periphery of the species' range (BLM 2005). One area is located in the far northwestern extent of the species' presumptive range near Whitewater in Riverside County, and the other is located in a canyon west of Ocotillo along the Sunrise Powerlink corridor in Imperial County within approximately 8 km of the Yuha Basin MA. In addition to the already operational Ocotillo Express Wind Farm in the latter zone, approvals for testing in the same area have been issued to two other wind energy development companies (BLM 2016b). There are several dozen parcels with geothermal leases located in approximately four areas within the Flat-tailed Horned Lizard's range (BLM 2013). The East Mesa Geothermal Field lies partially within the East Mesa MA, the Truckhaven Geothermal Leasing Area is located within the Ocotillo Wells RA, and the West Chocolate Mountains Geothermal Leasing Area is within the West Chocolate Mountains REEA. The Truckhaven Geothermal Project recently completed a reconnaissance survey and subsequently decided not to proceed with any future development (M. Rodriguez pers. comm.). In addition, renewable energy facilities are being approved on county lands that are not requiring implementation of the RMS conservation measures, although renewable energy companies are expected to evaluate potential impacts to Flat-tailed Horned Lizards and mitigate to a less than significant level through CEQA compliance (see Existing Management section above).

With so many different agencies involved in renewable energy development oversight and approval and such a high demand in California, state and federal agencies recognized the need for a comprehensive plan to guide development in appropriate areas while protecting sensitive resources. In 2008, the BLM, California Energy Commission, USFWS, and the Department began a collaborative effort to draft a Desert Renewable Energy Conservation Plan (DRECP) covering the Mojave and Colorado/Sonora desert region of California. The Draft DRECP EIR/EIS was released for public comment in September 2014. As a result of feedback, the agencies decided to implement the DRECP in a phased approach starting with just BLM-administered lands. In November 2015, the BLM proposed Land Use Plan Amendment (LUPA) and DRECP Final EIS were released for public comment. In March 2016, the notice describing the proposed updates to the Areas of Critical Environmental Concern in the LUPA was published. The latter document proposes to designate 130 ACECs covering approximately 2,418,400 ha (including 445,569 ha within Wildlife Study Areas and Wilderness Areas) and includes Conservation and Management Actions (CMAs) and resource use limitations to manage those ACECs, including a detailed methodology for implementing and managing for ground disturbance caps in ACECs (DRECP 2015). Figure 12 depicts the Development Focus Areas (DFAs) in relation to the RMS areas and proposed expansion of protected areas.

Within the LUPA area there are approximately 173,610 ha of Flat-tailed Horned Lizard habitat located on BLM-managed lands primarily in the Imperial Borrego Valley Ecoregion Subarea (DRECP 2015). Impacts would occur in three BLM managed areas: the western foothills of the

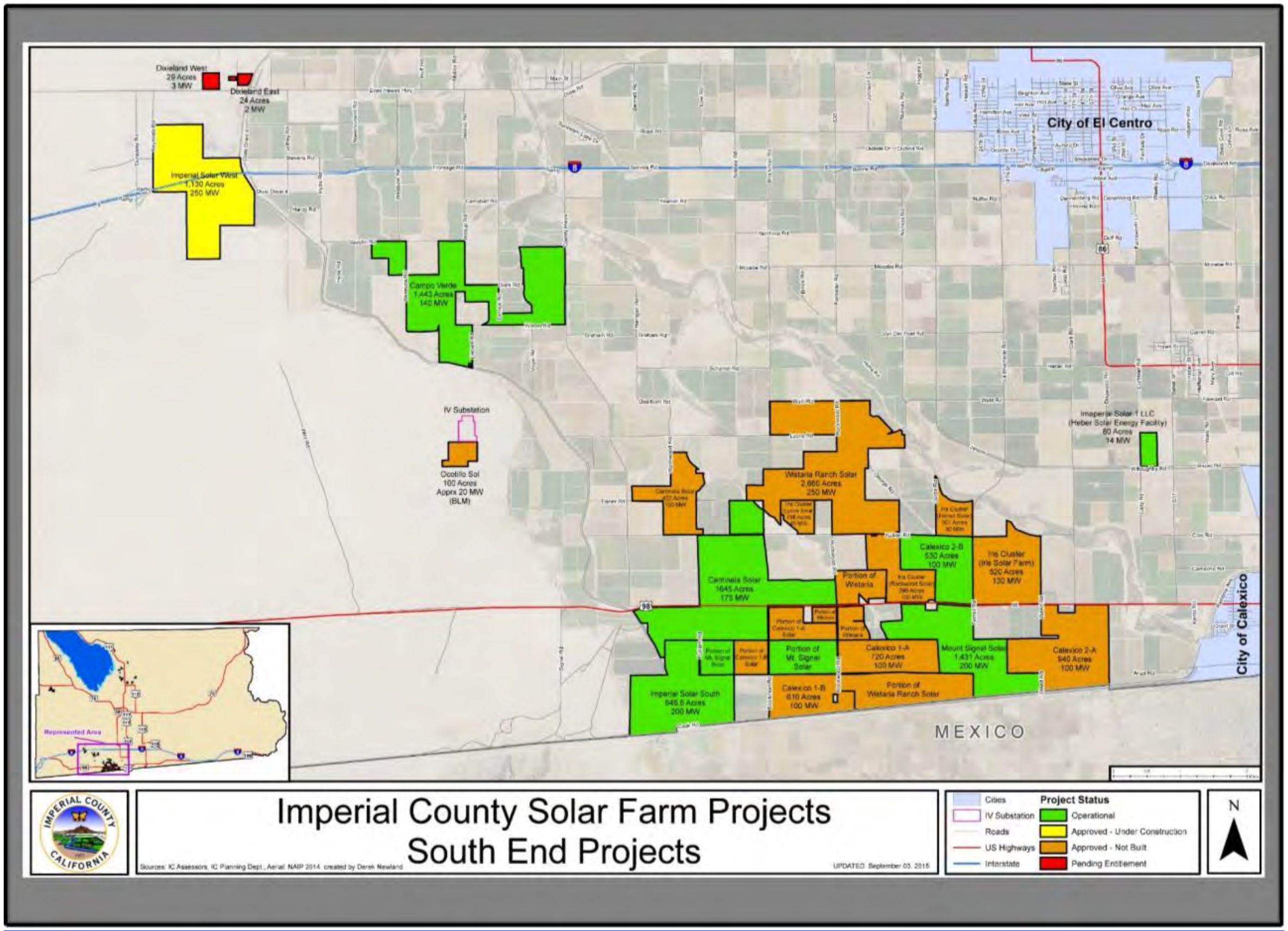


Figure 11. Solar Facility Footprints in Southwestern Imperial County

Figure 12. Land Use Designations under the Proposed BLM LUPA

Chocolate Mountains that include geothermal leasing areas studied in the 2008 Geothermal PEIS; BLM land along the western edge of East Mesa ACEC; and in BLM managed lands on the west side of the Salton Sea that include the Truckhaven Geothermal Leasing Area within the Ocotillo Wells RA. Under the Preferred Alternative, approximately 2,833 ha of solar, 8 ha of wind, 2,023 ha of geothermal, and 2,023 ha of transmission (includes BLM and non-BLM land) development would be permitted, slightly less than 4% of the total available (Ibid.). The RMS conservation, mitigation, and compensation measures are incorporated into the LUPA (Ibid.). In addition, the Preferred Alternative would expand Flat-tailed Horned Lizard protections by increasing the size of some of the ACECs within the species' range and restrict the type of uses (Table 4) (Ibid.). The Record of Decision has not yet been published for DRECP Phase I. Consequently, these amounts are subject to change, and it is unknown how much renewable energy development will be authorized by Imperial, Riverside, and San Diego counties.

Table 4. ACECs within Flat-tailed Horned Lizard's Range (LUPA Preferred Alternative)

ACEC	Current Area (ha)	Proposed Area (ha)	Renewable Energy	Mining	OHV
Coachella Valley Fringe-toed Lizard Preserve	4,151	4,158	No	No	No
Dos Palmas Preserve	3,371	3,371	No	Mineral Materials[1]	No
East Mesa	34,064	35,808	Geothermal[2]	Oil and Gas	Yes
Lake Cahuilla[3]	2,139	3,486	Geothermal[2]	Mineral Materials[4], Oil and Gas	Yes
Ocotillo	5,030	5,924	No	All Types	Yes
San Sebastian Marsh-San Felipe Creek	2,630	2,630	Geothermal (all NSO)	Locatable[5] Minerals, Mineral Materials	Yes
West Mesa	33,075	33,424	Geothermal	Mineral Materials	Yes
Yuha Basin	29,758	31,283	Geothermal	Mineral Materials	Yes

[1] Mineral materials = sand, gravel, rock, etc.

[2] New leases are subject to a "No Surface Occupancy" (NSO) stipulation (i.e., no surface disturbance, extraction only through directional drilling from outside the area)

[3] No disturbance cap (all others are 1%)

[4] Limited to historic operations only

[5] Locatable minerals = gold, silver, gems, limestone, etc.

Mining

The area of mining and mineral sites within the Flat-tailed Horned Lizard's range have not been mapped or quantified (BLM 2011), although Rado (1981) estimated 2,070 ha of active and intermittent sand and gravel quarries at the time of his study. Most mining activity within the Flat-tailed Horned Lizard's range is sand and gravel extraction, which has a relatively small physical footprint but can have a larger ecological footprint (BLM 2011, FTHLICC 2003). Like other types of development, mining activities remove and fragment, habitat, can impact air quality, create erosion and substantial noise, promote invasive species, release contaminants, and result in increased mortality along roads or through subsidizing predators (Ibid.). The Yuha Basin MA has been identified as a source of suitable sand and gravel (DRECP 2015), and there is an ongoing operation adjacent to and partially within East Mesa MA (BLM 2011). Among the few exemptions from the requirement to compensate for impacts to Flat-tailed Horned Lizards in the RMS are sites that have previously been mined along the East Highline Canal, either inside or outside of the East Mesa MA, if the applicant will be reclaiming the site and no further mining would occur (FTHLICC 2003).

Oil and gas leases were issued throughout the Salton Trough in the early 1980s, but only one test well was drilled (FTHLICC 2003). The well was not profitable, no oil or gas resources have been identified, and all oil and gas leases within the Flat-tailed Horned Lizard's habitat have expired (USFWS 1997, FTHLICC 2003).

Gold mining was listed as a potential future threat to Flat-tailed Horned Lizards in the Department's previous status review due to numerous mining claims being staked in the area of OWSVRA (Bolster and Nicol 1989); however, this threat never manifested.

Off-highway Vehicles

Most Flat-tailed Horned Lizard habitat is available for OHV recreational opportunities to some degree; closed areas are restricted to military lands, wilderness designations, and Anza-Borrego Desert State Park (BLM 2003). The BLM allows trail-only riding within the East Mesa, West Mesa, and Yuha Basin MAs (Ibid.). The adverse effects that OHVs can cause to desert ecosystems have been well documented, including compacting soil and destroying soil crusts, which leads to erosion and limits plant germination, growth, and vigor; damaging and destroying the plants themselves and crushing animal burrows, which reduces habitat availability and quality; raising fugitive dust and emitting byproducts of combustion, which impacts air quality and plant growth; spreading invasive species; directly wounding or killing wildlife; and producing excessive noise, which can alter animal behavior and physiology (Ouren et al. 2007).

The most recent estimate of OHV route proliferation and surface disturbance within the Flat-tailed Horned Lizard's range in California occurred in the early 2000s (USFWS 2003, Wright 2002), prior to adoption of the Western Colorado OHV Routes of Travel Designation Plan and construction of the border fence (BLM 2003, USCBP 2012a). Wright (2002) estimated the number of routes and graded roads increased by 387% within the West Mesa MA from 1985 to 2001, increased by 23% within the Yuha Basin MA from 1994 to 2001, and decreased 45% within the East Mesa MA from 1994 to 2001. Wright (2002) estimated 11.4% of the West Mesa MA had vehicle tracks in 2001, and the USFWS (USFWS 2003) estimated that 9.7% and 7.8% of the surface area was disturbed in 2002 within the Yuha Basin and East Mesa MAs,

respectively. Wright and Grant (2003) noted a 45% drop in vehicle track coverage in one year, speculating it could be the result of a big sandstorm and change in Border Patrol activities. This serves as a good example of why vehicle track coverage is an imperfect estimate of OHV impacts. Tracks disappear more quickly in sand than other surfaces, and a high number of tracks does not necessarily equate to frequent, or even recent, vehicle traffic since they can last for a long time in certain substrates (Ibid.). Nevertheless, it has been used as the metric of OHV use in nearly all studies of potential impacts to Flat-tailed Horned Lizards.

Comment [K&A19]: I noticed a sharp decline in OHV tracks on the Yuma MA once the border fence was built and Border Patrol was not driving around offroad so much. (1999-2001 were the worst years, if I recall, with Border Patrol activity at a peak).

There have been numerous attempts to study the impacts of OHVs on Flat-tailed Horned Lizards over the past three and a half decades, but complications associated with the low detectability of the species and variable detectability in different habitats, the unreliability of using scat as a surrogate index of abundance, and difficulty categorizing level or intensity of OHV use at a site have rendered the results equivocal. There have only been a few rigorously designed studies undertaken.

Setser and Young (2000), studying radiotracked Flat-tailed Horned Lizards in mudhill habitat within OWSVRA, found positive associations between Flat-tailed Horned Lizard habitat use and rocks and plants, but a negative association with OHV disturbance; however, this avoidance was only detectable out to 10m from tracks. Hollenbeck (2004, 2006) found sand was the only significant variable associated with Flat-tailed Horned Lizard abundance on several plots across OWSVRA, track coverage was not. Gardner (2005) found that Flat-tailed Horned Lizards were positively associated with sand and shrub abundance, even when the sandy plots were within an OHV route within a wash. McGrann et al. (2006) found that ant mound densities, mean adult mass, and mean juvenile mass were significantly greater on low impact plots (i.e., lower vehicle track %) than high impact plots, but overall density was greater on the high impact plots at one site and lower on another. Because they controlled for sand and vegetation, they speculate the difference was regularity of OHV use, which was greater at the site with lower densities (Ibid.). Because the OHV season occurs largely during the Flat-tailed Horned Lizard's hibernation period, Grant and Doherty (2009) investigated the risk of being crushed by OHVs during this time by simulating high and low impact riding intensities. Five of twelve Flat-tailed Horned Lizards were directly run over during the high impact treatment and three in the low, but none were injured or killed despite hibernating at shallow depths (Ibid.). They noted that a higher proportion of lizards hibernated under shrubs in OWSVRA (high use area) than East Mesa (low use area) and that rainfall may have played a part in the results, speculating that OHVs may cut less deeply into wet soil because the water tension helps hold it together (Ibid.). Nicolai and Lovich (2000) radio-tracked three male Flat-tailed Horned Lizards before and after a race and found a reduced rate of movement after the race, although the biological significance of the difference was dubious since the mean activity areas after the race were variable (i.e., one lower, one nearly the same, and one higher than before the race). Young (1999) did not find a difference in Flat-tailed Horned Lizard reaction to an OHV passing by vs. a person walking by.

Noise associated with OHVs (as well as military activities, construction equipment, transmission lines, power plants, and wind farms) has been speculated to adversely affect Flat-tailed Horned Lizards (Bolster and Nichol 1989, CBD 2014). The degree to which noise impacts Flat-tailed Horned Lizards is uncertain, although it is likely very little. Heffner and Heffner (1998) concluded that reptiles show few, if any, responses to sound, and it appears they do not make as wide a use of hearing as most other vertebrates. Bondello (1976) and Brattstrom and Bondello (1983) demonstrated prolonged acoustical sensitivity loss in Desert Iguanas (*Dipsosaurus dorsalis*) and Mohave Fringe-toed Lizards (*Uma scoparia*), respectively, after short duration exposure to OHV-level noises. These studies have been used to support the notion that similar impacts to Flat-tailed Horned Lizards are likely (Bolster and Nichol 1989). However, Flat-tailed Horned Lizards have a different ear anatomy than these species. Flat-tailed Horned Lizards have no exterior ear opening, and Norris and Lowe (1951) concluded that the species' tympanum (i.e., eardrum) was so degenerate, it appears to have become functionless. The tympanum is covered with skin and encroached upon by bone, and the middle ear has been invaded by jaw bone, a condition that approximates that of snakes (Norris and Lowe 1951, Stebbins and McGinnis 2012). These changes have been noted in other lizard genera as well and are thought to be adaptations to burrowing (Ibid.). Christensen et al. (2012) concluded "that pythons, and possibly all snakes, lost effective pressure hearing with the complete reduction of a functional outer and middle ear, but have an acute vibration sensitivity that may be used for communication and detection of predators and prey." In addition, Wone et al. (1994) experimented with high frequency sounds to determine if they could elicit Flat-tailed Horned Lizards to run and thus be more easily detected; however, none of the Flat-tailed Horned Lizards exposed to the sounds reacted, remaining crouched and motionless whether the units were turned on at a distance or nearby.

It is difficult to find any conclusive evidence of significantly detrimental effects of OHVs on Flat-tailed Horned Lizards. They certainly are injured and killed on roads and trails, but the frequency of this source of mortality and its impact on population dynamics are unknown. A very small proportion (two out of hundreds) of all the Flat-tailed Horned Lizards tracked with radio-transmitters was known to be killed by OHVs (Goode and Parker 2015, Grant and Doherty 2009, Muth and Fisher 1992, Setser 2001). This could be explained if Flat-tailed Horned Lizards are selecting habitat features like rocks and shrubs that OHV riders tend to avoid (Gardner 2005). In addition, not all OHV activity is the same, and the risk to Flat-tailed Horned Lizards likely varies dramatically depending on a number of factors that go into habitat suitability, time of year, and available resources. For instance, Grant and Doherty (2006) observed that lighter Flat-tailed Horned Lizards tended to enter hibernation later in the year and speculated that they may need to stay active longer to put on fat reserves to last the winter. They also noted, as others have, that juveniles may not hibernate at all. It is possible in lean years, Flat-tailed Horned Lizards may not hibernate as long, and the longer they stay active, the more likely they are to be exposed to OHVs on the surface.

Where OHV use intensity is so great that it substantially reduces shrubs or prey, particularly in areas where these habitat features may already be scarce, Flat-tailed Horned Lizard density and body condition are likely to suffer. Luckenbach and Bury (1983) observed marked declines in herbaceous and perennial plants, arthropods, lizards, and mammals in open OHV riding areas of the Algodones Dunes vs. closed/low use areas. The extent to which these changes in vegetation and prey have occurred as a result of OHV activity across the Flat-tailed Horned Lizard's range is unknown. Whether the vibrations from OHVs detected by Flat-tailed Horned Lizards impact their ability to respond to predators or other threats (like OHVs) is similarly unknown.

United States-Mexico Border Activities

In response to illegal immigration and narcotics smuggling, U.S. Customs and Border Patrol (BP) actively patrols the border and surrounding areas, using OHVs, pedestrian and vehicle (PV) fences, and surveillance cameras and towers (Cohn 2007, FTHLICC 2003, Lasky et al. 2011). Flat-tailed Horned Lizards may be adversely affected by both illegal activities and the efforts to halt them through habitat fragmentation caused by the border fence, increased predation facilitated by tall perches (fences and towers) and trash, road mortality, and habitat degradation from cross-country driving.

There is limited literature available specifically assessing border related impacts on the Flat-tailed Horned Lizard and other species (Cohn 2007; Lasky et al. 2011; USCBP 2012a, 2012b). The USFWS estimated that if border-related activities involved a zone of high impact 1 km north of the border, that would amount to disturbance of approximately 2,318 ha (0.7%) and 5,012 ha (3%) of the Flat-tailed Horned Lizard's range west and east of the Imperial Valley, respectively (USFWS 2011). The actual area of disturbance is probably less in the eastern section since the All American Canal runs the length of the border less than 1 km north of it (Ibid.). The construction of a border fence along the entire California range of the species is expected to dramatically reduce that impact (Ibid.). While vehicle-related mortality associated with the main access road along the border fence undoubtedly occurs, evidence suggests the PV fencing in Arizona has resulted in reduced impacts to Flat-tailed Horned Lizard habitat associated with trans-border illegal immigration activities, OHV activity, drug smuggling, and ensuing law enforcement activities (USFWS 2011, FTHLICC 2012, Rorabaugh 2010).

The border fence is nearly continuous across the Flat-Tailed Horned Lizard's range in California (USCBP 2012a) and consists of four types (PV-1, P-2, PV-4, and VF-2) that are at least semi-permeable to lizards (Figure 13) (Lasky et al. 2011, Rorabaugh 2010, USCBP 2012a). Given the relatively large home ranges of Flat-tailed Horned Lizards, it is likely that at least some genetic exchange is still occurring in spite of the fence and increased mortality adjacent to it from road mortality and potentially increased predation. The VF-2 fence, which is only a deterrent to vehicle traffic, was only sporadically constructed along approximately 2 km of the border west of Calexico adjacent to the Yuha Basin MA (USCBP 2012a), which could potentially concentrate illegal activity in this area (Lasky et al. 2011).

In addition to the fence, BP has installed remote video surveillance system (RVSS) towers to monitor illegal activities. There are approximately 20 of these towers within the Flat-tailed Horned Lizard's current range in California (J. Petrilla pers. comm.). These RVSS towers can monitor a much larger area than border patrol agents can cover by vehicle (USCBP 2012b) and may reduce the amount of road mortality associated with law enforcement activities.

The REAL ID Act of 2005 (Pub.L. 109–13, 119 Stat. 302) authorizes the Department of Homeland Security to waive all laws as necessary, including environmental review and mitigation, to "ensure expeditious construction of certain barriers and roads at the U.S border." In spite of this, BP and personnel from the BLM-El Centro office participate in monthly meetings and coordinate regular Flat-tailed Horned Lizard orientation sessions to reduce BP impacts to the species' habitat (FTHLICC 2012).

Figure 13. Border Fence Designs: (a) PV-1, (b) VF-2, (c) P-2, (d) PV-4

Military Activities

Military lands and activities occur within the Flat-tailed Horned Lizard's California range. Naval Air Facility El Centro (NAFEC) has two bombing ranges, one containing 12,060 ha of land within the West Mesa MA (representing 22% of the MA), and a 3,440 ha range in the East Mesa MA (covering 7% of the MA) (FTHLICC 2003). Although most training is aircraft-related, ground-based activities that can cause surface disturbance include non-exploding bombing, training, various target activities that include maintenance and site clean-up, road travel, and maintenance (FTHLICC 2003, USFWS 2011). These activities can adversely impact Flat-tailed Horned Lizards through direct mortality, habitat degradation, increased risk of fire, and potential noise effects.

The military is a participant in the Flat-tailed Horned Lizard ICC and implements the conservation measures in the RMS through their INRMPs (Navy 2014, USAF and USMC 2013). "At NAFEC, any new or maintenance activities conducted within Flat-tailed Horned Lizard MAs are confined to previously disturbed areas. Work crews are trained in Flat-tailed Horned Lizard recognition and disturbance minimization. For projects which upgrade or install new infrastructure to targets, construction is limited to previously disturbed ground and a Flat-tailed Horned Lizard monitor is on site at all times to ensure that mortality is minimized" (R. Powell pers. comm., USFWS 2011). In addition, main range roads and gates have posted Flat-tailed Horned Lizard notification signs, and NAFEC is producing a Range Training Handbook that highlights Flat-tailed Horned Lizard and all natural resource concerns for those who come to train, work on, or utilize their facilities (R. Lovich pers. comm.). In addition, these lands are not open to the public, affording them greater protection from illegal OHV activity and vandalism (Muth and Fisher 1992). Furthermore, Young and Young (2000) observed that jets flying to and from the targets or dog fighting did not seem to bother the Flat-tailed Horned Lizards they were studying in at the Barry M. Goldwater Reserve in Yuma.

Overexploitation

Collecting Flat-tailed Horned Lizards for scientific and educational purposes or herpetoculture (pet trade) may have impacted populations decades ago (Stewart 1971, Turner and Medica 1982), but these practices currently are not common. Horned lizards do not make good pets in general because they are difficult to keep alive in captivity (Sherbrooke 2003), and Flat-tailed Horned Lizards are no exception (Goode and Parker 2015). In addition, sport collection of this species is illegal (Cal. Code Regs., tit. 14, § 5.60). A Scientific Collecting Permit issued by the Department is required to capture Flat-tailed Horned Lizards for scientific or educational purposes (Cal. Code Regs., tit. 14, § 650). Research on Flat-tailed Horned Lizards may have some adverse effects. Goode and Parker (2015) observed that handling associated with attaching radio transmitters appears to affect predation rates of telemetered Flat-tailed Horned Lizards. Nearly half (48.4%) of predated Flat-tailed Horned Lizards were killed within the first week of handling, and 20.3% were killed within a day of handling, indicating that there is a period of increased vulnerability to predators after handing (Ibid.). They suspect scent from the adhesive used to attach the transmitters may have alerted predators like Kit Foxes with a keen sense of smell to the lizards, although effects from handling may also play a part (Ibid.). Setser and Young (2000) attributed two telemetered Flat-tailed Horned Lizard mortalities to research. One was impaled by a marker flag while in a burrow, and one apparently overheated when its transmitter got stuck in a pile of rocks (Ibid.).

Predation

As previously described, the largest natural cause of Flat-tailed Horned Lizard mortality is predation, accounting for as much as 40-50% of the observed mortality in certain years (Goode and Parker 2015, Muth and Fisher 1992, Young and Young 2000). Increased predation by American Kestrels, Loggerhead Shrikes, and Round-tailed Ground Squirrels near urban and agricultural development has been implicated in declines in Flat-tailed Horned Lizards as far as 450 m from the habitat edge (Barrows et al. 2006, Young and Young 2005). In addition, anthropogenic structures such as power poles, transmission lines, fences, ornamental or invasive tree species, and hedgerows, located in otherwise intact habitat act as perching or nesting platforms, which can augment the populations of avian predators and provide a better vantage point for hunting.

Goode and Parker (2015) recorded far fewer Flat-tailed Horned Lizards and far more avian predators along a stretch of road with power poles than one without one. They also reported that preliminary data suggested that minimally-traveled roads alone have minimal effects on the number of Flat-tailed Horned Lizard scat present, while roads with power lines and poles had significantly less scat within the 75 m nearest to the power line, and the power pole/road effect may extend even further than 150 m (Ibid.). The mean of the abundance estimates from plots adjacent to roads with power poles was nearly three times lower than the mean from plots without them. Years earlier at the same site, Young and Young (2000) reported that shrikes were commonly seen hunting from the power poles, and they found many remains of shrike-killed Flat-tailed Horned Lizards in the creosote bushes along this section of road, even though they rarely saw any live individuals there.

Flat-tailed Horned Lizards are relatively short-lived; have a low reproductive index; their populations experience wide fluctuations in abundance in response to resource availability; and they are particularly sensitive to predation (Barrows and Allen 2009, Fisher 1998, FTHLICC 2003, Grimsley and Leavitt 2016, Howard 1974, Young and Young 2000).

Competition

Flat-tailed Horned Lizards are not considered to be territorial (Muth and Fisher 1992), and individuals with overlapping home ranges generally ignore or avoid one another (Young 1999). As a result, intraspecific competition for resources does not seem to be a limiting factor. Other sympatric lizards also consume ants; however, their diets are much more diverse than the Flat-tailed Horned Lizard's. While their diets and ranges overlap substantially in California, Desert Horned Lizards and Flat-tailed Horned Lizards rarely occur together because they prefer different soil types, the former being associated with coarser, more gravely and rocky substrates (Barrows and Allen 2009). There are no known reports of competition between Flat-tailed Horned Lizards and other types of animals.

Disease

There are few reports in the literature of parasites on Flat-tailed Horned Lizards, and none of naturally occurring diseases (Johnson and Spicer 1985). Klauber (1939) and Norris (1949) found nematodes in Flat-tailed Horned Lizards, and the latter also noted that red mites were common ectoparasites on them as well.

Contaminants

Although pesticides could kill harvester ants and other Flat-tailed Horned Lizard food sources, the use of aerial pesticides in the species' range is currently very limited (FTHLICC 2003, USFWS 2011). An aerial and ground-based malathion spray program to control the curly top virus occurs roughly every three years, but includes avoidance and minimization measures to limit potential effects on Flat-tailed Horned Lizards (USFWS 2011). No pesticide treatments are applied within the MAs, although use of targeted hand-applied herbicides (e.g., for tamarisk eradication projects) is allowed (FTHLICC 2003).

Invasive Species and Fire

Native plants provide seeds for harvester ants (Pianka and Parker 1975, Young and Young 2000), as well as shade and refuge from predators, and they trap the windblown sand substrate preferred by Flat-tailed Horned Lizards (Muth and Fisher 1992). Non-native plants, especially those that have become invasive, can alter landscapes and ecosystems. Several species of non-native, invasive plants are common in Flat-tailed Horned Lizard habitat, many of which are Mediterranean or Asian annual species that germinate in the winter or spring months such as Split grass (*Schismus barbatus*), Russian-thistle (*Salsola tragus*), and Sahara mustard (FTHLICC 2003). Many other non-native annual species may be present, particularly near agricultural areas and near streams or wetlands (Ibid.). Most are not adapted to the severe aridity of the Flat-tailed Horned Lizard's range and require years of heavy precipitation to rapidly proliferate (Barrows et al. 2009, Rao and Allen 2010). While these are typically temporary eruptions, more recently Sahara mustard is becoming the dominant annual plant in the Coachella Valley during non-drought years as well (CVCC 2013a).

Sahara mustard is a highly invasive annual plant that is locally abundant in some years throughout portions of the Flat-tailed Horned Lizard's California range. It is most common in wind-blown sand deposits and disturbed sites such as roadsides and abandoned fields (Minnich and Sanders 2000). It was first collected in North America in 1927 in the Coachella Valley (Ibid.), where its impacts on Flat-tailed Horned Lizards and other flora and fauna have been the focus of many studies (Barrows and Allen 2010, Barrows et al. 2009, CVCC 2013b, Hulton VanTassel et al. 2014). Minnich and Sanders (2000) speculate that Sahara mustard's rapid spread through the Sonoran Desert may be related to the fact that, during rains, a sticky gel forms over the species' seed case that adheres to animals as well as automobiles. In this way, on- and off-road vehicles may be accelerating the spread of this invasive species.

Sahara mustard cover appears to influence both community structure and the extent to which arthropods (including ants) inhabit multiple aeolian (wind-blown) sand habitats within the Coachella Valley (Hulton VanTassel et al. 2014). In the Coachella Valley, Sahara mustard has been found to retard Flat-tailed Horned Lizard population growth (CVCC 2013a). Flat-tailed Horned Lizards prefer stabilized sand dune habitats (Barrows and Allen 2009), but since the most recent explosive mustard growth event in 2005, they have been found more frequently on active sand dunes, a habitat type they typically rarely occupy, where mustard growth is limited (CVCC 2013b). Juvenile Flat-tailed Horned Lizards were found to be 10% smaller on stabilized sand fields as compared to active dunes, potentially due to limited food resources (primarily ants) in areas dominated by mustard (Ibid.). Possible other reasons for this include reduced mobility as a result of dense mustard growth and increased soil compaction due to mustard inhibiting aeolian sand movement (CVCC 2013b). Mustard has been implicated as the cause for a Flat-tailed Horned Lizard population response similar to one during drought conditions, despite recent years with average or above average rainfall (CVCC 2013b).

Creosote bush scrub habitat throughout the southern Californian desert has also been invaded and subsequently altered by nonnative annual grasses (Brown and Minnich 1986, Lovich and Bainbridge 1999, Rao and Allen 2010, Steers and Allen 2011). Invasive annual grasses are known to increase the extent, frequency, and severity of natural fire regimes throughout desert shrublands (Abatzglou and Kolden 2011; Brown and Minnich 1986; Rao and Allen 2010; Steers and Allen 2010, 2011). Though fire is rare in the Colorado Desert (Figures 14 and 15), the exception may be the very northwestern edge of the Flat-tailed Horned Lizard's range in the Coachella Valley, which is "a major wildland-urban interface area that has been significantly impacted by atmospheric nitrogen deposition concomitant with fuel alterations from invasive annual grasses and increased ignition frequencies from human activities" (Steers and Allen 2011). Post fire recovery of desert shrublands has been studied here, demonstrating that species composition shifts, and long-lived native species like creosote bush and white bursage that are important to Flat-tailed Horned Lizards struggle to recover (Steers and Allen 2011).

In addition to non-native plants, non-native ants have been implicated as a potential threat to Flat-tailed Horned Lizards. Native ants within the Flat-tailed Horned Lizard's range, primarily harvester ants, are adapted to desert conditions (Pianka and Parker 1975). The exotic vegetation, changes in soil condition, and extra moisture associated with the edges of human development (agriculture, irrigation canals, and urban areas) can facilitate invasion by Argentine ants (*Linepithema humile*) and other non-natives, resulting in displacement of native ants (Suarez et al. 1998). In California, red fire ants (*Solenopsis invicta*) frequently build mounds on irrigated turf or nest in places such as rotten logs, walls of buildings, under sidewalks, and in outdoor electric and water utility boxes (Greenberg and Kabashima 2013). Barrows and Allen (2009) reported that Argentine ants and red fire ants have invaded the Coachella Valley, but not Flat-tailed Horned Lizard habitat, which they presume is the result of a barrier created by hyper-arid conditions.

Drought and Climate Change

California entered what has become an historic drought in 2011. A similarly severe event has not occurred in the last 1200 years (Griffin and Anchukaitis 2014). Seager et al. (2007) reported broad consensus among climate models that the transition to a more arid American Southwest is already underway, and that if the models are correct, droughts will become the new norm. Empirical data over the last century confirm the Sonoran Desert warming trends in winter and spring, decreased frequency of freezing temperatures, lengthening of the freeze-free season, and increased minimum temperatures per winter year (Weiss and Overpeck 2005). In addition, variability in cool season rainfall (i.e., when the majority of precipitation within the Flat-tailed Horned Lizard's California range falls) is increasing (Abatzoglou and Kolden 2011). These changes in temperature and precipitation are already driving shifts in vegetation in the Sonoran Desert, including a decrease in creosotebush and increase in invasive grasses (Kimball et al. 2010, Munson et al. 2012, Weiss and Overpeck 2005).

While the Flat-tailed Horned Lizard is adapted to one of the most arid places in the country, it may nevertheless be at greater than average risk of localized extinctions from prolonged droughts due to its small geographic range, specialized diet, low reproductive index, short lifespan, and increasing habitat fragmentation (USFWS 1993, Barrows and Allen 2009). Populations of Coachella Valley Fringe-toed Lizards have already lost substantial genetic diversity since the last drought (Vandergast et al. 2016). The Flat-tailed Horned Lizard has the highest measured active body temperature of *Phrynosomids* in the United States (Pianka and Parker 1975) and, like other desert-adapted reptiles, may already approach its physiological tolerances (Barrows 2011). There are only two mechanisms for a species to persist in the face of climate change: given enough time and unobstructed ability to move, dispersal to a more favorable thermal environment (typically north or higher elevation) may be possible; otherwise, it will have to behaviorally and/or physiologically adapt (Sinervo et al. 2010).

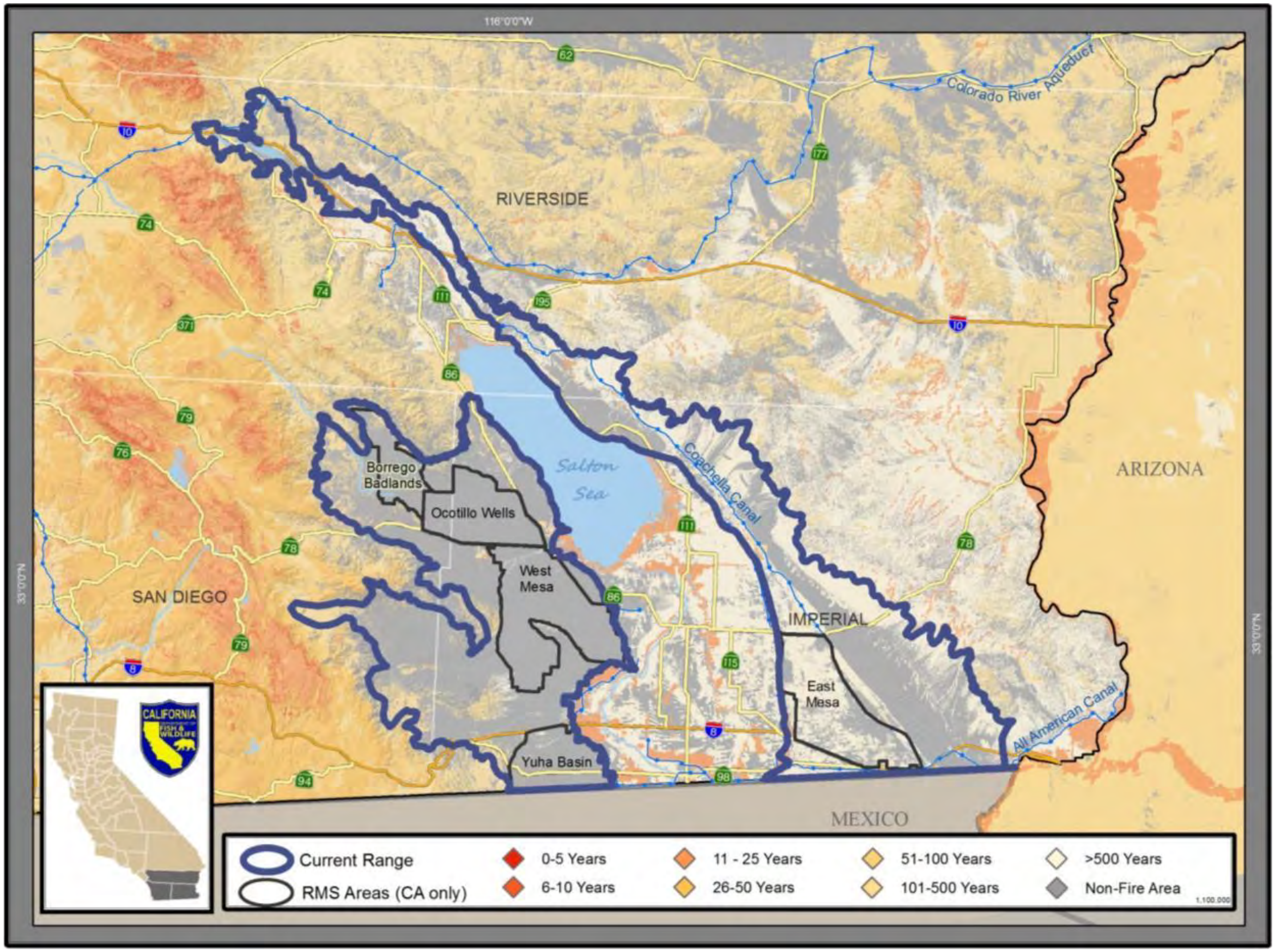


Figure 14. Mean Fire Return Interval within and around the Flat-tailed Horned Lizard's California Range

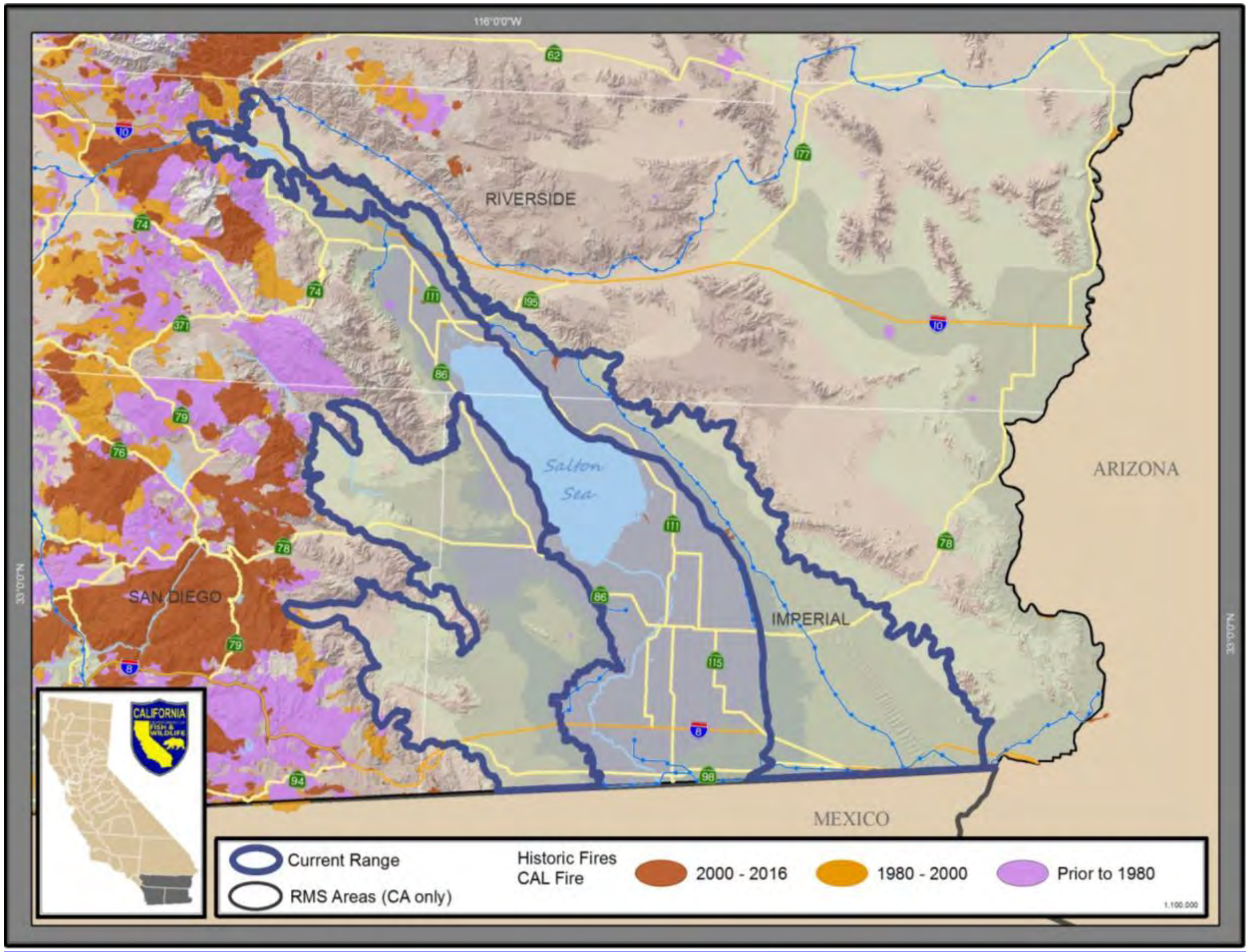

116°0'0"W
RIVERSIDE
ARIZONA
Salton Sea
SAN DIEGO
IMPERIAL
MEXICO
33°0'0"N
CALIFORNIA FISH & WILDLIFE
Current Range
RMS Areas (CA only)
Historic Fires CAL Fire
2000 - 2016
1980 - 2000
Prior to 1980
1:100,000

Figure 15. Historic Large Fires within and near the Flat-tailed Horned Lizard's California Range

Flat-tailed Horned Lizards in California are located at the farthest northern extent of their range, and the populations in the Coachella Valley are already extremely small and fragmented. The species' range boundary in California is surrounded by mountains and unsuitable habitat (i.e., rocky substrate). Even with a relatively short generation time, given the predicted pace of climate change in the region, it is unlikely the species will be able to migrate upwards and adapt to a different substrate and vegetative community in time. Behavioral strategies to cope with rising temperatures include spending more time in the shade or in a burrow, which leaves less time available for foraging and mating (Sinervo et al. 2010). In addition to adult lizards being at greater risk of reaching a critical thermal maximum, embryos in the nest will be subjected to increasingly higher temperatures and may exceed their critical thermal maximum temperature more often (Levy et al. 2015). Flat-tailed Horned Lizards have been shown to burrow substantial depths (90 cm) to reach the zone of soil moisture in drought situations (Young and Young 2000), so they may be able to adjust in that way, but the fate of hatchlings that are buried that far below the surface is unknown. They could also potentially lay nests in a greater amount of shade, but as climate change appears to be favoring invasive grasses over native shrubs (Abatzoglou and Kolden 2011, Munson et al. 2012), this may become a scarcer option.

Two studies of potential climate change risk to Flat-tailed Horned Lizards have been undertaken. Wright et al. (2013) used an ecological niche model built with Flat-tailed Horned Lizard locality data (from California and Arizona, not Mexico) and several climate change scenarios to predict the climatic suitability of the species' range at 2050. There was overwhelming consensus among the models that predicted Flat-tailed Horned Lizard habitat remaining fairly stable to that date (Ibid.); however, this analysis did not take changes in habitat into account. The Department modeled the relative environmental stress a vegetative community would undergo given different climate scenarios in the short-term (2039) and long-term (2099) (Figures 16 and 17). It appears in the short-term, if the climate is hot and dry, Flat-tailed Horned Lizard habitat will undergo less stress than a warm and wet climate (Figure 16), but by 2099, large portions of the species' range will be under extreme stress and may no longer support the viable habitat (Figure 17).

Climate change is likely to adversely impact most native species over time. Flat-tailed Horned Lizard populations already experience dramatic fluctuations over time, typically in response to rainfall and its effect on resource availability. Setser and Young (2000) observed Flat-tailed Horned Lizards putting on weight rapidly and engaging in courtship and mating almost immediately after a series of monsoonal rains that increased ant availability. Drought conditions reduce harvester ant abundance, which reduces reproduction in a species with already very low reproductive output (Howard 1974, Young and Young 2000). In addition, drought effects may also place Flat-tailed Horned Lizards at greater risk from OHV-related mortality since it appears Flat-tailed Horned Lizards with lower body mass enter hibernation later in the year (Grant and Doherty 2009). Given its short lifespan and already low reproductive potential, prolonged droughts are very likely to cause decreases in population size that amount to loss of genetic diversity, the same diversity necessary to adapt to a rapidly warming environment.

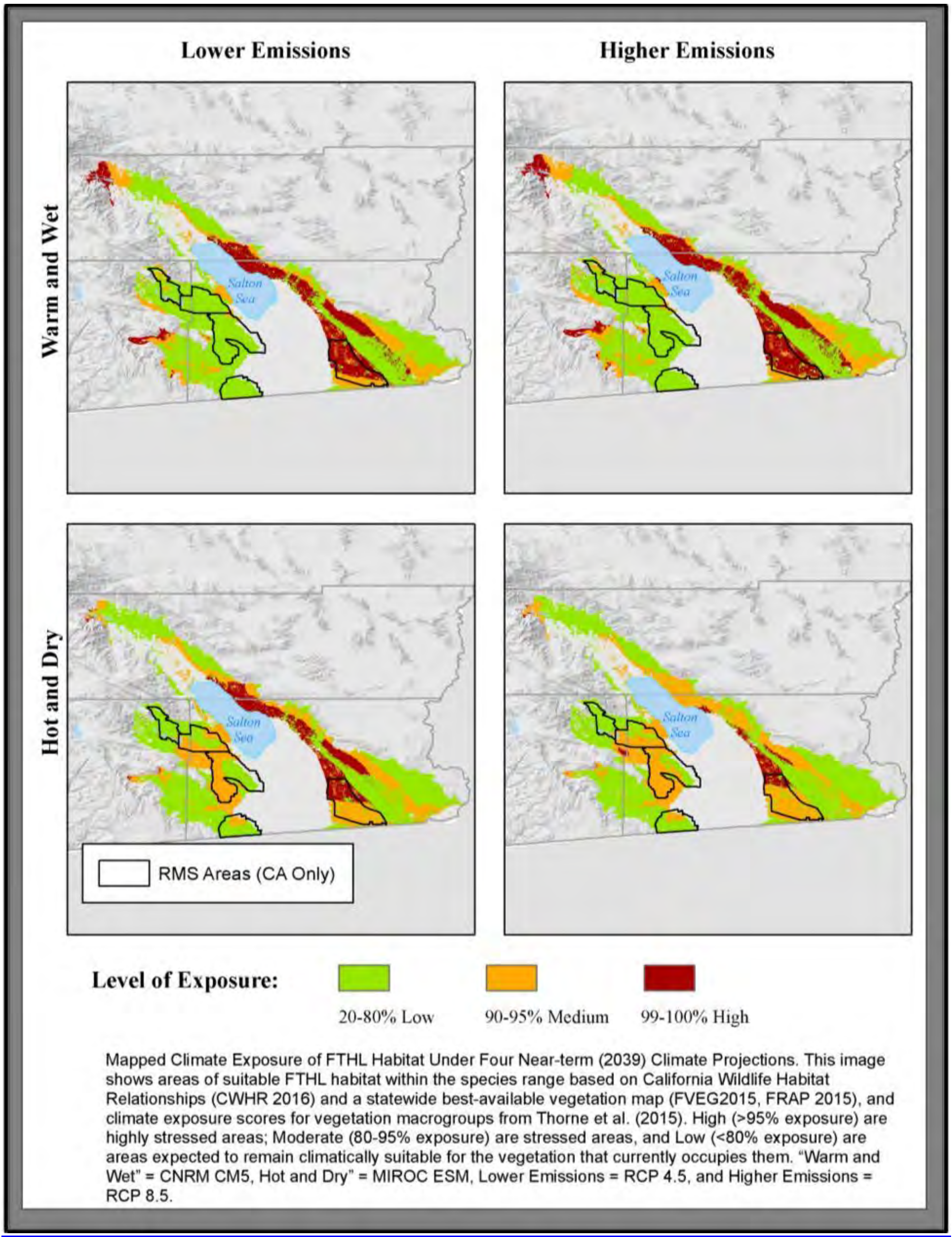


Figure 16. Predicted Climate Change Impacts to Habitat in 2039

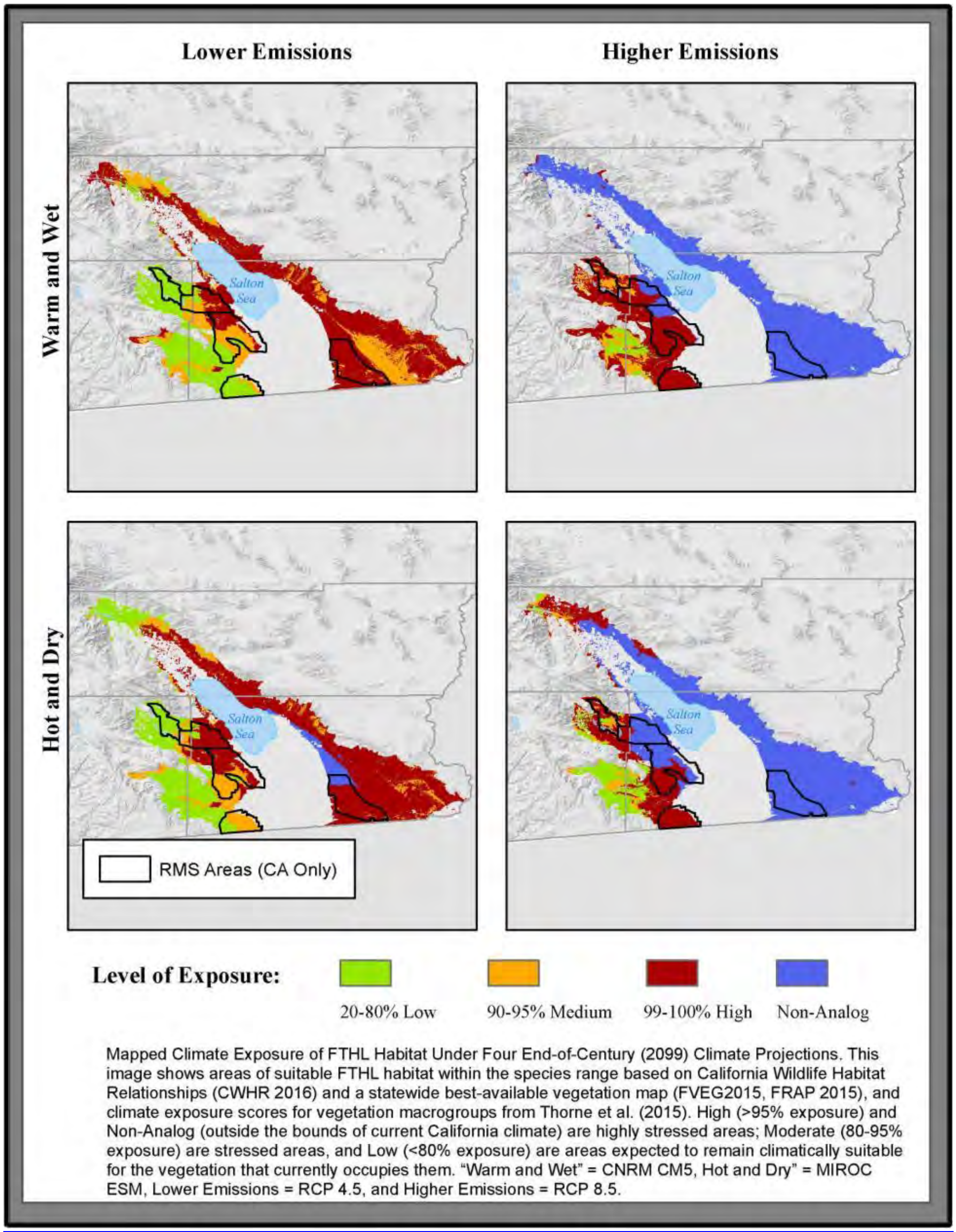


Figure 17. Predicted Climate Change Impacts to Habitat in 2099

PROTECTION AFFORDED BY LISTING

It is the policy of the state to conserve, protect, restore and enhance any endangered or any threatened species and its habitat. (Fish & G. Code, § 2052) The conservation, protection, and enhancement of listed species and their habitat is of statewide concern (Fish & G. Code, § 2051(c).) CESA defines “take” as hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill. (Fish & G. Code, § 86.) The Fish and Game Code provides the Department with related authority to authorize “take” under certain circumstances through incidental take permits, memorandum of understandings, natural community conservation plans, or other plans or agreements approved by or entered into by the Department. (Fish & G. Code, §§ 2081, 2081.1, 2086, 2087 and 2835.) Any person violating the take prohibition would be punishable under State law.

Approximately 77% of the Flat-tailed Horned Lizard’s range is owned or managed by the RMS participating agencies. Implementation of the RMS includes, in most circumstances, requiring compensatory mitigation for long-term, unavoidable impacts to Flat-tailed Horned Lizard habitat within MAs whether the site is occupied or not. This compensatory mitigation is used to purchase private lands, which are turned over to the BLM for management, or it is used to fund RMS activities like habitat restoration.

If the Flat-tailed Horned Lizard were listed under CESA, impacts of take caused by activities authorized through incidental take permits must be minimized and fully mitigated according to state standards. These standards include protection of the land in perpetuity with an easement, development and implementation of a species-specific adaptive management plan, and funding through an endowment to pay for long-term monitoring and maintenance to ensure the mitigation land meets performance criteria. Because the RMS is voluntary, the participating agencies often struggle with funding and staffing to carry out the RMS activities in spite of the compensatory mitigation funding received. Additionally, the lands within it continue to be multiple-use under the BLM’s management. However, mitigation lands required under CESA would be expected to guarantee protection and level of habitat quality for a longer time.

Additional protection of Flat-tailed Horned Lizard following listing would occur with required public agency environmental review under CEQA and its federal counterpart, the National Environmental Policy Act (NEPA). CEQA and NEPA both require affected public agencies to analyze and disclose project-related environmental effects, including potentially significant impacts on endangered, rare, and threatened special status species. In common practice, potential impacts to listed species are examined more closely in CEQA and NEPA documents than potential impacts to unlisted species.

Under CEQA’s “substantive mandate,” state and local agencies in California must avoid or substantially lessen significant environmental effects to the extent feasible. (Pub. Resources Code, § 21080; Cal. Code Regs., tit.14., §§ 15002 & 15021). With that mandate and the Department’s regulatory jurisdiction, the Department expects related CEQA and NEPA review will likely result in increased information regarding the status of Flat-tailed Horned Lizard in California due to, among other things, updated occurrence and abundance information for individual projects. Where significant impacts are identified under CEQA, the Department expects required project-specific avoidance, minimization, and mitigation measures will benefit the species. State listing, in this respect, and required consultation with the Department during state and local agency environmental review under CEQA, would also be expected to benefit the species in terms of related impacts for individual project that might otherwise occur absent listing.

Unlike many other species whose listing under CESA may increase interagency coordination and the likelihood that State and federal land and resource management agencies will allocate funds towards protection and recovery actions, the participating agencies already meet and coordinate regularly to strategize how best to implement the RMS. When sufficient funding and staffing are available, these actions include monitoring, specific research studies, acquisition of private inholdings, and habitat restoration (among other things). As mentioned previously in Existing Management, the RMS has already been codified into the BLM's land use plans for the East Mesa, West Mesa, and Yuha Desert MAs through adoption of ACECs in the CDCA, as well as the Department of Defense's properties through their INRMPs, making these conservation measures mandatory. In other areas, if the Flat-tailed Horned Lizard is listed under CESA, it is possible some, or all, aspects of RMS implementation will be abandoned or reduced in priority to focus limited funding and staffing on mandatory CESA-compliance.

Also, unlike other species that may benefit from CESA listing by having a greater likelihood of being incorporated into large-scale conservation and planning documents like Habitat Conservation Plans and Natural Community Conservation Plans, the Flat-tailed Horned Lizard is already a covered species (or proposed to be covered as an "individual focal species" in the case of the DRECP/BLM LUPA) throughout its entire range in California for the vast majority of projected development impacts (i.e., urban and agricultural in Coachella Valley and renewable energy throughout the rest of the range). The exceptions would be any future development on local government and private lands in San Diego and Imperial counties, which while not amounting to a large proportion of the Flat-tailed Horned Lizard's range, could have large impacts on the species' connectivity to the limited remaining habitat in the north if the areas along the Salton Sea are developed. The DRECP does not provide CESA take coverage but does implement the RMS, which contains measures on BLM lands that extend beyond mitigation for projects that would result in take of Flat-tailed Horned Lizards.

A further potential challenge to implementing CESA protections for the Flat-tailed Horned Lizard is the scarcity of private land within the species' range that could be used for mitigation. A recent option to use BLM land for CESA mitigation has become available through an agreement entered into by the Department and BLM in 2015, referred to as the Durability Agreement (BLM and CDFW 2015). If mutually agreeable between the two agencies, CESA compensatory mitigation actions could be implemented on BLM Conservation Lands (e.g., ACECs and Wilderness Areas), including restoration of habitat and movement corridors, rehabilitation of closed roads, predator control, invasive plant species removal and control, and additional law enforcement (Ibid.).

SUMMARY OF LISTING FACTORS

CESA directs the Department to prepare this report regarding the status of Flat-tailed Horned Lizard based upon the best scientific information available to the Department. CESA's implementing regulations identify key factors that are relevant to the Department's analyses. Specifically, a "species shall be listed as endangered or threatened ... if the Commission determines that its continued existence is in serious danger or is threatened by any one or any combination of the following factors: (1) present or threatened modification or destruction of its habitat; (2) overexploitation; (3) predation; (4) competition; (5) disease; or (6) other natural occurrences or human-related activities." (Cal. Code Regs., tit. 14, § 670.1, subd. (i)(1)(A).)

The definitions of endangered and threatened species in the Fish and G. Code provide key guidance to the Department's scientific determination. An endangered species under CESA is one "which is in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, over exploitation, predation, competition, or disease." (Fish & G. Code, § 2062.) A threatened species under CESA is one "that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of special protection and management efforts required by [CESA]." (Id., § 2067.)

The following summarizes the Department's determination regarding the factors to be considered by the Commission in making its decision on whether to list the Flat-tailed Horned Lizard. This summary is based on the best available scientific information, as presented in the foregoing sections of the report.

Present or Threatened Modification or Destruction of Habitat

Agricultural and Urban Development

While agricultural development has reduced and fragmented available habitat, this impact is fairly concentrated down the middle of the Flat-tailed Horned Lizard's range in California and is not expected to increase in any significant way in the future. Flat-tailed Horned Lizards have already disappeared from most historically occupied sites in the Coachella Valley over the past 30 years due to agricultural and urban development (CVCC 2013a), threatening the species' long-term persistence in this area. Another threat is posed by the proposed future urban development in Imperial County (County of Imperial 2013) along the shores of the Salton Sea, particularly on the east side, which could eliminate the only habitat corridor between the population east of the Imperial Valley and the Dos Palmas population.

Renewable Energy Development

Expansion of renewable energy development is expected to continue within the Flat-tailed Horned Lizard's range, and Phase I of the DRECP (i.e., the BLM LUPA), if implemented, is expected to reduce impacts to the species by focusing most of the impacts on or near existing disturbed areas and existing transmission lines as opposed to relatively undisturbed open desert. However, the lack of county and city participation in the plan could compromise its efficacy if relatively undisturbed private and local government managed lands are developed.

Mining

It appears that sand and gravel mining are the most common mining activities currently in operation within the Flat-tailed Horned Lizard's range, but the area available for mineral extraction in Imperial County is largely depleted (BLM 2011). In addition, oil, gas, and gold exploration have proven unprofitable. Therefore, the threat to Flat-tailed Horned Lizards posed by mining is considered relatively small.

Off-highway Vehicles

Where OHV use intensity is so great that it substantially reduces shrubs or prey, particularly in areas where these habitat features may already be scarce, Flat-tailed Horned Lizard, it may pose a threat to the species. The extent to which these changes in vegetation and prey have occurred as a result of OHV activity across the Flat-tailed Horned Lizard's range is unknown since very few focused surveys have detected a demonstrable connection between OHV activity and Flat-tailed Horned Lizard abundance.

United States-Mexico Border Activities

While there are likely some adverse effects arising from road mortality and increased avian predation within a short distance from the border fence, there also appear to be some benefits from it including reduced habitat damage from illegal border crossing. Additionally, the fencing used in California does not appear to create a barrier to movement or gene flow. Border activities do not appear to pose a serious threat to Flat-tailed Horned Lizards.

Military Activities

The vast majority of Flat-tailed Horned Lizard habitat on military lands is protected and managed in a way to conserve the species, so military activities do not appear to pose a threat to them.

Overexploitation

Collecting for the pet trade does not appear to be a current threat, although some evidence exists that the listing process alone can increase the likelihood of it becoming a threat due to the human disposition to place exaggerated value on rare or "off limits" species (Courchamp et al. 2006). Illegal commercial collection of Flat-tailed Horned Lizards likely would not be very difficult due to the common observation among researchers that they frequently use, and are highly visible on, roads compared to on native substrates, and tend to freeze instead of flee. However, their renowned difficulty to keep alive in captivity may negate this potential threat. While there may be increased mortality due to research activities, these take place over a very small portion of the species' range, and the beneficial information derived from them outweighs the minimal threat they may pose to Flat-tailed Horned Lizard populations. There is no evidence to suggest Flat-tailed Horned Lizards are or will be substantially threatened by overexploitation.

Predation

Anthropogenic increases in predation pose a threat to Flat-tailed Horned Lizards, but the severity of the threat likely depends on the vulnerability of the Flat-tailed Horned Lizard population (e.g., small and isolated in Thousand Palms, Coachella Valley vs. large and intact in East Mesa MA) and the surrounding land use. For example, the effect of predation along the edge of urban or agricultural development appears to be greater than it is along a powerline in the middle of the desert because the former provides more subsidized resources. Given development is relatively concentrated within the Coachella and Imperial Valleys, this area of heightened predation comprises a small fraction of the Flat-tailed Horned Lizard's range.

Competition

There is no evidence to suggest that competition threatens Flat-tailed Horned Lizards.

Disease

There is no evidence to suggest that disease threatens Flat-tailed Horned Lizards.

Other Natural Events or Human-Related Activities

<u>Fragmentation, Edge Effects, and Small Populations</u>

Currently large expanses of relatively intact habitat remain within the Flat-tailed Horned Lizard's range in California. While habitat fragmentation, edge effects, and small population sizes may pose serious threats to Flat-tailed Horned Lizards in portions of their California range, the degree to which this would significantly adversely impact the species as a whole is uncertain. How and where future development is constructed will affect the severity of this threat.

<u>Roads, Canals, and Railroads</u>

Major roads, canals, and railroads may pose a serious threat to Flat-tailed Horned Lizards through habitat fragmentation and/or edge effects. In addition, mortality associated with major roads could create a localized sink on both sides of the road. Minor, lightly travelled roads (including OHV trails), especially those without associated power poles or other human-provided perches, likely contribute to some mortality but also likely do not pose a serious threat to Flat-tailed Horned Lizards.

<u>Contaminants</u>

There is no evidence to suggest that herbicides, pesticides, or other contaminants pose a significant threat to Flat-tailed Horned Lizards.

<u>Invasive Species and Fire</u>

Invasive species like Sahara mustard appear to be playing a role in Flat-tailed Horned Lizard declines in portions of the species range (e.g., the Coachella Valley). The degree to which invasive plants are having population-level impacts, either alone or in conjunction with other factors, throughout other parts of the species' range in California is unknown. While invasive grasses increase the risk of fire, this threat has not been observed within the Flat-tailed Horned Lizard's range with the exception of the Coachella Valley, which is located in a major wildland-urban interface area (Steers and Allen 2011). In the Coachella Valley, the Flat-tailed Horned Lizard could be at risk of local extinction due to the interaction of both invasive plant species and climate change (CVCC 2013a). Non-native ants do not appear to pose a threat to Flat-tailed Horned Lizards.

Drought and Climate Change

Drought, in combination with other factors such as habitat fragmentation and degradation, and climate change appear to pose a serious threat to Flat-tailed Horned Lizards.

LISTING RECOMMENDATION

[Note to readers: This section will be completed after external peer review.]

MANAGEMENT RECOMMENDATIONS

These recommendations were developed by the Department in accordance with the requirements of Fish and Game Code, section 2074.6. The Department recommends these actions be implemented regardless of the Commission's decision on listing Flat-tailed Horned Lizard as threatened or endangered. This list includes recommendations for actions that could be undertaken by the Department as well as by other public agencies, non-governmental organizations, and private land owners.

Revisit Flat-tailed Horned Lizard Status in Three to Five Years

Several research and planning efforts are in progress that are expected to provide additional insights into the status of the Flat-tailed Horned Lizard in California in the next three to five years. For example, in that time, at least preliminary results from the following studies should be available: landscape genomics, population viability analysis, habitat connectivity along the east side of the Salton Sea, and the extent to which avian predation that is subsidized by anthropogenic features or actions is affecting Flat-tailed Horned Lizard mortality rates. In that time, it is likely the OWSVRA General Plan will be prepared and potentially implemented. The degree to which Flat-tailed Horned Lizards are addressed and afforded protection in that plan is expected to contribute to either the conservation or decline of the species into the future. Additionally, in that time, a Record of Decision on the BLM LUPA should have been published, so at least a few years of implementation of its measures will be available to better determine to what degree the potential threats and benefits to Flat-tailed Horned Lizards are realized. In addition, the species currently is experiencing what appears to be a widespread drought-related decline in abundance. The next three to five years will likely reveal whether the species can rebound from prolonged drought or not. If the data indicate a change in status is warranted, the Department should prepare the appropriate document to address that change.

Increase Department Participation in RMS Implementation

Like the other participating agencies, the Department's contribution to Flat-tailed Horned Lizard conservation through implementation of the RMS is subject to funding and staffing availability.. The Department should increase its participation in implementation of the RMS, including working with partners to identify outside funding opportunities (e.g., State Wildlife Grants) and providing staff to assist with population monitoring, habitat restoration, education and outreach, and international coordination and collaboration.

Improve Population Monitoring Methods

Investigate the use of scent detection dogs in Occupancy and Demography surveys to increase detectability, which may greatly reduce duration and number of personnel necessary to achieve reliable estimates of distribution and abundance. Encourage annual budgeting by participating agencies to fully fund population monitoring efforts on the MAs and RA and expand them to other parts of the range for comparison. In addition to collecting data on Flat-tailed Horned Lizards, data on environmental covariates should also be collected such as habitat quality, predators and prey, and anthropogenic threats, so that an informed adaptive management strategy can be developed. Investigate whether stressor monitoring may be more cost-effective and better able to inform management decisions.

Comment [K&A20]: I have tried this on my own, which is not a very good test. My experience was that the dry, hot conditions made it very difficult for the dogs (I tried 2 different dogs). I was able to get dogs to detect scat, but not find lizards, even when I gave them a lot of help. A better dog trainer and more experienced dog could better address this question.

Increase Habitat Quality and Quantity

Restore areas degraded by OHVs and mining. Increase patrol of areas and cite illegal cross-country OHV or other public trespass in closed or limited use areas. Immediately obscure and/or restore any new unsanctioned trails. Decommission powerlines or other anthropogenic structures that provide perches for avian predators. Remove or trim hedgerows along roads that attract avian predators. To the extent feasible, remove or reduce the abundance and extent of non-native grasses, Sahara mustard, and other invasive species. Clean up illegally dumped material as quickly as possible.

Reduce Habitat Fragmentation and its Effects

Investigate how barriers may be limiting gene flow across the species' range. Use this information to protect important habitat linkages and movement corridors such as Yuha Basin to West Mesa and East Mesa to Dos Palmas. Try to improve seemingly broken linkages, such as by creating effective road and canal crossings. Continue to purchase private inholdings within the larger public land matrix. Coordinate with and assist the Mexican government on Flat-tailed Horned Lizard conservation across the border. Implementers of the RMS and CVMSHCP should coordinate on reestablishing connectivity. If necessary, develop an assisted migration and or repatriation strategy to address loss of diversity and local extirpations.

Reduce Habitat Loss and Edge Effects from Renewable Energy Projects

Encourage siting renewable energy development outside of the desert completely (see Hernandez et al. 2015) or if within the Flat-tailed Horned Lizard's range, make sure it is located on compatible lands (e.g., near existing transmission line on agricultural lands). Limit the amount of new transmission lines by encouraging construction of a single line with additional capacity for future expansion. Bury lines whenever possible. Close (permanently or temporarily) areas to OHVs that are losing shrub cover.

Further Investigate the Impacts of Relocation

To date, only one study has simultaneously investigated the effects to relocated and resident Flat-tailed Horned Lizards where relocations have occurred (Goode and Parker 2015). Large numbers of Flat-tailed Horned Lizards are relocated out of harm's way on construction projects, and their fate, as well as the fate of the recipient populations, is not well understood. Exclusion fencing may be somewhat useful in reducing mortality; however, it requires continuous maintenance that may limit its utility. Research in this area should develop relocation plans that take the recipient population's density and the habitat quality into account. Develop a strategy that is informed by landscape-level genetics, to relocate Flat-tailed Horned Lizards to restored or apparently suitable, but unoccupied, habitat, even if it is located relatively far from the project site and monitor the results.

Modify the Mitigation and Compensation Strategy

Purchase and/or set aside lands specifically for Flat-tailed Horned Lizard conservation in high quality habitat, whereas few threats as possible exist (i.e., closed to OHV, far from human development, roads, and power lines). Use compensation funds to create an endowment, or higher interest earning account, that pays for routine management, maintenance, and monitoring of these sites and their populations.

ECONOMIC CONSIDERATIONS

The Department is charged in an advisory capacity in the present context to provide a written report and a related recommendation to the Commission based on the best scientific information available regarding the status of Flat-tailed Horned Lizard in California. The topic areas and related factors the Department is required to address as part of that effort are biological and not economic. (See Fish & G. Code, § 2074.6; Cal. Code Regs., tit. 14, § 670.1, subd. (f).)

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Lovich, R. Electronic mail received April 28, 2016.

Petrilla, J. Electronic mail received May 4, 2016.

Powell, R. Electronic mail received April 28, 2016.

Rodriguez, M. Electronic mail received June 15, 2016.

Ronning, C. Electronic mail received April 26, 2016.

APPENDIX 1. Flat-Tailed Horned Lizard Rangewide Management Strategy, 2003 Revision

[In the final version, the entire document will be inserted, but since this is Word, not PDF, I'm just providing this page. Use the link within the narrative to download the 2003 RMS: https://www.wildlife.ca.gov/Regions/6/Flat-Tailed-Horned-Lizard-Copy]

APPENDIX 2. List of Acronyms and Abbreviations

ac	acre
ACEC	Area of Critical Environmental Concern
BLM	United States Bureau of Land Management
C	Celsius
CDCA	California Desert Conservation Act
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
cm	centimeter
CMA	Conservation and Management
CNDDB	California Natural Diversity Database
Commission	California Fish and Game Commission
CVMSHCP	Coachella Valley Multiple Species Habitat Conservation Plan
CWHR	California Wildlife Habitat Relationships
Department	California Department of Fish and Wildlife
DFA	Development Focus Areas
DRECP	Desert Renewable Energy Conservation Plan
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ESA	Endangered Species Act (federal)
F	Fahrenheit
FLPMA	Federal Land Policy and Management Act
ft	feet
hr	hour
ha	hectare
HCP	Habitat Conservation Plan
ICA	Interagency Conservation Agreement
in	inch
INRMP	Integrated Natural Resources Management Plan
km	kilometer

LCR MSCP	Lower Colorado River Multi-species Conservation Program
LUPA	Land Use Plan Amendment
m	meter
MA	Flat-tailed Horned Lizard Management Area
mi	mile
NCCP	Natural Communities Conservation Plan
OHMVRD	Off-highway Motor Vehicle Recreation Division
OHV	Off-highway Vehicle
OWSVRA	Ocotillo Wells State Vehicular Recreation Area
RA	Flat-tailed Horned Lizard Research Area
RMS	Flat-tailed Horned Lizard Rangewide Management Strategy
RMS Areas	Borrego Badlands MA, West Mesa MA, East Mesa MA, Yuha Desert MA, and Ocotillo Wells State Vehicular Recreation Area
RA	
SSC	Species of Special Concern
USFWS	United States Fish and Wildlife Service

APPENDIX 3. Public Notice

APPENDIX 4. External Peer Review Solicitation Letters

APPENDIX 5. External Peer Review Comments

APPENDIX 6. Public Comments

STATE OF CALIFORNIA
NATURAL RESOURCES AGENCY
DEPARTMENT OF FISH AND WILDLIFE

REPORT TO THE FISH AND GAME COMMISSION
A STATUS REVIEW OF THE
FLAT-TAILED HORNED LIZARD
(*PHRYNOSOMA MCALLII*) IN CALIFORNIA

CHARLTON H. BONHAM, DIRECTOR
CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

September 2016

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ACKOWLEDGMENTS

[Note to readers: This section will be completed after external peer review.]

EXECUTIVE SUMMARY

[Note to readers: This section will be completed after external peer review.]

REGULATORY FRAMEWORK

Petition Evaluation Process

"A Petition to List the Flat-tailed Horned Lizard (*Phrynosoma mcallii*) as Endangered Under the California Endangered Species Act" (Petition) was submitted to the Fish and Game Commission (Commission) on June 10, 2014 by the Center for Biological Diversity. Commission staff transmitted the Petition to the Department of Fish and Wildlife (Department) pursuant to Fish and Game Code section 2073 on June 12, 2014, and published a formal notice of receipt of the Petition on July 11, 2014 (Cal. Reg. Notice Register 2014, No. 28-Z, p. 1238). The Department's charge and focus in its advisory capacity to the Commission is scientific. A Petition to list or delist a species under the California Endangered Species Act (CESA) must include "information regarding the population trend, range, distribution, abundance, and life history of a species, the factors affecting the ability of the population to survive and reproduce, the degree and immediacy of the threat, the impact of existing management efforts, suggestions for future management, and the availability and sources of information. The Petition shall also include information regarding the kind of habitat necessary for species survival, a detailed distribution map, and other factors the Petitioner deems relevant." (Fish & G. Code, § 2072.3.)

On September 30, 2014, the Department provided the Commission with its evaluation of the Petition, "Evaluation of the Petition from the Center for Biological Diversity to List the Flat-Tailed Horned Lizard (*Phrynosoma mcallii*) as Endangered Under the California Endangered Species Act" (Evaluation), to assist the Commission in making a determination as to whether the petitioned action may be warranted based on the sufficiency of scientific information. (Fish & G. Code, §§ 2073.5 & 2074.2; Cal. Code Regs., tit. 14, § 670.1, subds. (d) & (e).) Focusing on the information available to it relating to each of the relevant categories, the Department recommended to the Commission that the Petition be accepted.

At its scheduled public meeting on February 12, 2015, in Sacramento, California, the Commission considered the Petition, the Department's Evaluation and recommendation, and comments received. The Commission found that sufficient information existed to indicate the petitioned action may be warranted and accepted the Petition for Consideration. Upon publication of the Commission's notice of its findings, Flat-tailed Horned Lizard was designated a candidate species on March 6, 2015 (Cal. Reg. Notice Register 2015, No. 10-Z, p. 410).

Status Review Overview

The Commission's action designating the Flat-Tailed Horned Lizard as a candidate species triggered the Department's process for conducting a status review to inform the Commission's decision on whether to list the species. At its scheduled public meeting on February 11, 2016, in Sacramento, California, the Commission granted the Department a six-month extension to facilitate external peer review.

This written status review report, based upon the best scientific information available and including independent peer review of the draft report by scientists with expertise relevant to Flat-tailed Horned Lizard, is intended to provide the Commission with the most current information available on the Flat-tailed Horned Lizard and to serve as the basis for the Department's recommendation to the Commission on whether the petitioned action is warranted. The status

review report also presents preliminary identification of habitat that may be essential to the continued existence of the species and provides management recommendations for recovery of the species. (Fish & G. Code, § 2074.6.). Receipt of this report is to be placed on the agenda for the next available meeting of the Commission after delivery. At that time, the report will be made available to the public for a 30-day public comment period prior to the Commission taking any action on the Department's recommendation.

Existing Regulatory Status

The Flat-tailed Horned Lizard was the subject of a previous CESA listing petition. Dr. Wilbur Mayhew and Ms. Barbara Carlson of the University of California at Riverside petitioned the Commission to list the Flat-tailed Horned Lizard as an endangered species under CESA on January 25, 1988. Consistent with the Department's recommendation, the Commission designated the Flat-tailed Horned Lizard as a candidate species for CESA listing on May 13, 1988. After completing the status review, the Department recommended listing the species as threatened; however, on June 22, 1989, the Commission voted against the proposed listing, citing insufficient scientific information on population densities.

The Flat-tailed Horned Lizard also has a listing history under the federal Endangered Species Act (ESA). The United States Fish and Wildlife Service (USFWS) initially proposed to list the species as threatened under the ESA in 1993 (USFWS 1993); however, its determination was delayed in part due to Public Law No. 104-6, 109 Stat. 73, enacted in 1995, which placed a moratorium on new species' listings and critical habitat designations under the ESA. The moratorium was lifted in 1996. In 1997, the Department of the Interior Secretary was sued to compel the USFWS to make a listing determination within 60 days, at which point the USFWS withdrew its proposed listing (USFWS 1997). That decision sparked numerous additional court cases, the primary issue of each centered on whether or not the USFWS sufficiently analyzed Flat-tailed Horned Lizard population viability across its entire range. After multiple court-ordered re-evaluations, the USFWS withdrew its proposed rule to list, most recently in 2011 (USFWS 2003, 2006, 2011). One of the contributing factors in the USFWS's decisions not to list the Flat-tailed Horned Lizard was the development of an Interagency Conservation Agreement, signed by multiple federal and state agencies tasked with managing most of the species' habitat in the U.S., and the creation and implementation of a Rangewide Management Strategy (RMS) for the species.

The Flat-tailed Horned Lizard is listed as a Species of Special Concern (SSC) by the Department and as a Sensitive Species by the U.S. Bureau of Land Management (BLM). The Department's SSC designation is administrative and is intended to alert biologists, land managers, and others to a species' declining or at-risk status, to encourage additional management considerations for these species to ensure population viability, and to preclude the need for listing under CESA. SSCs are defined as species, subspecies, or distinct populations of an animal native to California that currently satisfies one or more of the following (not necessarily mutually exclusive) criteria: is extirpated from the State within the recent past; is listed under ESA (but not CESA) as threatened or endangered or meets the State's definition of threatened or endangered but has not been formally listed; is experiencing, or formerly experienced, serious (noncyclical) population declines or range retractions (that have not been reversed), which if continued or resumed, could qualify it for threatened or endangered status

under CESA; has naturally small populations and/or range size and exhibits high susceptibility to risk from any factor(s) that, if realized, could lead to declines that would qualify it for threatened or endangered status (Thomson et al. 2016).

Neither of these administrative designations provides the species with formal regulatory status like the ESA or CESA (see Existing Management section); however, the RMS requires conservation measures, including compensatory mitigation, for surface disturbance within the five Flat-tailed Horned Lizard Management Areas (MA) established through the RMS (Figure 1). There are four MAs within California (Borrego Badlands, West Mesa, Yuha Basin, and East Mesa) that comprise approximately 21% of the species' range in the State (using the Department's range map), as well as one Research Area (RA; Ocotillo Wells State Vehicular Recreation Area). Collectively, the MAs and RA will be referred to as the "RMS areas" in this status review. More information on the protections afforded and efforts aimed at conserving the Flat-tailed Horned Lizard, including monitoring the species' distribution through occupancy studies and its trends in abundance through demography surveys, is provided in the Status and Trends in California and Existing Management sections.

BIOLOGY AND ECOLOGY

Species Description

The Flat-tailed Horned Lizard, like all horned lizards in the genus *Phrynosoma*, has a dorsoventrally flattened body with spiny scales, including head spines or "horns," and cryptic coloration, ranging from pale gray to light rust brown, which closely matches the substrate on which it lives. The Flat-tailed Horned Lizard has multiple diagnostic traits that distinguish it from other *Phrynosomids*, including a distinctive dark dorsal stripe down its midline with a series~~ous~~ of dark spots on either side; particularly long, sharp occipital and temporal horns; a prominent umbilical scar on an otherwise unspotted white or cream venter; and, as its name suggests, a relatively long broad flattened tail (Funk 1981, Muth and Fisher 1992, Sherbrooke 2003, Young and Young 2000). Flat-tailed horned lizards also possess two lateral fringe scale rows and lack external ear openings (Funk 1981, Johnson and Spicer 1985). Adults typically range in size from 57-8~~4~~7 mm (2.2-3.~~3~~4 in) snout-to-vent length (i.e., excluding tail length), while hatchlings are about 35-38 mm (1.4-1.5 in) (Howard 1974, Boundy and Balgooyen 1988).

Taxonomy

Flat-tailed Horned Lizards (Class Reptilia, Order Squamata) belong to the Family Phrynosomatidae, a large and diverse group that, in addition to horned lizards, includes zebra-tailed, earless, rock, spiny, fringe-toed, tree, brush, and side-blotched lizards. Hallowell (1852) classified the species as *Anota m'callii*, but the current species classification is *Phrynosoma mcallii* (Crother et al. 2012). The genus *Phrynosoma* consists of a unique group of lizards known commonly as horned lizards or colloquially as horned toads (in Greek *phrynos* = toad and *soma* = body). This group, compared to other lizards, is characterized by strongly dorsoventrally flattened bodies; sharp spines; a reluctance to run when approached; long activity period; more variable body temperatures; a specialized, often ant-rich, diet; and specialized dentition that facilitates ant-eating (Pianka and Parker 1975).

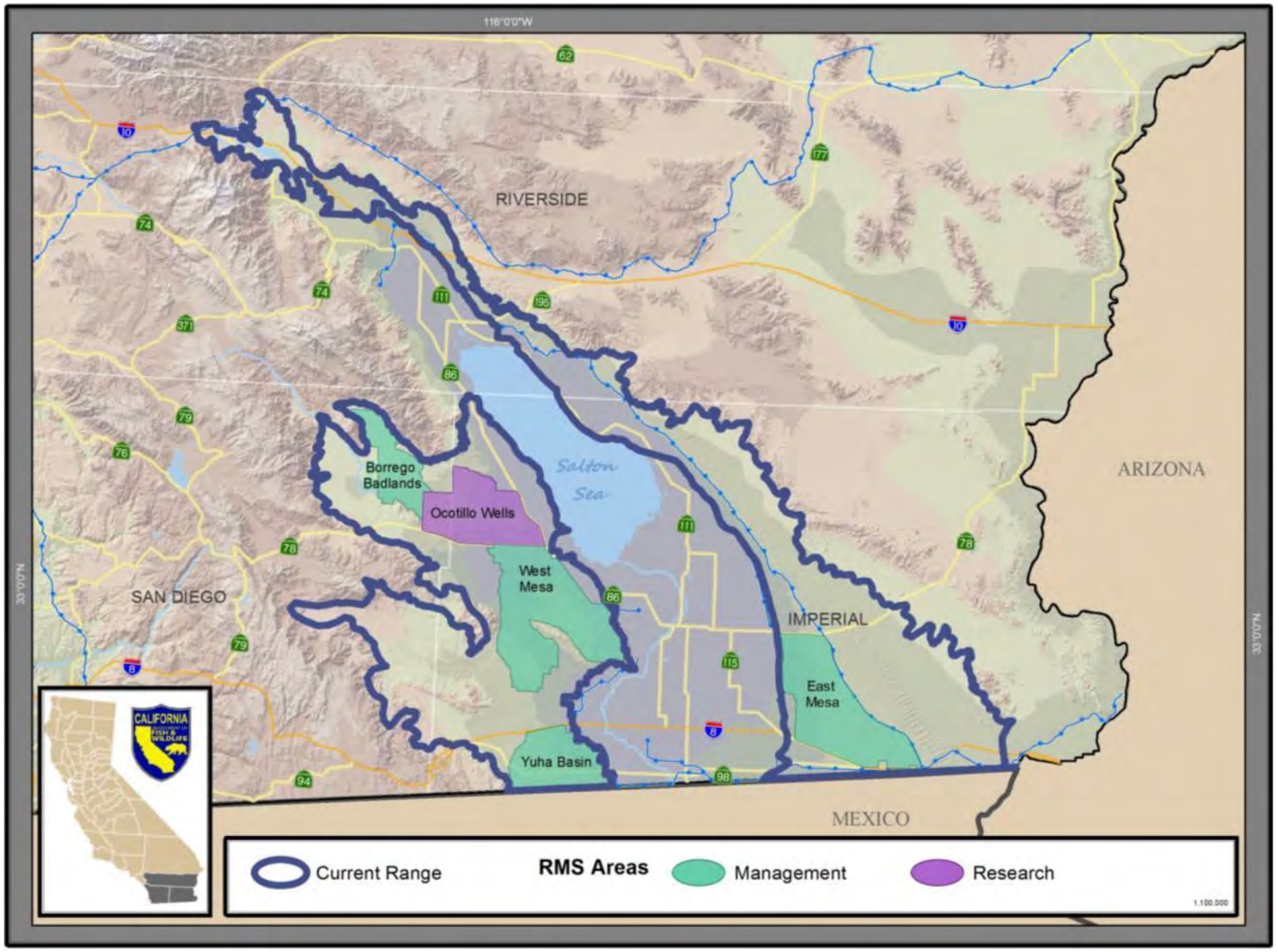


Figure 1. Flat-tailed Horned Lizard RMS Areas in California

Genetics

Phylogenetic relationships of *Phrynosomids* are not well understood (Leaché and McGuire 2006, Mulcahy et al. 2006). There are no recognized subspecies of Flat-tailed Horned Lizards (Crother et al. 2012), but two major clades east and west of the Colorado River have been revealed through genetic analyses (Culver and Dee 2008, Mulcahy et al. 2006). The western clade is predominantly located in California and shows signs of genetic differentiation among regions when mitochondrial DNA is used (Mulcahy et al. 2006); however, there was no evidence of genetic differentiation among the California populations using microsatellite data (Culver and Dee 2008). Mulcahy et al. (2006) determined that the populations east and west of the Imperial Valley, currently separated by urban and agricultural development, are significantly differentiated, although the data suggest that gene flow was limited prior to this anthropogenic change in landscape. While the Coachella Valley population and the population west of the Imperial Valley are also separated by urban and agricultural development, they are not significantly genetically differentiated from each other (Ibid.). Hybrids with morphological characters that are intermediate between Flat-tailed Horned Lizards and Desert Horned Lizards (*P. platyrhinos*) have been reported from near Ocotillo, California (Stebbins 2003) and between Flat-tailed Horned Lizards and Goode's Horned Lizards (*P. goodei*) from near Yuma, Arizona (Mulcahy et al. 2006).

Geographic Range and Distribution

The Flat-tailed Horned Lizard has the smallest range of any horned lizard found within the United States and has among the smallest ranges of all horned lizards (Sherbrooke 2003). The species is restricted to southeastern California, the extreme southwestern portion of Arizona, and the adjacent portions of northeastern Baja California ~~Norte~~ and northwestern Sonora, Mexico (Funk 1981). The majority of the species' range is within Mexico, while the majority of the U.S. range is within California (USFWS 2011). In California, Flat-tailed Horned Lizards are distributed throughout much of the Salton Trough, in sections of eastern San Diego County, central Riverside County, and western and southern ~~central~~ Imperial County. Flat-tailed Horned Lizards are most frequently found below 230 m (750 ft) in elevation, although they have been reported up to 520 m (1,700 ft) above sea level (Turner et al. 1980). Figure 2 shows the Department's approximation of the Flat-tailed Horned Lizard's current range (referred to as "Current CDFW Range" in map legends), based on aerial imagery interpretation of disturbed lands (e.g., urban and agricultural areas), soil types, elevation, and slope compared to the historical range boundary from the RMS (FTHLICC 2003). Figure 3 shows the distribution of Flat-tailed Horned Lizard observations, categorized by date.

Comment [J1]: The name of the state is just Baja California.

Growth, Reproduction, and Survival

Flat-tailed horned lizards have relatively long active periods, on average 277 days/year, without any prolonged periods of inactivity or aestivation (Muth and Fisher 1992), providing them plenty of time to grow and seek mates when conditions are favorable. Hibernation usually begins on average in mid-November but can range from October through December (Grant and Doherty 2009, Muth and Fisher 1992, Wone and Beauchamp 2003), although some individuals, particularly juveniles, remain active in the winter (Muth and Fisher 1992). Muth and Fisher (1992) speculate that juveniles may not have the fat reserves to get through winter without

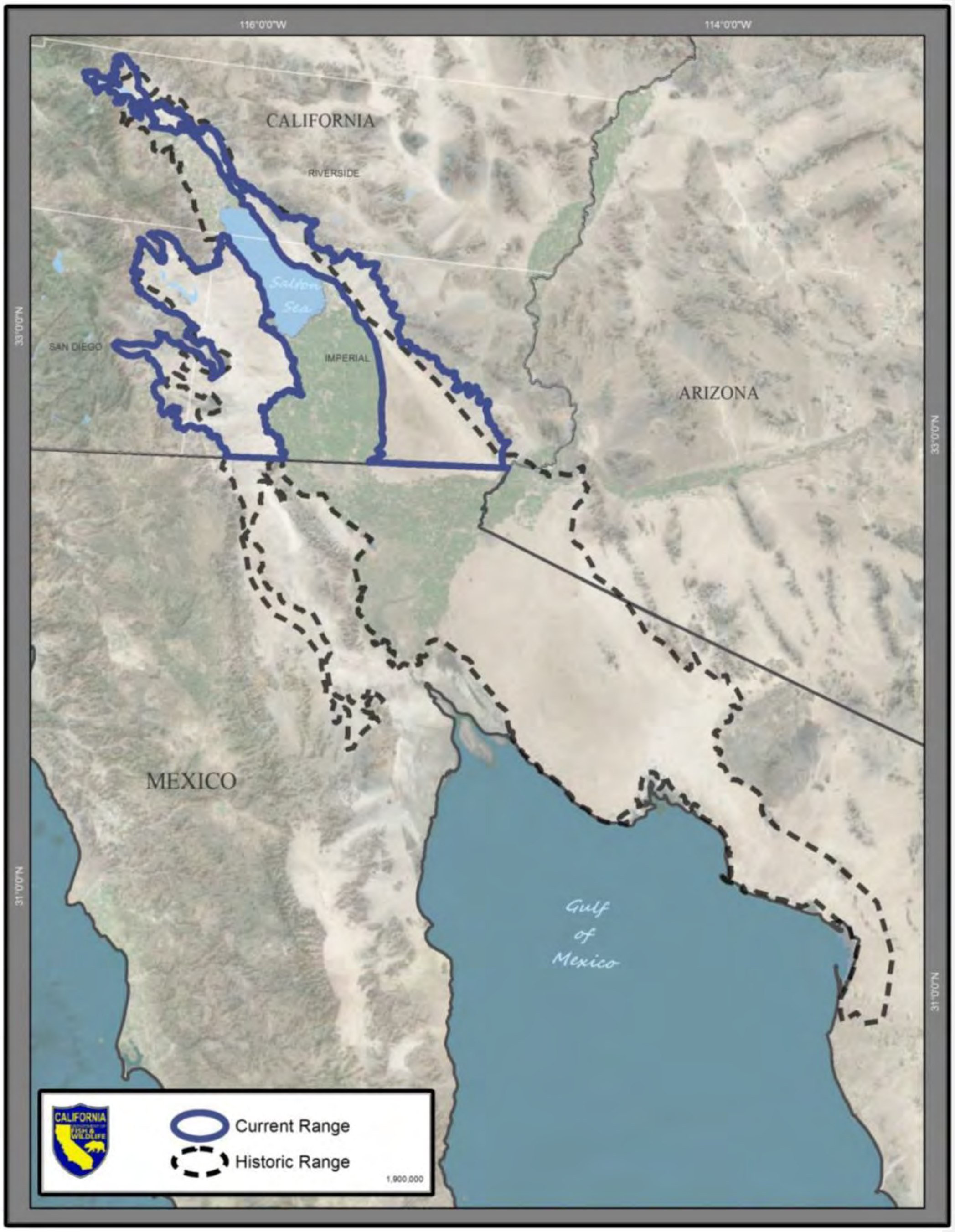


Figure 2. Flat-tailed Horned Lizard Current and Historic Range

Comment [J2]: There is a problem, because in CA the current range extends outside of the historical range in places.

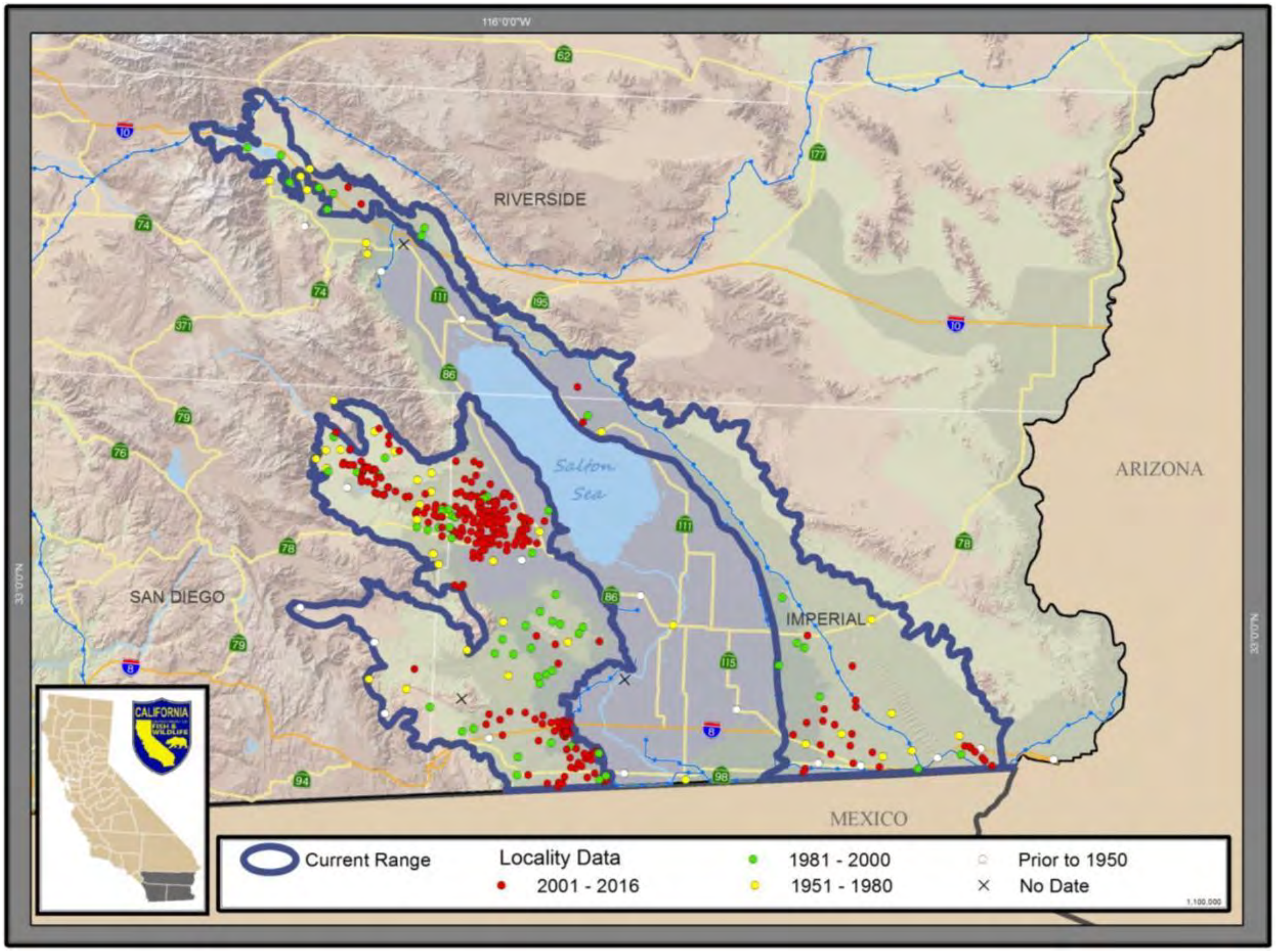


Figure 3. Flat-tailed Horned Lizard Observations in California

Comment [J3]: Mayhew collected hundreds of FTHLs along Hwy 78 during 1961-64 through East Mesa and on the east side of the dunes (see Turner and Medica 1982).

feeding, or they may remain active to attain the minimum reproductive size (60-66 mm, 2.4-2.6 in) (Howard 1974, Root 2010) as quickly as possible. Time of emergence is variable and can range from December to April, but averages in February (Mayhew 1965, Wone and Beauchamp 2003). When surface temperatures reach 50°C (122ºF), most Flat-tailed Horned Lizards will retreat into rodent or self-constructed burrows, although Young and Young (2000) observed them at surface temperatures of 55°C (131ºF).

Flat-tailed Horned Lizards are oviparous (egg-laying) and early maturing (FTHLICC 2003). They are generally capable of mating upon emergence from hibernation, and females may be able to produce two separate clutches of eggs (Howard 1974, Muth and Fisher 1992, Turner and Medica 1982). Several researchers report that the first hatchlings appear mid to late July, while a second set appears from late August through October (Ibid.). In dry years, females may only produce a single clutch that does not hatch until late August or September (Setser 2001, Young and Young 2000). It is also possible that females do not lay multiple clutches, but rather different individuals lay at distinct times throughout the active period (Young and Young 2000).

Comment [J4]: Some or most do not mature until their second year (see Howard 1974, T&M 1982). Not sure that qualifies as "early maturing".

Comment [J5]: Turner and Medica (1982), who followed females through a summer in 1978, state that two clutches were laid by most females that year.

Gravid females deposit their eggs in deep burrows over a period of two to four days (Young and Young 2000). Nests depths are variable depending on substrate and weather conditions (observed range: 14-90 cm, 5.5-35.4 in) but are deep enough to ensure that the eggs are laid in moist soil (Setser 2001, Young and Young 2000). Eggs are incubated for approximately 52 days before hatching (Ibid.). Flat-tailed Horned Lizards produce small clutches (averaging 4.7-5.4 eggs) and have the lowest productivity index (i.e., average clutch size x frequency) of the seven southwest *Phrynosomids* studied by Howard (1974).

Juveniles grow quickly, but growth rate appears to be dependent on when and where hatchlings were born and resource availability. Under favorable conditions, hatchlings born in the first cohort are able to reach adult size prior to hibernation and thus are able to breed at the beginning of the next year's active season, while hatchlings from a second cohort may not mature until the middle of the following summer, delaying breeding until their second year (Muth and Fisher 1992, Young and Young 2000). Drought may also delay sexual maturity, since growth rates slow under these conditions (Young and Young 2000).

Comment [J6]: See above comment.

Most Flat-tailed Horned Lizards live to three years in age, but individuals can live four or even six years (FTHLICC 2003, Leavitt 2013b, Young and Young 2000). Muth and Fisher (1992) estimated the mean annual survival rate at approximately 53%, noting the lowest survival rates occurred in spring and summer. During hibernation, survival is typically 100% (Grant and Doherty 2009, Muth and Fisher 1992). Annual survival estimates from demography surveys on East Mesa and West Mesa MAs between 2007 and 2013 varied substantially, ranging from 27%-70% and 4%-59%, respectively (Leavitt 2013b). Leavitt (2013b) noted that these estimates suggest low annual survival is the norm. Juvenile survivorship is not clear, but the annual juvenile survival rate for Desert Horned Lizards is significantly lower than adult survivorship (Pianka and Parker 1975).

The largest natural cause of Flat-tailed Horned Lizard mortality is predation, which, based on telemetry data, has been recorded as high as 40-50% of the population in certain years (Goode and Parker 2015, Muth and Fisher 1992, Young and Young 2000). Primary predators of Flat-tailed Horned Lizards are Loggerhead Shrikes (*Lanius ludovicianus*) and Round-tailed Ground

Squirrels (*Xerospermophilus tereticaudus*), but they are also preyed upon by a number of other reptiles, birds, and mammals, including Sidewinders (*Crotalus cerastes*), Coachwhips (*Coluber flagellum*), American Kestrels (*Falco sparverius*), Common Ravens (*Corvus corax*), and Kit Foxes (*Vulpes macrotis*) (Barrows et al. 2006, Duncan et al. 1994,Goode and Parker 2015, Muth and Fisher 1992, Young and Young 2000). Predation by some species, particularly birds and squirrels, increases near human development due to the availability of subsidized resources such as water and artificial perches (Barrows et al. 2006, Young and Young 2005).

To avoid predation, Flat-tailed Horned Lizards rely on their cryptic coloration and typically freeze instead of fleeing (Wone and Beauchamp 1995b). This can make them especially vulnerable to road mortality, which has also been suggested as a substantial source of mortality (Muth and Fisher 1992, Turner et al. 1980, Young and Young 2000). A population viability analysis suggested that Flat-tailed Horned Lizard persistence is particularly sensitive to changes in mortality versus other factors such as reproductive output or growth (Fisher et al. 1998, FTHLICC 2003).

Comment [J7]: The authorship was the Flat-tailed Horned Lizard Conservation Team.

Diet and Food Habits

According to Johnson and Spicer (1985), although the Flat-tailed Horned Lizard is remarkably swift compared to other horned lizards, it is basically a “sit and wait” predator. Ants comprise 97% of the Flat-tailed Horned Lizard’s diet, higher than any other *Phrynosomid* (Pianka and Parker 1975). Flat-tailed Horned Lizards primarily eat native harvester ants (genera *Messor* and *Pogonomyrmex*) but are known to eat smaller ants and other invertebrates opportunistically as well (FTHLICC 2003, Turner and Medica 1982, Young and Young 2000). During a severe drought in 1997, Young and Young (2000) measured scat contents and found less than half the number of ants were present in scat collected during wetter years, and they observed that Flat-tailed Horned Lizards lost weight during drought conditions. In drought years, annual vegetation is depressed, resulting in decreased seed abundance, which in turn negatively affects the harvester ants that feed primarily on seeds (Barrows and Allen 2009). Freestanding water and dew are not commonly available in Flat-tailed Horned Lizard habitat, so the species primarily relies on preformed water (water found within their food) to maintain proper water balance (FTHLICC 2003).

Comment [J8]: Johnson and Spicer (1985) demonstrated water harvesting by FTHLs off their backs in captives, although it has not been observed in the wild.

Home Range and Territoriality

Compared to their size, Flat-tailed Horned Lizards have very large home ranges and do not appear to be territorial (Muth and Fisher 1992). Young (1999) investigated interactions among Flat-tailed Horned Lizards with overlapping home ranges and found that lizards were actively avoiding each other. Home range sizes among individual Flat-tailed Horned Lizards can vary widely even in the same area, but method of data collection and analysis, location, season, sex, climatic conditions, and density dependence may all be influential. Goode and Parker (2015) measured male home ranges from 0.04-6.8 ha, and female home ranges from 0.02-14.5 ha. These ranges overlap the lowest and highest mean home range sizes observed by other researchers (Muth and Fisher 1992, Setser 2001, Setser and Young 2000, Turner and Medica 1982, Young and Young 2000). Males appear to have larger home ranges than females, at least in spring and early summer, which can likely be attributed to searching for mates (Goode and Parker 2015, Setser and Young 2000, Turner and Medica 1982, Young 1999). Some gravid

females will leave their home range, traveling as far as 1,647 m to deposit their eggs before returning to their original home range site (Setser 2001, Young and Young 2000). Climatic conditions, specifically drought, are presumed to reduce home range size and activity (Young and Young 2000).

Habitat that May be Essential for the Species' Continued Existence in California

Flat-tailed Horned Lizard habitat is characterized by hot summers ranging from 30-45^{0}C and generally mild winters in the very low 20s ^{0}C (FTHLICC 2003, Johnson and Spicer 1985). Annual rainfall is typically low and varies spatially and temporally (Ibid.). Within the California portion of the species' range, rainfall averages approximately 5.8 cm in El Centro and 13.5 cm in Palm Springs (FTHLICC 2003) and predominantly falls during winter, while the Arizona portion of the species' range generally receives summer rains (Johnson and Spicer 1985). Flat-tailed Horned Lizard habitat is subjected to frequent drought conditions (Johnson and Spicer 1985) and flash floods during periods of heavy rain (Turner and Medica 1982). Although it is sympatric with the Desert Horned Lizard in some parts of its range, the Flat-tailed Horned Lizard occupies hotter, drier, and more severe habitats than any other *Phrynosomid* (Johnson and Spicer 1985).

According to Turner et al. (1980), the best habitats for Flat-tailed Horned Lizards generally exhibit "surface soils of fine packed sand, or pavement, overlain intermittently with loose, fine sand." Most records of Flat-tailed Horned Lizards come from the creosote bush (*Larrea tridentata*)-white bursage (*Ambrosia dumosa*) assemblage, and occasionally saltbush (*Atriplex* spp.) (FTHLICC 2003, Turner et al. 1980). However, the species has been recorded in a broader range of habitats in California than in ~~compared to~~ Arizona, including sandy flats and hills, badlands, salt flats, and gravelly soils (FTHLICC 2003). Flat-tailed Horned Lizards have also been found on sandy~~the~~ rocky slopes at lower elevations, along the vegetated edges of active sand dunes, on stabilized sand fields, and less frequently, within active dunes themselves (Barrows and Allen 2009, Luckenbach and Bury 1983, Turner et al. 1980). The species has even been found in fallowed agricultural fields dominated by non-native weedy species (RECON 2010).

There are five habitats associated with Flat-tailed Horned Lizards in the California Wildlife Habitat Relationships System (CWHR) (Figure 4). CWHR is a state-of-the-art information system for California's wildlife that contains life history, geographic range, habitat relationships, and management information on 712 species of amphibians, reptiles, birds, and mammals known to occur in the state. Desert Scrub, Desert Wash, and Barren are considered high quality habitat, while Alkali Desert Scrub and Desert Succulent Scrub are considered marginal (CDFW 2014). Desert Scrub habitats typically are open, scattered assemblages of broadleaved evergreen or deciduous microphyll shrubs, usually between 0.5 and 2 m in height; canopy cover is generally less than 50%, usually much less; bare ground is often between plants; and creosote bush is often considered a dominant species (CDFG 1988). Barren is considered any habitat with <2% total vegetation cover by herbaceous, desert, or non-wildland species and <10% cover by tree or shrub species (Ibid.). Desert Wash habitats are characterized by the presence of arborescent, often spiny, shrubs generally associated with intermittent streams

Comment [J9]: Actually, female home range size increased in dry years (Young and Young 2000), presumably because they had to go farther afield to find food.

Comment [J10]: Percentage of annual rainfall falling in the summer months generally increases from the northwest to the southeast, within the range if the FTHL. But saying that the Arizona portion generally receives summer rains is inaccurate or misleading. On average, 52% of annual precipitation falls in Yuma from April through October (48% from November through March). At Palm Springs, 77% of annual precipitation falls from November through March. The distinction is important, though. The summer rains come at a time of high stress for plants and animals, and the rains relieve that stress. Furthermore, climate models do not model the summer monsoon well. There has been no detectable trend in the amount of rainfall in the Arizona monsoon. However, the models consistently show a predicted and measured decrease in winter rainfall. So, areas to the southeast within the FTHL range that receive decent summer rainfall will (presumably) be less affected by climate change than areas such as the Coachella Valley.

(washes) or drier bajadas (alluvial deposits adjacent to washes), especially in the Sonoran Desert (Ibid.).

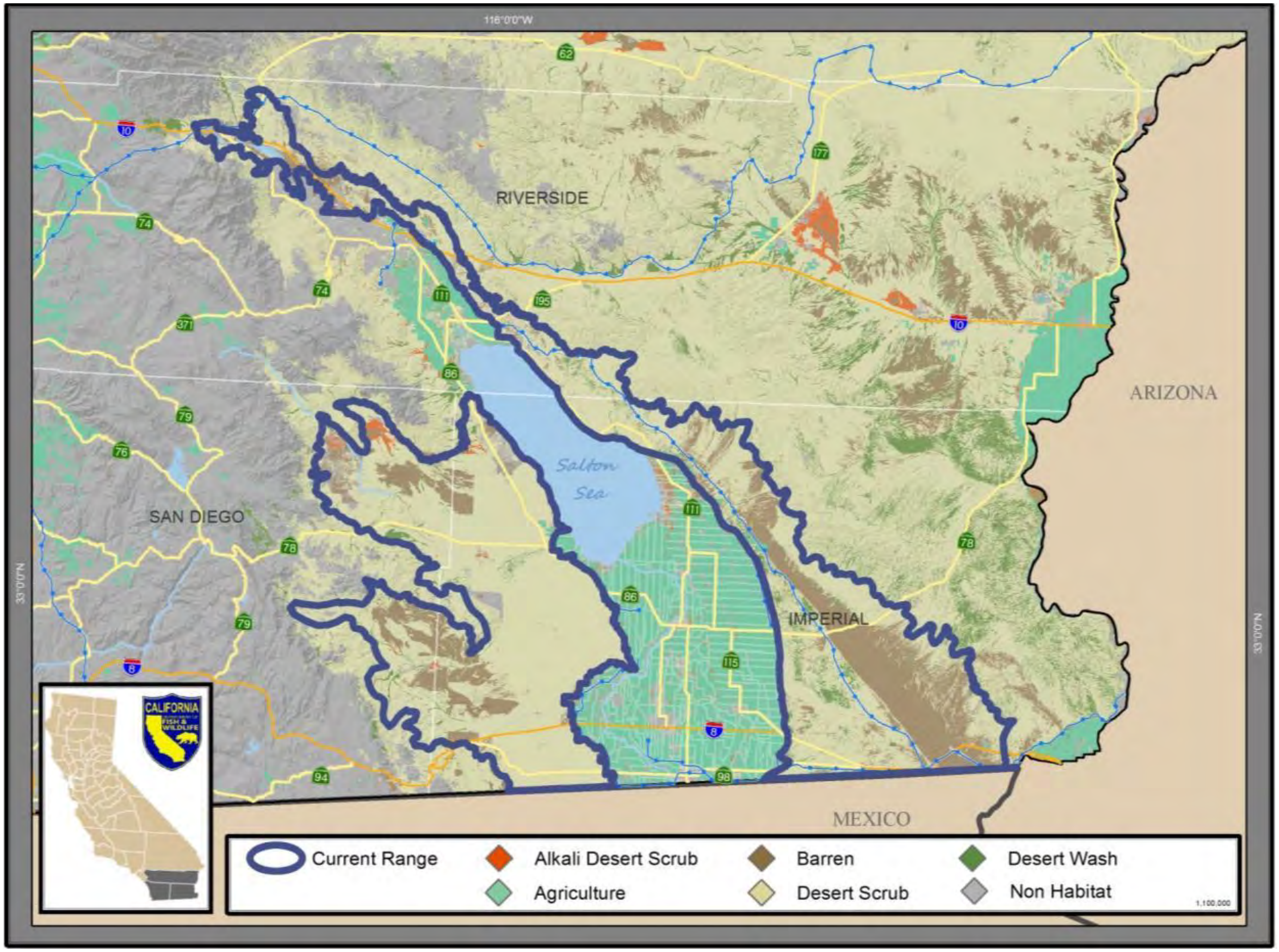


Figure 4. Flat-tailed Horned Lizard Habitat Associations

A number of studies have attempted to identify habitat characteristics that are significantly correlated with presence and abundance of Flat-tailed Horned Lizards, but their results have varied. In most cases, there is a positive correlation between Flat-tailed Horned Lizard abundance and perennial plant density (Altman et al. 1980, Barrows and Allen 2009, Muth and Fisher 1992, Turner and Medica 1982). However, it should be noted that typical Flat-tailed Horned Lizard habitat is sparsely-vegetated, so maximum coverage of perennial plant density is likely never very high at any of the sites. Positive correlations have also been reported between Flat-tailed Horned Lizards and the abundance of sand (Gardner 2005, Hollenbeck 2004, Wright and Grant 2003), as well as harvester ant nests (Barrows and Allen 2009, Rorabaugh et al. 1987, Turner and Medica 1982). Barrows and Allen (2009) found that soil compaction was significantly correlated with Flat-tailed Horned Lizard abundance in opposite directions on stabilized sand fields (negative) and active dunes (positive), suggesting that the "availability of moderately compacted sands may be important to horned lizards for digging burrows that are used for thermoregulation and nesting."

STATUS AND TRENDS IN CALIFORNIA

Range

Uncertainty exists regarding what constituted historically suitable habitat available for the Flat-tailed Horned Lizard in California due to periodic Colorado River flooding of the Salton Trough (FTHLICC 2003, USFWS 2011). This uncertainty affects estimates of losses in the species' range and distribution because the vast majority of land converted to agriculture and urban development occurs within this area of historical flooding. A detailed description of the geologic and hydrologic history is provided in the Setting and Habitat section of the USFWS's (2011) withdrawal of the proposed rule to list the Flat-Tailed Horned Lizard as threatened. Based on evidence of its ephemeral persistence and marginal suitability, the USFWS did not consider habitat within the historic Lake Cahuilla lakebed (Figure 5) as part of the species' historical range (USFWS 2006). Barrows et al. (2008) also did not consider this area as potential habitat when modeling changes in Flat-tailed Horned Lizard distribution in the Coachella Valley pre- and post-development.

Alternatively, Hodges (1997), while omitting areas of unsuitable habitat containing marshes, obvious rocky mountains, new alluvial deposits, and the main body of the Algodones Dunes, included the Salton Trough in her estimate of historic habitat due to the existence of Flat-tailed Horned Lizard records from areas within the Imperial Valley and around the Salton Sea. Based on this, she concluded that the total possible inhabitable area of historic Flat-tailed Horned Lizard habitat in California was as large as 899,000 ha (Ibid.). Flooding of the Salton Sea, agricultural development, and urbanization were the primary sources of habitat loss, leading to a reduction in range of approximately 51% in Imperial County, 58% in Riverside County, and 9% in San Diego County (Ibid.). Hodges (1997) considered the Riverside County estimate to be very conservative, and more recently, Barrows et al. (2008) reported that an estimated 83-92% of suitable Flat-tailed Horned Lizard habitat has been lost in the Coachella Valley. Conversely, the Imperial Valley estimate is likely inflated based on the periodic historic flooding that rendered much of the area unsuitable for extended periods. While at least some of the habitat

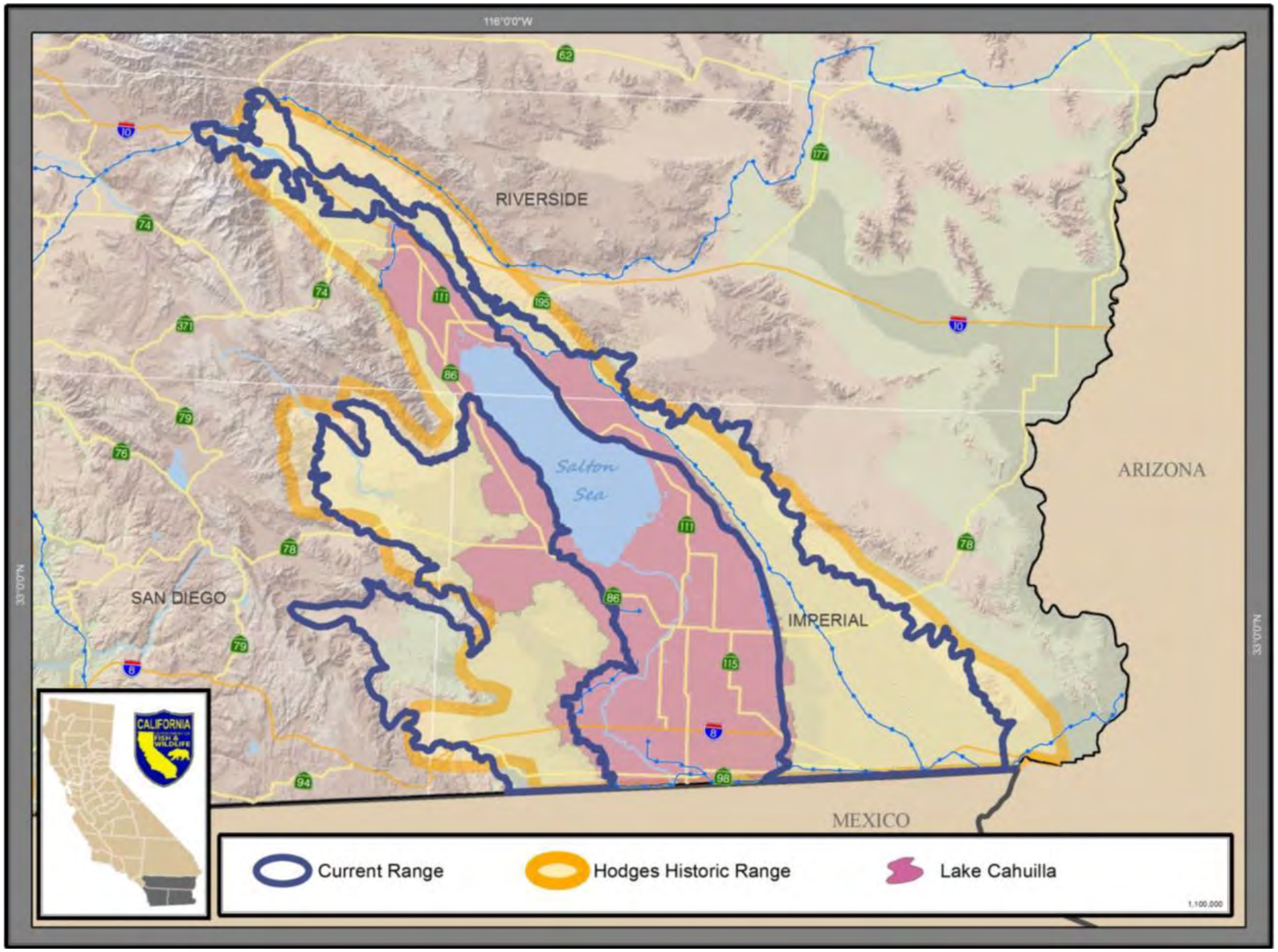


Figure 5. Historical Range Boundary Estimates Compared to Current Range Estimate

appears to have been suitable as recently as the end of the 19th century based on collections from the area (Hodges 1997), genetic data reveal that gene flow across the Imperial Valley was limited centuries before agricultural development began and the current Salton Sea flooded in the early 1900s (Mulcahy et al. 2006).

Regardless of the exact amount of loss, it is clear that the current Flat-tailed Horned Lizard range has been reduced from its historical extent due to agricultural and urban development. As a result, connectivity, even if historically infrequent, between the populations east and west of the Imperial Valley has been lost, and connectivity between the Coachella Valley and these populations may have been lost as well.

Distribution

With the exception of the Coachella Valley, the Flat-tailed Horned Lizard's distribution within its species' California range appears to have remained fairly stable in the areas for which data are available. As recently as the early 1980s, Flat-tailed Horned Lizards had a broader distribution in the Coachella Valley, occurring on what is now the Whitewater Floodplain Preserve, on the southern flanks of Edom Hill, and at the eastern end of the Indio Hills (CVCC 2013a). Currently, the only presumed remaining populations are on the Thousand Palms Preserve and f~~u~~arther south within the Dos Palmas Preserve (Ibid). If they do inhabit the other areas, it is at a density below detection levels (Ibid.).

The distribution of Flat-tailed Horned Lizards within the RMS Areas (Figure 1) has been monitored using survey methods that incorporate the species' low detection probability into estimates of occupancy and local colonization and extinction rates (i.e., occupancy surveys in the RMS). Until recently, these methods included the use of sign (e.g., scat or tracks), which provide a much greater power to detect changes from survey period to survey period than visual confirmation of a Flat-tailed Horned Lizard (Root 2010) but are also problematic. Several studies have demonstrated that Flat-tailed Horned Lizard scat~~sign~~ is not always positively correlated with current presence or abundance (Beauchamp et al. 1998, Muth and Fisher 1992, Rorabaugh 1994, Rorabaugh et al. 1987, Turner and Medica 1982, Wone and Beauchamp 1995a, Wright 2002, Young and Young 2000). This is due to any number of reasons, including (1) the fact that substrate and weather (e.g., wind, rain) can affect scat detectability and persistence (minutes to months) of scat or tracks in the environment (Beauchamp et al. 1998, Rorabaugh 1994); (2) it is impossible to distinguish the difference between multiple scats per lizard vs. several lizards defecating once (Beauchamp et al. 1998); (3) lizards produce fewer and smaller scats during times of low resource availability like drought (Rorabaugh 1994, Young and Young 2000); (4) Flat-tailed Horned Lizard scat are indistinguishable from Desert and Goode's Horned Lizards where they are sympatric (Root 2010, Rorabaugh et al. 1987, Young and Young 2000); and (5) surveyors who concentrate on finding scat invariably find fewer lizards (Wone et al. 1994). At best, scat can serve as an indication that the area was at least used by a Flat-tailed Horned Lizards, even if only as the species passed through it (Root 2010). Table 1 depicts the estimated likelihood that a Flat-tailed Horned Lizard will be present at a random spot within the RMS areas, based solely on lizard observations (i.e., not scat).

Comment [J11]: The old museum records show that FTHLs used the old lakebed when the lake was dry. What has removed that ephemeral habitat in the last century is agricultural and urban development. The lake is very unlikely to form again due to channelization of the Colorado River. An interesting sideboard is that the sand source for the lizard's habitat, which is primarily silica sands eroded from the Colorado Plateau and carried to the area by the Colorado River (and subsequently redistributed by wind), has been cut off by upstream dams. This is not a dune species, but stabilization or other processes over time could affect the lizard in the long term.

Comment [J12]: I believe there are no current records for the Vallecitas Valley in San Diego County, although old records exist. Mayhew found FTHLs to be very common on Hwy 78 through East Mesa and the edges of the Algodones Dunes during 1961-64, but the species is either very rare or absent in that area now (see Turner and Medica 1982). Northern East Mesa also burned in 1992 (~3600 acres), which may have affected the species. The area has yet to recover fully.

Comment [J13]: I think the only study that used tracks as an index to abundance was Barrows and Allen (2009), but no one has studied the relationship between track counts and lizard abundance (so same problems but less studied in regard to scat and abundance). Tracks have been used and are used to find lizards during occupancy and other surveys, but the metric is lizards, not tracks.

Comment [J14]: Interestingly though, and no one has really looked into this, but the broader, general areas where scat counts were high are also the same areas where horned lizards are frequently found. They are the same areas that were identified as MAs (which were selected based on scat count and lizard observational data).

Table 1. Occupancy Probability Estimates for RMS Areas (California only)[1]

	East Mesa	West Mesa	Yuha Basin	Borrego Badlands	Ocotillo Wells
2005		0.06			
2006	0.44				1.00
2007					1.00
2008			0.56		0.66
2009		0.86			0.86
2010	0.75				0.85
2011				0.42	0.91
2012				0.20	0.84
2013				0.10	0.78

[1] 2005-2010 data from Frary (2011); 2011-2013 data from Leavitt (2013b)

Occupancy probabilities were generally high across the RMS areas, particularly Ocotillo Wells, where extinction (0.07 ± 0.07) and colonization rates (0.00 ± 0.00) were estimated to be low (Leavitt 2013b). Despite being relatively close to Ocotillo Wells, occupancy probability and colonization rate estimates (0.01 ± 0.04) at Borrego Badlands were relatively low, and local extinction rates (0.54 ± 0.19) were predicted to be very high (Ibid.). Leavitt (2013b) posited that indications of a steady decline at Borrego Badlands are likely due to irregular sampling at that location and that this trend is an artifact of a poor sampling regime. Unfortunately, the relatively low power to detect changes from visual-only surveys, coupled with irregular and inconsistent monitoring on the MAs since 2005, has led in some cases to large standard errors and the inability to estimate population parameters (Grimsley and Leavitt 2016). Properly executed occupancy studies have far greater power to detect long-term changes in distribution when plots are sampled more frequently (i.e., annually vs. biennially or triennially) and all survey passes (days/plot) within the survey year are completed (Leavitt 2013b, Zylstra et al. 2010).

With the exception of the Coachella Valley, there are no quantitative distributional trend data on Flat-tailed Horned Lizards outside of the RMS areas. It should be noted that the MAs were chosen because they were thought to represent some of the highest quality contiguous habitat available to the species, and there are limits on disturbance within them. Therefore, extrapolation of these occupancy estimates to the rest of the species' range may not be prudent because areas of presumably lower quality and greater disturbance would be expected to have a lower likelihood of occupancy by Flat-tailed Horned Lizards.

Abundance

Obtaining reliable rangewide abundance or density estimates for Flat-tailed Horned Lizards is complicated due to the species' relatively low detectability and large home range size, as well as researchers' use of un-standardized, and in some cases, inappropriate survey methods (e.g., scat detection rates as an index of abundance). The Petition (Table 2, page 23 in CBD 2014) provides a list of abundance estimates based on scat and lizard observations per hour of survey effort using results of studies ranging from 1979-2001. Due to the unreliability of these estimates and no clear correlation with Flat-tailed Horned Lizard abundance, they are not reproduced here.

Since then, only three studies have used solely lizard observations and an appropriate sampling design to estimate abundance of adult Flat-tailed Horned Lizards across the RMS areas (Table 2). Some sites (West Mesa 2003 and Yuha Basin 2004) suffered from sparse data (Grant and Doherty 2007), and their 95% confidence intervals (C.I.) reflect that. Hollenbeck (2006) estimated the abundance of juveniles, in addition to adults, because they were encountered throughout the duration of the study and accounted for a majority of the individual Flat-tailed Horned Lizards captured and recaptured.

Table 2. Abundance and Density Estimates from RMS Areas (California only)

RMS Area	Abundance	Lower C.I.	Upper C.I.	Lizards/ha	(Lizards/ac)
Yuha Basin 2002[1]	25,514	12,761	38,790	1.05	(0.42)
East Mesa 2003[1]	42,619	19,704	67,639	0.91	(0.37)
West Mesa 2003[1]	10,849	3,213	23,486	0.20	(0.08)
Ocotillo Wells 2003[2]	19,222	18,870	26,752	0.61	(0.25)
Yuha Basin 2004[1]	73,017	4,837	163,635	3.00	(1.21)
Ocotillo Wells 2005[3,4]	24,345	14,329	69,922	0.78	(0.32)
Ocotillo Wells 2005[3,5]	37,085	22,166	74,812	1.19	(0.48)

[1] Grant and Doherty (2007), [2] Hollenbeck (2004), [3] Hollenbeck (2006), [4] adults, [5] juveniles

There has only been one attempt at estimating the number of Flat-tailed Horned Lizards across the species' range. The USFWS (2011) used a density of 0.3 lizards/ha (0.1 lizards/ac) and its estimate of the Flat-tailed Horned Lizard's remaining range to make that calculation. The density USFWS used was the smallest estimate derived by Root (2010) from data obtained between 2007 and 2009 on the MAs. Within California, this amounted to approximately 73,000 individuals west of the Imperial Valley; 44,000 east of it; and 1,100 in the Coachella Valley. The USFWS (2011) acknowledged that there were numerous assumptions in its calculations that limited accuracy of the extrapolated population sizes, but it concluded that, even using the most conservative density estimate, the populations east and west of the Imperial Valley were large enough that any threats associated with small populations would be unlikely to occur. The minimum viable population size for Flat-tailed Horned Lizards is unknown, and the USFWS (2011) also acknowledged that within these coarse-scale populations, barriers to movement fragment the habitat into various patches, which could result in deleterious effects from small population sizes (see Fragmentation, Edge Effects, and Small Populations below).

Not surprisingly, an increased level of survey effort (i.e., number of surveyors and amount of time looking specifically for lizards) appears to increase the likelihood of detecting Flat-tailed Horned Lizards. For example, surveys by biological monitors and incidental observations by construction personnel trained to look out for Flat-tailed Horned Lizards can sometimes find unexpectedly high densities when compared to the RMS area demography survey results. For example, prior to and during construction of the Imperial Solar Energy Center West's (CSolar)

transmission line within the Yuha Basin MA in 2014, 152 Flat-tailed Horned Lizards were located along the 6.6 ha (16.3 ac) right-of-way that was dominated by creosote bush and white bursage, resulting in an estimated density of 23.0 lizards/ha (9.3 lizards/ac) (UltraSystems 2015) (Figure 6). To put this density into context, using the RMS demography survey data from the Yuha Basin MA, the highest plot-level density estimate between 2007 and 2015 was 4.9 lizards/ha (2.0 lizards/ac) in 2011, and the 2014 estimate (i.e., the same year as the construction surveys as well as the third consecutive year of drought) was 2.5 lizards/ha (1.0 lizards/ac). These estimates were derived from abundance data in Grimsley and Leavitt (2016), which were then divided by 15.2 ha (37.6 ac), the estimated effective survey area, based on a 45 m (147 ft) movement buffer around the survey plot as suggested for standardization with other surveys by Root (2010). The solar facility portion of the CSolar project was located on 457 ha (1,130 ac) of abandoned agricultural fields that were considered barren or in the early seral stages of desert scrub in 2015 (Ultrasystems 2015) but were dominated by non-native weeds such as Sahara mustard (*Brassica tournefortii*) and London rocket (*Sisymbrium irio*) five years prior (RECON 2010). In this degraded habitat, another 95 Flat-tailed Horned Lizards were found, or approximately 0.21 lizards/ha (0.08 lizards/ac) (Dudek 2016).

Population Trend

Flat-tailed Horned Lizard populations appear to be highly sensitive to environmental fluctuations, which can result in high variability in abundance over short periods of time (Young and Young 2000). For example, within stabilized sand fields in the Coachella Valley, Barrows and Allen (2009) recorded the Flat-tailed Horned Lizard population decline by approximately 50% per year from 2002 to 2005, with a >90% decline overall; however, it was able to recover with no management action. This high level of variability coupled with the species' low detectability make accurate estimates of population trends exceedingly challenging, and comparisons in abundance or rate of detection from a small number of time periods should be viewed with caution.

Comment [J15]: Based on tracks, which is an unproven method for indexing abundance.

Until fairly recently, evidence of population trends were limited to anecdotal accounts, primarily of seemingly precipitous localized declines (Altman 1980, Turner et al. 1980) that may have at least partially been attributable to wet vs. dry years (Turner and Medica 1982), and use of Flat-tailed Horned Lizard sign (e.g., scat and tracks) as well as individual lizards, which as previously mentioned is often unreliable. As an example, Wright (2002) analyzed scat and lizard detection rate data from 1979 to 2001 across a number of BLM properties and found no significant population trend over that period, but he cautioned that the survey methodology was inconsistently conducted throughout this period. In addition to the complications associated with making assumptions about correlations between scat detection and lizard abundance, in all years except one, the survey effort was less than the estimated minimum necessary to have an 80% probability of being within 50% of the true mean sighting rate (Ibid.). However, when the data from the Yuha Basin, West Mesa, and East Mesa were combined, they met or exceeded this threshold, and the detection rate per 10 hr of surveying was 1.1 lizards in 1979, 1.0 lizards in 1985, 0.0 lizards in 1989, 1.2 lizards in 1991, and 1.1 lizards in 2001 (Ibid.).

Comment [J16]: I think this undervalues the apparent declines along Hwy 78 in East Mesa. No one has seen the #s of FTHLs along that road that Mayhew saw in the early 60s. You can postulate as to why the decline in observations occurred, but it's tough to deny that they are hard to find there now, but were easy in the early 60s. Scat counts are not involved.

Standardized demography survey protocols using solely mark-recapture Flat-tailed Horned Lizard data are a relatively recent development. Consequently, dataset with the longest duration on population trends using this method only spans 2007-2015. Grimsley and Leavitt (2016)

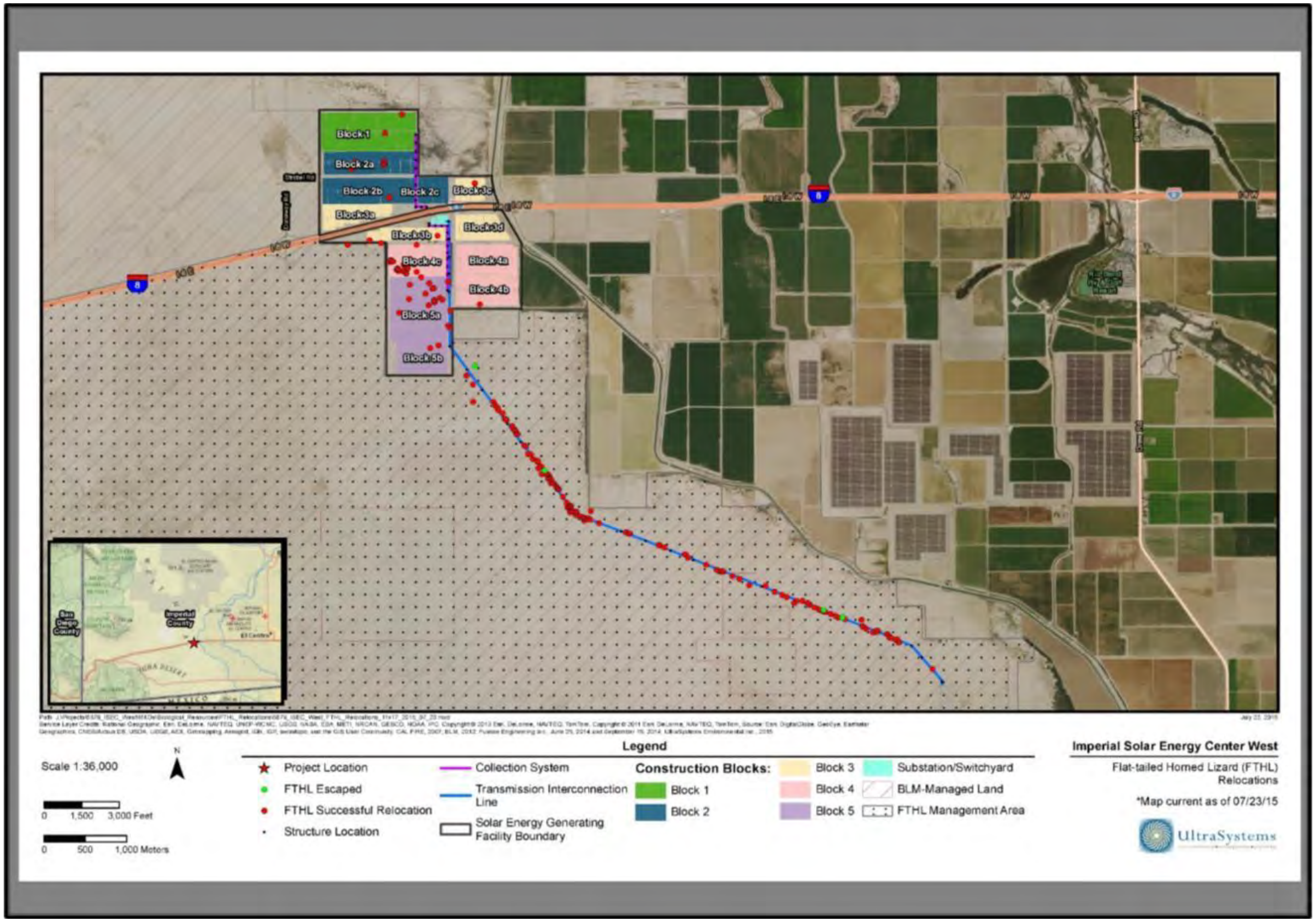


Figure 6. Flat-tailed Horned Lizard Observations (Relocations) within a Solar Project Footprint

calculated and plotted Flat-tailed Horned Lizard abundance estimates from Demography surveys on 9-ha plots within the RMS areas over that period of time (Figure 7). Demography surveys only began at Ocotillo Wells in 2014, and they have never been conducted on Borrego Badlands. As with the occupancy surveys, inconsistencies in demography survey data collection (e.g., number of surveyors and/or survey days) have led to large standard errors and the inability to estimate population parameters in some cases (Grimsley and Leavitt 2016). Nevertheless, the populations generally appear to be cycling up and down in concert (Leavitt et al. 2015). It should be noted that unlike the occupancy study plots, the demography survey plots were non-randomly selected within areas known or suspected to support greater than average Flat-tailed Horned Lizard densities, which are required in order to obtain robust enough datasets for use in population estimation models. Therefore, extrapolation of density estimates to areas outside of the high-quality survey plots cannot be legitimately undertaken. Nevertheless, these data do provide meaningful population trend data.

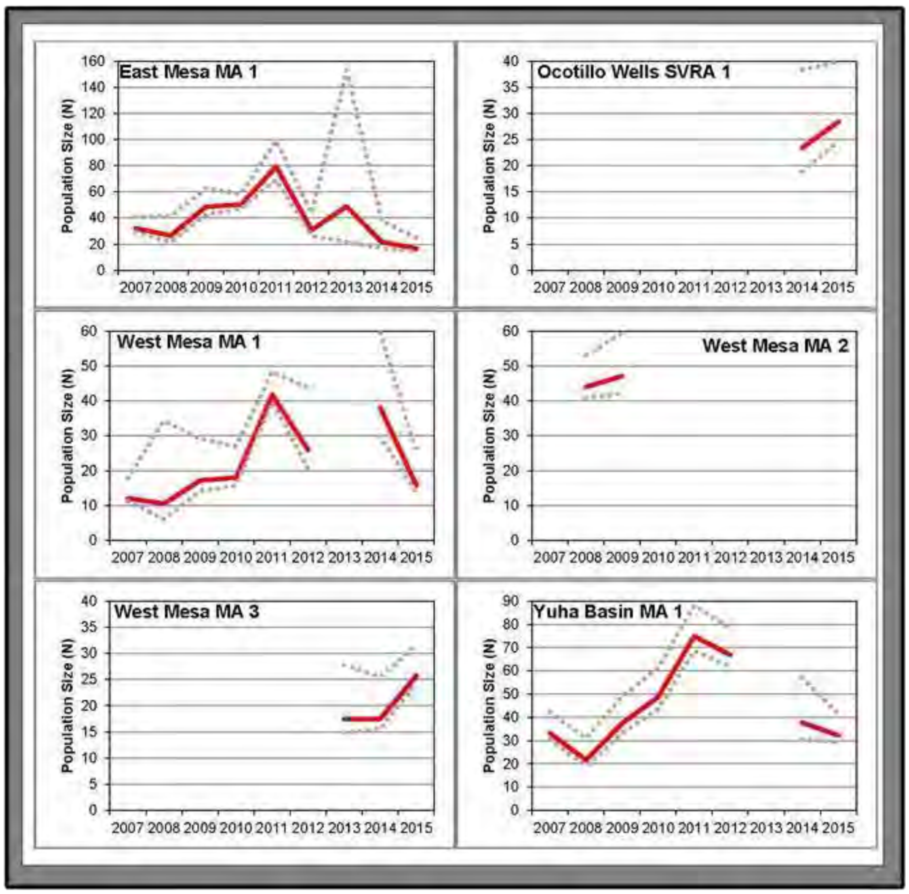


Figure 7. Annual Plot-level Flat-tailed Horned Lizard Population Estimates and Trends

The nearly fourfold increases in abundance from 2008 to 2011 on the three MAs in California that were surveyed consistently over that time reflect how rapidly and dramatically Flat-tailed Horned Lizards can respond to favorable conditions, and the subsequent declines to near 2008 levels from 2011 to 2015 reflect how rapidly they can decline as well. These fluctuations are often attributed to differences in precipitation, but the relationship between rainfall and Flat-tailed Horned Lizard abundance is complex and not always positively correlated (Barrows and Allen 2009, Leavitt 2013a, Young and Young 2000). California is currently experiencing an extreme drought that began in 2011. Predictions for a wetter 2015-2016 winter have not manifested as of March 31, 2016, and a vast majority of the Flat-tailed Horned Lizard's range in California is more than 50% below average precipitation for this water year to date (Figure 8).

Comment [J17]: This might be the place to summarize what we know about FTHL populations and trends. You could give a range of population density estimates (but acknowledge that they are almost always from areas considered great habitat), and then say that populations apparently fluctuate greatly (four fold over a few years), but data are inadequate to determine any long-term trends, in the limited areas that have been sampled (and that it is difficult to extrapolate from those areas to the range of the FTHL because plots were not randomly selected). There is an apparent correlation between precip and lizard abundance, which has been hypothesized for this species and shown to be true for other desert lizards, but other factors could be important, as well. Predators also increase in good times, and decrease in dry times, countering the effects of precipitation (see Young and Young 2000, P.C. Rosen 2000 – A Monitoring Study of Vertebrate Community Ecology in the Northern Sonoran Desert Arizona, UoA Dissertation).

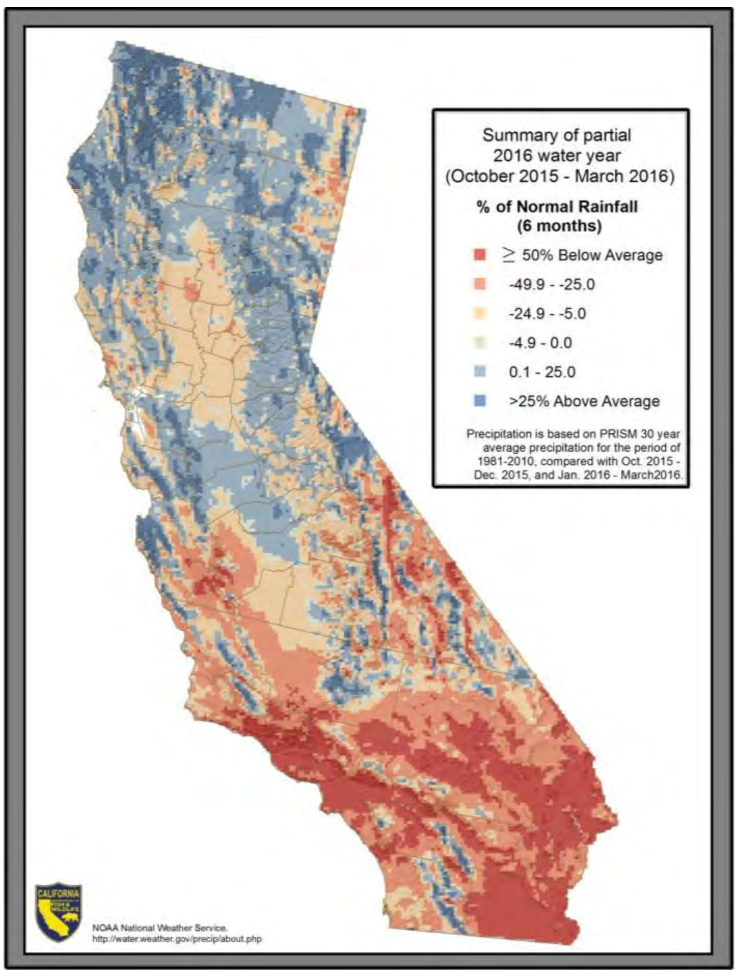


Figure 8. 2016 Water Year Statewide Precipitation Comparison to Average

EXISTING MANAGEMENT

Land Ownership within the California Range

Using the Department's current Flat-tailed Horned Lizard range in California, approximately 77% of the 666,916 ha (1,647,979 ac) are owned or managed by public agencies (Table 3, Figure 9). Of that land, 99% is managed by RMS participating agencies.

Table 3. Public Landownership within the Flat-tailed Horned Lizard's California Range[1]

Agency	Hectares	Acres	Group %	Unit %
Federal	*393,021*	*971,172*	*58.93%*	
U.S. Bureau of Land Management[2]	317,055	783,457		47.54%
U.S. Navy and Marine Corps[2]	67,876	167,725		9.28%
U.S. Bureau of Reclamation[2]	12,335	38,480		1.85%
U.S. Fish and Wildlife Service[2]	1,524	3,766		0.23%
U.S. Forest Service	231	571		0.03%
State	*121,122*	*299,298*	*18.16%*	
California Department of Parks and Recreation[2]	116,099	286,886		17.41%
State Lands Commission	3,066	7,576		0.46%
California Department of Fish and Wildlife[2]	1,641	4,055		0.25%
Coachella Valley Mountains Conservancy	216	534		0.03%
California Wildlife Conservation Board	81	200		0.01%
University of California	20	49		0.00%
County	*362*	*895*	*0.05%*	
San Diego, County of	360	890		0.05%
Imperial, County of	2	5		0.00%
City	*49*	*121*	*0.01%*	
Palm Springs	37	91		0.01%
Cathedral City	9	22		0.00%
Palm Desert	2	5		0.00%
Indio	1	2		0.00%
Special District	*1,458*	*3,603*	*0.22%*	
Imperial Irrigation District	878	2,170		0.13%
Coachella Valley Water District	470	1,161		0.07%
Borrego Water District	64	158		0.01%
Desert Water Agency	31	77		0.00%
Palm Springs Unified School District	7	17		0.00%
Salton Community Services District	7	17		0.00%
Desert Recreation District	1	2		0.00%
Grand Total	**516,012**	**1,275,088**		**77.37%**

[1] California Protected Areas Database (CPAD) 2015   [2] RMS Participating Agency

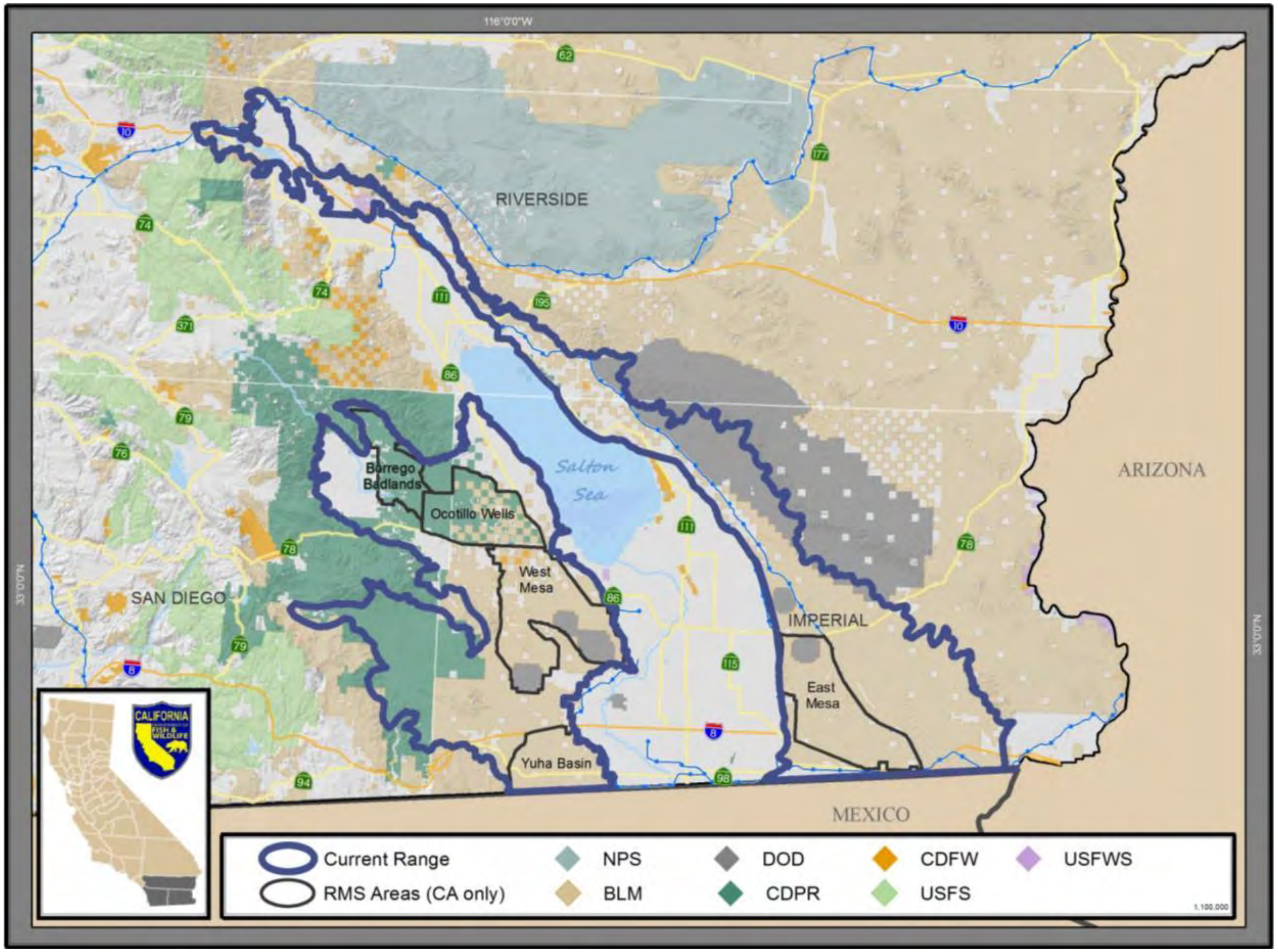


Figure 9. Main Land Ownership within the Flat-tailed Horned Lizard's California Range

Flat-tailed Horned Lizard Rangewide Management Strategy

In 1997, a voluntary long-term Interagency Conservation Agreement (ICA) was signed by the Department, USFWS, BLM, U.S. Bureau of Reclamation, U.S. Marine Corps, U.S. Navy, Arizona Game and Fish Department, and the California Department of Parks and Recreation (California State Parks) to implement the Flat-tailed Horned Lizard Rangewide Management Strategy (RMS), which was subsequently revised in 2003 (FTHLICC 2003, Foreman 1997). The RMS is implemented by the Interagency Coordinating Committee (ICC) and the Management Oversight Group (MOG), both comprised of members of the signatory agencies. The overall goal of the RMS is to "maintain self-sustaining populations of Flat-tailed Horned Lizard in perpetuity" (FTHLICC 2003). As briefly discussed in the Existing Regulatory Status section, the RMS established five Management Areas (MA), four in California and one in Arizona, and one Research Area (RA) in an active off-highway vehicle (OHV) park (Foreman 1997). MAs were designed to include as much high-quality Flat-tailed Horned Lizard habitat (as identified in previous studies) and as large an area as possible, while avoiding extensive, existing, and predicted management conflicts such as OHV open riding areas (FTHLICC 2003). The RA was established to encourage research on the potential impacts of OHV use on Flat-tailed Horned Lizards, funded through the California Department of Parks and Recreation's Off-Highway Motor Vehicle Recreation Division (OHMVRD) (Foreman 1997).

Management objectives for MAs include:

- Continue to secure and/or manage sufficient habitat to maintain self-sustaining Flat-tailed Horned Lizard populations in each of the five designated MAs;
- Maintain a "long-term stable" or increasing population of Flat-tailed Horned Lizards in all MAs (a population that is stable over the long term exhibits no downward population trend after the effects of natural demographic and environmental stochasticity are removed);
- Continue to support research that promotes conservation of the species;
- Within and outside of MAs, limit the loss of habitat and effects on Flat-tailed Horned Lizard populations through the application of effective mitigation and compensation; and
- Encourage and assist Mexico in the development and implementation of a Flat-tailed Horned Lizard conservation program (FTHLICC 2003).

Although entry into the ICA and implementation of the RMS is voluntary and based on available funding, BLM and the Department of Defense have formally adopted the RMS within some of their agencies' environmental planning documents. The BLM, through a California Desert Conservation Area Plan amendment, adopted the three California MAs as Areas of Critical Environmental Concern (ACEC) in 2005 (FTHLICC 2013). Under the Sikes Act, the Department of Defense has codified the RMS into the Integrated Natural Resources Management Plans (INRMPs) for their installations (Navy 2014, USAF and USMC 2013).

California State Parks, the third main landowner within the Flat-tailed Horned Lizard's California range, has not formally adopted the RMS into its planning documents. The Anza-Borrego Desert State Park Final General Plan and Environmental Impact Report (EIR) were approved by the State Parks and Recreation Commission in 2005. While they include goals and guidelines for conservation of significant and sensitive biota (CDPR 2005), they do not directly address

Flat-tailed Horned Lizard, which affects dedication of funding and staffing availability to implement the RMS. Management for the Flat-tailed Horned Lizard within the Ocotillo Wells State Vehicular Recreation Area (OWSVRA) falls under guidelines incorporated by California State Parks to evaluate and sustain park resources, but as an RA, OWSVRA is not subject to the same protections from disturbance in the RMS as the MAs are. OWSVRA is mandated to provide OHV recreation (e.g., free-play, racing, and touring) in a manner to sustain long-term use (FTHLICC 2003). The OHMVRD, in cooperation with the BLM, is preparing a General Plan/Recreation Area Management Plan/California Desert Conservation Area Land Use Plan Amendment ("Ocotillo Wells SVRA Plan") and associated EIR/Environmental Impact Statement (EIS), which will update the current general plan that was developed in 1982 (CDPR 2015). The objective of the Ocotillo Wells SVRA Plan is to create a comprehensive planning tool under both state and federal guidelines to effectively manage Ocotillo Wells SVRA for high quality recreation, while protecting its resources in a sustainable manner (Ibid.).

Each MA is controlled by multiple agencies, and all MAs in California include private inholdings, which are targeted for acquisition to reduce the chance of development within the MA boundaries (Ibid.). Land management within the MAs is designed to avoid or reduce permanent surface disturbance and to promote reclamation of disturbed areas (e.g., duplicate roads that are no longer needed) (Ibid.). The RMS requires compensatory mitigation for long-term impacts to Flat-tailed Horned Lizard habitat at ratios anywhere from 3:1 to 6:1 within MAs and 1:1 outside of them, and surface disturbance cannot exceed 1% of the total area within the MAs (Ibid.). While there is no indication the participating agencies will increase this disturbance cap in the future, it is a voluntary measure in areas where it has not been formally adopted (i.e., outside the ACECs).

The land area within the California MA boundaries totals 142,518 ha, approximately 21% of the Flat-tailed Horned Lizard's range in the state (using the Department's current estimated range map, Figure 1). Since 1997, impacts to 346 ha have been approved within the California MAs, and 6,811 ha of private lands have been acquired (FTHLICC 2015). In 2014, authorized surface impacts increased in MAs as a result of solar energy development and military projects (Ibid). The most recent RMS implementation progress report concludes "there is some concern the 1% development cap may be reached, and exceeded, in some MAs due to utility-scale renewable energy development and Navy projects" (Ibid.).

As already described in the Status and Trends in California sections, participating agencies conduct occupancy and demography surveys to monitor Flat-tailed Horned Lizard trends on the RMS areas. Formal monitoring under the RMS began in 2002, and as techniques were refined, a Flat-tailed Horned Lizard Monitoring Plan was developed in 2008 to standardize data collection (Ibid.). The Monitoring Plan was further revised in 2011 "to improve the precision of occupancy estimates and detection probability" (Ibid). The general inconsistency of data collection over the years has made population trend analysis somewhat challenging (Grimsley and Leavitt 2016), and the participating agencies admit that full population monitoring efforts needed to quantify critical population indices and detect trends suffer from funding and staffing constraints over most of the areas managed in California (FTHLICC 2015). Aside from that, the most recent RMS implementation progress report concludes that "the majority of the tasks outlined by the [RMS] are being completed on schedule" (only "provide public information and

education" is ongoing but not on schedule, and "determine effects of natural barriers" has not been completed) (Ibid).

In addition to conducting population monitoring, the participating agencies have supported and are currently supporting several research projects since the inception of the RMS through direct funding and personnel. These include, but are not limited to, evaluating the potential for OHVs to crush Flat-tailed Horned Lizards during hibernation (Grant and Doherty 2009), ecological associations with Flat-tailed Horned Lizard occupancy at OWSVRA (Beauchamp et al. 1998, Gardner 2005), OHV effects (McGrann et al. 2006, Wone et al. 1994, Young 1999), genetics (Culver and Dee 2008), landscape genomics (FTHLICC 2016), use of culverts (Painter and Ingraldi 2007), effects of translocation (Goode and Parker 2015, Painter et al. 2008), road mortality (Goode and Parker 2015), efficacy of barrier fencing along roads (Gardner et al. 2001), habitat suitability modeling (FTHLICC 2016), population viability analyses (Fisher et al. 1998, FTHLICC 2016), potential eastern Salton Trough movement corridor (FTHLICC 2016), anthropogenic influences on avian predation (Ibid.), and climate change (Ibid.).

Comment [J18]: Some of these (e.g. Wone 1994) were initiated or completed before the RMS was completed and the conservation agreement was signed (1997). Fisher et al. 1998 (which should be FTHL Conservation Committee 1998) was done as part of the RMS and conservation agreement development.

Comment [J19]: I was on the ICC, and then the MOG from the beginning of those committees until I retired in 2010. I chaired both at times. I was also on the ITAC, which came before the ICC and the conservation agreement. Yes, the agreement is voluntary, but in my opinion it works pretty well at conserving the lizard in MAs. You will not find a disturbance of cap of 1% even in designated critical habitat for federal endangered species, so that is a pretty high bar. As I mention below, though, surface disturbance from vehicles may exceed that by ten fold. And obviously the involved agencies cannot control climate change and other stressors beyond their authority, like Border Patrol activities. But within their spheres of influence, they do pretty well, they meet on a regular basis, fund monitoring and research, mitigate and compensate for projects they authorize, and have complied with the RMS to the best of their ability. It is a model conservation agreement in that regard.

Coachella Valley Multiple Species Habitat Conservation Plan

The Coachella Valley Multiple Species Habitat Conservation Plan (CVMSHCP) is a multi-agency plan, adopted pursuant to the federal Endangered Species Act and the California Natural Communities Conservation Planning Act. It provides for the long-term conservation of ecological diversity within the Coachella Valley region of Riverside County, while streamlining the development application review process throughout the plan area. The Department and the USFWS issued permits for the 75-year term CVMSCHP in 2008. The CVMSCHP includes an area of approximately 445,000 ha that do not include Indian Reservation Lands (CVCC 2015).

Within the plan area there are 13,122 ha of predicted modeled habitat for the Flat-tailed Horned Lizard of which 1,678 ha are identified as core habitat (CVMSHCP 2007). The CVMSHCP conserves 98% of the core habitat and 93% of other habitat beneficial to the conservation of the species (Ibid.). Outside of the conservation areas, 52% of predicted modeled habitat and 29% of potential habitat are authorized for take of Flat-tailed Horned Lizards (Ibid.). These areas are already highly fragmented, surrounded by existing development, and have a compromised sand source/transport system (Ibid.).

Although the CVMSHCP predicts there is suitable or potential habitat within a number of conservation areas, Flat-tailed Horned Lizards appear to have been extirpated from nearly all of the Coachella Valley with the exception of the Thousand Palms Preserve and possibly Dos Palmas. While the CVMSCHP (2007) states that "[i]deally, three or more sites with discrete sand sources and of sufficient size to maintain a viable population should be preserved," it also recognizes that "[r]ealistically there are not three such sites remaining that are not already fragmented or otherwise compromised by Development." Only Thousand Palms is considered "core habitat," meaning it is presumably large enough to sustain a population, although see the Fragmentation, Edge Effects, and Small Populations section below (Ibid.). Nevertheless, the CVMSCHP (2007) concludes that the Conservation Areas benefit the FTHL "by securing the long-term sand source-sand transport systems for their preferred habitat in the dune areas of the western and central Coachella Valley and by securing the unprotected habitat …throughout the plan area" (Ibid).

As of 2015, 81% of the Flat-tailed Horned Lizard Habitat to be conserved within the Thousand Palms Conservation Area has been acquired (CVCC 2015), although the vast majority of it was already conserved prior to the plan. Only 15% of the Flat-tailed Horned Lizard habitat to be conserved in the Dos Palmas Conservation Area, and none of the East Indio Hills Conservation Area has been acquired from 2006-2014 (Ibid.).

Comment [J20]: I think we need to admit that the CVMSHCP came a bit too late for comprehensive conservation of the FTHL there. Dos Palmas is outside of and disjunct from the core of the Coachella Valley. The FTHL's status in the Valley is tenuous, but perhaps 1678 ha of core habitat may be enough for it to persist if the area is managed well. In retrospect, we (the group that developed the RMS/agreement) should have pushed for an MA in the Coachella Valley, but we knew planning for a multi-species plan was underway, and an HCP for Uma inornata was in place.

Lower Colorado River Multi-Species Conservation Program

The 50-year Lower Colorado River Multi-Species Conservation Program (LCR MSCP) was signed by the Department of the Interior Secretary and representatives from agencies within Arizona, California, and Nevada in 2005. The LCR MSCP was created to balance the use of the Colorado River water resources with the conservation of native species and their habitats from Lake Mead to the southernmost border of Mexico (LCR MSCP 2016). The plan is implemented by the Bureau of Reclamation (Ibid.).

None of the LCR MSCP area falls within the Flat-tailed Horned Lizard's range in California, but a small portion occurs between Imperial Dam and the Mexican border in Arizona (LCR MSCP 2015). There are two Flat-tailed Horned Lizard-specific conservation measures in the plan. The first is to acquire and protect 230 acres of unprotected occupied Flat-tailed Horned Lizard habitat, which was completed by purchasing two privately owned parcels totaling 240 acres adjacent to the Yuha Basin MA in 2012 (C. Ronning pers. comm.). The second is to implement conservation measures to avoid or minimize take of Flat-tailed Horned Lizards including those described in the RMS (LCR MSCP 2015).

California Desert Conservation Area Plan

In 1976, the Federal Land Policy and Management Act (FLPMA) authorized the BLM to conserve and manage public lands, and required the preparation of the California Desert Conservation Area Plan (CDCA). The BLM can designate ACECs through the CDCA. ACECs are defined as "areas within the public lands where special management attention is required (when such areas are developed or used or where no development is required) to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources or other natural systems or processes, or to protect life and safety from natural hazards" (DOI 2001). The goals of ACECs are to:

Identify and protect the significant natural and cultural resources requiring special management attention found on the BLM-administered lands in the CDCA;

Provide for other uses in the designated areas, compatible with the protection and enhancement of the significant natural and cultural resources; and

Systematically monitor the preservation of the significant natural and cultural resources on BLM-administered lands, and the compatibility of other allowed uses with these resources (DOI 1980).

Portions of the three MAs administered by the BLM (East Mesa, Yuha Basin, and West Mesa) were designated as ACECs to protect the Flat-tailed Horned Lizard in 2005 (BLM 2016c, FTHLICC 2006). The Coachella Valley Fringe-toed Lizard and Dos Palmas ACECs in the Coachella Valley also provide protection for the Flat-tailed Horned Lizard (BLM 2016c). North

Algodones Dunes, which supports Flat-tailed Horned Lizards along its vegetated edges, was an ACEC but was recently withdrawn because it is already designated wilderness under the National Landscape Conservation System and the ACEC designation was unnecessary (BLM 2016c). Management requirements vary by location but in general include controlling and erecting signs explaining vehicle access areas and routes, restricting mineral exploration/development, developing additional habitat/water sources, conducting intensive resource inventories, controlling exotic and introducing native species, and stabilizing/rehabilitating/salvaging features (DOI 1980).

California Environmental Quality Act

Flat-tailed Horned Lizards are designated as a SSC by the Department, and as such the California Environmental Quality Act (CEQA) provides the species with certain protections from projects undertaken or approved by public agencies. CEQA is a California law (Public Resources Code Section 21000 et seq.) that requires state and local agencies to publicly disclose, analyze, and potentially mitigate environmental impacts from projects over which they have discretionary approval power. In particular, CEQA requires that actions that may substantially reduce the habitat, decrease the number, or restrict the range of any species that can be considered rare, threatened, or endangered must be identified, disclosed, considered, and mitigated or justified. (Cal. Code Regs., tit. 14, §§ 15065(a)(1), 15380.)

CEQA compliance is not always thorough because the process can be very costly and time-consuming. Agencies may also determine projects are exempt (i.e., they do not need to go through the impact analysis, public disclosure, and mitigation process). Mitigation is required if a project is not CEQA-exempt and impacts would be potentially “significant.” Mitigation must reduce impacts to below a level of significance or minimize unavoidable significant impacts, where feasible. The CEQA process generally incentivizes agencies and project applicants to implement mitigation thereby avoiding significant impacts.

Impacts on Flat-tailed Horned Lizards are generally considered potentially significant if agencies determine on a project-specific basis that the species meets the CEQA criteria for endangered, rare, or threatened. However, agencies are not required to make this determination for Flat-tailed Horned Lizards and other species that are not listed under the California or federal Endangered Species Acts. Even when they are considered in a CEQA analysis, lack of readily available information on which to base impact analyses and lack of understanding of the law may result in projects having an unknown significant impact on the species.

One measure that is often used to minimize adverse impacts to sensitive species is translocation of encountered individuals a safe distance away from the construction site. However, its utility in conserving species has been questioned (Germano and Bishop 2009, Germano et al. 2015). Two recent studies evaluated the efficacy of translocation for conserving Flat-tailed Horned Lizards (Goode and Parker 2015, Painter et al. 2008). While their methods were somewhat different, their results were quite similar. Both studies compared survival, persistence, behavior, and movement patterns using radio-telemetry on translocated and control Flat-tailed Horned Lizards (Ibid.). In the months immediately following translocation (late summer/fall 2012), both translocated males and females had significantly larger home ranges than non-translocated individuals; however, after that, there was no significant difference

between the two groups (Goode and Parker 2015). Survival probabilities were lower for translocated Flat-tailed Horned Lizards, although the difference was not statistically significant (Goode and Parker 2015, Painter et al. 2008). This result indicates Flat-tailed Horned Lizards may have a period of acclimation following translocation as they adjust to their new locations (Ibid.). Painter et al. (2008) noted greater movements in translocated individuals up to 14 days post-release. Goode and Parker (2015) ~~did~~ observed translocated Flat-tailed Horned Lizards engaging in reproductive behavior and concluded that "[w]hile the results of this project certainly do not justify making translocation a commonly used mitigation measure for Flat-tailed Horned Lizards, there were some promising results that warrant further study."

In order for translocation to be effective, exclusion fencing must be maintained. Goode and Parker (2015) observed telemetered Flat-tailed Horned Lizards crossing the fence with some regularity; thirty individuals, both non-translocated and translocated, crossed the fence at least once. The fence used in this study "began falling into disrepair almost immediately after it was constructed, with sand drifts accumulating quickly and holes appearing after several weeks" (Ibid). Most, if not all, of these individuals were placed immediately outside the exclusion fencing, and given the relatively large home ranges of Flat-tailed Horned Lizards, it is not surprising that they would attempt to re-enter. Painter et al. (2008) noted that while none of the translocated Flat-tailed Horned Lizards that were moved greater than 1.6 km (1 mi) away showed signs of homing behavior, control individuals that were released 100 m (328 ft) away from their capture point did.

Comment [J21]: The greatest benefit for FTHL conservation from translocation would be to move animals into areas where the lizard has been extirpated, but suitable habitat exists (e.g. recovering fallow agricultural fields).

FACTORS AFFECTING ABILITY TO SURVIVE AND REPRODUCE

Fragmentation, Edge Effects, and Small Populations

It is well established that loss of habitat is the primary reason for a vast majority of species' declines and extinctions globally; however, declines can occur even in seemingly relatively undisturbed habitat when barriers to movement fragment once contiguous blocks into smaller areas and when adverse impacts from adjacent land uses extend into that habitat (i.e., edge effects). Depending on their severity, edge effects around habitat fragments can create perpetual population sinks (areas of negative population growth) because the habitat is still intact, so individuals will continue to move into it where they can experience high mortality risk than in the habitat block's core. Such sinks will have the greatest impact on overall population dynamics in small reserves with high perimeter-to-area ratios and in species that range widely and therefore come into frequent contact with edge more often (Woodroffe and Ginsberg 1998).

Fragmentation and edge effects can be particularly deleterious when they impact species with small populations or create smaller populations, which are more at risk of decline or localized extinctions from random fluctuations in abundance and loss of genetic diversity through drift (Woodroffe and Ginsberg 1998). For example, Vandergast et al. (2016) discovered that genetic structure among Coachella Valley Fringe-toed Lizard (*Uma inornata*) populations increased, while genetic diversity and effective population sizes decreased between 1996 and 2008. They suggested this rapid differentiation was likely a synergistic effect of population declines during the historic drought of the late 1990s–early 2000s and habitat fragmentation that precluded

post-drought genetic rescue (Ibid.). Flat-tailed Horned Lizard populations in the Coachella Valley are even smaller and more fragmented than the Coachella Valley Fringe-toed Lizard, apparently only persisting in two preserves (Barrows et al. 2008). Similarly, Culver and Dee (2008) discovered that a small population of Flat-tailed Horned Lizards, separated from the rest of the species' range in Arizona by development and Interstate 8, was moderately genetically differentiated from those located south of the road. Their observation of a disproportionately high frequency of an allele that was otherwise rare in all other populations suggested evidence of either a strong selective force north of the freeway or random genetic drift or inbreeding due to the effects of isolation and small population size (Ibid.).

Edge effects, reported as reductions in Flat-tailed Horned Lizard detections, have been observed as great as 450 m away from a habitat edge and are primarily associated with increased predation by round-tailed ground squirrels, loggerhead shrikes, and American kestrels, as well as road mortality (Barrows et al. 2006, Goode and Parker 2015, Young and Young 2005). In some cases, these edge effects appear to be able to shift Flat-tailed Horned Lizard population dynamics from a bottom-up process, where the lizard numbers are regulated by native ant abundance, to a top-down process, where the lizards are limited by predation and possibly road mortality, creating a population sink along the habitat boundary (Barrows et al. 2006).

The USFWS (2011) evaluated Flat-tailed Horned Lizard habitat fragmentation by major canals and highways, the international border, and several railways by multiplying the size of the habitat fragment by the density estimate they used to calculate rangewide abundance (see Abundance above). Because no one knows what the minimum viable population size is for Flat-tailed Horned Lizards, the USFWS used 7,000 individuals per population (based on Reed et al. 2003) to differentiate between habitat fragments that were likely large enough to avoid deleterious effects from small population sizes from those that weren't (Ibid.). Based on this calculation, which did not incorporate edge effects, neither occupied preserve in the Coachella Valley appears large enough to support a "large enough" population, only three of nine areas west of the Imperial Valley were large enough (83% of the total area), and only two of eight areas east of the Imperial Valley were large enough (69% of the total area) (Ibid.).

Some species-specific evidence (Barrows et al. 2006, 2008; Culver and Dee 2008; Goode and Parker 2015; Young and Young 2005), as well as some speculation (USFWS 2011) and population dynamics theory (Woodroffe and Ginsberg 1998), support the contention that Flat-tailed Horned Lizards are susceptible to the adverse effects of habitat fragmentation, edge effects, and small population sizes.

Comment [J22]: This is just anecdotal, but I have observed that some lizard species, such as Dipsosaurus, Callisaurus, Aspidoscelis tigris and others can persist in small patches of desert around and in urban areas, or in rural areas, but P. mcallii does not. Even patches up to a section that have good habitat quality are very unlikely to support P. mcallii.

Roads, Canals, and Railroads

Major highways, ~~irrigation~~ canals, and railroads form large-scale near-complete barriers to Flat-tailed Horned Lizard movement, migration, and gene flow (Figure 10). These linear features fragment the habitat and can have demonstrable edge effects through increased mortality. The permeability (i.e., likelihood Flat-tailed Horned Lizards can cross the barrier) of these features differs somewhat across the species' range.

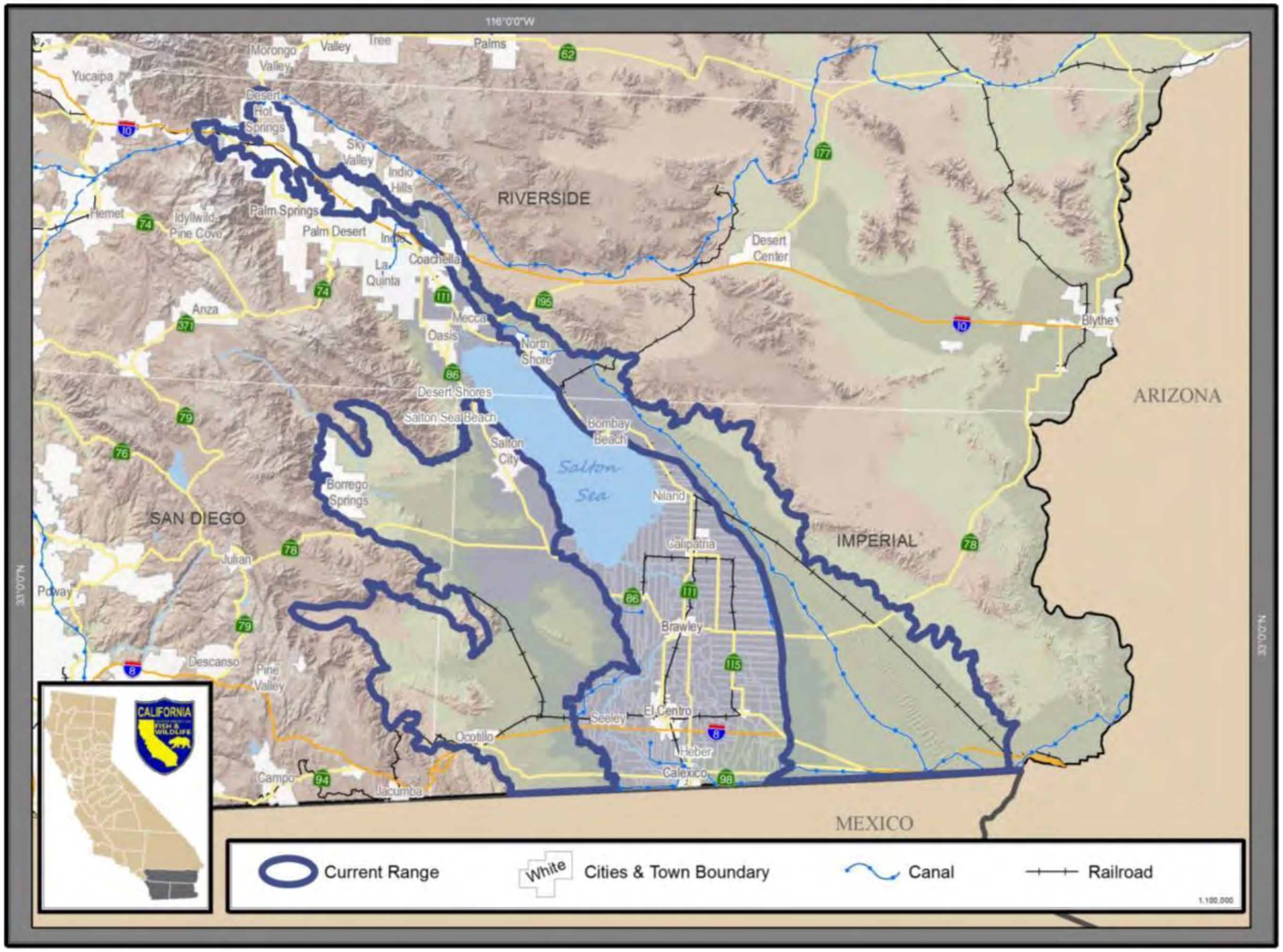


Figure 10. Major Barriers to Movement with the Flat-tailed Horned Lizard's California Range

Several major highways bisect the species' range in California. Flat-tailed Horned Lizards are frequently found on and around roads, and because they often freeze in the presence of threats, including vehicles, they're particularly susceptible to being killed on roads. Flat-tailed horned lizards were the most commonly encountered reptile (dead or alive) on paved roads within a military base in Arizona during three years out of a four-year study (Goode and Parker 2015). They accounted for 40.2% of all dead-on-road reptile observations, although only 3/353 (0.8%) of radio-telemetered Flat-tailed Horned Lizard deaths were known road kills, and individuals were frequently tracked moving across roads (Ibid.). Reports of proportions of dead vs. live Flat-tailed Horned Lizards on roads range from 3% - 27% (Goode and Parker 2015, Muth and Fisher 1992, Turner et al. 1980, Young and Young 2000) but do little to assess the impacts roads may be having at a population level. At least two studies (Barrows et al. 2006, Goode and Parker 2015) have studied this population-level effect specifically on Flat-tailed Horned Lizards.

Using mark-recapture data, Goode and Parker (2015) reported no significant differences in population abundance estimates in plots adjacent to roads compared to control plots. In fact, two of the highest abundance estimates came from plots adjacent to roads. However, it should be noted that these were from plots without adjacent power poles (Ibid.), suggesting predation may be the primary driver of the observed edge effect, not road mortality (see Predation below). In a similar pattern, Barrows et al. (2006) reported a much greater and more abrupt reduction in Flat-tailed Horned Lizard detections near wider, well-traveled roads with curbs vs. narrower, less-traveled roads without curbs; however, they could not absolutely attribute this to road mortality because they simultaneously observed a high level of predation by American Kestrels using a palm tree planted across the wider road. While road mortality may be having a population-level effect in some areas, the sparse data available do not strongly validate this assertion.

Nearly all of the ~~irrigation~~ canals in the Flat-tailed Horned Lizard's range are located within the existing developed lands in the Imperial and Coachella valleys. Two major exceptions are the All American Canal and the Coachella Canal (Figure 9). No studies have been conducted regarding the impact of canals on Flat-tailed Horned Lizards; however, it is clear that they present a complete barrier to movement with the possible exception of overcrossings. The Coachella Canal has several overcrossings to accommodate water and sediment transport down washes coming from the mountains to the east. In contrast, the All American Canal has very few crossings, all of which are narrow vehicle bridges.

Canal maintenance or improvements and construction of any new facilities have the potential to injure or kill Flat-tailed Horned Lizards or destroy their habitat. Imperial Irrigation District is discussing potentially constructing an intake canal off the All American Canal heading north close to the East Highline Canal that would discharge into a reservoir (J. Lovecchio pers. comm.), which if constructed would likely adversely impact a relatively small area in the overall Flat-tailed Horned Lizard's range.

There are several railroad tracks that run through the Flat-tailed Horned Lizard's range in California that pose a barrier to movement over long distances. It is unclear whether Flat-tailed Horned Lizards would avoid the trestles. In some areas, there are bridges constructed over

Comment [J23]: I do not have this study, but I believe they worked entirely on the BMGR in an area closed to the public. The road in question gets very little use compared to public highways like Hwy 78, Interstate 8, etc. No comparison.

Comment [J24]: I believe this misconstrues the results of Barrows et al. 06. They found support for the hypotheses that predators and the road itself (probably mortality) were affecting FTHLs within 100-200 m of the road. They also found evidence that the size/traffic on the road influenced the road effect. So scaling up to a Highway 78 or Interstate 8, one would expect a considerable dead zone along those busy roads. Going back to the work of Mayhew on Hwy 78, that may be exactly what happened after he worked there in the early 60s (which was soon after the road was paved). Young and Young (2000) determined lizards up to 500 m from a road could be affected, and populations within 250 m would be severely impacted.

Comment [J25]: Technically, they can be irrigation or drainage canals, and some, like the Coachella and All-American Canals carry water that is used for a variety of purposes.

Comment [J26]: Trestles? The rails are probably an absolute barrier, but as you say, railroads always have culverts and bridges over drainageways, though which lizards could pass.

washes that would allow more unrestricted movement from one side to another, so even if they do avoid the trestles and tracks, some movement and gene flow is still possible.

Agricultural and Urban Development

As previously described in the Distribution section, the two primary sources of Flat-tailed Horned Lizard habitat loss over the past century have been agricultural and urban development in Coachella, Borrego, and Imperial valleys. New agricultural development has slowed substantially due to reduced water deliveries from the Lower Colorado River, and some fields have been fallowed (USFWS 2011) and converted to solar farms. Although the fallow fields may only be marginally suitable, Flat-tailed Horned Lizards have been observed using them (RECON 2010).

Most land within the California portion of the Flat-tailed Horned Lizard's range is owned by the State or various federal agencies, so extensive new urban development is unlikely (USFWS 2011), although the California Department of Finance (2014) projects Imperial County's population is likely to grow from 187,689 in 2010 to 336,492 in 2060 (79%). The majority of this growth in the near term (2021) will be directed to existing incorporated townsites, including Bombay Beach, Desert Shores, Heber, Niland, Ocotillo, Salton City, Salton Sea Beach, and Seeley (County of Imperial 2013) (Figure 10). Private land holdings are relatively small and discontinuous throughout the range (USFWS 2011), indicating development of private land is likely to have small, localized impacts. Additionally, the Flat-tailed Horned Lizard ICC has been using compensatory mitigation money from approved project disturbances to purchase private inholdings within the MA boundaries, reducing the likelihood urban (or other) development will fragment the habitat within these areas. Future urban development in the Coachella Valley has been permitted through the CVMSHCP, which authorizes development in approximately 50% of the modeled suitable Flat-tailed Horned Lizard habitat, although nearly all of it is already fragmented and surrounded by existing development, so it would not likely support the species anyway (CVMSHCP 2007). Within the conservation areas, under the worst case scenario, take would occur within 2% (39 ha) of core habitat (i.e., able to sustain a population), 6% (336 ha) of modeled suitable habitat, and 7% (100 ha) of potentially suitable habitat (Ibid.).

Comment [J27]: In the HCP area?

Comment [J28]: Again, compare this to the 1% disturbance cap in a much larger area addressed by the RMS. The RMS looks pretty good.

Renewable Energy Development

Unlike agricultural and urban development, renewable energy (solar, wind, geothermal) development within the Flat-tailed Horned Lizard's range has increased dramatically in recent years. Lovich and Ennen (2011, 2013) synthesize the literature on potential impacts from utility scale renewable energy projects on desert ecosystems and wildlife. These include but are not limited to (1) creating a barrier to movement and fragmenting habitat; (2) increasing mortality on access roads and through increased avian predation along transmission lines; (3) opening up previously inaccessible areas to the public, facilitating illegal OHV use; (4) producing fugitive dust; (5) increasing soil erosion; (6) spreading invasive species; (7) increasing exposure to contaminants; (8) producing persistent loud noise and vibrations (wind); (9) increasing risk of fire; and (10) potentially altering local temperature, precipitation, and wind conditions (Ibid.).

There are no known studies investigating the specific impacts of renewable energy facilities and their associated infrastructure on Flat-tailed Horned Lizards, although some information from

other studies provided above on the effects habitat fragmentation, road mortality, and increased predation could apply. In addition, Olech (1984) reported that localized declines in indexed Flat-tailed Horned Lizard detections (scat and lizards) within the Yuha Basin corresponded with increased public use of those sites via construction of access roads for transmission lines and San Diego Gas and Electric's Imperial Valley Substation. Non-authorized OHV use was the most common "competing use" along all transects, and for transects where it was the only competing use of habitat, the temporal declines in observations were significant (Ibid.).

To date, renewable energy development in California has been permitted on a project-by-project basis. To facilitate this, the BLM has produced Programmatic Environmental Impact Statements (PEIS) for wind (BLM 2005), geothermal (BLM and USFS 2008), energy corridors (DOE and BLM 2008), and solar (BLM and DOE 2012). Wind resource potential is low throughout nearly all of the Flat-tailed Horned Lizard's range in California with the exception of the area around Ocotillo (BLM 2005) near the southwestern edge of the species' range, where the Ocotillo Wind Energy Facility was constructed in 2012 (BLM 2016a). Geothermal potential is greater, but its footprint is relatively small, and sites can typically be reclaimed and restored after extraction (BLM and USFS 2008).

The potential for solar energy facilities to impact a substantial amount of Flat-tailed Horned Lizard habitat is greater than that of wind or geothermal. Two Solar Energy Zones (SEZ) were identified in the PEIS, but only one is located within the Flat-tailed Horned Lizard's range (BLM and DOE 2012). The 2,314 ha Imperial East SEZ is located immediately south of the East Mesa MA in a fragmented patch of habitat bordered by Interstate 8, Highway 98, and Imperial Valley agriculture (Ibid.). An additional SEZ, the 4,354 ha West Chocolate Mountains SEZ, was subsequently established within the approximately 26,000 ha West Chocolate Mountains Renewable Energy Evaluation Area (REEA), located immediately south of Dos Palmas east of the Salton Sea (BLM 2012). The Final EIS for the West Chocolate Mountains REEA incorporated the RMS as its conservation measures for Flat-tailed Horned Lizards (Ibid.). There were no pending solar project applications within the Imperial East SEZ as of April 2015 (BLM 2015) or West Chocolate Mountains SEZs as of June 2014 (BLM 2014).

From January 2009-September 2015, the BLM approved right-of-way grants for five solar, one wind, and zero geothermal energy projects within the Flat-tailed Horned Lizard's range (BLM 2016a). Prior to 2009, the BLM had not approved any solar energy projects on public lands (Ibid.). The conservation, mitigation, and compensation measures in the RMS were incorporated into the environmental documents for these renewable energy projects, including minimizing impacts to Flat-tailed Horned Lizard habitat to the extent feasible, particularly within MAs, and purchasing compensation land or paying into a special fund for unavoidable impacts. For each approved project within a Flat-tailed Horned Lizard MA, the maximum (6:1) compensation ratio was applied.

Two energy corridors were identified that run roughly east to west through the Flat-tailed Horned Lizard's range in California, one in the far southern and one in the far northern parts of the range, overlapping portions of the East Mesa and Yuha Basin MAs as well as the Thousand Palms Preserve (DOE and BLM 2008). To date all of the solar projects with a BLM right-of-way grant have been located in the vicinity of the Imperial Valley Substation and Sunrise and Southwest Powerlinks (major transmission lines) in or around the Yuha Basin MA (BLM 2016a).

Most of the solar facilities were constructed on private agricultural land, and disturbance to Flat-tailed Horned Lizard habitat was restricted to construction of transmission lines connecting the facilities with existing infrastructure (Figure 11).

Aside from solar projects on BLM lands, there are several other authorized or pending renewable energy projects within the Flat-tailed Horned Lizard's range in California. Wind energy facilities are concentrated in the two locations that possess moderate to high wind resource levels, each along the periphery of the species' range (BLM 2005). One area is located in the far northwestern extent of the species' presumptive range near Whitewater in Riverside County, and the other is located in a canyon west of Ocotillo along the Sunrise Powerlink corridor in Imperial County within approximately 8 km of the Yuha Basin MA. In addition to the already operational Ocotillo Express Wind Farm in the latter zone, approvals for testing in the same area have been issued to two other wind energy development companies (BLM 2016b). There are several dozen parcels with geothermal leases located in approximately four areas within the Flat-tailed Horned Lizard's range (BLM 2013). The East Mesa Geothermal Field lies partially within the East Mesa MA, the Truckhaven Geothermal Leasing Area is located within the Ocotillo Wells RA, and the West Chocolate Mountains Geothermal Leasing Area is within the West Chocolate Mountains REEA. The Truckhaven Geothermal Project recently completed a reconnaissance survey and subsequently decided not to proceed with any future development (M. Rodriguez pers. comm.). In addition, renewable energy facilities are being approved on county lands that are not requiring implementation of the RMS conservation measures, although renewable energy companies are expected to evaluate potential impacts to Flat-tailed Horned Lizards and mitigate to a less than significant level through CEQA compliance (see Existing Management section above).

Comment [J29]: This might be a good place to review the effects and the effectiveness of mitigation on the geothermal facility in the southwest corner of the East Mesa (Ormesa Geothermal Plant). I believe the plant is just outside the MA. But I also know the BLM worked hard to make it compatible with FTHL, and I think it has worked out quite well (you would need to contact BLM El Centro for the specifics). In any case, geothermal development can be compatible with FTHL persistence.

With so many different agencies involved in renewable energy development oversight and approval and such a high demand in California, state and federal agencies recognized the need for a comprehensive plan to guide development in appropriate areas while protecting sensitive resources. In 2008, the BLM, California Energy Commission, USFWS, and the Department began a collaborative effort to draft a Desert Renewable Energy Conservation Plan (DRECP) covering the Mojave and Colorado/Sonora desert region of California. The Draft DRECP EIR/EIS was released for public comment in September 2014. As a result of feedback, the agencies decided to implement the DRECP in a phased approach starting with just BLM-administered lands. In November 2015, the BLM proposed Land Use Plan Amendment (LUPA) and DRECP Final EIS were released for public comment. In March 2016, the notice describing the proposed updates to the Areas of Critical Environmental Concern in the LUPA was published. The latter document proposes to designate 130 ACECs covering approximately 2,418,400 ha (including 445,569 ha within Wildlife Study Areas and Wilderness Areas) and includes Conservation and Management Actions (CMAs) and resource use limitations to manage those ACECs, including a detailed methodology for implementing and managing for ground disturbance caps in ACECs (DRECP 2015). Figure 12 depicts the Development Focus Areas (DFAs) in relation to the RMS areas and proposed expansion of protected areas.

Within the LUPA area there are approximately 173,610 ha of Flat-tailed Horned Lizard habitat located on BLM-managed lands primarily in the Imperial Borrego Valley Ecoregion Subarea (DRECP 2015). Impacts would occur in three BLM managed areas: the western foothills of the

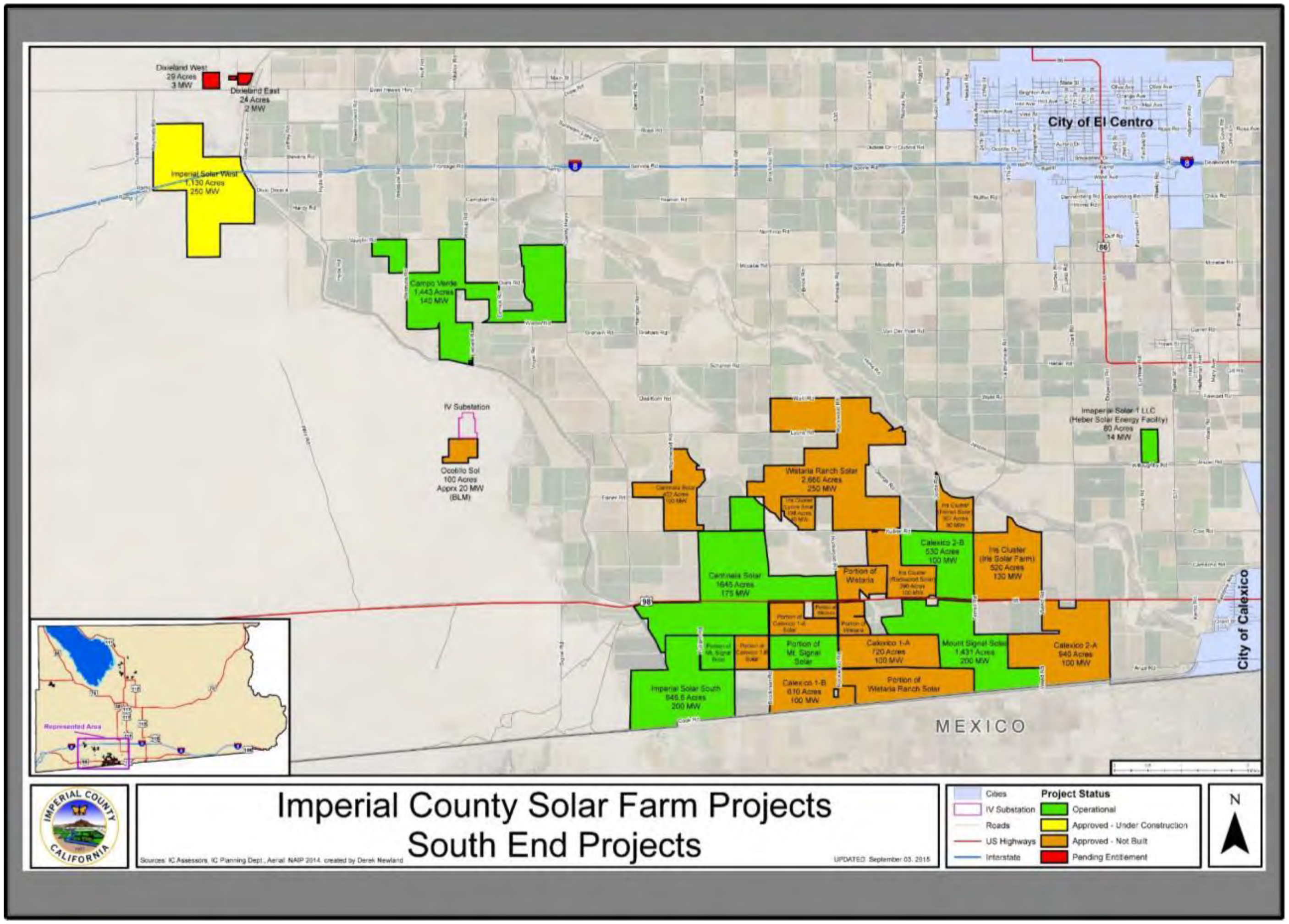


Figure 11. Solar Facility Footprints in Southwestern Imperial County

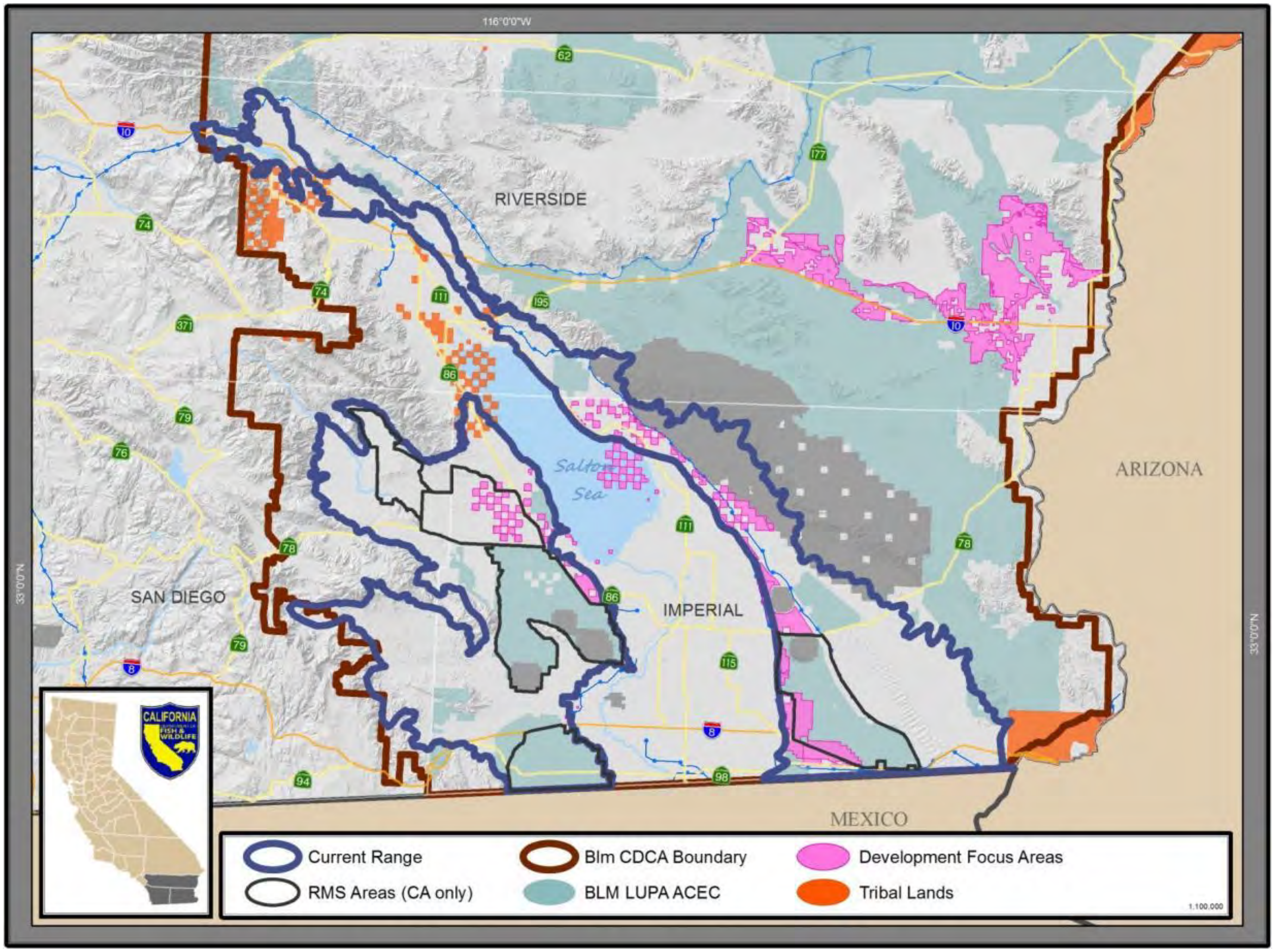


Figure 12. Land Use Designations under the Proposed BLM LUPA

Chocolate Mountains that include geothermal leasing areas studied in the 2008 Geothermal PEIS; BLM land along the western edge of East Mesa ACEC; and in BLM managed lands on the west side of the Salton Sea that include the Truckhaven Geothermal Leasing Area within the Ocotillo Wells RA. Under the Preferred Alternative, approximately 2,833 ha of solar, 8 ha of wind, 2,023 ha of geothermal, and 2,023 ha of transmission (includes BLM and non-BLM land) development would be permitted, slightly less than 4% of the total available (Ibid.). The RMS conservation, mitigation, and compensation measures are incorporated into the LUPA (Ibid.). In addition, the Preferred Alternative would expand Flat-tailed Horned Lizard protections by increasing the size of some of the ACECs within the species' range and restrict the type of uses (Table 4) (Ibid.). The Record of Decision has not yet been published for DRECP Phase I. Consequently, these amounts are subject to change, and it is unknown how much renewable energy development will be authorized by Imperial, Riverside, and San Diego counties.

Table 4. ACECs within Flat-tailed Horned Lizard's Range (LUPA Preferred Alternative)

ACEC	Current Area (ha)	Proposed Area (ha)	Renewable Energy	Mining	OHV
Coachella Valley Fringe-toed Lizard Preserve	4,151	4,158	No	No	No
Dos Palmas Preserve	3,371	3,371	No	Mineral Materials[1]	No
East Mesa	34,064	35,808	Geothermal[2]	Oil and Gas	Yes
Lake Cahuilla[3]	2,139	3,486	Geothermal[2]	Mineral Materials[4], Oil and Gas	Yes
Ocotillo	5,030	5,924	No	All Types	Yes
San Sebastian Marsh-San Felipe Creek	2,630	2,630	Geothermal (all NSO)	Locatable[5] Minerals, Mineral Materials	Yes
West Mesa	33,075	33,424	Geothermal	Mineral Materials	Yes
Yuha Basin	29,758	31,283	Geothermal	Mineral Materials	Yes

[1] Mineral materials = sand, gravel, rock, etc.

[2] New leases are subject to a "No Surface Occupancy" (NSO) stipulation (i.e., no surface disturbance, extraction only through directional drilling from outside the area)

[3] No disturbance cap (all others are 1%)

[4] Limited to historic operations only

[5] Locatable minerals = gold, silver, gems, limestone, etc.

Mining

The area of mining and mineral sites within the Flat-tailed Horned Lizard's range have not been mapped or quantified (BLM 2011), although Rado (1981) estimated 2,070 ha of active and intermittent sand and gravel quarries at the time of his study. Most mining activity within the Flat-tailed Horned Lizard's range is sand and gravel extraction, which has a relatively small physical footprint but can have a larger ecological footprint (BLM 2011, FTHLICC 2003). Like other types of development, mining activities remove and fragment, habitat, can impact air quality, create erosion and substantial noise, promote invasive species, release contaminants, and result in increased mortality along roads or through subsidizing predators (Ibid.). The Yuha Basin MA has been identified as a source of suitable sand and gravel (DRECP 2015), and there is an ongoing operation adjacent to and partially within East Mesa MA (BLM 2011). Among the few exemptions from the requirement to compensate for impacts to Flat-tailed Horned Lizards in the RMS are sites that have previously been mined along the East Highline Canal, either inside or outside of the East Mesa MA, if the applicant will be reclaiming the site and no further mining would occur (FTHLICC 2003).

Oil and gas leases were issued throughout the Salton Trough in the early 1980s, but only one test well was drilled (FTHLICC 2003). The well was not profitable, no oil or gas resources have been identified, and all oil and gas leases within the Flat-tailed Horned Lizard's habitat have expired (USFWS 1997, FTHLICC 2003).

Gold mining was listed as a potential future threat to Flat-tailed Horned Lizards in the Department's previous status review due to numerous mining claims being staked in the area of OWSVRA (Bolster and Nicol 1989); however, this threat never manifested.

Off-highway Vehicles

Most Flat-tailed Horned Lizard habitat is available for OHV recreational opportunities to some degree; closed areas are restricted to military lands, wilderness designations, and Anza-Borrego Desert State Park (BLM 2003). The BLM allows vehicles on designated routes~~trail-only riding~~ within the East Mesa, West Mesa, and Yuha Basin MAs (Ibid.). The adverse effects that OHVs can cause to desert ecosystems have been well documented, including compacting soil and destroying soil crusts, which leads to erosion and limits plant germination, growth, and vigor; damaging and destroying the plants themselves and crushing animal burrows, which reduces habitat availability and quality; raising fugitive dust and emitting byproducts of combustion, which impacts air quality and plant growth; spreading invasive species; directly wounding or killing wildlife; and producing excessive noise, which can alter animal behavior and physiology (Ouren et al. 2007).

Comment [J30]: Perhaps need to define OHV. OHVs can be used on designated routes in Anza Borrego, but they cannot drive off road.

The most recent estimate of OHV route proliferation and surface disturbance within the Flat-tailed Horned Lizard's range in California occurred in the early 2000s (USFWS 2003, Wright 2002), prior to adoption of the Western Colorado OHV Routes of Travel Designation Plan and construction of the border fence (BLM 2003, USCBP 2012a). Wright (2002) estimated the number of routes and graded roads increased by 387% within the West Mesa MA from 1985 to 2001, increased by 23% within the Yuha Basin MA from 1994 to 2001, and decreased 45% within the East Mesa MA from 1994 to 2001. Wright (2002) estimated 11.4% of the West Mesa MA had vehicle tracks in 2001, and the USFWS (USFWS 2003) estimated that 9.7% and 7.8%

of the surface area was disturbed in 2002 within the Yuha Basin and East Mesa MAs, respectively. Wright and Grant (2003) noted a 45% drop in vehicle track coverage in one year, speculating it could be the result of a big sandstorm and change in Border Patrol activities. This serves as a good example of why vehicle track coverage is an imperfect estimate of OHV impacts. Tracks disappear more quickly in sand than other surfaces, and a high number of tracks does not necessarily equate to frequent, or even recent, vehicle traffic since they can last for a long time in certain substrates (Ibid.). Nevertheless, it has been used as the metric of OHV use in nearly all studies of potential impacts to Flat-tailed Horned Lizards.

Comment [J31]: These numbers are significant given that according to the RMS new (since 1997) surface disturbance is supposed to remain below 1% (see 2.2.1, page 26 of the RMS). One could argue, based on the language in 2.2, that that cap only applies to permitted land use authorizations. So illegal off-road use by recreationists or Border Patrol doesn't count. But if that is the case, it undermines the purposes of the RMS. Action 7.1 (page 30) has the participants providing law enforcement necessary to ensure compliance with OHV regs. There is not supposed to be off-road vehicle use in MAs, so a roughly 10% surface coverage by vehicle tracks represents either 1) a failure of law enforcement to control recreational use, or 2) a failure to convince Border Patrol to not drive off-road. It is probably both. These studies occurred in the early 2000s. It would be nice to have more recent data (I am unaware of any).

There have been numerous attempts to study the impacts of OHVs on Flat-tailed Horned Lizards over the past three and a half decades, but complications associated with the low detectability of the species and variable detectability in different habitats, the unreliability of using scat as a surrogate index of abundance, and difficulty categorizing level or intensity of OHV use at a site have rendered the results equivocal. There have only been a few rigorously designed studies undertaken.

Setser and Young (2000), studying radiotracked Flat-tailed Horned Lizards in mudhill habitat within OWSVRA, found positive associations between Flat-tailed Horned Lizard habitat use and rocks and plants, but a negative association with OHV disturbance; however, this avoidance was only detectable out to 10m from tracks. Hollenbeck (2004, 2006) found sand was the only significant variable associated with Flat-tailed Horned Lizard abundance on several plots across OWSVRA, track coverage was not. Gardner (2005) found that Flat-tailed Horned Lizards were positively associated with sand and shrub abundance, even when the sandy plots were within an OHV route within a wash. McGrann et al. (2006) found that ant mound densities, mean adult mass, and mean juvenile mass were significantly greater on low impact plots (i.e., lower vehicle track %) than high impact plots, but overall density was greater on the high impact plots at one site and lower on another. Because they controlled for sand and vegetation, they speculate the difference was regularity of OHV use, which was greater at the site with lower densities (Ibid.). Because the OHV season occurs largely during the Flat-tailed Horned Lizard's hibernation period, Grant and Doherty (2009) investigated the risk of being crushed by OHVs during this time by simulating high and low impact riding intensities. Five of twelve buried, dormant Flat-tailed Horned Lizards were directly run over during the high impact treatment and three in the low, but none were injured or killed despite hibernating at shallow depths (Ibid.). They noted that a higher proportion of lizards hibernated under shrubs in OWSVRA (high use area) than East Mesa (low use area) and that rainfall may have played a part in the results, speculating that OHVs may cut less deeply into wet soil because the water tension helps hold it together (Ibid.). Nicolai and Lovich (2000) radio-tracked three male Flat-tailed Horned Lizards before and after a race and found a reduced rate of movement after the race, although the biological significance of the difference was dubious since the mean activity areas after the race were variable (i.e., one lower, one nearly the same, and one higher than before the race). Young (1999) did not find a difference in Flat-tailed Horned Lizard reaction to an OHV passing by vs. a person walking by.

Comment [J32]: See comment J34.

Noise associated with OHVs (as well as military activities, construction equipment, transmission lines, power plants, and wind farms) has been speculated to adversely affect Flat-tailed Horned Lizards (Bolster and Nichol 1989, CBD 2014). The degree to which noise impacts Flat-tailed Horned Lizards is uncertain, although it is likely very little. Heffner and Heffner (1998) concluded that reptiles show few, if any, responses to sound, and it appears they do not make as wide a use of hearing as most other vertebrates. Bondello (1976) and Brattstrom and Bondello (1983) demonstrated prolonged acoustical sensitivity loss in Desert Iguanas (*Dipsosaurus dorsalis*) and Mohave Fringe-toed Lizards (*Uma scoparia*), respectively, after short duration exposure to OHV-level noises. These studies have been used to support the notion that similar impacts to Flat-tailed Horned Lizards are likely (Bolster and Nichol 1989). However, Flat-tailed Horned Lizards have a different ear anatomy than these species. Flat-tailed Horned Lizards have no exterior ear opening, and Norris and Lowe (1951) concluded that the species' tympanum (i.e., eardrum) was so degenerate, it appears to have become functionless. The tympanum is covered with skin and encroached upon by bone, and the middle ear has been invaded by jaw bone, a condition that approximates that of snakes (Norris and Lowe 1951, Stebbins and McGinnis 2012). These changes have been noted in other lizard genera as well and are thought to be adaptations to burrowing (Ibid.). Christensen et al. (2012) concluded "that pythons, and possibly all snakes, lost effective pressure hearing with the complete reduction of a functional outer and middle ear, but have an acute vibration sensitivity that may be used for communication and detection of predators and prey." In addition, Wone et al. (1994) experimented with high frequency sounds to determine if they could elicit Flat-tailed Horned Lizards to run and thus be more easily detected; however, none of the Flat-tailed Horned Lizards exposed to the sounds reacted, remaining crouched and motionless whether the units were turned on at a distance or nearby.

It is difficult to find any conclusive evidence of significantly detrimental effects of OHVs on Flat-tailed Horned Lizards. They certainly are injured and killed on roads and trails, but the frequency of this source of mortality and its impact on population dynamics are unknown. A very small proportion (two out of hundreds) of all the Flat-tailed Horned Lizards tracked with radio-transmitters was known to be killed by OHVs (Goode and Parker 2015, Grant and Doherty 2009, Muth and Fisher 1992, Setser 2001). This could be explained if Flat-tailed Horned Lizards are selecting habitat features like rocks and shrubs that OHV riders tend to avoid (Gardner 2005). In addition, not all OHV activity is the same, and the risk to Flat-tailed Horned Lizards likely varies dramatically depending on a number of factors that go into habitat suitability, time of year, and available resources. For instance, Grant and Doherty (2006) observed that lighter Flat-tailed Horned Lizards tended to enter hibernation later in the year and speculated that they may need to stay active longer to put on fat reserves to last the winter. They also noted, as others have, that juveniles may not hibernate at all. It is possible in lean years, Flat-tailed Horned Lizards may not hibernate as long, and the longer they stay active, the more likely they are to be exposed to OHVs on the surface.

Where OHV use intensity is so great that it substantially reduces shrubs or prey, particularly in areas where these habitat features may already be scarce, Flat-tailed Horned Lizard density and body condition are likely to suffer. Luckenbach and Bury (1983) observed marked declines in herbaceous and perennial plants, arthropods, lizards, and mammals in open OHV riding areas of the Algodones Dunes vs. closed/low use areas. The extent to which these changes in vegetation and prey have occurred as a result of OHV activity across the Flat-tailed Horned Lizard's range is unknown. Whether the vibrations from OHVs detected by Flat-tailed Horned

Comment [J33]: This is perhaps deceiving in that researchers are not likely to transmitter FTHLs in areas with high levels of off-road use. Percentages of FTHLs alive versus dead on roads is another way to measure this.

Comment [J34]: The peak riding season in the Imperial Valley is from late October into mid April. Particularly in the spring months (mid February to mid April) FTHLs are going to be active much of the day (their activity is much more mornings and evenings when it gets hot). So active FTHLs are going to be particularly susceptible to being run over at that time of the year in OHV areas. Saying that they are hibernating underground when OHV activity occurs is not accurate. That would be a particularly bad time for spring annual plants, too. They could easily be crushed, unearhed, and killed. Ants, other insects, and in turn, lizards and up the trophic levels depend on that annual plant production. Churning up the soil would promote invasive, non-native plants, increasing the likelihood of fire. There is a good reason why off-road or off-trail vehicle use is prohibited in MAs. In addition, anywhere near the border, Border Patrol will drive off-road, anytime of the year, and basically anywhere they believe it is necessary (including in MAs and wilderness areas). In Arizona FTHL areas, off-road use by Border Patrol is the majority of OHV travel. I can't say for California, but I suspect that is true in many areas near the border. Border Patrol is an entirely different type of OHV activity – can't be regulated and it happens year-round.

Comment [J35]: In the first paragraph of this section, you outline the depth of the ecological effects of OHV/ORV on deserts. Elsewhere, you have made the case that it is extremely difficult to quantify populations of FTHLs and changes in populations over time. Given the range of adverse effects OHVs have on desert ecosystems, it is hard to make the case that OHVs are not bad for FTHLs, and it is almost certainly an incremental adverse effect. The more vehicles traveling off road (and the more vehicles traveling on dirt roads or trails) the greater the impact. But off-road is particularly detrimental to soils, plants, and cryptobiotic crusts. The level of OHV use in CA MAs was quantified in the early 2000s (Wright 2002, USFWS 2003) and vehicle tracks covered roughly 10% of the surface area (that is a lot, especially given that tracks are scrubbed away by the wind in many areas). So OHV is another stressor on FTHL. Is it enough to drive a population to extinction on its own? Perhaps not (no evidence of that), but combined with other stressors, it could contribute to declines and an increased risk of local extinction or extirpation. The only way to assess the actual impacts would be to implement a study with experimental (quantified levels of OHV) and control plots (no OHV) and follow FTHL abundance over several years. That study has not been done.

Lizards impact their ability to respond to predators or other threats (like OHVs) is similarly unknown.

United States-Mexico Border Activities

In response to illegal immigration and narcotics smuggling, U.S. Customs and Border Patrol (BP) actively patrols the border and surrounding areas, using OHVs, pedestrian and vehicle (PV) fences, and surveillance cameras and towers (Cohn 2007, FTHLICC 2003, Lasky et al. 2011). Flat-tailed Horned Lizards may be adversely affected by both illegal activities and the efforts to halt them through habitat fragmentation caused by the border fence, increased predation facilitated by tall perches (fences and towers) and trash, road and off-road mortality, and habitat degradation from cross-country driving.

There is limited literature available specifically assessing border related impacts on the Flat-tailed Horned Lizard and other species (Cohn 2007; Lasky et al. 2011; USCBP 2012a, 2012b). The USFWS estimated that if border-related activities involved a zone of high impact 1 km north of the border, that would amount to disturbance of approximately 2,318 ha (0.7%) and 5,012 ha (3%) of the Flat-tailed Horned Lizard's range west and east of the Imperial Valley, respectively (USFWS 2011). The actual area of disturbance is probably less in the eastern section since the All American Canal runs the length of the border less than 1 km north of it (Ibid.). The construction of a border fence along the entire California range of the species is expected to dramatically reduce that impact (Ibid.). While vehicle-related mortality associated with the main access road along the border fence undoubtedly occurs, evidence suggests the PV fencing in Arizona has resulted in reduced impacts to Flat-tailed Horned Lizard habitat associated with trans-border illegal immigration activities, OHV activity, drug smuggling, and ensuing law enforcement activities (USFWS 2011, FTHLICC 2012, Rorabaugh 2010).

The border fence is nearly continuous across the Flat-Tailed Horned Lizard's range in California (USCBP 2012a) and consists of four types (PV-1, P-2, PV-4, and VF-2) that are at least semi-permeable to lizards (Figure 13) (Lasky et al. 2011, Rorabaugh 2010, USCBP 2012a). Given the relatively large home ranges of Flat-tailed Horned Lizards, it is likely that at least some genetic exchange is still occurring in spite of the fence and increased mortality adjacent to it from road mortality and potentially increased predation. The VF-2 fence, which is only a deterrent to vehicle traffic, was only sporadically constructed along approximately 2 km of the border west of Calexico adjacent to the Yuha Basin MA (USCBP 2012a), which could potentially concentrate illegal activity in this area (Lasky et al. 2011).

In addition to the fence, BP has installed remote video surveillance system (RVSS) towers to monitor illegal activities. There are approximately 20 of these towers within the Flat-tailed Horned Lizard's current range in California (J. Petrilla pers. comm.). These RVSS towers can monitor a much larger area than border patrol agents can cover by vehicle (USCBP 2012b) and may reduce the amount of road mortality associated with law enforcement activities.

The REAL ID Act of 2005 (Pub.L. 109–13, 119 Stat. 302) authorizes the Department of Homeland Security to waive all laws as necessary, including environmental review and mitigation, to "ensure expeditious construction of certain barriers and roads at the U.S border." In spite of this, BP and personnel from the BLM-El Centro office participate in monthly meetings

Comment [J36]: And? Are you saying the BP does not patrol East Mesa? That they limit their activities to the area south of the canal? I doubt that is true. People swim the canal and can cross at siphons (although there is fencing and often BP stationed at siphon drops). In southwestern Arizona, BP patrols – off-road and on-road extensively all the way north to Interstate 8 – a distance of as much as 65 miles north of the border. Wilderness areas, National Park Service lands, military lands, and FTHL MAs do not stop them from driving anywhere they believe they need to. I suspect the same thing happens in California. USBP was invited to participate in and be a signatory agency to the conservation agreement, but they declined.

Comment [J37]: Off-road travel by agents will probably decline as number of immigrants and smugglers decline. But BP still has many thousands of agents (that number is not decreasing), and they need to patrol somewhere. They will be out driving roads at the very least, and will still be driving off-road when they believe it is necessary.

and coordinate regular Flat-tailed Horned Lizard orientation sessions to reduce BP impacts to the species' habitat (FTHLICC 2012).

Figure 13. Border Fence Designs: (a) PV-1, (b) VF-2, (c) P-2, (d) PV-4

Comment [J38]: The distinction here is that VF-2 is a vehicle barrier, not meant to stop pedestrians. The other three are pedestrian barriers (which also are meant to stop vehicles). None are impermeable.

Military Activities

Military lands and activities occur within the Flat-tailed Horned Lizard's California range. Naval Air Facility El Centro (NAFEC) has two bombing ranges, one containing 12,060 ha of land within the West Mesa MA (representing 22% of the MA), and a 3,440 ha range in the East Mesa MA (covering 7% of the MA) (FTHLICC 2003). Although most training is aircraft-related, ground-based activities that can cause surface disturbance include non-exploding bombing, training, various target activities that include maintenance and site clean-up, road travel, and maintenance (FTHLICC 2003, USFWS 2011). These activities can adversely impact Flat-tailed Horned Lizards through direct mortality, habitat degradation, increased risk of fire, and potential noise effects.

The military is a participant in the Flat-tailed Horned Lizard ICC and implements the conservation measures in the RMS through their INRMPs (Navy 2014, USAF and USMC 2013). "At NAFEC, any new or maintenance activities conducted within Flat-tailed Horned Lizard MAs are confined to previously disturbed areas. Work crews are trained in Flat-tailed Horned Lizard recognition and disturbance minimization. For projects which upgrade or install new infrastructure to targets, construction is limited to previously disturbed ground and a Flat-tailed Horned Lizard monitor is on site at all times to ensure that mortality is minimized" (R. Powell pers. comm., USFWS 2011). In addition, main range roads and gates have posted Flat-tailed Horned Lizard notification signs, and NAFEC is producing a Range Training Handbook that highlights Flat-tailed Horned Lizard and all natural resource concerns for those who come to train, work on, or utilize their facilities (R. Lovich pers. comm.). In addition, these lands are not open to the public, affording them greater protection from illegal OHV activity and vandalism (Muth and Fisher 1992). Furthermore, Young and Young (2000) observed that jets flying to and from the targets or dog fighting did not seem to bother the Flat-tailed Horned Lizards they were studying in at the Barry M. Goldwater Range~~eserve~~ near~~in~~ Yuma.

Overexploitation

Collecting Flat-tailed Horned Lizards for scientific and educational purposes or herpetoculture (pet trade) may have impacted populations decades ago (Stewart 1971, Turner and Medica 1982), but these practices currently are not common. Horned lizards do not make good pets in general because they are difficult to keep alive in captivity (Sherbrooke 2003), and Flat-tailed Horned Lizards are no exception (Goode and Parker 2015). In addition, sport collection of this species is illegal (Cal. Code Regs., tit. 14, § 5.60). A Scientific Collecting Permit issued by the Department is required to capture Flat-tailed Horned Lizards for scientific or educational purposes (Cal. Code Regs., tit. 14, § 650). Research on Flat-tailed Horned Lizards may have some adverse effects. Goode and Parker (2015) observed that handling associated with attaching radio transmitters appears to affect predation rates of telemetered Flat-tailed Horned Lizards. Nearly half (48.4%) of predated Flat-tailed Horned Lizards were killed within the first week of handling, and 20.3% were killed within a day of handling, indicating that there is a period of increased vulnerability to predators after handing (Ibid.). They suspect scent from the adhesive used to attach the transmitters may have alerted predators like Kit Foxes with a keen sense of smell to the lizards, although effects from handling may also play a part (Ibid.). Setser and Young (2000) attributed two telemetered Flat-tailed Horned Lizard mortalities to research. One was impaled by a marker flag while in a burrow, and one apparently overheated when its transmitter got stuck in a pile of rocks (Ibid.).

Predation

As previously described, the largest natural cause of Flat-tailed Horned Lizard mortality is predation, accounting for as much as 40-50% of the observed mortality in certain years (Goode and Parker 2015, Muth and Fisher 1992, Young and Young 2000). Increased predation by American Kestrels, Loggerhead Shrikes, and Round-tailed Ground Squirrels near urban and agricultural development has been implicated in declines in Flat-tailed Horned Lizards as far as 450 m from the habitat edge (Barrows et al. 2006, Young and Young 2005). In addition, anthropogenic structures such as power poles, transmission lines, fences, ornamental or invasive tree species, and hedgerows, located in otherwise intact habitat act as perching or nesting platforms, which can augment the populations of avian predators and provide a better vantage point for hunting.

Goode and Parker (2015) recorded far fewer Flat-tailed Horned Lizards and far more avian predators along a stretch of road with power poles than one without one. They also reported that preliminary data suggested that minimally-traveled roads alone have minimal effects on the number of Flat-tailed Horned Lizard scat present, while roads with power lines and poles had significantly less scat within the 75 m nearest to the power line, and the power pole/road effect may extend even f~~u~~arther than 150 m (Ibid.). The mean of the abundance estimates from plots adjacent to roads with power poles was nearly three times lower than the mean from plots without them. Years earlier at the same site, Young and Young (2000) reported that shrikes were commonly seen hunting from the power poles, and they found many remains of shrike-killed Flat-tailed Horned Lizards in the creosote bushes along this section of road, even though they rarely saw any live individuals there.

Flat-tailed Horned Lizards are relatively short-lived; have a low reproductive index; their populations experience wide fluctuations in abundance, likely in response to resource availability; and they are particularly sensitive to predation (Barrows and Allen 2009, Fisher 1998, FTHLICC 2003, Grimsley and Leavitt 2016, Howard 1974, Young and Young 2000).

Competition

Flat-tailed Horned Lizards are not considered to be territorial (Muth and Fisher 1992), and individuals with overlapping home ranges generally ignore or avoid one another (Young 1999). As a result, intraspecific competition for resources does not seem to be a limiting factor. Other sympatric lizards also consume ants; however, their diets are much more diverse than the Flat-tailed Horned Lizard's. While their diets and ranges overlap substantially in California, Desert Horned Lizards and Flat-tailed Horned Lizards rarely occur together because they prefer different soil types, the former being associated with coarser, more gravely and rocky substrates (Turner et al. 1980, Barrows and Allen 2009). There are no known reports of competition between Flat-tailed Horned Lizards and other types of animals.

Disease

There are few reports in the literature of parasites on Flat-tailed Horned Lizards, and none of naturally occurring diseases (Johnson and Spicer 1985). Klauber (1939) and Norris (1949) found nematodes in Flat-tailed Horned Lizards, and the latter also noted that red mites were common ectoparasites on them as well.

Comment [J39]: Sherbrooke (2003) says that as many as 75% of individuals in horned lizard populations have Nematods in their stomach. These nematods extract energy and nutrients from stomach contents. Although not specifically studied in FTHLs, most scat contain dried nematods, suggesting most FTHLs are parasitized. Just what effect this has on the lizards is unknown.

Contaminants

Although pesticides could kill harvester ants and other Flat-tailed Horned Lizard food sources, the use of aerial pesticides in the species' range is currently very limited (FTHLICC 2003, USFWS 2011). An aerial and ground-based malathion spray program to control the curly top virus occurs roughly every three years, but includes avoidance and minimization measures to limit potential effects on Flat-tailed Horned Lizards (USFWS 2011). No pesticide treatments are applied within the MAs, although use of targeted hand-applied herbicides (e.g., for tamarisk eradication projects) is allowed (FTHLICC 2003).

Invasive Species and Fire

Native plants provide seeds for harvester ants (Pianka and Parker 1975, Young and Young 2000), as well as shade and refuge from predators, and they trap the windblown sand substrate preferred by Flat-tailed Horned Lizards (Muth and Fisher 1992). Non-native plants, especially those that have become invasive, can alter landscapes and ecosystems. Several species of non-native, invasive plants are common in Flat-tailed Horned Lizard habitat, many of which are Mediterranean or Asian annual species that germinate in the winter or spring months such as Split grass (*Schismus barbatus*), Russian-thistle (*Salsola tragus*), and Sahara mustard (FTHLICC 2003). Many other non-native annual species may be present, particularly near agricultural areas and near streams or wetlands (Ibid.). Most are not adapted to the severe aridity of the Flat-tailed Horned Lizard's range and require years of heavy precipitation to rapidly proliferate (Barrows et al. 2009, Rao and Allen 2010). While these are typically temporary eruptions, more recently Sahara mustard is becoming the dominant annual plant in the Coachella Valley during non-drought years as well (CVCC 2013a).

Sahara mustard is a highly invasive annual plant that is locally abundant in some years throughout portions of the Flat-tailed Horned Lizard's California range. It is most common in wind-blown sand deposits and disturbed sites such as roadsides and abandoned fields (Minnich and Sanders 2000). It was first collected in North America in 1927 in the Coachella Valley (Ibid.), where its impacts on Flat-tailed Horned Lizards and other flora and fauna have been the focus of many studies (Barrows and Allen 2010, Barrows et al. 2009, CVCC 2013b, Hulton VanTassel et al. 2014). Minnich and Sanders (2000) speculate that Sahara mustard's rapid spread through the Sonoran Desert may be related to the fact that, during rains, a sticky gel forms over the species' seed case that adheres to animals as well as automobiles. In this way, on- and off-road vehicles may be accelerating the spread of this invasive species.

Sahara mustard cover appears to influence both community structure and the extent to which arthropods (including ants) inhabit multiple aeolian (wind-blown) sand habitats within the Coachella Valley (Hulton VanTassel et al. 2014). In the Coachella Valley, Sahara mustard has been found to retard Flat-tailed Horned Lizard population growth (CVCC 2013a). In dunes, Flat-tailed Horned Lizards prefer stabilized areas~~sand dune habitats~~ (Barrows and Allen 2009), but since the most recent explosive mustard growth event in 2005, they have been found more frequently on active sand dunes, a habitat type they typically rarely occupy, where mustard growth is limited (CVCC 2013b). Juvenile Flat-tailed Horned Lizards were found to be 10% smaller on stabilized sand fields as compared to active dunes, potentially due to limited food resources (primarily ants) in areas dominated by mustard (Ibid.). Possible other reasons for this include reduced mobility as a result of dense mustard growth and increased soil compaction due to mustard inhibiting aeolian sand movement (CVCC 2013b). Mustard has been implicated as the cause for a Flat-tailed Horned Lizard population response similar to one during drought conditions, despite recent years with average or above average rainfall (CVCC 2013b).

Creosote bush scrub habitat throughout the southern Californian desert has also been invaded and subsequently altered by nonnative annual grasses (Brown and Minnich 1986, Lovich and Bainbridge 1999, Rao and Allen 2010, Steers and Allen 2011). Invasive annual grasses are known to increase the extent, frequency, and severity of natural fire regimes throughout desert shrublands (Abatzglou and Kolden 2011; Brown and Minnich 1986; Rao and Allen 2010; Steers and Allen 2010, 2011). Though fire is rare in the Colorado Desert (Figures 14 and 15), the exception may be the very northwestern edge of the Flat-tailed Horned Lizard's range in the Coachella Valley, which is "a major wildland-urban interface area that has been significantly impacted by atmospheric nitrogen deposition concomitant with fuel alterations from invasive annual grasses and increased ignition frequencies from human activities" (Steers and Allen 2011). Post fire recovery of desert shrublands has been studied here, demonstrating that species composition shifts, and long-lived native species like creosote bush and white bursage that are important to Flat-tailed Horned Lizards struggle to recover (Steers and Allen 2011).

In addition to non-native plants, non-native ants have been implicated as a potential threat to Flat-tailed Horned Lizards. Native ants within the Flat-tailed Horned Lizard's range, primarily harvester ants, are adapted to desert conditions (Pianka and Parker 1975). The exotic vegetation, changes in soil condition, and extra moisture associated with the edges of human development (agriculture, irrigation canals, and urban areas) can facilitate invasion by Argentine ants (*Linepithema humile*) and other non-natives, resulting in displacement of native ants (Suarez et al. 1998). In California, red fire ants (*Solenopsis invicta*) frequently build mounds on irrigated turf or nest in places such as rotten logs, walls of buildings, under sidewalks, and in outdoor electric and water utility boxes (Greenberg and Kabashima 2013). Barrows and Allen (2009) reported that Argentine ants and red fire ants have invaded the Coachella Valley, but not Flat-tailed Horned Lizard habitat, which they presume is the result of a barrier created by hyper-arid conditions.

Comment [J40]: This phenomenon occurs elsewhere in the Sonoran Desert – such as at East Mesa where a Schismus-fueled fire burned ~3600 acres of FTHL lizard, within the MA, in 1992 (see the RMS for more info). Creosote has still not completely recovered.

Comment [J41]: Schismus and some other non-native plants can be so dense as to make it difficult for a wide-bodied lizard like a horned lizard to move through it. This will slow it down and potentially make it more susceptible to predation.

Drought and Climate Change

California entered what has become an historic drought in 2011. A similarly severe event has not occurred in the last 1200 years (Griffin and Anchukaitis 2014). Seager et al. (2007) reported broad consensus among climate models that the transition to a more arid American Southwest is already underway, and that if the models are correct, droughts will become the new norm. Empirical data over the last century confirm the Sonoran Desert warming trends in winter and spring, decreased frequency of freezing temperatures, lengthening of the freeze-free season, and increased minimum temperatures per winter year (Weiss and Overpeck 2005). In addition, variability in cool season rainfall (i.e., when the majority of precipitation within the Flat-tailed Horned Lizard's California range falls) is increasing (Abatzoglou and Kolden 2011). These changes in temperature and precipitation are already driving shifts in vegetation in the Sonoran Desert, including a decrease in creosotebush and increase in invasive grasses (Kimball et al. 2010, Munson et al. 2012, Weiss and Overpeck 2005).

Comment [J42]: In the Sonoran Desert, there have also been a recent increase in catastrophic freezes (2007, 2011 and 2013) that killed or froze back many plant species of tropical origin. So temperature fluctuation, as well as warming may be in the future for our area.

While the Flat-tailed Horned Lizard is adapted to one of the most arid places in the country, it may nevertheless be at greater than average risk of localized extinctions from prolonged droughts due to its small geographic range, specialized diet, low reproductive index, short lifespan, and increasing habitat fragmentation (USFWS 1993, Barrows and Allen 2009). Populations of Coachella Valley Fringe-toed Lizards have already lost substantial genetic diversity since the last drought (Vandergast et al. 2016). The Flat-tailed Horned Lizard has the highest measured active body temperature of *Phrynosomids* in the United States (Pianka and Parker 1975) and, like other desert-adapted reptiles, may already approach its physiological tolerances (Young and Young 2000, Barrows 2011). During a drought in the Yuma Desert that began in 1996, Flat-tailed Horned Lizards lost weight and reproductive output was low before the drought broke in late 1997. Scat in 1997 contained only half as many ants during wetter periods (Young and Young 2000). There are only two mechanisms for a species to persist in the face of climate change: given enough time and unobstructed ability to move, dispersal to a more favorable thermal environment (typically north or higher elevation) may be possible; otherwise, it will have to behaviorally and/or physiologically adapt (Sinervo et al. 2010).

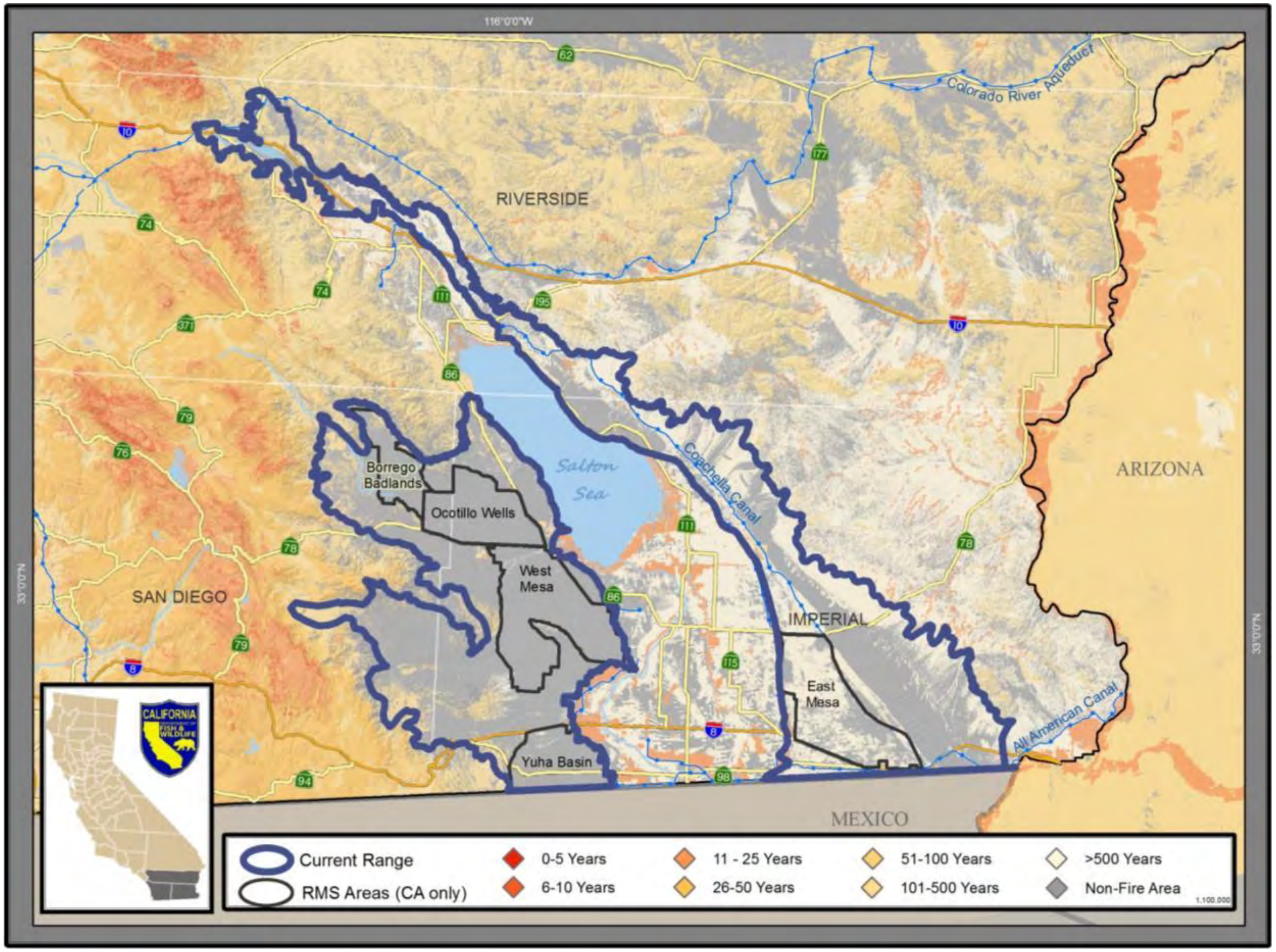


Figure 14. Mean Fire Return Interval within and around the Flat-tailed Horned Lizard's California Range

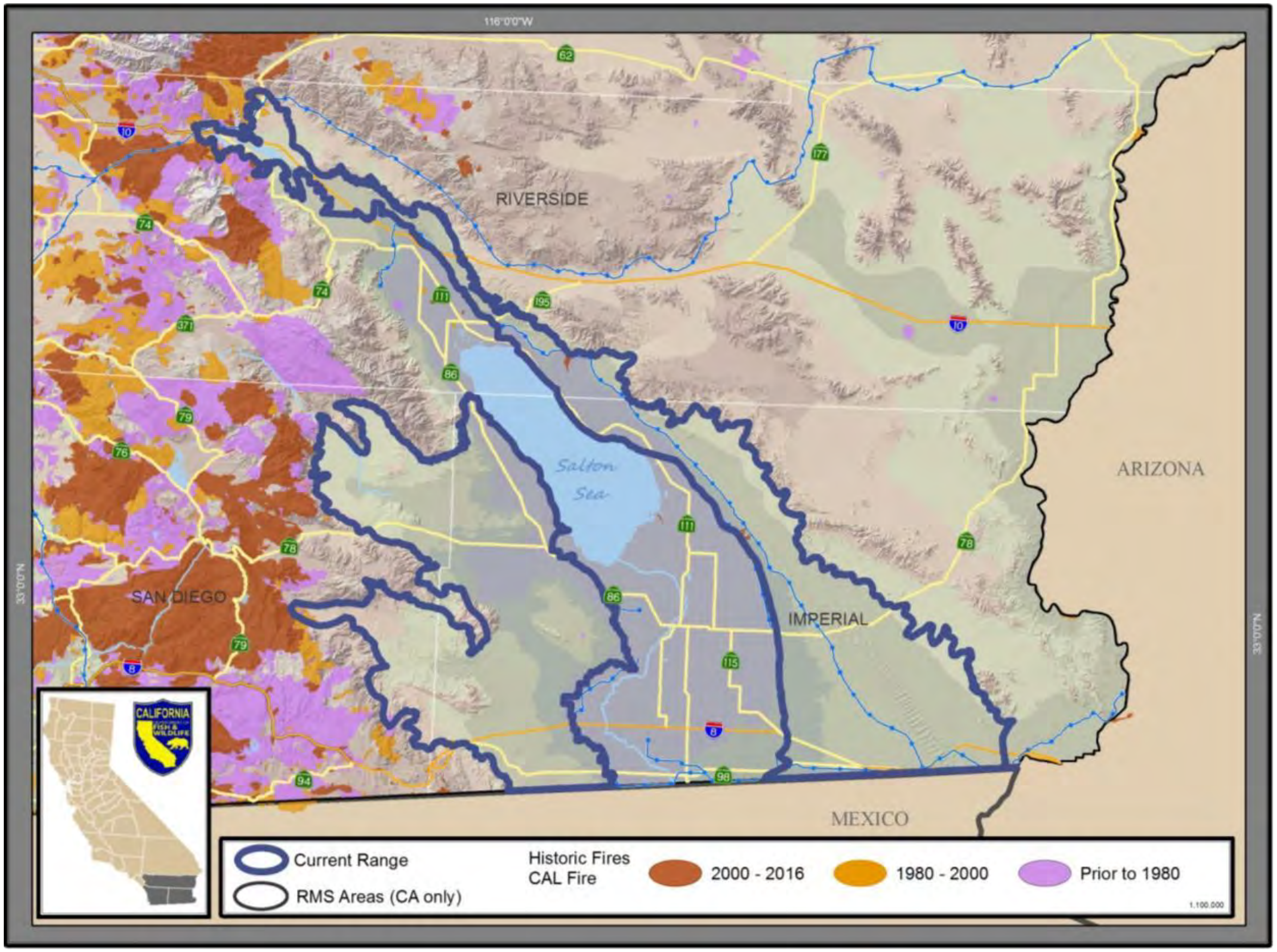


Figure 15. Historic Large Fires within and near the Flat-tailed Horned Lizard's California Range

Comment [J43]: You are missing the 1992 ~3600 acre fire in East Mesas. It was mostly (or entirely) south of Hwy 78 but west of the Coachella Canal.

Flat-tailed Horned Lizards in California are located at the farthest northern extent of their range, and the populations in the Coachella Valley are already extremely small and fragmented. The species' range boundary in California is surrounded by mountains and unsuitable habitat (i.e., rocky substrate). Even with a relatively short generation time, given the predicted pace of climate change in the region, it is unlikely the species will be able to migrate upwards and adapt to a different substrate and vegetative community in time. Behavioral strategies to cope with rising temperatures include spending more time in the shade or in a burrow, which leaves less time available for foraging and mating (Sinervo et al. 2010). In addition to adult lizards being at greater risk of reaching a critical thermal maximum, embryos in the nest will be subjected to increasingly higher temperatures and may exceed their critical thermal maximum temperature more often (Levy et al. 2015). Flat-tailed Horned Lizards have been shown to burrow substantial depths (90 cm) to reach the zone of soil moisture in drought situations (Young and Young 2000), so they may be able to adjust in that way, but the fate of hatchlings that are buried that far below the surface is unknown. They could also potentially lay nests in a greater amount of shade, but as climate change appears to be favoring invasive grasses over native shrubs (Abatzoglou and Kolden 2011, Munson et al. 2012), this may become a scarcer option.

Comment [J44]: It is adapted to fine, loose sand in valleys. There is no place to go. This species is not going to move upslope.

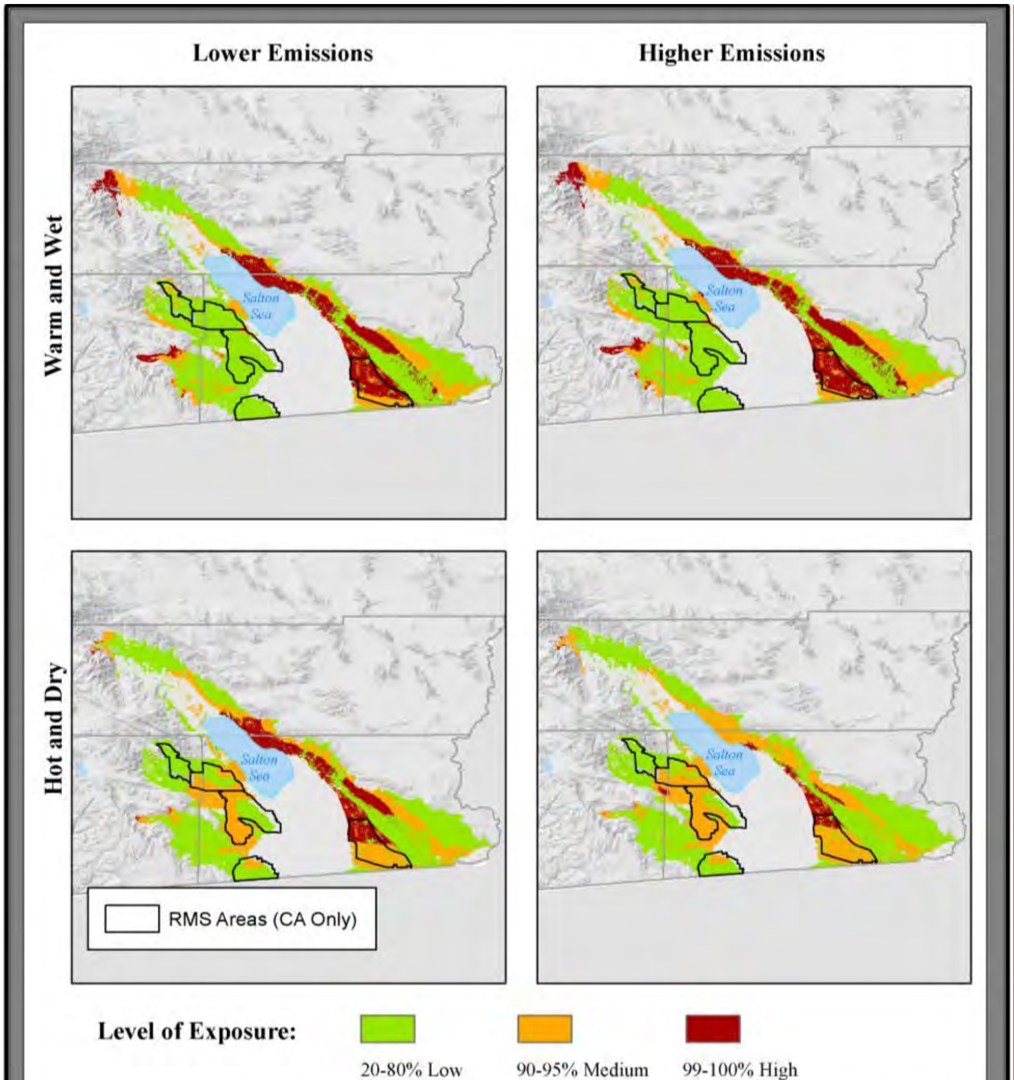
Two studies of potential climate change risk to Flat-tailed Horned Lizards have been undertaken. Wright et al. (2013) used an ecological niche model built with Flat-tailed Horned Lizard locality data (from California and Arizona, not Mexico) and several climate change scenarios to predict the climatic suitability of the species' range at 2050. There was overwhelming consensus among the models that predicted Flat-tailed Horned Lizard habitat remaining fairly stable to that date (Ibid.); however, this analysis did not take changes in habitat into account. The Department modeled the relative environmental stress a vegetative community would undergo given different climate scenarios in the short-term (2039) and long-term (2099) (Figures 16 and 17). It appears in the short-term, if the climate is hot and dry, Flat-tailed Horned Lizard habitat will undergo less stress than a warm and wet climate (Figure 16), but by 2099, large portions of the species' range will be under extreme stress and may no longer support the viable habitat (Figure 17).

Comment [J45]: You need to look closely at that model. FTHLs do better in wetter periods (see discussions above and results from ICC study plots).

Climate change is likely to adversely impact most native species over time. Flat-tailed Horned Lizard populations already experience dramatic fluctuations over time, typically in response to rainfall and its effect on resource availability. Setser and Young (2000) observed Flat-tailed Horned Lizards putting on weight rapidly and engaging in courtship and mating almost immediately after a series of monsoonal rains that increased ant availability. Drought conditions reduce harvester ant abundance and activity, which reduces reproduction in a species with already very low reproductive output (Howard 1974, Young and Young 2000). In addition, drought effects may also place Flat-tailed Horned Lizards at greater risk from OHV-related mortality since it appears Flat-tailed Horned Lizards with lower body mass enter hibernation later in the year (Grant and Doherty 2009). Given its short lifespan and already low reproductive potential, prolonged droughts are very likely to cause decreases in population size that amount to loss of genetic diversity, the same diversity necessary to adapt to a rapidly warming environment.

Comment [J46]: Often when conditions are very dry there are almost no harvester ants active. Get some rainfall, and they are everywhere.

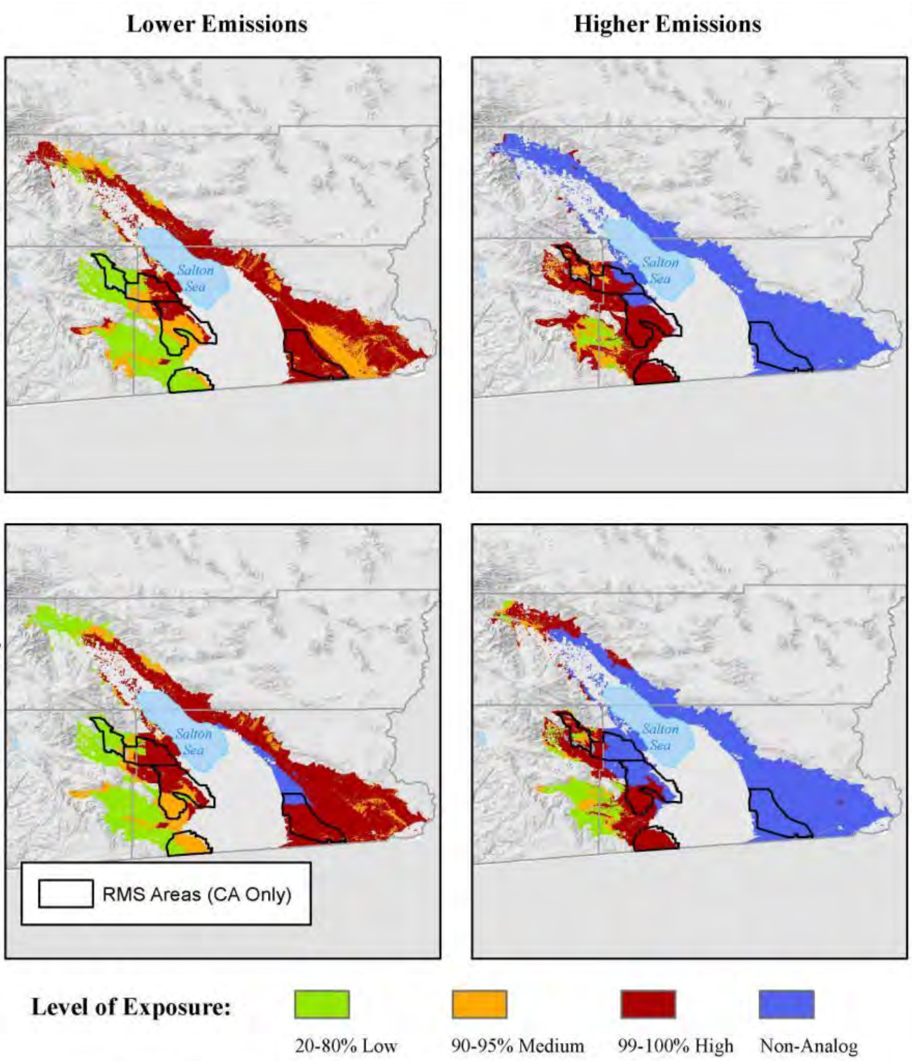
Comment [J47]: They are at risk, regardless.



Mapped Climate Exposure of FTHL Habitat Under Four Near-term (2039) Climate Projections. This image shows areas of suitable FTHL habitat within the species range based on California Wildlife Habitat Relationships (CWHR 2016) and a statewide best-available vegetation map (FVEG2015, FRAP 2015), and climate exposure scores for vegetation macrogroups from Thorne et al. (2015). High (>95% exposure) are highly stressed areas; Moderate (80-95% exposure) are stressed areas, and Low (<80% exposure) are areas expected to remain climatically suitable for the vegetation that currently occupies them. "Warm and Wet" = CNRM CM5, Hot and Dry" = MIROC ESM, Lower Emissions = RCP 4.5, and Higher Emissions = RCP 8.5.

Figure 16. Predicted Climate Change Impacts to Habitat in 2039

Comment [J48]: Without more explanation of how this work was done, these two Figures are not very insightful. I do not know what many of the acronyms mean in the legends.



Mapped Climate Exposure of FTHL Habitat Under Four End-of-Century (2099) Climate Projections. This image shows areas of suitable FTHL habitat within the species range based on California Wildlife Habitat Relationships (CWHR 2016) and a statewide best-available vegetation map (FVEG2015, FRAP 2015), and climate exposure scores for vegetation macrogroups from Thorne et al. (2015). High (>95% exposure) and Non-Analog (outside the bounds of current California climate) are highly stressed areas; Moderate (80-95% exposure) are stressed areas, and Low (<80% exposure) are areas expected to remain climatically suitable for the vegetation that currently occupies them. "Warm and Wet" = CNRM CM5, Hot and Dry" = MIROC ESM, Lower Emissions = RCP 4.5, and Higher Emissions = RCP 8.5.

Figure 17. Predicted Climate Change Impacts to Habitat in 2099

PROTECTION AFFORDED BY LISTING

It is the policy of the state to conserve, protect, restore and enhance any endangered or any threatened species and its habitat. (Fish & G. Code, § 2052) The conservation, protection, and enhancement of listed species and their habitat is of statewide concern (Fish & G. Code, § 2051(c).) CESA defines "take" as hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill. (Fish & G. Code, § 86.) The Fish and Game Code provides the Department with related authority to authorize "take" under certain circumstances through incidental take permits, memorandum of understandings, natural community conservation plans, or other plans or agreements approved by or entered into by the Department. (Fish & G. Code, §§ 2081, 2081.1, 2086, 2087 and 2835.) Any person violating the take prohibition would be punishable under State law.

Approximately 77% of the Flat-tailed Horned Lizard's range in California is owned or managed by the RMS participating agencies. Implementation of the RMS includes, in most circumstances, requiring compensatory mitigation for long-term, unavoidable impacts to Flat-tailed Horned Lizard habitat within MAs whether the site is occupied or not. This compensatory mitigation is used to purchase private lands, which are turned over to the BLM for management, or it is used to fund RMS activities like habitat restoration.

Comment [J49]: It seems as though the greatest benefits of CESA listing would be in areas outside of MAs and the HCP area in the Coachella Valley.

If the Flat-tailed Horned Lizard were listed under CESA, impacts of take caused by activities authorized through incidental take permits must be minimized and fully mitigated according to state standards. These standards include protection of the land in perpetuity with an easement, development and implementation of a species-specific adaptive management plan, and funding through an endowment to pay for long-term monitoring and maintenance to ensure the mitigation land meets performance criteria. Because the RMS is voluntary, the participating agencies often struggle with funding and staffing to carry out the RMS activities in spite of the compensatory mitigation funding received. Additionally, the lands within it continue to be multiple-use under the BLM's management. However, mitigation lands required under CESA would be expected to guarantee protection and level of habitat quality for a longer time.

Comment [J50]: True, but that does not affect regulations and mitigation requirements. It mostly affects monitoring.

Comment [J51]: Only on BLM lands. Military and Anza Borrego DSP are not multiple use.

Additional protection of Flat-tailed Horned Lizard following listing would occur with required public agency environmental review under CEQA and its federal counterpart, the National Environmental Policy Act (NEPA). CEQA and NEPA both require affected public agencies to analyze and disclose project-related environmental effects, including potentially significant impacts on endangered, rare, and threatened special status species. In common practice, potential impacts to listed species are examined more closely in CEQA and NEPA documents than potential impacts to unlisted species.

Comment [J52]: Many actions by the Border Patrol are exempted from NEPA and other laws. USBP has often ignored compliance for actions such as patrols.

Under CEQA's "substantive mandate," state and local agencies in California must avoid or substantially lessen significant environmental effects to the extent feasible. (Pub. Resources Code, § 21080; Cal. Code Regs., tit.14., §§ 15002 & 15021). With that mandate and the Department's regulatory jurisdiction, the Department expects related CEQA and NEPA review will likely result in increased information regarding the status of Flat-tailed Horned Lizard in California due to, among other things, updated occurrence and abundance information for individual projects. Where significant impacts are identified under CEQA, the Department expects required project-specific avoidance, minimization, and mitigation measures will benefit the species. State listing, in this respect, and required consultation with the Department during state and local agency environmental review under CEQA, would also be expected to benefit the species in terms of related impacts for individual project that might otherwise occur absent listing.

Unlike many other species whose listing under CESA may increase interagency coordination and the likelihood that State and federal land and resource management agencies will allocate funds towards protection and recovery actions, the participating agencies already meet and coordinate regularly to strategize how best to implement the RMS. When sufficient funding and staffing are available, these actions include monitoring, specific research studies, acquisition of private inholdings, and habitat restoration (among other things). As mentioned previously in Existing Management, the RMS has already been codified into the BLM's land use plans for the East Mesa, West Mesa, and Yuha Desert MAs through adoption of ACECs in the CDCA, as well as the Department of Defense's properties through their INRMPs, making these conservation measures mandatory. In other areas, if the Flat-tailed Horned Lizard is listed under CESA, it is possible some, or all, aspects of RMS implementation will be abandoned or reduced in priority to focus limited funding and staffing on mandatory CESA-compliance.

Comment [J53]: There has always been enough staffing to implement mitigation and compensation, and BLM, Anza Borrego, and the military have at least some law enforcement staff to enforce vehicle and other regulations in the MAs (although it falls short in some cases – see comment j31.

Comment [J54]: The only other area left is the Borrego Badlands MA. I doubt if they would have much CESA compliance to fret about. Outside of MAs, though, CESA would provide additional benefit. Outside of MAs, the RMS provides only mitigation and compensation on signatory lands.

Also, unlike other species that may benefit from CESA listing by having a greater likelihood of being incorporated into large-scale conservation and planning documents like Habitat Conservation Plans and Natural Community Conservation Plans, the Flat-tailed Horned Lizard is already a covered species (or proposed to be covered as an "individual focal species" in the case of the DRECP/BLM LUPA) throughout its entire range in California for the vast majority of projected development impacts (i.e., urban and agricultural in Coachella Valley and renewable energy throughout the rest of the range). The exceptions would be any future development on local government and private lands in San Diego and Imperial counties, which while not amounting to a large proportion of the Flat-tailed Horned Lizard's range, could have large impacts on the species' connectivity to the limited remaining habitat in the north if the areas along the Salton Sea are developed. The DRECP does not provide CESA take coverage but does implement the RMS, which contains measures on BLM lands that extend beyond mitigation for projects that would result in take of Flat-tailed Horned Lizards.

A further potential challenge to implementing CESA protections for the Flat-tailed Horned Lizard is the scarcity of private land within the species' range that could be used for compensation~~mitigation~~. A recent option to use BLM land for CESA compensation~~mitigation~~ has become available through an agreement entered into by the Department and BLM in 2015, referred to as the Durability Agreement (BLM and CDFW 2015). If mutually agreeable between the two agencies, CESA compensatory mitigation actions could be implemented on BLM Conservation Lands (e.g., ACECs and Wilderness Areas), including restoration of habitat and movement corridors, rehabilitation of closed roads, predator control, invasive plant species removal and control, and additional law enforcement (Ibid.).

SUMMARY OF LISTING FACTORS

CESA directs the Department to prepare this report regarding the status of Flat-tailed Horned Lizard based upon the best scientific information available to the Department. CESA's implementing regulations identify key factors that are relevant to the Department's analyses. Specifically, a "species shall be listed as endangered or threatened ... if the Commission determines that its continued existence is in serious danger or is threatened by any one or any combination of the following factors: (1) present or threatened modification or destruction of its habitat; (2) overexploitation; (3) predation; (4) competition; (5) disease; or (6) other natural occurrences or human-related activities." (Cal. Code Regs., tit. 14, § 670.1, subd. (i)(1)(A).)

The definitions of endangered and threatened species in the Fish and G. Code provide key guidance to the Department's scientific determination. An endangered species under CESA is one "which is in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, over exploitation, predation, competition, or disease." (Fish & G. Code, § 2062.) A threatened species under CESA is one "that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of special protection and management efforts required by [CESA]." (Id., § 2067.)

The following summarizes the Department's determination regarding the factors to be considered by the Commission in making its decision on whether to list the Flat-tailed Horned Lizard. This summary is based on the best available scientific information, as presented in the foregoing sections of the report.

Present or Threatened Modification or Destruction of Habitat

Agricultural and Urban Development

While agricultural development has reduced and fragmented available habitat, this impact is fairly concentrated down the middle of the Flat-tailed Horned Lizard's range in California and is not expected to increase in any significant way in the future. Flat-tailed Horned Lizards have already disappeared from most historically occupied sites in the Coachella Valley over the past 30 years due to agricultural and urban development (CVCC 2013a), threatening the species' long-term persistence in this area. Another threat is posed by the proposed future urban development in Imperial County (County of Imperial 2013) along the shores of the Salton Sea, particularly on the east side, which could eliminate the only potential habitat corridor between the population east of the Imperial Valley and the Dos Palmas population.

Renewable Energy Development

Expansion of renewable energy development is expected to continue within the Flat-tailed Horned Lizard's range, and Phase I of the DRECP (i.e., the BLM LUPA), if implemented, is expected to reduce impacts to the species by focusing most of the impacts on or near existing disturbed areas and existing transmission lines as opposed to relatively undisturbed open desert. However, the lack of county and city participation in the plan could compromise its efficacy if relatively undisturbed private and local government managed lands are developed.

Mining

It appears that sand and gravel mining are the most common mining activities currently in operation within the Flat-tailed Horned Lizard's range, but the area available for mineral extraction in Imperial County is largely depleted (BLM 2011). In addition, oil, gas, and gold exploration have proven unprofitable. Therefore, the threat to Flat-tailed Horned Lizards posed by mining is considered relatively small.

Off-highway Vehicles

Where OHV use intensity is so great that it substantially reduces shrubs or prey, particularly in areas where these habitat features may already be scarce, Flat-tailed Horned Lizard, it may pose a threat to the species. The extent to which these changes in vegetation and prey have occurred as a result of OHV activity across the Flat-tailed Horned Lizard's range is unknown since very few focused surveys have detected a demonstrable connection between OHV activity and Flat-tailed Horned Lizard abundance.

United States-Mexico Border Activities

While there are likely some adverse effects arising from road mortality and increased avian predation within a short distance from the border fence, there also appear to be some benefits from it including reduced habitat damage from illegal border crossing. Additionally, the fencing used in California does not appear to create a barrier to movement or gene flow. Border activities do not appear to pose a serious threat to Flat-tailed Horned Lizards.

Military Activities

The vast majority of Flat-tailed Horned Lizard habitat on military lands is protected and managed in a way to conserve the species, so military activities do not appear to pose a significant threat to them at present.

Overexploitation

Collecting for the pet trade does not appear to be a current threat, although some evidence exists that the listing process alone can increase the likelihood of it becoming a threat due to the human disposition to place exaggerated value on rare or "off limits" species (Courchamp et al. 2006). Illegal commercial collection of Flat-tailed Horned Lizards likely would not be very difficult due to the common observation among researchers that they frequently use, and are highly visible on, roads compared to on native substrates, and tend to freeze instead of flee. However, their renowned difficulty to keep alive in captivity may negate this potential threat. While there may be increased mortality due to research activities, these take place over a very small portion of the species' range, and the beneficial information derived from them outweighs the minimal threat they may pose to Flat-tailed Horned Lizard populations. There is no evidence to suggest Flat-tailed Horned Lizards are or will be substantially threatened by overexploitation.

Predation

Anthropogenic increases in predation pose a threat to Flat-tailed Horned Lizards, but the severity of the threat likely depends on the vulnerability of the Flat-tailed Horned Lizard population (e.g., small and isolated in Thousand Palms, Coachella Valley vs. large and intact in East Mesa MA) and the surrounding land use. For example, the effect of predation along the edge of urban or agricultural development appears to be greater than it is along a powerline in the middle of the desert because the former provides more subsidized resources. Given

Comment [J55]: This sentence needs work.

Comment [J56]: I believe this understates the threat for reasons I've given above. A well-planned out study with control and experimental plots that follows populations over time has not been done.

Comment [J57]: I disagree. BP on road and off-road activity is much greater than vehicle activity ever was from illegals and drug smugglers. BP activity is not limited to the border and it cannot be regulated like other agency actions.

Comment [J58]: DOD and other federal agencies are currently doing a pretty good job implementing the RMS. It is not appropriate to engage in political speculation in a document such as this, however, the USA at the federal level may be at a turning point, in which priorities on DOD and other federal lands may change. The results of the November election could be telling. So if the CDF&W decision is to not list the FTHL, you may want to revisit that decision in the future.

development is relatively concentrated within the Coachella and Imperial Valleys, this area of heightened predation comprises a small fraction of the Flat-tailed Horned Lizard's range.

Competition

There is no evidence to suggest that competition threatens Flat-tailed Horned Lizards.

Disease

There is no evidence to suggest that disease threatens Flat-tailed Horned Lizards.

Other Natural Events or Human-Related Activities

Fragmentation, Edge Effects, and Small Populations

Currently large expanses of relatively intact habitat remain within the Flat-tailed Horned Lizard's range in California outside of the Coachella Valley. While habitat fragmentation, edge effects, and small population sizes may pose serious threats to Flat-tailed Horned Lizards in portions of their California range, the degree to which this would significantly adversely impact the species as a whole is uncertain. How and where future development is constructed will affect the severity of this threat.

Roads, Canals, and Railroads

Major roads, canals, and railroads may pose a serious threat to Flat-tailed Horned Lizards through habitat fragmentation and/or edge effects. In addition, mortality associated with major roads could create a localized population sink on both sides of the road. Minor, lightly travelled roads (including OHV trails), especially those without associated power poles or other human-provided perches, ~~likely~~ contribute to some mortality but the degree to which Flat-tailed Horned Lizard populations are affected is unknown~~also likely do not pose a serious threat to Flat-tailed Horned Lizards~~.

Contaminants

There is no evidence to suggest that herbicides, pesticides, or other contaminants pose a significant threat to Flat-tailed Horned Lizards.

Invasive Species and Fire

Invasive species like Sahara mustard appear to be playing a role in Flat-tailed Horned Lizard declines in portions of the species range (e.g., the Coachella Valley). *Schismus* fueled a large fire in the East Mesa MA, but how or if it affected Flat-tailed Horned Lizard populations is unknown. The degree to which invasive plants are having population-level impacts, either alone or in conjunction with other factors, throughout other parts of the species' range in California is unknown. While invasive grasses increase the risk of fire, this threat has not been observed within the Flat-tailed Horned Lizard's range with the exception of East Mesa and the Coachella Valley, the later of which is located in a major wildland-urban interface area (Steers and Allen 2011). In the Coachella Valley, the Flat-tailed Horned Lizard could be at risk of local extinction due to the interaction of both invasive plant species and climate change (CVCC 2013a). Non-native ants do not appear to pose a threat to Flat-tailed Horned Lizards.

Drought and Climate Change

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Drought, in combination with other factors such as habitat fragmentation and degradation, and climate change appear to pose a serious threat to Flat-tailed Horned Lizards.

LISTING RECOMMENDATION

[Note to readers: This section will be completed after external peer review.]

MANAGEMENT RECOMMENDATIONS

These recommendations were developed by the Department in accordance with the requirements of Fish and Game Code, section 2074.6. The Department recommends these actions be implemented regardless of the Commission's decision on listing Flat-tailed Horned Lizard as threatened or endangered. This list includes recommendations for actions that could be undertaken by the Department as well as by other public agencies, non-governmental organizations, and private land owners.

Revisit Flat-tailed Horned Lizard Status in Three to Five Years

Several research and planning efforts are in progress that are expected to provide additional insights into the status of the Flat-tailed Horned Lizard in California in the next three to five years. For example, in that time, at least preliminary results from the following studies should be available: landscape genomics, population viability analysis, habitat connectivity along the east side of the Salton Sea, and the extent to which avian predation that is subsidized by anthropogenic features or actions is affecting Flat-tailed Horned Lizard mortality rates. In that time, it is likely the OWSVRA General Plan will be prepared and potentially implemented. The degree to which Flat-tailed Horned Lizards are addressed and afforded protection in that plan is expected to contribute to either the conservation or decline of the species into the future. Additionally, in that time, a Record of Decision on the BLM LUPA should have been published, so at least a few years of implementation of its measures will be available to better determine to what degree the potential threats and benefits to Flat-tailed Horned Lizards are realized. In addition, the species currently is experiencing what appears to be a widespread drought-related decline in abundance. The next three to five years will likely reveal whether the species can rebound from prolonged drought or not. If the data indicate a change in status is warranted, the Department should prepare the appropriate document to address that change.

Comment [J59]: Note. Barry Sinervo's lab (Rafa Lara) is about to embark on a study to model the effects of climate change on FTHL.

Increase Department Participation in RMS Implementation

Like the other participating agencies, the Department's contribution to Flat-tailed Horned Lizard conservation through implementation of the RMS is subject to funding and staffing availability. The Department should increase its participation in implementation of the RMS, including working with partners to identify outside funding opportunities (e.g., State Wildlife Grants) and providing staff to assist with population monitoring, habitat restoration, education and outreach, and international coordination and collaboration.

Improve Population Monitoring Methods

Comment [J60]: It would also be good to repeat disturbance monitoring in the MAs. Are OHVs still disturbing ~10% of the surface area in MAs? As I've said before, that is a lot.

Investigate the use of scent detection dogs in Occupancy and Demography surveys to increase detectability, which may greatly reduce duration and number of personnel necessary to achieve reliable estimates of distribution and abundance. Encourage annual budgeting by participating agencies to fully fund population monitoring efforts on the MAs and RA and expand them to other parts of the range for comparison. In addition to collecting data on Flat-tailed Horned Lizards, data on environmental covariates should also be collected such as habitat quality, predators and prey, and anthropogenic threats, so that an informed adaptive management strategy can be developed. Investigate whether stressor monitoring may be more cost-effective and better able to inform management decisions.

Comment [J61]: This has been done informally without any success. But its worth a try. The work is often done when its really hot. Could be tough on a dog. Although I have never understood why the work isn't done earlier in the year when the lizards are active most of the day instead of mornings and evenings.

<u>Increase Habitat Quality and Quantity</u>

Restore areas degraded by OHVs, ~~and~~ mining, and agriculture. Increase patrol of areas and cite illegal cross-country OHV or other public trespass in closed or limited use areas. Immediately obscure and/or restore any new unsanctioned trails. Decommission powerlines or other anthropogenic structures that provide perches for avian predators. Remove or trim hedgerows along roads that attract avian predators. To the extent feasible, remove or reduce the abundance and extent of non-native grasses, Sahara mustard, and other invasive species. Clean up illegally dumped material as quickly as possible.

Comment [J62]: This doesn't work where Border Patrol is active. They'll just drive over restored areas.

Comment [J63]: What about investigating deterrents to perching? It works to some degree for raptors.

Comment [J64]: Probably futile unless biological control is developed, which may have its own innate problems.

<u>Reduce Habitat Fragmentation and its Effects</u>

Investigate how barriers may be limiting gene flow across the species' range. Use this information to protect important habitat linkages and movement corridors such as Yuha Basin to West Mesa and East Mesa to Dos Palmas. Try to improve seemingly broken linkages, such as by creating effective road and canal crossings. Continue to purchase private inholdings within the larger public land matrix. Coordinate with and assist the Mexican government on Flat-tailed Horned Lizard conservation across the border. Implementers of the RMS and CVMSHCP should coordinate on reestablishing connectivity. If necessary, develop an assisted migration and or repatriation strategy to address loss of diversity and local extirpations.

Comment [J65]: There is never mention of the "Frink" FTHL observations, which are between Dos Palmas and northern East Mesa. Is that population still extant? Has anyone looked in the intervening areas? There appear to be very little potential habitat in this possible corridor along the Coachella Canal east and north of Niland, and northwest of Dos Palmas/east of Mecca. It seems likely that the habitat connection between the Coachella Valley and the Imperial Valley on that side of the Salton Sea is already severed.

Comment [J66]: This is the first mention of actions outside of California. Are you thinking that if populations are maintained south of the border, they will help bolster FTHL in California?

<u>Reduce Habitat Loss and Edge Effects from Renewable Energy Projects</u>

Encourage siting renewable energy development outside of the desert completely (see Hernandez et al. 2015) or if within the Flat-tailed Horned Lizard's range, make sure it is located on compatible lands (e.g., near existing transmission line on agricultural lands). Limit the amount of new transmission lines by encouraging construction of a single line with additional capacity for future expansion. Bury lines whenever possible. Close (permanently or temporarily) areas to OHVs that are losing shrub cover.

<u>Further Investigate the Impacts of Relocation</u>

To date, only one study has simultaneously investigated the effects to relocated and resident Flat-tailed Horned Lizards where relocations have occurred (Goode and Parker 2015). Large numbers of Flat-tailed Horned Lizards are relocated out of harm's way on construction projects, and their fate, as well as the fate of the recipient populations, is not well understood. Exclusion fencing may be somewhat useful in reducing mortality; however, it requires continuous maintenance that may limit its utility. Research in this area should develop relocation plans that take the recipient population's density and the habitat quality into account. Develop a strategy that is informed by landscape-level genetics, to relocate Flat-tailed Horned Lizards to restored or apparently suitable, but unoccupied, habitat, even if it is located relatively far from the project site and monitor the results.

Comment [J67]: The observation previously made that FTHLs are colonizing old agricultural fields suggests some potential for reclaiming habitat and rebuilding populations.

Modify the Mitigation and Compensation Strategy

Purchase and/or set aside lands specifically for Flat-tailed Horned Lizard conservation in high quality habitat, where~~as~~ few threats ~~as possible~~ exist (i.e., closed to OHV, far from human development, roads, and power lines). Use compensation funds to create an endowment, or higher interest earning account, that pays for routine management, maintenance, and monitoring of these sites and their populations.

Comment [J68]: A good idea perhaps once all the lands within the MAs are acquired. But it would take a huge endowment to fund these RMS activities. Sharing the funds among agencies would be an administrative challenge.

ECONOMIC CONSIDERATIONS

The Department is charged in an advisory capacity in the present context to provide a written report and a related recommendation to the Commission based on the best scientific information available regarding the status of Flat-tailed Horned Lizard in California. The topic areas and related factors the Department is required to address as part of that effort are biological and not economic. (See Fish & G. Code, § 2074.6; Cal. Code Regs., tit. 14, § 670.1, subd. (f).)

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Personal Communications

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Rodriguez, M. Electronic mail received June 15, 2016.

Ronning, C. Electronic mail received April 26, 2016.

APPENDIX 1. Flat-Tailed Horned Lizard Rangewide Management Strategy, 2003 Revision

[In the final version, the entire document will be inserted, but since this is Word, not PDF, I'm just providing this page. Use the link within the narrative to download the 2003 RMS: https://www.wildlife.ca.gov/Regions/6/Flat-Tailed-Horned-Lizard-Copy]

APPENDIX 2. List of Acronyms and Abbreviations

ac	acre
ACEC	Area of Critical Environmental Concern
BLM	United States Bureau of Land Management
C	Celsius
CDCA	California Desert Conservation Act
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
cm	centimeter
CMA	Conservation and Management
CNDDB	California Natural Diversity Database
Commission	California Fish and Game Commission
CVMSHCP	Coachella Valley Multiple Species Habitat Conservation Plan
CWHR	California Wildlife Habitat Relationships
Department	California Department of Fish and Wildlife
DFA	Development Focus Areas
DRECP	Desert Renewable Energy Conservation Plan
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ESA	Endangered Species Act (federal)
F	Fahrenheit
FLPMA	Federal Land Policy and Management Act
ft	feet
hr	hour
ha	hectare
HCP	Habitat Conservation Plan
ICA	Interagency Conservation Agreement
in	inch
INRMP	Integrated Natural Resources Management Plan
km	kilometer
LCR MSCP	Lower Colorado River Multi-species Conservation Program

LUPA	Land Use Plan Amendment
m	meter
MA	Flat-tailed Horned Lizard Management Area
mi	mile
NCCP	Natural Communities Conservation Plan
OHMVRD	Off-highway Motor Vehicle Recreation Division
OHV	Off-highway Vehicle
OWSVRA	Ocotillo Wells State Vehicular Recreation Area
RA	Flat-tailed Horned Lizard Research Area
RMS	Flat-tailed Horned Lizard Rangewide Management Strategy
RMS Areas	Borrego Badlands MA, West Mesa MA, East Mesa MA, Yuha Desert MA, and Ocotillo Wells State Vehicular Recreation Area RA
SSC	Species of Special Concern
USFWS	United States Fish and Wildlife Service

APPENDIX 3. Public Notice

APPENDIX 4. External Peer Review Solicitation Letters

APPENDIX 5. External Peer Review Comments

APPENDIX 6. Public Comments

21 July 2016

Laura Patterson, Senior Environmental Scientist
Wildlife Branch
Wildlife and Fisheries Division
California Department of Fish and Wildlife
Sacramento, California

Dear Laura,

Thank you for the opportunity to review the Department's Status Review of the Flat-tailed Horned (FTHL) in California. On the whole, I found the document to be well-written and consistent with available literature and other information. My specific comments are in the form of track changes edits and comments in the document. Below I summarize my major points.

I have a unique perspective on this species and its management. I worked on the original status surveys by the BLM in California in 1978 (Turner *et al*. 1980), which were replicated in Arizona (Rorabaugh *et al*. 1987). I was the primary author on the 1993 U.S. Fish and Wildlife Service's (USFWS) proposal to list the species as threatened. When the BLM's Desert District convened a group to develop a conservation strategy and agreement for the species in 1994, I represented the USFWS's Arizona Ecological Services Office. I served on the Interagency Coordinating Committee and then the Management Oversight Group, and chaired both of those committees at one time or another from their inception until I retired from the USFWS in 2010. I am also familiar with the species in Sonora and Baja California. I am the senior author on a recently published, 688-page field guide to the amphibians and reptiles of Sonora (Rorabaugh and Lemos Espinal 2016). During my years in the Southwest, I have witnessed a lot of degradation and loss of FTHL habitat, the most dramatic of which has occurred in the Coachella Valley and the Yuma Desert.

The Rangewide Management Strategy (RMS) and Conservation Agreement that was signed in 1997 is the best thing that could have happened for FTHL conservation and management. I have served on a number of recovery implementation teams for federally-listed species, and the conservation measures in the RMS and the determination of the participating agencies to implement those measures, including providing significant funding, exceeds what I've seen for most federally-listed species. But that does not mean that the RMS and Conservation Agreement can solve all problems.

Climate change is probably the biggest threat that cannot be adequately dealt with by the participating agencies. As my comments in the document suggest, and monitoring since 2011 supports, the FTHL is sensitive to periods of drought. Yes it lives in one of the hottest and most arid portions of North America, but if that aridity and heat increase, the species has nowhere to go. Young and Young (2000) showed that during drought, FTHLs lose weight and less reproduction occurs. In long-term drought, the lizards may disappear from marginal areas. Identification of and perhaps enhancement of refuges from drought may be important for management. During a drought in the Yuma Desert in the early 90s, lizards (of various species) appeared to be relatively common at the base of a rocky hill, in areas that received runoff, versus flats that were farther away and did not receive this extra water. Because of the influence of the summer monsoon storms in alleviating stress in mid-summer, those summer storms are more common to the southeast, and absence of climate modeling or observed trends that suggest the monsoon rains have or will decline, climate change is most likely to affect FTHLs in the Coachella Valley and other areas near the northwestern portions of the species' range.

As I mention in my comments in the document, the RMS and participating agencies have not done a particularly great job in dealing with off-road vehicle activity within MAs, at least based on the latest data (from the early 2000s), at which time roughly 10% of the surface area in the West Mesa, Yuha, and East Mesa MAs were disturbed by vehicle tracks. Not only does this exceed the 1% new disturbance cap in the RMS by an order of magnitude, but it represents failure of law enforcement and substantial adverse effects to FTHL habitat. Furthermore, I have problems with the Department's assessment that most OHV activity occurs when FTHLs are dormant (see my comments in the document). The Department's assessment also appears to underestimate the potential ecological damage of OHV activity and subsequent cascading effects on the FTHL. It is true that studies have generally failed to show significant effects to the FTHL from off- or on-road vehicle activity, but no properly controlled study to assess those effects has been completed. In addition, much of the off-road activity may be the result of Border Patrol. That activity is difficult or impossible to control, and Border Patrol is not a signatory to the Conservation Agreement.

Invasive annual plants are something that has dramatically increased in the FTHL's range since I started working with the species in 1978. *Schismus* has been common and widespread for a long time, but Sahara Mustard (*Brassica tournefortii*), in particular, is on the increase. It is now notably dominant in spring blooms in southwestern Arizona and the Gran Desierto de Altar of northwestern Sonora. Fire is a serious potential consequence of abundant, dense stands of these invasive plants. Further discussion of the 3,600 acre fire that occurred in the East Mesa MA in 1992 should be included in your assessment, including any analyses of how FTHL populations responded (if known). Creosote bush scrub is not adapted to fire. The agencies participating in the Conservation Agreement can put fires out, but controlling the invasive plants that fuel those fires is a much more difficult task.

I hope you find these comments useful. Do not hesitate to contact me if any of my comments are unclear.

Sincerely,

Jim Rorabaugh
P.O. Box 31
Saint David, Arizona 85630

520/425-6563
jrorabaugh@hotmail.com

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STATE OF CALIFORNIA
NATURAL RESOURCES AGENCY
DEPARTMENT OF FISH AND WILDLIFE

REPORT TO THE FISH AND GAME COMMISSION
A STATUS REVIEW OF THE
FLAT-TAILED HORNED LIZARD
(*PHRYNOSOMA MCALLII*) IN CALIFORNIA

CHARLTON H. BONHAM, DIRECTOR
CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

September 2016

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ACKOWLEDGMENTS

[Note to readers: This section will be completed after external peer review.]

EXECUTIVE SUMMARY

[Note to readers: This section will be completed after external peer review.]

REGULATORY FRAMEWORK

Petition Evaluation Process

"A Petition to List the Flat-tailed Horned Lizard (*Phrynosoma mcallii*) as Endangered Under the California Endangered Species Act" (Petition) was submitted to the Fish and Game Commission (Commission) on June 10, 2014 by the Center for Biological Diversity. Commission staff transmitted the Petition to the Department of Fish and Wildlife (Department) pursuant to Fish and Game Code section 2073 on June 12, 2014, and published a formal notice of receipt of the Petition on July 11, 2014 (Cal. Reg. Notice Register 2014, No. 28-Z, p. 1238). The Department's charge and focus in its advisory capacity to the Commission is scientific. A Petition to list or delist a species under the California Endangered Species Act (CESA) must include "information regarding the population trend, range, distribution, abundance, and life history of a species, the factors affecting the ability of the population to survive and reproduce, the degree and immediacy of the threat, the impact of existing management efforts, suggestions for future management, and the availability and sources of information. The Petition shall also include information regarding the kind of habitat necessary for species survival, a detailed distribution map, and other factors the Petitioner deems relevant." (Fish & G. Code, § 2072.3.)

On September 30, 2014, the Department provided the Commission with its evaluation of the Petition, "Evaluation of the Petition from the Center for Biological Diversity to List the Flat-Tailed Horned Lizard (*Phrynosoma mcallii*) as Endangered Under the California Endangered Species Act" (Evaluation), to assist the Commission in making a determination as to whether the petitioned action may be warranted based on the sufficiency of scientific information. (Fish & G. Code, §§ 2073.5 & 2074.2; Cal. Code Regs., tit. 14, § 670.1, subds. (d) & (e).) Focusing on the information available to it relating to each of the relevant categories, the Department recommended to the Commission that the Petition be accepted.

At its scheduled public meeting on February 12, 2015, in Sacramento, California, the Commission considered the Petition, the Department's Evaluation and recommendation, and comments received. The Commission found that sufficient information existed to indicate the petitioned action may be warranted and accepted the Petition for Consideration. Upon publication of the Commission's notice of its findings, Flat-tailed Horned Lizard was designated a candidate species on March 6, 2015 (Cal. Reg. Notice Register 2015, No. 10-Z, p. 410).

Status Review Overview

The Commission's action designating the Flat-Tailed Horned Lizard as a candidate species triggered the Department's process for conducting a status review to inform the Commission's decision on whether to list the species. At its scheduled public meeting on February 11, 2016, in Sacramento, California, the Commission granted the Department a six-month extension to facilitate external peer review.

This written status review report, based upon the best scientific information available and including independent peer review of the draft report by scientists with expertise relevant to Flat-tailed Horned Lizard, is intended to provide the Commission with the most current information available on the Flat-tailed Horned Lizard and to serve as the basis for the Department's recommendation to the Commission on whether the petitioned action is warranted. The status

review report also presents preliminary identification of habitat that may be essential to the continued existence of the species and provides management recommendations for recovery of the species. (Fish & G. Code, § 2074.6.). Receipt of this report is to be placed on the agenda for the next available meeting of the Commission after delivery. At that time, the report will be made available to the public for a 30-day public comment period prior to the Commission taking any action on the Department's recommendation.

Existing Regulatory Status

The Flat-tailed Horned Lizard was the subject of a previous CESA listing petition. Dr. Wilbur Mayhew and Ms. Barbara Carlson of the University of California at Riverside petitioned the Commission to list the Flat-tailed Horned Lizard as an endangered species under CESA on January 25, 1988. Consistent with the Department's recommendation, the Commission designated the Flat-tailed Horned Lizard as a candidate species for CESA listing on May 13, 1988. After completing the status review, the Department recommended listing the species as threatened; however, on June 22, 1989, the Commission voted against the proposed listing, citing insufficient scientific information on population densities.

The Flat-tailed Horned Lizard also has a listing history under the federal Endangered Species Act (ESA). The United States Fish and Wildlife Service (USFWS) initially proposed to list the species as threatened under the ESA in 1993 (USFWS 1993); however, its determination was delayed in part due to Public Law No. 104-6, 109 Stat. 73, enacted in 1995, which placed a moratorium on new species' listings and critical habitat designations under the ESA. The moratorium was lifted in 1996. In 1997, the Department of the Interior Secretary was sued to compel the USFWS to make a listing determination within 60 days, at which point the USFWS withdrew its proposed listing (USFWS 1997). That decision sparked numerous additional court cases, the primary issue of each centered on whether or not the USFWS sufficiently analyzed Flat-tailed Horned Lizard population viability across its entire range. After multiple court-ordered re-evaluations, the USFWS withdrew its proposed rule to list, most recently in 2011 (USFWS 2003, 2006, 2011). One of the contributing factors in the USFWS's decisions not to list the Flat-tailed Horned Lizard was the development of an Interagency Conservation Agreement, signed by multiple federal and state agencies tasked with managing most of the species' habitat in the U.S. and Mexico, and the creation and implementation of a Rangewide Management Strategy (RMS) for the species.

The Flat-tailed Horned Lizard is listed as a Species of Special Concern (SSC) by the Department and as a Sensitive Species by the U.S. Bureau of Land Management (BLM). The Department's SSC designation is administrative and is intended to alert biologists, land managers, and others to a species' declining or at-risk status, to encourage additional management considerations for these species to ensure population viability, and to preclude the need for listing under CESA. SSCs are defined as species, subspecies, or distinct populations of an animal native to California that currently satisfies one or more of the following (not necessarily mutually exclusive) criteria: is extirpated from the State within the recent past; is listed under ESA (but not CESA) as threatened or endangered or meets the State's definition of threatened or endangered but has not been formally listed; is experiencing, or formerly experienced, serious (noncyclical) population declines or range retractions (that have not been reversed), which if continued or resumed, could qualify it for threatened or endangered status

under CESA; has naturally small populations and/or range size and exhibits high susceptibility to risk from any factor(s) that, if realized, could lead to declines that would qualify it for threatened or endangered status (Thomson et al. 2016).

Neither of these ~~administrative~~ designations provides the species with formal regulatory status like the ESA or CESA (see Existing Management section); however, the RMS requires conservation measures and provides quantitative limitations (e.g. 1% cap on surface disturbance), including compensatory mitigation, for surface disturbance within the five Flat-tailed Horned Lizard Management Areas (MA) established through the RMS (Figure 1). There are four MAs within California (Borrego Badlands, West Mesa, Yuha Basin, and East Mesa) ~~that comprise approximately 21% of the species' range in the State (using the Department's range map)~~, as well as one Research Area (RA; Ocotillo Wells State Vehicular Recreation Area). Collectively, the MAs and RA will be referred to as the "RMS areas" in this status review. More information on the protections afforded and efforts aimed at conserving the Flat-tailed Horned Lizard, including monitoring the species' distribution through occupancy studies and its trends in abundance through demography surveys, is provided in the Status and Trends in California and Existing Management sections.

Comment [RL1]: Too descriptive a term, and maybe not entirely accurate. Designations are more than administrative.

Comment [RL2]: The department's map is incorrect in many ways (too large/inclusive of suspect habitats and areas), resulting in the 21% metric to be incorrect.

Comment [RL3]: Should be bolded, italicized or otherwise called out form adjacent text since it refers to particular section headers in the status review.

BIOLOGY AND ECOLOGY

Species Description

The Flat-tailed Horned Lizard, like all horned lizards in the genus *Phrynosoma*, has a dorsoventrally flattened body with spiny scales, including head spines or "horns," and cryptic coloration, ranging from pale gray to light rust brown, which closely matches the substrate on which it lives. The Flat-tailed Horned Lizard has multiple diagnostic traits that distinguish it from other *Phrynosomatids*, including a distinctive dark dorsal stripe down its midline with a serious of dark spots on either side; long, sharp occipital horns; a prominent umbilical scar on an otherwise unspotted white or cream venter; and, as its name suggests, a relatively long broad flattened tail (Funk 1981, Muth and Fisher 1992, Sherbrooke 2003, Young and Young 2000). Flat-tailed horned lizards also possess two lateral fringe scale rows and lack external ear openings (Funk 1981, Johnson and Spicer 1985). Adults typically range in size from 57-84 mm (2.2-3.3 in) snout-to-vent length (i.e., excluding tail length), while hatchlings are about 35-38 mm (1.4-1.5 in) (Howard 1974).

Comment [RL4]: Please change to Phrynosomatids globally. Phrynosomids refer to lizards well beyond horned lizards in the genus Phrynosoma.

Taxonomy

Flat-tailed Horned Lizards (Class Reptilia, Order Squamata) belong to the Family Phrynosomatidae, a large and diverse group that, in addition to horned lizards, includes zebra-tailed, earless, rock, spiny, fringe-toed, tree, brush, and side-blotched lizards. Hallowell (1852) classified the species as *Anota m'callii*, but the current species classification is *Phrynosoma mcallii* (Crother et al. 2012). The genus *Phrynosoma* consists of a unique group of lizards known commonly as horned lizards or colloquially as horned toads (in Greek *phrynos* = toad and *soma* = body). This group, compared to other lizards, is characterized by strongly dorsoventrally flattened bodies; sharp spines; a reluctance to run when approached; long

activity period; more variable body temperatures; a specialized, often ant-rich, diet; and specialized dentition that facilitates ant-eating (Pianka and Parker 1975).

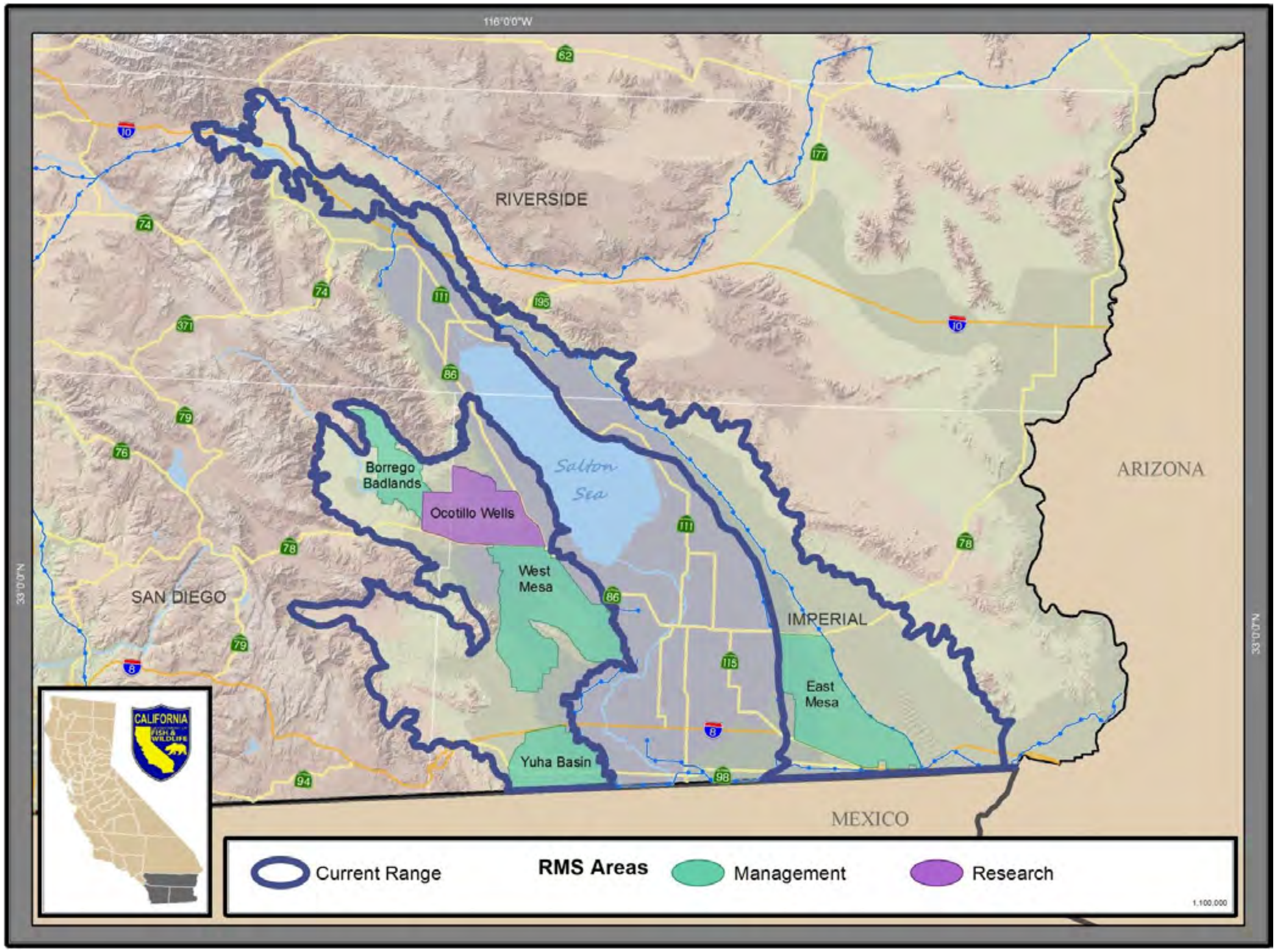


Figure 1. Flat-tailed Horned Lizard RMS Areas in California

Comment [RL5]: The current range map does not match the actual present distribution of the species. Large areas included within the "current range" as depicted do not have FTHL, and likely never did and within which there are no historical records.

Comment [RL6]: AGFD: This map is not based on known records and is used as the basis for the "21% of its California range is under MA" argument

Genetics

Phylogenetic relationships of *Phrynosomatids* are not well understood (Leaché and McGuire 2006, Mulcahy et al. 2006). There are no recognized subspecies of Flat-tailed Horned Lizards (Crother et al. 2012), but two major clades east and west of the Colorado River have been revealed through genetic analyses (Culver and Dee 2008, Mulcahy et al. 2006). The western clade is predominantly located in California and shows signs of genetic differentiation among regions when mitochondrial DNA is used (Mulcahy et al. 2006); however, there was no evidence of genetic differentiation among the California populations using microsatellite data (Culver and Dee 2008). Mulcahy et al. (2006) determined that the populations east and west of the Imperial Valley, currently separated by urban and agricultural development, are significantly differentiated, although the data suggest that gene flow was limited prior to this anthropogenic change in landscape. While the Coachella Valley population and the population west of the Imperial Valley are also separated by urban and agricultural development, they are not significantly genetically differentiated from each other (Ibid.). Hybrids with morphological characters that are intermediate between Flat-tailed Horned Lizards and Desert Horned Lizards (*P. platyrhinos*) have been reported from near Ocotillo, California (Stebbins 2003) and between Flat-tailed Horned Lizards and Goode's Horned Lizards (*P. goodei*) from near Yuma, Arizona (Mulcahy et al. 2006).

Geographic Range and Distribution

The Flat-tailed Horned Lizard has the smallest range of any horned lizard found within the United States and has among the smallest ranges of all horned lizards (Sherbrooke 2003). The species is restricted to southeastern California, the extreme southwestern portion of Arizona, and the adjacent portions of northeastern Baja California Norte and northwestern Sonora, Mexico (Funk 1981). The majority of the species' range is within Mexico, while the majority of the U.S. range is within California (USFWS 2011). In California, Flat-tailed Horned Lizards are distributed throughout much of the Salton Trough, in sections of eastern San Diego County, central Riverside County, and western and south-central Imperial County. Flat-tailed Horned Lizards are most frequently found below 230 m (750 ft) in elevation, although they have been reported up to 520 m (1,700 ft) above sea level (Turner et al. 1980). Figure 2 shows the Department's approximation of the Flat-tailed Horned Lizard's current range (referred to as "Current CDFW Range" in map legends), based on aerial imagery interpretation of disturbed lands (e.g., urban and agricultural areas), soil types, elevation, and slope compared to the historical range boundary from the RMS (FTHLICC 2003). Figure 3 shows~~shows~~ the distribution of Flat-tailed Horned Lizard observations, categorized by date.

Growth, Reproduction, and Survival

Flat-tailed horned lizards have relatively long active periods, on average 277 days/year, without any prolonged periods of inactivity or aestivation (Muth and Fisher 1992), providing them plenty of time to grow and seek mates when conditions are favorable. Hibernation usually begins on average in mid-November but can range from October through December (Grant and Doherty 2009, Muth and Fisher 1992, Wone and Beauchamp 2003), although some individuals, particularly juveniles, remain active in the winter (Muth and Fisher 1992). Muth and Fisher (1992) speculate that juveniles may not have the fat reserves to get through winter without

Comment [RL7]: Based on inaccuracies in Depts. Range map in Fig. 3, we can provide the latest FTHL ICC range map if that would be helpful. While these maps share an overestimated range boundary, providing the dot-locations of all FTHL observations through time.

Comment [CDoPaR8]: Where are these observations from? CNDDB? As we saw at the last ICC meeting the CNDDB does not have many of the observations that can be found in various other databases. If these are only from the CNDDB then it is by no means a true representation of FTHL observations.

Comment [RL9]: AGFD: This should be prefaced with: "at one site in California"

Comment [RL10]: FTHL actually don't hibernate, they brumate. See Mayhew, Wilber W. 1965. *Hibernation in the Horned Lizard, Phrynosoma m'calli*. Comparative Biochemical Physiology. Vol 16, pp. 103-119. doi: 10.1016/0010-406X(65)90167-2

However, convention dictates use of the term hibernate. Since brumation was identified through study of FTHL, some mention of this may be useful.

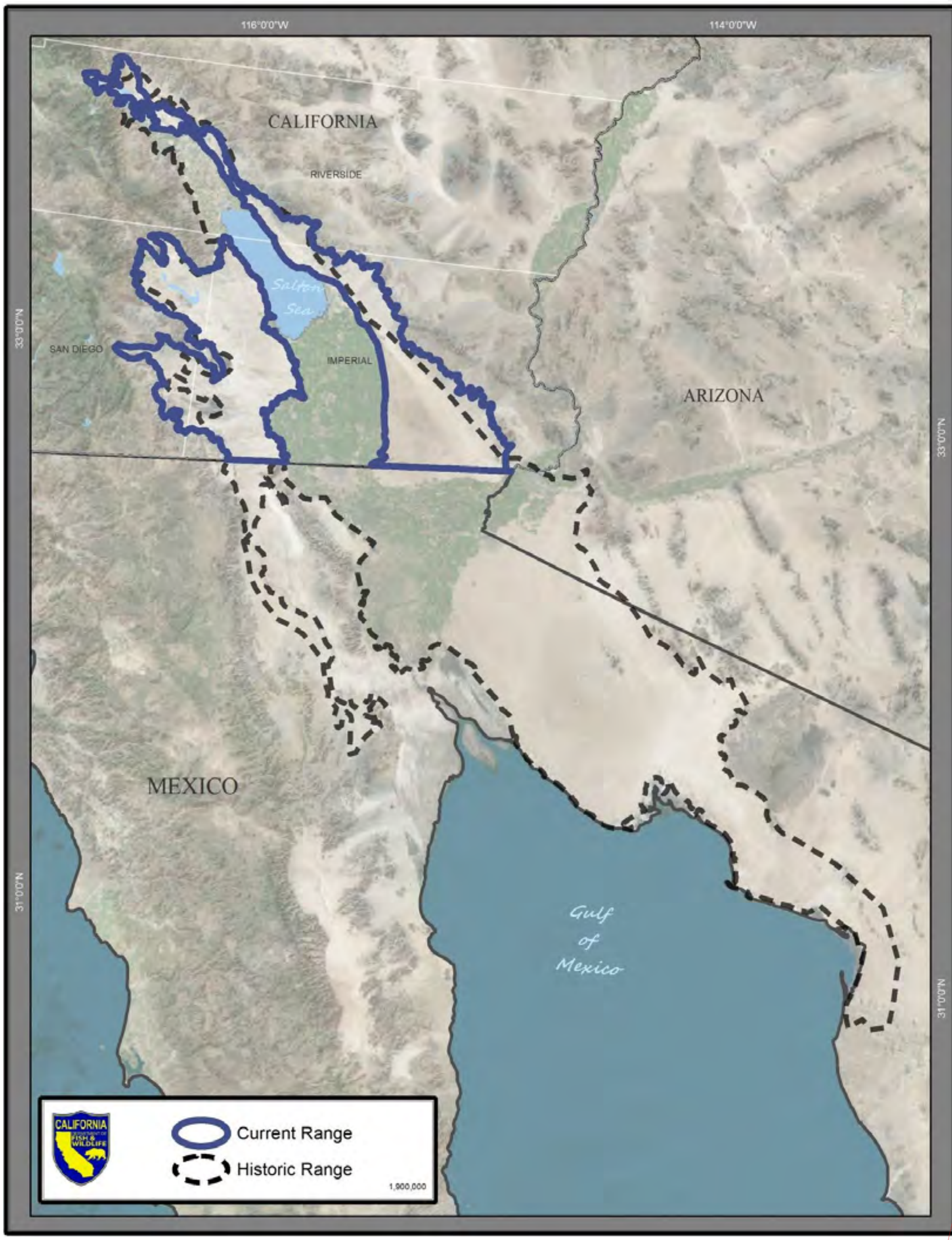


Figure 2. Flat-tailed Horned Lizard Current and Historic Range

Comment [RL11]: Map lacks context without dot-map occurrences of FTHL through time. Please replace with FTHL ICC map, or overlay historical records.

Comment [RL12]: NAF El Centro: This map is misleading. The current range is largely still within the outside borders of historic range as depicted.

Comment [RL13]: AGFD: Map shows range contraction and expansion without any indication on how it was determined without historic occurrences

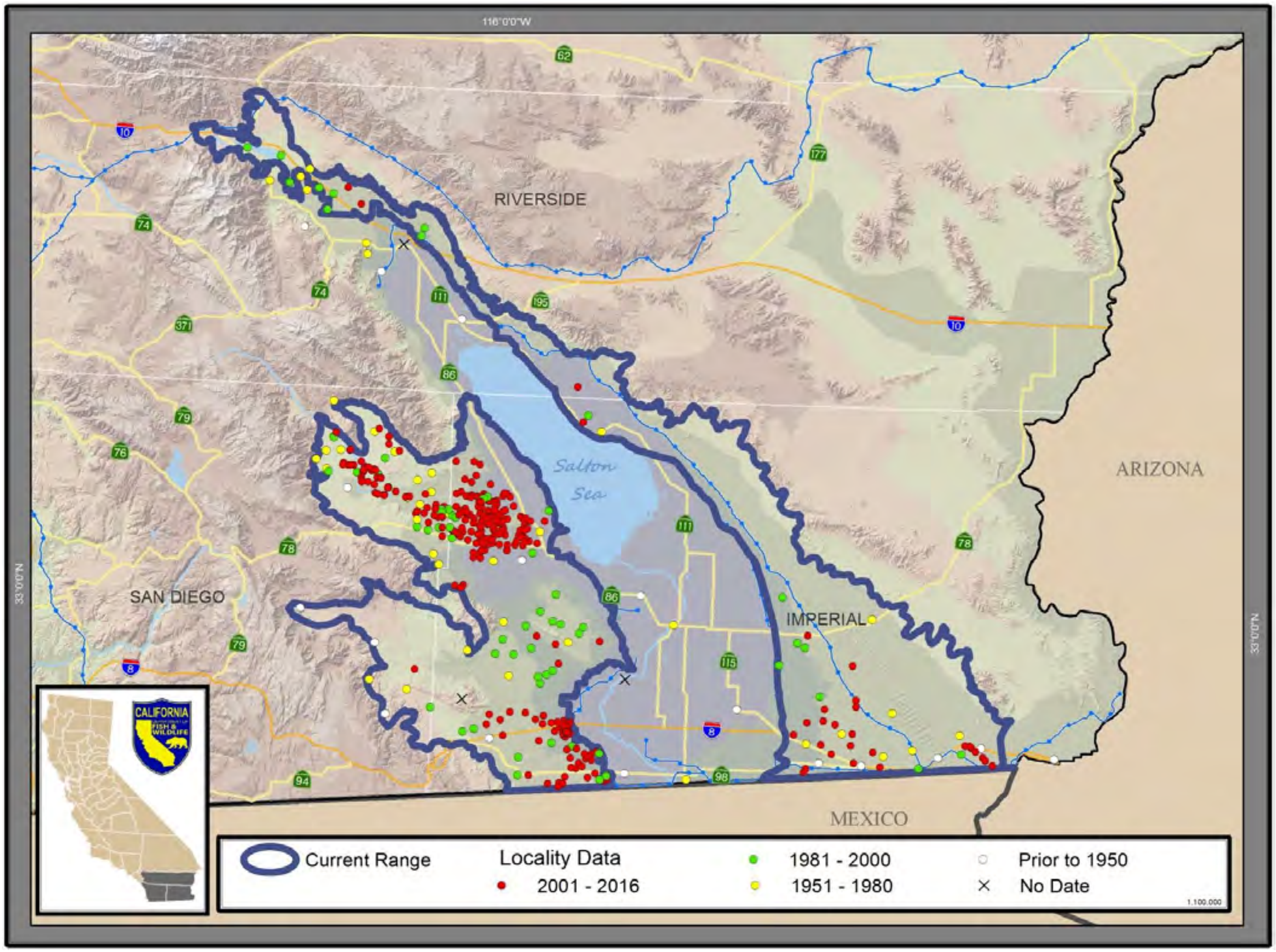


Figure 3. Flat-tailed Horned Lizard Observations in California

Comment [RL14]: Please define dat a used to compile these observations. CNDDB? VertNet? FTHL ICC? "Current Range" may be exaggerated per prior comments also.

Comment [RL15]: AGFD: Blue dotted line is not in legend. Please clarify

feeding, or they may remain active to attain the minimum reproductive size (60-66 mm, 2.4-2.6 in) (Howard 1974, Root 2010) as quickly as possible. Time of emergence is variable and can range from December to April, but averages in February (Mayhew 1965, Wone and Beauchamp 2003). When surface temperatures reach 50°C (122ºF), most Flat-tailed Horned Lizards will retreat into rodent or self-constructed burrows, although Young and Young (2000) observed them at surface temperatures of 55°C (131ºF).

Flat-tailed Horned Lizards are oviparous (egg-laying) and early maturing (FTHLICC 2003). They are generally capable of mating upon emergence from hibernation, and females may be able to produce two separate clutches of eggs (Howard 1974, Muth and Fisher 1992, Turner and Medica 1982). Several researchers report that the first hatchlings appear mid to late July, while a second set appears from late August through October (Ibid.). In dry years, females may only produce a single clutch that does not hatch until late August or September (Setser 2001, Young and Young 2000). It is also possible that females do not lay multiple clutches, but rather different individuals lay at distinct times throughout the active period (Young and Young 2000).

Comment [RL16]: AGFD: There is little evidence of this the direct quote from Young and Young is "it seemed like clutches were staggered" this should be backed up with data or a graphic to make it more digestible for an ecologist.

Comment [RL17]: This report is also not peer-reviewed. Suggest deletion, or rewording to be more accurate.

Gravid females deposit their eggs in deep burrows over a period of two to four days (Young and Young 2000). Nests depths are variable depending on substrate and weather conditions (observed range: 14-90 cm, 5.5-35.4 in) but are deep enough to ensure that the eggs are laid in moist soil (Setser 2001, Young and Young 2000). Eggs are incubated for approximately 52 days before hatching (Ibid.). Flat-tailed Horned Lizards produce small clutches (averaging 4.7-5.4 eggs) and have the lowest productivity index (i.e., average clutch size x frequency) of the seven southwest *Phrynosomids* studied by Howard (1974).

Juveniles grow quickly, but growth rate appears to be dependent on when and where hatchlings were born and resource availability. Under favorable conditions, hatchlings born in the first cohort are able to reach adult size prior to hibernation and thus are able to breed at the beginning of the next year's active season, while hatchlings from a second cohort may not mature until the middle of the following summer, delaying breeding until their second year (Muth and Fisher 1992, Young and Young 2000). Drought may also delay sexual maturity, since growth rates slow under these conditions (Young and Young 2000).

Most Flat-tailed Horned Lizards live to three years in age, but individuals can live four or even six years (FTHLICC 2003, Leavitt 2013b, Young and Young 2000). Muth and Fisher (1992) estimated the mean annual survival rate at approximately 53%, noting the lowest survival rates occurred in spring and summer. During hibernation, survival is typically 100% (Grant and Doherty 2009, Muth and Fisher 1992). Annual survival estimates from demography surveys on East Mesa and West Mesa MAs between 2007 and 2013 varied substantially, ranging from 27%-70% and 4%-59%, respectively (Leavitt 2013b). Leavitt (2013b) noted that these estimates suggest low annual survival is the norm. Juvenile survivorship is not clear, but the annual juvenile survival rate for Desert Horned Lizards is significantly lower than adult survivorship (Pianka and Parker 1975).

The largest natural cause of Flat-tailed Horned Lizard mortality is predation, which, based on telemetry data, has been recorded as high as 40-50% of the population in certain years (Goode and Parker 2015, Muth and Fisher 1992, Young and Young 2000). Primary predators of Flat-tailed Horned Lizards are Loggerhead Shrikes (*Lanius ludovicianus*) and Round-tailed Ground

Squirrels (*Xerospermophilus tereticaudus*), but they are also preyed upon by a number of other reptiles, birds, and mammals, including Sidewinders (*Crotalus cerastes*), Coachwhips (*Coluber flagellum*), American Kestrels (*Falco sparverius*), Common Ravens (*Corvus corax*), and Kit Foxes (*Vulpes macrotis*) (Barrows et al. 2006, Duncan et al. 1994,Goode and Parker 2015, Muth and Fisher 1992, Young and Young 2000). Predation by some species, particularly birds and squirrels, increases near human development due to the availability of subsidized resources such as water and artificial perches (Barrows et al. 2006, Young and Young 2005).

To avoid predation, Flat-tailed Horned Lizards rely on their cryptic coloration and typically freeze instead of fleeing (Wone and Beauchamp 1995b). This can make them especially vulnerable to road mortality, which has also been suggested as a substantial source of mortality (Muth and Fisher 1992, Turner et al. 1980, Young and Young 2000). A population viability analysis suggested that Flat-tailed Horned Lizard persistence is particularly sensitive to changes in mortality versus other factors such as reproductive output or growth (Fisher et al. 1998, FTHLICC 2003).

Diet and Food Habits

According to Johnson and Spicer (1985), although the Flat-tailed Horned Lizard is remarkably swift compared to other horned lizards, it is basically a “sit and wait” predator. Ants comprise 97% of the Flat-tailed Horned Lizard’s diet, higher than any other *Phrynosomid* (Pianka and Parker 1975). Flat-tailed Horned Lizards primarily eat native harvester ants (genera *Messor* and *Pogonomyrmex*) but are known to eat smaller ants and other invertebrates opportunistically as well (FTHLICC 2003, Turner and Medica 1982, Young and Young 2000). During a severe drought in 1997, Young and Young (2000) measured scat contents and found less than half the number of ants were present in scat collected during wetter years, and they observed that Flat-tailed Horned Lizards lost weight during drought conditions. In drought years, annual vegetation is depressed, resulting in decreased seed abundance, which in turn negatively affects the harvester ants that feed primarily on seeds (Barrows and Allen 2009). Freestanding water and dew are not commonly available in Flat-tailed Horned Lizard habitat, so the species primarily relies on preformed water (water found within their food) to maintain proper water balance (FTHLICC 2003).

Home Range and Territoriality

Compared to their size, Flat-tailed Horned Lizards have very large home ranges and do not appear to be territorial (Muth and Fisher 1992). Young (1999) investigated interactions among Flat-tailed Horned Lizards with overlapping home ranges and found that lizards were actively avoiding each other. Home range sizes among individual Flat-tailed Horned Lizards can vary widely even in the same area, but method of data collection and analysis, location, season, sex, climatic conditions, and density dependence may all be influential. Goode and Parker (2015) measured male home ranges from 0.04-6.8 ha, and female home ranges from 0.02-14.5 ha. These ranges overlap the lowest and highest mean home range sizes observed by other researchers (Muth and Fisher 1992, Setser 2001, Setser and Young 2000, Turner and Medica 1982, Young and Young 2000). Males appear to have larger home ranges than females, at least in spring and early summer, which can likely be attributed to searching for mates (Goode and Parker 2015, Setser and Young 2000, Turner and Medica 1982, Young 1999). Some gravid

females will leave their home range, traveling as far as 1,647 m to deposit their eggs before returning to their original home range site (Setser 2001, Young and Young 2000). Climatic conditions, specifically drought, are presumed to reduce home range size and activity (Young and Young 2000).

Habitat that May be Essential for the Species' Continued Existence in California

Flat-tailed Horned Lizard habitat is characterized by hot summers ranging from 30-45^{0}C and generally mild winters in the very low 20s ^{0}C (FTHLICC 2003, Johnson and Spicer 1985). Annual rainfall is typically low and varies spatially and temporally (Ibid.). Within the California portion of the species' range, rainfall averages approximately 5.8 cm in El Centro and 13.5 cm in Palm Springs (FTHLICC 2003) and predominantly falls during winter, while the Arizona portion of the species' range generally receives summer rains (Johnson and Spicer 1985). Flat-tailed Horned Lizard habitat is subjected to frequent drought conditions (Johnson and Spicer 1985) and flash floods during periods of heavy rain (Turner and Medica 1982). Although it is sympatric with the Desert Horned Lizard in some parts of its range, the Flat-tailed Horned Lizard occupies hotter, drier, and more severe habitats than any other *Phrynosomid* (Johnson and Spicer 1985).

According to Turner et al. (1980), the best habitats for Flat-tailed Horned Lizards generally exhibit "surface soils of fine packed sand, or pavement, overlain intermittently with loose, fine sand." Most records of Flat-tailed Horned Lizards come from the creosote bush (*Larrea tridentata*)-white bursage (*Ambrosia dumosa*) assemblage, and occasionally saltbush (*Atriplex* spp.) (FTHLICC 2003, Turner et al. 1980). However, the species has been recorded in a broad range of habitats in California compared to Arizona, including sandy flats and hills, badlands, salt flats, and gravelly soils (FTHLICC 2003). Flat-tailed Horned Lizards have also been found on the rocky slopes at lower elevations, along the vegetated edges of active sand dunes, on stabilized sand fields, and less frequently, within active dunes themselves (Barrows and Allen 2009, Luckenbach and Bury 1983, Turner et al. 1980). The species has even been found in fallowed agricultural fields dominated by non-native weedy species (RECON 2010).

There are five habitats associated with Flat-tailed Horned Lizards in the California Wildlife Habitat Relationships System (CWHR) (Figure 4). CWHR is a state-of-the-art information system for California's wildlife that contains life history, geographic range, habitat relationships, and management information on 712 species of amphibians, reptiles, birds, and mammals known to occur in the state. Desert Scrub, Desert Wash, and Barren are considered high quality habitat, while Alkali Desert Scrub and Desert Succulent Scrub are considered marginal (CDFW 2014). Desert Scrub habitats typically are open, scattered assemblages of broadleaved evergreen or deciduous microphyll shrubs, usually between 0.5 and 2 m in height; canopy cover is generally less than 50%, usually much less; bare ground is often between plants; and creosote bush is often considered a dominant species (CDFG 1988). Barren is considered any habitat with <2% total vegetation cover by herbaceous, desert, or non-wildland species and <10% cover by tree or shrub species (Ibid.). Desert Wash habitats are characterized by the presence of arborescent, often spiny, shrubs generally associated with intermittent streams (washes) or drier bajadas (alluvial deposits adjacent to washes), especially in the Sonoran Desert (Ibid.).

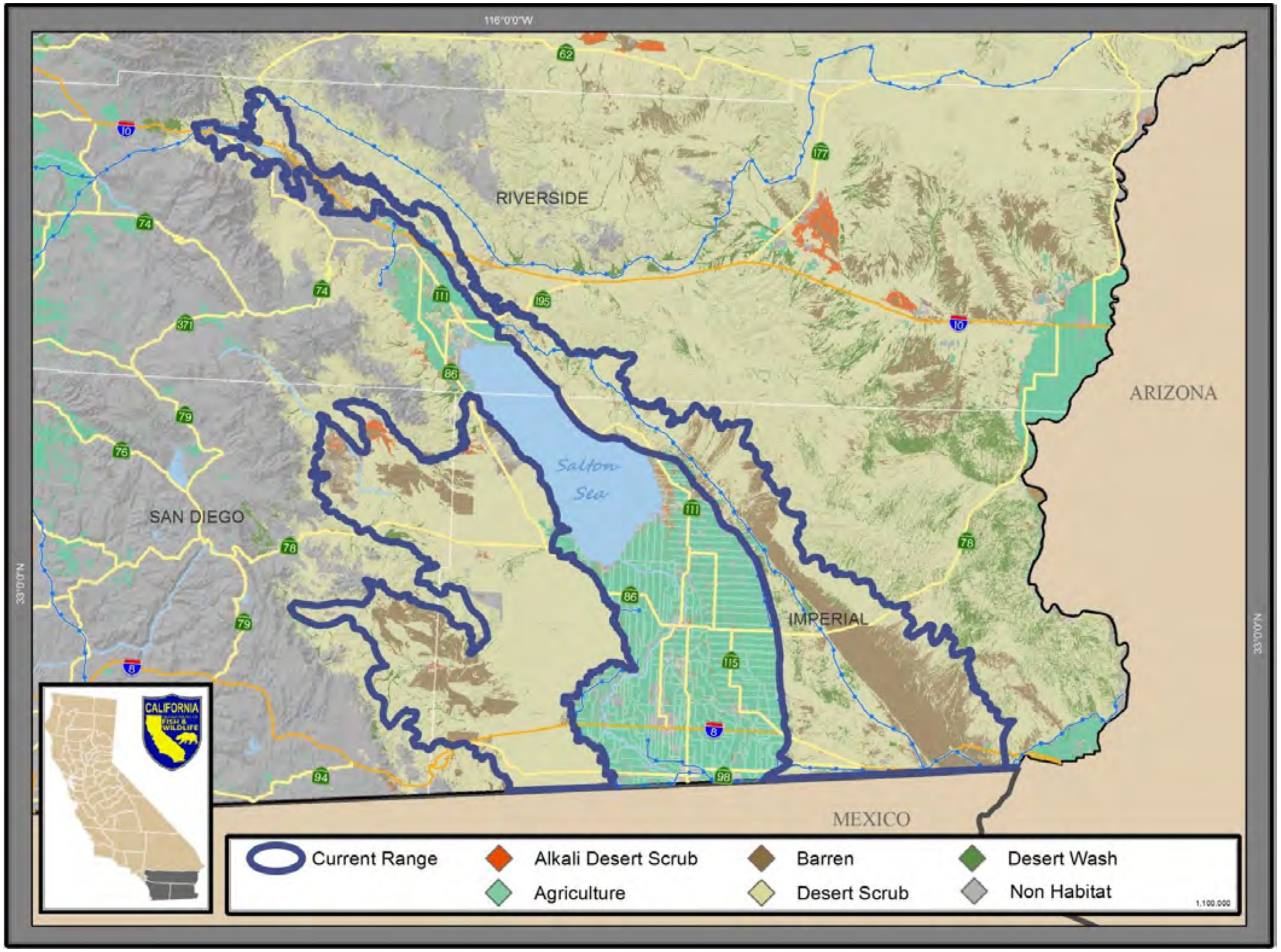


Figure 4. Flat-tailed Horned Lizard Habitat Associations

A number of studies have attempted to identify habitat characteristics that are significantly correlated with presence and abundance of Flat-tailed Horned Lizards, but their results have varied. In most cases, there is a positive correlation between Flat-tailed Horned Lizard abundance and perennial plant density (Altman et al. 1980, Barrows and Allen 2009, Muth and Fisher 1992, Turner and Medica 1982). However, it should be noted that typical Flat-tailed Horned Lizard habitat is sparsely-vegetated, so maximum coverage of perennial plant density is likely never very high at any of the sites. Positive correlations have also been reported between Flat-tailed Horned Lizards and the abundance of sand (Gardner 2005, Hollenbeck 2004, Wright and Grant 2003), as well as harvester ant nests (Barrows and Allen 2009, Rorabaugh et al. 1987, Turner and Medica 1982). Barrows and Allen (2009) found that soil compaction was significantly correlated with Flat-tailed Horned Lizard abundance in opposite directions on stabilized sand fields (negative) and active dunes (positive), suggesting that the "availability of moderately compacted sands may be important to horned lizards for digging burrows that are used for thermoregulation and nesting."

STATUS AND TRENDS IN CALIFORNIA

Range

Uncertainty exists regarding what constituted historically suitable habitat available for the Flat-tailed Horned Lizard in California due to periodic Colorado River flooding of the Salton Trough (FTHLICC 2003, USFWS 2011). This uncertainty affects estimates of losses in the species' range and distribution because the vast majority of land converted to agriculture and urban development occurs within this area of historical flooding. A detailed description of the geologic and hydrologic history is provided in the Setting and Habitat section of the USFWS's (2011) withdrawal of the proposed rule to list the Flat-Tailed Horned Lizard as threatened. Based on evidence of its ephemeral persistence and marginal suitability, the USFWS did not consider habitat within the historic Lake Cahuilla lakebed (Figure 5) as part of the species' historical range (USFWS 2006). Barrows et al. (2008) also did not consider this area as potential habitat when modeling changes in Flat-tailed Horned Lizard distribution in the Coachella Valley pre- and post-development.

Alternatively, Hodges (1997), while omitting areas of unsuitable habitat containing marshes, obvious rocky mountains, new alluvial deposits, and the main body of the Algodones Dunes, included the Salton Trough in her estimate of historic habitat due to the existence of Flat-tailed Horned Lizard records from areas within the Imperial Valley and around the Salton Sea. Based on this, she concluded that the total possible inhabitable area of historic Flat-tailed Horned Lizard habitat in California was as large as 899,000 ha (Ibid.). Flooding of the Salton Sea, agricultural development, and urbanization were the primary sources of habitat loss, leading to a reduction in range of approximately 51% in Imperial County, 58% in Riverside County, and 9% in San Diego County (Ibid.). Hodges (1997) considered the Riverside County estimate to be very conservative, and more recently, Barrows et al. (2008) reported that an estimated 83-92% of suitable Flat-tailed Horned Lizard habitat has been lost in the Coachella Valley. Conversely, the Imperial Valley estimate is likely inflated based on the periodic historic flooding that rendered much of the area unsuitable for extended periods. While at least some of the habitat

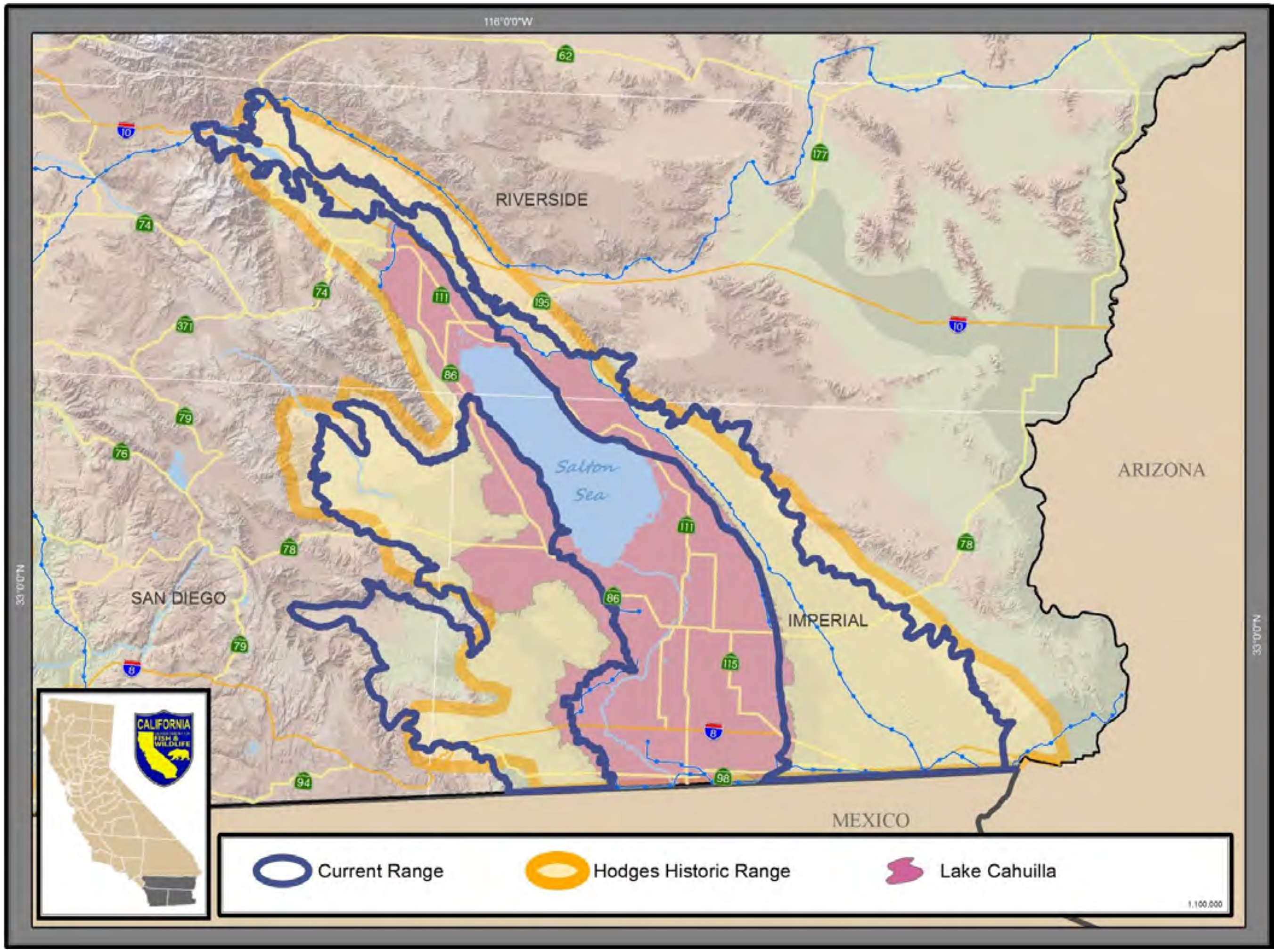


Figure 5. Historical Range Boundary Estimates Compared to Current Range Estimate

Comment [RL18]: Please define timeframe. "Historical range Boundary from Pleistocene?" "?Miocene?" Maybe add citation if range is based on Hodges (1997) also.

appears to have been suitable as recently as the end of the 19th century based on collections from the area (Hodges 1997), genetic data reveal that gene flow across the Imperial Valley was limited centuries before agricultural development began and the current Salton Sea flooded in the early 1900s (Mulcahy et al. 2006).

Regardless of the exact amount of loss, it is clear that the current Flat-tailed Horned Lizard range has been reduced from its historical extent due to agricultural and urban development. As a result, connectivity, even if historically infrequent, between the populations east and west of the Imperial Valley has been lost, and connectivity between the Coachella Valley and these populations may have been lost as well.

Distribution

With the exception of the Coachella Valley, the Flat-tailed Horned Lizard's distribution within its species' California range appears to have remained fairly stable in the areas for which data are available. As recently as the early 1980s, Flat-tailed Horned Lizards had a broader distribution in the Coachella Valley, occurring on what is now the Whitewater Floodplain Preserve~~Preserve~~, on the southern flanks of Edom Hill, and at the eastern end of the Indio Hills (CVCC 2013a). Currently, the only presumed remaining populations are on the Thousand Palms Preserve and further south within the Dos Palmas Preserve (Ibid). If they do inhabit the other areas, it is at a density below detection levels (Ibid.).

Comment [FMS19]: The use of the term 'Preserve' may be outdated as it was associated with the CV fringe-toed lizard HCP, which expired in April 2016. I recommend replacing it with Conservation Area, which is associated with the CVMSHCP, and more recognized in terms of where these areas are located geographically within the Coachella Valley.

The distribution of Flat-tailed Horned Lizards within the RMS Areas (Figure 1) has been monitored using survey methods that incorporate the species' low detection probability into estimates of occupancy and local colonization and extinction rates (i.e., occupancy surveys in the RMS). Until recently, these methods included the use of sign (e.g., scat or tracks), which provide a much greater power to detect changes from survey period to survey period than visual confirmation of a Flat-tailed Horned Lizard (Root 2010) but are also problematic. Several studies have demonstrated that Flat-tailed Horned Lizard sign is not always positively correlated with current presence or abundance (Beauchamp et al. 1998, Muth and Fisher 1992, Rorabaugh 1994, Rorabaugh et al. 1987, Turner and Medica 1982, Wone and Beauchamp 1995a, Wright 2002, Young and Young 2000). This is due to any number of reasons, including (1) the fact that substrate and weather (e.g., wind, rain) can affect scat detectability and persistence (minutes to months) of scat or tracks in the environment (Beauchamp et al. 1998, Rorabaugh 1994); (2) it is impossible to distinguish the difference between multiple scats per lizard vs. several lizards defecating once (Beauchamp et al. 1998); (3) lizards produce fewer and smaller scats during times of low resource availability like drought (Rorabaugh 1994, Young and Young 2000); (4) Flat-tailed Horned Lizard scat are indistinguishable from Desert and Goode's Horned Lizards where they are sympatric (Root 2010, Rorabaugh et al. 1987, Young and Young 2000); and (5) surveyors who concentrate on finding scat invariably find fewer lizards (Wone et al. 1994). At best, scat can serve as an indication that the area was at least used by a Flat-tailed Horned Lizards (in areas where they are not sympatric with other horned lizards)~~,~~ even if only as the species passed through it (Root 2010). Table 1 depicts the estimated likelihood that a Flat-tailed Horned Lizard will be present at a random spot within the RMS areas, based solely on lizard observations (i.e., not scat).

Table 1. Occupancy Probability Estimates for RMS Areas (California only)[1]

	East Mesa	West Mesa	Yuha Basin	Borrego Badlands	Ocotillo Wells
2005		0.06			
2006	0.44				1.00
2007					1.00
2008			0.56		0.66
2009		0.86			0.86
2010	0.75				0.85
2011				0.42	0.91
2012				0.20	0.84
2013				0.10	0.78

[1] 2005-2010 data from Frary (2011); 2011-2013 data from Leavitt (2013b)

Comment [RL20]: AGFD: Report S.E. as well

Occupancy probabilities were generally high across the RMS areas, particularly Ocotillo Wells, where extinction (0.07 ± 0.07) and colonization rates (0.00 ± 0.00) were estimated to be low (Leavitt 2013b). Despite being relatively close to Ocotillo Wells, occupancy probability and colonization rate estimates (0.01 ± 0.04) at Borrego Badlands were relatively low, and local extinction rates (0.54 ± 0.19) were predicted to be very high (Ibid.). Leavitt (2013b) posited that indications of a steady decline at Borrego Badlands are likely due to irregular sampling at that location and that this trend is an artifact of a poor sampling regime. Unfortunately, the relatively low power to detect changes from visual-only surveys, coupled with irregular and inconsistent monitoring on the MAs since 2005, has led in some cases to large standard errors and the inability to estimate population parameters (Grimsley and Leavitt 2016). Properly executed occupancy studies have far greater power to detect long-term changes in distribution when plots are sampled more frequently (i.e., annually vs. biennially or triennially) and all survey passes (days/plot) within the survey year are completed (Leavitt 2013b, Zylstra et al. 2010).

With the exception of the Coachella Valley, there are no distribution data on Flat-tailed Horned Lizards outside of the RMS areas. It should be noted that the MAs were chosen because they were thought to represent some of the highest quality contiguous habitat available to the species, and there are limits on disturbance within them. Therefore, extrapolation of these occupancy estimates to the rest of the species' range may not be prudent because areas of presumably lower quality and greater disturbance would be expected to have a lower likelihood of occupancy by Flat-tailed Horned Lizards.~~areas of presumably lower quality and greater disturbance would be expected to have a lower likelihood of occupancy by Flat-tailed Horned Lizards.~~

Comment [RL21]: Please change, or define this. There are distributional records from outside RMS areas, and those **do** represent distributional data. They may not be part of occupancy surveys, but they are distributional data for the species.

Comment [PRJCNS22]: This sentence needs some attention as highly disturbed areas within Ocotillo Wells seem to have relatively high population densities.

Abundance

Obtaining reliable rangewide abundance or density estimates for Flat-tailed Horned Lizards is complicated due to the species' relatively low detectability and large home range size, as well as researchers' use of un-standardized, and in some cases, inappropriate survey methods (e.g., scat detection rates as an index of abundance). The Petition (Table 2, page 23 in CBD 2014) provides a list of abundance estimates based on scat and lizard observations per hour of survey effort using results of studies ranging from 1979-2001. Due to the unreliability of these estimates and no clear correlation with Flat-tailed Horned Lizard abundance, they are not reproduced here.

Since then, only three studies have used solely lizard observations and an appropriate sampling design to estimate abundance of adult Flat-tailed Horned Lizards across the RMS areas (Table 2). Some sites (West Mesa 2003 and Yuha Basin 2004) suffered from sparse data (Grant and Doherty 2007), and their 95% confidence intervals (C.I.) reflect that. Hollenbeck (2006) estimated the abundance of juveniles, in addition to adults, because they were encountered throughout the duration of the study and accounted for a majority of the individual Flat-tailed Horned Lizards captured and recaptured.

Table 2. Abundance and Density Estimates from RMS Areas (California only)

RMS Area	Abundance	Lower C.I.	Upper C.I.	Lizards/ha	(Lizards/ac)
Yuha Basin 2002[1]	25,514	12,761	38,790	1.05	(0.42)
East Mesa 2003[1]	42,619	19,704	67,639	0.91	(0.37)
West Mesa 2003[1]	10,849	3,213	23,486	0.20	(0.08)
Ocotillo Wells 2003[2]	19,222	18,870	26,752	0.61	(0.25)
Yuha Basin 2004[1]	73,017	4,837	163,635	3.00	(1.21)
Ocotillo Wells 2005[3,4]	24,345	14,329	69,922	0.78	(0.32)
Ocotillo Wells 2005[3,5]	37,085	22,166	74,812	1.19	(0.48)

[1] Grant and Doherty (2007), [2] Hollenbeck (2004), [3] Hollenbeck (2006), [4] adults, [5] juveniles

There has only been one attempt at estimating the number of Flat-tailed Horned Lizards across the species' range. The USFWS (2011) used a density of 0.3 lizards/ha (0.1 lizards/ac) and its estimate of the Flat-tailed Horned Lizard's remaining range to make that calculation. The density USFWS used was the smallest estimate derived by Root (2010) from data obtained between 2007 and 2009 on the MAs. Within California, this amounted to approximately 73,000 individuals west of the Imperial Valley; 44,000 east of it; and 1,100 in the Coachella Valley. The USFWS (2011) acknowledged that there were numerous assumptions in its calculations that limited accuracy of the extrapolated population sizes, but it concluded that, even using the most conservative density estimate, the populations east and west of the Imperial Valley were large enough that any threats associated with small populations would be unlikely to occur. The minimum viable population size for Flat-tailed Horned Lizards is unknown, and the USFWS (2011) also acknowledged that within these coarse-scale populations, barriers to movement fragment the habitat into various patches, which could result in deleterious effects from small population sizes (see Fragmentation, Edge Effects, and Small Populations below).

Not surprisingly, an increased level of survey effort (i.e., number of surveyors and amount of time looking specifically for lizards) appears to increase the likelihood of detecting Flat-tailed Horned Lizards. For example, surveys by biological monitors and incidental observations by construction personnel trained to look out for Flat-tailed Horned Lizards can sometimes find unexpectedly high densities when compared to the RMS area demography survey results. For example, prior to and during construction of the Imperial Solar Energy Center West's (CSolar) transmission line within the Yuha Basin MA in 2014, 152 Flat-tailed Horned Lizards were located along the 6.6 ha (16.3 ac) right-of-way that was dominated by creosote bush and white bursage, resulting in an estimated density of 23.0 lizards/ha (9.3 lizards/ac) (UltraSystems 2015) (Figure 6). To put this density into context, using the RMS demography survey data from the Yuha Basin MA, the highest plot-level density estimate between 2007 and 2015 was 4.9 lizards/ha (2.0 lizards/ac) in 2011, and the 2014 estimate (i.e., the same year as the construction surveys as well as the third consecutive year of drought) was 2.5 lizards/ha (1.0 lizards/ac). These estimates were derived from abundance data in Grimsley and Leavitt (2016), which were then divided by 15.2 ha (37.6 ac), the estimated effective survey area, based on a 45 m (147 ft) movement buffer around the survey plot as suggested for standardization with other data analysis conducted~~surveys~~ by Root (2010). The solar facility portion of the CSolar project was located on 457 ha (1,130 ac) of abandoned agricultural fields that were considered barren or in the early seral stages of desert scrub in 2015 (Ultrasystems 2015) but were dominated by non-native weeds such as Sahara mustard (*Brassica tournefortii*) and London rocket (*Sisymbrium irio*) five years prior (RECON 2010). In this degraded habitat, another 95 Flat-tailed Horned Lizards were found, or approximately 0.21 lizards/ha (0.08 lizards/ac) (Dudek 2016).

Comment [RL23]: USFWS: So as not to compare apples to oranges, you should verify if the two survey efforts, CSolar West's project monitoring vs. demographic monitoring, can be evaluated in this context. For example, were all 152 lizards found by Ultra-Systems unique individuals?

Comment [FMS24]: Root did not conduct surveys, he crunched the numbers from previous surveys done from 2005 to 2009.

Population Trend

Flat-tailed Horned Lizard populations appear to be highly sensitive to environmental fluctuations, which can result in high variability in abundance over short periods of time (Young and Young 2000). For example, within stabilized sand fields in the Coachella Valley, Barrows and Allen (2009) recorded the Flat-tailed Horned Lizard population decline by approximately 50% per year from 2002 to 2005, with a >90% decline overall; however, it was able to recover with no management action. This high level of variability coupled with the species' low detectability make accurate estimates of population trends exceedingly challenging, and comparisons in abundance or rate of detection from a small number of time periods should be viewed with caution.

Until fairly recently, evidence of population trends were limited to anecdotal accounts, primarily of seemingly precipitous localized declines (Altman 1980, Turner et al. 1980) that may have at least partially been attributable to wet vs. dry years (Turner and Medica 1982), and use of Flat-tailed Horned Lizard sign (e.g., scat and tracks) as well as individual lizards, which as previously mentioned is often unreliable. As an example, Wright (2002) analyzed scat and lizard detection rate data from 1979 to 2001 across a number of BLM properties and found no significant population trend over that period, but he cautioned that the survey methodology was inconsistently conducted throughout this. In addition to the complications associated with making assumptions about correlations between scat detection and lizard abundance, in all years except one, the survey effort was less than the estimated minimum necessary to have an 80% probability of being within 50% of the true mean sighting rate (Ibid.). However, when the data from the Yuha Basin, West Mesa, and East Mesa were combined, they met or exceeded this threshold, and the detection rate per 10 hr of surveying was 1.1 lizards in 1979, 1.0 lizards in 1985, 0.0 lizards in 1989, 1.2 lizards in 1991, and 1.1 lizards in 2001 (Ibid.).

Standardized demography survey protocols using solely mark-recapture Flat-tailed Horned Lizard data are a relatively recent development. Consequently, dataset with the longest duration on population trends using this method only spans 2007-2015. Grimsley and Leavitt (2016)

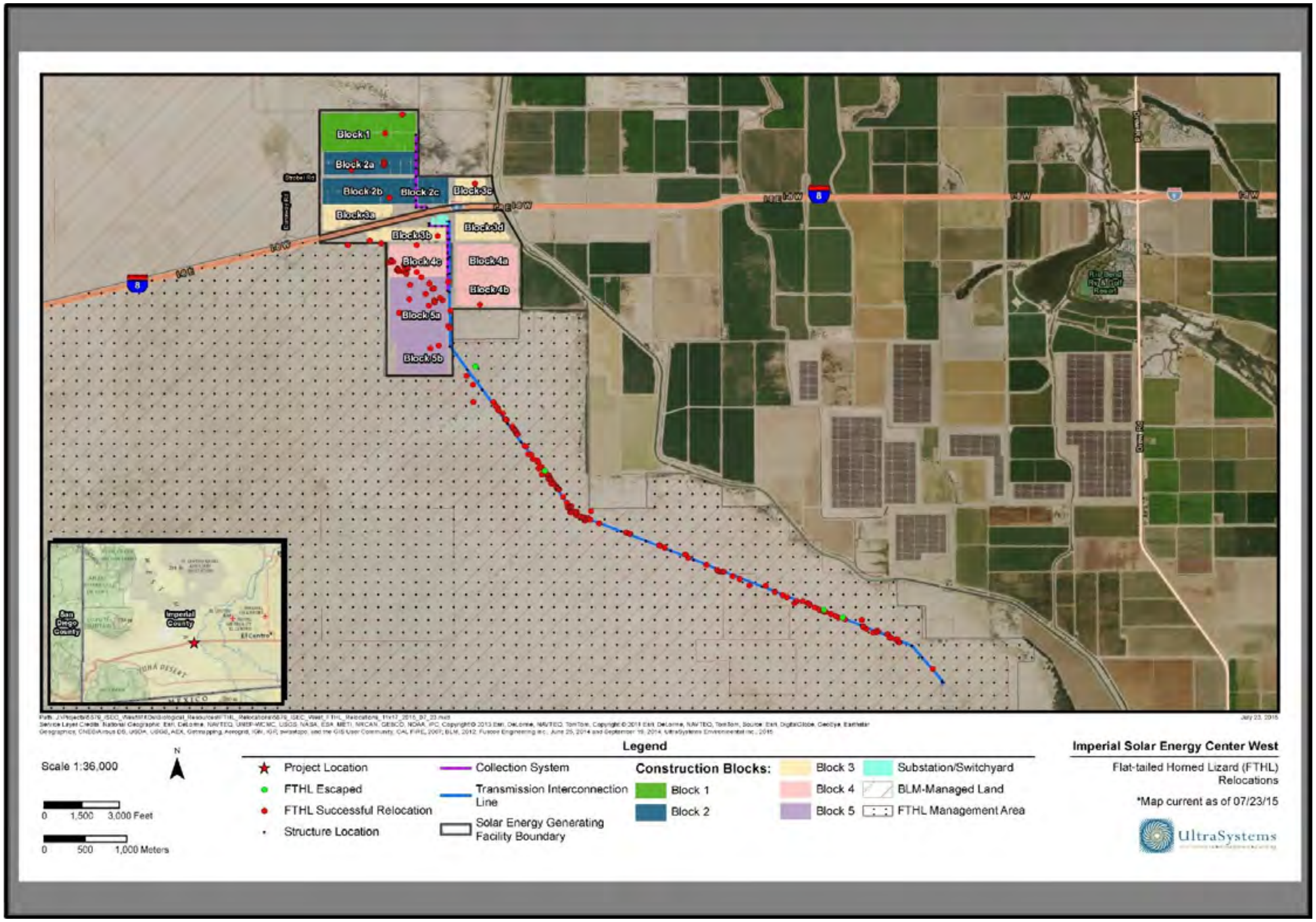


Figure 6. Flat-tailed Horned Lizard Observations (Relocations) within a Solar Project Footprint

calculated and plotted Flat-tailed Horned Lizard abundance estimates from Demography surveys on 9-ha plots within the RMS areas over that period of time (Figure 7). Demography surveys only began at Ocotillo Wells in 2014, and they have never been conducted on Borrego Badlands. As with the occupancy surveys, inconsistencies in demography survey data collection (e.g., number of surveyors and/or survey days) have led to large standard errors and the inability to estimate population parameters in some cases (Grimsley and Leavitt 2016). Nevertheless, the populations generally appear to be cycling up and down in concert (Leavitt et al. 2015). It should be noted that unlike the occupancy study plots, the demography survey plots were non-randomly selected within areas known or suspected to support greater than average~~average~~ Flat-tailed Horned Lizard densities, which are required in order to obtain robust enough datasets for use in population estimation models. Therefore, extrapolation of density estimates to areas outside of the high-quality survey plots cannot be legitimately undertaken. Nevertheless, these data do provide meaningful population trend data.

Comment [CDoPaR25]: Is "greater than average" correct? I believe the goal was to find average or "normal" populations. The only real criteria was to not have so few captures the data was unusable.

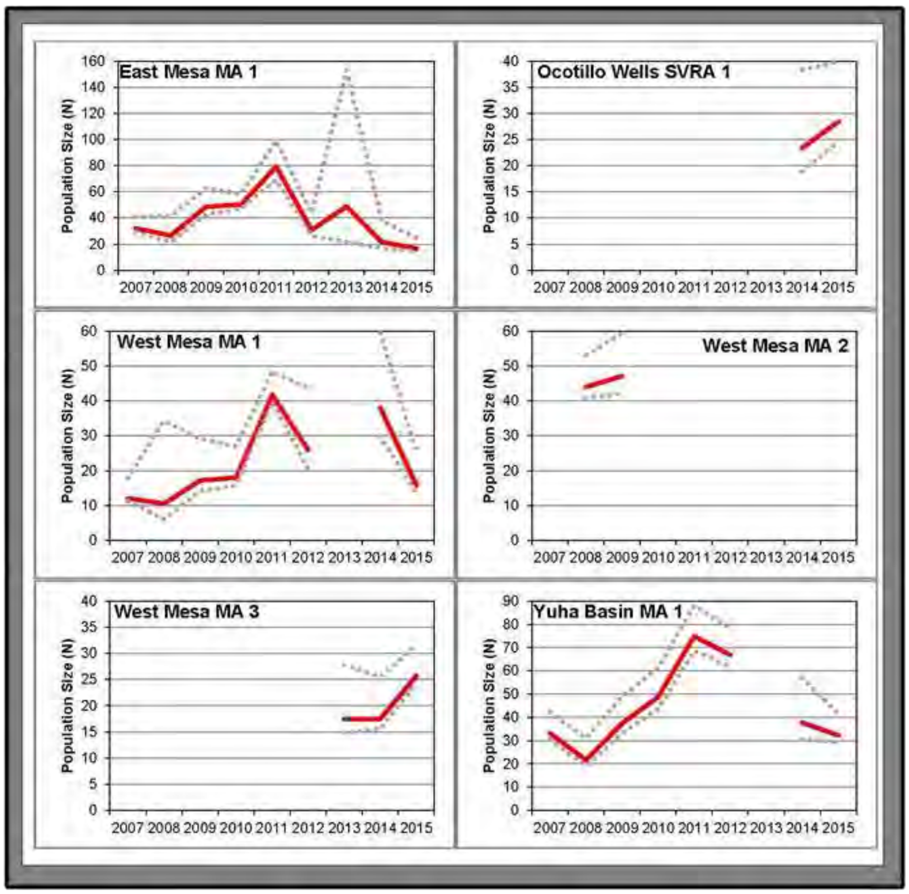


Figure 7. Annual Plot-level Flat-tailed Horned Lizard Population Estimates and Trends

The nearly fourfold increases in abundance from 2008 to 2011 on the three MAs in California that were surveyed consistently over that time reflect how rapidly and dramatically Flat-tailed Horned Lizards can respond to favorable conditions, and the subsequent declines to near 2008 levels from 2011 to 2015 reflect how rapidly they can decline as well. These fluctuations are often attributed to differences in precipitation, but the relationship between rainfall and Flat-tailed Horned Lizard abundance is complex and not always positively correlated (Barrows and Allen 2009, Leavitt 2013a, Young and Young 2000). California is currently experiencing an extreme drought that began in 2011. Predictions for a wetter 2015-2016 winter have not manifested as of March 31, 2016, and a vast majority of the Flat-tailed Horned Lizard's range in California is more than 50% below average precipitation for this water year to date (Figure 8).

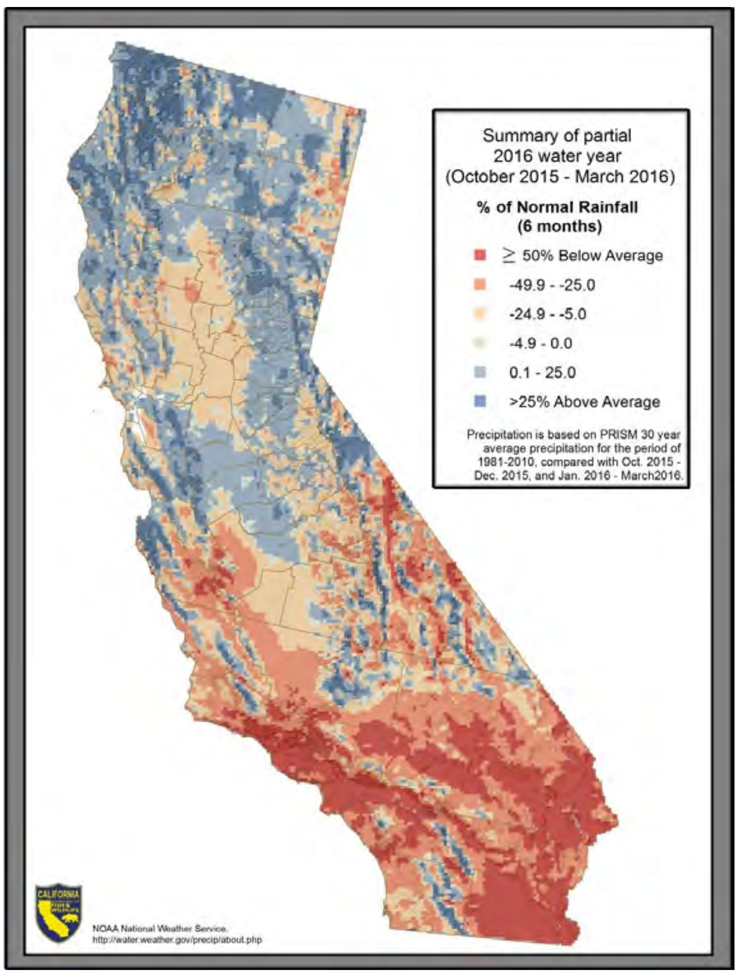


Figure 8. 2016 Water Year Statewide Precipitation Comparison to Average

EXISTING MANAGEMENT

Land Ownership within the California Range

Using the Department's current Flat-tailed Horned Lizard range in California, approximately 77% of the 666,916 ha (1,647,979 ac) are owned or managed by public agencies (Table 3, Figure 9). Of that land, 99% is managed by RMS participating agencies.

Table 3. Public Landownership within the Flat-tailed Horned Lizard's California Range[1]

Agency	Hectares	Acres	Group %	Unit %
Federal	*393,021*	*971,172*	*58.93%*	
U.S. Bureau of Land Management[2]	317,055	783,457		47.54%
U.S. Navy ~~and Marine Corps~~[2]	67,876	167,725		9.28%
U.S. Bureau of Reclamation[2]	12,335	38,480		1.85%
U.S. Fish and Wildlife Service[2]	1,524	3,766		0.23%
U.S. Forest Service	231	571		0.03%
State	*121,122*	*299,298*	*18.16%*	
California Department of Parks and Recreation[2]	116,099	286,886		17.41%
State Lands Commission	3,066	7,576		0.46%
California Department of Fish and Wildlife[2]	1,641	4,055		0.25%
Coachella Valley Mountains Conservancy	216	534		0.03%
California Wildlife Conservation Board	81	200		0.01%
University of California	20	49		0.00%
County	*362*	*895*	*0.05%*	
San Diego, County of	360	890		0.05%
Imperial, County of	2	5		0.00%
City	*49*	*121*	*0.01%*	
Palm Springs	37	91		0.01%
Cathedral City	9	22		0.00%
Palm Desert	2	5		0.00%
Indio	1	2		0.00%
Special District	*1,458*	*3,603*	*0.22%*	
Imperial Irrigation District	878	2,170		0.13%
Coachella Valley Water District	470	1,161		0.07%
Borrego Water District	64	158		0.01%
Desert Water Agency	31	77		0.00%
Palm Springs Unified School District	7	17		0.00%
Salton Community Services District	7	17		0.00%
Desert Recreation District	1	2		0.00%
Grand Total	**516,012**	**1,275,088**		**77.37%**

[1] California Protected Areas Database (CPAD) 2015 [2] RMS Participating Agency

Comment [RL26]: My understanding is that no USMC lands are occupied by FTHL in California.

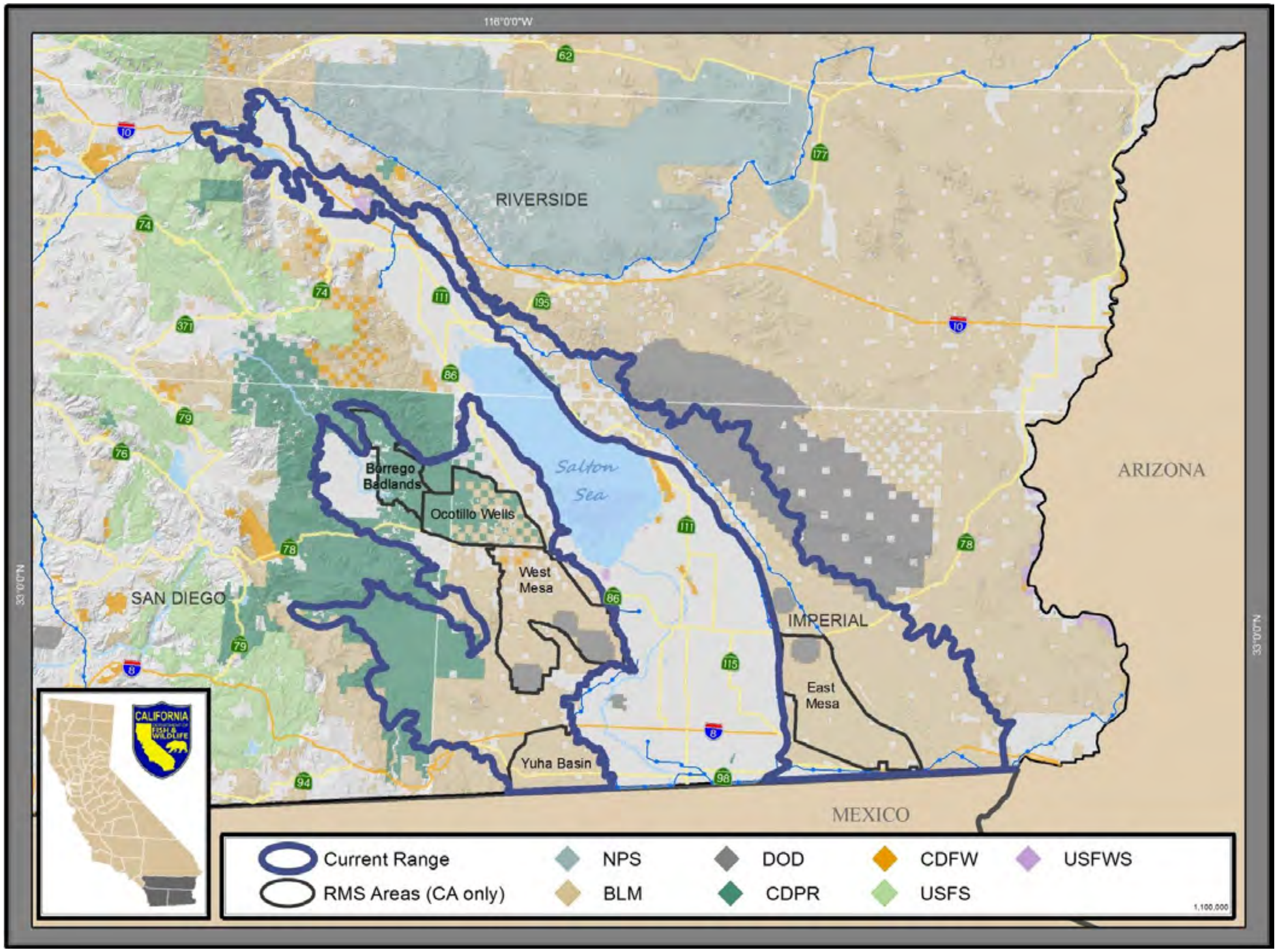


Figure 9. Main Land Ownership within the Flat-tailed Horned Lizard's California Range

Comment [RL27]: NAF El Centro: This map is inaccurate. Although much of our NAFEC range is Navy controlled, the underlying land owner is BLM. This map shows all of our ranges as DOD owned.

Flat-tailed Horned Lizard Rangewide Management Strategy

In 1997, a voluntary long-term Interagency Conservation Agreement (ICA) was signed by the Department, USFWS, BLM, U.S. Bureau of Reclamation, U.S. Marine Corps, U.S. Navy, Arizona Game and Fish Department, and the California Department of Parks and Recreation (California State Parks) to implement the Flat-tailed Horned Lizard Rangewide Management Strategy (RMS), which was subsequently revised in 2003 (FTHLICC 2003, Foreman 1997). The RMS is implemented by the Interagency Coordinating Committee (ICC) and the Management Oversight Group (MOG), both comprised of members of the signatory agencies. The overall goal of the RMS is to “maintain self-sustaining populations of Flat-tailed Horned Lizard in perpetuity” (FTHLICC 2003~~2003~~). As briefly discussed in the Existing Regulatory Status section, the RMS established five Management Areas (MA), four in California and one in Arizona, and one Research Area (RA) in an active off-highway vehicle (OHV) park (Foreman 1997). MAs were designed to include as much high-quality Flat-tailed Horned Lizard habitat (as identified in previous studies) and as large an area as possible, while avoiding extensive, existing, and predicted management conflicts such as OHV open riding areas (FTHLICC 2003). The RA was established to encourage research on the potential impacts of OHV use on Flat-tailed Horned Lizards, funded through the California Department of Parks and Recreation’s Off-Highway Motor Vehicle Recreation Division (OHMVRD) (Foreman 1997).

Management objectives for MAs include:

- Continue to secure and/or manage sufficient habitat to maintain self-sustaining Flat-tailed Horned Lizard populations in each of the five designated MAs;
- Maintain a “long-term stable” or increasing population of Flat-tailed Horned Lizards in all MAs (a population that is stable over the long term exhibits no downward population trend after the effects of natural demographic and environmental stochasticity are removed);
- Continue to support research that promotes conservation of the species;
- Within and outside of MAs, limit the loss of habitat and effects on Flat-tailed Horned Lizard populations through the application of effective mitigation and compensation; and
- Encourage and assist Mexico in the development and implementation of a Flat-tailed Horned Lizard conservation program (FTHLICC 2003).

Although entry into the ICA and implementation of the RMS is voluntary and based on available funding, BLM and the Department of Defense have formally adopted the RMS within some of their agencies’ environmental planning documents. The BLM, through a California Desert Conservation Area Plan amendment, adopted the three California MAs as Areas of Critical Environmental Concern (ACEC) in 2005 (FTHLICC 2013). Under the Sikes Act, the Department of Defense has codified the RMS into the Integrated Natural Resources Management Plans (INRMPs) for their installations (Navy 2014, USAF and USMC 2013).

California State Parks, the third main landowner within the Flat-tailed Horned Lizard’s California range, has not formally adopted the RMS into its planning documents. The Anza-Borrego Desert State Park Final General Plan and Environmental Impact Report (EIR) were approved by the State Parks and Recreation Commission in 2005. While they include goals and guidelines for conservation of significant and sensitive biota (CDPR 2005), they do not directly address

Comment [CDoPaR28]: OWSRVA is also compelled to protect all plants and animals and review all projects/special events for CEQA compliance. California Species of Special Concern are afforded the same protection s as “listed” species during project review utilizing minimization, mitigation and avoidance when needed.

Comment [RL29]: Is this in the acronym table and spelled out at first use?

Flat-tailed Horned Lizard, which affects dedication of funding and staffing availability to implement the RMS. Management for the Flat-tailed Horned Lizard within the Ocotillo Wells State Vehicular Recreation Area (OWSVRA) falls under guidelines incorporated by California State Parks to evaluate and sustain park resources, but as an RA, OWSVRA is not subject to the same protections from disturbance in the RMS as the MAs are. OWSVRA is mandated to provide OHV recreation (e.g., free-play, racing, and touring) in a manner to sustain long-term use (FTHLICC 2003). The OHMVRD, in cooperation with the BLM, is preparing a General Plan/Recreation Area Management Plan/California Desert Conservation Area Land Use Plan Amendment ("Ocotillo Wells SVRA Plan") and associated EIR/Environmental Impact Statement (EIS), which will update the current general plan that was developed in 1982 (CDPR 2015). The objective of the Ocotillo Wells SVRA Plan is to create a comprehensive planning tool under both state and federal guidelines to effectively manage Ocotillo Wells SVRA for high quality recreation, while protecting its resources in a sustainable manner (Ibid.).

Each MA is controlled by multiple agencies, and all MAs in California include private inholdings, which are targeted for acquisition to reduce the chance of development within the MA boundaries (Ibid.). Land management within the MAs is designed to avoid or reduce permanent surface disturbance and to promote reclamation of disturbed areas (e.g., duplicate roads that are no longer needed) (Ibid.). The RMS requires compensatory mitigation for long-term impacts to Flat-tailed Horned Lizard habitat at ratios anywhere from 3:1 to 6:1 within MAs and 1:1 outside of them, and surface disturbance cannot exceed 1% of the total area within the MAs (Ibid.). While there is no indication the participating agencies will increase this disturbance cap in the future, it is a voluntary measure in areas where it has not been formally adopted (i.e., outside the ACECs), and has never been exceeded on any MA.

The land area within the California MA boundaries totals 142,518 ha, approximately 21% of the Flat-tailed Horned Lizard's range in the state (using the Department's current estimated range map, Figure 1). Since 1997, impacts to 346 ha have been approved within the California MAs, and 6,811 ha of private lands have been acquired (FTHLICC 2015). In 2014, authorized surface impacts increased in MAs as a result of solar energy development and military projects (Ibid). The most recent RMS implementation progress report concludes "there is some concern the 1% development cap may be reached, and exceeded, in some MAs due to utility-scale renewable energy development and Navy projects" (Ibid.). However, there is no consideration of revising the 1% cap on surface disturbance in the RMS by the FTHL ICC.

As already described in the Status and Trends in California sections, participating agencies conduct occupancy and demography surveys to monitor Flat-tailed Horned Lizard trends on the RMS areas. Formal monitoring under the RMS began in 2002, and as techniques were refined, a Flat-tailed Horned Lizard Monitoring Plan was developed in 2008 to standardize monitoring methods, data collection, and related activities (Ibid.). The Monitoring Plan was further revised in 2011 "to improve the precision of occupancy estimates and detection probability" (Ibid). The general inconsistency of data collection over the years preceding the development of standardized monitoring ha~~s~~ve made population trend analysis somewhat challenging until the monitoring data from 2008-onward became available (Grimsley and Leavitt 2016).~~, and t~~The participating agencies ~~admit~~ recognize that full population monitoring efforts needed to quantify critical population indices and detect trends take significant amounts of time and resources to

Comment [RL30]: See previous map comments. Range map is suspect as depicted.

understand. ~~suffer from f~~Funding and staffing constraints over most of the areas managed in California (FTHLICC 2015) are always a challenge, for any species or monitoring in the region, not only the FTHL. Despite the difficulties, monitoring actions taken under the RMS have produced the best monitoring data available on FTHL rangewide, and have made significant advances in understanding the sought-after indices and trends to an extent that was unreachable prior to implementation of monitoring from 2008-onward. Aside from ~~that~~that the advances in monitoring, and continued refinement of the monitoring data with each new year of data, the most recent RMS implementation progress report concludes that “the majority of the tasks outlined by the [RMS] are being completed on schedule” (only “provide public information and education” is ongoing but not on schedule, and “determine effects of natural barriers” has not been completed) (Ibid). The determination of natural barriers is actively being pursued through multiple projects funded directly by the ICC at the present time, including Rangewide landscape genomics, development of a habitat model, and a focused analysis of corridors important to the species.

In addition to ~~conducting~~ population monitoring, ~~the participating agencies have supported and are currently supporting several~~numerous research ~~projects~~ studies have been completed since the inception of the RMS to provide for better understanding and conservation of the species. These have been accomplished using compensation funds collected and administered by the ICC and through direct funding and personnel by RMS participant agencies. These include, but are not limited to, a detailed general ecology (Young 2010), evaluating the potential for OHVs to crush Flat-tailed Horned Lizards during hibernation (Grant and Doherty 2009), quantification of disturbance (Villarreal 2014), effects of military activities (Goode and Parker 2015), ecological associations with Flat-tailed Horned Lizard occupancy at OWSVRA (Beauchamp et al. 1998, Gardner 2005), OHV effects (Nicolai and Lovich 2000, McGrann et al. 2006, Wone et al. 1994, Young 1999), genetics (Culver and Dee 2008, Mulcahy et al. 2006), landscape genomics (FTHLICC 2016), use of culverts (Painter and Ingraldi 2007), effects of translocation (Goode and Parker 2015, Painter et al. 2008), road mortality (Goode and Parker 2015), efficacy of barrier fencing along roads (Gardner et al. 2001) and large scale projects (Goode and Parker 2015), habitat suitability modeling (FTHLICC 2016), population viability analyses (Fisher et al. 1998, FTHLICC 2016), potential eastern Salton Trough movement corridor (FTHLICC 2016), disturbance mapping (Villarreal 2014, Fernandez et al. 2006, Rorabaugh et al. 2002), anthropogenic influences on avian predation (Ibid.), and climate change (Ibid.).

Coachella Valley Multiple Species Habitat Conservation Plan

The Coachella Valley Multiple Species Habitat Conservation Plan (CVMSHCP) is a multi-jurisdiction~~agency~~ plan, adopted pursuant to the federal Endangered Species Act and the California Natural Communities Conservation Planning Act. It provides for the long-term conservation of ecological diversity within the Coachella Valley region of Riverside County, while streamlining the development application review process throughout the plan area. The Department and the USFWS issued permits for the 75-year term CVMSCHP in 2008. The CVMSCHP includes an area of approximately 445,000 ha that do not include Indian Reservation Lands (CVCC 2015). The Flat-tailed horned lizard is a Covered Species under the plan.

Comment [LP31]: K. V. Young. COMPARATIVE ECOLOGY OF NARROWLY SYMPATRIC HORNED LIZARDS UNDER VARIABLE CLIMATIC CONDITIONS. Dissertation, Utah Statue Univ. 142 p.

Comment [LP32]: Evaluation of Anthropogenic Impacts on the Barry M. Goldwater Range-West. Final Report. USGS Cooperative Ecosystem Studies Unit agreement W9126G-11-1-0045

Comment [LP33]: Matt Goode and Mickey Ray Parker. Evaluation of Potential Impacts of the Joint Strike Fighter Program on the Flat-Tailed Horned Lizard at MCAS-Yuma, Barry M. Goldwater Range
FINAL REPORT

Comment [RL34]: AGFD: Preliminary observations of the behavior of male flat-tailed horned lizards before and after an off-highway vehicle race In California. California Fish and Game 86(3):208-212.

Comment [RL35]: AGFD: DANIEL G. MULCAHY, ALLEN W. SPAULDING, JOSEPH R. MENDELSON III and EDMUND D. BRODIE JR. 2006. Phylogeography of the flat-tailed horned lizard (Phrynosoma mcallii) and systematics of the P. mcallii–platyrhinos mtDNA complex. Molecular Ecology (2006) 1-20.

Comment [ASR36]: Villarreal, M.L. 2014. Disturbance mapping of the Flat-tailed Horned Lizard Yuma Management Area. Prepared by the USGS in cooperation with the University of Arizona

Comment [ASR37]: Fernandez E., Rorabaugh, J., Piest, L. 2006. Human Disturbance in the Flat-tailed Horned Lizard Yuma Desert Management Area. Prepared by the U.S. Fish and Wildlife Service and Arizona Game and Fish Department.

Comment [ASR38]: Rouabaugh, J., Coffeen, M., and Piest, L. 2002. Human Disturbance in the Flat-tailed Horned Lizard Yuma Desert Management Area. Prepared by the U.S. Fish and Wildlife Service and Arizona Game and Fish Department.

Within the plan area there are 13,122 ha of predicted modeled habitat for the Flat-tailed Horned Lizard of which 1,678 ha are identified as core habitat (CVMSHCP 2007). The CVMSHCP will conserve~~s~~ 98% of the core habitat and 93% of other habitat beneficial to the conservation of the species (Ibid.). Outside of the ~~c~~Conservation A~~a~~reas designated by the plan, 52% of predicted modeled habitat and 29% of potential habitat are authorized for incidental take of Flat-tailed Horned Lizards (Ibid.). These areas are already highly fragmented, surrounded by existing development, and have a compromised sand source/transport system (Ibid.).

Although the CVMSHCP predicts there is suitable or potential habitat within a number of conservation areas, Flat-tailed Horned Lizards appear to have been extirpated from nearly all of the Coachella Valley with the exception of the Thousand Palms ~~Preserve~~ Conservation Area and ~~possibly~~ the Dos Palmas Conservation Area. While the CVMSCHP (2007) states that "[i]deally, three or more sites with discrete sand sources and of sufficient size to maintain a viable population should be preserved," it also recognizes that "[r]ealistically there are not three such sites remaining that are not already fragmented or otherwise compromised by Development." Only Thousand Palms is considered "core habitat," meaning it is presumably large enough to sustain a population, although see the Fragmentation, Edge Effects, and Small Populations section below (Ibid.). Nevertheless, the CVMSCHP (2007) concludes that the Conservation Areas benefit the FTHL "by securing the long-term sand source-sand transport systems for their preferred habitat in the dune areas of the western and central Coachella Valley and by securing the unprotected habitat …throughout the plan area" (Ibid).

Comment [RL39]: FTHL were confirmed extant at Dos Palmas last year in the ICC's corridor analysis project.

As of 2015, 81% of the Flat-tailed Horned Lizard Habitat to be conserved within the Thousand Palms Conservation Area has been acquired (CVCC 2015), although the vast majority of it was ~~already~~ conserved prior to permitting the CVMSHCP through conservation actions associated with the Fringe-toed Lizard Habitat Conservation Plan~~the plan~~. Only 15% of the Flat-tailed Horned Lizard habitat to be conserved in the Dos Palmas Conservation Area, and none of the East Indio Hills Conservation Area has been acquired from 2006-2014 (Ibid.).

Lower Colorado River Multi-Species Conservation Program

The 50-year Lower Colorado River Multi-Species Conservation Program (LCR MSCP) was signed by the Department of the Interior Secretary and representatives from agencies within Arizona, California, and Nevada in 2005. The LCR MSCP was created to balance the use of the Colorado River water resources with the conservation of native species and their habitats from Lake Mead to the southernmost border of Mexico (LCR MSCP 2016). The plan is implemented by the Bureau of Reclamation (Ibid.).

None of the LCR MSCP area falls within the Flat-tailed Horned Lizard's range in California, but a small portion occurs between Imperial Dam and the Mexican border in Arizona (LCR MSCP 2015). There are two Flat-tailed Horned Lizard-specific conservation measures in the plan. The first is to acquire and protect 230 acres of unprotected occupied Flat-tailed Horned Lizard habitat, which was completed by purchasing two privately owned parcels totaling 240 acres adjacent to the Yuha Basin MA in 2012 (C. Ronning pers. comm.). The second is to implement conservation measures to avoid or minimize take of Flat-tailed Horned Lizards including those described in the RMS (LCR MSCP 2015).

California Desert Conservation Area Plan

In 1976, the Federal Land Policy and Management Act (FLPMA) authorized the BLM to conserve and manage public lands, and required the preparation of the California Desert Conservation Area Plan (CDCA). The BLM can designate ACECs through the CDCA. ACECs are defined as “areas within the public lands where special management attention is required (when such areas are developed or used or where no development is required) to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources or other natural systems or processes, or to protect life and safety from natural hazards” (DOI 2001). The goals of ACECs are to:

• Identify and protect the significant natural and cultural resources requiring special management attention found on the BLM-administered lands in the CDCA;

• Provide for other uses in the designated areas, compatible with the protection and enhancement of the significant natural and cultural resources; and

• Systematically monitor the preservation of the significant natural and cultural resources on BLM-administered lands, and the compatibility of other allowed uses with these resources (DOI 1980). ~~Identify and protect the significant natural and cultural resources requiring special management attention found on the BLM-administered lands in the CDCA;~~

~~Provide for other uses in the designated areas, compatible with the protection and enhancement of the significant natural and cultural resources; and~~

~~Systematically monitor the preservation of the significant natural and cultural resources on BLM-administered lands, and the compatibility of other allowed uses with these resources (DOI 1980).~~

Portions of the three MAs administered by the BLM (East Mesa, Yuha Basin, and West Mesa) were designated as ACECs to protect the Flat-tailed Horned Lizard in 2005 (BLM 2016c, FTHLICC 2006). The Coachella Valley Fringe-toed Lizard and Dos Palmas ACECs in the Coachella Valley also provide protection for the Flat-tailed Horned Lizard (BLM 2016c). North Algodones Dunes, which supports Flat-tailed Horned Lizards along its vegetated edges, was an ACEC but was recently withdrawn because it is already designated wilderness under the National Landscape Conservation System and the ACEC designation was unnecessary (BLM 2016c). Management requirements vary by location but in general include controlling and erecting signs explaining vehicle access areas and routes, restricting mineral exploration/development, developing additional habitat/water sources, conducting intensive resource inventories, controlling exotic and introducing native species, and stabilizing/rehabilitating/salvaging features (DOI 1980).

California Environmental Quality Act

Flat-tailed Horned Lizards are designated as a SSC by the Department, and as such the California Environmental Quality Act (CEQA) provides the species with certain protections from projects undertaken or approved by public agencies. CEQA is a California law (Public Resources Code Section 21000 et seq.) that requires state and local agencies to publicly disclose, analyze, and potentially mitigate environmental impacts from projects over which they have discretionary approval power. In particular, CEQA requires that actions that may substantially reduce the habitat, decrease the number, or restrict the range of any species that can be considered rare, threatened, or endangered must be identified, disclosed, considered, and mitigated or justified. (Cal. Code Regs., tit. 14, §§ 15065(a)(1), 15380.)

CEQA compliance is not always thorough because the process can be very costly and time-consuming. Agencies may also determine projects are exempt (i.e., they do not need to go through the impact analysis, public disclosure, and mitigation process). Mitigation is required if a project is not CEQA-exempt and impacts would be potentially “significant.” Mitigation must reduce impacts to below a level of significance or minimize unavoidable significant impacts, where feasible. The CEQA process generally incentivizes agencies and project applicants to implement mitigation thereby avoiding significant impacts.

Impacts on Flat-tailed Horned Lizards are generally considered potentially significant if agencies determine on a project-specific basis that the species meets the CEQA criteria for endangered, rare, or threatened. However, agencies are not required to make this determination for Flat-tailed Horned Lizards and other species that are not listed under the California or federal Endangered Species Acts. Even when they are considered in a CEQA analysis, lack of readily available information on which to base impact analyses and lack of understanding of the law may result in projects having an unknown significant impact on the species.

One measure that is often used to minimize adverse impacts to sensitive species is translocation of encountered individuals a safe distance away from the construction site. However, its utility in conserving species has been questioned (Germano and Bishop 2009, Germano et al. 2015). Two recent studies evaluated the efficacy of translocation for conserving Flat-tailed Horned Lizards (Goode and Parker 2015, Painter et al. 2008). While their methods were somewhat different, their results were quite similar. Both studies compared survival, persistence, behavior, and movement patterns using radio-telemetry on translocated and control Flat-tailed Horned Lizards (Ibid.). In the months immediately following translocation (late summer/fall 2012), both translocated males and females had significantly larger home ranges than non-translocated individuals; however, after that, there was no significant difference between the two groups (Goode and Parker 2015). Survival probabilities were lower for translocated Flat-tailed Horned Lizards, although the difference was not statistically significant (Goode and Parker 2015, Painter et al. 2008). This result indicates Flat-tailed Horned Lizards may have a period of acclimation following translocation as they adjust to their new locations (Ibid.). Painter et al. (2008) noted greater movements in translocated individuals up to 14 days post-release. Goode and Parker (2015) did observe~~d~~ translocated Flat-tailed Horned Lizards engaging in reproductive behavior and concluded that “[w]hile the results of this project certainly do not justify making translocation a commonly used mitigation measure for Flat-tailed Horned Lizards, there were some promising results that warrant further study.”

In order for translocation to be effective, exclusion fencing must be maintained. Goode and Parker (2015) observed telemetered Flat-tailed Horned Lizards ~~crossing~~ climbing over the fence with some regularity; thirty individuals, both non-translocated and translocated, crossed the fence at least once. The fence used in this study “began falling into disrepair almost immediately after it was constructed, with sand drifts accumulating quickly and holes appearing after several weeks” (Ibid). Most, if not all, of these individuals were placed immediately outside the exclusion fencing, and given the relatively large home ranges of Flat-tailed Horned Lizards, it is not surprising that they would attempt to return to where they were captured~~re-enter~~. Painter et al.

(2008) noted that while none of the translocated Flat-tailed Horned Lizards that were moved greater than 1.6 km (1 mi) away showed signs of homing behavior, control individuals that were released 100 m (328 ft) away from their capture point did.

FACTORS AFFECTING ABILITY TO SURVIVE AND REPRODUCE

Fragmentation, Edge Effects, and Small Populations

It is well established that loss of habitat is the primary reason for a vast majority of species' declines and extinctions globally; however, declines can occur even in seemingly relatively undisturbed habitat when barriers to movement fragment once contiguous blocks into smaller areas and when adverse impacts from adjacent land uses extend into that habitat (i.e., edge effects). Depending on their severity, edge effects around habitat fragments can create perpetual population sinks (areas of negative population growth) because the habitat is still intact, so individuals will continue to move into it where they can experience high mortality risk than in the habitat block's core. Such sinks will have the greatest impact on overall population dynamics in small reserves with high perimeter-to-area ratios and in species that range widely and therefore come into frequent contact with edge more often (Woodroffe and Ginsberg 1998).

Fragmentation and edge effects can be particularly deleterious when they impact species with small populations or create smaller populations, which are more at risk of decline or localized extinctions from random fluctuations in abundance and loss of genetic diversity through drift (Woodroffe and Ginsberg 1998). For example, Vandergast et al. (2016) discovered that genetic structure among Coachella Valley Fringe-toed Lizard (*Uma inornata*) populations increased, while genetic diversity and effective population sizes decreased between 1996 and 2008. They suggested this rapid differentiation was likely a synergistic effect of population declines during the historic drought of the late 1990s–early 2000s and habitat fragmentation that precluded post-drought genetic rescue (Ibid.). Flat-tailed Horned Lizard populations in the Coachella Valley are even smaller and more fragmented than the Coachella Valley Fringe-toed Lizard, apparently only persisting in two ~~preserves~~ conservation areas (Barrows et al. 2008). Similarly, Culver and Dee (2008) discovered that a small population of Flat-tailed Horned Lizards, separated from the rest of the species' range in Arizona by development and Interstate 8, was moderately genetically differentiated from those located south of the road. Their observation of a disproportionately high frequency of an allele that was otherwise rare in all other populations suggested evidence of either a strong selective force north of the freeway or random genetic drift or inbreeding due to the effects of isolation and small population size (Ibid.).

Edge effects, reported as reductions in Flat-tailed Horned Lizard detections, have been observed as great as 450 m away from a habitat edge and are primarily associated with increased predation by round-tailed ground squirrels, loggerhead shrikes, and American kestrels, as well as road mortality (Barrows et al. 2006, Goode and Parker 2015, Young and Young 2005). In some cases, these edge effects appear to be able to shift Flat-tailed Horned Lizard population dynamics from a bottom-up process, where the lizard numbers are regulated by native ant abundance, to a top-down process, where the lizards are limited by predation and

Comment [RL40]: Consider adding the fact that the vast majority of FTHL range in CA (77% from pg. 22 of this document) is managed by the RMS agencies, and fragmentation and edge effects not a pervasive problem across the MA's, which for the most part are vast, unfragmented areas within each MA.

Comment [RL41]: This is not true. They were found on a highway off-ramp project along I-10 in recent years. There have been addl. observations as well I believe.

possibly road mortality, creating a population sink along the habitat boundary (Barrows et al. 2006).

The USFWS (2011) evaluated Flat-tailed Horned Lizard habitat fragmentation by major canals and highways, the international border, and several railways by multiplying the size of the habitat fragment by the density estimate they used to calculate rangewide abundance (see Abundance above). Because no one knows what the minimum viable population size is for Flat-tailed Horned Lizards, the USFWS used 7,000 individuals per population (based on Reed et al. 2003) to differentiate between habitat fragments that were likely large enough to avoid deleterious effects from small population sizes from those that weren't (Ibid.). Based on this calculation, which did not incorporate edge effects, neither occupied ~~preserve~~ conservation area in the Coachella Valley appears large enough to support a "large enough" population, only three of nine areas west of the Imperial Valley were large enough (83% of the total area), and only two of eight areas east of the Imperial Valley were large enough (69% of the total area) (Ibid.).

Some species-specific evidence (Barrows et al. 2006, 2008; Culver and Dee 2008; Goode and Parker 2015; Young and Young 2005), ~~as well as some speculation (USFWS 2011)~~ and population dynamics theory (Woodroffe and Ginsberg 1998), support the contention that Flat-tailed Horned Lizards are susceptible to the adverse effects of habitat fragmentation, edge effects, and small population sizes.

Roads, Canals, and Railroads

Major highways, irrigation canals, and railroads form large-scale near-complete barriers to Flat-tailed Horned Lizard movement, migration, and gene flow (Figure 10). These linear features fragment the habitat and can have demonstrable edge effects through increased mortality. The permeability (i.e., likelihood Flat-tailed Horned Lizards can cross the barrier) of these features differs somewhat across the species' range.

Comment [RL42]: While Reed et al (2003) is a laudable effort, it is not tailored to FTHL specifically, and drawing inference from this manuscript should be viewed with caution, and not extrapolated precisely to FTHL.

Comment [USFWS43]: USFWS 2011 contains several pages of analysis of fragmentation, edge effects, and small population size, which do not support the "speculation" that FTHL are susceptible to these factors. Please carefully read the 2011 withdrawal rule and correctly summarize its analysis and conclusions.

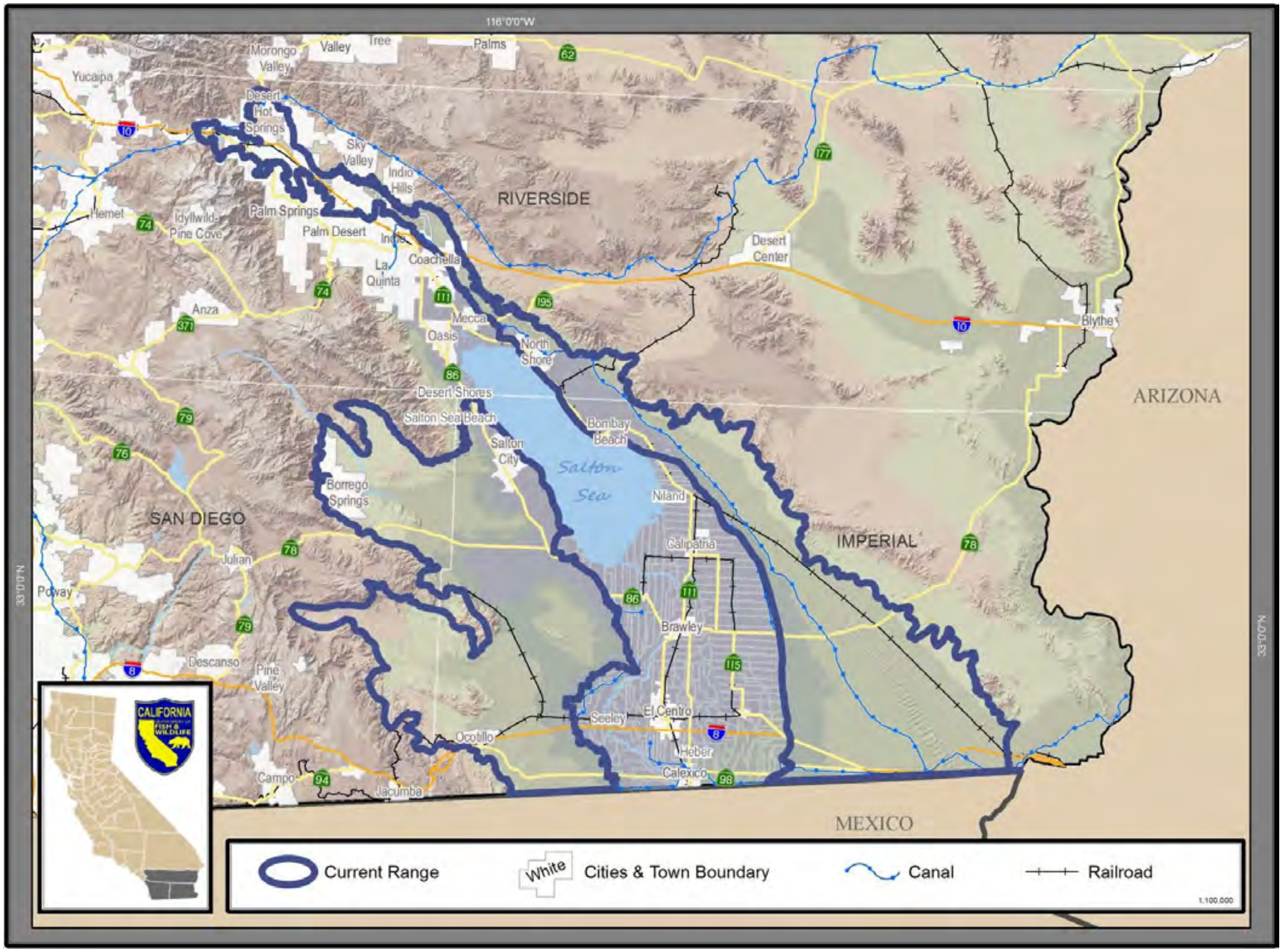


Figure 10. Major Barriers to Movement with the Flat-tailed Horned Lizard's California Range

Comment [RL44]: NAF El Centro: This map and the paragraph above imply that railroads are major barriers to movement. I doubt it and I doubt that there is a FTHL study supporting this assertion. Also, the map shows a railroad running east to west in the Dos Palmas area. This railroad track exists, but is not active and therefore is certainly not much of a barrier to gene flow. Also, the section refers to "m Major highways, but this map shows smaller highways, like Highway 78 while probably a source for higher mortality and a population sink, certainly is not much of a barrier to gene flow.

Several major highways bisect the species' range in California. Flat-tailed Horned Lizards are frequently found on and around roads, and because they often freeze in the presence of threats, including vehicles, they're particularly susceptible to being killed on roads. Flat-tailed horned lizards were the most commonly encountered reptile (dead or alive) on paved roads within a military base in Arizona during three years out of a four-year study (Goode and Parker 2015). They accounted for 40.2% of all dead-on-road reptile observations, although only 3/353 (0.8%) of radio-telemetered Flat-tailed Horned Lizard deaths were known road kills, and individuals were frequently tracked moving across roads (Ibid.). Reports of proportions of dead vs. live Flat-tailed Horned Lizards on roads range from 3% - 27% (Goode and Parker 2015, Muth and Fisher 1992, Turner et al. 1980, Young and Young 2000) but do little to assess the impacts roads may be having at a population level. At least two studies (Barrows et al. 2006, Goode and Parker 2015) have studied this population-level effect specifically on Flat-tailed Horned Lizards~~Several major highways bisect the species' range in California. Flat-tailed Horned Lizards are frequently found on and around roads, and because they often freeze in the presence of threats, including vehicles, they're particularly susceptible to being killed on roads. Flat-tailed horned lizards were the most commonly encountered reptile (dead or alive) on paved roads within a military base in Arizona during three years out of a four-year study (Goode and Parker 2015). They accounted for 40.2% of all dead-on-road reptile observations, although only 3/353 (0.8%) of radio-telemetered Flat-tailed Horned Lizard deaths were known road kills, and individuals were frequently tracked moving across roads (Ibid.). Reports of proportions of dead vs. live Flat-tailed Horned Lizards on roads range from 3% - 27% (Goode and Parker 2015, Muth and Fisher 1992, Turner et al. 1980, Young and Young 2000) but do little to assess the impacts roads may be having at a population level. At least two studies (Barrows et al. 2006, Goode and Parker 2015) have studied this population-level effect specifically on Flat-tailed Horned Lizards.~~

Comment [PRJCNS45]: Dead lizards on a two lane road are an indication that lizards are using the road surface for transit between areas and that it is not much of a barrier to gene flow.

Comment [RL46]: Which is also the highest density population on earth.

Using mark-recapture data, Goode and Parker (2015) reported no significant differences in population abundance estimates in plots adjacent to roads compared to control plots. In fact, two of the highest abundance estimates came from plots adjacent to roads. However, it should be noted that these were from plots without adjacent power poles (Ibid.), suggesting predation may be the primary driver of the observed edge effect, not road mortality (see Predation below). In a similar pattern, Barrows et al. (2006) reported a much greater and more abrupt reduction in Flat-tailed Horned Lizard detections near wider, well-traveled roads with curbs vs. narrower, less-traveled roads without curbs; however, they could not absolutely attribute this to road mortality because they simultaneously observed a high level of predation by American Kestrels using a palm tree planted across the wider road. While road mortality may be having a population-level effect in some areas, the sparse data available do not strongly validate this assertion.

Nearly all of the irrigation canals in the Flat-tailed Horned Lizard's range are located within the existing developed lands in the Imperial and Coachella valleys. Two major exceptions are the All American Canal and the Coachella Canal (Figure 9). No studies have been conducted regarding the impact of canals on Flat-tailed Horned Lizards; however, it is clear that they present a complete barrier to movement with the possible exception of overcrossings. The Coachella Canal has several overcrossings to accommodate water and sediment transport down washes coming from the mountains to the east. In contrast, the All American Canal has very few crossings, all of which are narrow vehicle bridges.

Canal maintenance or improvements and construction of any new facilities have the potential to injure or kill Flat-tailed Horned Lizards or destroy their habitat. Imperial Irrigation District is discussing potentially constructing an intake canal off the All American Canal heading north close to the East Highline Canal that would discharge into a reservoir (J. Lovecchio pers. comm.), which if constructed would likely adversely impact a relatively small area in the overall Flat-tailed Horned Lizard's range.

There are several railroad tracks that run through the Flat-tailed Horned Lizard's range in California that pose a barrier to movement over long distances. ~~There are several railroad tracks that run through the Flat-tailed Horned Lizard's range in California that pose a barrier to movement over long distances.~~ It is unclear whether Flat-tailed Horned Lizards would avoid the trestles. In some areas, there are bridges constructed over washes that would allow more unrestricted movement from one side to another, so even if they do avoid the trestles and tracks, some movement and gene flow is still possible.

Comment [PRJCNS47]: Should say " which constitutes an unknown hindrance to lizard movement"

Agricultural and Urban Development

As previously described in the Distribution section, the two primary sources of Flat-tailed Horned Lizard habitat loss over the past century have been agricultural and urban development in Coachella, Borrego, and Imperial valleys. New agricultural development has slowed substantially due to reduced water deliveries from the Lower Colorado River, and some fields have been fallowed (USFWS 2011) and converted to solar farms. Although the fallow fields may ~~only~~ be ~~marginally~~ suitable, Flat-tailed Horned Lizards have been observed using them (RECON 2010).

Comment [RL48]: Please watch the use of adverbs and adjectives in the document that seem to embellish topics being discussed. There is no need for embellishment.

Most land within the California portion of the Flat-tailed Horned Lizard's range is owned by the State or various federal and municipal agencies, so extensive urban development is unlikely (USFWS 2011), although the California Department of Finance (2014) projects Imperial County's population is likely to grow from 187,689 in 2010 to 336,492 in 2060 (79%). The majority of this growth in the near term (2021) will be directed to existing incorporated townsites, including Bombay Beach, Desert Shores, Heber, Niland, Ocotillo, Salton City, Salton Sea Beach, and Seeley (County of Imperial 2013) (Figure 10). Private land holdings are relatively small and discontinuous throughout the range (USFWS 2011), indicating development of private land is likely to have small, localized impacts. Additionally, the Flat-tailed Horned Lizard ICC has been using compensatory mitigation money from approved project disturbances to purchase private inholdings within and adjacent to the MA boundaries, reducing the likelihood urban (or other) development will fragment the habitat within these areas. Incidental take resulting from f~~F~~uture urban development in the Coachella Valley has been permitted through the CVMSHCP in areas outside the plan's designated Conservation Areas, which authorizes take resulting from development in approximately 50% of the modeled suitable Flat-tailed Horned Lizard habitat, although nearly all of it is already fragmented and surrounded by existing development, so it would not likely support the species anyway (CVMSHCP 2007). Within the ~~conservation~~ Conservation A~~a~~reas, under the worst case scenario, take would occur within 2% (39 ha) of core habitat (i.e., able to sustain a population), 6% (336 ha) of modeled suitable habitat, and 7% (100 ha) of potentially suitable habitat (Ibid.).

Renewable Energy Development

Unlike agricultural and urban development, renewable energy (solar, wind, geothermal) development within the Flat-tailed Horned Lizard's range has increased dramatically in recent years. Lovich and Ennen (2011, 2013) synthesize the literature on potential impacts from utility scale renewable energy projects on desert ecosystems and wildlife. These include but are not limited to (1) creating a barrier to movement and fragmenting habitat; (2) increasing mortality on access roads and through increased avian predation along transmission lines; (3) opening up previously inaccessible areas to the public, facilitating illegal OHV use; (4) producing fugitive dust; (5) increasing soil erosion; (6) spreading invasive species; (7) increasing exposure to contaminants; (8) producing persistent loud noise and vibrations (wind); (9) increasing risk of fire; and (10) potentially altering local temperature, precipitation, and wind conditions (Ibid.).

There are no known studies investigating the specific impacts of renewable energy facilities and their associated infrastructure on Flat-tailed Horned Lizards, although some information from other studies provided above on the effects habitat fragmentation, road mortality, and increased predation could apply. In addition, Olech (1984) reported that localized declines in indexed Flat-tailed Horned Lizard detections (scat and lizards) within the Yuha Basin corresponded with increased public use of those sites via construction of access roads for transmission lines and San Diego Gas and Electric's Imperial Valley Substation. Non-authorized OHV use was the most common "competing use" along all transects, and for transects where it was the only competing use of habitat, the temporal declines in observations were significant (Ibid.).

To date, renewable energy development in California has been permitted on a project-by-project basis. To facilitate this, the BLM has produced Programmatic Environmental Impact Statements (PEIS) for wind (BLM 2005), geothermal (BLM and USFS 2008), energy corridors (DOE and BLM 2008), and solar (BLM and DOE 2012). Wind resource potential is low throughout nearly all of the Flat-tailed Horned Lizard's range in California with the exception of the area around Ocotillo (BLM 2005) near the southwestern edge of the species' range, where the Ocotillo Wind Energy Facility was constructed in 2012 (BLM 2016a). Geothermal potential is greater, but its footprint is relatively small, and sites can typically be reclaimed and restored after extraction (BLM and USFS 2008).

Comment [RL49]: This project is very much at the edge of FTHL range, and not within by any means. Most of the project is located above FTHL range by elevation. They are largely absent from west of Ocotillo.

The potential for solar energy facilities to impact a substantial amount of Flat-tailed Horned Lizard habitat is greater than that of wind or geothermal. Two Solar Energy Zones (SEZ) were identified in the PEIS, but only one is located within the Flat-tailed Horned Lizard's range (BLM and DOE 2012). The 2,314 ha Imperial East SEZ is located immediately south of the East Mesa MA in a fragmented patch of habitat bordered by Interstate 8, Highway 98, and Imperial Valley agriculture (Ibid.). An additional SEZ, the 4,354 ha West Chocolate Mountains SEZ, was subsequently established within the approximately 26,000 ha West Chocolate Mountains Renewable Energy Evaluation Area (REEA), located immediately south of Dos Palmas east of the Salton Sea (BLM 2012). The Final EIS for the West Chocolate Mountains REEA incorporated the RMS as its conservation measures for Flat-tailed Horned Lizards (Ibid.). There were no pending solar project applications within the Imperial East SEZ as of April 2015 (BLM 2015) or West Chocolate Mountains SEZs as of June 2014 (BLM 2014).

From January 2009-September 2015, the BLM approved right-of-way grants for five solar~~five solar~~, one wind, and zero geothermal energy projects within the Flat-tailed Horned Lizard's range (BLM 2016a). Prior to 2009, the BLM had not approved any solar energy projects on public lands (Ibid.). The conservation, mitigation, and compensation measures in the RMS were incorporated into the environmental documents for these renewable energy projects, including minimizing impacts to Flat-tailed Horned Lizard habitat to the extent feasible, particularly within MAs, and purchasing compensation land or paying into a special fund for unavoidable impacts. For each approved project within a Flat-tailed Horned Lizard MA, the maximum (6:1) compensation ratio was applied.

Comment [FMS50]: The applicants for Imperial Valley Solar and Ocotillo Sol solar projects withdrew their ROW requests so if those projects are included in the 5, you should state that they will not be built or they were withdrawn.

Two energy corridors were identified that run roughly east to west through the Flat-tailed Horned Lizard's range in California, one in the far southern and one in the far northern parts of the range, overlapping portions of the East Mesa and Yuha Basin MAs as well as the Thousand Palms Preserve (DOE and BLM 2008). To date all of the solar projects with a BLM right-of-way grant have been located in the vicinity of the Imperial Valley Substation and Sunrise and Southwest Powerlinks (major transmission lines) in or around the Yuha Basin MA (BLM 2016a). Most of the solar facilities were constructed on private agricultural land, and disturbance to Flat-tailed Horned Lizard habitat was restricted to construction of transmission lines connecting the facilities with existing infrastructure (Figure 11).

Aside from solar projects on BLM lands, there are several other authorized or pending renewable energy projects within the Flat-tailed Horned Lizard's range in California. Wind energy facilities are concentrated in the two locations that possess moderate to high wind resource levels, each along the periphery of the species' range (BLM 2005). One area is located in the far northwestern extent of the species' presumptive range near Whitewater in Riverside County, and the other is located in a canyon west of Ocotillo along the Sunrise Powerlink corridor in Imperial County within approximately 8 km of the Yuha Basin MA. In addition to the already operational Ocotillo Express Wind Farm in the latter zone, approvals for testing in the same area have been issued to two other wind energy development companies (BLM 2016b). There are several dozen parcels with geothermal leases located in approximately four areas within the Flat-tailed Horned Lizard's range (BLM 2013). The East Mesa Geothermal Field lies partially within the East Mesa MA, the Truckhaven Geothermal Leasing Area is located within the Ocotillo Wells RA, and the West Chocolate Mountains Geothermal Leasing Area is within the West Chocolate Mountains REEA. The Truckhaven Geothermal Project recently completed a reconnaissance survey and subsequently decided not to proceed with any future development (M. Rodriguez pers. comm.). In addition, renewable energy facilities are being approved on county lands that are not requiring implementation of the RMS conservation measures, although renewable energy companies are expected to evaluate potential impacts to Flat-tailed Horned Lizards and mitigate to a less than significant level through CEQA compliance (see Existing Management section above).

With so many different agencies involved in renewable energy development oversight and approval and such a high demand in California, state and federal agencies recognized the need for a comprehensive plan to guide development in appropriate areas while protecting sensitive resources. In 2008, the BLM, California Energy Commission, USFWS, and the Department began a collaborative effort to draft a Desert Renewable Energy Conservation Plan (DRECP) covering the Mojave and Colorado/Sonora desert region of California. The Draft DRECP EIR/EIS was released for public comment in September 2014. As a result of feedback, the agencies decided to implement the DRECP in a phased approach starting with just BLM-administered lands. In November 2015, the BLM proposed Land Use Plan Amendment (LUPA) and DRECP Final EIS were released for public comment. In March 2016, the notice describing the proposed updates to the Areas of Critical Environmental Concern in the LUPA was published. The latter document proposes to designate 130 ACECs covering approximately 2,418,400 ha (including 445,569 ha within Wildlife Study Areas and Wilderness Areas) and includes Conservation and Management Actions (CMAs) and resource use limitations to manage those ACECs, including a detailed methodology for implementing and managing for ground disturbance caps in ACECs (DRECP 2015). Figure 12 depicts the Development Focus Areas (DFAs) in relation to the RMS areas and proposed expansion of protected areas.

Within the LUPA area there are approximately 173,610 ha of Flat-tailed Horned Lizard habitat located on BLM-managed lands primarily in the Imperial Borrego Valley Ecoregion Subarea (DRECP 2015). Impacts would occur in three BLM managed areas: the western foothills of the

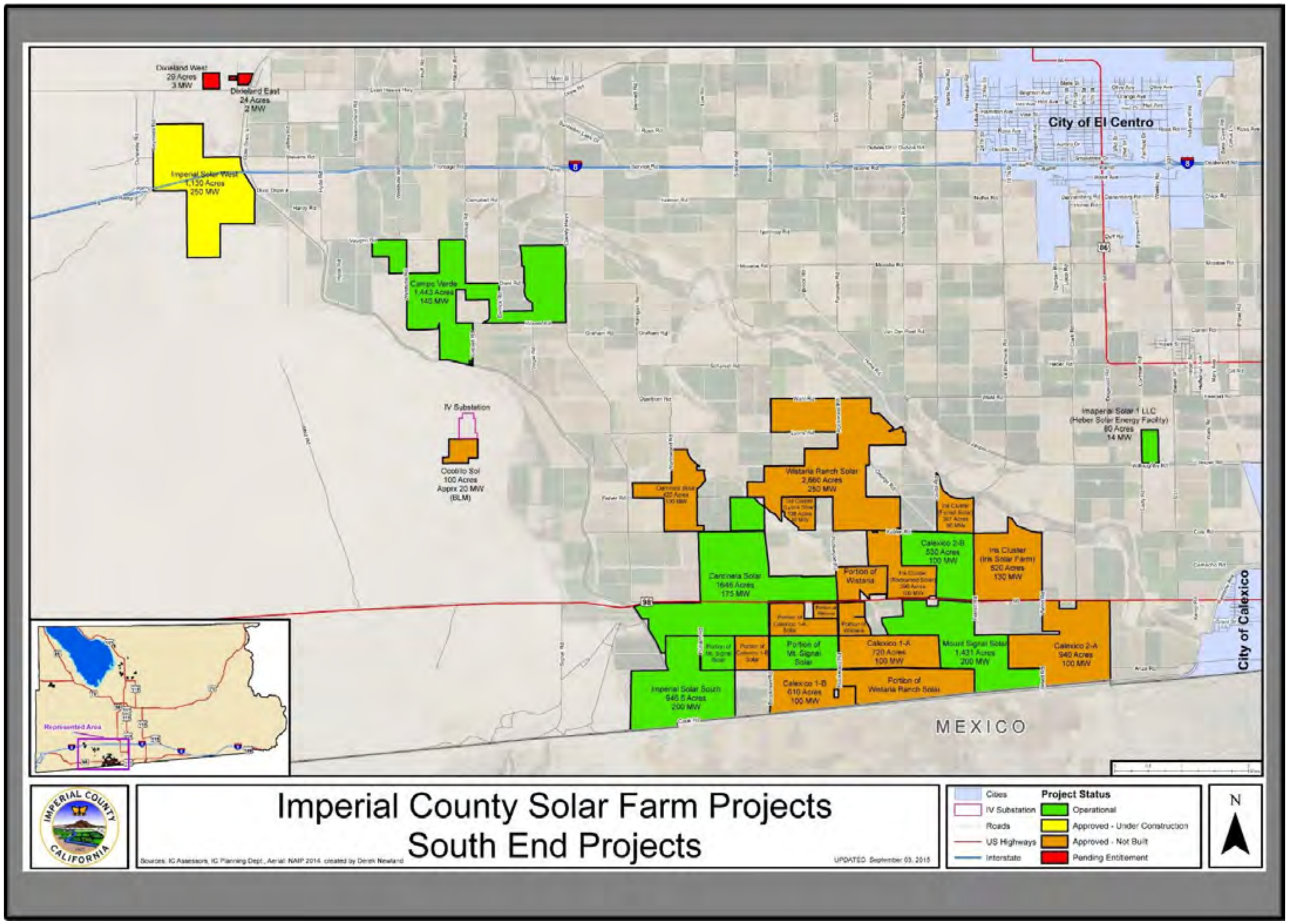


Figure 11. Solar Facility Footprints in Southwestern Imperial County

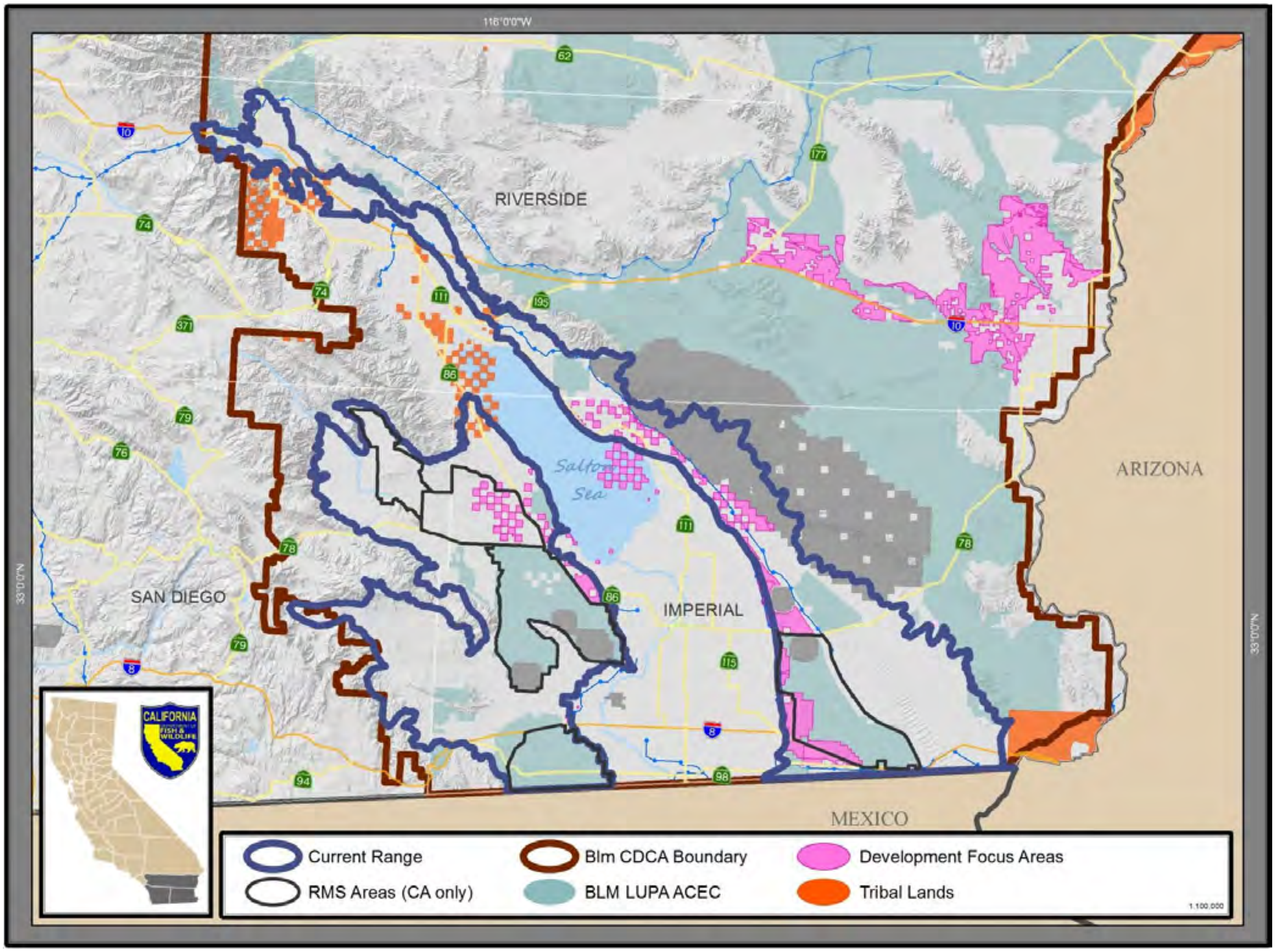


Figure 12. Land Use Designations under the Proposed BLM LUPA

Chocolate Mountains that include geothermal leasing areas studied in the 2008 Geothermal PEIS; BLM land along the western edge of East Mesa ACEC; and in BLM managed lands on the west side of the Salton Sea that include the Truckhaven Geothermal Leasing Area within the Ocotillo Wells RA. Under the Preferred Alternative, approximately 2,833 ha of solar, 8 ha of wind, 2,023 ha of geothermal, and 2,023 ha of transmission (includes BLM and non-BLM land) development would be permitted, slightly less than 4% of the total available (Ibid.). The RMS conservation, mitigation, and compensation measures are incorporated into the LUPA (Ibid.). In addition, the Preferred Alternative would expand Flat-tailed Horned Lizard protections by increasing the size of some of the ACECs within the species' range and restrict the type of uses (Table 4) (Ibid.). The Record of Decision has not yet been published for DRECP Phase I. Consequently, these amounts are subject to change, and it is unknown how much renewable energy development will be authorized by Imperial, Riverside, and San Diego counties.

Table 4. ACECs within Flat-tailed Horned Lizard's Range (LUPA Preferred Alternative)

ACEC	Current Area (ha)	Proposed Area (ha)	Renewable Energy	Mining	OHV
Coachella Valley Fringe-toed Lizard Preserve	4,151	4,158	No	No	No
Dos Palmas Preserve	3,371	3,371	No	Mineral Materials[1]	No
East Mesa	34,064	35,808	Geothermal[2]	Oil and Gas	Yes
Lake Cahuilla[3]	2,139	3,486	Geothermal[2]	Mineral Materials[4], Oil and Gas	Yes
Ocotillo	5,030	5,924	No	All Types	Yes
San Sebastian Marsh-San Felipe Creek	2,630	2,630	Geothermal (all NSO)	Locatable[5] Minerals, Mineral Materials	Yes
West Mesa	33,075	33,424	Geothermal	Mineral Materials	Yes
Yuha Basin	29,758	31,283	Geothermal	Mineral Materials	Yes

[1] Mineral materials = sand, gravel, rock, etc.

[2] New leases are subject to a "No Surface Occupancy" (NSO) stipulation (i.e., no surface disturbance, extraction only through directional drilling from outside the area)

[3] No disturbance cap (all others are 1%)

[4] Limited to historic operations only

[5] Locatable minerals = gold, silver, gems, limestone, etc.

Mining

The area of mining and mineral sites within the Flat-tailed Horned Lizard's range have not been mapped or quantified (BLM 2011), although Rado (1981) estimated 2,070 ha of active and intermittent sand and gravel quarries at the time of his study. Most mining activity within the Flat-tailed Horned Lizard's range is sand and gravel extraction, which has a relatively small physical footprint but can have a larger ecological footprint (BLM 2011, FTHLICC 2003). Like other types of development, mining activities remove and fragment, habitat, can impact air quality, create erosion and substantial noise, promote invasive species, release contaminants, and result in increased mortality along roads or through subsidizing predators (Ibid.). The Yuha Basin MA has been identified as a source of suitable sand and gravel (DRECP 2015), and there is an ongoing operation adjacent to and partially within East Mesa MA (BLM 2011). Among the few exemptions from the requirement to compensate for impacts to Flat-tailed Horned Lizards in the RMS are sites that have previously been mined along the East Highline Canal, either inside or outside of the East Mesa MA, if the applicant will be reclaiming the site and no further mining would occur (FTHLICC 2003).

Oil and gas leases were issued throughout the Salton Trough in the early 1980s, but only one test well was drilled (FTHLICC 2003). The well was not profitable, no oil or gas resources have been identified, and all oil and gas leases within the Flat-tailed Horned Lizard's habitat have expired (USFWS 1997, FTHLICC 2003).

Gold mining was listed as a potential future threat to Flat-tailed Horned Lizards in the Department's previous status review due to numerous mining claims being staked in the area of OWSVRA (Bolster and Nicol 1989); however, this threat never manifested.

Off-highway Vehicles

Most Flat-tailed Horned Lizard habitat is available for OHV recreational opportunities to some degree; closed areas are restricted to military lands, wilderness designations, and Anza-Borrego Desert State Park (BLM 2003). The BLM allows trail-only riding within the East Mesa, West Mesa, and Yuha Basin MAs (Ibid.). The adverse effects that OHVs can cause to desert ecosystems have been well documented, including compacting soil and destroying soil crusts, which leads to erosion and limits plant germination, growth, and vigor; damaging and destroying the plants themselves and crushing animal burrows, which reduces habitat availability and quality; raising fugitive dust and emitting byproducts of combustion, which impacts air quality and plant growth; spreading invasive species; directly wounding or killing wildlife; and producing excessive noise, which can alter animal behavior and physiology (Ouren et al. 2007).

Comment [RL51]: It would be nice to see addl. references since this one is a BLM-specific reference.

The most recent estimate of OHV route proliferation and surface disturbance within the Flat-tailed Horned Lizard's range in California occurred in the early 2000s (USFWS 2003, Wright 2002), prior to adoption of the Western Colorado OHV Routes of Travel Designation Plan and construction of the border fence (BLM 2003, USCBP 2012a). Wright (2002) estimated the number of routes and graded roads increased by 387% within the West Mesa MA from 1985 to 2001, increased by 23% within the Yuha Basin MA from 1994 to 2001, and decreased 45% within the East Mesa MA from 1994 to 2001. Wright (2002) estimated 11.4% of the West Mesa MA had vehicle tracks in 2001, and the USFWS (USFWS 2003) estimated that 9.7% and 7.8% of the surface area was disturbed in 2002 within the Yuha Basin and East Mesa MAs,

respectively. Wright and Grant (2003) noted a 45% drop in vehicle track coverage in one year, speculating it could be the result of a big sandstorm and change in Border Patrol activities. This serves as a good example of why vehicle track coverage is an imperfect estimate of OHV impacts. Tracks disappear more quickly in sand than other surfaces, and a high number of tracks does not necessarily equate to frequent, or even recent, vehicle traffic since they can last for a long time in certain substrates (Ibid.). Nevertheless, it has been used as the metric of OHV use in nearly all studies of potential impacts to Flat-tailed Horned Lizards.

There have been numerous attempts to study the impacts of OHVs on Flat-tailed Horned Lizards over the past three and a half decades, but complications associated with the low detectability of the species and variable detectability in different habitats, the unreliability of using scat as a surrogate index of abundance, and difficulty categorizing level or intensity of OHV use at a site have rendered the results equivocal. There have only been a few rigorously designed studies undertaken.

Setser and Young (2000), studying radiotracked Flat-tailed Horned Lizards in mudhill habitat within OWSVRA, found positive associations between Flat-tailed Horned Lizard habitat use and rocks and plants, but a negative association with OHV disturbance; however, this avoidance was only detectable out to 10m from tracks. Hollenbeck (2004, 2006) found sand was the only significant variable associated with Flat-tailed Horned Lizard abundance on several plots across OWSVRA, track coverage was not. Gardner (2005) found that Flat-tailed Horned Lizards were positively associated with sand and shrub abundance, even when the sandy plots were within an OHV route within a wash. McGrann et al. (2006) found that ant mound densities, mean adult mass, and mean juvenile mass were significantly greater on low impact plots (i.e., lower vehicle track %) than high impact plots, but overall density was greater on the high impact plots at one site and lower on another. Because they controlled for sand and vegetation, they speculate the difference was regularity of OHV use, which was greater at the site with lower densities (Ibid.). Because the OHV season occurs largely during the Flat-tailed Horned Lizard's hibernation period, Grant and Doherty (2009) investigated the risk of being crushed by OHVs during this time by simulating high and low impact riding intensities. Five of twelve Flat-tailed Horned Lizards were directly run over during the high impact treatment and three in the low, but none were injured or killed despite hibernating at shallow depths (Ibid.). They noted that a higher proportion of lizards hibernated under shrubs in OWSVRA (high use area) than East Mesa (low use area) and that rainfall may have played a part in the results, speculating that OHVs may cut less deeply into wet soil because the water tension helps hold it together (Ibid.). Nicolai and Lovich (2000) radio-tracked three male Flat-tailed Horned Lizards before and after a race and found a reduced rate of movement after the race, although the biological significance of the difference was dubious since the mean activity areas after the race were variable (i.e., one lower, one nearly the same, and one higher than before the race). Young (1999) did not find a difference in Flat-tailed Horned Lizard reaction to an OHV passing by vs. a person walking by. FTHL were tracked by the ICC in April 2014 during the Imperial Valley 250 Off-Highway Vehicle (OHV) S.C.O.R.E. race (R. Lovich pers. Obs.) Preliminary results indicate that distances moved between consecutive relocations varied with no obvious pattern related to the race. There were no mortalities, despite the fact that 9 lizards were tracked directly on the track before, during, and after the race. Activity area size ranged from increased, same, and decreased among the 9 lizards on the race course. Rates of movement were not significantly correlated with wind speed or relative humidity, but were significantly correlated with air temperature (r = -0.289, P = 0.083). Results of this race are being developed into a manuscript at the present time (R. Lovich pers. Comm.)

Noise associated with OHVs (as well as military activities, construction equipment, transmission lines, power plants, and wind farms) has been speculated to adversely affect Flat-tailed Horned Lizards (Bolster and Nichol 1989, CBD 2014). The degree to which noise impacts Flat-tailed Horned Lizards is uncertain, although it is likely very little. Heffner and Heffner (1998) concluded that reptiles show few, if any, responses to sound, and it appears they do not make as wide a use of hearing as most other vertebrates. Bondello (1976) and Brattstrom and Bondello (1983) demonstrated prolonged acoustical sensitivity loss in Desert Iguanas (*Dipsosaurus dorsalis*) and Mohave Fringe-toed Lizards (*Uma scoparia*), respectively, after short duration exposure to OHV-level noises. These studies have been used to support the notion that similar impacts to Flat-tailed Horned Lizards are likely (Bolster and Nichol 1989). However, Flat-tailed Horned Lizards have a different ear anatomy than these species. Flat-tailed Horned Lizards have no exterior ear opening, and Norris and Lowe (1951) concluded that the species' tympanum (i.e., eardrum) was so degenerate, it appears to have become functionless. The tympanum is covered with skin and encroached upon by bone, and the middle ear has been invaded by jaw bone, a condition that approximates that of snakes (Norris and Lowe 1951, Stebbins and McGinnis 2012). These changes have been noted in other lizard genera as well and are thought to be adaptations to burrowing (Ibid.). Christensen et al. (2012) concluded "that pythons, and possibly all snakes, lost effective pressure hearing with the complete reduction of a functional outer and middle ear, but have an acute vibration sensitivity that may be used for communication and detection of predators and prey." In addition, Wone et al. (1994) experimented with high frequency sounds to determine if they could elicit Flat-tailed Horned Lizards to run and thus be more easily detected; however, none of the Flat-tailed Horned Lizards exposed to the sounds reacted, remaining crouched and motionless whether the units were turned on at a distance or nearby.

It is difficult to find any conclusive evidence of significantly detrimental effects of OHVs on Flat-tailed Horned Lizards. They certainly are injured and killed on roads and trails, but the frequency of this source of mortality and its impact on population dynamics are unknown. A very small proportion (two out of hundreds) of all the Flat-tailed Horned Lizards tracked with radio-transmitters was known to be killed by OHVs (Goode and Parker 2015, Grant and Doherty 2009, Muth and Fisher 1992, Setser 2001). Conversely, none were killed during the IV 250 Road Race in 2014 among 9 telemetered individuals (R. Lovich, pers. Obs.). This could be explained if Flat-tailed Horned Lizards are selecting habitat features like rocks and shrubs that OHV riders tend to avoid (Gardner 2005). In addition, not all OHV activity is the same, and the risk to Flat-tailed Horned Lizards ~~likely varies dramatically~~may vary depending on a number of factors ~~that go into~~including habitat suitability, time of year, and available resources. For instance, Grant and Doherty (2006) observed that lighter Flat-tailed Horned Lizards tended to enter hibernation later in the year and speculated that they may need to stay active longer to put on fat reserves to last the winter. They also noted, as others have, that juveniles may not hibernate at all. It is possible in lean years, Flat-tailed Horned Lizards may not hibernate as long, and the longer they stay active, the more likely they are to be exposed to OHVs on the surface.

Where OHV use intensity is so great that it substantially reduces shrubs or prey, particularly in areas where these habitat features may already be scarce, Flat-tailed Horned Lizard density and body condition are likely to suffer. Luckenbach and Bury (1983) observed marked declines in herbaceous and perennial plants, arthropods, lizards, and mammals in open OHV riding areas of the Algodones Dunes vs. closed/low use areas. The extent to which these changes in vegetation and prey have occurred as a result of OHV activity across the Flat-tailed Horned Lizard's range is unknown. Whether the vibrations from OHVs detected by Flat-tailed Horned Lizards impact their ability to respond to predators or other threats (like OHVs) is similarly unknown.

United States-Mexico Border Activities

In response to illegal immigration and narcotics smuggling, U.S. Customs and Border Patrol (BP) actively patrols the border and surrounding areas, using OHVs, pedestrian and vehicle (PV) fences, and surveillance cameras and towers (Cohn 2007, FTHLICC 2003, Lasky et al. 2011). Flat-tailed Horned Lizards may be adversely affected by both illegal activities and the efforts to halt them through habitat fragmentation caused by the border fence, increased predation facilitated by tall perches (fences and towers) and trash, road mortality, and habitat degradation from cross-country driving. Likewise, FTHL may benefit from reductions in illegal border-crossing activities through more frequent patrols and construction of numerous barriers which limit off-road vehicles, etc.

There is limited literature available specifically assessing border related impacts on the Flat-tailed Horned Lizard and other species (Cohn 2007; Lasky et al. 2011; USCBP 2012a, 2012b). The USFWS estimated that if border-related activities involved a zone of high impact 1 km north of the border, that would amount to disturbance of approximately 2,318 ha (0.7%) and 5,012 ha (3%) of the Flat-tailed Horned Lizard's range west and east of the Imperial Valley, respectively (USFWS 2011). The actual area of disturbance is probably less in the eastern section since the All American Canal runs the length of the border less than 1 km north of it (Ibid.). The construction of a border fence along the entire California range of the species is expected to dramatically reduce that impact (Ibid.). While vehicle-related mortality associated with the main access road along the border fence undoubtedly occurs, evidence ~~suggests~~ directly indicates the PV fencing in Arizona has resulted in reduced impacts to Flat-tailed Horned Lizard habitat associated with trans-border illegal immigration activities, OHV activity, drug smuggling, and ensuing law enforcement activities (USFWS 2011, FTHLICC 2012, Rorabaugh 2010).

Comment [RL52]: Illegal crossings went from dozens a year to almost zero at BMGR West following construction of the border fence.

The border fence is nearly continuous across the Flat-Tailed Horned Lizard's range in California (USCBP 2012a) and consists of four types (PV-1, P-2, PV-4, and VF-2) that are at least semi-permeable to lizards (Figure 13) (Lasky et al. 2011, Rorabaugh 2010, USCBP 2012a). Given the relatively large home ranges of Flat-tailed Horned Lizards, it is likely that at least some genetic exchange is still occurring in spite of the fence and increased mortality adjacent to it from road mortality and potentially increased predation. The VF-2 fence, which is only a deterrent to vehicle traffic, was only sporadically constructed along approximately 2 km of the border west of Calexico adjacent to the Yuha Basin MA (USCBP 2012a), which could potentially concentrate illegal activity in this area (Lasky et al. 2011).

In addition to the fence, BP has installed remote video surveillance system (RVSS) towers to monitor illegal activities. There are approximately 20 of these towers within the Flat-tailed Horned Lizard's current range in California (J. Petrilla pers. comm.). These RVSS towers can monitor a much larger area than border patrol agents can cover by vehicle (USCBP 2012b) and may reduce the amount of road mortality associated with law enforcement activities.

The REAL ID Act of 2005 (Pub.L. 109–13, 119 Stat. 302) authorizes the Department of Homeland Security to waive all laws as necessary, including environmental review and mitigation, to "ensure expeditious construction of certain barriers and roads at the U.S border." In spite of this, BP and personnel from the BLM-El Centro office participate in monthly meetings and coordinate regular Flat-tailed Horned Lizard orientation sessions to reduce BP impacts to the species' habitat (FTHLICC 2012).

Figure 13. Border Fence Designs: (a) PV-1, (b) VF-2, (c) P-2, (d) PV-4

Military Activities

Military lands and activities occur within the Flat-tailed Horned Lizard's California range. Naval Air Facility El Centro (NAFEC) has two bombing ranges, one containing 12,060 ha of land within the West Mesa MA (representing 22% of the MA), and a 3,440 ha range in the East Mesa MA (covering 7% of the MA) (FTHLICC 2003). Although most training is aircraft-related, ground-based activities that can cause surface disturbance include non-exploding bombing, training, various target activities that include maintenance and site clean-up, road travel, and maintenance (FTHLICC 2003, USFWS 2011). These activities can adversely impact Flat-tailed Horned Lizards through direct mortality, habitat degradation, increased risk of fire, and potential noise effects.

The military is a participant in the Flat-tailed Horned Lizard ICC and implements the conservation measures in the RMS through their INRMPs which are required under the Sikes Act (Navy 2014, USAF and USMC 2013). "At NAFEC, any new or maintenance activities conducted within Flat-tailed Horned Lizard MAs are confined to previously disturbed areas. Work crews are trained in Flat-tailed Horned Lizard recognition and disturbance minimization. For projects which upgrade or install new infrastructure to targets, construction is limited to previously disturbed ground and a Flat-tailed Horned Lizard monitor is on site at all times to ensure that mortality is minimized" (R. Powell pers. comm., USFWS 2011). In addition, main range roads and gates have posted Flat-tailed Horned Lizard notification signs, and NAFEC ~~is producing a Range Training Handbook~~ produced a printed document entitled "Environmental Handbook: NAF El Centro Range Complex" in 2016 that highlights Flat-tailed Horned Lizard and all natural resource concerns for those who come to train, work on, or utilize their facilities (R. Lovich pers. comm.). In addition, these lands are not open to the public, affording them greater protection from illegal OHV activity and vandalism (Muth and Fisher 1992). Furthermore, Young and Young (2000) observed that jets flying to and from the targets or dog fighting did not seem to bother the Flat-tailed Horned Lizards they were studying ~~in at~~on the Barry M. Goldwater R~~eserve in~~ange near Yuma.

Overexploitation

Collecting Flat-tailed Horned Lizards for scientific and educational purposes or herpetoculture (pet trade) may have impacted populations decades ago (Stewart 1971, Turner and Medica 1982), but these practices currently are not common. Horned lizards do not make good pets in general because they are difficult to keep alive in captivity (Sherbrooke 2003), and Flat-tailed Horned Lizards are no exception (Goode and Parker 2015). In addition, sport collection of this species is illegal (Cal. Code Regs., tit. 14, § 5.60). A Scientific Collecting Permit issued by the Department is required to capture Flat-tailed Horned Lizards for scientific or educational purposes (Cal. Code Regs., tit. 14, § 650). Research on Flat-tailed Horned Lizards may have some adverse effects. Goode and Parker (2015) observed that handling associated with attaching radio transmitters appears to affect predation rates of telemetered Flat-tailed Horned Lizards. Nearly half (48.4%) of predated Flat-tailed Horned Lizards were killed within the first week of handling, and 20.3% were killed within a day of handling, indicating that there is a period of increased vulnerability to predators after handing (Ibid.). They suspect scent from the adhesive used to attach the transmitters may have alerted predators like Kit Foxes with a keen sense of smell to the lizards, although effects from handling may also play a part (Ibid.). Setser

Comment [RL53]: It doesn't really fit into this section, but I would recommend including a section on captive husbandry. Most recently the ICC has given 20 FTHL to the San Diego Zoo from the BMGR West (with blessing of state agencies) to study their life in captivity. Several zoos and institutions have maintained them in captivity for extended periods of time from the 1950's to the present, and have learned valuable information on their captive rearing, husbandry, maintenance, diet, longevity, etc. Simply from the standpoint of providing a viable alternative to ex situ conservation efforts, the zoo information would be a worthy inclusion to this status review. I am more than happy to assist in pulling it together with you.

and Young (2000) attributed two telemetered Flat-tailed Horned Lizard mortalities to research. One was impaled by a marker flag while in a burrow, and one apparently overheated when its transmitter got stuck in a pile of rocks (Ibid.).

Predation

As previously described, the largest natural cause of Flat-tailed Horned Lizard mortality is predation, accounting for as much as 40-50% of the observed mortality in certain years (Goode and Parker 2015, Muth and Fisher 1992, Young and Young 2000). Increased predation by American Kestrels, Loggerhead Shrikes, and Round-tailed Ground Squirrels near urban and agricultural development has been implicated in declines in Flat-tailed Horned Lizards as far as 450 m from the habitat edge (Barrows et al. 2006, Young and Young 2005). In addition, anthropogenic structures such as power poles, transmission lines, fences, ornamental or invasive tree species, and hedgerows, located in otherwise intact habitat act as perching or nesting platforms, which can augment the populations of avian predators and provide a better vantage point for hunting.

Goode and Parker (2015) recorded far fewer Flat-tailed Horned Lizards and far more avian predators along a stretch of road with power poles than one without one. They also reported that preliminary data suggested that minimally-traveled roads alone have minimal effects on the number of Flat-tailed Horned Lizard scat present, while roads with power lines and poles had significantly less scat within the 75 m nearest to the power line, and the power pole/road effect may extend even further than 150 m (Ibid.). The mean of the abundance estimates from plots adjacent to roads with power poles was nearly three times lower than the mean from plots without them. Years earlier at the same site, Young and Young (2000) reported that shrikes were commonly seen hunting from the power poles, and they found many remains of shrike-killed Flat-tailed Horned Lizards in the creosote bushes along this section of road, even though they rarely saw any live individuals there.

Flat-tailed Horned Lizards are relatively short-lived; have a low reproductive index; their populations experience wide fluctuations in abundance in response to resource availability; and they are particularly sensitive to predation (Barrows and Allen 2009, Fisher 1998, FTHLICC 2003, Grimsley and Leavitt 2016, Howard 1974, Young and Young 2000).

Competition

Flat-tailed Horned Lizards are not considered to be territorial (Muth and Fisher 1992), and individuals with overlapping home ranges generally ignore or avoid one another (Young 1999). As a result, intraspecific competition for resources does not seem to be a limiting factor. Other sympatric lizards also consume ants; however, their diets are much more diverse than the Flat-tailed Horned Lizard's. While their diets and ranges overlap substantially in California, Desert Horned Lizards and Flat-tailed Horned Lizards rarely occur together because they prefer different soil types, the former being associated with coarser, more gravely and rocky substrates (Barrows and Allen 2009). There are no known reports of competition between Flat-tailed Horned Lizards and other types of animals.

Disease

There are few reports in the literature of parasites on Flat-tailed Horned Lizards, and none of naturally occurring diseases (Johnson and Spicer 1985). Klauber (1939) and Norris (1949) found nematodes in Flat-tailed Horned Lizards, and the latter also noted that red mites were common ectoparasites on them as well.

Contaminants

Although pesticides could kill harvester ants and other Flat-tailed Horned Lizard food sources, the use of aerial pesticides in the species' range is currently very limited (FTHLICC 2003, USFWS 2011). An aerial and ground-based malathion spray program to control the curly top virus occurs roughly every three years, but includes avoidance and minimization measures to limit potential effects on Flat-tailed Horned Lizards (USFWS 2011). No pesticide treatments are applied within the MAs, although use of targeted hand-applied herbicides (e.g., for tamarisk eradication projects) is allowed (FTHLICC 2003).

Comment [RL54]: Kevin Young conducted a study on herbicide and FTHL that should be mentioned. I may be able to find it if you don't have a copy. Basically it found no correlation with reduced FTHL as long as there was available habitat and ants as a food source. This is also consistent with the FTHL found on Fallow Ag. Land at the solar project on the immediate west side of El Centro north of I-8.

NAF El Centro has also hosted aerial pesticide spray trials a few times recently, but has not used those pesticides on the ground, and monitored FTHL before and after with no ill effects or mortalities seen.

Invasive Species and Fire

Native plants provide seeds for harvester ants (Pianka and Parker 1975, Young and Young 2000), as well as shade and refuge from predators, and they trap the windblown sand substrate preferred by Flat-tailed Horned Lizards (Muth and Fisher 1992). Non-native plants, especially those that have become invasive, can alter landscapes and ecosystems. Several species of non-native, invasive plants are common in Flat-tailed Horned Lizard habitat, many of which are Mediterranean or Asian annual species that germinate in the winter or spring months such as Split grass (*Schismus barbatus*), Russian-thistle (*Salsola tragus*), and Sahara mustard (FTHLICC 2003). Many other non-native annual species may be present, particularly near agricultural areas and near streams or wetlands (Ibid.). Most are not adapted to the severe aridity of the Flat-tailed Horned Lizard's range and require years of heavy precipitation to rapidly proliferate (Barrows et al. 2009, Rao and Allen 2010). While these are typically temporary eruptions, more recently Sahara mustard is becoming the dominant annual plant in the Coachella Valley during non-drought years as well (CVCC 2013a).

Sahara mustard is a highly invasive annual plant that is locally abundant in some years throughout portions of the Flat-tailed Horned Lizard's California range. It is most common in wind-blown sand deposits and disturbed sites such as roadsides and abandoned fields (Minnich and Sanders 2000). It was first collected in North America in 1927 in the Coachella Valley (Ibid.), where its impacts on Flat-tailed Horned Lizards and other flora and fauna have been the focus of many studies (Barrows and Allen 2010, Barrows et al. 2009, CVCC 2013b, Hulton VanTassel et al. 2014). Minnich and Sanders (2000) speculate that Sahara mustard's rapid spread through the Sonoran Desert may be related to the fact that, during rains, a sticky gel forms over the species' seed case that adheres to animals as well as automobiles. In this way, on- and off-road vehicles may be accelerating the spread of this invasive species.

Sahara mustard cover appears to influence both community structure and the extent to which arthropods (including ants) inhabit multiple aeolian (wind-blown) sand habitats within the Coachella Valley (Hulton VanTassel et al. 2014). In the Coachella Valley, Sahara mustard has been found to retard Flat-tailed Horned Lizard population growth (CVCC 2013a). Flat-tailed Horned Lizards prefer stabilized sand dune habitats (Barrows and Allen 2009), but since the most recent explosive mustard growth event in 2005, they have been found more frequently on active sand dunes, a habitat type they typically rarely occupy, where mustard growth is limited (CVCC 2013b). Juvenile Flat-tailed Horned Lizards were found to be 10% smaller on stabilized sand fields as compared to active dunes, potentially due to limited food resources (primarily ants) in areas dominated by mustard (Ibid.). Possible other reasons for this include reduced mobility as a result of dense mustard growth and increased soil compaction due to mustard inhibiting aeolian sand movement (CVCC 2013b). Mustard has been implicated as the cause for a Flat-tailed Horned Lizard population response similar to one during drought conditions, despite recent years with average or above average rainfall (CVCC 2013b).

Creosote bush scrub habitat throughout the southern Californian desert has also been invaded and subsequently altered by nonnative annual grasses (Brown and Minnich 1986, Lovich and Bainbridge 1999, Rao and Allen 2010, Steers and Allen 2011). Invasive annual grasses are known to increase the extent, frequency, and severity of natural fire regimes throughout desert shrublands (Abatzglou and Kolden 2011; Brown and Minnich 1986; Rao and Allen 2010; Steers and Allen 2010, 2011). Though fire is rare in the Colorado Desert (Figures 14 and 15), the exception may be the very northwestern edge of the Flat-tailed Horned Lizard's range in the Coachella Valley, which is "a major wildland-urban interface area that has been significantly impacted by atmospheric nitrogen deposition concomitant with fuel alterations from invasive annual grasses and increased ignition frequencies from human activities" (Steers and Allen 2011). Post fire recovery of desert shrublands has been studied here, demonstrating that species composition shifts, and long-lived native species like creosote bush and white bursage that are important to Flat-tailed Horned Lizards struggle to recover (Steers and Allen 2011).

In addition to non-native plants, non-native ants have been implicated as a potential threat to Flat-tailed Horned Lizards. Native ants within the Flat-tailed Horned Lizard's range, primarily harvester ants, are adapted to desert conditions (Pianka and Parker 1975). The exotic vegetation, changes in soil condition, and extra moisture associated with the edges of human development (agriculture, irrigation canals, and urban areas) can facilitate invasion by Argentine ants (*Linepithema humile*) and other non-natives, resulting in displacement of native ants (Suarez et al. 1998). In California, red fire ants (*Solenopsis invicta*) frequently build mounds on irrigated turf or nest in places such as rotten logs, walls of buildings, under sidewalks, and in outdoor electric and water utility boxes (Greenberg and Kabashima 2013). Barrows and Allen (2009) reported that Argentine ants and red fire ants have invaded the Coachella Valley, but not Flat-tailed Horned Lizard habitat, which they presume is the result of a barrier created by hyper-arid conditions.

Comment [RL55]: Argentine ants do not occur in any appreciable numbers inside any of the Mas that I am aware of.

Drought and Climate Change

California entered what has become an historic drought in 2011. A similarly severe event has not occurred in the last 1200 years (Griffin and Anchukaitis 2014). Seager et al. (2007) reported broad consensus among climate models that the transition to a more arid American Southwest is already underway, and that if the models are correct, droughts will become the new norm. Empirical data over the last century confirm the Sonoran Desert warming trends in winter and spring, decreased frequency of freezing temperatures, lengthening of the freeze-free season, and increased minimum temperatures per winter year (Weiss and Overpeck 2005). In addition, variability in cool season rainfall (i.e., when the majority of precipitation within the Flat-tailed Horned Lizard's California range falls) is increasing (Abatzoglou and Kolden 2011). These changes in temperature and precipitation are already driving shifts in vegetation in the Sonoran Desert, including a decrease in creosotebush and increase in invasive grasses (Kimball et al. 2010, Munson et al. 2012, Weiss and Overpeck 2005).

While the Flat-tailed Horned Lizard is adapted to one of the most arid places in the country, it may ~~nevertheless~~ be at greater than average risk of localized extinctions from prolonged droughts due to its small geographic range, specialized diet, low reproductive index, short lifespan, and increasing habitat fragmentation (USFWS 1993, Barrows and Allen 2009). Likewise, it could be better adapted to change by virtue of evolved plasticity to endure extreme habitats as previously described. This has not been tested experimentally. ~~Populations of Coachella Valley Fringe-toed Lizards have already lost substantial genetic diversity since the last drought (Vandergast et al. 2016).~~ The Flat-tailed Horned Lizard has the highest measured active body temperature of *Phrynosomids* in the United States (Pianka and Parker 1975) and, like other desert-adapted reptiles, may already approach its physiological tolerances (Barrows 2011). ~~There are only~~Sinervo et al. (2010) hypothesize that there are two mechanisms for a species to persist in the face of climate change: given enough time and unobstructed ability to move, dispersal to a more favorable thermal environment (typically north or higher elevation) may be possible; otherwise, it will have to behaviorally and/or physiologically adapt (Sinervo et al. 2010). Vicariance and stochasticity provide additional mechanisms whereby species could exist in a location and/or habitat that would not be subjected to the same climate change extremes that could potentially threaten its persistence.

Comment [RL56]: However, it is unclear if drought was the direct reason for the decline of Uma inornata. Also, Uma inornata are not FTHL.

Comment [RL57]: There are more than two mechanisms, and this is patently untrue. Vicariance is at least a third mechanism whereby species could persist in a climate change scenario. Keep in mind that the species lives on top of the San Andreas Fault, where vicariance has generated thousands of species in relatively little time. In fact, most of the creation of the Sea of Cortez occurred in the last 3-7 million years. Vicariance is fully in play in the range of the FTHL.

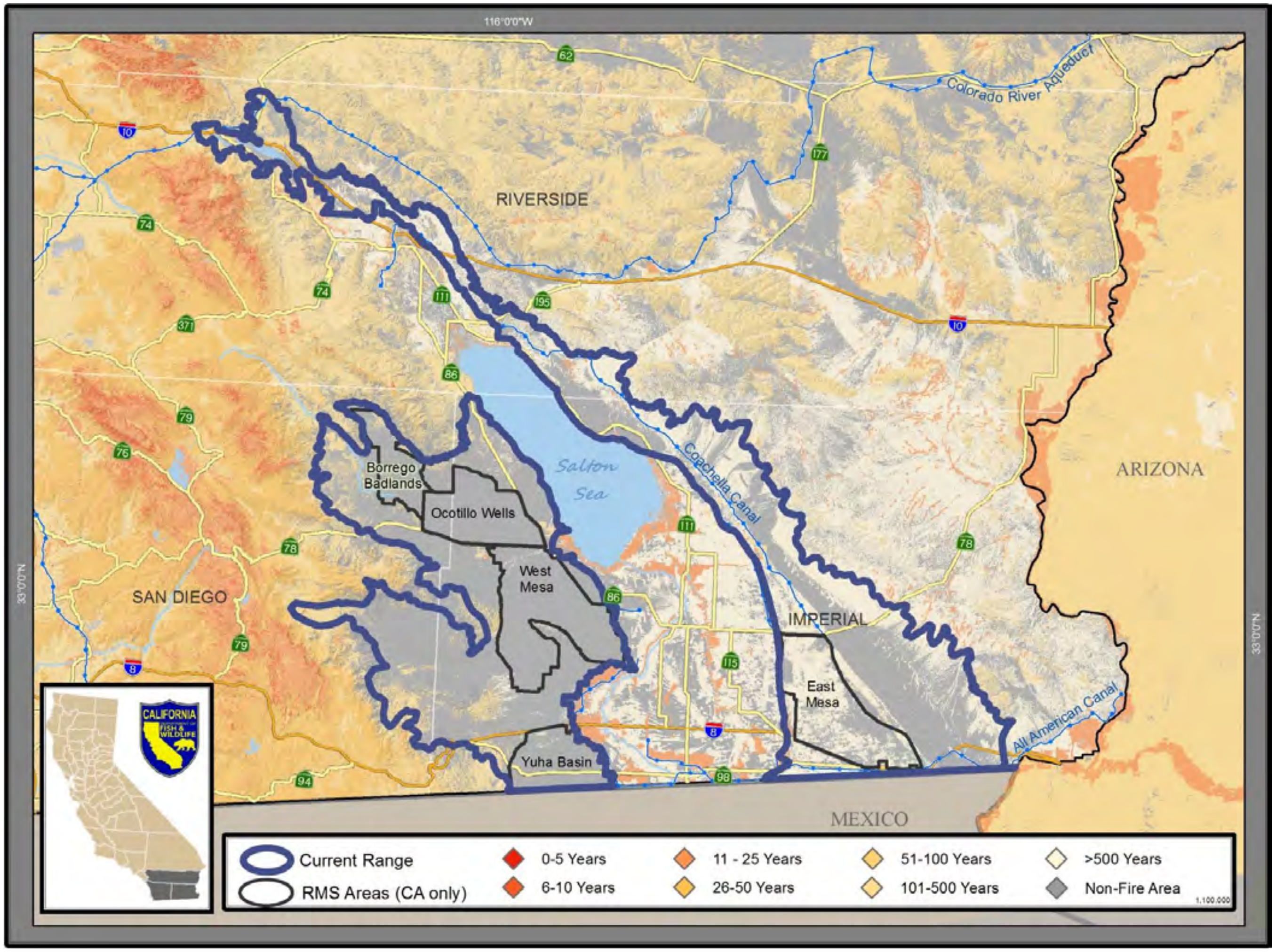


Figure 14. Mean Fire Return Interval within and around the Flat-tailed Horned Lizard's California Range

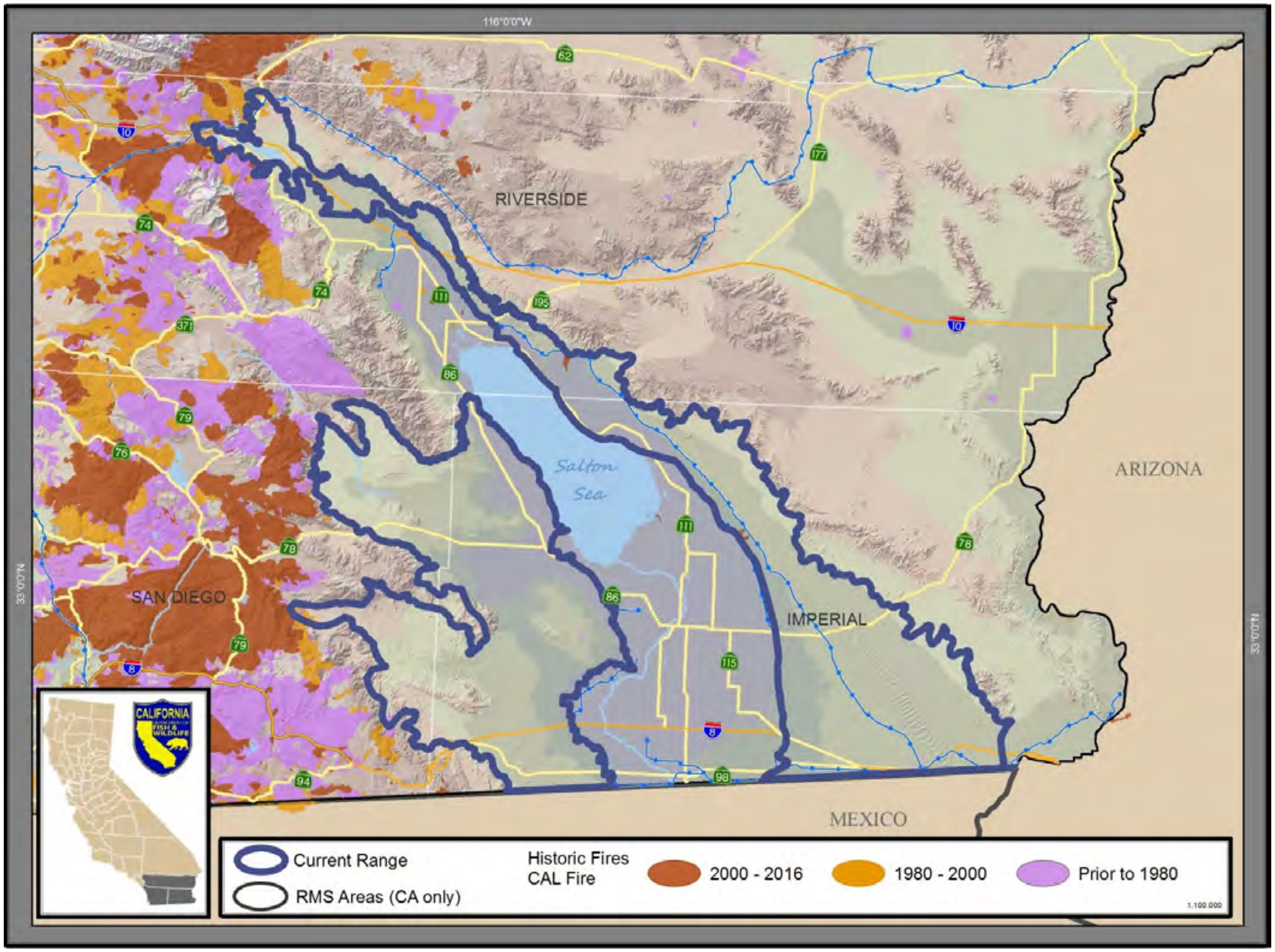


Figure 15. Historic Large Fires within and near the Flat-tailed Horned Lizard's California Range

Flat-tailed Horned Lizards in California are located at the ~~farthest~~ northern extent of their range, and the populations in the Coachella Valley are already ~~extremely~~ small and fragmented. The species' range boundary in California is surrounded by mountains and unsuitable habitat (i.e., rocky substrate). Even with a ~~relatively~~ short generation time, given the predicted pace of climate change in the region, it is unlikely the species will be able to migrate upwards and adapt to a different substrate and vegetative community in time. Behavioral strategies to cope with rising temperatures include spending more time in the shade or in a burrow, which leaves less time available for foraging and mating (Sinervo et al. 2010). In addition to adult lizards being at greater risk of reaching a critical thermal maximum, embryos in the nest will be subjected to increasingly higher temperatures and may exceed their critical thermal maximum temperature more often (Levy et al. 2015). Flat-tailed Horned Lizards have been shown to burrow substantial depths (90 cm) to reach the zone of soil moisture in drought situations (Young and Young 2000), so they may be able to adjust in that way, but the fate of hatchlings that are buried that far below the surface is unknown. They could also potentially lay nests in a greater amount of shade, but as climate change appears to be favoring invasive grasses over native shrubs (Abatzoglou and Kolden 2011, Munson et al. 2012), this may become a scarcer option.

Two studies of potential climate change risk to Flat-tailed Horned Lizards have been undertaken. Wright et al. (2013) used an ecological niche model built with Flat-tailed Horned Lizard locality data (from California and Arizona, not Mexico) and several climate change scenarios to predict the climatic suitability of the species' range at 2050. There was overwhelming consensus among the models that predicted Flat-tailed Horned Lizard habitat remaining fairly stable to that date (Ibid.); however, this analysis did not take changes in habitat into account. The Department modeled the relative environmental stress a vegetative community would undergo given different climate scenarios in the short-term (2039) and long-term (2099) (Figures 16 and 17). It appears in the short-term, if the climate is hot and dry, Flat-tailed Horned Lizard habitat will undergo less stress than a warm and wet climate (Figure 16), but by 2099, large portions of the species' range will be under extreme stress and may no longer support the existence of viable habitat (Figure 17).

Climate change is likely to adversely impact most native species over time. Flat-tailed Horned Lizard populations ~~already~~ experience natural ~~dramatic~~ fluctuations over time, typically in response to rainfall and its effect on resource availability (Leavitt et al. 2015). Setser and Young (2000) observed Flat-tailed Horned Lizards putting on weight rapidly and engaging in courtship and mating almost immediately after a series of monsoonal rains that increased ant availability. Drought conditions reduce harvester ant abundance, which reduces reproduction in a species with already very low reproductive output (Howard 1974, Young and Young 2000). In addition, drought effects may also place Flat-tailed Horned Lizards at greater risk from OHV-related mortality~~mortality~~ since it appears Flat-tailed Horned Lizards with lower body mass enter hibernation later in the year (Grant and Doherty 2009). ~~Given its~~With a short lifespan and ~~already~~ low reproductive potential, prolonged droughts ~~are very likely to~~ cause decreases in population size that amount to loss of genetic diversity. , ~~the same diversity necessary to adapt to a rapidly warming environment.~~

Comment [RL58]: Too many unnecessary adverbs.

Comment [RL59]: This paper is not about FTHL in particular.

Comment [RL60]: This paper is a generalized meta-analysis, and not specific to FTHL.

Comment [RL61]: What native species? California's?

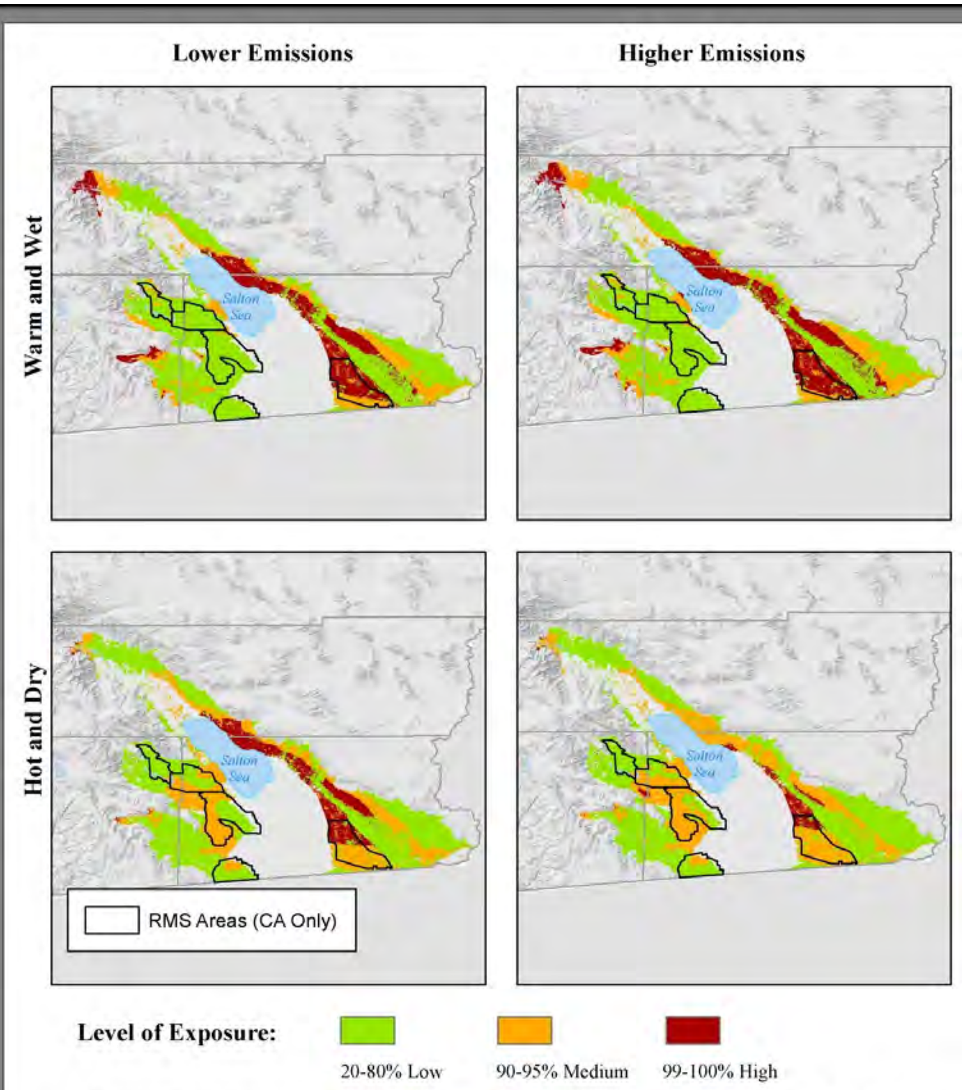
Comment [CDoPaR62]: Which as previously stated is not a significant threat to populations.

Comment [RL63]: Evidence indicates that OHV related mortality is not that great, however.

Comment [RL64]: Too many adverbs

Comment [RL65]: Too many adverbs

Comment [RL66]: There is no evidence to correlate gene loss to fitness or survivorship under different climatic conditions.

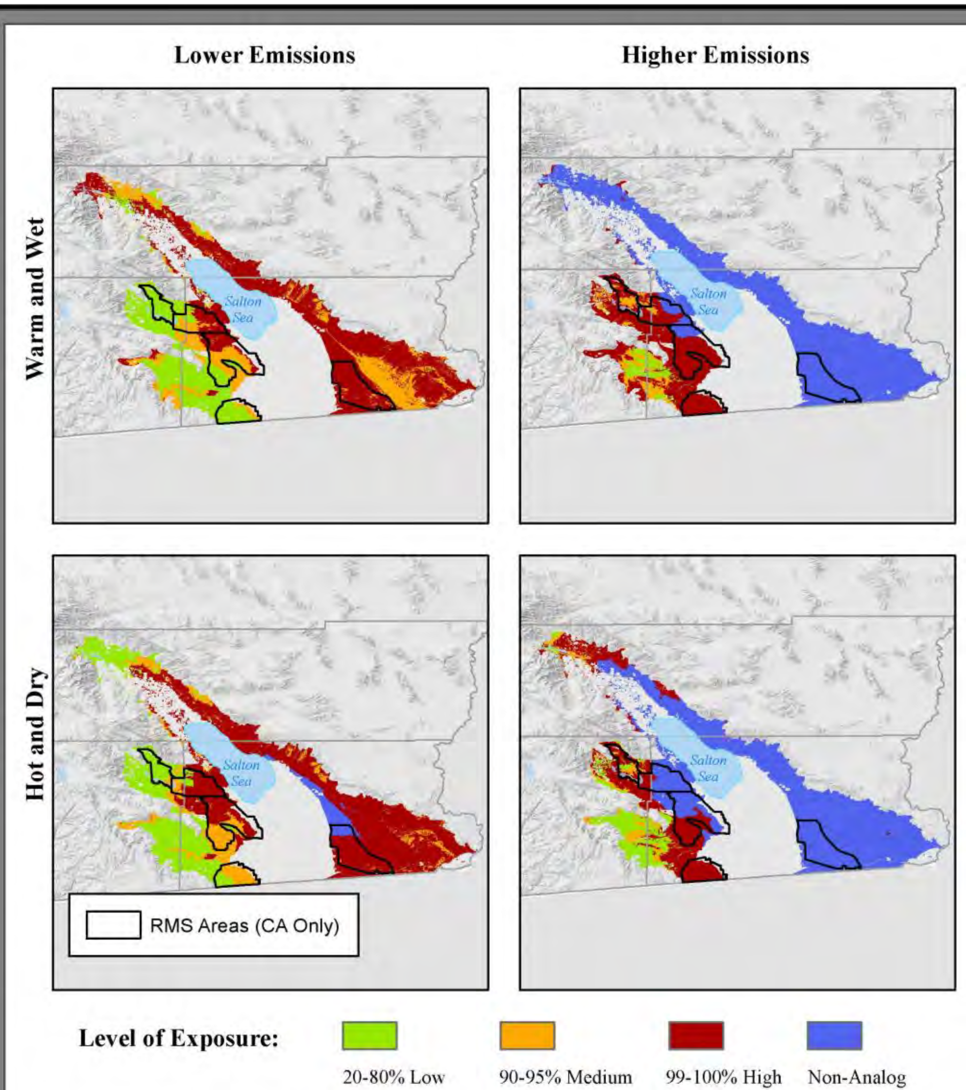


Mapped Climate Exposure of FTHL Habitat Under Four Near-term (2039) Climate Projections. This image shows areas of suitable FTHL habitat within the species range based on California Wildlife Habitat Relationships (CWHR 2016) and a statewide best-available vegetation map (FVEG2015, FRAP 2015), and climate exposure scores for vegetation macrogroups from Thorne et al. (2015). High (>95% exposure) are highly stressed areas; Moderate (80-95% exposure) are stressed areas, and Low (<80% exposure) are areas expected to remain climatically suitable for the vegetation that currently occupies them. "Warm and Wet" = CNRM CM5, Hot and Dry" = MIROC ESM, Lower Emissions = RCP 4.5, and Higher Emissions = RCP 8.5.

Figure 16. Predicted Climate Change Impacts to Habitat in 2039

Comment [RL67]: All of these maps are suspect, since as stated earlier, they include large areas where FTHL do not occur.
Since CDFW has been a member of the FTHL ICC and signatory to the RMS for 20 years, why are those maps not included?

Also, in the figure caption, you use the term "best-available" with respect to the vegetation map. Please define. How good, or how bad is that data? What is missing that could make it better?



Mapped Climate Exposure of FTHL Habitat Under Four End-of-Century (2099) Climate Projections. This image shows areas of suitable FTHL habitat within the species range based on California Wildlife Habitat Relationships (CWHR 2016) and a statewide best-available vegetation map (FVEG2015, FRAP 2015), and climate exposure scores for vegetation macrogroups from Thorne et al. (2015). High (>95% exposure) and Non-Analog (outside the bounds of current California climate) are highly stressed areas; Moderate (80-95% exposure) are stressed areas, and Low (<80% exposure) are areas expected to remain climatically suitable for the vegetation that currently occupies them. "Warm and Wet" = CNRM CM5, Hot and Dry" = MIROC ESM, Lower Emissions = RCP 4.5, and Higher Emissions = RCP 8.5.

Figure 17. Predicted Climate Change Impacts to Habitat in 2099

Comment [RL68]: in the figure caption, you use the term "best-available" with respect to the vegetation map. Please define. How good, or how bad is that data? What is missing that could make it better?

PROTECTION AFFORDED BY LISTING

It is the policy of the state to conserve, protect, restore and enhance any endangered or any threatened species and its habitat. (Fish & G. Code, § 2052) The conservation, protection, and enhancement of listed species and their habitat is of statewide concern (Fish & G. Code, § 2051(c).) CESA defines “take” as hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill. (Fish & G. Code, § 86.) The Fish and Game Code provides the Department with related authority to authorize “take” under certain circumstances through incidental take permits, memorandum of understandings, natural community conservation plans, or other plans or agreements approved by or entered into by the Department. (Fish & G. Code, §§ 2081, 2081.1, 2086, 2087 and 2835.) Any person violating the take prohibition would be punishable under State law.

Approximately 77% of the Flat-tailed Horned Lizard’s range is owned or managed by the RMS participating agencies. Implementation of the RMS includes, in most circumstances, requiring compensatory mitigation for long-term, unavoidable impacts to Flat-tailed Horned Lizard habitat within MAs whether the site is occupied or not. This compensatory mitigation is used to purchase private lands, which are turned over to the BLM, BOR, or other appropriate agency for management, or it is used to fund ~~RMS~~ ICC ~~activities like habitat restoration~~approved actions related to the RMS.

If the Flat-tailed Horned Lizard were listed under CESA, impacts of take caused by activities authorized through incidental take permits must be minimized and fully mitigated according to state standards. These standards include protection of the land in perpetuity with an easement, development and implementation of a species-specific adaptive management plan, and funding through an endowment to pay for long-term monitoring and maintenance to ensure the mitigation land meets performance criteria. Because the RMS is voluntary, the participating agencies often struggle with funding and staffing to carry out the RMS activities in spite of the compensatory mitigation funding received. Additionally, the lands within it continue to be multiple-use ~~multiple use~~ under the BLM’s management. However, mitigation lands required under CESA would be expected to guarantee protection and level of habitat quality for a longer time.

Additional protection of Flat-tailed Horned Lizard following listing would occur with required public agency environmental review under CEQA and its federal counterpart, the National Environmental Policy Act (NEPA). CEQA and NEPA both require affected public agencies to analyze and disclose project-related environmental effects, including potentially significant impacts on endangered, rare, and threatened special status species. In common practice, potential impacts to listed species are examined more closely in CEQA and NEPA documents than potential impacts to unlisted species.

Under CEQA’s “substantive mandate,” state and local agencies in California must avoid or substantially lessen significant environmental effects to the extent feasible. (Pub. Resources Code, § 21080; Cal. Code Regs., tit.14., §§ 15002 & 15021). With that mandate and the Department’s regulatory jurisdiction, the Department expects related CEQA and NEPA review will likely result in increased information ~~increased information~~ regarding the status of Flat-tailed Horned Lizard in California due to, among other things, updated occurrence and abundance

Comment [RL69]: General comment that the whole section should be revised. The idea of federal versus state authority should lead the section, since the majority of habitat for FTHL occurs on federal lands. See the last paragraph.

Comment [RL70]: AGFD: My impression is that CESA does not apply on federal land. If true, this should be pointed in this discussion out since Table 3 shows that 59% of the range in CA is federal.

Comment [RL71]: This is seldom accomplished on federal lands, and the majority of the species range is on federal land, thus rendering this statement hollow, and false in application for this, or any presently listed species under CESA.

Please demonstrate how many projects on federal lands have been “fully mitigated, etc.” for the desert tortoise, a species listed under CESA.

Comment [RL72]: Voluntary is irrelevant since the RMS is now mandated by NEPA uder the BLM El Centro’s land use plan, and the INRMP at the BMGR West and NAF El Centro under the Sikes Act.

Comment [RL73]: There is no “struggle” to carry out an action when the action is voluntary. It is either accomplished or it isn’t, minus a judgement of negative connotation.

Comment [RL74]: There is no correlation to compensatory mitigation being received and any lapse in RMS activities. This statement is false. Compensatory mitigation is used for primarily land acquisition, and secondarily for ...

Comment [RL75]: Can CDFW provide an example of where the state of CA perfectly protects a species under CESA with no struggle for funding and staffing annually?

Comment [FMS76]: USFWS: Most of the RMS managed lands are within ACEC’s with a 1 percent disturbance cap, so there is a highe ...

Comment [RL77]: They are multiple use, and with no detriment to the FTHL populations seen as a result through the many years of monitoring. Look at the data.

Comment [RL78]: Can you please quantify this expectation? It sounds like you think it would, but it may not. Thus, is that expectatio ...

Comment [RL79]: Longer than what? The RMS has not failed in 20 years. CDFW is a legacy member thereof and signatory. They have never said that they could do better, sin ...

Comment [RL80]: NEPA has already been done on the FTHL through the BLM land-use plan.

Comment [FMS81]: USFWS: Maybe on non-federal lands, but since the Conservation Agreement was signed, NEPA review for projects with effects to FTHL have been fully ...

information for individual projects. Where significant impacts are identified under CEQA, the Department expects required project-specific avoidance, minimization, and mitigation measures will benefit the species. State listing, in this respect, and required consultation with the Department during state and local agency environmental review under CEQA, would also be expected to benefit ~~the species~~FTHL in terms of related impacts for individual project that might otherwise occur absent listing~~listing~~.

Unlike many other species whose listing under CESA may increase interagency coordination and the likelihood that State and federal land and resource management agencies will allocate funds towards protection and recovery actions, the participating agencies already meet and coordinate regularly to strategize how best to implement the RMS. When sufficient funding and staffing are available, these actions include monitoring, specific research studies, acquisition of private inholdings, and habitat restoration (among other things). As mentioned previously in Existing Management, the RMS has already been codified into the BLM's land use plans for the East Mesa, West Mesa, and Yuha Desert MAs through adoption of ACECs in the CDCA, as well as the Department of Defense's properties through their INRMPs, making these conservation measures mandatory. In other areas, if the Flat-tailed Horned Lizard is listed under CESA, it is possible some, or all, aspects of RMS implementation will be abandoned or reduced in priority to focus limited funding and staffing on mandatory CESA-compliance., for which federal agencies, conducting federal projects, do not have to comply.

Also, unlike other species that may benefit from CESA listing by having a greater likelihood of being incorporated into large-scale conservation and planning documents like Habitat Conservation Plans and Natural Community Conservation Plans, the Flat-tailed Horned Lizard is already a covered species (or proposed to be covered as an "individual focal species" in the case of the DRECP/BLM LUPA) throughout its entire range in California for the vast majority of projected development impacts (i.e., urban and renewable energy development and agricultural in Coachella Valley and renewable energy throughout the rest of the range). The exceptions would be any future development on local government and private lands in San Diego and Imperial counties, which while not amounting to a large proportion of the Flat-tailed Horned Lizard's range, could have large impacts on the species' connectivity to the limited remaining habitat in the north if the areas along the Salton Sea are developed. The DRECP does not provide CESA take coverage but does implement the RMS, which contains measures on BLM lands that extend beyond mitigation for projects that would result in take of Flat-tailed Horned Lizards.

A further potential challenge to implementing CESA protections for the Flat-tailed Horned Lizard is the scarcity of private land within the species' range that could be used for mitigation. A recent option to use BLM land for CESA mitigation has become available through an agreement entered into by the Department and BLM in 2015, referred to as the Durability Agreement (BLM and CDFW 2015). If mutually agreeable between the two agencies, CESA compensatory mitigation actions could be implemented on BLM Conservation Lands (e.g., ACECs and Wilderness Areas), including restoration of habitat and movement corridors, rehabilitation of closed roads, predator control, invasive plant species removal and control, and additional law enforcement (Ibid.).

Comment [RL82]: The same reporting already exists. Also, how much data is pouring into CDFW as a result of other state listed species, and how is their conservation strategy better than the RMS and member-agencies involvement?

Comment [RL83]: How so on federal lands?

Comment [CDoPaR84]: How can this statement be made without the DFW having established FTHL mitigation ratios or requirements. For all we know the DFW requirements will be less stringent than the ICC. The DFW is a member agency of the ICC and their feedback has been applied to the RMS. In essence consultations with the Department already occur.

Comment [RL85]: This could only occur through the complete abandonment of responsibilities each member agency has as a signatory to the RMS.

Comment [USFWS86]: Agriculture is NOT a covered activity under the CVMSHCP. Construction of renewable energy projects IS a covered activity.

SUMMARY OF LISTING FACTORS

CESA directs the Department to prepare this report regarding the status of Flat-tailed Horned Lizard based upon the best scientific information available to the Department. CESA's implementing regulations identify key factors that are relevant to the Department's analyses. Specifically, a "species shall be listed as endangered or threatened ... if the Commission determines that its continued existence is in serious danger or is threatened by any one or any combination of the following factors: (1) present or threatened modification or destruction of its habitat; (2) overexploitation; (3) predation; (4) competition; (5) disease; or (6) other natural occurrences or human-related activities." (Cal. Code Regs., tit. 14, § 670.1, subd. (i)(1)(A).)

The definitions of endangered and threatened species in the Fish and G. Code provide key guidance to the Department's scientific determination. An endangered species under CESA is one "which is in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, over exploitation, predation, competition, or disease." (Fish & G. Code, § 2062.) A threatened species under CESA is one "that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of special protection and management efforts required by [CESA]." (Id., § 2067.)

The following summarizes the Department's determination regarding the factors to be considered by the Commission in making its decision on whether to list the Flat-tailed Horned Lizard~~Lizard~~. This summary is based on the best available scientific information, as presented in the foregoing sections of the report.

Comment [PRJCNS87]: Shouldn't "As endangered" be added here since the department only has to consider an "endangered" listing-not a "threatened" listing?

Present or Threatened Modification or Destruction of Habitat

Agricultural and Urban Development

While agricultural development has reduced and fragmented available habitat, this impact is fairly concentrated ~~down~~ in the middle of the Flat-tailed Horned Lizard's range in California and is not expected to increase ~~in any~~ significantly ~~way~~ in the future. Flat-tailed Horned Lizards have already disappeared from most historically occupied sites in the Coachella Valley over the past 30 years due to agricultural and urban development (CVCC 2013a), threatening the species' long-term persistence in this area. Another threat is posed by the proposed future urban development in Imperial County (County of Imperial 2013) along the shores of the Salton Sea, particularly on the east side, which could eliminate the only habitat corridor between the population east of the Imperial Valley and the Dos Palmas population, if that corridor exists..

Renewable Energy Development

Expansion of renewable energy development is expected to continue within the Flat-tailed Horned Lizard's range, and Phase I of the DRECP (i.e., the BLM LUPA), if implemented, is expected to reduce impacts to the species by focusing most of the impacts on or near existing disturbed areas and existing transmission lines as opposed to relatively undisturbed open desert. However, the lack of county and city participation in the plan could compromise its efficacy if relatively undisturbed private and local government managed lands are developed.

Mining

It appears that sand and gravel mining are the most common mining activities currently in operation within the Flat-tailed Horned Lizard's range, but the area available for mineral extraction in Imperial County is largely depleted (BLM 2011). In addition, oil, gas, and gold exploration have proven unprofitable. Therefore, the threat to Flat-tailed Horned Lizards posed by mining is considered relatively small.

Off-highway Vehicles

Where OHV ~~use~~ intensity ~~is so great that it~~ substantially reduces shrubs or prey, particularly in areas where these habitat features may ~~already~~ be scarce, ~~Flat-tailed Horned Lizard,~~ it may pose a threat to the species. The extent to which these changes in vegetation and prey have occurred as a result of OHV activity across the Flat-tailed Horned Lizard's range is unknown since very few focused surveys have detected a demonstrable connection between OHV activity and Flat-tailed Horned Lizard abundance~~abundance~~.

United States-Mexico Border Activities

While there are likely some adverse effects arising from road mortality and increased avian predation within a short distance from the border fence, there also appear to be some benefits from it including reduced habitat damage from illegal border crossing. Additionally, the fencing used in California does not appear to create a barrier to movement or gene flow. Border activities do not appear to pose a serious threat to Flat-tailed Horned Lizards.

Military Activities

The vast majority of Flat-tailed Horned Lizard habitat on military lands is protected and managed in a way to conserve the species, so military activities do not appear to pose a threat to them. Sikes Act compliance is a direct benefit to the species, and the environment.

Overexploitation

Collecting for the pet trade does not appear to be a current threat, although some evidence exists that the listing process alone can increase the likelihood of it becoming a threat due to the human disposition to place exaggerated value on rare or "off limits" species (Courchamp et al. 2006). Illegal commercial collection of Flat-tailed Horned Lizards likely would not be very difficult due to the common observation among researchers that they frequently use, and are highly visible on, roads compared to on native substrates, and tend to freeze instead of flee. However, their renowned difficulty to keep alive in captivity may negate this potential threat. While there may be increased mortality due to research activities, these take place over a very small portion of the species' range, and the beneficial information derived from them outweighs the minimal threat they may pose to Flat-tailed Horned Lizard populations. There is no evidence to suggest Flat-tailed Horned Lizards are or will be substantially threatened by overexploitation.

Predation

Anthropogenic increases in predation pose a threat to Flat-tailed Horned Lizards, but the severity of the threat likely depends on the vulnerability of the Flat-tailed Horned Lizard

Comment [RL88]: Data from OWSVRA show OHV use to be compatible with very high densities of FTHL.

Comment [RL89]: Incomplete sentence.

Comment [K90]: The available data from OW shows that the FTHL may be present in numbers comparable to areas with no OHV activity.

population (e.g., small and isolated in Thousand Palms, Coachella Valley vs. large and intact in East Mesa MA) and the surrounding land use. For example, the effect of predation along the edge of urban or agricultural development appears to be greater than it is along a powerline in the middle of the desert because the former provides more subsidized resources. Given development is relatively concentrated within the Coachella and Imperial Valleys, this area of heightened predation comprises a small fraction of the Flat-tailed Horned Lizard's range.

Competition

There is no evidence to suggest that competition threatens Flat-tailed Horned Lizards.

Disease

There is no evidence to suggest that disease threatens Flat-tailed Horned Lizards.

Other Natural Events or Human-Related Activities

Fragmentation, Edge Effects, and Small Populations

Currently large expanses of relatively intact habitat remain within the Flat-tailed Horned Lizard's range in California. While habitat fragmentation, edge effects, and small population sizes~~habitat fragmentation, edge effects, and small population sizes~~ may pose ~~serious~~ threats to Flat-tailed Horned Lizards in portions of their California range, the degree to which this would ~~significantly adversely~~ impact the species as a whole is uncertain. How and where future development is constructed will affect the severity of this threat.

Comment [USFWS91]: USFWS 2011 did not find these factors to be serious threats.

Comment [RL92]: Use of the deleted terms is unnecessary, and lacks definition and quantification of severity, significant, and adverse thresholds.

Roads, Canals, and Railroads

Major roads, canals, and railroads may pose a ~~serious~~ threat to Flat-tailed Horned Lizards through habitat fragmentation and/or edge effects. In addition, mortality associated with major roads could create a localized sink on both sides of the road. Minor, lightly travelled roads (including OHV trails), especially those without associated power poles or other human-provided perches, likely contribute to some mortality but ~~also~~ likely do not pose a serious threat to Flat-tailed Horned Lizards.

Comment [RL93]: See above.

Contaminants

There is no evidence to suggest that herbicides, pesticides, or other contaminants pose a significant threat to Flat-tailed Horned Lizards.

Invasive Species and Fire

Invasive species like Sahara mustard appear to be playing a role in Flat-tailed Horned Lizard declines in portions of the species range (e.g., the Coachella Valley). The degree to which invasive plants are having population-level impacts, either alone or in conjunction with other factors, throughout other parts of the species' range in California is unknown. While invasive grasses increase the risk of fire, this threat has not been observed within the Flat-tailed Horned Lizard's range with the exception of the Coachella Valley, which is located in a major wildland-urban interface area (Steers and Allen 2011). In the Coachella Valley, the Flat-tailed Horned Lizard could be at risk of local extinction due to the interaction of both invasive plant species and climate change (CVCC 2013a). Non-native ants do not appear to pose a threat to Flat-tailed Horned Lizards.

Comment [RL94]: Terminology incorrect. Please replace with extirpation.

Drought and Climate Change

Drought, in combination with other factors such as habitat fragmentation and degradation, and climate change appear to pose a ~~serious~~ threat to Flat-tailed Horned Lizards.

LISTING RECOMMENDATION

[Note to readers: This section will be completed after external peer review.]

MANAGEMENT RECOMMENDATIONS

These recommendations were developed by the Department in accordance with the requirements of Fish and Game Code, section 2074.6. The Department recommends these actions be implemented regardless of the Commission's decision on listing Flat-tailed Horned Lizard as threatened or endangered. This list includes recommendations for actions that could be undertaken by the Department as well as by other public agencies, non-governmental organizations, and private land owners.

Revisit Flat-tailed Horned Lizard Status in Three to Five Years

Several research and planning efforts are in progress that are expected to provide additional insights into the status of the Flat-tailed Horned Lizard in California in the next three to five years. For example, in that time, at least preliminary results from the following studies should be available: landscape genomics, population viability analysis, habitat connectivity along the east side of the Salton Sea, and the extent to which avian predation that is subsidized by anthropogenic features or actions is affecting Flat-tailed Horned Lizard mortality rates. In that time, it is likely the OWSVRA General Plan will be prepared and potentially implemented. The degree to which Flat-tailed Horned Lizards are addressed and afforded protection in that plan is expected to contribute to either the conservation or decline of the species into the future~~future~~. Additionally, in that time, a Record of Decision on the BLM LUPA should have been published, so at least a few years of implementation of its measures will be available to better determine to what degree the potential threats and benefits to Flat-tailed Horned Lizards are realized. In addition, the species currently is experiencing what appears to be a widespread drought-related decline in abundance. The next three to five years will likely reveal whether the species can rebound from prolonged drought or not. If the data indicate a change in status is warranted, the Department should prepare the appropriate document to address ~~that change~~the newly acquired data.

Increase Department Participation in RMS Implementation

Like the other participating agencies, the Department's contribution to Flat-tailed Horned Lizard conservation through implementation of the RMS is subject to funding and staffing availability, and mgt. prioritization~~.~~. The Department should increase its participation in implementation of the RMS, including working with partners to identify outside funding opportunities (e.g., State Wildlife Grants) and providing staff to assist with population monitoring, habitat restoration,

Comment [CDoPaR95]: OWSVRA Already offers protections to the FTHL during project and special event review/implementation. All Species of Special Concern at OWSVRA are considered and protected during CEQA review. It is also worth pointing out that all plants and animals are currently protected in all California State parks regardless of conservation status.

Comment [RL96]: OWSVRA: The EIR/EIS associated with the Plan will address the FTHL as required by law.

Comment [RL97]: Change follows findings, it does not lead findings.

education and outreach, and international coordination and collaboration, as necessary to implement the RMS.

Improve Population Monitoring Methods

Investigate the use of scent detection dogs in Occupancy and Demography surveys to increase detectability, which may greatly reduce duration and number of personnel necessary to achieve reliable estimates of distribution and abundance. Encourage annual budgeting by participating agencies to fully fund population monitoring efforts on the MAs and RA and expand them to other parts of the range for comparison. In addition to collecting data on Flat-tailed Horned Lizards, data on environmental covariates should also be collected such as habitat quality~~quality~~, predators and prey, and anthropogenic threats, so that an informed adaptive management strategy can be developed. Investigate whether stressor monitoring may be more cost-effective and better able to inform management decisions.

Increase Habitat Quality and Quantity

Restore areas degraded by OHVs and mining. Increase patrol of areas and cite illegal cross-country OHV or other public trespass in closed or limited use areas. Immediately obscure and/or restore any new unsanctioned trails. Decommission powerlines or other anthropogenic structures that provide perches for avian predators. Remove or trim hedgerows along roads that attract avian predators. To the extent feasible, remove or reduce the abundance and extent of non-native grasses, Sahara mustard, and other invasive species. Clean up illegally dumped material as quickly as possible.

Reduce Habitat Fragmentation and its Effects

Investigate how barriers may be limiting gene flow across the species' range. Use this information to protect important habitat linkages and movement corridors such as Yuha Basin to West Mesa and East Mesa to Dos Palmas. Try to improve ~~seemingly~~ potentially broken linkages, such as by creating effective road and canal crossings. Continue to purchase private inholdings within the larger public land matrix. Coordinate with and assist the Mexican government on Flat-tailed Horned Lizard conservation across the border. Implementers of the RMS and CVMSHCP should coordinate on reestablishing connectivity. If necessary, develop an assisted migration and or repatriation strategy to address loss of diversity and local extirpations.

Reduce Habitat Loss and Edge Effects from Renewable Energy Projects

Encourage siting renewable energy development outside of the desert completely (see Hernandez et al. 2015) or if within the Flat-tailed Horned Lizard's range, make sure it is located on compatible lands (e.g., near existing transmission line on agricultural lands, previously developed lands, or fallow agricultural lands, etc.). Limit the amount of new transmission lines by encouraging construction of a single line with additional capacity for future expansion. Bury lines whenever possible. Close (permanently or temporarily) areas to OHVs that are losing shrub cover.

Further Investigate the Impacts of Relocation

To date, only one study has simultaneously investigated the effects to relocated and resident Flat-tailed Horned Lizards where relocations have occurred (Goode and Parker 2015). Large

Comment [RL98]: This is not a good idea. It is only beneficial to occupancy surveys, is untried at present, and would not add substantially to what we already know. It also takes a vast amount of human handling time for use of the dogs. It sounds good, and is great for extraordinarily cryptic, subterranean, or fossorial species, but the FTHL is none of those. It is not a good idea for FTHL.

Comment [RL99]: Please define "fully fund." Since monitoring is adaptive by nature, and monitoring depends on the question being asked, I would argue that it is impossible to ever "fully" fund an adaptive target like monitoring. You simply pursue monitoring, you never fully know it in real time.

Comment [K100]: OW collects "habitat quality" data on all FTHL surveys conducted. OHV use and intensity is also recorded at all sites.

Comment [RL101]: CDFW was at the table during the numerous workshops and monitoring review workshops held by the ICC where we analyzed all of the data, person-effort, results, etc. There, we formulated the best and most scientifically rigorous ways to monitor the species per the RMS at intervals. One of the most prominent findings was that it is a distraction from the goal of monitoring FTHL to document covariates, etc, It significantly reduced area covered, and decreased detection probabilities.

Comment [RL102]: What stressor?

Comment [RL103]: We analyzed that and covariates measured are not a significantly correlated stressor. Leavitt et al. 2015.

Comment [RL104]: Why? How is this a benefit to FTHL directly, when no evidence indicates they are harming populations. To the contrary, OWSVRA has some of the highest densities of FTHL in the state of CA.

Comment [RL105]: For what purpose? See above comment.

Comment [RL106]: These are guesses at best to benefitting FTHL. There is no direct evidence to suggest this is beneficial to the long-term persistence of the species throughout its natural range in CA.

Comment [RL107]: Between what and what? Please describe.

Comment [RL108]: Thus far this is unnecessary for the species, and may continue to be except for Coachella Valley.

Comment [RL109]: Data shows that this may or may not have any direct benefit to FTHL.

numbers of Flat-tailed Horned Lizards are relocated out of harm's way on construction projects, and their fate, as well as the fate of the recipient populations, is not well understood. Exclusion fencing may be somewhat useful in reducing mortality; however, it requires continuous maintenance that may limit its utility. Research in this area should develop relocation plans that take the recipient population's density and the habitat quality into account. Develop a strategy that is informed by landscape-level genetics, to relocate Flat-tailed Horned Lizards to restored or apparently suitable, but unoccupied, habitat, even if it is located relatively far from the project site and monitor the results.

Modify the Mitigation and Compensation Strategy

Purchase and/or set aside lands specifically for Flat-tailed Horned Lizard conservation in high quality habitat, where as few threats as possible exist (i.e., closed to OHV, far from human development, roads, and power lines). Use compensation funds to create an endowment, or higher interest earning account, that pays for routine management, maintenance, and monitoring of these sites and their populations.

Comment [RL110]: Why move any FTHL when that increases risk of mortality, genetic contamination, potential disease transmission, etc.? Risks outweigh benefits into the foreseeable future.

Comment [RL111]: How is this different from present land mitigation and compensation strategy? As CDFW already is aware and helped script as a member of the ICC and RMS, we are already acquiring lands "in high quality habitat, where as few threats..exist"…and there is no need for an endowment because the signatories of the RMS pay into annual "management, maintenance, and monitoring…"

ECONOMIC CONSIDERATIONS

The Department is charged in an advisory capacity in the present context to provide a written report and a related recommendation to the Commission based on the best scientific information available regarding the status of Flat-tailed Horned Lizard in California. The topic areas and related factors the Department is required to address as part of that effort are biological and not economic. (See Fish & G. Code, § 2074.6; Cal. Code Regs., tit. 14, § 670.1, subd. (f).)

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Personal Communications

Lovecchio, J. Electronic mail received May 3, 2016.

Lovich, R. Electronic mail received April 28, 2016.

Petrilla, J. Electronic mail received May 4, 2016.

Powell, R. Electronic mail received April 28, 2016.

Rodriguez, M. Electronic mail received June 15, 2016.

Ronning, C. Electronic mail received April 26, 2016.

APPENDIX 1. Flat-Tailed Horned Lizard Rangewide Management Strategy, 2003 Revision

[In the final version, the entire document will be inserted, but since this is Word, not PDF, I'm just providing this page. Use the link within the narrative to download the 2003 RMS: https://www.wildlife.ca.gov/Regions/6/Flat-Tailed-Horned-Lizard-Copy]

APPENDIX 2. List of Acronyms and Abbreviations

ac	acre
ACEC	Area of Critical Environmental Concern
BLM	United States Bureau of Land Management
C	Celsius
CDCA	California Desert Conservation Act
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
cm	centimeter
CMA	Conservation and Management
CNDDB	California Natural Diversity Database
Commission	California Fish and Game Commission
CVMSHCP	Coachella Valley Multiple Species Habitat Conservation Plan
CWHR	California Wildlife Habitat Relationships
Department	California Department of Fish and Wildlife
DFA	Development Focus Areas
DRECP	Desert Renewable Energy Conservation Plan
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ESA	Endangered Species Act (federal)
F	Fahrenheit
FTHL	Flat-tailed Horned Lizard
FLPMA	Federal Land Policy and Management Act
ft	feet
hr	hour
ha	hectare
HCP	Habitat Conservation Plan
ICA	Interagency Conservation Agreement
ICC	Interagency Coordinating Committee
in	inch
INRMP	Integrated Natural Resources Management Plan

km	kilometer
LCR MSCP	Lower Colorado River Multi-species Conservation Program
LUPA	Land Use Plan Amendment
m	meter
MA	Flat-tailed Horned Lizard Management Area
mi	mile
NCCP	Natural Communities Conservation Plan
OHMVRD	Off-highway Motor Vehicle Recreation Division
OHV	Off-highway Vehicle
OWSVRA	Ocotillo Wells State Vehicular Recreation Area
RA	Flat-tailed Horned Lizard Research Area
RMS	Flat-tailed Horned Lizard Rangewide Management Strategy
RMS Areas	Borrego Badlands MA, West Mesa MA, East Mesa MA, Yuha Desert MA, and Ocotillo Wells State Vehicular Recreation Area RA
SSC	Species of Special Concern
USFWS	United States Fish and Wildlife Service

APPENDIX 3. Public Notice

APPENDIX 4. External Peer Review Solicitation Letters

APPENDIX 5. External Peer Review Comments

APPENDIX 6. Public Comments