Petition to List the Mohave Ground Squirrel (*Xerospermophilus mohavensis*)
as Threatened Under the Endangered Species Act

Photo Credit: Phil Leitner, USGS

Submitted to the U.S. Secretary of the Interior
acting through the U.S. Fish and Wildlife Service

December 13, 2023

Defenders of Wildlife, Desert Tortoise Preserve Committee, Inc.,
Mohave Ground Squirrel Conservation Council and Dr. Philip Leitner

Desert Tortoise
Preserve Committee, Inc.

NOTICE OF PETITION

December 13, 2023

Deb Haaland
Secretary of the Interior
U.S. Department of the Interior
1849 C Street NW
Washington, DC 20240

Martha Williams
Director
U.S. Fish and Wildlife Service
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via email

Dear Secretary Haaland:

Pursuant to the Endangered Species Act ("ESA"), 16 U.S.C. § 1533(b), the Administrative Procedure Act, 5 U.S.C. § 553(e), and the ESA's implementing regulations, 50 C.F.R. § 424.14, Defenders of Wildlife, Desert Tortoise Preserve Committee, Inc., the Mohave Ground Squirrel Conservation Council and Dr. Philip Leitner formally petition the Secretary of the Interior to list the Mohave ground squirrel (*Xerospermophilus mohavensis*) as a threatened species and to designate critical habitat concurrent with the listing. 50 C.F.R. § 424.12.

This Petition sets in motion a specific process, placing definite response requirements on the Secretary of the Interior and the U.S. Fish and Wildlife Service ("FWS"), by delegation. Specifically, FWS must issue an initial finding as to whether the Petition "presents substantial scientific or commercial information indicating that the petitioned action may be warranted." 16 U.S.C. §1533(b)(3)(A). FWS must make this initial finding "[t]o the maximum extent practicable, within 90 days after receiving the petition." *Id.* Petitioners need not demonstrate that listing or reclassification is warranted; rather, petitioners must only present information demonstrating that the petitioned action may be warranted. The petitioners believe that there can be no reasonable dispute that the best available information indicates that listing the Mohave ground squirrel as threatened throughout all or a significant portion of its range may be warranted. FWS must promptly make an initial finding on the Petition and commence a status review as required by 16 U.S.C. § 1533(b)(3)(B).

As required by 50 C.F.R. § 424.14(b), Defenders provided written notice (via email) to the state agency responsible for the management and conservation of the Mohave ground squirrel on November 9, 2023, more than 30 days prior to the submission of this Petition. A copy of the notice accompanies this Petition. *See* 50 C.F.R. § 424.14(c)(9). We anticipate that, in keeping with 50 C.F.R. § 424.14(f)(2), FWS will acknowledge the receipt of this Petition within a reasonable timeframe. As fully set forth below, this Petition contains all the information requested in 50 C.F.R. § 424.14(c)–(e) and 16 U.S.C. § 1533(e). All cited documents are listed in the Literature Cited section. *See* 50 C.F.R. § 424.14(c)(5)–(6).

If you have any questions, please feel free to contact us via the information contained in the signature blocks below.

Sincerely,

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Summary

Defenders of Wildlife, Desert Tortoise Preserve Committee, Inc., Mohave Ground Squirrel Conservation Council and Dr. Philip Leitner (Petitioners) hereby petition the Secretary of the U.S. Department of the Interior, acting through the U.S. Fish and Wildlife Service, to list the Mohave ground squirrel (*Xerospermophilus mohavensis*), or MGS, as a Threatened species under the Endangered Species Act (16 United States Code 1531 et seq.) and concurrently designate its critical habitat. This species is threatened with endangerment within the foreseeable future throughout all of its range in California. Material presented in this petition, under Endangered Species Act listing factors A, D, E and synergistic/cumulative effects, demonstrates this species warrants federal listing.

Standards and Background

The standard for substantial scientific or commercial information under the Code of Federal Regulations (CFR) regarding a 90-day Endangered Species Act (ESA) petition finding is "that amount of information that would lead a reasonable person to believe that the action recommended in the petition may be warranted." [50 CFR 424.14(b)].

This petition includes the petitioner identification information as required under 50 CFR 424.14(a). The petition identifies a species and its scientific name which is eligible for consideration for listing under provisions of the ESA, and which was previously considered by the U.S. Fish and Wildlife Service (Service) for listing based on two previous listing petitions.

Petitioners believe the MGS warrants listing under the ESA based on the present and ongoing destruction, modification and curtailment of the species' limited habitat and range (Factor A). We document the specific ongoing and foreseeable activities that support listing this species, summarized below and in the supporting documentation in this Petition:

- Habitat destruction and degradation due to multiple land use activities;
- Habitat modification due to urbanization, transportation infrastructure expansion and modification, military training and maneuvers, off-road vehicle use, agricultural development, livestock grazing, mining, and urban development; and
- Habitat modification, range contraction, habitat linkage elimination and curtailment due to climate change.

Petitioners believe the MGS warrants listing based on the inadequacy of existing regulatory mechanisms (Factor D). The specific regulatory mechanism inadequacies supporting a listing are summarized below, with citations referenced in the Literature Cited Section of this Petition:

- Insufficient management of MGS habitat on public, military and private lands, and absence of sufficient dedicated conservation lands essential for MGS population persistence; and
- Inadequate project impact avoidance and mitigation policies at the local, county, state and federal levels for authorized land uses and activities impacting MGS and its habitat.

Petitioners believe MGS warrants listing based on other natural or manmade factors affecting its survival (Factor E). Specifically, we provide scientific evidence that climate change poses a threat to MGS populations due to altered behavior to avoid excessive heat, less available forage and diminished cover; and that loss of habitat reduces population size and constrains movement of MGS between existing populations. In addition, MGS faces competition and hybridization with the round-tailed ground squirrel (*Xerospermophilus tereticaudus*), which is expanding its range into that of MGS.

Petitioners also believe MGS threats and impacts documented in this petition under listing Factors A, D and E, as well as supporting information in the Literature Cited section of this Petition, have synergistic and cumulative effects such that the species warrants listing with concurrent designation of its critical habitat. Our position that MGS warrants listing under the ESA has strengthened since 1993 when Dr. Glenn Stewart submitted a petition to list the MGS, which included extensive documentation indicating that the MGS is threatened with endangerment throughout its range. Defenders of Wildlife submitted an MGS listing petition in 2005 that provided additional information on threats to the MGS. Due to new information and increased threats and habitat loss, we believe now more than ever the MGS warrants listing as Threatened.

The first MGS listing petition (Stewart 1993; in Service 2011, p. 62214) was submitted when the species was considered by the Service as a category 2 candidate for ESA listing – taxa for which information indicates a species' listing may be warranted, but for which sufficient data on biological vulnerability and threats were not available to support a listing rule. The Service (1995, p. 46571) issued a 90-day Finding that the 1993 petition did not present substantial information indicating that MGS listing was warranted given the uncertainties of urban growth and other threats, as well as a lack of credible biological status evidence.

A second MGS listing petition (Wilkerson and Stewart 2005, in Service 2013, p. 62214) was also submitted in which the Service (2010, p. 22069) announced in a 90-day finding that MGS warranted a status review. The Service (2011a, p. 62258) subsequently announced in a 12-month Finding that MGS listing was not warranted because the species "*does not face elevated threats in most portions of its range"* and that those portions of its range *"that may have concentrated threats (the Southern and Central portions of the range) do not contribute to the resiliency, redundancy and representation of the Mohave ground squirrel such that without these portions, the species would be in danger of extinction*."

This petition will not repeat all 1993 and 2005 MGS listing petition information; but we incorporate, by reference, all relevant material, as well as all pertinent information presented in LaRue and Leitner (2023, updated MGS bibliography). New information concerning MGS impacts and threats is included in this petition. Information overlooked and/or inadequately analyzed by the Service in previous MGS listing petition reviews is also included. We present this information below under ESA listing factors A, D, E and synergistic/cumulative effects, which demonstrate MGS warrants federal listing as Threatened under the Endangered Species Act.

1.0 Factor A. The Present or Threatened Destruction, Modification or Curtailment of the Species' Habitat or Range

1.1 Current Extent of MGS Habitat Loss

According to the California Department of Fish and Wildlife (CDFW 2019) the greatest known cause of MGS decline is habitat loss, with more than two thirds of connected suitable habitat within the species' historical range lost in less than 100 years. This extent of habitat loss has led to a significant decrease in dispersal opportunities within the last remaining portions of occupied MGS habitat (Gustafson 1993), which ultimately led to a 1971 listing of the species as Rare under the California Endangered Species Act (CESA). It was reclassified as Threatened in 1984 when CESA listing categories were changed to align with the ESA.

Habitat loss has resulted from urban and rural development, agriculture, military operations, renewable energy development, highway construction, and open pit mining. Degradation and fragmentation of remaining habitat caused by off-highway vehicle (OHV) use, livestock grazing and highway expansion within occupied portions of the species' range has continued unabated since the species was first listed under CESA (CDFW 2019).

According to the Service (2011, Fed. Reg. 76:62214), OHV use, livestock grazing, commercial filming, recreational activity, pesticide and herbicide use have caused degradation of MGS habitat. Lack of contiguous, suitable habitat decreases the species' ability to persist as connected populations during periods of drought. In drought years, the MGS may forgo reproduction to conserve energy due to the lack of food supply (Leitner and Leitner 1998), further limiting population recruitment over time.

Leitner (2021) reviewed MGS occurrence records based on field studies for the period 2013-2020 and reported that the records confirmed that MGS continues to persist in four Key Population Centers (KPCs, also referred to as Core Populations or Important Population Areas) and is widespread in the northern and central portions of its range. Field studies also confirm the species has been extirpated from the southern, northeastern and western portions of its range. Based on recent field surveys using camera traps, he reported that MGS appears to be absent from large portions of the South Range at the China Lake Naval Air Weapons Station (CL-NAWS), and that the round-tailed ground squirrel has replaced MGS on large portions of the National Training Center at Fort Irwin (NTC-Fort Irwin). He concluded by stating:

"A number of actions will be required to adequately meet the conservation needs of the Mohave ground squirrel. These include 1) continuing field studies to document patterns of occurrence and to identify areas of concern, 2) careful siting of renewable energy projects to avoid loss of important habitat, 3) designing new military training sites on Fort Irwin to minimize significant impacts, and 4) prioritizing the protection of high quality habitat in areas on the northern parts of the range where winter rainfall is more likely to be adequate in the future."

Leitner and Leitner (2022) conducted a large-scale camera survey for MGS in 2021-2022 at 110 sites within the central and southern portion of the species' range and found the species was absent from or in very low numbers at the South of Edwards Air Force Base, Searles Valley, Ridgecrest, South of China Lake, Spangler and Teagle Wash study areas. These same areas were surveyed with cameras in 2011-2012 (Leitner and Delaney 2014), where they found the MGS present at 73 of the 110 sites. Of concern, however, is that MGS were present on only 47 of the 110 sites, a decline of 33% over the 10-year period between surveys. Leitner and Leitner concluded by stating:

> *...both of these camera studies are encompassed within the 22-year mega-drought currently prevailing in the southwestern United States which has brought the driest conditions in the past 1,200 years (Williams et al. 2020). The Conservation Strategy for the MGS indicates that many measures of temperature (mean, maximum and minimum) have increased since the late 1890s (CDFW 2019)*, and *The effects of 2- and 3-year droughts are likely to be significant for a relatively short-lived rodent that cannot reproduce under such conditions*, and *With climate change, prolonged drought and higher temperatures, especially in summer, may be of concern because of habitat alteration, affecting available food and cover for MGS*.

Improved methods of detecting MGS (Leitner 2015b) and sophisticated habitat suitability modeling in the past 15 years have resulted in revised range maps depicting extirpated MGS populations and occupied MGS habitat (Carreras-Dias 2006; U.S. Geological Survey undated; Conservation Biology Institute 2016 DataBasin; Defenders 2016b). This refined habitat modeling has resulted in new data regarding crucial habitat linkages and barriers compared to supporting data referenced by the Service in its 2011 MGS Petition Finding (Figure 1).

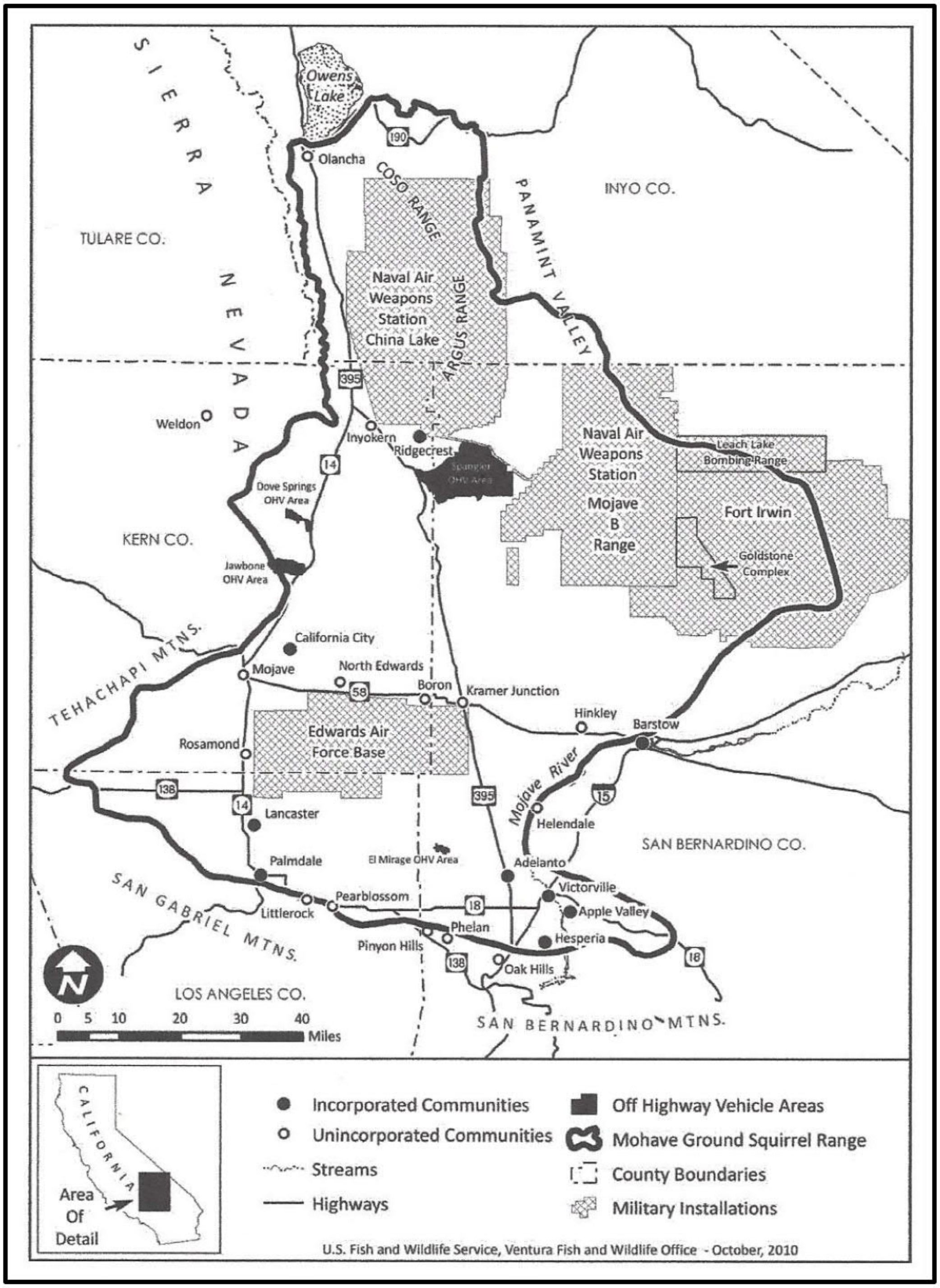


Figure 1. Range of the MGS as identified by the Service (2011a, p. 62216). Significant acreage within this outlined region is unlikely to have ever been occupied by the species, particularly areas west of Highway 14 and south of the community of Mojave, and several range contractions have occurred in recent decades.

MGS habitat modeling, connectivity and landscape genetics have been evaluated under a California Energy Commission contract for renewable energy planning (Esque et al. 2013). In this work, both climate change risk and resilience areas, as well as potential renewable energy development issues, were discussed relative to the current extent of MGS habitat loss and linkage.

In its 2011 MGS Petition Finding, the Service calculated about 2.6% of habitat within the range of the MGS had been lost to urban, suburban and rural development. At that time, more of the species' range was predicted to be lost in the future, mostly adjacent to existing urban and suburban areas in the southern portion of the range (Service 2011, Fed. Reg. 76:62214). Unincorporated areas were thought likely to have a relatively small loss of habitat from development due to lack of existing infrastructure, with such areas comprising most of the central and northern portion of the MGS range.

Under the highest impact scenario presented by the Service in its 2011 review, all unincorporated area habitat within the range of MGS (about 8.9%) would be developed. However, the Service considered this complete build-out unlikely (Service 2011, Fed. Reg. 76:62214). Inman et al. (2013) subsequently calculated a doubling of impacts – 16% of the historical MGS habitat – have likely occurred due to urban development. In summary, Inman et al. (2013) and Service (2011) Petition Finding estimates of foreseeable future habitat loss, up to 25% of the MGS range could be considered currently threatened directly by development footprints.

The federal government owns and manages 62% of MGS habitat within the species' range, little of which is subject to full development (Service 2011, Fed. Reg. 76:62214). Most of this federal land is managed by the U.S. Bureau of Land Management (BLM) and the Department of Defense (DOD). DOD lands within the CL-NAWS, Edwards Air Force Base (EAFB) and NTC-Fort Irwin overlap MGS range and include KPCs of the species but are dedicated to military purposes.

While federal lands other than those managed by DOD contain mines, utility and transportation right of ways and renewable energy developments, they are largely protected from large-scale development resulting in complete MGS habitat loss but are subject to a variety of land use activities that degrade and fragment MGS habitat. Livestock grazing and OHV use (discussed in further detail below) significantly degrade and fragment MGS habitat on a regular, recurring basis. Further, while 6,880 km^2 (2,656 mi^2) of important MGS habitat has been identified on public lands managed by BLM specifically for conservation purposes, little has been done to conserve MGS on these lands. On DOD-managed land, a small amount of development precluding MGS use occurs primarily in cantonment areas and loss of MGS habitat has occurred due to residential and commercial development (Service 2011, Fed. Reg. 76:62214). Military training and weapons testing activities have severely degraded MGS habitat in specific locations within all DOD installations in the range of the MGS.

The greatest MGS habitat loss has occurred on private lands surrounding western Mojave Desert cities, including Palmdale, Lancaster, Victorville, Adelanto, Hesperia, Apple Valley, Barstow, California City and Ridgecrest. Smaller areas of habitat have been lost in and near towns such as Hinkley, Boron, North Edwards, Mojave, Rosamond, Inyokern and Littlerock, and unincorporated communities such as Pearblossom, Phelan, Desert Lake, Lake Los Angeles, Lucerne Valley, Pinon Hills, and to a lesser extent Trona and Argus. Defenders' 2005 geographic information system analysis indicated urban development has occurred on more than 437 km^2 (169 mi^2), roughly 2.1% of the total MGS geographic range. Rural development has occurred on more than 114 km^2 (44 mi^2), roughly 0.5% of the total MGS geographic range (Wilkerson and Stewart 2005).

The human population centers in the western Mojave Desert and their associated golf courses, landfills and prisons within the range of MGS, grew an average of 85% between 1990 and 2010 (Alfred Gobar Associates as cited in BLM 2005, Table 3-38; U.S. Bureau of the Census 2000 as cited in Wilkerson and Stewart 2005; AnySite Online as cited in Wilkerson and Stewart 2005). Future city growth is anticipated to exacerbate human pressure upon adjacent extant MGS habitat, particularly in the southern half (i.e., south of State Route 58) of the species' historical range.

According to the California Native Diversity Database (CNDDB), MGS have been detected near certain urban areas, particularly to the north in and around Ridgecrest (CDFW 2023). MGS living near such areas could obviously be affected by future development. Gustafson (1993) noted that while no single development project threatens the existence of MGS regionally unless it destroys the last population, the combined impacts of all large and small development projects could result in regional extirpation of the species, such as what has occurred east of Victorville. Questionably, the Service (2011) determined that urban, suburban and rural development did not pose a substantial threat to MGS due to destruction and degradation of its habitat (Service 2011, Fed. Reg. 76:62214). Part of this finding was based on conservation measures outlined in BLM's 2006 West Mojave (WEMO) Plan, after which the Service determined that the current MGS range had shrunk to less than half of its historical range.

BLM's 2006 and 2019 WEMO Plan amendments (see Petition section 1.8.2) to the 1980 California Desert Conservation Area (CDCA) Plan progressively increased designated routes open to OHV use above what the 1980 CDCA Plan allowed within BLM-designated MGS Crucial Habitat. The plan amendments and their associated environmental impact analyses did not sufficiently address livestock impacts on select perennial shrubs needed by MGS within its Crucial Habitat in dry years. Nor has any land use plan amendment or habitat management plan been developed to safeguard this habitat in the almost 40 years since it was identified by BLM. Further, the BLM's 2006 West Mojave Plan amendment that largely dismissed MGS conservation concerns was successfully challenged by ten conservation groups (U.S. District Court 2009) as inadequate in conserving MGS.

While BLM was required to correct legal deficiencies in its 2006 WEMO plan by 2014 under federal court mandate (U.S. District Court 2011), completion was delayed until 2019. Unfortunately, BLM protective measures for MGS provided in 2006 were reduced considerably 10 years later with the BLM's completion of the Desert Renewable Energy Conservation Plan (DRECP) in 2016. The DRECP significantly reduced MGS conservation by designating the area north of Kramer Junction, a critical north-south MGS linkage corridor and location of an MGS KPC, as a Development Focus Area for renewable energy development. Former private lands within this area were acquired through exchange by BLM primarily for MGS, desert tortoise and rare plant conservation under the BLM's West Mojave Land Tenure Adjustment Program. More detail on this issue is provided in Section 1.10.1.4.

Current MGS habitat loss is based on the estimated historical extent of its range based on a limited number of MGS museum specimens collected at specific locations, rather than based upon stratified sampling surveys, suitable habitat mapping and small mammal trapping undertaken to ascertain true range extent and cumulative habitat loss. The placement of an artificial, east-central MGS range boundary following the Mojave River in the Adelanto to Barstow area has generally been accepted in MGS literature (Leitner 2008, p. 11-12). However, recent evidence (Leitner et al. 2017, p. 6) suggests this generally accepted range limit does not accurately reflect current MGS distributional limits.

The City of Barstow in the northern portion of the MGS historical range has repeatedly come into question as to whether the species occurs on both sides of the Mojave River, which flows through the city. Five CNDDB records once documenting MGS occurrence in the Barstow area south and east of the river have recently been removed from the database maintained by CDFW, including three suspected auditory detections. The CNDDB's 1981 MGS records near Coyote Lake and Daggett north of Barstow have also recently been removed based on research indicating these specimens were identified by Hafner and Yates (1983) as round-tailed ground squirrel.

Distribution and genetic data analyzed by Leitner and Matocq (2017) strongly indicate the eastern boundary of the MGS range lies well to the west of the Mojave River in the vicinity of Barstow. The only recent MGS record from east of the Mojave River is based on a 2005 visual observation near the Barstow Landfill that has not since been confirmed by trapping. Both current trapping data and genetic analysis indicate that the dominant *Xerospermophilus* species in the Hinkley Valley, west of the Mojave River, is the round-tailed ground squirrel (Leitner and Matocq 2017, p. 11). Since they are generally recognized as more disturbance-tolerant than MGS, it is possible that round-tailed ground squirrels replaced MGS in the Barstow region and perhaps elsewhere along the Mojave River contact zone because of habitat loss over time, as suggested in the southern part of MGS range by Wessman (1977, p 12).

Modeling by Inman et al. (2013) produced a predicted MGS habitat suitability map (Figure 2), which strongly indicates the amount of suitable MGS habitat within the species' historical range is substantially less than its historical range area and that the present extent of habitat loss (cleared vegetation, impermeable surfaces, major roads) is significant.

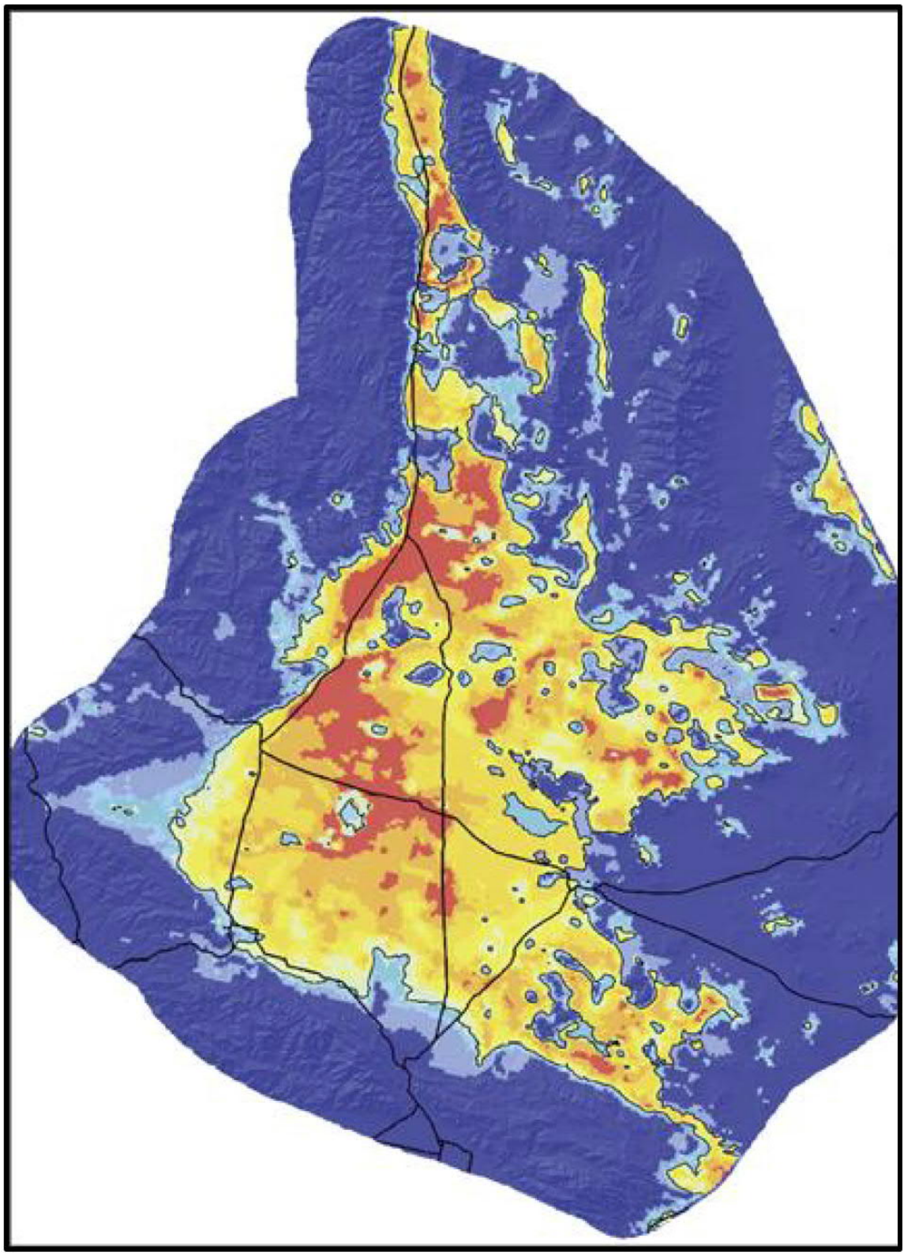


Figure 2. Predicted habitat suitability for the endemic MGS in the Mojave Desert, California (Inman et al. 2013, p. 1), ranging from low (blue) to high (red). A significant amount of higher suitability habitat has been lost to urban and rural development, type-conversion of native vegetation, agricultural activities, mining actions and renewable energy development. Remaining habitat has been severely degraded by off-road vehicle use, military training maneuvers and livestock grazing.

Habitat modelling by Esque et al. (2013, p. 33) stated the following (emphasis in bold):

"To illustrate the utility of the habitat model for regional planning purposes, the model was compared to a previously published range map (Zeiner et al. 1988-1990) and core habitat areas (Leitner 2008). The previously published range for MGS represents a hypothesis for the historical range and extent of MGS in the western Mojave Desert, and has served as a guide for implementing conservation strategies in the western Mojave Desert (BLM 2005) and the foundation for the 2011 FWS decision to deny MGS listing under the Endangered Species Act."

"The model of MGS habitat illustrates that many areas within the extent of the previously published MGS range map are not suitable as habitat for MGS, and that much of the northern and eastern portions of the previously published range map contain unsuitable habitat."

The potential habitat was reduced to 15,927 km² [6,149 mi²]*, 16,525 km²* [6,380 mi²] *and 17,139 km²* [6,617 mi²] for *the High, Medium, and Low* [impact] *scenarios, respectively (Table 2). These scenarios estimate that somewhere between 1,884 km²* [727 mi²] *(9.9 percent) and 3,096 km²* [1,195 mi²] *(16.3 percent) of predicted suitable habitat have already been lost to the development of urban areas, roads and cleared vegetation during recent human settlements in the region."*

Early estimates of the size of the MGS geographic range are just 20,000 km² (7,722 mi²) (Hall 1981, p. 405) and Zeiner et al. (1988, 1990, in Esque et al. 2013, p. 7). An estimated 19,023 km² (7,345 mi²) of suitable MGS habitat existed prior to European settlement (Esque et al. 2013, p. 2).

The Service (2011a, p. 62215) estimated there is at least 21,525 km² (8,311 mi²) of MGS habitat within its range. It also acknowledged (2011a, p. 62217) MGS has a patchy distribution due to environmental factors affecting habitat suitability (e.g., vegetation, soil, rainfall, elevation, slope and temperature). However, the Service (2011a) does not appear to have adequately subtracted unsuitable MGS habitat (e.g., lakebeds, areas greater than 5,600 feet elevation, steep slopes and rocky substrate) from its habitat calculations. Further, areas within the Service's calculated species' range are known through trapping surveys to no longer support MGS, and no longer serve as functional habitat linkages due to urban and rural growth, agriculture, vegetative type conversion, renewable energy development, highways and military training. Lastly, landscape connectivity, defined as to the degree it facilitates or impedes movement among resource patches (Taylor et al. 1993), is currently low in MGS KPCs.

Consequently, less suitable habitat is considered available for MGS occupation, and fewer linkages between habitats currently exist than estimates and analyses previously provided by the Service

(2011a, p. 62215). There also appears to have been an error in the Service's identification of overall MGS range by 2,502 km^2 (966 mi^2) (likely more), which represents over 11% of the species' reported range (2011a, p. 62215).

Esque et al. (2013, pp. 13-36) used a sophisticated habitat model to assess current suitable MGS habitat lost due to human-related activities. The National Land Cover Database, Topologically Integrated Geographic Encoding and Referencing line files, and recent remote sensing imagery were used in this modelling. Results showed that from 10 to 16% (1,884 to 3,096 km^2, or 727 to 1,195 mi^2, respectively) of suitable MGS habitat has been lost due to past human-related activities and additional lands may be affected by renewable energy development.

Resulting estimates of remaining suitable MGS habitat range from 15,927 to 17,139 km^2 (6,149 to 6,617 mi^2), an amount 20 to 26% less than the 21,525 km^2 (8,311 mi^2) of MGS habitat identified by the Service (2011a, p. 62215) as available and suitable for MGS occupation. Questionably, those MGS habitats extensively degraded from urban and rural development, military training, roads and cleared vegetation appear to have been included in the Service's (2011a, p. 62215) analysis as providing suitable, long-term MGS habitat.

Esque et al. (2013, pp. 13-36) modeling reveals that crucial habitat linkages between MGS KPCs have been lost or compromised by past and ongoing development and other land use activities. These include urban and rural growth, agriculture, highways, military training, domestic sheep grazing, off-road vehicle use and route proliferation, and renewable energy development. Table 1, below, summarizes the habitat loss.

Table 1. Change in MGS habitat from pre-European settlement to 2080 based on Esque et al. 2013.

Period	Area of Habitat Present (km^2/mi^2)	Loss of Habitat from previous period (km^2/mi^2)
Prior to European Settlement	19,023/7,345	0
In 2012	15,927-17,139/6,149-6,617	1,884-3,096/727-1,195
Renewable Energy Development[1]	14,027-15,239/5,479-5,884	1,900/734
In 2030 from Climate Change	6,553-6,649/2,530-2,567	7,995-8,686/3,087-3,354
In 2080 from Climate Change	2,548-2,742/984-1,059	13,379-14,397/5,166-5,559

[1]The analyses conducted by Esque et al (2013) considered the footprint of renewable energy and associated transmission corridors. There are additional indirect sources of disturbance that were not considered, which means the impacts to MGS habitat would be greater.

Davis et al. (2013, pp. 8-42) also developed an MGS distribution model showing habitat intactness and concluded that 30 to 40% of formerly suitable MGS habitat has already been lost to anthropogenic disturbance, which is not reflected in traditional MGS range maps. This model also incorporated the anticipated effects of climate change on habitat suitability for desert species, including MGS, and predicted that 81% of currently suitable habitat in the western Mojave Desert would be lost by 2050, resulting in MGS population contraction due to significant vegetation changes in response to increased temperature and lower precipitation (Davis et al. 2013, pp. 43-51).

1.2 Historical MGS Range Currently Unoccupied

According to the Service's (2011a, pp. 62215-62216) analysis, 31.8% of MGS range occurs south of State Route 58 in San Bernardino County. However, Leitner's (2015b; Figure 3) analysis of 2008-2012 MGS records indicate no MGS detection in most of the southern extent of the species' range for over three decades. Exceptions include a KPC in the central portion of EAFB, with no recent observations further to the south in Los Angeles County (LaRue 2016a, p. 3) and only one record from 2011 in nearby Adelanto (Leitner 2015b, p. 12). Most currently occupied MGS habitat is believed to occur within Kern and San Bernardino counties.

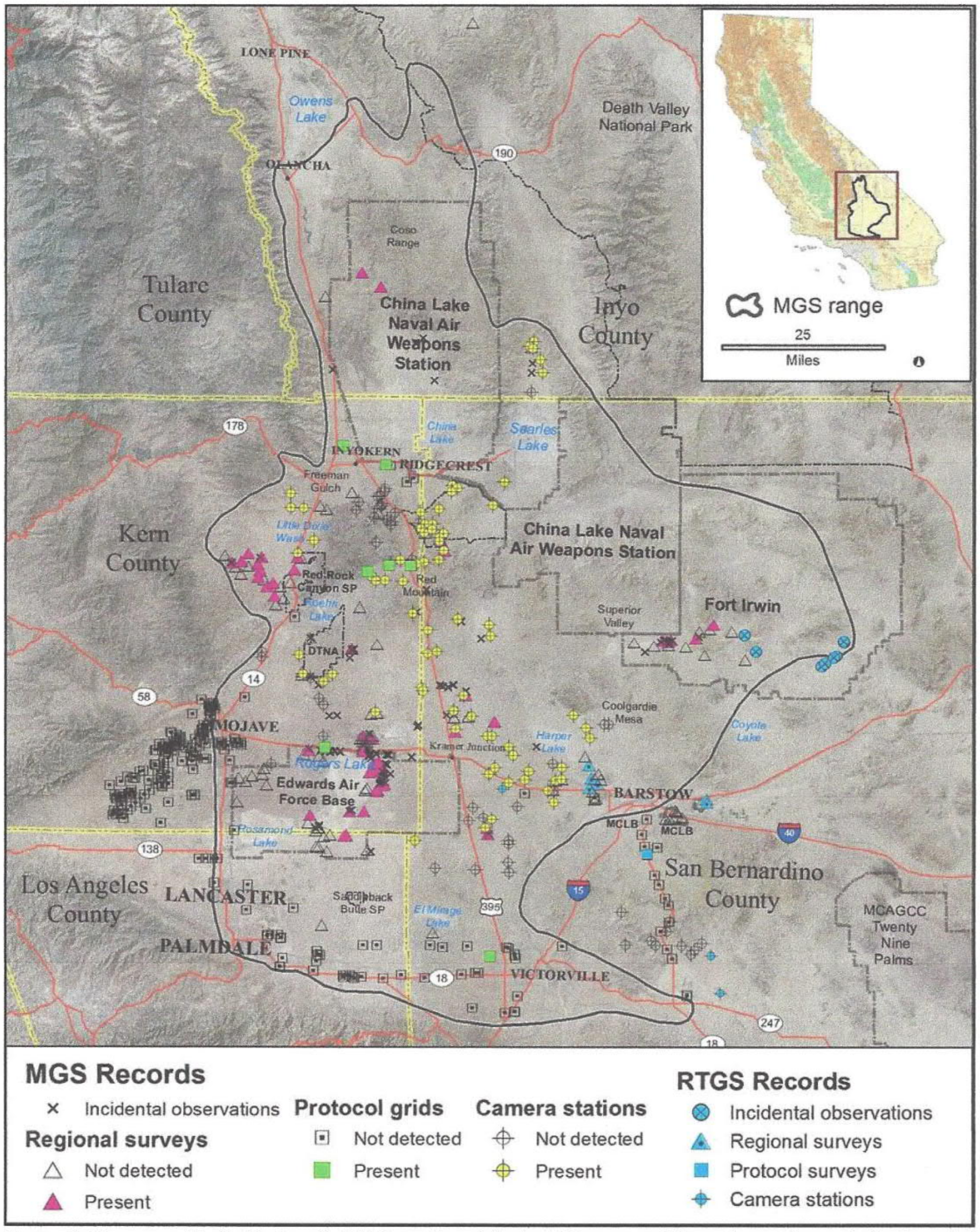


Figure 1. The geographic distribution of all Mohave Ground Squirrel (*Xerospermophilus mohavensis*) records for the period 2008–2012. Occurrences of the Round-tailed Ground Squirrel (*Xerospermophilus tereticaudus*) in the contact zone between the two species are also shown.

Figure 3. Geographic distribution of the MGS in the western Mojave Desert, California for the period 2008-2012 (Figure 1 in Leitner 2015b, p. 11).

A total of 123 protocol trapping sites located southwest of the town of Mojave yielded no MGS from 2008-2012 (Leitner 2015b, p. 13). Further, analyses of 1998-2012 MGS data (Leitner 2008, p. 15-16; 2015, p. 15-18) strongly suggest MGS absence from the southern Antelope Valley west of State Route 14 from near Mojave south to Palmdale; south of State Route 58 between Barstow and

El Mirage; from Victor Valley/Hesperia; and from the Rabbit Springs type locality (Grinnell and Dixon 1918, p. 667) near Lucerne Valley.

Leitner (2021) updated MGS occurrence records for years 2013 to 2020 and reported the following:

- *In general, the new data confirm the patterns documented in the 2 previous status reviews (Leitner 2008, 2015).*
- *There have been no recent occurrence records outside the historical range boundaries.*
- *...there continues to be clear evidence that Mohave ground squirrels are no longer present in large areas within the historical range.*

He noted there were no MGS occurrence records from northeastern Los Angeles County and Lucerne Valley, and only one occurrence record from the vicinity of Victorville. Furthermore, multiple surveys using live-trapping and cameras within the western portion of EAFB and around the community of Mojave failed to detect any MGS; and camera surveys within NTC-Fort Irwin confirmed that round-tailed ground squirrels are present throughout most of the installation and within the historical range of MGS. Similarly, a large-scale MGS camera survey covering the South Ranges of CL-NAWS failed to detect MGS except for relatively small areas along the western and southern boundaries of the installation (Vernadero Group, Inc. 2019). Figure 4 is a map showing the MGS occurrence records for the period 2013 to 2020.

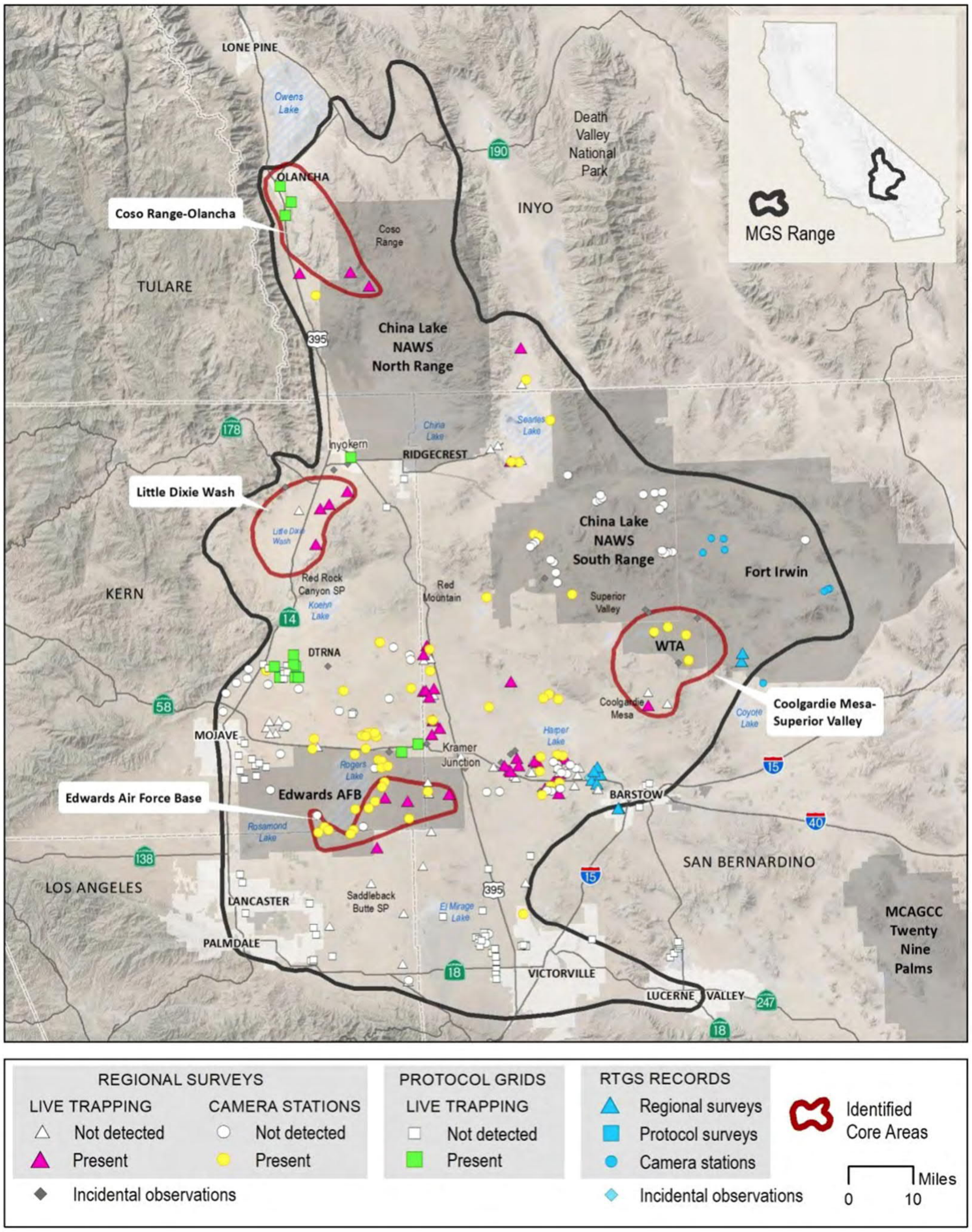


Figure 4. Geographic distribution of the MGS in the western Mojave Desert, California for the period 2013-2020 (Figure 1 in Leitner 2021, p. 304).

Defenders, using the California Natural Diversity Database (CDFW 2016b, 2023), habitat suitability and climate change modeling by Inman et al. (2013, pp. 3-8), and lands modeled with high to very high terrestrial intactness (CBI 2014), prepared a map (Figure 5) based on these data. MGS populations are highly patchy in distribution, occupy small areas and possess low densities (Burt 1936, p. 222; Hoyt 1972; Wessman 1977; as cited in Krzysik 1994, pp. 16-17). These factors and behavioral characteristics make species presence and abundance determinations difficult (Service 2011, p. 62219).

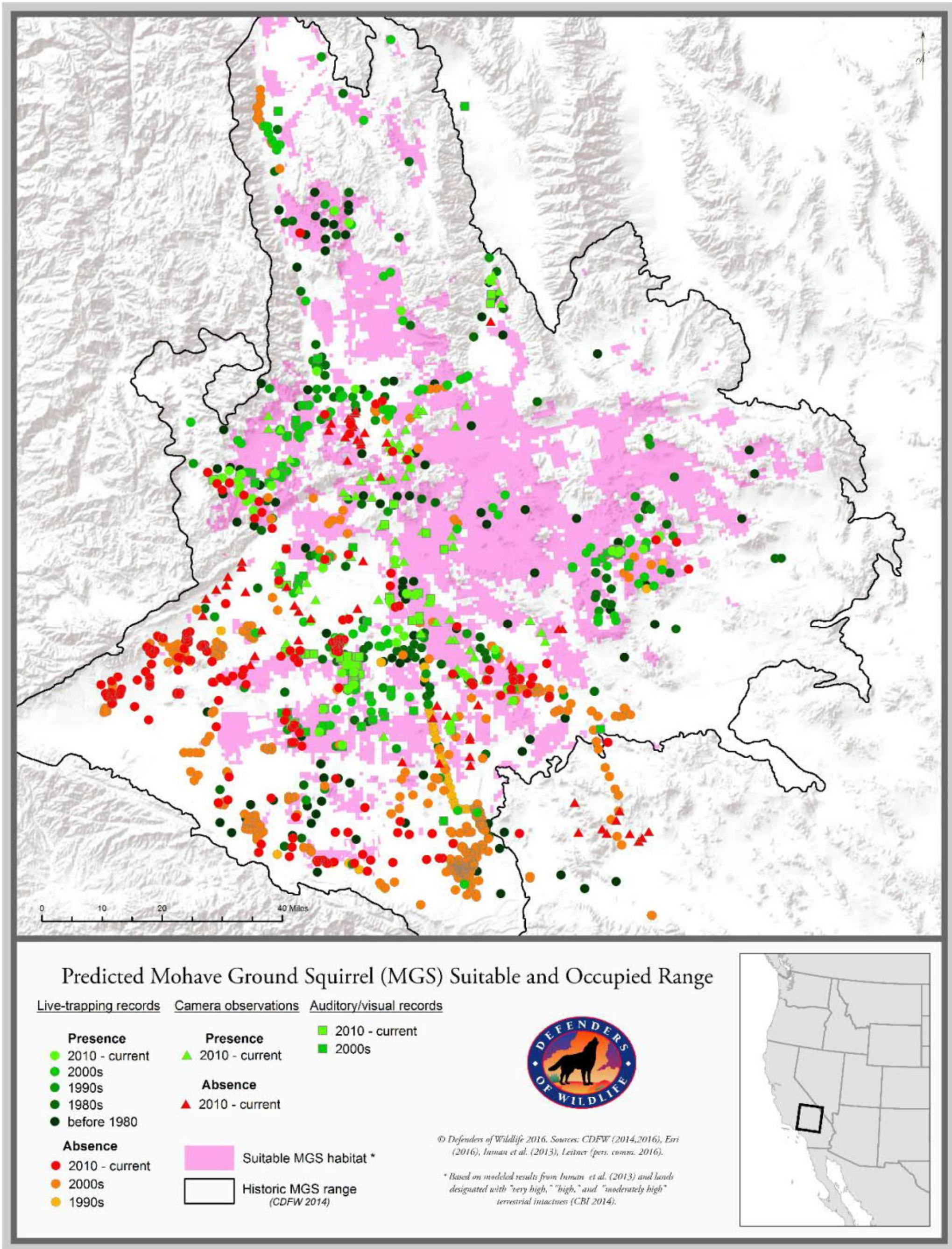


Figure 5. Occupied MGS range and predicted suitable habitat (Defenders 2016a).

Two individual MGS have been reported slightly outside the recognized species' range (CDFW 2016b). However, these anecdotal records do not substantially indicate MGS range to be larger than existing records show. One of these MGS observations (CNDDB Occurrence 336; CDFW 2016b, 2023) was recorded in 2007 from 3,503 feet elevation near Weldon, California, eight miles northwest of Little Dixie Wash, which is within the species' known range. Another dead MGS (CNDDB Occurrence 448; CDFW 2016b) was recorded on State Route 178 in 2000 from near Panamint Springs at an elevation of 1,550 feet, approximately 45 miles northeast of Searles Valley, which is within the species' known range. Linkages supporting MGS habitat that connect to known MGS populations occur in both these instances and only single animals were recorded. No subsequent detections have occurred in these known exterior range locations and there is no evidence of resident populations (Leitner 2015b, p. 17).

Urban growth, rural development, agriculture and habitat degradation; as well as competition with, or displacement by, other squirrel species (i.e., round-tailed ground squirrel and California ground squirrel (*Otospermophilus beecheyi*), may have contributed to MGS extirpation in the southern portion of its range. Wessman (1977, p. 12) suggested round-tailed ground squirrels were expanding into former MGS habitat, noting they replaced MGS in Lucerne Valley. However, agricultural conversion may be more responsible for MGS extirpation in the latter instance (Krzysik 1994, p. 20). Similar agricultural conversion has occurred on the eastern edge of MGS range along the Mojave River, where both California ground squirrels and round-tailed ground squirrels occur.

Round-tailed ground squirrels also occur on the eastern edge of MGS habitat north of State Route 58 and appear to be moving north/westward over time (P. Leitner, 2016, personal communication). Krzysik (1994, p. 21) suggested that round-tailed ground squirrels may be expanding into MGS habitat in dry years, a potential harbinger of the effects of climate change. As noted by CDFW (2019), round-tailed ground squirrel range now overlaps the MGS range in Lucerne Valley, along the Mojave River near Barstow, along State Route 58 west of Barstow and in the NTC-Fort Irwin (Zeiner et al., 1990; Leitner, 2008a) due to relatively recent westward expansion. A juvenile hybrid cross between an MGS and round-tailed ground squirrel was captured by LaRue in 2014 at Harper Lake Road, located approximately six miles west of Hinkley (LaRue, personal communication).

Additional westward expansion of round-tailed ground squirrels into the MGS range to about 10 miles east of Kramer Junction (P. Leitner, 9/14/2012, personal communication, in CDFW 2019) was also indicated in 2012 field surveys. Trail camera surveys at the NTC-Fort Irwin in 2018 documented areas of round-tailed ground squirrel expansion into the eastern portion of the MGS geographic range (Leitner 2021).

CDFW (2019) suggested differences in habitat selection may reproductively isolate MGS from round-tailed ground squirrels (Wessman 1977, Hafner and Yates 1983, Hafner 1992). According to their reasoning, MGS prefers sandy soils mixed with gravel and undisturbed desert scrub vegetation, while the more generalist round-tailed ground squirrel prefers soft windblown sand and can subsist in disturbed land (Ingles 1965, Wessman 1977, Zeiner et al. 1990, Krzysik 1994). Behavioral differences may also tend to isolate MGS and round-tailed ground squirrels from each other. For example, the MGS is a solitary species while the round-tailed ground squirrel is generally colonial, which may reduce contact and cross breeding (Recht, 1992 comment letter in Gustafson 1993, in CDFW 2019). Taken together, these species' attributes appear to facilitate round-tailed ground squirrel expansion into the eastern edges of MGS habitat.

Leitner (2015b, p. 9-10) included occurrence data obtained by small mammal live-trapping and trail cameras from 2011-2012 at 123 widely distributed locations within the species' historic range (i.e., Lucerne Valley in the south to Searles Valley and the Coso Mountains in the north). MGS trapping has also been conducted at 48 well-distributed sites between Lancaster and Palmdale in the west, extending east to Victorville. Despite this extensive survey work, Leitner (2015b, p. 17) found only one relatively recent record of a juvenile MGS in the southernmost portion of the species' historical range near Adelanto in 2011. Leitner (2015b, p. 17) found no evidence of MGS east of the Mojave River between Victorville and Lucerne Valley from the time one was captured by Wessman (1977).

Within historical MGS range, coinciding with a cool mesic Wisconsinian Mojave Desert refugium (Hafner and NatureServe 2008), six distinct regions have been identified as no longer supporting the species (Leitner 2015b, pp. 14-17). This includes that portion of the Fremont Valley located west of California City, the western portion of EAFB, much of northeastern Los Angeles County, east of the Mojave River from Victorville to Lucerne Valley, Barstow west to Hinkley Valley (where round-tailed ground squirrels may be expanding westward), and much of NTC-Fort Irwin. The only current records from NTC-Fort Irwin are in the extreme western part of the installation where both species were documented in earlier decades (Wessman 1977, p. 12), and where MGS have probably always occurred as patchy, low-density populations (Krzysik 1994, p. 29).

1.3 Habitat Suitability

Noted from deep, sandy to gravelly soils (Burt 1936, p. 222) on flat to moderately sloping terrain, MGS appear to avoid elevations exceeding 5,600 feet throughout most of its range (Gustafson 1993, p. viii; Best 1995, p. 1; Service 2011a, p. 62215). The species rarely occupies rocky lands or dry lakes (Wessman 1977, pp. 7–9; Zembal and Gall 1980, p. 348), and has not been recorded from wetlands, riparian forests, sand fields/dunes, lava, urban areas, severely-disturbed lands or fenced renewable energy project sites (CDFW 2016a). Soil characteristics are important, as MGS constructs burrows to provide temperature regulation, avoid predators and reside during inactive seasons (USFWS 2011a, p. 62221).

Creosote bush (*Larrea tridentata*) scrub appears to be a preferred habitat of the MGS (Aardahl and Roush 1985, pp. 22-23; Hoyt 1972, Wessman 1977, Recht 1988, as cited in Gustafson 1993, p. 66).

It has also been found in saltbush (*Atriplex* spp.) scrub, desert sink scrub and Joshua tree (*Yucca brevifolia*) woodland (Best 1995, p. 4).

Data collected by BLM (2005b, p. 3-156) suggest MGS is a generalist because the percentages of MGS occurrences within the range correlated exactly with the percentages of habitats. Higher shrub diversity found in creosote bush scrub compared to saltbush scrub may provide critical forage in certain seasons and life stages, as well as in drought periods. LaRue (2016a; 2016b, p. 8-10, 37-38) reported trapping in a relatively dry year, observing 11 MGS in creosote bush scrub and two in saltbush scrub (LaRue 2016b, p. 10; Figure 6), with 43% of trapping sites located in saltbush scrub. While MGS is known to use saltbush scrub and other plant communities, the importance of creosote bush scrub in supporting MGS population persistence in dry years should not be overlooked. BLM (2005b, p. 3-156) reported that 53.96% of 252 MGS records were from creosote bush scrub, comprising 53.97% of the WEMO planning area, whereas only 19.84% of these records were from saltbush scrub.

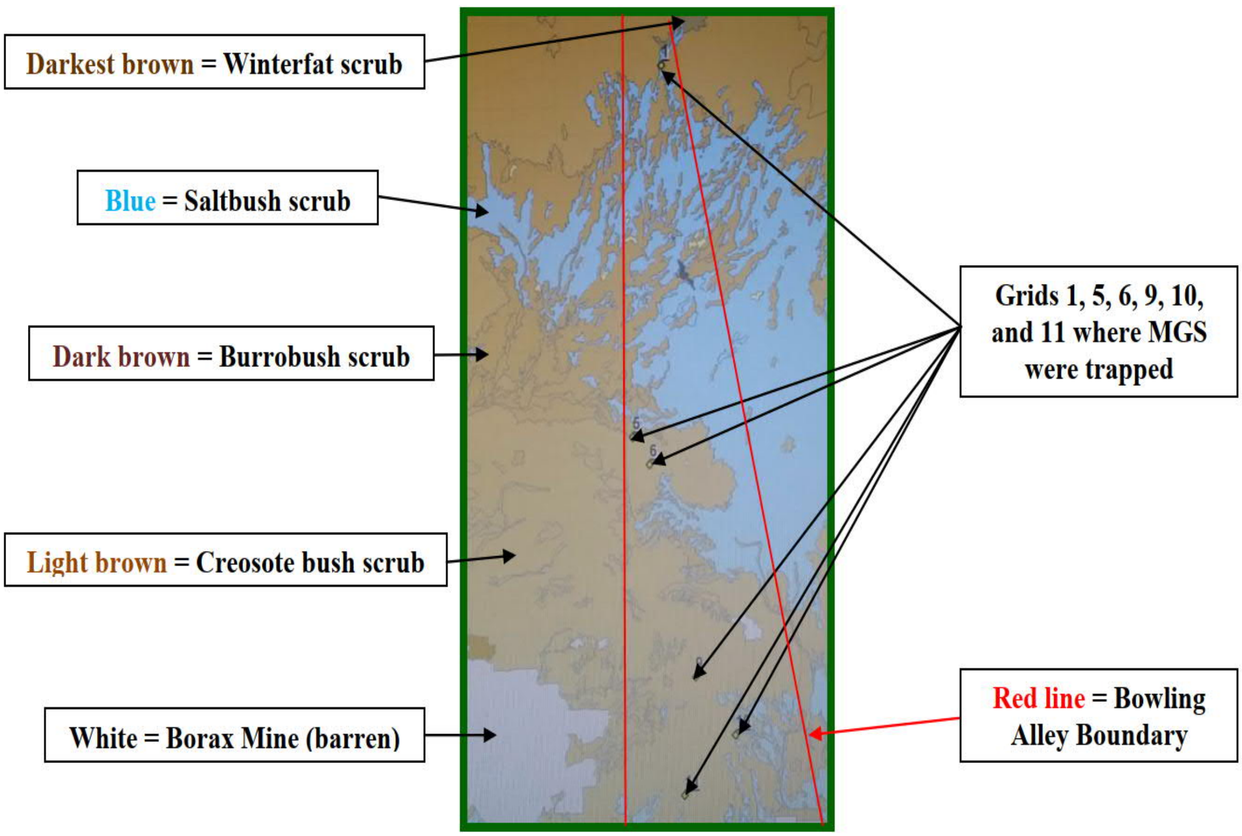


Figure 6. MGS distribution by plant community based on live trapping in the North of Kramer KPC and crucial linkage corridor designated by the BLM (2016b) as a renewable energy Development Focus Area in the western Mojave Desert, California (Figure 3 in LaRue 2016b, p. 10).

MGS is omnivorous (Morton 1979, p. 256), feeding predominantly on forbs and shrub leaves, as well as seeds (Laabs 1998, p. 2). Fecal analyses indicate that forbs comprise 50-85% of MGS diet (Best 1995, p. 4). Invertebrates, such as butterfly larvae (Leitner 1991, p. 5), can comprise a small proportion of diet, along with *Opuntia* cactus seeds in particularly dry years. Recht (1977, p. 80) characterized MGS as a facultative specialist, feeding on desert thorn (*Lycium andersonii*), coreopsis (*Coreopsis bigelovii*), fiddleneck (*Amsinckia tesselata*) and Russian thistle (*Salsola tragus*) opportunistically based on plant availability and potentially influenced by highest food-water content.

Recht (1977) found that forage plants were not consumed simultaneously, but at different times relative to maximum water content. Reder (2011, p. 1) observed MGS foraging on both dry and green annual plants and shrub seeds and flowers. Joshua tree fruits appear favored in some areas when available (Jameson and Peeters 1988, p. 265).

MGS diet varies over the season, with tender green forbs dominating in early spring (Burt 1936, p. 223; Harris and Leitner 2004, p. 1) and shrub foliage important during the mating season (Best 1995, p. 4). Shrub leaves are consumed with greater frequency when annual plants are unavailable (Laabs 1998, p. 2). March-June blooming winterfat (*Krasheninnikovia lanata*), spiny hopsage (*Grayia spinosa*) and saltbush (*Atriplex* spp.) have been found to comprise up to 60% of MGS diet when forbs are unavailable (Dudek 2012, p. 8).

Higher water content shrubs (i.e., winterfat, spiny hopsage and desert thorn) occur more frequently in creosote bush scrub compared to other plant communities (T. Egan, pers. obs.). Communities that lack these shrubs have been suggested as sub-optimal MGS habitat (MGS Working Group 2011); particularly in drier seasons (Leitner and Leitner 1998, p. 20). These observations, along with the bulk of MGS records in the CNDDB identifying creosote bush scrub as a supporting habitat (BLM 2005a, p. 3-156), may indicate creosote bush scrub is a preferred, or even necessary, MGS habitat.

Habitat supporting persistent MGS populations appear to contain higher frequencies of these shrubs, perhaps sustaining MGS populations during droughts. Little suitable soil, plant community and terrain mapping has been completed for MGS, despite it having one of the most restricted ground squirrel distributions in North America (Hoyt 1972, p. 3). Nor were these habitat components fully considered by the Service (2011a, p. 62218) in its conservation area mapping, though patchy habitat was acknowledged.

MGS habitat modelling by Esque et al. (2013) incorporated certain MGS habitat parameters but did not include fine scale vegetation cover and road layers, which are now available (MGS Technical Advisory Group (TAG) pers. comm. with A. Fesnock, BLM, 2017). When integrated, these habitat suitability layers are likely to indicate that the remaining suitable MGS habitat is far less than previously mapped. Considering anticipated climate change increases in precipitation variability and likely vegetation shifts, a careful analysis of optimal habitat components should be conducted in reviewing suitable MGS habitat.

1.4 Climate Change

The Service (2011a) in its 12-month Petition Finding (pp. 62239-62240) stated that climate change was not a threat to MGS (emphasis in bold):

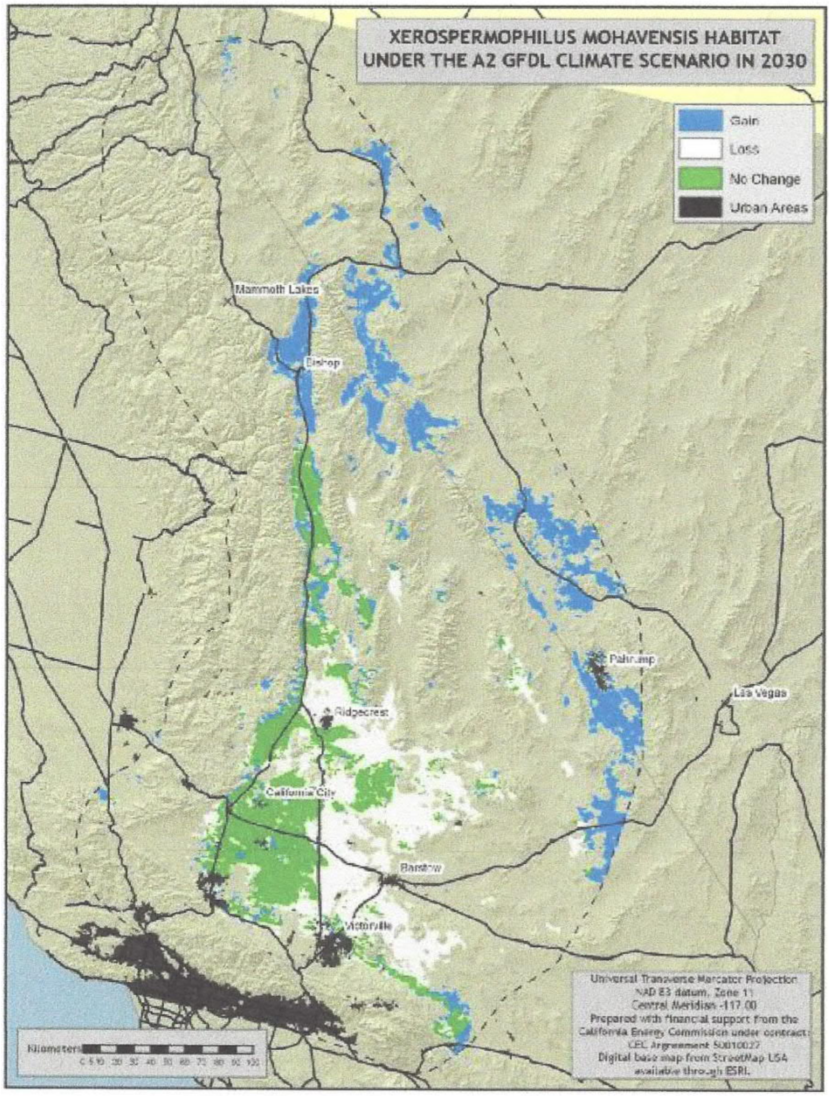
> "*It is difficult with currently available models to make meaningful predictions of climate change for areas such as the range of the Mohave ground squirrel (Parmesan and Matthews 2005, p. 354). … Although climate change may have some effect on the species, at this time we cannot make meaningful projections on either how the climate within the range of the Mohave ground squirrel may change, or how the species may react to climate change…Therefore, based on a review of the best available scientific and commercial data, **we conclude that climate change does not currently pose a threat to the Mohave ground squirrel in relation to the present or threatened destruction, modification, or curtailment of its habitat or range, nor do we anticipate it posing a threat in the future**.*"

We argue that "*uncertainty*" associated with climate change is "*not a reason to fail to address climate change*" (United States District Court for the District of Columbia 2007). Current analyses suggest climate change is perhaps the most serious threat to the persistence of MGS (CDFW 2019):

- *There have been steady increases in mean, maximum, and minimum temperatures within the Mojave Desert since 1890s, and temperature can adversely affect MGS activity;*
- *The mean temperature in Lancaster/Palmdale on the northwestern* [sic] *edge of MGS range has been projected to increase by about 5 °F (2.8 °C) from baseline temperatures (1981-2000) by the middle of the 21st Century (2041-2060) (Hall et al. 2012); and*
- *The number of extremely hot days per year (over 95 °F or 35 °C) in the Lancaster area is projected to triple (Hall et al. 2012).*
- *Winter freezes in the western Mojave Desert are projected to decrease (Smith et al. 2009; Conservation Biology Institute (CBI) 2013). CBI (2013) models project a maximum temperature increase of up to 14 °F (7.8 °C) in parts of the western Mojave Desert by 2069;*
- *Vegetation composition studies within the Mojave Desert show changes in the vegetation over time due to increasing temperatures, drought, and fire (Thomas et al. 2004);*
- *Certain saltbush (Atriplex spp.) alliances crucial to MGS in dry years have disappeared in drier years or after fire, particularly when non-native grasses are present (Thomas et al. 2004) or following domestic sheep grazing; and*
- *More drought-tolerant plant and animal species may take the place of less drought-tolerant species.*

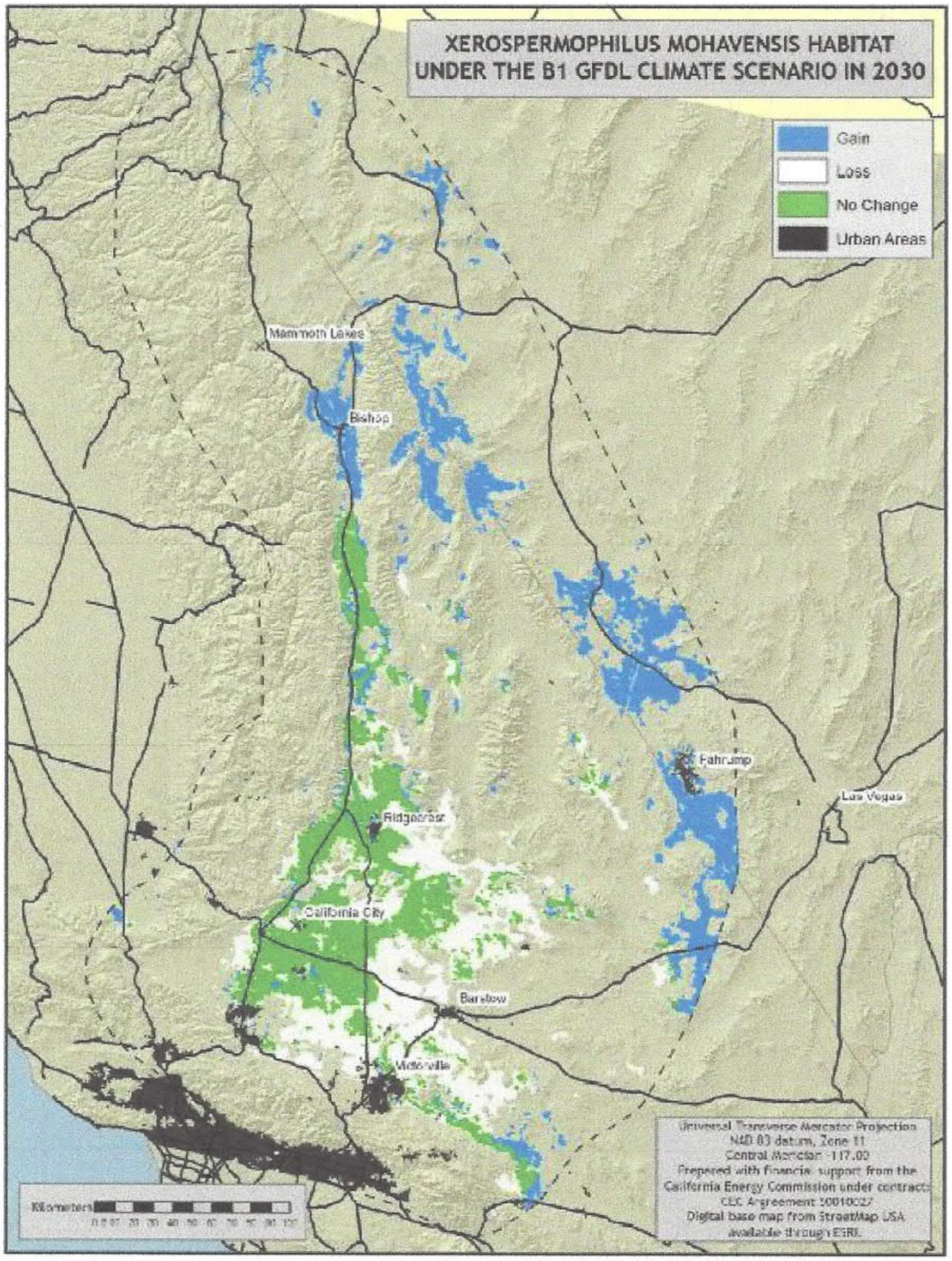
CDFW (2019) suggested that shrubs and forbs needed by MGS could become even more infrequent or disappear regionally as changes in precipitation affect plant growth and viability. Other predicted climate change impacts in the western Mojave Desert include nitrification, increased atmospheric carbon dioxide (CO_2) deposition, and changed timing and intensity of rainfall. These changes could promote additional invasive grass abundance, adversely changing the composition and availability of suitable flora in MGS habitat (Smith et al. 2009).

Suitable MGS habitat predicted under a Geophysical Fluid Dynamics Laboratory (GFDL) A2 scenario by 2030 is depicted in Figure 7 and suitable MGS habitat predicted under a GFDL B1 scenario is depicted in Figure 8. The modeled remaining habitat for MGS predicted in 2080 is significantly less than current MGS habitat acreage, with over half of today's suitable habitat predicted to be lost due to the effects of climate change.



Current habitat that is predicted to remain habitat in 2030 is shown (green), while current habitat that is predicted to become unsuitable is shown in white. New habitat is shown in blue. The study area is shown with a dashed line.

Figure 7. MGS habitat distribution in 2030 under the GFDL A2 climate change scenario, based on modeling by Esque et al. (2013, p. 41). It should be noted that significant barriers exist between current MGS populations (green) and possible habitat gains (blue).



Current habitat that is predicted to remain habitat in 2030 is shown (green), while current habitat that is predicted to become unsuitable is shown in white. New habitat is shown in blue. The study area is showr with a dashed line.

Figure 8. MGS habitat distribution in 2030 under the GFDL B1 climate change scenario, based on modeling by Esque et al. (2013, p. 42). It should be noted that significant barriers exist between current MGS populations (green) and possible habitat gains (blue).

Climate change effects under the Esque et al. (2013) model indicate a reduction of MGS habitat by up to 57% by 2030, and up to 84% by 2080, constituting high magnitude impacts. The year 2030, seven years away, is easily "within the foreseeable future," based on the following accepted definition:

"*Extending as far into the future as predictions based on best available data can provide a reasonable degree of confidence*." (U.S. Department of the Interior 2009).

This modeling was based upon emissions scenarios from the Intergovernmental Panel on Climate Change (IPCC) Assessment Report 4 and the National Oceanic and Atmospheric Administration (NOAA) 2006 GFDL CM2.1 climate model, because (emphasis in bold):

"…*of its ability to predict a range of environmental conditions and a realistic representation of California's recent historical climate and because it was identified as producing a realistic representation of California's recent historical climate, including the strong seasonal precipitation cycles of the California desert region*."

The Esque et al. (2013) model outputs were combined with an accurate MGS habitat suitability model (*Ibid*., Ch. 2), which predicts changes in MGS habitat suitability and distribution associated with climate change with a high degree of confidence. Other modeling (Inman et al. 2016) indicates potential detrimental vegetation shifts of critically important plant communities in remaining MGS habitat. MGS habitat loss due to past/existing human land uses, and potential future habitat loss, were determined during the later study using two frequently applied, changing climate scenarios: (1) medium-high emissions (A2); and (2) low emissions (B1). Current MGS habitat loss by 2030 was projected to be 57% for the A2 scenario, and 52% for the B1 scenario.

When planned renewable energy projects were added to the projected suitable MGS habitat loss by 2030, the result was an additional habitat loss of 615 km^2 (237 mi^2) under the A2 scenario and 641 km^2 (247 mi^2) under the B1 scenario. MGS habitat losses under these scenarios would total 61% for the A2 scenario, and 57% for the B2 scenario, respectively.

Potential suitable MGS habitat expansion far to the east into Pahrump Valley and the Amargosa Desert in California and Nevada and north into Owens Valley along U.S. Highway 395 and Chalfant-Hammil Valleys/Volcanic Tableland along U.S. Route 6 have been identified because of climate change. However, MGS use of these lands would likely be precluded by existing barriers to MGS movement, constricted linkages and unsuitable habitat. Habitat modeling also indicates a high potential for further restriction, and likely elimination, of connectivity within and among the three remaining MGS KPCs. This is particularly so within and between the northern and central subpopulations of MGS.

On its own, the anticipated 57% reduction in the current MGS range by 2030 due to climate change and ongoing habitat loss justifies federal ESA listing of the species and designation of its critical habitat. Such habitat loss occurring in a relatively short timeframe is well within the "foreseeable future" – a mere seven years, especially considering legal determinations associated with the polar bear (*Ursus maritimus*) listing decision, as discussed below.

When the USFWS (2008) issued its final decision to list the polar bear as threatened, it considered climate change effects as follows:

> "*Because increases in GHGs* [greenhouse gases] *have lag effects on climate and projections of GHG emissions can be extrapolated with greater confidence over the next few decades, model results projecting out for the next 40 to 50 years (near-term climate change estimates) have greater credibility than results projected much further into the future (long-term climate change) (J. Overland, NOAA, in litt. to the Service, 2007.*"

Near term (next few decades) climate change estimates were judged by the Service to have greater credibility than the much more dire results projected further out into the future with climate change. Esque et al. (2013) models indicating MGS habitat losses due to climate change appear imminent (Esque et al. 2013, p. 136), and constitute the best scientific and commercial data available on the effects of climate change on MGS. It is considerably more robust than the analysis presented by the Service (2011a, p. 62239-62240), even though it also acknowledges climate change may be impacting MGS (Service 2011, p. 62238).

A relatively short prediction timeframe (16 years) was used in these modelling studies, as were widely accepted IPCC emissions scenarios. Model projections are also based on specific anticipated adverse climate change effects on the MGS (e.g., increased ambient temperatures, decreased annual rainfall/soil moisture and vegetation composition/phenology changes). Esque et al.'s (2013) confidence in their model outputs led them to state (emphasis in bold):

> "*The models predicted substantial loss of current habitat by 2080, even under the least extreme of the two climatic scenarios, suggesting that **conservation of current habitat for this rare and endemic species is even more critical than previously thought**.*"

As for the Service (2011a, p. 62240) refusing to evaluate climate change effects on MGS, (i.e., "*at this time we cannot make meaningful projections"*), federal courts have also recently provided direction to the Service. This direction reinforces again, that uncertainty is "*not a reason to fail to address climate change."*

This clear direction to address climate change came from the Ninth Circuit Court of Appeals (2016) reinstatement of ESA protections established for Distinct Population Segment (DPS) of the Pacific bearded seal (*Erignathus barbatus*), which resulted in overturning a previous decision. The former decision maintained the National Marine Fisheries Service (NMFS) listing of the DPS was arbitrary and capricious, as the Court found NMFS reasonably concluded that sea ice habitat loss by the year 2095 would render the DPS endangered (United States Court of Appeals for the Ninth Circuit 2016).

In response to the earlier District Court's conclusion about agency speculation, the Ninth Circuit Court of Appeals (2016) stated that the ESA "*does not require NMFS to base its decisions on ironclad evidence when it determines that a species is likely to become endangered in the foreseeable future; it simply requires the agency to consider the best and most reliable scientific and commercial data and to identify the limits of that data when making a listing determination.*"

The Ninth Circuit Court of Appeals (2016) further opined that "*the ESA does not require an agency to quantify population losses, the magnitude of risk, or a projected 'extinction threshold' to determine whether a species is 'more likely than not' to become endangered in the foreseeable future.*" This underscores that the best, most reliable scientific and commercial data available need be considered in agency analyses and decisions.

Annual mean temperature trends in the Mojave Desert changed dramatically over the twentieth century compared to the 1949-2005 baseline (DRECP Renewable Energy Action Team, or REAT 2012). Droughts are longer and rainfall has been more erratic over the last 50 years (USDA Agricultural Research Service 2021). Temperatures are anticipated to increase further with climate change; precipitation is expected to decrease and become more variable; and the frost-free season is anticipated to begin earlier and last longer.

Climate change is also expected to produce increased extreme heat events (Herring et al. 2016, p. 144). A hotter/drier future can reasonably be anticipated. Increased water stress is likely, as are declines and distributional shifts in plant species with higher water needs; prolonged periods of drought; and higher heat-sensitive species mortality. Shrub community changes detrimental to MGS population stability may already be occurring (Leitner 2016a). Habitat loss and fragmentation can limit or prevent colonization of previously occupied MGS habitat lost during drought periods. Low rainfall reduces annual and perennial plant productivity, which is likely to affect the distribution of critical plants like winterfat, spiny hopsage and desert thorn relied on by MGS during drought.

Charis (2003, p. 4-10) reported that seven spring seasons from 1989-2003 were drought years with negligible forage production. Other researchers have noted a seven-year period between 2000 and 2010 of below-average annual precipitation across much of the Mojave Desert. Munson et al. (2016, p. 435-439) noted this drought adversely affected perennial vegetation in large parts of the southwestern Mojave Desert, resulting in significant perennial vegetation losses. Experts are currently warning there is a 'Megadrought' in the western U.S. directly linked to climate change (ABC News 2021) – "*Nearly 75% of the American West is currently in severe drought, according to the U.S. Drought Monitor. The situation in the Southwest has origins dating back to the late 1990s, but the ongoing megadrought has intensified in the last year…*"

The largest perennial vegetation cover reductions found by Munson et al. (2016) occurred within three MGS KPCs. While these data represent only a single drought period and it is believed that cumulative droughts, rather than the effect of several short dry intervals, drive widespread decline of perennial species (Ponce-Campos et al. 2013, p. 349), multi-year droughts and corresponding aridity are expected to become increasingly common as a result of climate change (Seager & Vecchi 2010, p. 4). Cool-season rainfall which strongly influences perennial vegetation growth in the Mojave Desert (Beatley 1974, p. abstract) is likely to significantly decrease with climate change.

Munson et al. (2016, p. 438) found strong precipitation deficits of 2002 and 2007 correlated with loss of perennial vegetation cover. However, not all variability was ascribed to rainfall anomalies alone. Warming trends in the Mojave Desert likely contributed to perennial vegetation loss, and such trends are expected to intensify (Redmond 2009, p. 11-30). Huggens et al. (2010) found that shrub cover and volume decreased 10% from 2000-2009, with 48% loss due to mortality and only 5% recruitment of new shrubs into the population.

Historical data suggest long-term vegetation changes in the Southwest often coincide with broad climate fluctuations, while fine-scale patterns are determined by land management practices (Villarreal et al. 2013, p. 194). The increasing impacts of climate change and past/current land management practices are likely interacting at a finer scale in adversely affecting remaining MGS habitat. Certain highways, pipelines, transmission lines, livestock grazing, OHV use and military training impact extensive MGS habitat, and all reduce perennial vegetation cover to varying degrees. Anecdotal information (MGS TAG pers. comm. with B. Vanherwig, 2017) suggests that round-tailed ground squirrels, with their more generalist diet and higher activity patterns in warm weather, may have a competitive edge against MGS relative to a warming climate and anticipated perennial plant community changes.

The Munson et al. (2016) study, incorporating rainfall, soil depth to restrictive layer, visitor use, fire history and protected area status to explain changes in perennial vegetation cover in the Southwest, noted a 2000-2010 annual precipitation anomaly as a factor adversely affecting perennial vegetation cover. However, the extent of visitor use, soil depth to restrictive layer, fire history and protective area status were also noted as factors adversely affecting cover (Munson et al. 2016, p. 435).

Changes in perennial vegetation cover as OHV use increased over the years were also noted as not markedly different until the number of visitors exceeded a threshold of 14,200 per year, which resulted in a significant decrease in perennial vegetation cover (Munson et al. 2016, p. 435). A majority of the MGS range was encompassed within the reduced perennial vegetation area discussed above. This area also corresponds to four out of 10 evolutionary hotspots in the Mojave Desert suggested by Vandergast et al. (2013, p. 305).

Protected MGS habitat in the Mojave Desert, such as the Desert Tortoise Research Natural Area (DTRNA), had higher perennial vegetation cover increases over time compared to unprotected areas, and burned areas had larger decreases in perennial vegetation cover than unburned areas (Munson et al. 2016, p. 435). There were also gains over time in vegetative cover on shallow soils within the DTRNA compared to no significant changes on moderate depth soils, and perennial vegetation losses on deep soils.

The Southwestern U.S. is a climate change "hotspot," and MGS range may be within its epicenter. "*According to the 15-model consensus, the strongest U.S. hot spot by far stretches across the Southwest from southern California to west Texas and intensifies even more over northern Mexico*" (Wild Earth Guardians 2015, p. 26).

Projected climate changes, and the subsequent range shifts of native trees and shrubs, are large (Wild Earth Guardians 2015, p. 36). "*Changes of this extent would tend to have negative consequences for species that are rare, have narrow environmental tolerances, low dispersal rates, or are less competitive than other species*" (Shafer et al., 2001, p. 212), such as MGS.

There is already evidence of decreased precipitation and increased drought in the California Desert (Wild Earth Guardians 2015, p. 29). As the latter researchers stated, "*From 1988 through 2012, desert regions of southeastern California experienced a 16% decrease in precipitation compared with the previous 25-year period (1963 through 1987)*." And "*Drought severity appears to have been exacerbated by an annual temperature rise of approximately 2 °Centigrade (3.6 °F) beginning in the 1970s*" (Cornett, 2014, p. 73).

Certain climate models predict that "*by the second half of the 21st century, the number and duration of extreme dry events will increase markedly, with most projected dry spells lasting longer than five years and occasionally more than 12 years*" (Wild Earth Guardians 2015, p 28). The aggregate precipitation for the Southwest over the 11 past most extreme drought years has been found reduced to 77% of its 1951-1999 average (Cayan et al., 2010, p. 21,273). Soil moisture is projected to decrease over time, such that by the end of the 21st century, "*the soil moisture deficits range from 1.7 to more than 2 standard deviations below the mean*" (Cayan et al., 2010, p. 21,274). Decreased soil moisture, depending on magnitude, results in no appreciable reproduction through seed development, increased mortality of mature plants and especially young or mature individuals. The best available scientific evidence indicates MGS faces significant habitat losses associated with climate change (Esque et al. 2016, p. 61).

New threats to vegetation in the western Mojave Desert have been predicted due to the synergistic effects of climate change, non-native invasive plants and wildfire. A greater frequency and amplitude between El Niño wet phases that promote alien annual plant production, followed by dry La Niña phases results in conditions that can promote wildfires (DeFalco et al. 2010, p. 247). Wildfires here are not only becoming more frequent, but much larger than historical fires. The year 2020 was the largest wildfire year in California history according to the California Department of Forestry and Fire Protection, and a long annual wildfire season is predicted as record heatwaves parch the state

(Cable News Network 2021). More than 3,270 wildfires have been reported as of July 21, 2021, compared to 2,625 fires as of July 2020 according to CalFire statistics (Microsoft News 2021). Wildfires in the Mojave Desert, including within the range of MGS, are sustained by increasingly common non-native grasses, such as red brome and Mediterranean splitgrass, resulting in fire consuming native shrubs, such as creosote bush scrub, white bursage and Joshua trees. These losses remove vegetation used by MGS for cover and food supply.

1.5 Important Linkages and Connectivity Between MGS Populations

Loss of connectivity can reduce the size and quality of available habitat, impede and disrupt movement to new habitats and can lead to population declines, loss of genetic variation and ultimately species extinction (Rudnick et al. 2012, p. 1). Geologically, speciation between MGS and the sympatric round-tailed ground squirrel likely occurred when portions of the parent population were isolated during the uplift of the Sierra Nevada, the Transverse Ranges and the formation of the Mojave River, with MGS evolving in refugia (Bell et al. 2009, p. 9). Three MGS genetic groups have been found in the northern, central and southern portions of the species' range (Bell and Matocq 2011, p. 378). Relatively low genetic differentiation has occurred between these groups, indicating gene flow has been high in the past. Specific geographic areas may serve as important pathways facilitating gene flow among populations and allowing movement in response to climate change. Both MGS KPCs and habitat linkages have previously been suggested by Leitner (2008, Figure 9).

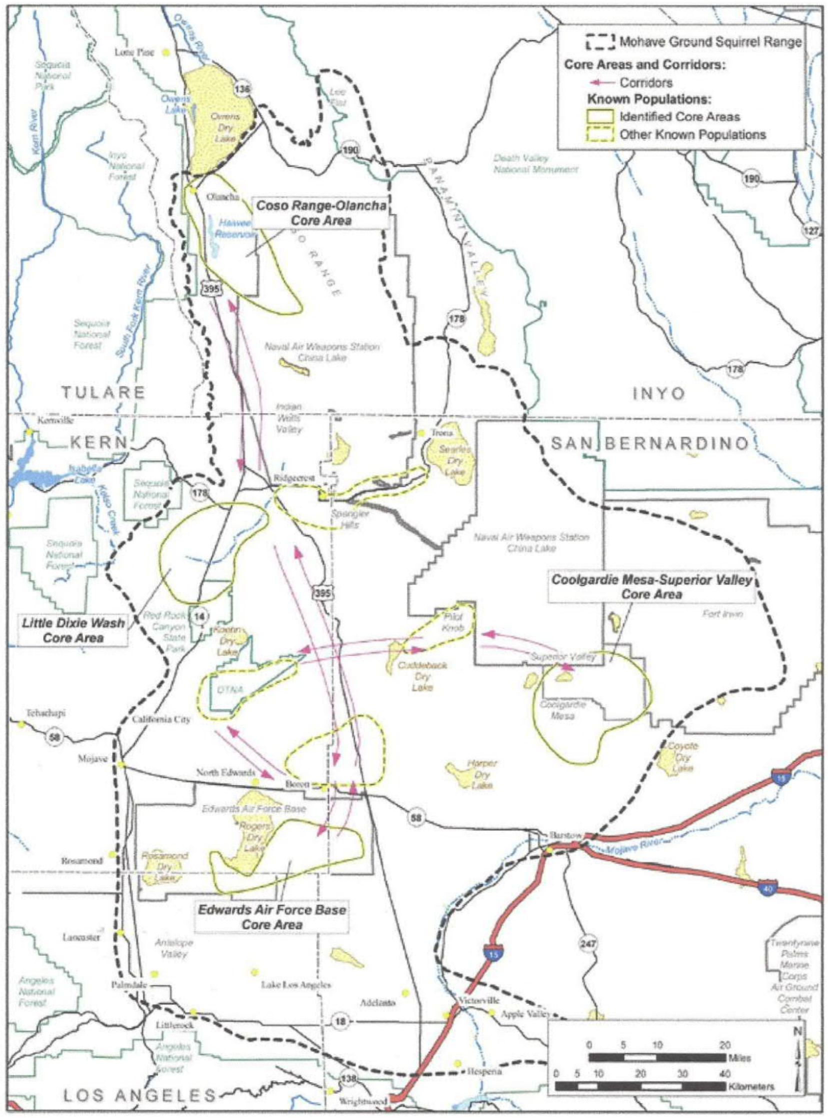


Figure 6. Map of potential habitat corridors that may provide connectivity between identified core areas and other known Mohave ground squirrel populations.

Figure 9. KPCs or Core populations and potential habitat corridors for MGS in the western Mojave Desert, California (Figure 6 <u>in</u> Leitner 2008, p. 24).

As Esque et al. (2013, p. 92) noted, habitat estimates and the identification of potential KPCs provide a useful starting point in defining critical MGS conservation lands. However, this information does not identify or address the importance of habitat linkages connecting MGS KPCs (MGS TAG 2010, pp. 1-3). Nor does it address the imminent threats MGS faces. For example, if a large suitable habitat patch supporting an MGS population becomes isolated, its connectivity is limited compared to a centrally located, well-connected one (Estrada and Bodin 2008, abstract). Linkage areas may or may not support large populations but have a disproportionately large role in habitat connectivity (Esque et al. 2013, p. 92), with animal movements potentially exceeding habitat value (Saura and Rubio 2010, p. 531).

The Service (2011a, p. 62258) has noted that gene flow appears to occur throughout MGS range. However, Bell's (2006, pp. 42-44) estimates of gene flow in the past few MGS generations at Coolgardie Mesa and EAFB were low based on an analysis of mitochondrial DNA, a maternally inherited genetic marker. Reduced gene flow may have been caused by the recent drought or by limited movements of female MGS (Service 2011a, p. 62258). Average dispersal distance for juvenile MGS from radio-tracking data is 1.5 km for males and 0-3.9 km for females, and generally exceeds adult dispersal distances (Harris and Leitner 2005, p. 192-195).

Long-distance juvenile dispersal is crucial for connecting MGS populations and re-colonization of suitable but unoccupied habitat (Esque et al. 2013, p. 103). Due to the multi-generational nature of dispersal for corridor-dwelling species (Beier et al. 2008, pp. 844, 847), suitable habitat needs to be well-managed within a movement corridor to ensure long-term connectivity. Esque et al. (2013, p. 94-98) used a modified graph theoretical approach in an MGS habitat connectivity analysis to accommodate the continuous distribution of MGS habitat suitability. A graph network of 1,777 individual 25 km² study cells defined network nodes (Figure 10). Saura and Rubio's (2010, p. 524-527) framework was used in the Esque et al. (2013, p. 92-131) connectivity analysis to simultaneously assess the value of a study cell in terms of its habitat suitability and its position within the habitat network. As described by Esque et al. (2013, p. 104):

> "*This approach recognizes that a study cell may serve one or more of three functions: (1) contain habitat suitable for occupation by the target species that is valuable even in the absence of connectivity to other cells; (2) produce a flux of emigrants that can colonize other study cells; and (3) serve as a "steppingstone" that facilitates movement between other cells because of its position within the network.*"

Landscape connectivity has structural and functional components and is both species and context dependent (Rudnick et al. 2012, p. 2). Probability of Connection (PC) indexing, Least Cost and Circuitscape (McRae 2006, p. 1558) analyses were conducted by Esque et al. (2013; Table 2, Figures 10-12), using MGS occurrence records.

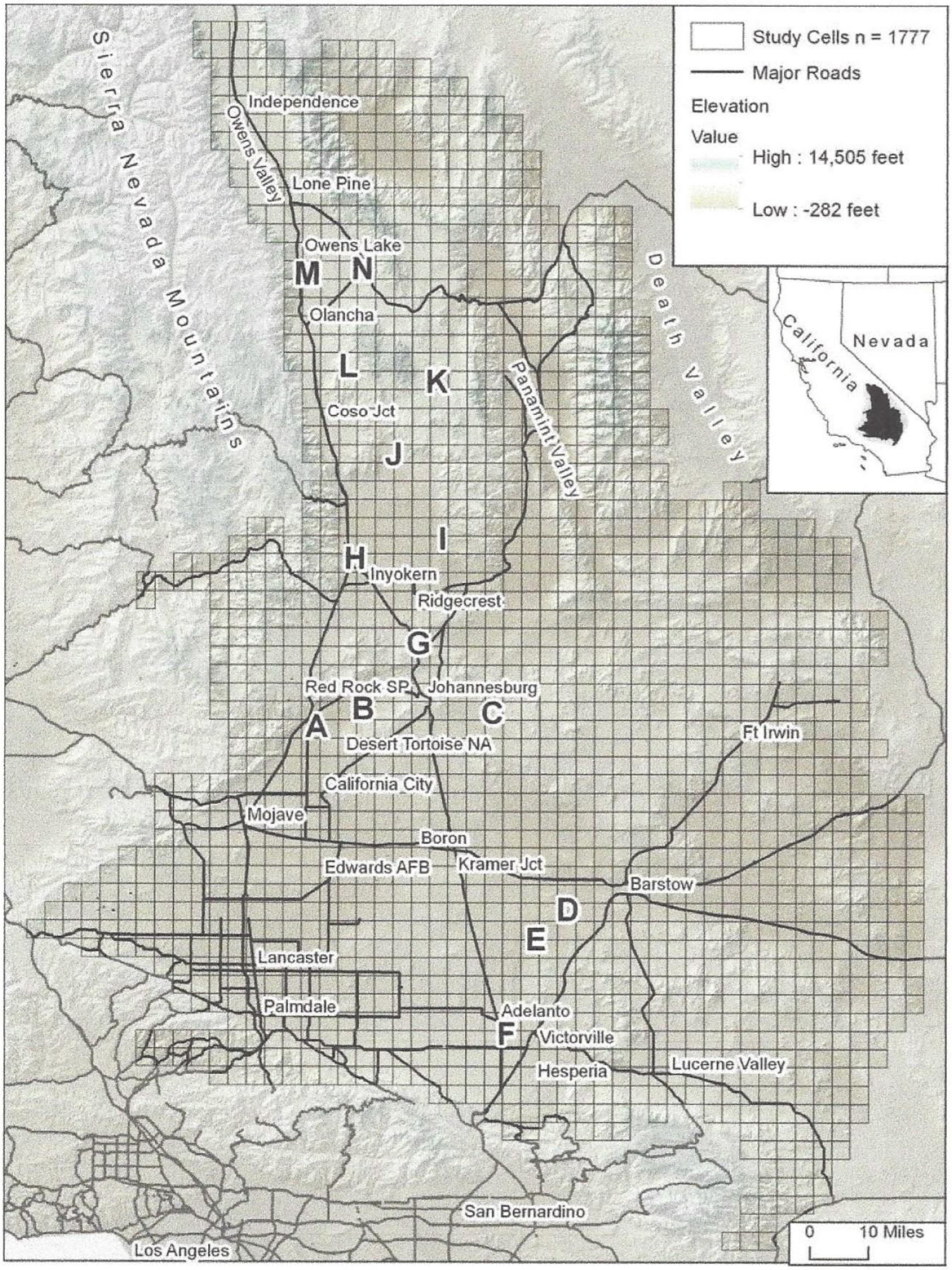
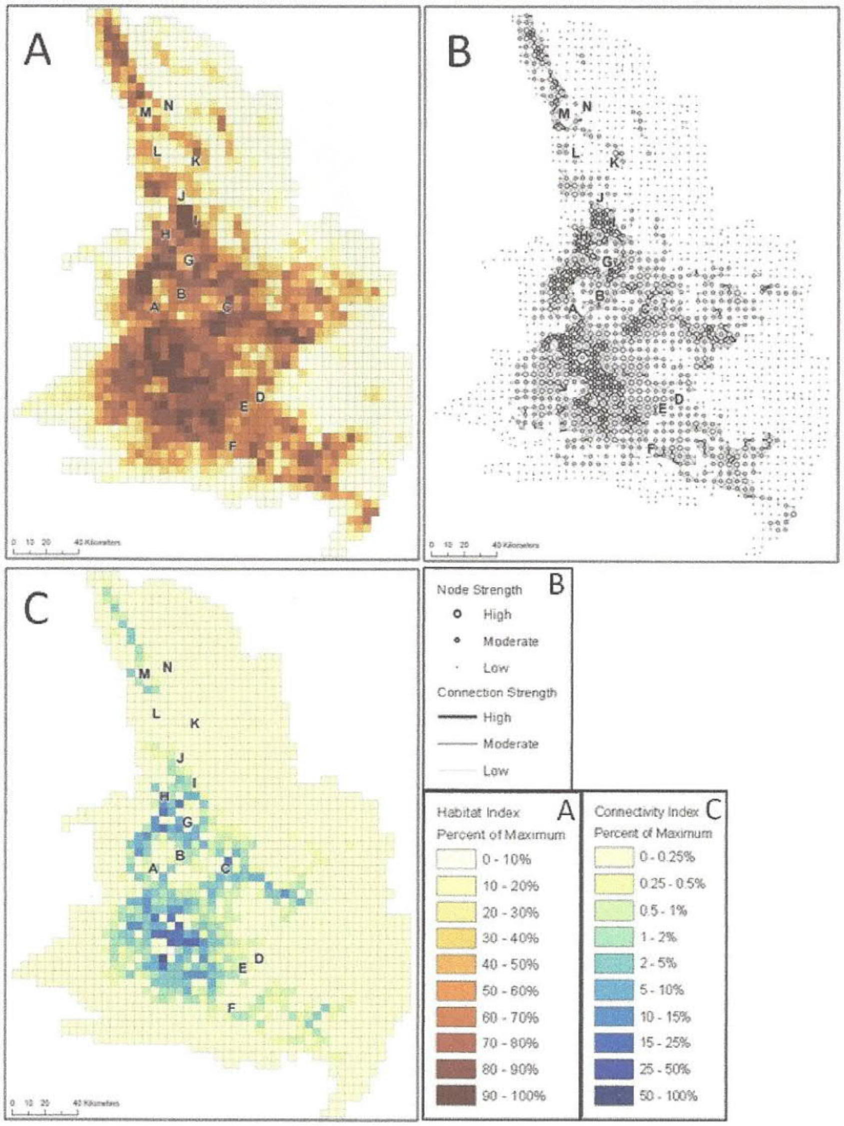


Figure 10. MGS study area depicting 1,775 km² study cells representing a subset of cells considered in Esque et al. (2013, p. 96) habitat model.

Table 2. MGS connectivity areas identified by Esque et al. (2013, p. 109) from a habitat graph were evaluated as strong or weak using a connectivity index (PCconnector); and similarly evaluated as strong or weak in a Circuitscape analysis. Map labels correspond to those depicted in Petition Figures 10, 11 and 13.

Map Label	Important Connectivity Linkage	PCconnector Index	Circuitscape Analysis
A	Fremont Valley	Yes (weak)	Yes (strong)
B	Summit Range	Yes (weak)	Yes (weak)
C	Cuddeback Lake	Yes (strong)	Yes (weak)
D	Johnston's Corner	No	No
E	Helendale	No	No
F	Mojave Heights/Adelanto	No	Yes (strong)
G	South of Ridgecrest	Yes (strongest)	Yes (strong)
H	Indian Wells	Yes (strong)	Yes (strong)
I	China Lake	Yes (strong)	Yes (strong)
J	Coso Basin	Yes (weak)	Yes (strongest)
K	Coles Flat	No	Yes (weak)
L	Cactus Flat	No	Yes (weak)
M	West of Owens Lake	Yes (weak)	No
N	East of Owens Lake	No	No



A) Habitat availability is expressed as a percentage of the maximum possible value derived from MGS probability of occurrence modeling. A value of 100% indicates that within a 5 km grid cell, all 1 km raster grid cells have the maximum habitat value. B) Graph view of the habitat network with the size of circles indicating node strength and the width and tone of lines indicating connection strength. Node strength was calculated based on the total available habitat within the 25 km^2 grid cells. Link strength was calculated based on the cost-weighted distance between the habitat-weighted centroids of the 25 km^2 grid cells. The position of nodes within the network is not perfectly gridded because the position of the habitat-weighted centroids was allowed to vary based upon the availability of habitat. C) The connector component of the probability of connection index (PCconnector, Saura and Rubio 2010) indicating the importance of the position of the 25 km^2 grid cell within the overall habitat network. Cells with a high value are more important for upholding connectivity because their position within the network is central and their redundancy is relatively low (Baranyi *et al.* 2011). The removal of one of these cells would have a larger-than-average impact on overall connectivity.

Figure 11. Current (as of 2013) MGS habitat availability and connectivity (Esque et al. 2013, p. 108). Habitat availability is expressed as a percentage of the maximum possible value derived from MGS probability of occurrence modeling. Letters on the three maps correspond to Table 2 and Figure 10 of this petition.

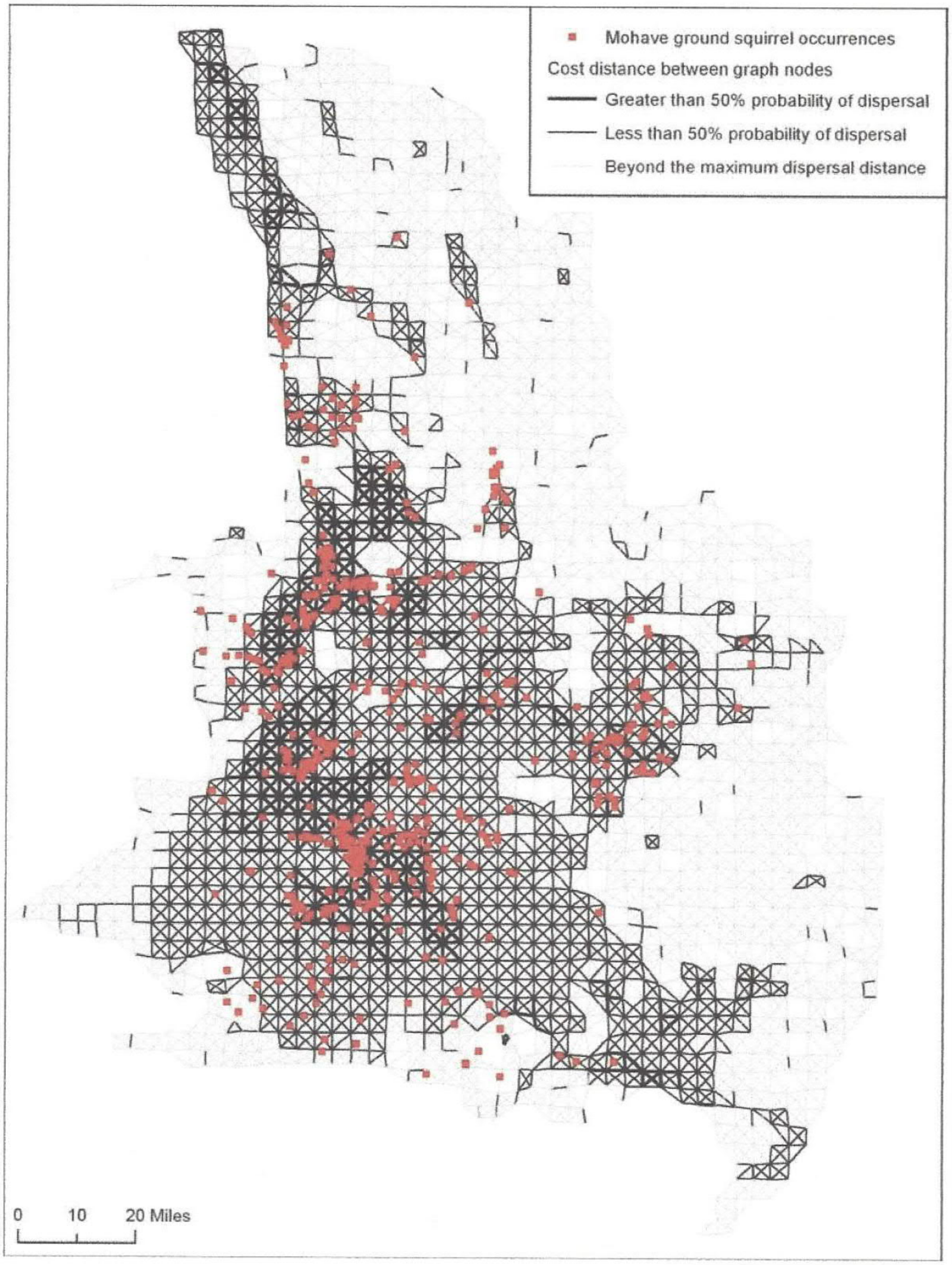


Figure 12. The minimum spanning tree approach to defining maximum MGS dispersal distance (Esque et al. 2013, p. 105). Gray-colored links are not available to dispersers due to high movement costs. Bold links represent high connection while moderately bold links are only moderately connected; with this approach estimating inter-generational dispersal, rather than individual dispersal.

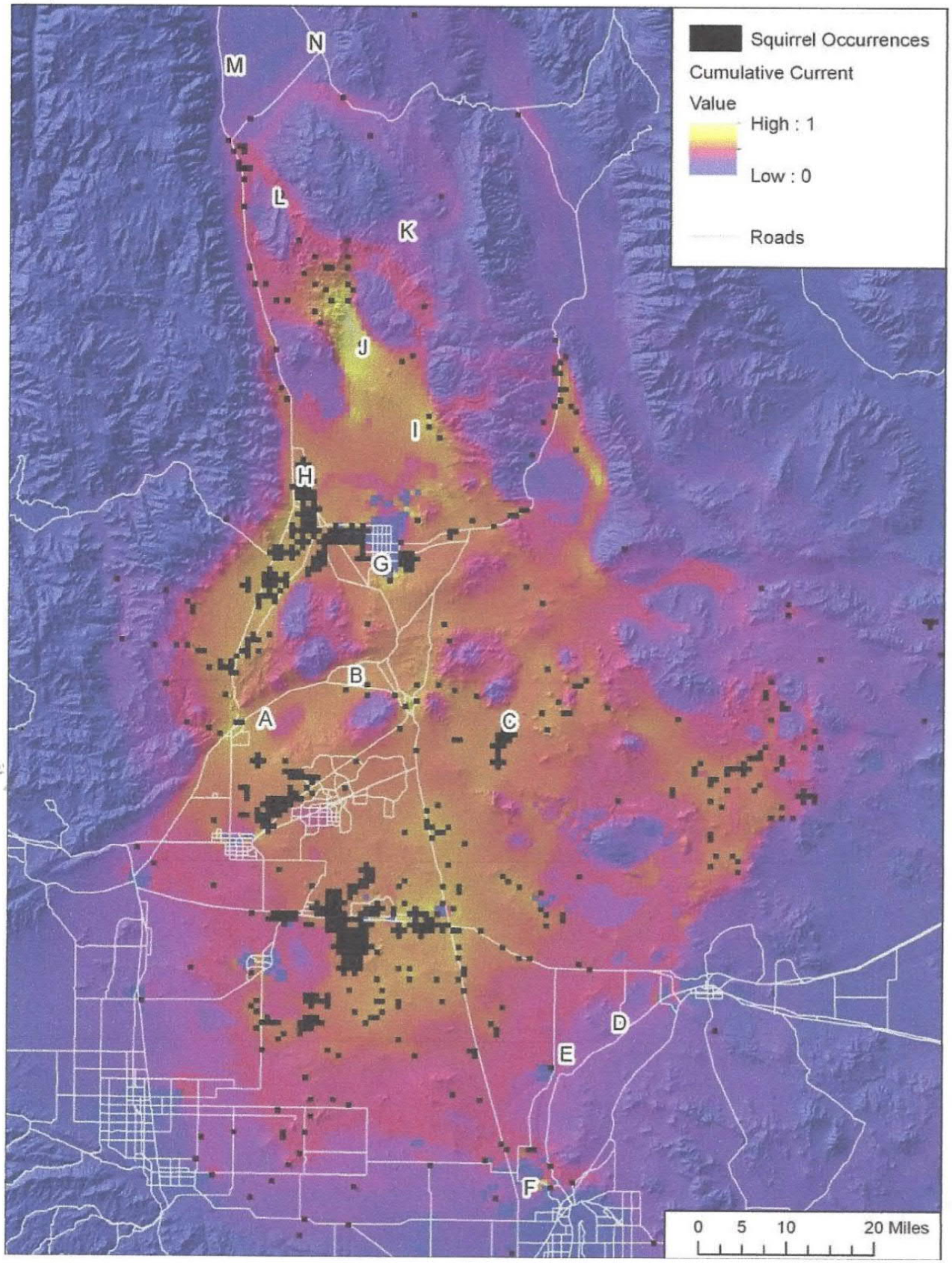


Figure 13. Map of cumulative connectivity current derived from Circuitscape analysis (Esque et al. 2013, p. 111). Sources (known MGS occurrences) are depicted in black, whereas warmer colors indicate high connectivity current either due to source cell proximity or constraints to movement.

The PCconnector index used in the Esque et al. (2013) study describes the importance of habitat patches facilitating MGS movement. Patches with a high habitat value are more important for connectivity, as their network position is central and redundancy is low. Least cost paths indicate the optimal route between source (known occurrence) and destination. Circuitscape analysis simultaneously assesses all pathways between source and destination (McRae et al. 2008, p. 2713-2714). Esque et al.'s (2013, p. 107) graphing identified 14 locales as "*important connectivity areas*."

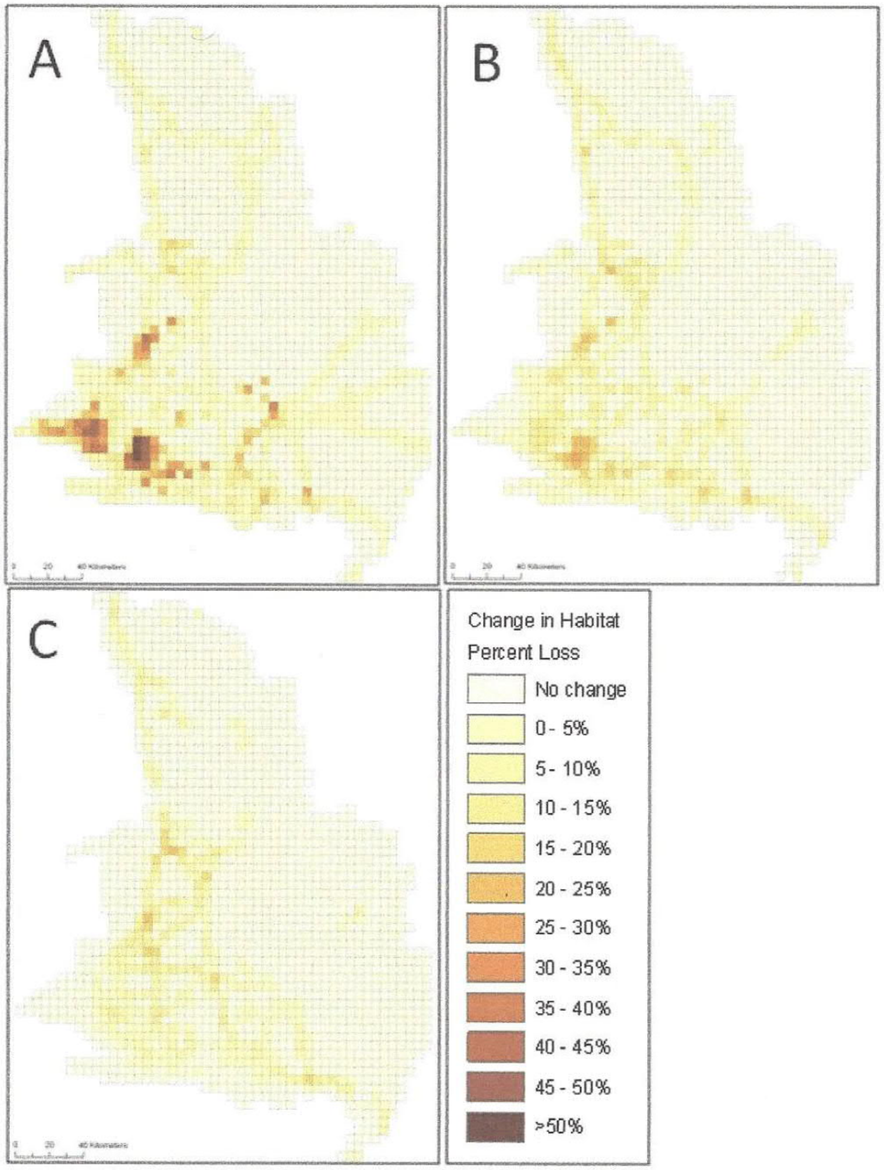
The habitat model created by Esque et al. (2013, p. 108; refer to Figure 11) depicts a highly clustered pattern, with suitable habitat extending from Palmdale in the south, north past the City of Ridgecrest and east to NTC-Fort Irwin, reflecting the current MGS range. The Fremont Valley, as well as lands surrounding Ridgecrest and Cuddeback Lake, were found to exhibit large PCconnector values, while other areas, such as Johnston's Corner, Helendale, Mojave Heights/Adelanto, Coles Flat, Cactus Flat and Owens Lake have very small PCconnector values (Esque et al. 2013, p. 109).

EAFB was also found to have high PCconnector values (Esque et al. 2013, p. 108), even though these connections were not visually detectable on the habitat graph. In fact, the two study cells with the highest connectivity values were found within the installation adjacent to Rogers Dry Lake, which serves as an MGS movement barrier.

The Circuitscape analysis (Esque et al. 2013; refer to Figure 13) augments the habitat suitability graph results by indicating either a high potential for MGS movement or areas where movement is constricted, referred to as a "bottleneck" or "pinchpoint" (Rudnick et al. 2012, p. 7-8). The Coso Basin was found to represent one such pinchpoint, and was interpreted by Esque et al. (2013, p. 107, 125) as critically important for maintaining the current "gateway" to northern MGS populations.

As might be expected, areas A, B, C, F, G, H, I, K and L (refer to Table 2 and Figure 13) appeared to exhibit increased connectivity compared to surrounding cells, whereas Areas D, E, M, and N were found to exhibit little connectivity (Esque et al. 2013, p. 110). Figures depicting these analyses highlight a conclusion that primary MGS habitat regions, corresponding to the three genetically distinct groups described by Bell and Matocq (2011, p. 378), are disconnected because of narrow, compromised habitat dispersal corridors. These regions include the northern MGS population area (i.e., Olancha, Cactus Peak, Coso Basin); the mid-western/Central MGS population area (i.e., Freeman Gulch, El Paso Mountains); and the southern MGS population area (i.e., DTRNA east to NTC-Fort Irwin).

Connectivity between the three primary high-suitability MGS habitat regions is not only tenuous, but these linkages have been degraded considerably over the years by recent and historical land-use activities. Using a moderate land-use impact classification, Esque et al. (2013, p. 54; Figure 14) found suitable MGS habitat reduced by 11% relative to a classification of only land-use impacts of urban areas (which excludes the effects of roads, agriculture and other land-use).



A) Difference between the "urban only" impacts estimation and the low land-use impacts estimation. B) Difference between the low land-use impacts estimation and the moderate land-use impacts estimation. C) Difference between the moderate land-use impacts estimation and the high land-use impacts estimation.

Figure 14. Differences in MGS habitat availability with different estimations of land use impacts (Esque et al. 2013, p. 114).

The latter analysis also found that habitat lost through land-use development is disproportionately important to MGS connectivity, with a 32% reduction in an equivalent connected area index.

Former agricultural areas and roads have diminished corridor functionality between Fremont Valley and Freeman Gulch, an area that historically may have been the most important linkage between mid-western, central and southern MGS populations (Esque et al. 2013, p. 113). They found that connectivity is even further reduced for the highly developed Ridgecrest area.

Potential climate change impacts (see Petition Section 1.4) exceed land use impacts to MGS habitat and overall landscape connectivity (Esque et al. 2013, p. 117). However, these impacts taken in context with the above connectivity impact information, are drastically fragmenting remaining MGS habitat. Rapidly increasing fragmentation, along with past habitat impacts, poses a distinct threat to MGS due to destruction and modification of its habitat.

Land-use impact scenarios prepared by Esque et al. (2013, p. 114; refer to Figure 14) estimate between 1,884 km² (9.9%) and 3,096 km² (16.3%) of predicted suitable MGS habitat has been lost to urban development, roads and cleared vegetation. Encroachment of urban areas on MGS habitat introduces off road vehicle use, roadways, airports and transmission lines (Leitner 2008, p.11) that affect MGS and its habitat. Additional renewable energy development, transmission lines and roads will contribute to future loss of MGS habitat.

Climate change predictions in Esque et al. (2013, p. 37-63) would result in further dramatic loss of currently suitable habitat, with most of becoming unsuitable by 2080, except for habitats at higher elevations in the Coso Range and the eastern edge of the Sierra Nevada. Some additional suitable habitat may become available in the north, within Owens Valley and to the east, but it is unlikely that linkage habitat is available for MGS movement to populate these areas. Areas of potential connectivity, given future climate change scenarios, may occur to the north, west and south of the current MGS Range, but all have land use and MGS movement constraints. Marginal habitat may be all that remains in the central and southern portions of MGS range under Esque et al. models, which predict low connectivity within and between suitable habitat patches. High connectivity is predicted to remain only in the northernmost portion of MGS habitat from Olancha north to Owens Lake, and potentially newly available habitat in the Coso Range.

According to Esque et al. (2013, p. 109), an essential MGS movement linkage encompasses much of the area north of Inyokern and the China Lake Basin. However, this essential MGS movement corridor under the A2 2030 climate scenario evaluated in their study is predicted to be restricted only to the immediate area along U.S. Highway 395. Only three potential north south MGS movement areas may exist under current climate conditions through the Ridgecrest/Inyokern area: east of Ridgecrest, west of U.S. Highway 395 and between Inyokern and Ridgecrest. The least-cost connectivity analysis conducted by Esque et al. (2013, p. 122) predicts the only linkage available under future climate change conditions will be west of Ridgecrest/Inyokern, as future climate conditions are likely to be too hot for MGS to persist at the lower elevations.

Future climate change models also suggest MGS will need to expand north into Owens Valley from its current, northernmost occupied habitats (Esque et al. 2013, p. 106). However, urban and agricultural development, as well as Owens Dry Lake and other unsuitable habitat, have all but eliminated MGS habitat linkages in these areas.

A similar situation exists between the mid-western, central and the northern MGS populations, where existing land use and degraded habitat are severely limiting connections between MGS KPCs. The loss of stepping-stone habitat patches can cause a sharp decline in the distance that can be traversed by the species that cannot be compensated by other factors (Saura et al. 2014, p. 171). Modeling by the latter researchers suggests that stepping-stone habitats 1) must be of sufficient size to be of conservation value, 2) are particularly crucial for the spread of species over long distances, and 3) can effectively reduce the isolation of the largest habitat blocks in reserves. When habitat patch stepping-stones are too small and disjunct to sustain a local population, species that are unable to cross the non-habitat portion of the landscape are ultimately reduced in overall population size and the probability of persistence becomes questionable (Fahrig 2003, p. 505).

The extensive analyses conducted by Esque et al. (2013) highlight the importance of protecting multiple north-south trending, low-elevation valleys in conserving landscape connectivity essential to MGS in meeting climate change adaptation needs. However, these lands are, in general, the most impacted by human use within the range of the species. While currently unoccupied habitat may become suitable for MGS occupation in the future, it will not benefit the species if linkage habitat is absent or too degraded to support MGS and facilitate movement between populations.

1.6 Habitat Conversion to Agricultural Use

The Service (2011a, p. 62238) stated the following regarding MGS threats posed by conversion of natural desert habitat to agricultural use:

- "*The current cost of pumping ground water to irrigate crops in the western Mojave Desert discourages the development of new areas for agriculture (Los Angeles County Cooperative Extension 2009, p. 1).*"
- "*After reviewing the information on Web sites of local agricultural agencies in the western Mojave Desert, we conclude that there will likely be no increase in agricultural development in the future.*"
- "*Given the best available scientific and commercial data, and the small percent of the range of the species affected by agriculture, we conclude that agriculture does not currently pose a threat to the Mohave ground squirrel in relation to the present or threatened destruction, modification, or curtailment of its habitat or range, nor do we anticipate it posing a threat in the future.*"

New information on agricultural development (California Department of Conservation 2014) has been identified since the Service (2011a) determined effects on the MGS. Conversion of native plant communities to support agriculture (e.g., alfalfa, pistachios) is expanding in the western extent of MGS range in Antelope Valley (University of California Cooperative Extension 2016), in the south/southwest in Palmdale and El Mirage Valley (California Department of Transportation 2014), in the east along the U.S. Highway 395 corridor and the Mojave River near Hinkley, and in the north within the Indian Wells Valley.

Agricultural development eliminates or fragments otherwise suitable MGS habitat. Recent agricultural development near Inyokern may sever a critical MGS habitat linkage between the Coso and Little Dixie Wash KPCs (Leitner 2008, p. 23; 2015a, p. 2). Here, conversion of MGS habitat to pistachio orchards, combined with existing alfalfa farms, has occurred on private lands (Henry 2014). This conversion of native vegetation habitat occurred without environmental review or permitting from the Kern County Planning and Natural Resources Department (KCPNRD).

In 2004, the updated Kern County General Plan zoned 27,000 acres of the Indian Wells Valley for agricultural development (KCPNRD 2004). This zoning was considered a ministerial action by Kern County and loss of MGS habitat was not analyzed in the supporting Environmental Impact Report (EIR). This General Plan update allows landowners to clear native Mojave Desert habitat for agricultural use without the need to notify the KCPNRD, obtain permits, or conduct site-specific environmental review under the California Environmental Quality Act (CEQA), which is clearly an inadequacy of existing regulatory mechanisms to protect MGS habitat. This MGS habitat impact does not appear to have been considered by the Service (2011a, p. 62237-62238).

CDFW has reportedly written the KCPNRD regarding MGS impacts resulting from Mojave Desert habitat conversion to pistachio orchards. However, this correspondence has not resulted in the need for KCPNRD notification, permits or environmental review. Henry (2014) in the *Bakersfield Californian* reported that approximately 3,000 acres of native Mojave Desert habitat have been lost and that the issue has not been resolved.

Loss of MGS habitat and direct harm to the species associated with agricultural development is a continuing and increasingly significant issue in the western Mojave Desert. As previously noted, agricultural development may also promote conditions favorable to the California ground squirrel to the detriment of MGS through displacement and competition. The totality of these impacts compromises a crucial habitat linkage and is not currently being considered by county, state or federal permitting authorities. Additional threats associated with development as outlined in the Indian Wells Valley Land Use Plan, which was approved by the Kern County Board of Supervisors in 2015 (KCPNRD 2015), is described in Section 1.7 (Indian Wells Valley Land Use Plan, Kern County), below.

Leitner's (2008, p. 20, 24; 2015, p. 13-16) KPCs were selected based on three primary criteria: 1) evidence of 20–30-year MGS persistence, 2) observations of the species in at least six separate locations, and 3) the detection of thirty or more individual MGS since 1998. The Little Dixie Wash KPC is one of four such areas. It is the westernmost area that is linked to KPCs to the north (Coso/Olancha) and south (EAFB). In 2007, an MGS was observed in the Kelso Creek drainage located west of the Scodie Mountains, indicating a habitat linkage extends to the west outside the current MGS range.

The Little Dixie Wash KPC represents one of three subpopulations with distinct genetic characteristics (Esque et al. 2013, p. 65). It is geographically and genetically linked with populations occurring in surrounding habitats, including the El Paso Mountains, areas surrounding Ridgecrest, and extending into Poison Canyon near Searles Valley.

It is also noteworthy that this subpopulation is tenuously connected with the northernmost MGS KPC in the Olancha, Coso Basin and Cactus Peak regions. This tenuous connection is supported by a narrow habitat corridor immediately east of the Sierra Nevada, west of the Coso Mountain Range that has already been impacted by the construction and maintenance of U.S. Highway 395 and adjacent utility corridors.

We also incorporate by reference this issue under listing Factor D: The Inadequacy of Existing Regulatory Mechanisms.

1.7 Indian Wells Valley Land Use Plan, Kern County

The KCPNRD (2014) began preparing a Draft EIR for proposed land use in Indian Wells Valley in 2014, and the final plan was approved by the Board of Supervisors in 2015. The primary purposes of the plan are to reduce groundwater use and make land uses compatible with the activities associated with the Air Installation Compatible Use Zone at CL-NAWS. This land use plan will be implemented through zoning changes affecting private land in the unincorporated portions of the Indian Wells Valley (KCPNRD 2015, p. 1-1 to 1-2). Proposed zoning changes entail:

- Removing agricultural zone designations on land that is not currently farmed, including Exclusive Agriculture Limited Agriculture Zoned lands; and
- Replacement of agricultural zoning with Large Lot Residential, Neighborhood Commercial, General Commercial or Light Industrial zones.

The Final EIR indicated the Indian Wells Valley Land Use Plan could result in substantial adverse effects to special-status species, either directly or through habitat modification. The proposed plan would encompass lands within MGS range, including the Little Dixie Wash KPC defined by Leitner (2008, p. 22). The Final EIR did not provide information on the specific acres of MGS habitat that would potentially be impacted by the proposed zoning changes, but the plan area is identified as encompassing 256,000 acres.

Approximately 4,120 acres are dedicated to agriculture (alfalfa and pistachio) within the Indian Wells Valley, with 917 additional acres proposed to be farmed (KCPNRD 2015, p. 1-5), contrary to the Service's (2011a, p. 62238) assertion that future agriculture development within the range of MGS is unlikely. Zoning changes in the Indian Wells Valley Land Use Plan would reduce, but not remove, new agricultural development on private land. However, replaced zoning allows for increased commercial and industrial development on roughly 7,400 acres in the Indian Wells Valley (KCPNRD 2015, p. 1-8).

Increased commercial development here is growth-inducing and stimulates a demand for housing and associated urbanization impacts upon MGS habitat in a tenuous linkage corridor. Kern County's 2015 Final EIR concluded that cumulative impacts to biological resources resulting from zoning changes, including MGS impacts, are potentially significant. These impacts purportedly will be reduced to less than significant through mitigation measures (KCPNRD 2015, p. 120-121) and compensatory habitat acquisition elsewhere for projects entailing five parcels or more. These measures would be developed on a project-by-project basis through coordination and consultation with state and federal wildlife agencies. However, Kern County does not always require compensatory habitat mitigation recommended by the wildlife agencies to be fulfilled by project applicants adjacent to project impact areas. Kern County has also not engaged in any form of conservation planning in the western Mojave Desert for over 20 years.

The zoning changes in the Indian Wells Valley Land Use Plan offer no mitigation measures or establishment of habitat reserves to offset cumulative impacts to MGS. The Kern County Board of Supervisors approved the above proposed zoning changes on May 19, 2015. The enacted changes are intended to reduce potential future demand for scarce groundwater resources, but overall, would contribute to the ongoing cumulative loss of MGS habitat without designating specific lands for MGS conservation. The KCPNRD has stated explicitly it will not conduct bioregional conservation planning for desert lands (L. Oviatt, Planning Director, personal communication, 2021).

1.8 OHV Use and Management

As discussed by Wilkerson and Stewart (2005, p. 22-24), OHV use adversely impacts MGS in a multitude of ways. Direct effects include vehicles running over individual animals and collapsing MGS burrows (Laabs 1998, p. 5); a reduction of spring annual plant forage in areas of OHV use; and breaking as well removing shrubs (Bury et al. 1977, p. 16) which provide cover habitat. Impacts of OHV use on MGS habitat can be substantial in high public use areas (Service 2011, p. 62226). The potential to crush MGS likely increases as the prevalence and use intensity on roads increases in each region (BLM 2005, p. 3-162 to 163), and it is particularly high adjacent to and within BLM's heavy OHV use areas, including the western Rand Mountains. BLM (2005a, p. 3-162 to 163) found 37% of 310 transects randomly established within MGS range to be bisected by roads, and 47% of those transects were bisected by OHV trails, and that there is a "spill-over effect" in areas adjacent to high-intensity OHV use areas. Direct mortality arising from vehicle crushing is also likely to disproportionately affect dispersing male juvenile MGS when adequate dispersal habitat is available, as they are more likely to travel longer distances during natal dispersal than adults or female juveniles (Harris and Leitner 2004, p. 192).

While the Service (2011, p. 62249) found few reports of MGS being run over by vehicles, LaRue, one of the Petitioners, has witnessed two vehicle strikes of juvenile male MGS; one on a dirt road east of Harper Lake in Water Valley and another on paved Route 66 north of Helendale. LaRue found a crushed post-lactating female MGS in 2022 on unpaved Cuddeback Road a mile east of Highway 395; and reported crushing a juvenile male MGS in 1998 on a dirt road as it attempted to cross in front of his vehicle (BLM 2005a, p. 3-162). Middlemiss also noted mortality on a dirt road in 1984 (CDFW 2016a; CNDDB Occ. 150). Berry (1974) reported MGS burrows in a road berm (CDFW 2016a; CNDDB Occ. 195) and LaRue noted a juvenile female MGS darting into burrows excavated in dirt berms on both sides of a road (BLM 2005a, p. 3-162). A similar observation was made by LaRue along Lockhart Road, north of Harper Lake, in May 2022, when a juvenile MGS ran 30 meters up the road ahead of his truck, darted into a burrow located one meter away and immediately plugged its burrow. OHV use commonly widens unimproved roads and disturbs roadway berms/shoulders (Egan et al. 2012, p. 7), placing burrowing animals at injury and mortality risk.

Indirect OHV impacts include disturbance of soils and destruction of shrubs, both of which combine to reduce spring annual and perennial plants used by MGS as forage. Even light OHV use can result in lost or compacted soil (Webb 2002, p. 292), seed unavailability for foraging mammals and disrupted soil mantles (Bury et al. 1977, p. 16-18).

Dirt roads and trails also serve as dispersal corridors for non-native plants (Lovich and Bainbridge 1999, p. 313) that may be less palatable or nutritious for MGS than native plant species. These invasive species tend to outcompete native species along roadsides. Conversely, some non-native water-rich plants that frequently occur on roadsides, such as Russian thistle (*Salsola tragus*) appear to attract MGS use (Recht 1977, p. 75) and as such, may serve to entice MGS into harm's way when they forage adjacent to roads.

Vegetation studies performed for BLM (2003, p. 29; 2005, p. 3-158) OHV route designation found that 47% of 310 transects were bisected by various types of OHV tracks. Individual tracks frequently become wider and eventually become well-established routes lacking suitable MGS habitat elements. Indirect impacts of OHV routes and their repeated use, including vegetation loss (Ouren et al. 2007, pp. 11-12), compacted soils (Webb 2002, p. 292) and habitat fragmentation can severely degrade MGS habitat. Four BLM-designated OHV Open Areas occur in MGS habitat (Jawbone Canyon, Dove Springs, El Mirage and Spangler Hills), and one State Vehicle Recreation Area (Eastern Kern County Onyx Ranch), all of which comprise over 417 km² (161 mi²) of habitat. The ecological condition of these lands is severely degraded by OHV use (Figure 15), rendering them questionable in sustaining MGS populations. Although the Service has stated it is unaware of any MGS habitat impact estimates, intensive and widespread OHV use in the western Mojave Desert has resulted in extensive MGS habitat loss and degradation (Service 2011, p. 62225).

Figure 15. Dove Spring Canyon OHV Open Area and surrounding public lands. Taken in 2020 by Defenders of Wildlife.

While the Service has acknowledged that OHV use areas are extensively degraded and provide little value to MGS, now or in the future (Service 2011, p. 62226), their analysis failed to accurately analyze the effect these areas have in the context of supporting long-term MGS population connectivity. Comprising relatively small overall acreage relative to the entire MGS range, the location of these five high-intensity OHV use areas has fragmented MGS population connectivity in the past and this fragmentation is predicted to increase dramatically over time.

MGS may occur and disperse through portions of certain intense OHV use areas, but not others. For example, MGS may occur within or move through portions of the Dove Springs Canyon OHV Open Area, but there is no evidence to suggest the species moves through any lands encompassed by the Spangler Hills OHV Open Area (P. Leitner, unpublished data).

Factors such as rainfall patterns and minimally disturbed habitat availability likely influence the degree of MGS dispersal through highly degraded habitats, such as intense OHV use areas. Further, an adverse “spill-over” habitat impact from OHV use occurs adjacent to all BLM-designated OHV Open Areas according to BLM’s 2005 WEMO Plan, with higher incidences of vehicle impact on adjacent private land, mitigation land or California State Ecological Reserves compared to lands located at a distance.

It is also apparent that similar heavy OHV use impacts occur in MGS habitat situated adjacent to most cities, towns and communities in the western Mojave Desert (BLM 2005a, p. 3-164; Figure 16). No county or private land OHV route designation within the range of the MGS has occurred to date, nor have effective use rules and enforcement been adopted and implemented by local government agencies. Unauthorized OHV use on private lands includes illegal trespass, off-trail riding, illegal operation of non-street legal vehicles, and vandalism (Ciani 2011, p. 1).

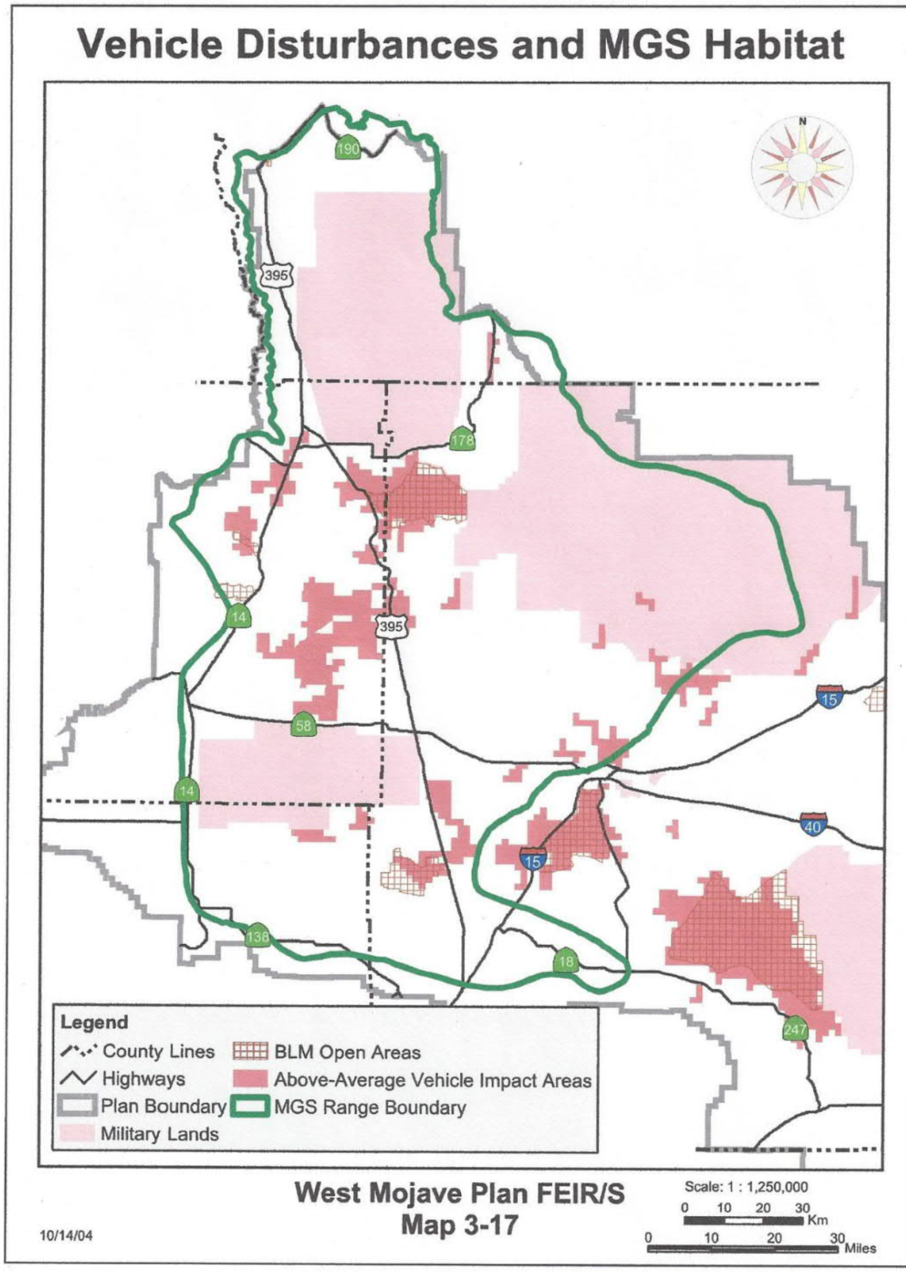


Figure 16. Distribution of vehicle impact regions (1998-2002) and MGS habitat from BLM's (2005a, p. 3-164) WEMO Plan.

Outside of high intensity OHV use areas, designated route networks fragment MGS habitat, reduce habitat patch size, and increase the ratio of edge to interior. This may have serious consequences for MGS movement corridors linking habitat patches (Ouren et al. 2007, p. 16) by precluding or inhibiting animal movements, which impacts dispersal and recolonization of adjacent suitable habitats, resulting in increased likelihood of local MGS population extirpations.

The combination of expansive and heavily used OHV route networks and numerous urban areas with densely clustered paved roadways and highways, has contributed to the extensive MGS range contraction documented in the southern extent of the species' historical range. The tenuous habitat linkages between the central and northern range extents of the species are similarly threatened by both authorized and unauthorized OHV use on public land.

BLM's (2005a, p. 3-161 to 165) WEMO Plan identified significant OHV impacts within the Mohave Ground Squirrel Conservation Area (MGSCA,[1] BLM 2006, p. 8), including "*lands within the Rand Mountains, west of Silver Lakes, within Kramer Hills, north of Hinkley, and southwest of Fort Irwin*." MGS habitat east and northeast of Fremont Peak, Fremont Valley, north of Silver Lakes, Superior Valley and southeast of Harper Lake were also identified as highly impacted by OHV use.

Wilkerson and Stewart (2005) in their MGS Listing Petition indicated that nearly 7,300 acres of additional MGS habitat was, as of 2005, impacted by legal OHV use. This estimate has increased considerably as of 2017. In its 12-month Petition Finding, the Service (2011a, p. 62225) stated the following regarding OHV use and management in the western Mojave Desert:

- "*We were unable to find information on the total number of miles of unpaved roads within the range of the Mohave ground squirrel. Based on a 2001–2002 inventory, the BLM estimated that 5,054 linear mi (8,134 km) of roads (including paved roads, unpaved roads, and trails) occur on BLM land in the western Mojave Desert*."

- "*However, subsequent to that (2001-2002) inventory, the BLM permanently closed 2,260 mi (3,637 km), or 45 percent of the roads and trails (BLM 2003, pp. 4–9). Most closures occurred in the DWMAs* [Desert Wildlife Management Areas] *in Mohave ground squirrel habitat (BLM 2003, p. 396).*"

- "*DWMAs are ACECs* [Areas of Critical Environmental Concern] *where the BLM can limit or exclude surface disturbance, including use of roads and trails (see Factor D).*"

- "*The West Mojave (WEMO) Plan commits the BLM to an aggressive program of closed route rehabilitation (BLM et al. 2005, chapter 4, p. 7).*"

- "*There are no State Vehicular Recreation Areas (SVRAs) in the range of the Mohave ground squirrel.*"

The analysis of the effects of OHV use and management on MGS habitat (Service 2011a, p. 62225) is faulty and outdated on several accounts. The Service (2011a, p. 62225) acknowledges a lack of

[1] The MGSCA, established in the Bureau of Land Management (BLM)'s West Mojave (WEMO) Plan, was in place from March 2006 until September 2016. It was replaced by a smaller Mojave Ground Squirrel Area of Critical Environmental Concern in the BLM's 2016 Desert Renewable Energy Conservation Plan.

estimates on the intensity and extent of OHV use occurring within managed and high-use areas, which adversely colored their impact analysis. A downward trend in MGS habitat protection has occurred between 1980 and 2017, as discussed below. Pointedly, BLM's (1980a; p. 30, 35) California Desert Conservation Area (CDCA) Plan additionally prescribed specific MGS habitat management actions requiring implementation within 1-3 years, which were not implemented, including developing an MGS habitat management plan to "protect, stabilize and/or enhance fish and wildlife values."

BLM's (2006) WEMO Plan focused on both desert tortoise and MGS protection, adopting the MGSCA, with a one-percent habitat disturbance cap and strong (5:1) compensatory mitigation for habitat loss due to BLM permitted activities. Yet BLM has failed to follow through in ensuring effective conservation of public land habitat within the MGSCA, specifically regarding management of OHV use. Recent BLM documents filed in federal district court on court-mandated relief confirm that a multitude of continuing OHV use violations in BLM law enforcement sectors with MGS habitat (BLM 2016c).

The Service's (2011a) Petition Finding analysis, as indicated above, contains significant errors and deficiencies relative to the current extent of MGS populations, its remaining habitat and condition of that habitat. These errors and deficiencies, combined with new information presented below, constitute significant new threats that support federal listing of remaining MGS populations.

1.8.1. OHV Routes in MGS Habitat

According to the 2005 WEMO Plan (BLM 2005b, p. 4-9), 5,054 miles of routes were formerly designated as open to OHV use, 51 miles were designated as available for such use with certain unimplemented restrictions (i.e., Limited Use designation) and 2,391 miles were designated as closed. These routes comprised a network of 7,496 miles of existing OHV routes within the planning area in 2005.

However, the Service (2011, p. 62225) stated there were a total of 5,054 miles of existing routes (paved roads, unpaved roads and motorcycle trails) on public land and that BLM (2005b, p. 4-9) previously closed approximately 45% of the dirt roads and trails within the WEMO Plan area.

The Service's (2011a, p. 62225) understanding of WEMO Plan route mileage designations is flawed. There were 2,260 more miles of routes that BLM designated as open to OHV use, rather than the 2,794 miles of open routes reported by the Service (2011a, p. 62225).

This error may be based on a belief that there were 5,054 miles of existing OHV routes on the ground at the time rather than 7,496 miles. This error undercounted designated OHV route mileage by 2,442 miles (32%). Consequently, the Service (2011, p. 62225) significantly underestimated existing adverse MGS habitat impact related solely to OHV travel. Notably, routes designated in the former MGSCA per the BLM's (2006, p. 8) WEMO Record of Decision (ROD), totaled 2,900 miles.

Contrary to the Service's (2011a, p. 62225) assertions about OHV route impact minimization (refer to second and fourth preceding quoted bullet points), there is no evidence that "*45 percent of the roads and trails*" totaling "*2,260 mi (3,637 km)*" reported as "*permanently closed*" within MGS habitat have changed in any manner on the ground since 2005 when routes were required by court order just to be signed as open or closed. Little successful closed route rehabilitation has been documented or even monitored in MGS habitat. Repeated OHV use on designated closed routes in MGS habitat is known to occur (Egan et al. 2012, p. 89) and previous OHV use impacts to MGS habitat have not diminished. Further, the MGSCA (BLM 2006, p. 8) no longer exists (MGS TAG pers. comm. with A. Fesnock, BLM, 2016), contrary to the MGS conservation overlay presented by the Service (2011a; refer to Figure 7). In its place, a smaller subset of public lands was designated as "MGS Conservation Lands" through the BLM's 2016 DRECP. Currently, these lands support a significant number of OHV routes, and associated use on both designated open and closed vehicle use routes is high (BLM 2005e, 2014a).

Under terms of a formal BLM (2001, p. 6) judicial settlement, many OHV routes were temporarily closed and minimally signed within MGS habitat in the Kramer and other Subregions of the West Mojave. Following closure, these route closures were monitored for compliance, and many were found reestablished (BLM 2003a, p. C14-140; 2003b, p. 4). No routes were closed or rehabilitated for MGS habitat protection.

BLM's (2005) WEMO Final Environmental Impact Statement incorporating this attempted route designation was found highly flawed, with a federal court finding BLM violated the Federal Land Policy and Management Act (FLPMA) and the National Environmental Policy Act (NEPA), relative to OHV route designation (United States District Court, Northern District of California 2009). The Service (2011a, p. 62225) indicated that the WEMO Plan "*commits the BLM to an aggressive program of closed route rehabilitation*"; however, we maintain this commitment was never implemented. In fact, BLM (2003, p. 2-20; 2005a, p. 2-163) even asserted: "*Closed routes would not be signed...*" and "*most of the routes designated closed would be left to natural reclamation.*" (BLM 2005d).

Without active rehabilitation, OHV impacts on soil and perennial shrub communities can take decades to recover after impacts cease (Ouren et al. 2007, p. 6; Wilshire et al. 2008, p. 305; Abella 2010, abstract). Little actual rehabilitation or natural reclamation of routes closed under BLM's WEMO Plan has occurred (Egan et al. 2012, p. 88-89; Egan, pers. obs. 2017). The long-term success of the few efforts undertaken is also questionable. BLM (2003, p. 2-20 to 2-21) has paradoxically stated that vehicle route rehabilitation is overemphasized and should not be implemented until other proactive means of route maintenance (e.g., signing) have been exhausted. In fact, a federal court remedy order was issued to compel BLM to implement OHV management actions (e.g., route signing, information kiosk installation, official map updating) and initiate vehicle use monitoring, as well as law enforcement compliance with the adopted 2003-2005 OHV route network (United States District Court for the Northern District of California 2010). Requested remedy relief was granted in part due the court finding BLM's inadequate NEPA and FLPMA compliance in route designation (including inconsistency with the CDCA Plan regarding designating routes not in existence as of 1980, and lack of applying OHV impact minimization criteria), and a showing of inadequate route signing, management and enforcement on the ground. Open route signing has taken place according to BLM, as required by court order. However, vandalism and removal of route markers is common on a recurring basis (T. Egan, pers. obs. 1990-2021).

Closed routes are not signed in a majority of MGS habitat because it would "*consume a great deal of staff time*" and signs are often removed as soon as they are installed (BLM 2003, p. 22). Currently, few closed routes in the range of MGS have been rehabilitated (T. Egan, pers. obs. 2017), naturally reclaimed, signed as unavailable for use or provide available MGS habitat. Affected soils have not become de-compacted, and soils can be significantly compacted by OHV use with even minor travel (Webb 2002, p. 292). Native shrub vegetation, including MGS forage shrubs, have not returned, and annual plant production and diversity is a fraction of that occurring prior to OHV route creation.

Based on a 2012-2013 route inventory, BLM (2015, p. 1-5) claimed there are approximately 15,000 miles of OHV routes in the WEMO planning area [refer to the West Mojave Route Network Project (WMRNP), p. 53 below]. However, the CDCA Desert Advisory Council (DAC 2013, p. 34) maintains that 30,000 miles existed prior to 1980 when the CDCA Plan was finalized. BLM's route mileage estimate is more than five times that considered as existing in 1985-87 (BLM 2003, p. 3-56 to 3-57), and more than double that considered for designation by BLM (2006, p. 9) and the Service (2006) in the biological opinion issued to BLM for the 2006 WEMO Plan.

This significant cumulative increase in OHV routes since 1985 reflects ineffective OHV use management and highly inaccurate mapping of existing routes on public lands, and likely pales in comparison with such impacts on interspersed/adjacent private lands. There is also an ongoing threat of additional OHV route proliferation and MGS habitat impact in upcoming years.

1.8.2 OHV Route Designation within MGS Conservation Lands

BLM has the authority and responsibility to manage all OHV use on public lands under its regulations. Yet nearly all OHV routes designated as closed to vehicle use in the BLM's WEMO Plan area occurred within the Fremont-Kramer and the Superior-Cronese Critical Habitat Units (CHUs) established for the recovery of the threatened desert tortoise. Only 46% of these public lands were designated as MGS conservation lands as of 2016, and an even smaller percentage are known to support MGS.

As stated above, most of the 2,391 miles of routes designated as closed by BLM (2005, Vol.1, Chapter 2, pp. 2-137 to 2-144) occur in desert tortoise CHUs. Few routes were designated closed under the WEMO Plan outside of these CHUs and no routes are known to have been closed specifically for MGS protection. These non-CHU lands comprise BLM's (2005) former MGSCA, including lands acquired west of U.S. Highway 395 for MGS and desert tortoise conservation in the 1990s, that have now been identified for solar development (BLM 2016).

In its 12-month MGS Petition Finding, the Service (2011a, p. 62225) stated the following regarding BLM's management of OHV use within the WEMO Plan area:

- "*In 2011, BLM is signing open routes, implementing a monitoring plan to determine compliance with route closures and whether any new illegal routes are being created, and implementing additional enforcement capability for the route network in the WEMO Plan area (U.S. District Court 2011, pp. 12–15).*"

- "*By 2014, the BLM will be preparing a revised OHV route network that complies with the Federal Land Policy and Management Act's (FLPMA) requirement to minimize damage to public resources and harassment and disruption of wildlife and habitat (U.S. District Court 2011, pp. 2, 13). These measures should reduce the impacts from OHV use on BLM land near management areas and on designated roads and trails in the range of the Mohave ground squirrel.*"

As of July 2021, all BLM-designated open routes within MGS habitat were not signed on the ground (T. Egan, pers. obs.), either never being signed since BLM informed the court that this mandated task was completed in 2012, or the signs have since been removed. Further, BLM has not installed any limited route signs, and minimal closed signs on routes designated as closed to public OHV use.

To comply with the federal court order, BLM monitored and documented public non-compliance with the 2005 WEMO closed route designations, confirming that additional illegal routes have been created. Outside of the Rand Mountains and Jawbone-Butterbredt ACECs, very little effective closed route rehabilitation has been initiated. Nor has successful long-term management of any rehabilitated closed routes been clearly demonstrated by BLM.

Despite this, no additional OHV use law enforcement needs have been identified, nor has full law enforcement staffing in applicable field offices been consistent since 2006 when BLM designated OHV routes. The monitoring program for these routes is also considered less than robust relative to monitoring location sample size; likely resulting in skewed long-term monitoring sampling results. While BLM (2019c) has finalized a revised OHV route network, it does not comply with FLPMA, and does not include all required impact minimization criteria required under the 2011 court order resulting from adoption of the BLM's (2005) WEMO Plan. Nor have DRECP Conservation

Management Action (CMA) disturbance caps (BLM 2016a-c) been incorporated into a current, revised WEMO route designation.

Below, we address these items and additional new information regarding the Service's 2011 Petition Finding regarding court-ordered OHV use compliance monitoring (United States District Court, Northern District of California 2011a) and BLM's previously adopted (2005b, p. 4-9; 2006, ROD) WEMO Plan for OHV route designation.

1.8.3 OHV Route Identification, Compliance Monitoring and Law Enforcement

As of November 2023, BLM continues to manage OHV use within the WEMO Plan area. Complete signing of open routes, as well as a minor amount of closed route rehabilitation, began following a 2011 court order on a legal challenge to the BLM's (2006) WEMO Plan, but has not been adequately maintained.

Closed routes, in general, have not been signed to any appreciable extent. A baseline inventory report of OHV use violations was filed with the Federal District Court (BLM 2012a); with quarterly reports filed with the court,[2] documenting that substantial OHV use on closed routes, and creation of new routes, occurs frequently.

Substantial non-compliance by OHV users has been documented through systematic sample monitoring and by BLM Law Enforcement Rangers, including 65 violations (e.g., use on closed routes) within MGS habitat in Travel Management Area (TMA) 2 (Sierra, Darwin, North & South Searles); 135 violations within MGS habitat in TMA 4 (Jawbone); 526 violations (nearly all of which involved new OHV route creation) in TMA 5 (Calico Mountain, Mitchel Mountain, Coolgardie, Harper Lake, Black Mountain and Fremont Peak); and 1,048 violations in TMA 7 (Rand Mountains, Fremont Valley, El Paso Mountains, Ridgecrest, and Red Mountain).

It is important to note that BLM's (2012, p. 1-3) baseline OHV use violation inventory consisted of the number of vehicle tracks occurring on closed routes and the presence of new cross-country routes that intersected designated open routes. This inventory did not account for all OHV use on routes within MGS habitat, the number of miles of unauthorized routes per violation, nor how many miles of new routes were created in previously undisturbed habitat.

The magnitude of the use violations documented in BLM's (2012, p. 1-3) baseline inventory indicates illegal use occurs over extensive portions of the MGS range, including closed areas (Shore 2001, App. B). Additionally, and more importantly, OHV use violations occur throughout areas identified for long-term MGS conservation, including public lands and interspersed private lands

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2 https://www.blm.gov/programs/planning-and-nepa/plans-in-development/california/west-mojave-route-network-plan/court-documents.

within the former MGSCA (BLM 2006, p. 8). Education, signing and OHV route rehabilitation adjacent to open vehicle use areas have been found inadequate in halting unauthorized use. Such ongoing unauthorized route use and proliferation of impacts indicate MGS conservation areas are not adequate to provide for long-term MGS conservation and recovery.

To illustrate this point, BLM (2013a, p. 6-8) proposed installing several miles of fences and vehicle barriers near the Grass Valley Wilderness within MGS conservation lands. These fences and barriers, to be located within the Fremont-Kramer CHU, were intended to halt regular illegal OHV use within wilderness and on designated closed routes even though signing (and some closed route rehabilitation) has been ongoing in the area on a continuous basis for over 18 years. The extent of this OHV use non-compliance problem, as well as BLM's effort to combat this illegal use, is described in its environmental assessment for the fencing and barrier project:

"*Wilderness boundaries were signed within two years of designation and BLM has consistently maintained signing ever since. A Student Conservation Association (SCA) Wilderness Restoration crew worked the entire perimeter of the Grass Valley Wilderness in 2001, restoring vehicle trespass routes, using minimum-tool, light-on-the-land, camouflage and passive restoration techniques, centering upon use of vertical mulch. Over the past ten years, this work has had to be reinforced multiple times with small vehicle barriers and continually repaired and extended to new sites along the wilderness boundary by staff and volunteers. Over the last five years, more than two dozen vehicle barriers and 200 wilderness boundary signs have been replaced as a result of vandalism and theft. On more than four occasions, unauthorized signs marking illegal vehicle routes through the wilderness have had to be removed and entry and exit points blocked off.*" BLM (2013a, p. 3).

And

"*Today seven miles of unrestored fence line and several miles of associated vehicle trespass routes on the west side of the Grass Valley corridor remain open and vulnerable, subject to frequent and recurring illegal vehicle use. Vehicle users continue to drive through old restoration sites, around signs and short vehicle barriers, off of the designated route system and into wilderness.*" BLM (2013a, p. 3).

And

"*Spillover from Cuddeback Lake, a popular RV camping and OHV-staging area has had ripple effects throughout the area, including the Grass Valley Wilderness. Vehicle users approach and exit the lake bed in multiple directions. While many riders stay on designated routes and out of wilderness, many frequently do not. This is a problem, particularly in washes and along fence lines which riders frequently follow off-route and into wilderness, creating multiple entry and exit points and additional tracks that crisscross the area. All of this activity contributes to the moderately to heavily-degraded aspect of much of the land, especially where it is in close proximity to the lakebed.*" BLM (2013a, p. 29).

Unauthorized OHV use is a widespread problem throughout the western Mojave Desert, and particularly within the washes and relatively level to hilly terrain that comprise most MGS habitat. This problem has been documented as particularly severe adjacent designated OHV Open Areas as well as surrounding most cities, towns and rural residential areas, which are commonly within MGS linkage areas (e.g., Adelanto, Atolia, Boron, California City, El Mirage, Helendale, Johannesburg, Kramer Junction, Lockhart, Olancha, North Edwards, Palmdale, Red Mountain, Ridgecrest and Victorville). A relatively recent BLM (2015a, p. 2-64) prescription for OHV management is to rehabilitate selected closed routes in certain ACECs. We note however, that route rehabilitation as currently practiced by BLM (e.g., vertical mulching) does not restore the ecological function of vehicle-damaged habitat.

Current route rehabilitation involving vertical mulching on public lands entails visually masking closed route entrances (Egan 2000, p. 1-2) within a line-of-sight distance of a vehicle user on an open route. Such work is labor intensive, costly and will likely take decades to complete on a network of 5,997 miles of open routes designated by BLM in 2019. Such treatment, if ever accomplished on a fraction of the thousands of open route intersections with closed routes, does not instantly result in rehabilitated and suitable MGS habitat.

While some route rehabilitation has occurred along certain wilderness borders, such work is often quickly vandalized and has not been initiated on most public lands situated away from wilderness. Further, almost no rehabilitation has been completed on private land or on public land adjacent to the rural communities where much of this illegal use originates. As noted previously, OHV use violations have been documented widely, and we assert such documentation greatly underestimates violations and the amount of MGS habitat adversely impacted.

Without active treatment of soils compacted by decades of OHV use and establishing native vegetation, designated closed routes will remain as they are: wind-swept, eroded surfaces with no vegetative cover with limited to unsuitable burrowing substrate. Affected habitats will likely remain in an impacted condition for decades or even centuries (Webb et al. 1983, p. 279-302; Lovich and Bainbridge 1999, p. 311) given the slow recovery of graded and compacted surfaces in arid landscapes. Additionally, this prolonged recovery would only occur if OHV use were curtailed on closed routes, an outcome BLM has yet to demonstrate as achievable.

OHV use is likely to increase in the future (Service 2011a, p. 62226). The BLM's 2019 OHV route designation will not, by itself, ensure adequate protection of MGS and its habitat. BLM's compliance monitoring, required by court order, reinforced this simple reality. Minimizing adverse impacts to at-risk species such as MGS and its habitat will not be possible until OHV users comply with the designated route network that effectively protects adequately sized and connected suitable habitat blocks needed to both conserve and recover MGS.

BLM is required by Executive Order 11989 (Carter 1977) to halt, through whatever means necessary, continued use of designated closed areas and routes. Yet BLM has not accomplished this in a meaningful way, which would entail securing sufficient funding to perform large-scale, effective, and timely rehabilitation of closed routes, conducting the necessary level of law enforcement and temporarily closing public lands to OHV use until full compliance can be achieved.

1.8.4 West Mojave Route Network Project (WMRNP)

Over the past 30 years, several OHV route designation plans for public lands have been developed within the western Mojave Desert, as described by BLM (2019):

"*In 2006, the BLM approved a comprehensive land use amendment covering the WEMO area of the CDCA. The WEMO plan amendment was evaluated in a 2005 Final EIS that was approved by BLM in a 2006 ROD. The 2006 WEMO Plan presented a comprehensive strategy to conserve and protect the desert tortoise and over 100 other sensitive species and their habitat, as well designating a motorized route network and managing livestock grazing.*"

"*The 2006 ROD was litigated by eleven organizations. Subsequently, the United States District Court issued summary judgment in 2009 and an order on remedy in 2011 that directed BLM to re-analyze specific issues in the 2006 WEMO Plan.*"

"*In March 2015, the BLM issued a Draft Supplemental EIS with a 90-day public comment period that was re-opened for an additional 120-day comment period in September 2015. This planning process was postponed to address another CDCA Plan amendment project, the Desert Renewable Energy Conservation Plan, for which a ROD was issued in September 2016.*"

Then BLM embarked on another route designation plan revision for the western Mojave Desert, amending the original CDCA Plan regarding route designation and formally designating "*5,997 miles of OHV Open and Limited routes*" (BLM 2019b):

"*These planning decisions include: change CDCA Plan language that limits routes of travel to existing routes as of 1980, identify travel management areas, change competitive event access, modify off-highway vehicle use on four lakebeds, eliminate the permit requirement for motorized access to the Rand Mountains-Fremont Valley Management Area, change the stop, park and camp limits adjacent to designated routes, and consider reallocating forage from livestock use to wildlife use and ecosystem function in desert tortoise critical habitat. The WMRNP also includes implementation-level decisions, including designation of a route network and associated travel management plans.*"

"*Lastly, in response to changes in land status from the John D. Dingell, Jr. Conservation, Management, and Recreation Act (Public Law 116-9), modifications were made to the travel and transportation management route network for consistency with the law. These modifications are discussed in the Errata.*"

Contrary to the Service's (2011, p. 62226) assertion that BLM has "*no plans to designate additional high use areas or roads and trails for the next few decades*," BLM begin several new route designations with its 2011 and subsequent 2014-2019 WMRNP route designation plans. In a request to the BLM's Desert Advisory Council (DAC), BLM previously sought recommendations for vehicle route designation (DAC 2013, p. 1). The DAC recommended designating multiple and redundant open routes – contrary to FLPMA, BLM guidelines, the CDCA Plan and the previously adopted 2006 WEMO Plan route designations, all for the purpose increasing OHV use opportunities on public lands.

The DAC (2013, p. 34-35) report included alternatives to increase the miles of routes available for OHV use without regard for imperiled species such as MGS. These recommended routes did not follow selection criteria identified in the 2010 United States District Court Order for injunctive relief, which instructed BLM to apply the appropriate minimization criteria per 43 CFR 8340-8342. Many of the routes the DAC recommended be open to OHV use were designated by BLM in 2006 as closed, but were not rehabilitated, or were recently created. The DAC (2013, p. 34) report recommended BLM designate 30,000 miles of open routes, maintaining these routes were in existence prior to BLM's completion of the CDCA Plan in 1980.

Open route signing and aerial photo analysis in 2013 based on 2009 data identified 15,000 miles of routes (BLM 2015, p. 1-5), roughly 7,000 miles more than the inventory used in BLM's 2006 WEMO Plan when it designated 5,098 miles of open routes. While BLM has maintained route mileage inventory discrepancies from 1985 to 1987 (2,949 miles; BLM 2003, p. 17), and subsequently from 2001 to 2005 (8,000 miles; BLM 2015, p. 1-5) were based on incomplete field survey and mapping errors, we believe vehicle route proliferation over the past 41 years is the primary reason for these map discrepancies.

After the DAC report was submitted, BLM (2014a, 2015a) published the WMRNP Draft CDCA Amendment and Supplemental EIS. Alternative 3 (Public Lands Access), which at the time was BLM's preferred alternative, called for designating 10,428 miles of existing OHV routes as open for public use, with a large percentage of open routes within the MGS conservation area (BLM 2014a, p. 3).

Maps of BLM's (2014a) preferred open route network and the calculated route mileage also underestimated existing routes. Further, we find little documentation supporting the Service's (2011a, p.62225) assertion that "*road density and OHV use of these roads are much lower than in management areas*" and that *"this lower use likely means potential impacts to the Mohave ground squirrel are less than in management and high-use areas*."

While BLM is required to apply impact minimization criteria in its route designation process under agency policy, the CDCA Plan and federal regulations, BLM's (2015a, p. 2-65 to 2-75) preferred alternative in 2014 would have increased designated OHV route miles by over 100% and would have done little to "*reduce the impacts from OHV use*" occurring within MGS habitat as concluded by the Service (2011a, p. 62225).

MGS habitat impacted by OHV use is considerably more than indicated by the Service (2011a, p. 62225). Since BLM's (1980b, p. 75) completion of the CDCA Plan, where BLM estimated 21,000 miles of unmaintained dirt roads existed in the entire CDCA, many were concentrated in the western Mojave Desert due to its proximity to large population centers in Los Angeles, the Inland Empire and southern San Joaquin Valley. The 30,000 miles of dirt routes suggested by the DAC as occurring in the West Mojave Plan area in 2015 indicates route proliferation from OHV use has been ongoing and the issues of habitat loss and fragmentation resulting from such use have not been resolved.

The driving force for preparing the CDCA plan was OHV route proliferation in the 1970s and how to prevent it pending formal route designation by 1983, which did not occur. Limiting designation consideration to routes in existence as of 1980 was mandatory because BLM acknowledged at that time that route proliferation had occurred and was continuing. Unfortunately, considering only those routes that existed in 1980 in BLM's route designation planning was removed with the BLM's (2019a, 2019b) WMRNP. Consequently, it appears new routes within MGS habitat have been created and subsequently designated as open to OHV use, and additional routes could be created in the future and designated as open in subsequent route designation plans.

1.8.5 State Vehicle Recreation Area within MGS Range

Contrary to the Service's (2011a, p. 62225) assertion that no State Vehicle Recreation Area (SVRA) occurs within MGS range, TRA Environmental Sciences Inc. (TRA 2013) prepared environmental documentation for the California Department of Parks and Recreation (CDPR), Off-highway Motor Vehicle Recreation (OHMVR) Division, to analyze the environmental effects of acquiring and managing 28,275 acres in eastern Kern County as a SVRA in 2013 as the Eastern Kern County Onyx Ranch SVRA.

Situated west of Red Rock Canyon State Park, private lands now comprising the Eastern Kern County Onyx Ranch SVRA (Figure 17) are interspersed with public lands managed by BLM (TRA 2013) within occupied MGS habitat (Leitner 2008, p. 22; 2015b, p. 14). Biosearch (2012, p. 22) found MGS at 10 of 18 sites sampled in the northeastern part of the SVRA, with a total of 25 individuals captured within live-trapping sites and three other MGS observed close by. As expected, no evidence of reproduction or juveniles was noted given the lack of rainfall the preceding winter. Biosearch (2012, p. 22) concluded that MGS is widespread throughout the northeastern part of the SVRA planning area and extending west to Butterbredt Canyon.

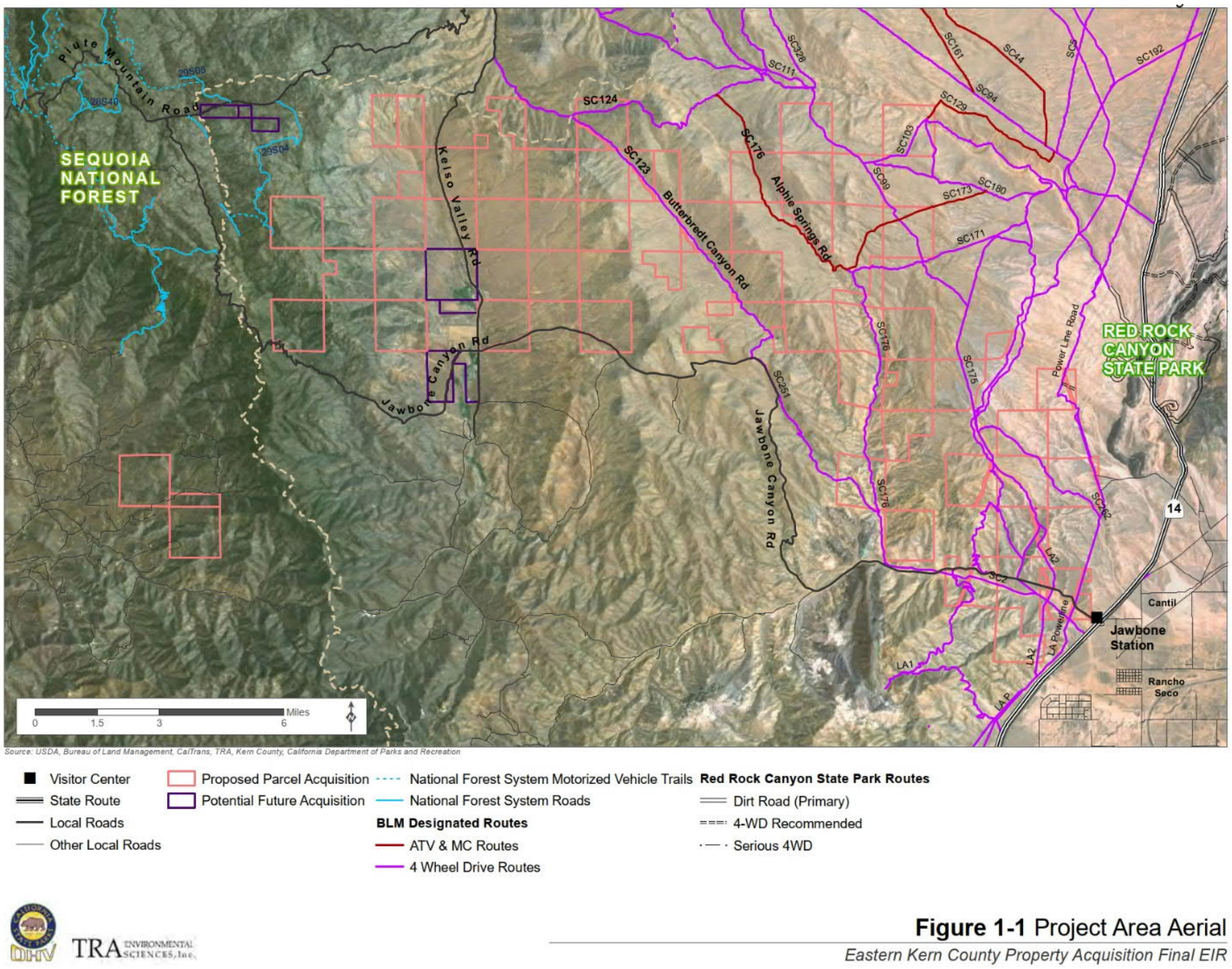

Figure 17. Map of Eastern Kern County Onyx Ranch SVRA showing land parcels acquired and adjacent lands.

TRA (2013, p. 6-52) found that OHV use can harm MGS through direct collision, disturbance of soils and burrows, destruction of shrubs and facilitation of invasive plants that displace native vegetation along roads and trails. However, TRA (2013, p. 6-55) concluded that while desert tortoises were vulnerable to vehicle collisions and an anticipated one-percent increase in area visitation (1,800 visitors) following designation of the SVRA, MGS were not vulnerable to vehicle collisions due to the species' increased mobility.

TRA reasoned (2013, p. 6-57) that the type and intensity of OHV use in the SVRA would not change due to OHMVR management and the expectation that there would be an insignificant increase in public use of the area, resulting in insignificant impacts to special status species such as MGS. Potential new or increased OHV use impacts to lands occurring to the east and interspersed public lands as a result of OHMVR management were similarly dismissed as insignificant.

CDFW (2019) commented on MGS habitat within the SVRA:

"*Approximately 20,000 of those acres (8,094 ha), between Red Rock Canyon and Kelso Valley, are within the MGS range. Management Measures were implemented under CDPR's Wildlife Habitat Protection Program and Habitat Monitoring System to protect sensitive biological resources from potential effects of existing uses* (California Department of Parks and Recreation 2013). *The OHMVRD found the project management activities, which included the implementation of these measures, would not adversely impact special-status species, such as the MGS. Therefore, no changes or alterations to the project were required to mitigate or avoid significant effects on the environment*."

"*MGS habitat in the Onyx Ranch SVRA varies across the area and the distribution and abundance of MGS there is unknown. A camera trapping protocol is being developed to survey for MGS in the area and should begin in 2019 (T. Farmer, pers. comm. 4/5/2018). The acquisition area is interspersed in checkerboard fashion with BLM land in the Little Dixie Wash population center described by Leitner (2008a) and is within potential expansion habitat (PPA) for that population. Detections as recent as 2004 are located just east of some of the acquired parcels (CNDDB occurrences #191, #395-396) and historical detections are within or adjacent to the acquired land (CNDDB occurrences in Dove Spring, 1974)*."

The OHMVR Division (2013a, p. 24) found significant unavoidable impacts would occur due to potential vehicle collision with the desert tortoise but adopted a statement of overriding consideration followed by formal SVRA designation and the acquisition of over 25,000 acres of private land (California Department of Parks and Recreation 2015a). A Memorandum of Understanding has been developed between the OHMVR Division and BLM to coordinate management of public lands and "*maximize ORV* [OHV] *recreation opportunities*" in the SVRA (California Department of Parks and Recreation 2015b).

While TRA predicted that SVRA designation would increase OHV use by only 1% from 2012 levels, OHMVR Division Commissioner Paul Slavic stated "*It will mean more trails, more single track, which they don't have there now...*" in a *Bakersfield Californian* article (Henry 2014). Consequently, both increased OHV use and additional route creation are anticipated, further impacting MGS habitat though soil disturbance, vegetation loss and habitat fragmentation in a crucial MGS linkage corridor.

Primary management objectives for the SVRA include "*establishing a broad public land ownership in and around a large-scale OHV recreation area; to facilitate a "destination" OHV recreation experience that provides for a broad spectrum of vehicle use skill levels; to facilitate access to regional public lands supporting MGS habitat such as the El Mirage, Jawbone, Dove Spring, Koehn Dry Lake* [sic] *and Spangler Hills open OHV play areas; and to provide a comprehensive recreation opportunity on adjacent public lands."* (California Department of Parks and Recreation, OHMVR Division, 2013a, pp. 2-3). The OHMVR Division (2013b, pp. 2-3) plans to adopt a program for public compliance monitoring with the management measures it has proposed to mitigate the significant environmental effects within the SVRA. There is no clear distinction between monitoring or reporting (California Department of Parks and Recreation, OHMVR Division, 2013b, p. 1); nor has monitoring, management or law enforcement on adjacent public lands impacted by increased OHV use been discussed and funding for such monitoring has not been secured.

Designated route signing, user education and law enforcement are intended to form the primary management tools for the SVRA, similar to what occurs on adjacent public lands. The OHMVR Division intends to inventory wildlife resources per Public Resources Code Section 5090.35 (c) at some point in the future and prepare a Wildlife Habitat Protection Plan (WHPP), as well as a Habitat Monitoring System (HMS) and a Soil Conservation Plan.

The goals of the WHPP will be to monitor and manage wildlife and plant populations and restore habitats where necessary to sustain a viable species composition within the SVRA. If the WHPP standards are not met in any portion of the SVRA, the CDPR OHMVR Division must close the non-compliant portion until the program standards are met. These requirements mirror mandatory direction specified in BLM's manual, CDCA Plan (1980, pp. 87-92) and in Executive Orders 11644 (*Use of Off-road Vehicles on Public Lands*, Nixon 1972) and 11989 (*Use of Off-road Vehicles on Public Lands*, Carter 1977). However, these requirements have never been enforced on public lands despite deteriorating natural resource conditions in all BLM-managed high-use vehicle play and limited use areas that overlap MGS habitat.

Data collected on OHV use, its impact and management in other SVRAs have documented that habitat degradation occurs over time (California Department of Parks and Recreation 1981, p. 5, 19-20). Adaptive management and conservation requirements of the WHPP and HMS in other SVRAs have not been complied with and/or have been found ineffective in the conservation of sensitive biological resources (Cashen and Kupferberg 2016, p. 2-3). This has resulted in impacts to natural areas and adjacent lands (California Department of Parks and Recreation 1981, p. 5, 19-20), as well as:

- Significantly lower herpetofauna occupancy;
- Significantly lower key indicator bird abundance;
- Extirpation of various species from the riding areas;
- Shifts in vertebrate composition; and
- Reductions in vegetative cover.

As the authors note, these effects are biologically significant, and statistical analysis ties these impacts directly to OHV use. Management that relies on future monitoring to detect impacts and adaptive management in the form of mitigation measures, combined with a lack of specific reference sites, has posed a serious flaw in SVRA management plans to protect special status species

(Kupferberg 2016, p. 2). Even when implemented (Cashen and Kupferberg 2016, p. 4), best management practices designed to minimize OHV use impacts on species identified for conservation have been ineffective (Kupferberg 2016, p. 2-3).

The risk of receiving a citation for unlawful OHV use within the Eastern Kern County Onyx Ranch SVRA or adjacent public lands is minimal due to their remoteness and insufficient law enforcement staff. BLM has been unable to keep OHV use out of nearby sensitive areas (CDFW 2015 5.6-31), even following increased law enforcement and formal closure. For example, BLM closed the 18,000-acre Western Rand Mountains ACEC in 2002, but OHV users routinely violated this closure (DMG 2002). As CDFW (2015, p. 5.6-31) has noted, numerous attempts have been made to minimize OHV damage to natural resources through route designation, but new trails continue to be created across MGS habitat in both high use recreational vehicle areas and adjacent public and private lands.

Livestock grazing is also allowed within the SVRA (TRA 2013, p. 6-54), a use that will contribute to cumulative impacts within MGS habitat. TRA (2013, p. S-6) concluded that "*land use management measures*" implemented by CDPR OHMVR (e.g., route designation, signing and law enforcement), will reduce the potential increase in off-route travel associated with increased visitation following SVRA designation. However, route signing without monitoring and adequate law enforcement can be futile (CDFW 2015, p. 5.6-31), as evidenced by the public land OHV use management problems described in this petition.

We also incorporate by reference continuing OHV use impacts to MGS habitat and management issues under listing Factor D: The Inadequacy of Existing Regulatory Mechanisms.

1.8.6 The John D. Dingell, Jr., Conservation, Management and Recreation Act (Dingell Act)

The Dingell Act (Public Law 116-9) of March 12, 2019, designated six OHV Recreation Areas on public lands in the CDCA, and expanded the El Mirage and Spangler Hills OHV Open Areas by 680 (1.1 mi^2) and 35,300 acres (55.2 mi^2), respectively, for a total of approximately 24,000 acres (37.5 mi^2) at El Mirage and 92,000 acres (143.7 mi^2) at Spangler Hills. These two areas are located within key MGS habitat linkages.

1.9 Renewable Energy Projects. The Service (2011a, p. 62233) concluded that wind energy projects within the MGS range are subject to restrictions in the BLM's (2005) WEMO Plan, and that such restrictions would help conserve MGS and its habitat by limiting habitat loss and requiring appropriate habitat impact compensatory mitigation:

> "*Under the current WEMO Plan, which may extend to 2035, wind development within the range of the Mohave ground squirrel will also be restricted because the BLM has a maximum cumulative limit of 1 percent new surface disturbance of any kind for the MGSCA and 1 percent for each of the two DWMAs.*

One large wind project within the MGSCA would meet or exceed this 1 percent cap on any kind of surface disturbance. The WEMO Plan also requires a mitigation ratio of 5:1 for lands within the DWMAs and the MGSCA for habitat lost from ground disturbance."

BLM established the amount of habitat loss resulting from permitted land uses based on actual habitat disturbance attributed to each authorized activity rather than the entire size of the project (pers. comm. J. Aardahl, with M. Sintetos, BLM 2014). Habitat loss associated with wind energy project ground disturbance has been estimated by BLM at 6% of a project's total area. There were 1,308,877 acres of public land within the BLM's former (2005) designated MGSCA.

For MGS habitat loss, the BLM's 2006 WEMO Plan adopted a one-percent cap; or 13,089 acres (20.4 mi^2) out of a total of 1,308,877 acres (2,045 mi^2) in the MGSCA over the plan's 30-year timeframe. Using BLM's 6% ground disturbance assumption for a wind energy project and the 1% habitat loss cap, a wind energy project(s) of up to 218,150 acres (340.9 mi^2) could theoretically be allowed within BLM's former MGSCA, including within KPCs and linkage habitats.

We believe the Service's (2011a, p. 62233) conclusion that one wind project would exceed the 1% habitat loss limit was in error, as it implies that this cap and a 5:1 habitat impact compensatory program would preclude large wind projects. While moot relative to BLM's (2016) DRECP and Inyo County provisions for wind development in MGS habitat, the reduction in the BLM's compensatory requirements for surface disturbance in MGS habitat (LaPre, Personal Communication with Judy Hohman 2009) remain relevant.

Further, public policy initiatives (e.g., American Recovery and Reinvestment Act of 2009, California Executive Order S-14-08 and California Senate Bill X1-2 among others) may result in former proposed renewable energy projects resurfacing, and past public land use planning has been amended to facilitate additional project permitting.

The potential for renewable energy development and impacts within high quality MGS habitat has been discussed by both Esque et al. (2013, pp. 37-63) and Inman et al. (2013). The latter researchers concluded that the potential for renewable energy project development in high quality MGS habitat was significantly greater than expected by the Service (2011a, p. 62236), stating:

"*In their 2011 decision, the Fish and Wildlife Service suggest that up to 6% of the MGS range may be affected by USRED* [utility scale renewable energy development] *on public and private lands, while in contrast, our high impact scenario suggests that up to 10% of current habitat will be negatively affected by USRED on public federal land alone. With an additional 3500 km*^{2} *of state and private land in our study area, the amount of MGS habitat affected by USRED may be substantially higher.*" and

"One proposed USRED in particular was noted in an area of high suitability habitat located northwest of Red Rock Canyon State Park, and approximately 30 km south and west of Ridgecrest, CA. In addition to high suitability habitat, this area has some of the highest densities of trapping records, may serve as an important corridor for dispersal among populations (P. J. Weisberg et al. unpubl. data) and is a region of high genetic variation that harbors one of 3 distinct genetic groups within the species (Bell & Matocq 2011)."

The extensive Kramer and Harper Lake solar projects – the first commercially developed solar facilities in the California Desert – as well as Abengoa's Mojave Solar Project and the Barren Ridge Solar Project, have all eliminated crucial MGS linkage habitat. Other solar projects totaling 20,561 acres (32 mi^2) have been approved or are expected to be approved by Kern and San Bernardino counties within the range of the MGS located west of U.S. Highway 395 to Harper Dry Lake, and north of State Route 58 and extending to Fremont Valley, will also fragment MGS linkage habitat. In addition, the Rio Tinto (formerly U.S. Borax) Mine development and State Route 58 expansion will form a formidable barrier to north-south and east-west MGS movement.

Esque et al. (2013, pp. 37-63) and Inman et al. (2013, p. 13), in noting the highly restricted MGS range, demonstrated through modeling that the small range of the MGS has been greatly affected by renewable energy development. Inman et al. (2013, p. 13) reported that 16% of historical MGS habitat has potentially been lost and that an additional 10% more of MGS range may be affected by renewable energy development in the near future. The authors also stated that MGS habitat suitability is higher in areas slated for renewable energy development compared to surrounding areas. Habitat lost due to planned energy development may be marginal compared to that lost from climate change impacts, but disproportionately affects current habitat (Inman et al. 2016; p. 116, abstract).

Geothermal energy development constitutes a threat to MGS habitat not adequately considered by the Service (2011a, p. 62233-62234). The Haiwee Geothermal Leasing Area is within the former MGSCA (BLM 2006, p. 8) designated in the WEMO Plan. In 2016, BLM approved the DRECP which established ACECs (Rose Spring, Ayers Rock, Sierra Canyons and Mohave Ground Squirrel) for protection of sensitive resources, including the significant MGS KPC habitats within the MGS conservation area.

However, in April 2020, BLM designated 22,800 acres of public land in Rose Valley area as the Haiwee Geothermal Leasing Area and lifted the no surface occupancy in all ACECs in the leasing area. (BLM 2020a; 2020b). The decision is contrary to the legal requirements in FLPMA regarding ACECs, which states BLM "*shall give priority to both the designation and protection of ACECs in the development and revision of land use plans, and BLM is obligated to manage ACECs to conserve, protect and restore their ecological and conservation values.*" In addition to designating the Haiwee Geothermal Leasing Area, BLM approved the processing of three existing geothermal lease applications covering 4,460 acres (7 mi^2) within the leasing area, all of which overlap MGS habitat.

Existing impacts within MGS habitat in Rose Valley and Coso Range include the Coso Geothermal Project administrative offices and equipment storage yards, a nine-mile-long buried water pipeline extending from Rose Valley to geothermal power plants in the CL-NAWS, as well as daily vehicular traffic through Rose Valley, a critical habitat linkage between MGS KPCs in the greater Indian Wells Valley and Olancha (Leitner 2008, p. 22; 2015a, p. 2).

1.10 Desert Renewable Energy Conservation Plan (DRECP)

BLM's (2016) DRECP established renewable energy Development Focus Areas (DFAs), conservation areas and Conservation Management Actions (CMAs) applicable to all land uses on 11 million acres of public lands in the planning area (Figure 18). Phase 2 of the DRECP, which addresses renewable energy development on private lands, has been completed by all counties in the DRECP plan area except for Kern County. The authorities and capability of counties to zone private lands for conservation purposes are limited.

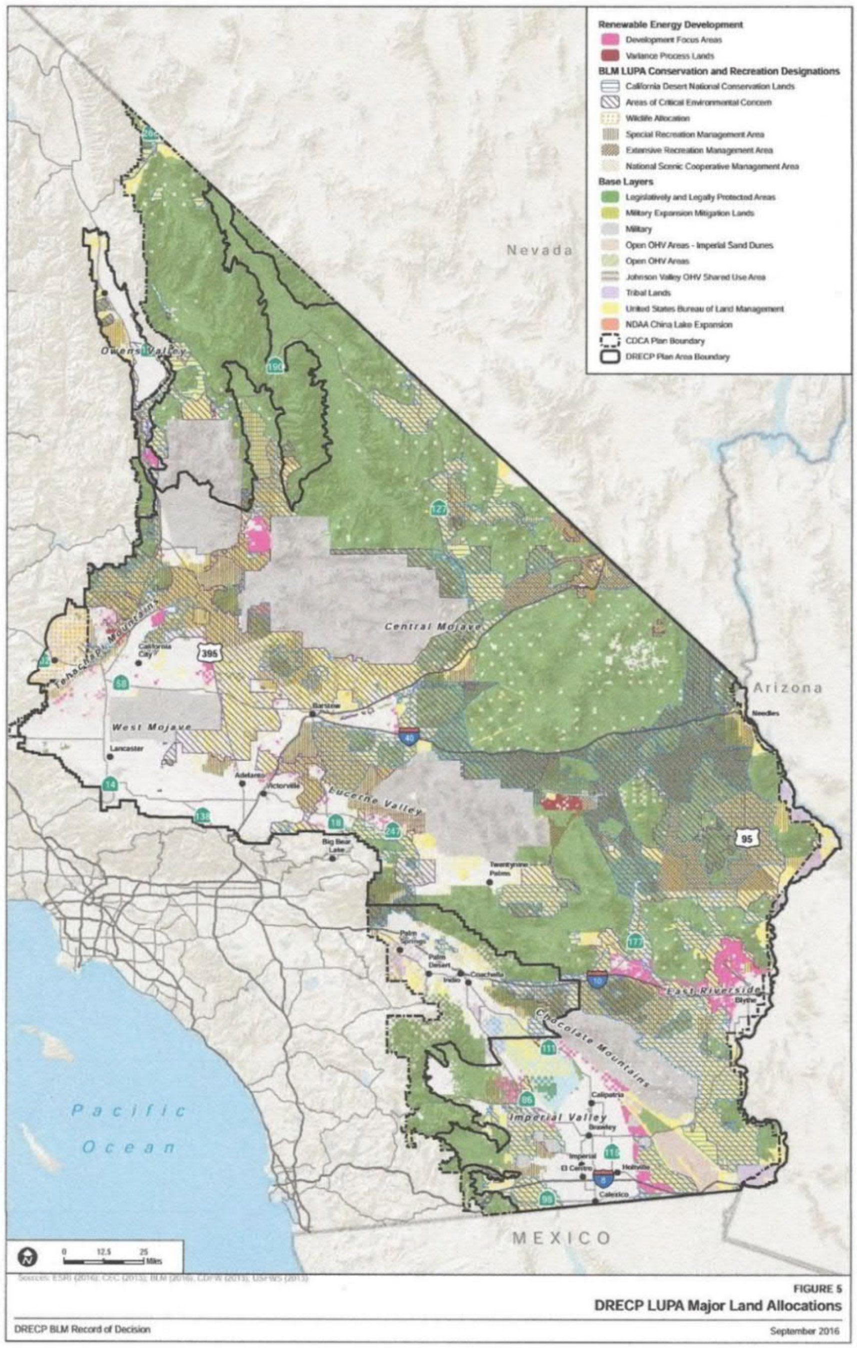

Figure 18. Major land allocations on public lands per the BLM's (2016b, p. 47) DRECP.

BLM's 2016 DRECP allocates certain public lands as DFAs for streamlined permitting of utility-scale renewable energy development. It established CMAs applicable throughout the plan area for all land use activities. However, the DRECP formally removed the MGSCA designated by BLM's (2006, p. 8) WEMO Plan. While MGS habitat has been included in the Fremont-Kramer ACEC for desert tortoise recovery east of U.S. Highway 395, this ACEC can be modified by a future CDCA Plan amendment.

Other public lands, some of which include MGS habitat, were previously designated through the BLM's (2005) WEMO Plan but were modified by the DRECP. Some were intended to provide for MGS conservation. We refer to these combined areas herein as MGS conservation lands. By streamlining and incentivizing utility-scale renewable energy development in DFAs, the DRECP presents new threats to the MGS and its habitat that undermine existing MGS conservation. Under the DRECP, approximately 10,000 acres (15.6 mi^2) of MGS habitat would potentially be lost in upcoming years, including 6,000 acres within MGS KPCs.

These provisions pose serious threats to continued MGS population viability, as described below.

1.10.1 DFAs of Concern

New public land DFAs were identified in the DRECP where renewable energy projects are encouraged and a streamlined permitting process applies. The four following DFAs are of particular concern regarding the MGS.

1.10.1.1 Rose Valley

This DFA spans nearly 12,000 acres and is located within a key MGS linkage and habitat expansion area. Public lands here were previously designated by BLM in 1980 as the MGS Management Area W11. Spanning the entire width of the Rose Valley, renewable energy development in this DFA will eliminate a critical linkage between southern/central and northern MGS KPCs.

1.10.1.2 Searles Valley

The Searles Valley DFA, located immediately south of Searles Dry Lake is the largest in the western Mojave Desert, development of which will virtually eliminate a habitat linkage between central and northeastern MGS KPCs.

1.10.1.3 Fremont Valley

This DFA overlaps approximately 800 acres of the BLM's (2006, p. 6) Western Rand Mountains ACEC established for desert tortoise and MGS conservation (MGS Crucial Habitat [Unit 29f] and Planned Wildlife [MGS] Management Area W20; BLM 1980). Buildout of utility-scale renewable energy development here would significantly constrain MGS movement linkage opportunities.

1.10.1.4 North of Edwards

This 13,000-acre DFA is located within an MGS KPC (BLM 2016a, p. C-127) and linkage corridor (Leitner 2008, p. 23). The BLM's (1990s) Land Tenure Adjustment (LTA) project, funded by the U.S. Air Force in cooperation San Bernardino County, acquired 7,700 acres (12 mi^2) of private land through a series of land exchanges which consolidated federal land ownership for protection of the desert tortoise and MGS habitat, as well as to ensure compatible land use with aircraft flight research and training at EAFB. Location of acquired lands within the DFA is based on mapping data (BLM 2005c, p. 2-28; CBI 2016, DRECP). Lands acquired were within BLM-designated MGS Crucial Habitat (Unit 29f) and Planned Wildlife [MGS] Management Area W21 (BLM 1980). The Service (1990) noted the BLM's LTA project would result in the destruction of habitat on public lands traded out of public ownership, but that land consolidation (acquisition) would promote conservation on far more acreage due to difference in value for the acquired vs. disposed lands. The Service was silent about the loss of acquired LTA conservation lands within the North of Kramer DFA in its 2016 DRECP biological opinion.

BLM's West Mojave Plan (2005c, p. 2-28 to 2-29; Figures 19-20) reaffirmed LTA public land disposal, including MGS habitat in areas in the southern portion of MGS range to be developed under private ownership. MGS habitat suitability within the North of Edwards DFA, where land acquisition occurred under the LTA project for desert tortoise and MGS conservation, now appears to be a climate change resilience area and of high importance to MGS. Climate change models (Davis et al. 2013; Esque et al. 2013) have projected these lands will remain relatively stable in the future, while lands further to the south were found to be less so. LaRue (2016a, p. 4) also found MGS reproduction here, even in a dry year.

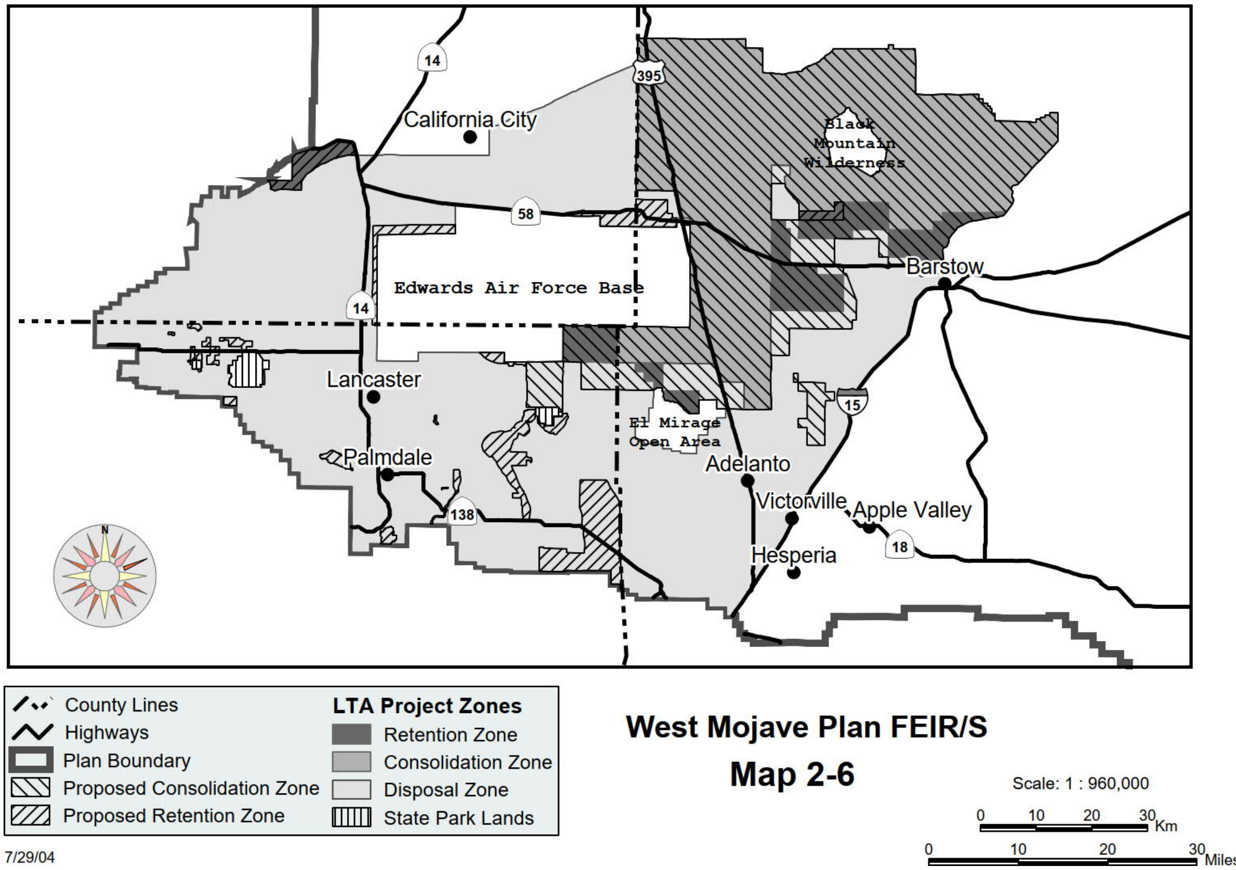

Figure 19. Land Tenure Adjustment Program Consolidation & Disposal Map (BLM 2005c).

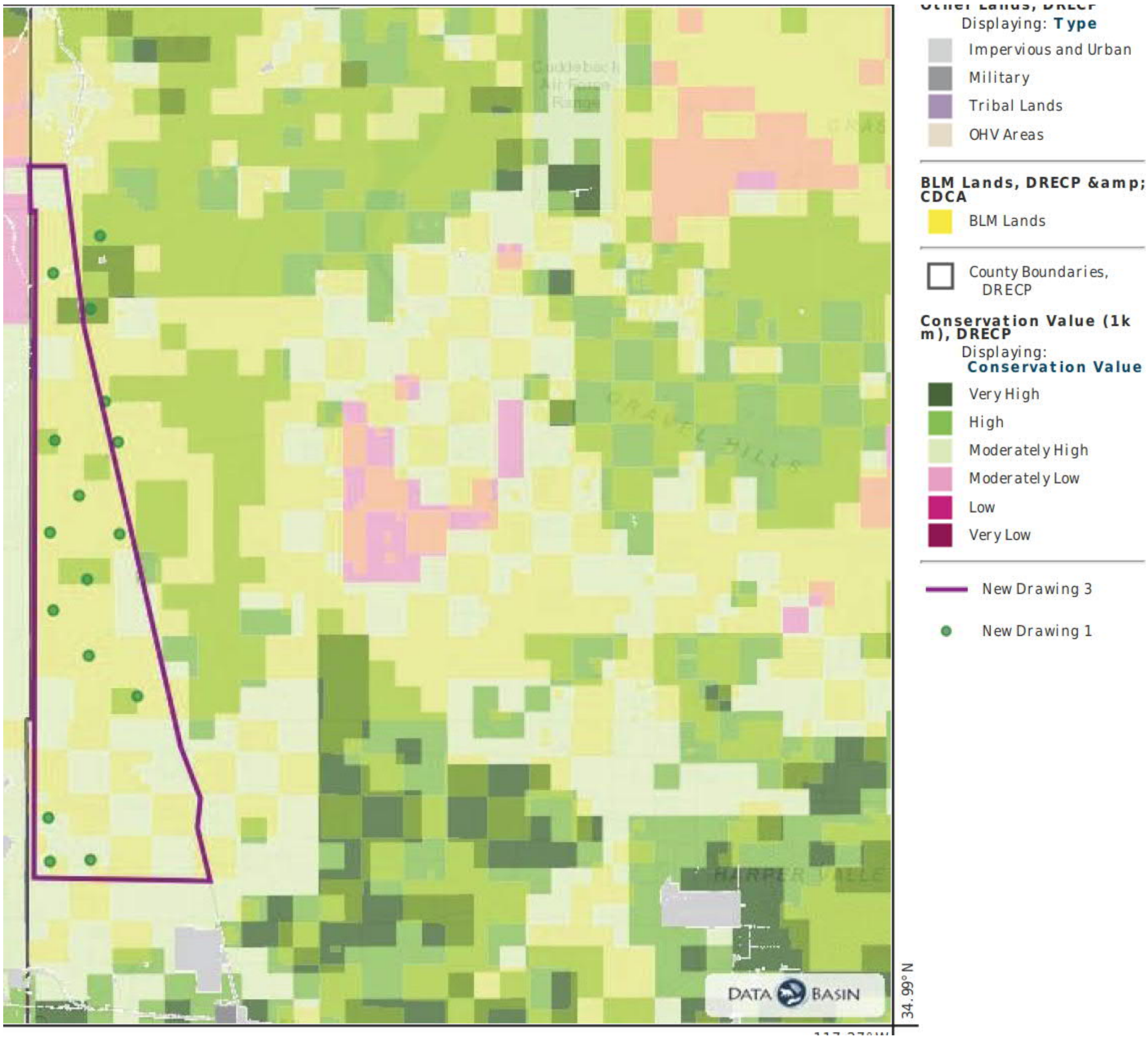

Figure 20. Public lands acquired in the Land Tenure Adjustment Program (Defenders 2016). Acquired sections (640 acres) are shown by green dots or circles within the purple DFA outlined area on the left side of the map.

Despite its previous endorsement of conservation land and the North of Edwards DFA climate change resilience area, the San Bernardino County Planning Commission (2016) and Board of Supervisors (2016) endorsed use of the North of Edwards DFA and adjacent private lands for renewable energy development. Planned solar development on interspersed private land within the North of Edwards DFA has already been described in PMC and Aspen (2016). The proposed 200-acre Kramer North and 386-acre Kramer South Solar Farms north and south of SR 58 (Figure 21), supporting high quality MGS linkage habitat, were also recently approved by the San Bernardino Planning Commission (2021).

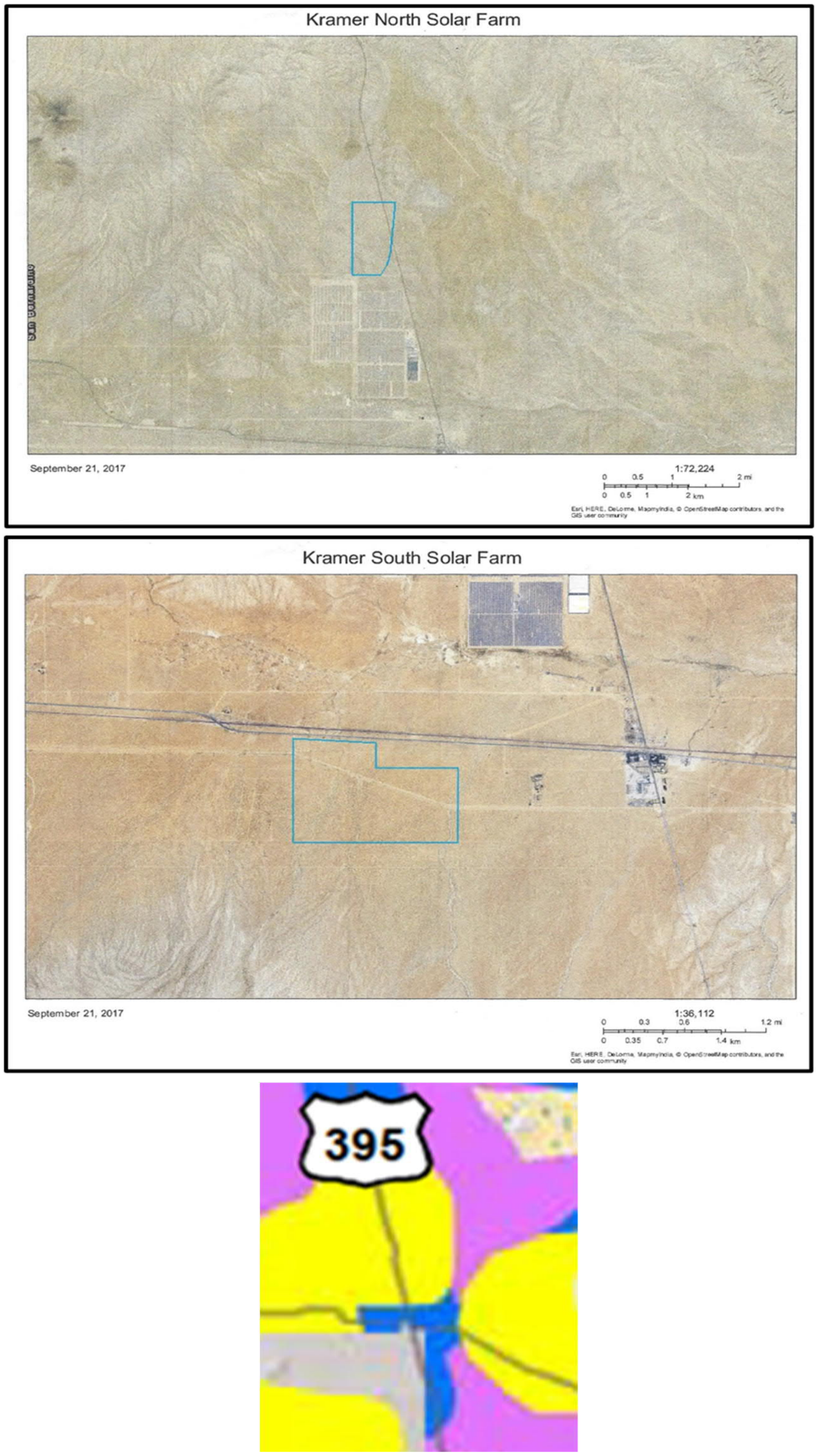

Figure 21. Recently approved Kramer North (top) & South (middle) Solar Farms located within the North of Kramer MGS KPC (yellow) and linkage habitats (blue) (bottom). Sources: SBC Parcel Reports 2017a-b; (DRECP, Figure D-18, Mohave Ground Squirrel Important Areas).

As mentioned previously, the Boron-Kramer Junction area is an MGS KPC where "*significant development in the DFA just north of Kramer Junction and west of U.S. Highway 395 could severely impact a core population center for the MGS and sever a viable north-south linkage between populations, as well as an east-west linkage between populations in the central part of the range*" (CDFW 2019). In consideration of the previous years of MGS conservation investment and MGSCA designation in the area north of Kramer Junction (BLM 2005c, 2006), several prerequisites for renewable energy development and a lease moratorium were established for the North of Edwards DFA in the final DRECP decision (BLM 2016a, 2016b). These prerequisites, listed below, were to be met within five years of DRECP ROD signing, with these options expiring in September 2021:

DFA-BIO-IFS-04: *The DFA in the North of Edwards Mohave ground squirrel key population center is closed to renewable energy applications and any activity that is likely to result in the mortality (killing) of a Mohave ground squirrel until Kern and San Bernardino counties complete county General Plan amendments/updates that include renewable energy development and Mohave ground squirrel conservation on nonfederal land in the West Mojave ecoregion and the CDFW releases a final Mohave Ground Squirrel Conservation Strategy, or for a period of 5 years after the signing of the DRECP LUPA ROD, whichever comes first. If Kern and San Bernardino counties and CDFW do not complete their respective plans within the 5-year period, prior to opening the DFA to renewable energy applications and other impacting activities, BLM will assess new Mohave ground squirrel information, in coordination with the CDFW, to determine if modifications to the DFA or CMAs are warranted based on new Mohave ground squirrel information*.

DFA-BIO-IFS-5: *Once the planning criteria in CMA DFA-BIO-IFS-4, are met, the DFA in the "North of Edwards" Mohave ground squirrel key population center will be reevaluated. If Kern and San Bernardino counties receive Mohave ground squirrel take authorizations from the CDFW through completed Natural Community Conservation Plans or county-wide conservation strategies that address Mohave ground squirrel conservation at a landscape level and include renewable energy development areas on nonfederal land in the West Mojave ecoregion, the "North of Edwards" key population center DFA will be eliminated and the management changed to General Public Lands, as part of adaptive management*.

DFA-LANDS-2: *Development of acquired lands within DFAs is allowed, at the discretion of the BLM California State Director, unless development is incompatible with the purposes of the acquisition and any applicable deed restrictions* (BLM 2016a, 2016b).

In response to a letter to the California BLM Desert District Manager regarding the status of the North of Edwards DFA from Defenders and the Desert Tortoise Council, District Manager Archuleta stated:

"*We* [BLM] *agree that the planning criteria in DFA-BIO-IFS-5 will not be completed by the 5-year deadline, September 15, 2021, making the CMA immaterial. As a result, we have pulled together a team of BLM staff to evaluate new, available information regarding the status and distribution of the Mohave ground squirrel (MGS).*

The team has been reviewing documents the last several weeks and have a series of meetings scheduled to discuss the latest studies and information. Once this internal evaluation is complete, we will begin our coordination with the California Department of Fish and Wildlife (CDFW) as outlined in DFA-BIO-IFS-4. Until this coordination is complete, the North of Edwards DFA will remain closed to renewable energy applications or other impacting activities as directed by DFA-BIO-IFS-4.

1.11 Compensatory Mitigation

Under the DRECP, BLM (2016a, p. 120) requires a 2:1 compensatory mitigation ratio for MGS habitat loss within KPCs on public lands, and a 1:1 compensatory ratio is required for habitat loss elsewhere. This is a significant reduction from previous mitigation requirements within the MGSCA which was at a ratio of 5:1. Fulfillment of this measure can occur through habitat restoration or enhancement or land acquisition. However, no mechanism is in place to dedicate MGS compensation lands to reserve-level MGS conservation. Although the compensation lands are mitigation for MGS habitat loss, these mitigation lands are managed for multiple use and are subject to future human use and development. In addition, there is no mechanism to funnel in-lieu compensatory payments to local BLM offices for use on the ground for management of this habitat for MGS. Further, federal compensatory mitigation requirements are generally less than that required under state-authorized incidental take permitting.

1.12 Expansion of CL-NAWS

The National Defense Authorization Act (2016) resulted in a public land withdrawal and expanded CL-NAWS by approximately 33,000 acres (51.6 mi^2) to support military mission activities (test and evaluation of unmanned systems, miniature munitions, expeditionary/irregular warfare, ground troop training and integrated warfighting capabilities) at sites located within the Cuddeback Range. Specific actions include construction of perimeter fencing; construction of a new access road connecting the Cuddeback Range to the South Range; installation or placement of mobile structures, generators, communications equipment and connectivity to the instrumented targets within the Cuddeback Range; and expeditionary/irregular warfare and ground troop training.

Public lands added to CL-NAWS were previously designated as Planned Wildlife [MGS] Management Area W21 (BLM 1980). The Navy estimated that impacts within the expansion area would total 2,776 acres and that impacts on habitat with no previous human disturbance would total approximately 68 acres. Since the lands added to CL-NAWS was due to federal law, no compensatory mitigation for impacts to MGS habitat was required.

1.13 Other Projects and Activities

Several additional projects and ongoing activities adversely impact habitat on public and private lands within MGS habitat, as described below.

1.13.1 Filming and Photography

Several popular filming locations occur within or are accessed by dirt roads traversing MGS habitat, including Cuddeback Dry Lake, Jawbone Canyon, Dove Spring Canyon and Spangler Hills (BLM 2014b). Other popular filming locations in MGS habitat include Shadow Mountain Road/U.S. Highway 395, Hi-Vista, Red Rock Canyon and Searles Valley; all of which are areas where MGS have been recorded (CDFW 2016a).

Access to Cuddeback Dry Lake, which is not MGS habitat, is by unimproved dirt road from Red Mountain across 10 miles of public land. Film permits for specific locations within MGS habitat are obtained from BLM Field Offices.[3] Additional information on popular filming locations in MGS habitat can be found on the Ridgecrest Area Convention and Visitors Bureau website (Ridgecrest Area Convention and Visitors Bureau 2014). We note this activity in response to the Service's (2011a, p. 62222) statement that no information was found indicating that filming activities occurred within MGS habitat or were likely to occur in the future even though filming was acknowledged to occur in the western Mojave Desert (Service 2011, p. 62222). Since filming activities involve vehicle use on dirt roads to access filming locations, the main threat to MGS is from vehicle strikes causing mortality or injury. The threat posed by vehicle access through MGS habitat to reach designated filming sites is low compared to the intense OHV use that occurs on the same access routes.

1.13.2 Coso Hay Ranch Water Pipeline

In 2009, BLM authorized a nine-mile-long water pipeline through the former MGSCA (BLM 2006, p. 8) to provide groundwater from Rose Valley for the geothermal operation at Coso inside CL-NAWS. All vegetation within a 50-foot zone adjacent to the paved Coso Road was removed along with extensive soil disturbance to prepare the site for installation of the pipeline, resulting in a loss of approximately 33 acres of MGS habitat. Compensatory mitigation for the impacts of the pipeline was previously established under a programmatic impact mitigation plan when the Coso geothermal facilities were constructed within CL-NAWS. The mitigation plan resulted in the removal of cattle grazing within CL-NAWS. Nearly all the impacts of installing the water pipeline were considered temporary due to reclamation requirements. However, Google Earth imagery in 2022 shows the disturbance in the pipeline corridor remains vegetation has not been restored (Figure 22, below).

[3] Contact Elaine Hanson, BLM Ridgecrest Field Office at ehanson@blm.gov; or Joan Patrovsky, BLM Barstow Field Office at jpatrovs@blm.gov for information on past filming permit frequency and limited environmental review procedures for filming generally applied within MGS habitat.

Figure 22. Habitat within the 50-foot Coso Hay Ranch Water Pipeline Right of Way (center diagonal scar) has remained void of perennial vegetation following reclamation treatments implemented in 2009. From 2022 Google Earth Image.

1.13.3 Indian Wells Valley Groundwater Authority Imported Water Pipeline Project

In July 2023, the Indian Wells Valley Groundwater Authority announced it was initiating preparation of an Environmental Impact Report for the proposed water pipeline that would deliver water from the Antelope Valley-East Kern Water Agency to the Indian Wells Valley. The project includes a 24” diameter, 50-mile imported water pipeline, three booster pump stations, and a regulating station starting in California City and terminating at a water storage tank southwest of Ridgecrest within the Indian Wells Valley.

Three booster pump stations and proposed regulation stations would be necessary to pump water over the El Paso Mountains located between California City and Ridgecrest. Approximately 20.6 miles of pipeline would be located on BLM public lands; 29 parcels of private land; 23 parcels owned by either companies or corporations, and seven private conservation parcels; and two parcels located within the Fremont Valley Ecological Reserve owned by CDFW.

The Project area is partly located within three BLM-designated ACECs, 1) El Paso to Golden Valley, Western Rand Mountains, and Fremont-Kramer. These ACECs include habitat for the MGS, and impacts will require the Indian Wells Valley Groundwater Authority to apply for and obtain an Incidental Take Permit from CDFW.

1.13.4 Mining Operations

The Service (2011a, p. 62238) recognized that mining occurs within the range of MGS and results in habitat loss. However, it concluded that only one large-scale mining operation impacted MGS. That operation, Rio Tinto's open pit borax mine at Boron, California, has significantly impacted MGS habitat and has expanded several times in recent years. The open pit mine covers approximately 2,300 acres, not including mine support and infrastructure facilities. Other mining operations that in the past have impacted MGS habitat were not identified or discussed by the Service (2011a, p. 62238).

Mining has contributed to cumulative MGS habitat loss and likely resulted in MGS mortality. Equipment use and material transport during the active MGS season poses a direct MGS mortality threat. BLM's recent 1:1 compensatory mitigation requirement for surface disturbance within MGS habitat, an abandonment of its previous 5:1 compensatory mitigation requirement in MGS conservation areas, and lack of application of collected MGS impact mitigation funding towards MGS conservation, demonstrates that cumulative mining impacts will not be adequately mitigated.

Such authorizations and associated impacts will not achieve a no net loss of habitat and will contribute to MGS mortality over time. Further, we have no information indicating BLM has ever required compensatory mitigation for the loss of habitat from previously authorized stone mining operations in the Rand Mountains, which pose another direct MGS mortality threat from authorized mining operations and heavy truck traffic hauling stone to markets.

BLM (2013b) authorized a 21-acre expansion of pumice mining within MGS habitat in the Coso Range. In this 2013 authorization, BLM formally abandoned the 5:1 compensatory mitigation requirement prescribed in BLM's (2005) WEMO Plan for impacts to high quality MGS habitat and required only a 1:1 compensation ratio for impacted habitat. As an alternative to compensatory mitigation through habitat acquisition and protective management, BLM allows payment of a fee based on current appraised land value. Further, an outdated (2002) land value appraisal as the basis for collecting in-lieu compensation fees of $770/acre and no long-term conservation management fee was collected, which is necessary to ensure the acquired lands are protected in perpetuity.

BLM's 2016 DRECP for public lands reduced compensatory mitigation for disturbance within key MGS population centers and linkages as well as within the designated MGS ACEC (Figure 23) when such disturbance exceeds a 1% cap. A 3:1 compensatory ratio is required for loss of undisturbed habitat and a 1.5:1 ratio is required for loss of previously disturbed habitat. The required compensatory ratio is not sufficient to fully mitigate authorized impacts and facilitate MGS recovery.

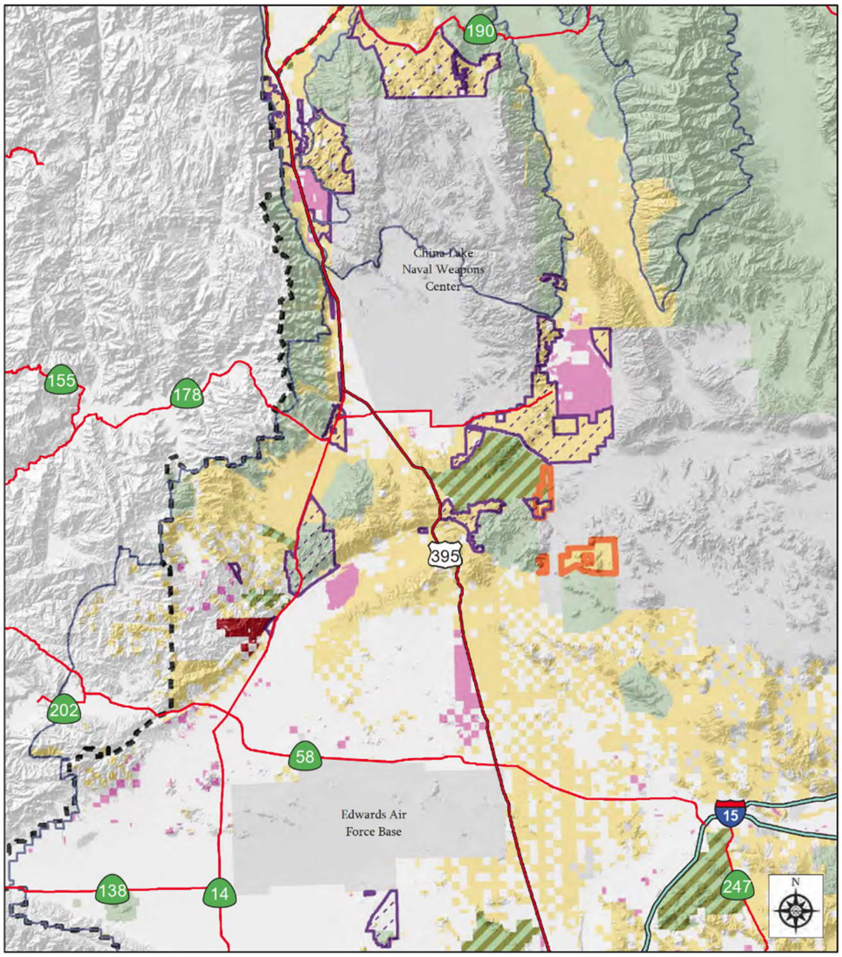

Figure 23. MGS ACEC designated in the 2016 DRECP. ACEC boundaries are shown in purple, and diagonal cross-hatched units have a 1% surface disturbance cap.

MGS mitigation fees collected for compensatory mitigation are deposited in the U.S. Treasury, rather than used locally for MGS protection or to further ACEC plan implementation. No conservation easements are required for any acquired compensatory lands, and such compensatory lands are not removed from public land uses following donation to the U.S. government. BLM (2021) recently approved a 25 acre expansion of the Makayla II Mine within the MGS ACEC in the Coso Range, just outside mapped key population centers and linkages.

BLM (2012d) prepared an EA for surface mining of pozzolan on approximately 34.5 acres of public land near the El Paso Mountains within the former MGSCA (BLM 2006, p. 8). The affected area is within the Little Dixie Wash MGS KPC or Core Population Area (Leitner 2008, p. 22). BLM required MGS habitat impact compensatory mitigation at a ratio of 1:1. This mitigation could be satisfied through in-lieu fees based on an outdated land value appraisal of $770/acre and transferred to the U.S. Treasury rather than used locally for MGS mitigation. As per long-standing BLM practice, no long-term fee for MGS conservation management was required.

Surface mining of stone slabs is currently permitted by BLM at two quarries on the south side of the Rand Mountains within BLM's (2006, p. 8) former MGSCA. Sanford Stone operates a 100-acre quarry, and the Blake Stone Quarry also occurs in this same region. Information on associated MGS habitat impact within the former MGSCA can be obtained from BLM.[4]

A significant amount of recreational gold mining (small-scale, scattered dry wash mining) has occurred and continues to occur within MGS habitat in the Coolgardie Mesa and in the vicinity of Lane Mountain. The Service (2014a) reported on the status of the endangered Lane Mountain milkvetch (*Astragalus jaegerianus*) and analyzed effects of various land use activities, including recreational gold mining. It found there are 22 mining claims covering about 785 acres where various recreational mining clubs conduct dry washing operations for gold. Under BLM's regulations governing mining certain minerals on mining claims, no plan of operations or reclamation is required for recreational mining that does not exceed two acres, which is defined as casual use. Seven of the 22 mining claims had active gold dry washing operations covering approximately 320 acres. Individuals engaged in casual use mining for gold are self-regulating, and there is no required BLM oversight, no mechanism for monitoring and reporting the location and extent of compliance with the BLM's regulations or monitoring the direct and indirect impacts to habitat.

Extensive tungsten mining has also occurred in Atolia-Red Mountain, a crucial MGS linkage habitat, and reclamation of the extensive pits and trenches has not occurred.

1.14 Livestock Grazing

The Service (2011a, p. 62237) noted that livestock grazing occurs in the MGS range and may result in soil and vegetation degradation. The Service suggested there was little information on dietary overlap between livestock and MGS, and maintained there was no data demonstrating negative livestock grazing impacts to MGS. The Service (2011a, p. 62237) concluded:

"…*livestock grazing does not currently pose a threat to the Mohave ground squirrel in relation to the present or threatened destruction, modification, or curtailment of its habitat or range, nor do we anticipate livestock grazing posing a threat in the future*."

However, according to a study of domestic sheep grazing effects on soils and vegetation in the western Mojave Desert (Webb and Stielstra 1979, abstract), domestic sheep grazing:

"…*caused a 60% reduction in the above-ground biomass under creosote bushes (Larrea tridentata), and sheep trampling caused an increase in soil strength and decreased intershrub annual densities 24 and 28% in two areas.*

[4] Contact Randall Porter, Geologist, U.S. Bureau of Land Management Ridgecrest Field Office at rporter@blm.gov.

The average area per individual (cover) of burrobush (Ambrosia dumosa) decreased 16–19% and the cover of spiny hop-sage (Grayia spinosa) decreased 29% under grazing pressure. The volumes of individual Ambrosia were 21 and 65% less in two heavily grazed areas than in two lightly grazed areas; the volume of goldenhead (Acamptopappus sphaerocephalus) was 68% less in one heavily grazed area. These changes indicate that the range quality of the Mojave Desert is deteriorating under sheep grazing pressures. Trampling reduces annual cover and disrupts the soil surface, thus promoting wind erosion. The loss of annual biomass and shrub cover should adversely affect reptiles and rodents by removing food sources and protection. Soil strength increases may retard future growth of annuals, further contributing to erosion and food source losses. Studies should be initiated to determine the long-term effects of grazing in the Mojave Desert."

Livestock grazing leads to deterioration of soil stability and porosity and increases erosion and soil compaction (Fleischner 1994). Livestock disturb biological soil crusts that make underlying soils susceptible to erosion by wind and water, which result in loss of nutrients and, subsequently, reduced plant vigor (Neff et al. 2005).

Grazing affects plant community composition via livestock selection/avoidance of specific plants, as well as through different grazed plant tolerances to herbivory (Szaro 1989, p. 74). Regular grazing reduces the competitive vigor of plants and releases avoided vegetation from competition (Service 2009, p. 2). Plant trampling can also injure vegetation, reducing competitive/reproductive capability (Service 2009, p. 2).

Grazing affects the physical structure of plants (Huntly 1991, p. 477-478); with grazing defoliation altering plant height/canopy cover and plant community composition (Fleischner 1994, p. 630-631). Grazing can decrease flower and seed production directly by consuming reproductive structures, or indirectly by stressing the plant and reducing energy available to develop seeds (Service 2009, p. 2). Grazing also alters wildfire fuel-load characteristics (Service 2009, p. 2). As fire frequency, intensity, and behavior are dictated largely by type, condition, and quantity of vegetation (DiTomaso and Johnson 2006), grazing-altered fuels can change fire-return cycles, fire intensity, and spread patterns (Service 2009, p. 2) resulting in deterioration in MGS habitat condition.

Consequently, livestock grazing can degrade wildlife habitat (Figure 24), particularly if mismanaged (Service 2009, p. 2). Direct grazing impacts include the removal and/or trampling of vegetation that would otherwise be used for wildlife food and cover. Indirect impacts include changes to plant community composition, structure, and productivity, which determine wildlife habitat quality. Decreases in cover can result in a decrease in the diversity and abundance of wildlife in arid ecosystems (Busack and Bury 1974).

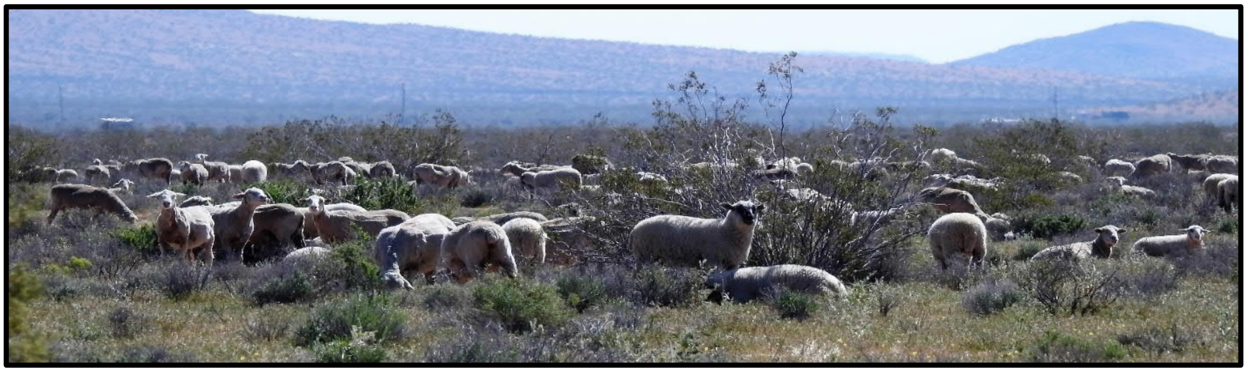

Figure 24. Photographs of domestic sheep grazing impacts within the DTRNA-Fremont Valley MGS KPC (previous page), and livestock impacts upon soil and vegetation in the Tunawee Common Allotment of Rose Valley, within the Coso-Olancha MGS KPC (bottom).

Domestic sheep in the arid West show a strong preference for forbs and shrubs (Hansen et al. 1976, p. 250). A study of sheep grazing at the Kramer Hills study plot in the western Mojave Desert documented that sheep made heavy use of native annual and perennial forbs (i.e., *Machaeranthera, Eriogonum, Dalea, Astragalus, Malacothrix, Erodium, Amsinckia* and *Chaenactis* ssp.), as well as spiny hopsage and other select shrubs (Nicholson and Humphreys 1981, p. 178), all of which are all forb/shrub species heavily relied on by MGS as primary forage (Best 1995, p. 4), and which documented dietary overlap. Per Nicholson and Humphreys (1981, abstract), mean annual plant cover was greatest in non-grazed areas and decreased 41% between April and May, with a 69% decrease in annual plant noted in heavy grazing areas. Annual plant frequency decreased 45% from April to June in the heavy grazing area, while decreasing only 5% in the ungrazed area.

Livestock grazing not only removes vegetative biomass and cover, including those plant species favored by MGS, but causes severe soil compaction (Webb 2002, p. 292) and results in seed bank loss (Brooks 1995, pp. 67–69). Together these magnify plant community changes over time. Livestock can also trample perennial shrubs (Service 1994, p. D19) and annual plants during foraging and bedding, with domestic sheep observed breaking apart shrubs to feed on annual plants, obtain shade and create bedding sites (Nicholson and Humphreys 1981, p. 178). Even short periods of grazing can result in a loss of shrub canopy cover, and disturbed surface strata like vehicle-induced compaction (Arndt 1966; Ellison 1960; Klemmedson 1956, as cited in Service 1994, p. D 19).

Resulting surface disturbance is conducive to subsequent exotic plant establishment and/or spread. In concert with other human uses adversely affecting soils and vegetation, and drought, livestock grazing can be devastating relative to hastening wildlife habitat degradation (Lovich and Bainbridge 1999, p. 312).

Eight domestic sheep allotments (Bissel, Boron, Monolith-Cantil, Cantil Common, Spangler Hills, Shadow Mountains, Buckhorn Canyon and West/Middle Stoddard) are currently active on public lands within the range of MGS (BLM 2005f, p. 2-130 to 2-132). Three additional sheep and cattle allotments (Rudnick[5], Hansen and Tunawee Common) have also been authorized, and the Service (2011, p. 62237) has referenced seven cattle allotments as also occurring within the range of MGS. See Figure 25 for a map of livestock grazing allotments on BLM-managed public lands.

[5] The Rudnick Common Allotment was reduced from 241,000 acres to 13,800 acres in 2020 as mitigation for impacts of solar energy projects within MGS habitat.

Figure 25. Livestock grazing allotments on BLM-managed public lands within the range of MGS. Source: DataBasin, Conservation Biology Institute (2013).

When BLM eliminated domestic sheep grazing in desert tortoise critical habitat located east of Highway 395 in 1994, the number of grazing permit holders using the expansive Cantil Common allotment remained the same. As a result of removing those portions of the allotment in desert tortoise critical habitat, domestic sheep grazing intensity increased significantly within the downsized allotment because the number of sheep authorized remained the same as prior to reduction of the allotment. This intense sheep grazing was especially evident within and surrounding the El Paso Mountains, all of which is within MGS habitat, including the KPC at Little Dixie Wash (J. Aardahl, personal observation).

Combined sheep and cattle grazing in the same area would have a greater adverse impact on MGS forage and habitat than grazing by either species alone. Together, the three common allotments grazed by both domestic sheep and cattle encompass a considerable percentage of MGS range. Allotments are commonly grazed during the critical March to May period when MGS reproduction, young-rearing, juvenile dispersal and weight acquisition needed for aestivation occurs (Gustafson 1993, p. 29), setting the stage for dietary overlap conflict.

In addition to authorized public land livestock grazing, non-permitted livestock grazing also occurs in MGS habitat, both on interspersed/adjacent private lands and within MGS conservation lands where such grazing has been excluded by BLM decisions (Figure 26; T. Egan 2014). Further, while attempts to halt illegal sheep grazing have been made (T. Egan, pers. comm. with B. Jones, CDFW; J. Hohman, Service; and A. Chavez, BLM, 2014), remedial actions to remove trespass livestock are rarely implemented. This was specifically documented in an April 21, 2014 trespass where BLM, CDFW and the Service were notified and unauthorized grazing continued (T. Egan, pers. obs. 2014).

Figure 26. Photographs of domestic sheep grazing impacts upon soil and vegetation on MGS conservation lands east of the Kramer Junction solar project and U.S. Highway 395, north of Kramer Junction, California (T. Egan, pers. obs. 2014). Sheep bands were followed for two days in the spring of 2014, first east of the highway, and then west, north of the Kramer solar project. All ephemeral vegetation was removed, and perennial vegetation was grazed far in excess of 50% utilization domestic sheep over a wide swath of both public and private lands. Perennial vegetation was crushed and defoliated in bedding areas and all vegetation was removed from the vicinity of watering sites.

Monitoring of authorized domestic sheep grazing use is infrequent (T. Egan, pers. obs. 2017), and there is no documentation that MGS habitat degradation associated with either cattle or sheep grazing has been alleviated in any way with the BLM's implementation of public land health standards for livestock grazing, as maintained by the Service (2011, p. 62237). In fact, "*public lands are not really managed for wildlife preservation in any real sense of the word: extensive grazing by sheep and cattle is unmonitored and essentially uncontrolled*..." (Recht 1992, in Gustafson 1993, p. 9).

The U.S. Government Accountability Office (2016, p. 14) found that BLM has kept poor records of unauthorized grazing and are unable to track violation patterns or responses. The frequency and extent of unauthorized grazing on federal lands have been reported as "*largely unknown*" and "*can severely degrade the range under certain conditions, such as drought*" (U.S. Government Accountability Office 2016, p. 12).

Many BLM staff have stated that unauthorized livestock grazing reporting takes them away from higher-priority responsibilities, and that conducting compliance inspections on grazing allotments are not a priority, have limited effectiveness and that some allotments are seldom visited (U.S. Government Accountability Office 2016, p. 22). Penalties for unauthorized grazing are also rarely or never an effective deterrent, with permittees reported to consider unauthorized grazing use penalties as a cost of doing business (U.S. Government Accountability Office 2016, p. 23).

The most substantial soil/vegetation impacts associated with livestock grazing occur in the vicinity of heavy use sites where livestock are watered, bedded down or trailed (Service 1994, p. D20) with vegetation cover loss and species composition shifts evident for many acres around such sites. Domestic sheep watering, bedding and trailing sites also change annually, depending on existing vegetation production, the vagaries of unattended sheep travel, as well as herder preferences on how often to move their mobile water trough sites (T. Egan, pers. obs. 2014).

The degree of livestock grazing impact in an area depends on several factors including soil and vegetation resiliency, stocking rates, season of use, years of use and rest, the introduction/spread of weeds, previous grazing-induced vegetation changes, fire, drought and other land uses (Service 1994, p. D18). Livestock grazing has altered native vegetation, including the reduction of native perennial grasses and shrub composition in the desert (Service 1994, p. D19). In North Africa, livestock grazing has changed desert vegetation composition and altered vegetation is less favorable to rodents (Stubbs 1989b, as cited in Service 1994, p. D18). In areas consistently grazed by sheep in the Mojave Desert, shrub cover of burrobush (*Ambrosia dumosa*), goldenhead (*Acamptopappus sphaerocephalus*) and Mojave aster (*Machaeranthera tortifolia*), and crucial MGS forage shrubs (*Grayia spinosa*, *Lycium andersonii*, and *Krasheninnikovia lanata*), have been substantially reduced (Service 1994, p. D20). Hutchins and Stewart (1953, p. 9 in Holechek et al. 1999) reported the average percent use of all livestock forage across multiple years was 35% and 60% for moderate and heavy grazing intensities, respectively, with up to 55% use of current year growth of *Krasheninnikovia lanata* utilized under moderate winter grazing, and 66% of this crucial MGS forage utilized under heavy grazing.

Grazing, and other surface disturbance as noted previously, promotes weed/exotic plant invasion which in turn enhances the destructive force of wildfires (Service 1994, p. 31), with fires more prevalent where weeds are successfully established, and such fires destroy native shrubs (Service 1994, p. D24), including those utilized by MGS for forage. Once fires occur, opportunities for additional weed invasion increase (Service 1994, p. D24) and can significantly affect the density/biomass of native plant seedlings (Brooks 2000, p. 105).

BLM has the responsibility for identifying appropriate public lands for authorized livestock grazing, setting proper forage utilization levels, and eliminating grazing where incompatible with resource protection. BLM is required to manage livestock grazing on public lands under various federal laws (e.g., FLPMA, Taylor Grazing Act, Public Rangelands Improvement Act), regulations and policies (e.g., 43 CFR 4100/Grazing Administration, Rangeland Health Policy/Manual 4100). However, we found no information that grazing has been reduced in MGS habitat as a result of applying public land health standards (e.g., reduced range stocking in prolonged drought), as asserted by the Service (2011a, p. 62252), or that the adherence to these standards/guidelines will demonstrably improve soils and vegetation for the benefit of long-term MGS conservation. We are also unaware of studies undertaken within grazing allotments by BLM to support specified forage utilization levels within MGS habitats to ensure adequate forage remains to provide adequate nutrients and energy reserves for MGS.

BLM's (2005, p. 2-132) WEMO Plan prescription for sheep grazing relative to MGS included stipulation (LG-24): *To avoid competition between sheep and the Mohave ground squirrel once the ephemeral forage is no longer available and both species rely on perennial forage, all sheep would be removed from the Mohave Ground Squirrel Conservation Area when ephemeral plants are no longer the primary forage being utilized by sheep*."

This prescription has been carried forward and is now part of the BLM's (2016, p. 129) DRECP. Sheep grazing is to be removed from BLM's (2006, p.8) former MGSCA when maximum utilization levels for winterfat (30%), spiny hopsage (25%), four-winged saltbush (*Atriplex canescens*, 25%), shadscale (*A. confertifolia*, 25%) and allscale (*A. polycarpa*, 25%) are met. However, we found no evidence to support that these utilization levels ensure shrub sustainability or provide adequate nutrition for MGS. Further, MGS are reliant on both ephemeral forbs and shrubs, and forage utilization monitoring by BLM on ephemeral vegetation is seldom sufficient, accurate or timely. There is no monitoring of livestock grazing on interspersed private lands. Thus, there is a potential for forage overutilization by domestic sheep at the expense of MGS when such grazing occurs. These factors do not appear to have been considered by the Service (2011a, p. 62237-62237). BLM's (2016, p. 135-136) DRECP also prescribes the following CMAs for livestock grazing:

LUPA-LIVE-7: *Make Pilot Knob, Valley View, Cady Mountain, Cronese Lake and Harper Lake allotments/forage allocations unavailable for livestock grazing and change to management for wildlife conservation and ecosystem function. Reallocate the forage previously allocated to grazing use … to wildlife and ecosystem functions."*

LUPA-LIVE-8: *The following vacant grazing allotments within the CDCA will have all vegetation previously allocated to grazing use reallocated to wildlife use and ecosystem functions and will be closed and unavailable to future livestock grazing: Buckhorn Canyon, Crescent Peak, Double Mountain, Jean Lake, Johnson Valley, Kessler Springs, Oak Creek, Chemehuevi Valley, and Piute Valley.*

LUPA-LIVE-9: *Allocate the forage that was allocated to livestock use in the Lava Mountain and Walker Pass Desert allotments* (relinquished per the U.S. 2012 Appropriations Act) *to wildlife use and ecosystem function and permanently eliminate livestock grazing on the allotments.*

Only the Buckthorn Canyon, Harper Lake, Lava Mountain and Pilot Knob allotment closures are pertinent to MGS conservation. Outside of these areas, livestock use affects MGS, because 1) this species resides in burrows that can be crushed by livestock movement; 2) livestock eat the same plant species as MGS at critical stages of this species' life history (i.e., reproduction/rearing of young, juvenile dispersal and weight gain prior to aestivation); and 3) MGS inhabit lands where livestock use facilitates non-native plant establishment and displacement of native plants.

Summarily, there is a specific dietary overlap between livestock and MGS on forbs and certain shrub species, with a greater reliance by both livestock and MGS on shrub leaves (particularly winterfat) in dry years (Leitner 2006, p. 38). Current livestock use on public lands allows for substantial removal of ephemeral forage and up to 25-30% utilization of perennial shrubs considered crucial to long-term MGS population persistence, and this level of grazing is not sufficiently monitored by BLM on public land grazing allotments. There is little to no management of livestock grazing on private lands relative to MGS conservation. There is no evidence that BLM regularly removes livestock at or prior to a 25-30% forage utilization threshold in drought years, minimizes livestock grazing impact on MGS habitat, or enforces any grazing restrictions beneficial to MGS conservation. Because the western Mojave Desert has been in a long-term drought for the past several years, overutilization of forage by livestock has likely been ongoing during this period at the expense of MGS nutrition, which affects reproduction (MGS suspend reproduction in drought years) and, when there is reproduction, dispersing juveniles need sufficient nutrition to survive their first year.

1.15 Military Installations

Impacts to MGS habitat on military installations include facility construction, operation and maintenance; development of support facilities; and field maneuvers. Installation developments have substantially affected valley habitat (Service 1994, p. D24). The Service (2011a, p. 62241) identified 37.2% of MGS range occurs within the boundaries of the NTC-Fort Irwin, EAFB and CL-NAWS. The Service (2011a, p. 62248) further noted that 8.2% of these lands are intensively used for military operations, with some areas severely impacted.

We found there is considerable facility and operational development at all three installations, which preclude MGS use of formerly suitable habitat and severely limits MGS movement between KPCs. Significant acreage within these installations also does not contain suitable habitat or is substantially degraded relative to long term MGS conservation.

The Service (2011a, p. 62228-62229) provided little supporting documentation on the percentage of suitable MGS habitat acreage in these installations occupied by the species, or whether crucial linkage corridors are compromised by severely impacted habitat. Further, in areas where development is restricted, military training and testing are the primary mission activities rather than long-term MGS conservation, as indicated by the Service's mapping (2011a, Figure 7). Conservation areas and actions for federally listed species have been identified, but not for MGS, with long-term conservation of this species not currently assured.

The Service (2010, p. 22069) has asserted that military installations within MGS range have implemented INRMPs that address MGS and "*implement actions to manage for the species*." However, in our review of past IMRMPs, we found no programs or specific actions for managing MGS that address long-term MGS conservation, and no conservation lands designated to specifically protect MGS habitat, including those MGS habitat lands designated as crucial to the species by CDFW.

1.15.1 NTC-Fort Irwin

Within NTC-Fort Irwin, MGS have been reported only from large valleys with fine to medium-textured soils vegetated with creosote, shadscale, or alkali sink scrub (U.S. Army 2006) in the far Western Expansion Area (Charis 2003, p. 4-39; ITS 2006, p. 63; U.S. Army 2016, p. 3-25), soon to be activated for training. Substantial portions of Fort Irwin do not contain MGS habitat, including the Cantonment Area, dry lakes and higher elevations. MGS have previously been recorded at Goldstone; Nelson, Bicycle and Drinkwater Lakes; Lucky Fuse and Lizard Gulch (U.S. Army 2006). However, MGS have not been detected in these areas recently, including east of the Gary Owen impact area or on the Goldstone Complex (U.S. Army 2016, p. 3-25). Fort Irwin training areas comprise about 360,500 acres of MGS habitat or roughly 7.4% of the species' range (Wilkerson and Stewart 2005, p. 20). Krzysik (1991, p. 29) noted heavy shrub losses and MGS habitat disturbance at NTC-Fort Irwin associated with vehicle use and bombing areas. Tank maneuver areas and long-term bombing targets established and upgraded by the U.S. Air Force (ITS 2006, p. 63) in the Leach Lake Tactical Range have likely rendered potential MGS habitat unsuitable.

No mitigation was identified to reduce the impact of training activities on MGS associated with the expansion of NTC-Fort Irwin into MGS habitat "[b]*ecause the Mojave ground squirrel is not federally listed.*" (Charis 2003, p. 4-39). Conservation areas have been identified corresponding to critical habitat for the federally listed desert tortoise and Lane Mountain milkvetch (*Astragalus jaegerianus*), but MGS conservation areas have not been identified (U.S. Army 2016, p. 3-18) because the species is not federally listed. The Army is also proceeding with plans to initiate large-scale military training activities in the Western Training Area (U.S. Army 2020), previously designated as Crucial MGS Habitat and Planned Wildlife [MGS] Management Area W22 (BLM 1980), further endangering remaining MGS populations and habitat.

1.15.2 EAFB

EAFB is comprised of approximately 308,000 acres of federal land in the western Mojave Desert and is the Air Force's primary facility for flight and ground testing of all aircraft, weapons systems, software and components. EAFB is home to the Air Force Flight Test Center.

Considerable portions of EAFB are unsuitable MGS habitat, including installation facilities, Rosamond and Rogers Dry Lakes (U.S. Air Force 2002). However, a persistent MGS population has been documented (Leitner 2008, p. 23; 2015b, p. 14) with suggested population stability (U.S. Air Force 2015, p. 4-21). Surface disturbance minimization requirements have been cited as the primary reason for this MGS population persistence. However, the U.S. Air Force noted:

"*...protection of non-listed species is not mandatory on Federal installations*" (2002, p. 6-4); and

"*While there are several species of interest at Edwards AFB, there is only one listed resident species with legally required management mandates: the desert tortoise (Gopherus agassizii)*" (2015, p. 3-16).

1.15.3 CL-NAWS

Military activities at CL-NAWS include research, development, acquisition, test, and evaluation of weapons systems for the Navy on the 1.1 million acres that comprise the installation. CL-NAWS was recently expanded to include the Cuddeback Range where test and evaluation of unmanned systems, miniature munitions, expeditionary/irregular warfare, ground troop training, and integrated warfighting capabilities at test sites will be located.

The southern half of the North Range (i.e., Mainside, Armitage Airfield, Ordnance Testing and Propulsion Laboratories) has also been highly developed (Naval Air Weapons Station and BLM 2004, p. 3.1-6 to 3.1-12). MGS habitat disturbance has also occurred in the Coso Geothermal Resource Area, and at least 7,000 acres of the installation has been impacted to varying degrees at target and test sites (Naval Air Weapons Station and BLM 2004, p. 3.1-11), particularly in the Coso target unit of the North Range.

Portions of the South Range in the Randsburg Wash Unit (i.e., Echo Range Mainsite, Landing Strip, Gun Line Road, Charlie Airfield) have also been developed. Considerable MGS habitat impacts have also occurred in the Superior Valley Target Range. Installation lands are dedicated to meeting the evolving U.S. Navy and Department of Defense readiness missions, including properties held in fee simple title and those withdrawn from the public domain (Naval Air Weapons Station and BLM 2004, p. 3.1-1 to 3.1-18). Operations are sited in previously disturbed areas to minimize overall land use effects.

Planning has been completed and specific conservation areas corresponding to designated critical habitat have been established for federally listed species, such as the endangered Mojave tui chub (*Siphateles bicolor mohavensis*), threatened desert tortoise, and threatened Inyo California towhee (*Pipilo crissalis eremophilus*). While no MGS conservation areas have been designated, the Coso Geothermal Resource Area and the conservation area designated for the desert tortoise (Naval Air Weapons Station and BLM 2004, p. 3.4-18) benefit MGS conservation.

1.16 Transportation Infrastructure

Numerous paved roads and highways are located within occupied MGS habitat including U.S. Highway 395, and State Routes 14, 18, 58, 138, 178 and 190. Of these, high-volume vehicle traffic is associated with U.S. Highway 395, and State Route 14 and 58. Average daily traffic volume within the range of the MGS for year 2020 is as follows[6]: U.S. Highway 395/7,700; State Route 14/5,900; and State Route 58/14,400.

Paved roads and highways are subject to ongoing routine maintenance (repaving, lane painting and shoulder clearing), and lane expansion in response to congestion due to high traffic volume (e.g., U.S. Highway 395, and State Routes 14 and 58).

Roads negatively affect biotic integrity (Trombulak and Frissell 2000, abstract). Roadways significantly impact MGS habitat through habitat loss and fragmentation, as well as facilitate non-native plant growth (Service 2011b, p. 71). Wider roads may also pose a physical or behavioral movement barrier.

Although radio-collared MGS have traversed 4-lane highways, these crossings are made at considerable mortality risk (P. Leitner, in Wilkerson and Stewart 2005, p. 22). In 1998, LaRue observed a juvenile MGS crushed on National Trails Highway (BLM 2005a, p. 3-162), and both Leitner (2005; CDFW 2016a, CNDDB Occ. 447) and Threloff (2007, *in litt.*, cited by Service 2011, p. 62249) have noted road mortality on State Route 190. Both State Route 58 and U.S. Highway 395 have resulted in significant MGS habitat loss and fragmentation. State Routes 14, 18, 138 and 178 have also contributed to MGS habitat loss and fragmentation. Negative highway impacts include MGS mortality and adjacent habitat degradation (BLM 2003, p. 30; Service 2011a, p. 62226; Wilkerson and Stewart 2005, p. 22).

[6] https://dot.ca.gov/programs/traffic-operations/census

Roadside trash and roadkill attract common raven (*Corvus corax*) and other potential MGS predators. Ravens specifically have been suggested as a potential MGS predator (Harris and Leitner 2005, p. 190). This avian species increased in the western Mojave Desert by as much as 795% from 1968-2004 (Boarman and Kristan 2006, p. 2) and has continued to increase in subsequent years.

Certain MGS forage plants occurring on highway shoulders (i.e., Russian thistle) may attract MGS, potentially to their detriment. Wilkerson and Stewart (2005, p. 22), using an impact zone analysis for State Routes 14 and 58, and U.S. Highway 395 inferred that 163,000+ acres of MGS habitat are potentially impacted, equal to 3.3% of the species' range. The Service (2011a, p. 62228) concluded that MGS habitat loss and roadway mortality, as well as future State Route 58 and U.S. Highway 395 expansions and realignments (Caltrans 2014a, Figures 3.1.3-1 & 2), do not pose a significant MGS threat relative to the destruction, modification, or curtailment of MGS habitat and range. The Service's rationale was that there are few major highways within the MGS range and that future projects would not affect MGS KPCs. No mention was made in this conclusion how MGS habitat linkage would remain functional.

The number of existing and proposed highways, as well as the density of other high-use roadways in specific portions of the MGS range, impede MGS movement. Garland and Bradley (1984, p. 53) noted vehicle traffic is a source of small mammal mortality and inhibits movement and suggested rodents may be attracted to desert roadsides.

Major roadways are associated with all MGS KPCs, even if these highways do not specifically bisect them. Further, U.S. Highway 395, and State Routes 58, 14 and 178 potentially act as population sinks (Pulliam 1988, abstract; Delibes et al. 2001, abstract). Roadways, together with other habitat losses and anticipated climate change vegetation shifts, cumulatively pose a significant threat to MGS population connectivity.

Per the Service (2010, p. 62226), roads and highways may result in direct MGS mortality from vehicle collisions, barriers to movement, and habitat loss. Roads can be a barrier to small mammals when mortality rates, road widths or traffic volume are high (Foreman et al. 2003, p. 130-132, 350); particularly with multiple lanes or other barriers in place.

Researchers have noted reduced flow restriction in small mammals and population fragmentation may follow increases in traffic volume, highway width, and time (Oxley et al. 1974, abstract). Most highways in MGS habitat have high traffic volume with multiple lanes, and few bridges or culverts in place due to level terrain. Other barriers (i.e., median dividers, tortoise exclusion fencing) occur on some of these highways, notably on State Route 58 and U.S. Highway 395. Traffic has drastically increased on the latter highways in recent years (T. Egan, pers. obs. 2017), and both highways have been expanded several times. Most recently, Caltrans (2015, p. 4-6) approved a State Route 58-U.S. Highway 395 highway interchange at Kramer Junction and a single 4 mile-length improvement project on U.S. Highway 395 (Caltrans 2016, p. 5). Both projects resulted in wider highways, and permanent loss of 48.57-acres of MGS habitat for the U.S. Highway 395 project (Caltrans 2016, p. 2-132). U.S. Highway 395 is designated a High Emphasis Focus Route, and a four-lane expressway is planned from Olancha to Cartago, along with additional lanes and shoulder widening from the San Bernardino / Kern County line to Lee Vining (Caltrans 2014b, p. 19-20). Traffic volumes on both U.S. Highway 395 and State Route 58 are expected to continue increasing in the future (Caltrans 2015, p. 3).

Habitats adjacent to major roadways have been disturbed in many locations by construction and facility maintenance within linear utility corridors (Boarman 2002, p. 56), with future renewable energy development expansions anticipated. These roadways are subject to disturbance and harvest of vegetation (LaRue and Dougherty 1999; Olson 1996, as cited in Service 2011b, p. 19). Such disturbance increases the potential for vehicle-related MGS mortality, habitat degradation and widening of potential MGS movement barriers.

While MGS movement across certain roadways likely occurs, successful MGS crossings likely decrease as road width, network density and other habitat disturbance increases. Small mammal road crossings have been found to be inversely related to road width in some areas (Barnett et al. 1978, p. 282), with larger roads sometimes severely restricting movement (Oxley et al. 1974, abstract). MGS movement capability between KPCs is threatened throughout most of its range due to high roadway density and large width thresholds have been exceeded. However, most ecological systems display a lag between the time when habitat degradation takes place and full impact realization (Foreman et al. 2003, p. 134). Road effects show such a lag response because the extent of animal mortality and habitat loss, as well as reductions in habitat quality and connectivity, occur at different rates. When dispersal between populations is hindered, the probability of local population extirpation increases.

Reduced animal movement through the landscape results in unoccupied habitat, and low landscape connectivity does not facilitate reoccupation of suitable habitats (Foreman et al. 2003, p. 129). The isolation of suitable habitat islands is not only dependent on the distance from the population source area, but also on the characteristics of the adjacent landscape (Knaupen et al. 1992, abstract). While the additive effect of multiple linear developments (i.e., roads, powerlines, pipelines, aqueducts) as MGS movement barriers may not be fully understood, conclusions that these features do not contribute to MGS population isolation are unsound. Transportation infrastructure and linear developments, urban areas, renewable energy developments and military installations sever crucial MGS movement linkages. Rocky habitat, playas and higher elevation lands additionally serve to isolate core MGS populations when interspersed with today’s level of human development.

1.16.1 State Route 58 and Habitat Fragmentation

State Route 58 in the past was a somewhat porous barrier to MGS movement between Harper Lake Road-Helendale Road west to Boron. It was retrofitted with tortoise-exclusion fencing and expanded in the 1990s, effectively separating southern and northern MGS populations. State Route 58 expansion work was again completed in 2020 at Kramer Junction, with a more complete barrier to north-south MGS movement established. The parallel railroad track and old highway were retained north of the expanding commercial hub. There are no north-south culverts or effective MGS travel linkages across the relatively flat terrain that State Route 58 traverses in the immediate vicinity of Kramer Junction with its heavy commercial truck traffic. Few effective habitat linkages exist across State Route 58 to the west as far as North Edwards, north of Rogers Dry Lake on EAFB, which likely serves as an MGS travel barrier. Further, additional solar development north/south of State Route 58, and Rio Tinto Mine expansion north of State Route 58, are planned.

Regular surface disturbance and vegetation removal associated with railroad and pipeline operations and maintenance immediately north of State Route 58 at Kramer Junction to points east and west constricts potential north-south MGS linkage movement opportunities even further. Additional pipeline activities also occur south of State Route 58 between Kramer Junction and Harper Lake Road-Helendale Road to the east. A few minimal width north-south culverts cross the multiple-lane State Route 58 here, however, while MGS is known from the vicinity of Harper Lake Road north of State Route 58, few MGS occurrence records are known immediately south of the highway. Even fewer MGS records are known from north and south of State Route 58 east of Harper Lake Road to Barstow.

1.17 CDFW's Conservation Strategy for MGS (CDFW 2019)

CDFW Director Charlton Bonham in introducing the MGS conservation strategy, stated:

"*In 2018, the Legislature passed Senate Bill 473, which, among other changes, amended the California Endangered Species Act to authorize the Department of Fish and Wildlife to develop and implement non-regulatory recovery plans for the conservation and survival of threatened and endangered species. This conservation strategy serves as an important first step in achieving that goal by outlining a multifaceted approach to conservation and recovery of the species.*"

The MGS Conservation Strategy provides guidance on MGS conservation and recovery:

- Assesses the conservation status of the MGS;
- Identifies achievable objectives intended to ensure the continued existence of the species; and
- Provides conservation measures that may realistically be implemented to achieve the objectives.

Per CDFW, habitat loss is the greatest known cause of MGS decline and has led to a reduction of the species' range and a decrease in dispersal opportunities (Gustafson 1993). Habitat loss has resulted from urban and rural development, agriculture, military operations, energy development, transportation infrastructure and mining. Other CDFW-reported major MGS threats include habitat degradation and habitat fragmentation, OHV use, grazing, commercial filming, recreational activity and pesticide and herbicide use can cause degradation of habitat (Service 2011, Fed. Reg. 76:62214). Importantly, "*lack of contiguous habitat decreases the species' ability to persist during drought*" (CDFW 2019).

The following actions have been recommended by CDFW (2019) to achieve the overall conservation goals of long-term MGS habitat protection and species' viability:

- *Identify and prioritize habitat protection and restoration areas*;
- *Protect habitat in currently known CPAs (Core Population Areas)* [Core Population Areas]*, PPAs (Peripheral Population Areas)* [Peripheral Population Areas]*, and linkages*;
- *Protect habitat in PPAs, Linkages, and areas where remnant populations may exist to ensure unique genotypes are conserved and opportunities for genetic exchange occur throughout the MGS geographic range*;
- *Mitigate impacts to MGS habitat quality for ground-disturbing projects*;
- *Reduce the impact of agriculture on MGS habitat*;
- *Monitor and minimize impacts of recreational activities to MGS habitat*;
- *Develop a recovery plan for MGS that includes recovery goals or targets that, if achieved, would help ensure the long-term viability of the species*;
- *Implement an MGS recovery plan*;
- *Integrate protection and enhancement of MGS habitat into land use planning decisions*;
- *Develop and implement standard practices and measures during the environmental review and implementation of CEQA and NEPA projects that may impact MGS*;
- *Encourage development to occur in areas where habitat value is already substantially diminished*;
- *Assess potential effects of climate change on MGS*;
- *Plan and implement climate adaptation strategies to minimize the impacts to MGS*;
- *Evaluate MGS population trends for decisions in conservation planning and habitat protection*;
- *Where trends suggest population decline, evaluate and adjust conservation actions*;
- *Evaluate and improve reporting process for CEQA and NEPA projects*;
- *Use information from captive propagation, reintroduction, and translocation pilot programs to inform management decisions*.

Unfortunately, recommended actions in the conservation strategy have yet to be reflected in county general plans and there is no indication BLM proposes to amend the DRECP based on the CDFW's MGS Conservation Strategy. Although we anticipate that the Service may conclude that completion of the CDFW's MGS Conservation Strategy will contribute to reasons why the MGS should not be federally listed as Threatened, we note that the completion of the federal recovery plan for the desert tortoise in 1994 and revised in 2011 has not resulted in reversing declines of the Threatened desert tortoise throughout the listed population.

A Regional Conservation Investment Strategy (RCIS) covering the Antelope Valley portion of Los Angeles County has recently been approved, and San Bernardino County is preparing a RCIS that includes the desert region. Both these RCISs include MGS as a focal species for future conservation on a voluntary basis for development projects that require compensatory mitigation through CDFW's incidental take requirements for impacts to state-listed species, including MGS. As noted previously, Kern County has stated it has no intention of amending its general plan for MGS conservation and has shown no interest in preparing a RCIS for the desert region of Kern County where MGS occurs.

1.18 Joshua Tree (*Yucca brevifolia*) California Endangered Species Act Listing Petition

A petition to list the western population of the Joshua tree under CESA (Center for Biological Diversity 2019) was accepted by the California Fish and Game Commission on September 22, 2020, and the species was approved as a candidate for listing for a period of one year:

"*On October 21, 2019, the Fish and Game Commission (Commission) received a petition from the Center for Biological Diversity to list the western Joshua tree (Yucca brevifolia; WJT) as threatened under the California Endangered Species Act (CESA). California Fish and Game Code (F&G Code) Section 2073.5 requires that the California Department of Fish and Wildlife (Department) evaluate the petition and submit a written evaluation with a recommendation to the Commission, which was received at the Commission's April 2020 meeting*."

"*CESA, and case law interpreting it, make clear that the Commission must accept a petition when the petition contains sufficient information to lead a reasonable person to conclude that there is a substantial possibility the requested listing could occur*."

"*Based upon the information contained in the petition and other relevant information, the Department* [California Department of Fish and Wildlife] *determined in its 90-day evaluation that there is sufficient scientific information available to indicate that the petitioned action may be warranted*."

"*On September 22, 2020, the Commission determined that listing may be warranted pursuant to F&G Code Section 2074.2. Western Joshua tree became a candidate species under CESA, effective upon publication of the notice of findings on October 9, 2020. Pursuant to F&G Code Section 2074.6, the Department will undertake a one-year status review. After the Commission receives the Department's status review, the Commission will make a final decision on listing. Candidate species are protected under CESA pursuant to F&G Code Section 2085 during the remainder of the CESA listing*" (California Fish and Game Commission [CFGC] 2020b).

This petition followed an ESA petition (Wild Earth Guardians 2015) on the Joshua tree in which the Service determined that listing was not warranted. However, the Service identified the western population of Joshua tree as a component in certain MGS habitat (Service 2011, p. 62221) and that creosote bush scrub is a preferred MGS habitat. While some MGS populations occupy areas where the slow-growing Joshua tree is absent, much high-quality MGS habitat supports scattered Joshua trees. Like MGS, the predicted effects of climate change in the western Mojave Desert pose a distinct threat to the western population of Joshua tree:

"*Climate change represents the single greatest threat to the continued existence of Yucca brevifolia. Even under the most optimistic climate scenarios, western Joshua trees will be eliminated from significant portions of their range by the end of the century; under warming scenarios consistent with current domestic and global emissions trajectories, the species will likely be close to being functionally extinct in the wild in California by century's end (Dole et al. 2003; Cole et al. 2011; Sweet et al. 2019*)" (CBD 2019).

"*Even in the absence of climate change, the convergence of factors necessary for recruitment results in successful establishment of new seedlings only a few times in a century. Such recruitment has already largely stopped at the drier, lower limits of the species' range. Prolonged droughts, which are projected to occur with greater frequency and intensity over the coming decades, will not only preclude recruitment across ever-greater areas of the species' range, but will lead to higher adult mortality, either directly due to temperature and moisture stress or indirectly due to increased herbivory from hungry rodents lacking alternative forage*."

"*Whether or not the species' pollinating moth will be able to keep pace with a changing climate is highly questionable. The Joshua tree's ability to colonize new habitat at higher elevations or latitudes is extremely limited and no such range expansion is yet occurring, even as the lower elevation and southern edge of its range is already contracting. And there is no safe refuge, as the higher elevation areas in which Joshua trees are projected to best be able to survive increasing temperatures and drying conditions are at great risk of fire due to the prevalence of invasive non-native grasses*."

"*Absent rapid and substantial reductions in GHG emissions and protection of habitat, the species [western Joshua tree] will likely be extirpated from all or most of California by the end of the century. In addition to climate change and fire, the western Joshua tree is threatened by habitat loss and degradation from other human activities*." (CBD 2019).

The CDFW and the CFGC have determined the listing of western Joshua tree under CESA may be warranted. Considering Joshua tree woodland is one of several plant communities occupied by MGS (CDFW 2019, p. 30), the implications of identified threats, any reductions of Joshua trees within remaining occupied MGS habitat will contribute to MGS endangerment.

1.19 California Endangered Species Act Listing Petition for the Desert Tortoise

A petition to change the status of the state-listed Threatened desert tortoise to Endangered under CESA was received by the California Fish and Game Commission (CFGC) (2020c), reviewed and concurred by CDFW (2020) and then subsequently approved by the CFGC as a candidate species for endangered status at its October 14, 2020, meeting. Due to the substantial overlap of desert tortoise with occupied MGS habitat, this petition and the CFGC and CDFW are relevant to MGS:

"*Defenders of Wildlife, the Desert Tortoise Council, and the Desert Tortoise Preserve Committee (Petitioners) submitted a petition (Petition) to the Fish and Game Commission (Commission) to change the status of Mohave desert tortoise (Gopherus agassizii) from threatened to endangered under the California Endangered Species Act (CESA).*"

"*The purpose of the Petition Evaluation is to assess the scientific information discussed and cited in the Petition in relation to other relevant and available scientific information possessed or received by the Department during the evaluation period and to recommend to the Commission whether the scientific information in the Petition is sufficient under the criteria prescribed by CESA to accept and consider the Petition to list Mohave desert tortoise as endangered.*"

"*After reviewing the Petition and other relevant information, the Department determined the Petition meets the requirement in Fish and Game Code section 2072.3 that it include sufficient scientific information to indicate the petitioned action may be warranted.*"

"*Specifically, the Department determined:*

- *The information in the Petition is sufficient to indicate the Mohave desert tortoise population in California has declined substantially from historical levels and has continued to trend downward since the species was listed as a threatened species by the Commission in 1989.*

- *Information in the Petition and otherwise available to the Department indicates the geographic range of the Mohave desert tortoise in California has not substantially changed since the early 1900s; however, some changes in its distribution within the range have occurred in recent years.*

- *The Petition provides sufficient information to indicate substantial reductions in Mohave desert tortoise abundance have occurred in large areas of their range, and that the abundance has continued to decline since the species was listed as threatened in California in 1989.*

- *The Petition provides sufficient information on the life history of the Mohave desert tortoise.*

- *The Petition presents sufficient information on Mohave desert tortoise habitat requirements.*

- *The Petition presents a list of the factors that affect the survival and reproduction of the Mohave desert tortoise, including land uses (ranching, mining, agriculture, urbanization, military operations, transportation networks, recreation, and utility corridors), weather impacts (storms, drought, availability of natural water), predation from artificially high predator populations, and factors associated with climate change.*

- *The Petition describes the degree and immediacy of threats to the continued existence of Mohave desert tortoise in California.*

- *The Petition describes land ownership and includes a cursory discussion of land management practices by ownership within designated Mohave desert tortoise Critical Habitat Units.*

- *The Petition includes potential monitoring suggestions, management actions, and additional protective measures that would benefit Mohave desert populations.*

- *The Petition provides internet links to three distribution maps for Mohave desert tortoise in California.*

- *Numerous scientific references were cited in the Petition and listed in Petition Attachment 4 – Literature Cited. In completing its Petition Evaluation, the Department has determined the Petition provides sufficient scientific information to indicate that the petitioned action to change the status of the Mohave Desert Tortoise from threatened to endangered may be warranted. Therefore, the Department recommends the Commission accept the Petition for further consideration under CESA*" (California Department of Fish and Wildlife 2020a).

A 5-year status report prepared by the Service (2021) on the status of the threatened desert tortoise, where impacts to the species' habitat in the western Mojave Desert were identified as severe, followed acceptance of the CESA petition submittal:

"*The threats described in the listing rule and both recovery plans (Service 1994, 2011) continue to affect the species. The most apparent threats to the desert tortoise are those that result in mortality and permanent habitat loss across large areas, such as urbanization and large-scale renewable energy projects and those that fragment and degrade habitats, such as proliferation of roads and highways, off-highway vehicle activity, wildfire, and habitat invasion by non-native invasive plant species.*"

"*We remain unable to precisely quantify how particular threats affect desert tortoise populations relative to other threats. The assessment of the original recovery plan emphasized the need for a better understanding of the implications of multiple, simultaneous threats facing desert tortoise populations and of the relative contribution of multiple threats on demographic factors (i.e., birth rate, survivorship, fecundity, and death rate; Tracy et al. 2004).*"

"*The vast majority of threats to the desert tortoise or its habitat are associated with human land uses. Using captive neonate and yearling desert tortoises, Drake et al. (2016) found that individuals 'eating native forbs had better body condition and immune functions, grew more, and had higher survival rates (>95%) than (desert) tortoises consuming any other diet'; health and body condition declined in individuals fed only grasses (native or non-native).*"

"*Current information indicates that invasive species likely affect a large portion of the desert tortoise's range. Furthermore, high densities of weedy species increase the likelihood of wildfires; wildfires, in turn, destroy native species and further the spread of invasive weeds.*"

"*Since the completion of the 5-year review, the Service has issued several biological opinions that affect large areas of desert tortoise habitat because of numerous proposals to develop renewable energy within its range. These biological opinions concluded that proposed solar plants were not likely to jeopardize the continued existence of the desert tortoise* *primarily because they were located outside of critical habitat and areas of critical environmental concern designated by the Bureau that contain most of the land base required for the recovery of the species*."

"*The acquisition of private lands as mitigation for most of these actions increases the level of protection afforded these lands; however, these acquisitions do not create new habitat and federal, state, and privately managed lands remain subject to most of the threats and stresses we discussed previously in this section*."

"*Therefore, the conversion of habitat into areas that are unsuitable for this species continues the trend of constricting the desert tortoise into a smaller portion of its range*."

"*As the Service notes in the 5-year review (Service 2010), "(t)he threats identified in the original listing rule continue to affect the (desert tortoise) today, with invasive species, wildfire, and renewable energy development coming to the forefront as important factors in habitat loss and conversion*."

"*Climate change is likely to affect the prospects for the long-term conservation of the desert tortoise. For example, predictions for climate change within the range of the desert tortoise suggest more frequent and/or prolonged droughts with an increase of the annual mean temperature by 3.5 to 4.0 degrees Celsius. The greatest increases will likely occur in summer (June-July-August mean increase of as much as 5 degrees Celsius [Christensen et al. 2007]). Precipitation will likely decrease by 5 to 15 percent annually in the region; with winter precipitation decreasing by up to 20 percent and summer precipitation increasing by up to 5 percent. Because germination of the desert tortoise's food plants is highly dependent on cool- season rains, increasing temperatures and decreasing winter precipitation could reduce the forage base*."

"*Although drought occurs routinely in the Mojave Desert, extended periods of drought have the potential to affect desert tortoises and their habitats through physiological effects to individuals (i.e., stress) and limited forage availability. To place the consequences of long-term drought in perspective, Longshore et al. (2003) demonstrated that even short-term drought could result in elevated levels of mortality of desert tortoises. Therefore, long-term drought is likely to have even greater effects, particularly given that the current fragmented nature of desert tortoise habitat (e.g., urban and agricultural development, highways, freeways, military training areas, etc.) will make recolonization of extirpated areas difficult, if not impossible*."

"*As noted in the 5-year review and revised recovery plan for the desert tortoise (Service 2010, 2011), critical habitat of the desert tortoise is subject to landscape-level impacts in addition to the site-specific effects of individual human activities*."

Like the western Joshua tree, the CDFW and the CFGC determined that endangered listing under CESA may be warranted for the desert tortoise to reflect the current dire situation the species is in today, with its populations occurring within the westernmost critical habitat units (also MGS habitat) declining more rapidly than in other tortoise critical habitat units. Considering the implications of documented tortoise threats and impacts as identified in the recent 5-year review (Service 2021), these same factors apply to MGS and its habitat where the two species' ranges overlap.

2.0 Factor D. Inadequacy of Existing Regulatory Mechanisms

Much of the remaining occupied MGS habitat occurs on federal land managed by the BLM, Army, Navy, and Air Force. The remainder occurs on private lands, with lesser amounts on state parks and the Kern County Onyx Ranch SVRA.

MGS conservation measures previously adopted by BLM on public lands have not been implemented as intended, nor have MGS impacts been substantially eliminated or reduced from federal lands where the species occurs. Private land project permitting by local governments is ongoing with no long-term MGS conservation areas established. However, if project applicants seek incidental take permits from CDFW for impacts to MGS, compensatory mitigation fees are typically collected by CDFW and used for habitat conservation.

Some previous conservation measures approved for public lands have been eliminated following subsequent plan amendments, such as the BLM's (2016a-b) DRECP, where pressure was placed on BLM to designate additional lands for renewable energy development. As a result, the MGSCA was removed, contributing to cumulative lack of protection for the past 40 years

"*There is little specific management consideration given to the species* [MGS] *on Federal lands sufficient to provide benefit over the long term*" (Gibbons 1992, in Gustafson 1993, p. 9).

Addendum No. 3 to the Master Memorandum of Understanding between the BLM and CDFW (1993) for notification of potential MGS impacts associated with actions permitted on public lands and the application of specific mitigation, was finalized, but is not currently followed by either the BLM's Barstow or Ridgecrest Field Offices for land use activities that adversely affect MGS. The recently approved MGS Conservation Strategy (CDFW 2019) has been finalized, but specific MGS conservation measures have not been adopted by local, county or federal entities when updating general plans, or in permitting surface disturbance on private lands located adjacent to federal lands. Nor has the CDCA Plan or DRECP Amendment been revised to implement the MGS Conservation Strategy.

2.1 BLM

<u>West Mojave and DRECP Plan Amendments.</u> The Service (2011a) repeatedly refers to the BLM's 2005 MGS conservation measures in effect for public lands, including appropriate vehicle use and livestock management, both of which, as indicated herein, are inadequate. The Service (2011a, p. 62243) also detailed a required compensatory mitigation ratio of 5:1 for authorized MGS habitat loss within the MGSCA (BLM 2006, p. 1, 8 and 17; Figure 27) and 1:1 elsewhere. This measure is no longer in effect. Further, BLM noted in a 2007 EA and 2013 ROD (BLM 2013b) that its adopted

WEMO plan Alternative B required a 5:1 compensatory ratio inside desert tortoise Desert Wildlife Management Areas (DWMAs) and a 1:1 ratio outside these areas, unless the area was heavily disturbed, for where a smaller ratio or no compensation would be applied.

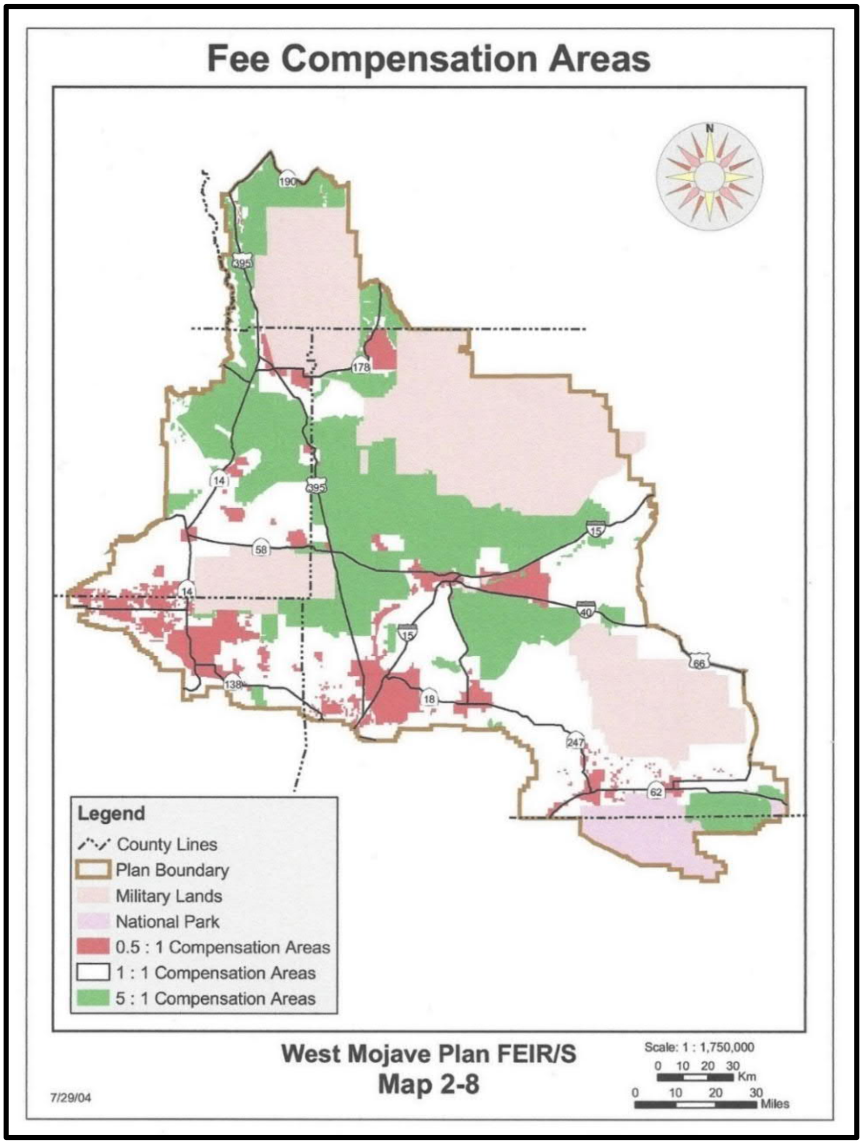

Figure 27. Former compensatory fee areas for surface disturbance and habitat loss per the BLM's (2005a, p. 2-36) WEMO Plan. The 5:1 compensatory mitigation ratio for the MGS Conservation Area has been replaced with a 1:1 to 2:1 ratio, and smaller area for MGS conservation, per the BLM's (2016a) DRECP.

The former MGSCA no longer exists (MGS TAG pers. comm. with A. Fesnock, BLM 2016) and a weaker habitat loss compensatory requirement is in place (i.e., 5:1 reduced to 2:1 in the DRECP (BLM 2016a, p. 120). A 2:1 compensatory mitigation ratio is now required only in MGS KPCs

(BLM 2016a, Figure 28), with a 1:1 ratio applied outside of DWMAs (54% of the former MGSCA), and the "DWMA" terminology was eliminated and not carried forward following adoption of the DRECP (BLM 2016).

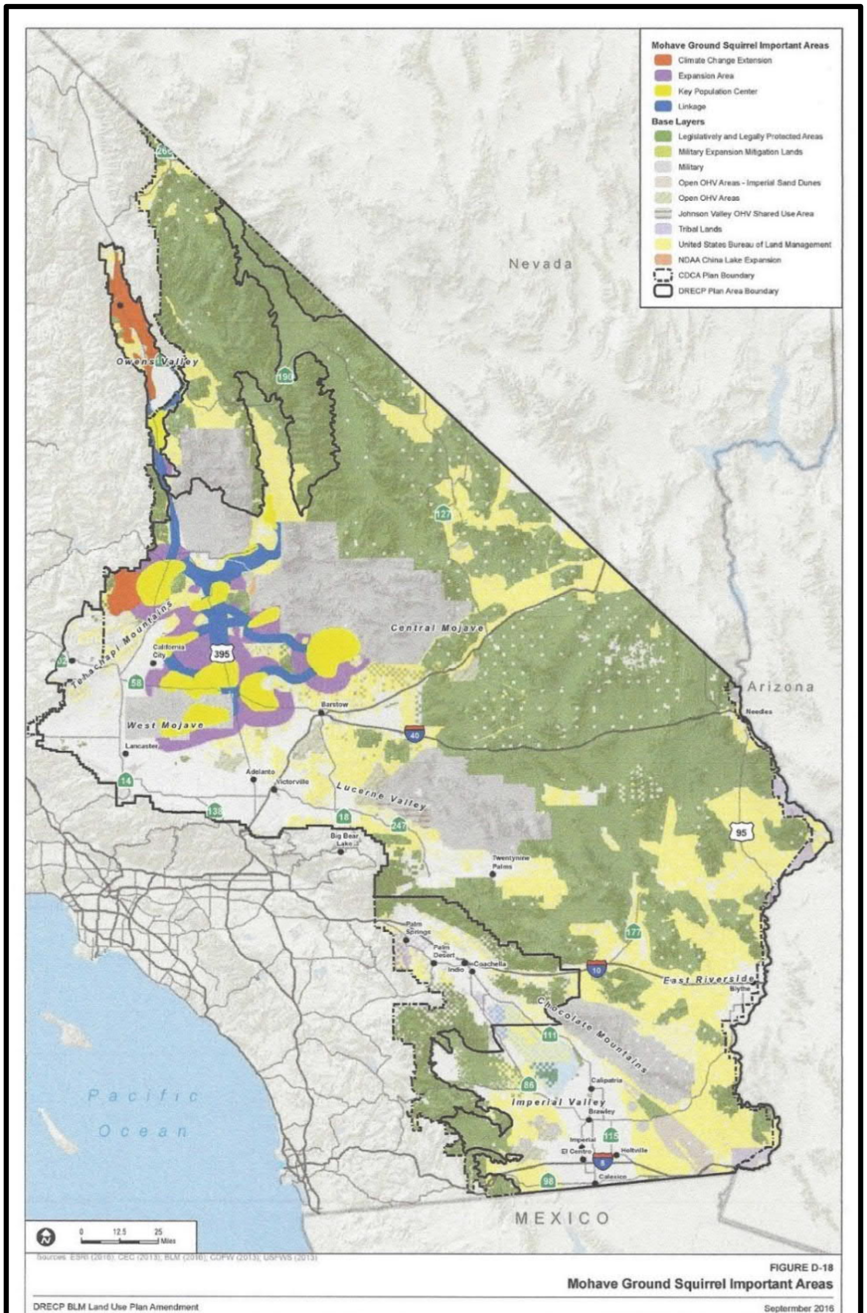

Figure 28. MGS Important Areas (BLM 2016a, Appendix D, Figure D-18, p. 41). A 2:1 compensatory ratio has been established for surface disturbance/habitat loss within MGS KPCs on public lands, with a 1:1 compensatory ratio applicable to lands outside these areas, unless heavily disturbed, per BLM's DRECP.

BLM's Special Status Species Management Policy (BLM Manual 6840). Based on the requirements contained in BLM Manual 6840 and a thorough review of BLM amendments to the 1980 CDCA Plan over the past several decades, it becomes clear that BLM has failed to fully comply with its policy for management of Special Status Species, which includes the Sensitive MGS. This has contributed to the ongoing decline in its populations and habitat from a variety of land use policies and uses that adversely impact the species. Generally, CDCA Plan amendments have incrementally reduced MGS conservation requirements over time. BLM policy for management of Special Status Species, and specifically those applicable to Sensitive species, include the following:

- *Initiate proactive conservation measures that reduce or eliminate threats to Sensitive species to minimize the likelihood of and need for listing of these species under the ESA.*

- *Ensure that land use plans and subsequent implementation-level plans identify appropriate outcomes, strategies, restoration opportunities, use restrictions, and management actions necessary for the conservation Sensitive species.*

- *Ensure that land use and implementation plans fully address appropriate conservation of BLM special status species.*

- *Monitor populations of Special Status Species to determine whether management objectives are being met. Records of monitoring activities are to be maintained and used to evaluate progress relative to such objectives. Monitoring shall be conducted consistent with the principles of adaptive management as defined in Department of the Interior policy, as appropriate.*

- *All actions authorized by the BLM shall further the conservation of Sensitive species. Sensitive species will be managed consistent with species and habitat management objectives in land use and implementation plans to promote their conservation and to minimize the likelihood and need for listing under the ESA.*

- *Land use plans shall be sufficiently detailed to identify and resolve significant land use conflicts with Sensitive species without deferring conflict resolution to implementation-level planning. Implementation-level planning should consider all site-specific methods and procedures needed to bring species and their habitats to the condition under which management under Sensitive species policies would no longer be necessary.*

- *BLM shall manage Sensitive species and their habitats to minimize or eliminate threats affecting the status of the species or to improve the condition of the species habitat, by:*

- *Determine, to the extent practicable, the distribution, abundance, population condition, current threats, and habitat needs for Sensitive species, and evaluating the significance of BLM-administered lands and actions undertaken by BLM in conserving those species.*

- *Ensure that BLM activities affecting Sensitive species are carried out in a way that is consistent with its objectives for managing those species and their habitats at the appropriate spatial scale.*

- *Monitoring populations and habitats of Sensitive species to determine whether species management objectives are being met.*

- *Work with partners and stakeholders to develop species-specific or ecosystem-based conservation strategies.*

- *Prioritize Sensitive species and their habitats for conservation actions based on considerations such as human and financial resource availability, immediacy of threats, and relationship to other BLM priority programs and activities.*

- *Use Land and Water Conservation Funds, as well as other land tenure adjustment tools, to acquire habitats for Sensitive species, as appropriate.*

- *Consider ecosystem management and the conservation of native biodiversity to reduce the likelihood that any native species will require Sensitive species status.*

- *In the absence of conservation strategies, incorporate best management practices, standard operating procedures, conservation measures, and design criteria to mitigate specific threats to Sensitive species during the planning of activities and projects. Land Health Standards should be used for managing Sensitive species habitats until range-wide or site-specific management plans or conservation strategies are developed. Off-site mitigation may be used to reduce potential effects on Sensitive species.*

- *Where existing land use plans are not adequate, use plan maintenance, plan conformance reviews, or plan amendments as a means of integrating conservation strategies into existing land use plans.*

Given the status of the MGS, and particularly its contracting range, we do not believe that BLM's implementation of these management policies, or lack thereof, has been effective in curtailing the species' decline.

2.2 Kern County General Plan Revisions

As noted under Listing Factor A, Kern County (2004, p. 1-1, 6-8) in revising its General Plan identified agricultural development as a "ministerial action" exempt from CEQA review.

Accordingly, Kern County (2004, p. 4-7-21) zoned 24,000 acres of the Indian Wells Valley (within MGS linkage areas) for agriculture. Kern County (2015, p. 3-24 to 3-28) has since rezoned these lands, reducing agricultural-zoned land by 7,400 acres and replacing it with residential, commercial, and light industrial zoning. Renewable energy development is being considered for the remainder. No MGS conservation lands or objectives have been identified. Active irrigated agricultural lands were excluded from zoning changes, including alfalfa fields/pistachio orchards, which occupy 3,000 acres of MGS habitat in a crucial linkage area. The Service (2011a, p. 62238) concluded that agricultural development did not pose a threat to MGS, with no future agricultural development likely.

MGS occurs over substantial portions of eastern Kern County on private lands where development is managed and permitted by the KCPNRD. There is a need to plan for and provide a long-term solution to the ongoing loss of MGS habitat, such as through the CDFW's Regional Conservation Investment Strategy.

2.3 San Bernardino County General Plan Revisions

The San Bernardino Planning Commission (2016, p. 1) recommended approval of the General Plan Renewable Energy Element (PMC and Aspen 2016, p. 3; Aspen 2016, p. 1-1, 4-8) adopting DRECP DFAs within MGS Important Areas and development of interspersed/adjacent private lands. Yet, no MGS conservation lands or objectives have been identified. The San Bernardino County Board of Supervisors (2016, p. 1-2) supported renewable energy development on both public and private lands (PMC and Aspen 2016, p. 37; Aspen 2016) in the Kramer, Trona, Hinkley and El Mirage areas of MGS habitat.

3.0 Factor E. Other Natural or Manmade Factors Affecting MGS Survival

3.1 MGS Population Demographics, Genetics and Threats

3.1.1 Important Populations. The Service (2011a, p. 62218) identified a large area managed for MGS conservation with "*restricted development*" (Figure 26). Eight Important Populations (referred to as KPCs in this Petition and as Important Population Areas, or IPAs elsewhere), supporting an unknown number of MGS, were described as "*well distributed*" across the species' range (Service 2011, p. 62258). However, no KPCs occur in almost half the species' historic range (i.e., the southern half of its historic range). Considering such a large area as mostly "*managed for the species*," (Service 2011a, p. 62258), the Service previously stated (emphasis in bold):

" *There is no portion of the range of Mohave ground squirrel identified as being necessary to conserve the species in case of a catastrophic event.*"

The above finding (Service 2011) was made without reliable MGS density estimates, with such data known to be limited (Leitner 2008, p. 8). While Burt (1936, p. 222) estimated MGS density in the southern part of the range at 5-8 animals/km^2, few others have done so (Service 2011, p. 62219). The Service's failure to base their "*No portion of the MGS range is necessary for conservation in case of a catastrophic event*" based on a lack of MGS density data is irrelevant. There is strong evidence that populations within its range are isolated and connected by linkages that have been impacted by numerous land uses. Further, the "*conservation area*" identified by the Service in Figure 29 is erroneous in that the phrase "*managed for the species*" (Service 2011, p. 62258) is not supported by currently authorized and allowable land use activities under land use plans, which are contrary to MGS conservation.

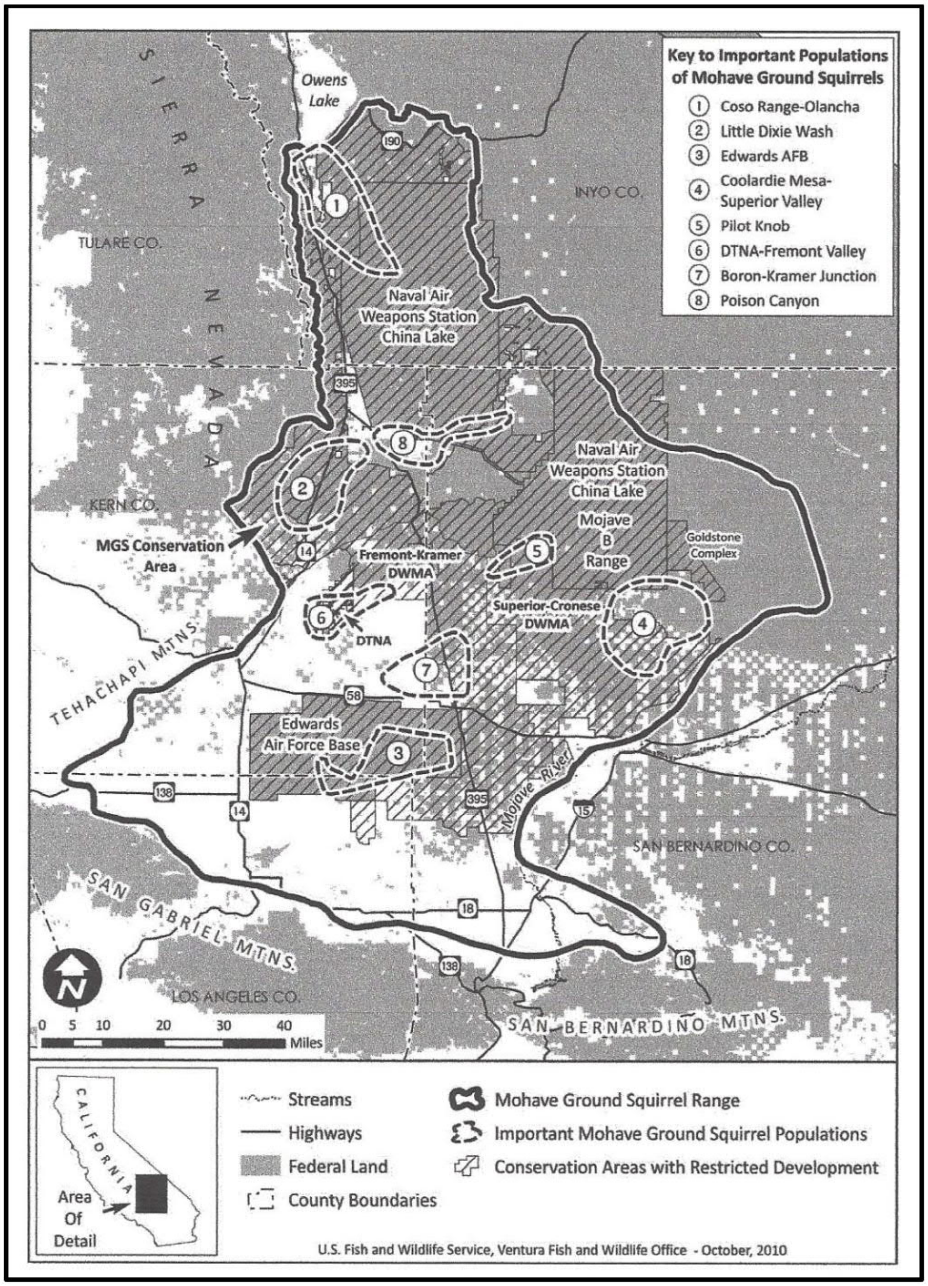

Figure 29. Important MGS populations (KPCs) and conservation areas with purported "restricted development," as identified by the Service (2011a, p. 62218). The term "conservation" as applied is questionable; the associated overlay misrepresents suitable habitat conserved for the species in perpetuity; and map particulars are outdated.

The Service (2011a, p. 62217) based its interpretation of "*important population area*" based on Leitner's (2008) work, where only four such areas were identified: 1) Coso Range-Olancha, 2) Little Dixie Wash, 3) EAFB, and 4) Coolgardie Mesa-Superior Valley. Four others (Pilot Knob, DTRNA-

Fremont Valley, Boron-Kramer, and Poison Canyon) were also noted. Criteria for identifying KPCs (Leitner 2008, p. 21) include:

- *MGS has been present for 2-3 decades*;
- *MGS has been found at a minimum of six locations*; and
- *Total individual records exceed 30, which was interpreted as a viable reproductive population*.

The other population areas identified as IPAs (Service 2011a, p. 62217) were defined as "*areas with multiple recent records of the species, although these areas are not known to have Mohave ground squirrels present for a substantial period*."

These eight IPAs were determined to comprise about 606,000 ac (245,240 ha), or 11.4% of the species' range (Service 2011a, p. 62217). However, no documentation supporting this acreage or the basis for determining the extent of this habitat was provided by the Service. Nor is this acreage and percent of range supported by independent study. MGS population estimates for individual KPCs, or for its population throughout its entire range, have never been estimated or even suggested by the Service, making the determinations of overall KPC value to long-term MGS persistence highly speculative at best.

Further, no credible population density estimates, or suitable occupied habitat patch size determinations have been calculated in defining what constitutes an important or other population area. Nor have KPCs identified to date been accurately mapped as to overall size based on all habitat suitability parameters. In addition to the eight KPCs identified by the Service (2011a, p. 62218), three other KPCs (i.e., Kramer-Harper Dry Lake, Fremont Valley-Spangler Hills and Northern Searles Valley) were identified in the DRECP, shown below in Figure 30.

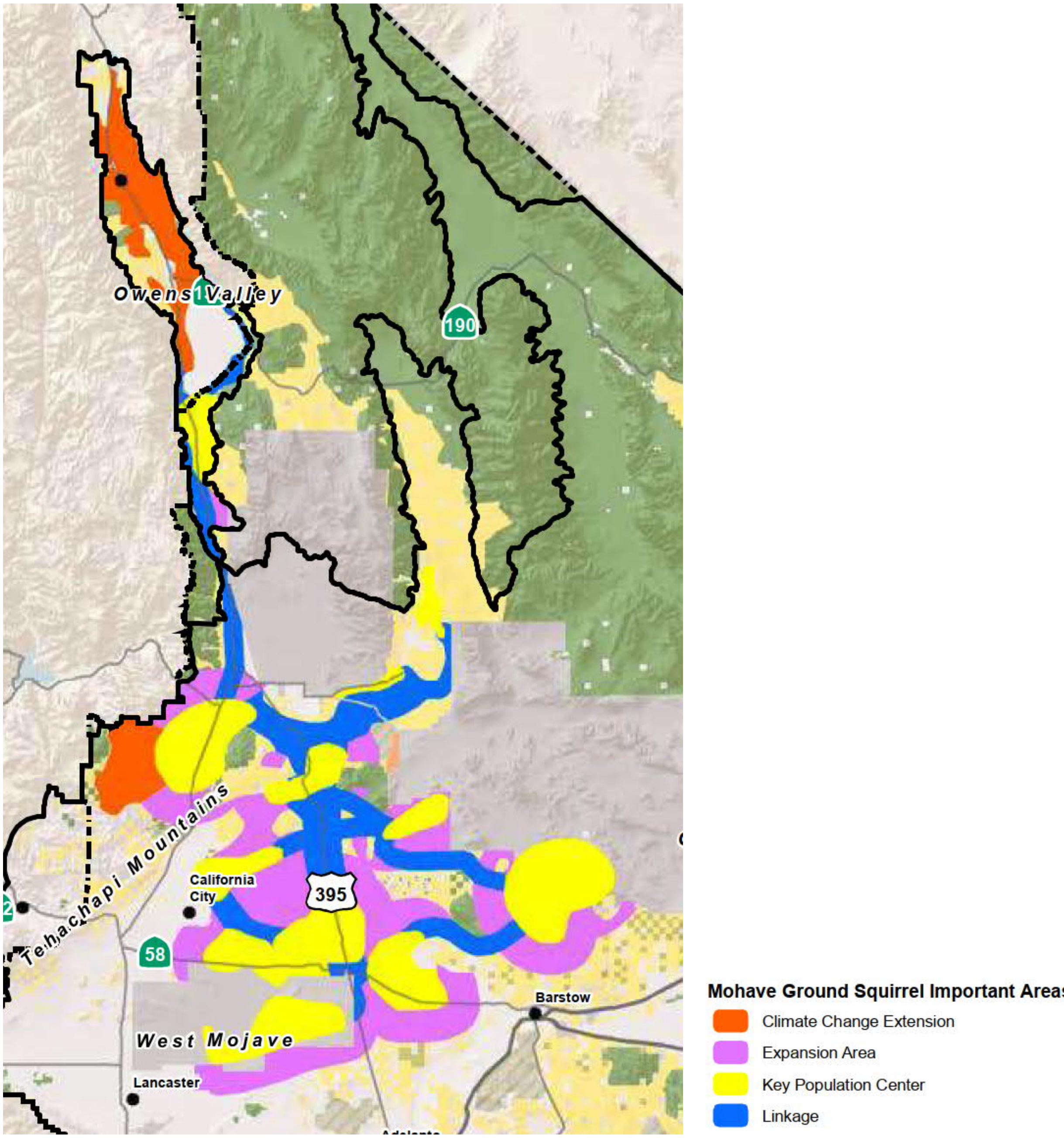

Figure 30. MGS KPCs from the DRECP, Figure D-18. The 11 KPCs are shown in yellow.

Little supporting documentation was provided by the Service (2011a) regarding the importance of specific MGS populations, including those in KPCs. As shown on the map above, the KPCs are isolated and connected by the Linkages shown in blue. Background information specific to these eleven KPCs is provided below.

3.1.1.1 Coso Range-Olancha

This northernmost 452 km² KPC (Leitner 2008, pp. 21-22) is located between the higher elevation, eastern Sierra Nevada Mountains and the rocky Coso Range to the east, with Owens Lake, State Route 190 and adjacent sand dunes forming a substantial MGS movement barrier to the north. Little Lake and extensive lava fields occur to the south-southeast. High elevation ridges and playas as well as sand fields also occur in the southeastern portion of the KPC, limiting potential MGS movements between populations.

The community of Olancha is located to the north, with the small community of Coso Junction, within Rose Valley, in the south. CL-NAWS North Range is located to the east. U.S. Highway 395, the Southern Pacific Railway and two Los Angeles Aqueducts are located within this narrow swath of MGS habitat, the latter of which limit or block MGS movement. In addition, the North and South Haiwee Reservoirs located in the southeast portion of the KPC are substantial barriers to MGS movement. Two electricity transmission lines traverse the entire north-south length of the KPC, and numerous secondary roads radiate out east and west from the centrally located highway. Livestock grazing allotments overlap most of the KPC and extensive mining, including open pit mines and sand/gravel operations, occurred within the eastern and southern portions.

The Rose Valley renewable energy DFA was designated by BLM in the DRECP (2016b, p. 47) and overlaps the southern portion of this KPC (refer to Petition Section 1.10, DRECP, p. 64-66) which spans the width of Rose Valley. This is a crucial linkage between north and south/central MGS KPCs which may be particularly important for MGS in face of climate change (Leitner 2015a, p. 2). In addition, BLM included a portion of the KPC in Rose Valley within the MGS ACEC designated in the DRECP, but subsequently made the decision to allow for geothermal energy project development within the ACEC (BLM 2020). Highway improvement projects (Inyo County Transportation Commission 2016) have also been proposed (i.e., the Olancha-Cartago Four-Lane Project).

3.1.1.2 Little Dixie Wash

This 393 km² KPC (Leitner 2008, p. 22) is located between the Sierra Nevada Mountains and the El Paso Mountains, southwest of the Ridgecrest in the western Indian Wells Valley. Freeman Gulch and surrounding areas in the northern portion of the KPC have been documented to support a persistent MGS population (Leitner 2008, p. 22) and is crucial for population connectivity (Esque et al. 2013, p. 113). However, recent surveys to document MGS in this area (i.e., live-trapping by LaRue in 2008, in 2023 by Leo Simone in 2023, in 2022 by The Wildlife Society, and camera-trapping by LaRue in 2022) suggest that populations may not be as persistent as expected.

The communities of Indian Wells and Inyokern, the Inyokern Airport and the east-west State Route 178 are located just to the north. U.S Highway 395 is located to the east and Red Rock Canyon State Park is located to the south. State Route 14 effectively bisects this KPC in a north-to-south direction, as does Red Rock-Inyokern Road and the two Los Angeles Aqueducts. Bowman Road and Last Chance Canyon Road, as well as numerous unpaved roads, bisect the KPC in an east-west fashion. A powerline utility corridor is situated in the western portion of the KPC.

Extensive mining has occurred in the western and southeastern portions of the KPC, and a large domestic sheep grazing allotment overlaps a majority of the area. Considerable OHV use occurs throughout the area. The Dove Springs and Jawbone Canyon OHV open areas, and California's recently designated Eastern Kern County Onyx Ranch SVRA, are situated to the south.

3.1.1.3 EAFB

Located in the southeastern portion of EAFB, this 311 km² KPC (Leitner 2008, p. 23) is flanked on the northwest by the expansive Rogers Dry Lake, to the west by the Buckhorn Dry Lake complex, and further west by Rosamond Dry Lake, with all three lakes considered MGS movement barriers. The communities of Boron and North Edwards are located to the north-northwest, as is the extensive Rio Tinto Borax Mine. The community of Kramer Junction is located to the north-northeast. Commercial, residential and mining developments in this KPC are barriers to MGS movement.

The rapidly developing cities of Lancaster and Palmdale in Antelope Valley are situated to the west and southwest, respectively. State Route 58 and the parallel Atchison Topeka and Santa Fe Railroad are located to the north. U.S. Highway 395 is located to the east and State Route 14 to the west. The residential community of Lake Los Angeles occurs to the southwest, and the agricultural lands of El Mirage Valley occur to the south. The growing cities of Adelanto and Victorville are located still further to the south.

Much of this KPC consists of the EAFB Precision Impact Range. The rocky, higher elevation Leuhman Ridge occurs just north of the area, as does the Air Force Rocket Propulsion Research Laboratory. An INRMP has been prepared to manage natural resources on the installation (see Petition Section 1.19.2).

Considerable historic mining and military training have occurred throughout the KPC, and an extensive unpaved road network has been established. Two OHV recreation areas have been established on EAFB totaling 15,140 acres. The El Mirage OHV Open Area, recently expanded into MGS habitat under the 2019 John D. Dingell Jr. Conservation, Management and Recreation Act

(Public Law 116 2019[7]) is located to the southeast. Domestic sheep grazing occurs to the north, east and south. Development of the BLM-designated North of Edwards DFA (BLM 2016b, p. 47), along with existing renewable energy development, will impede connectivity along the U.S. Highway 395 linkage corridor and to other KPCs located to the northeast.

3.1.1.4 Coolgardie Mesa-Superior Valley

Over half of this 516 km² KPC (Leitner 2008, p. 22) is situated in the southwest corner of NTC-Fort Irwin, a high-intensity, active brigade-level mechanized warfare training installation. It is bounded to the northwest by western Superior Dry Lake, with eastern Superior Dry Lake located within the KPC. Goldstone Dry Lake occurs to the northeast. The Fort Irwin Cantonment Area and Bicycle Dry Lake are located to the east. The anticipated use of the Western Training Area beginning in 2025 threatens to impact approximately 64,000 acres (100 mi^2) of MGS habitat, prompting the USGS to propose a translocation and captive breeding study to rescue MGS from this area before training begins next year (proposal in prep by Dr. Sharon Poessel, USGS).

The KPC is bounded on the west by a series of rocky, volcanic mountains with high ridgelines and mesas (i.e., Black Mountain), with a rocky, high ridgeline located within the KPC. Several rocky mountain ranges with high ridgelines also surrounds the area. The expansive Coyote Dry Lake occurs southeast of the KPC, and the similar-sized Harper Dry Lake occurs further to the southwest, with both considered unsuitable MGS habitat and movement barriers.

Plant communities vary from saltbush scrub at lower elevations to creosote bush scrub and Joshua tree woodland at higher elevations. MGS has been detected in the north but trapping in the easternmost portion of the KPC has failed to detect MGS, with RTGS visually detected (Leitner 2015b, p. 15).

Copper and gold mining have occurred historically. Extensive cyanide heap leach operations once occurred at Goldstone and hard-rock mining/dry washing continues to occur on Coolgardie Mesa. Both mining activities have resulted in extensive surface disturbance and perennial vegetation loss. Dry wash mining damage was so extensive in the 1990s that a temporary mining closure was enacted by BLM.

An extensive OHV route network occurs throughout the KPC. OHV use violations, fence vandalism, new route creation off Copper City Road, and various unauthorized routes have been created off designated open Coolgardie Mesa routes (AECOM 2013, p. 6, 8; BLM (2012a, p. 2; 2015c, p 2; 2016c, p. 3; Piechowski 2015, p. 8). Extensive renewable energy development has occurred to the southwest of the KPC along the western and southern fringes of Harper Dry Lake.

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[7] https://www.congress.gov/bill/116th-congress/senate-bill/47/text

3.1.1.5 Pilot Knob

This KPC, formerly BLM-managed public lands located southwest of the CL-NAWS (see Petition Section 1.15.3), was recently incorporated into the installation through federal legislation (see Petition Section 1.12). Cuddeback Dry Lake is located to the southwest, where BLM designated the lakebed as open to unrestricted OHV use (BLM 2019). The rocky, higher elevation Almond Mountain, Red Mountain, Lava Mountains and Summit Range occur to the northwest of the KPC. The rocky, higher elevation Black Hills, Pilot Knob and Slocum Mountain are located to the northeast and east.

The region is likely the most effective corridor linking the Coolgardie KPC with other populations (Leitner 2008, p. 23). However, past livestock use impacts have been extensive, particularly around and livestock water sources constructed west of Pilot Knob and at Blackwater Well. Livestock grazing ceased and the grazing allotment was eliminated by BLM following acquisition of the grazing permit and allotment base property by the Desert Tortoise Preserve Committee in the early 1990s.

The former U.S. Air Force Cuddeback Range to the southwest also previously supported sporadic military training maneuvers and ordinance use, resulting in surface disturbance. This training range was incorporated in the recently expanded CL-NAWS and has been de-contaminated of ordnance and contaminated soil. A considerable road network has been established in this KPC.

3.1.1.6 DTRNA-Fremont Valley

The DTRNA, comprised of approximately 104 km^2 (40 mi^2), was established by BLM in 1976 and managed as a preserve for the desert tortoise and MGS. Remaining private lands within the DTRNA boundary are being acquired by BLM, CDFW and the Desert Tortoise Preserve Committee as they become available for purchase. The DTRNA comprises a substantial west-central portion of this KPC within Fremont Valley. The KPC is bounded to the south and southeast by the densely-roaded California City and a large block of private land. The Desert Tortoise Preserve Committee (2016b), working collaboratively with the BLM, has an active conservation and public interpretation program, and a full-time Preserve Manager.

This KPC is bounded to the north and northeast by the Rand Mountains. The Randsburg Mojave Road traverses the southeastern portion, with the Twenty Mule Team Parkway located further to the southeast, State Route 58 to the south, U.S. Highway 395 to the east, and State Route 14 to the far west. The towns of Randsburg and Red Mountain are located to the northeast, as is the Red Mountain-Atolia Mining District, with its extensive mining impacts, including contamination from mercury, lead and arsenic used in the gold extraction processes (Chaffee and Berry 2006; Kim et al.

2012). The Fremont Valley DFA and the North of Edwards DFA (BLM 2016b, p. 47) are located to the northwest and southeast respectively.

Domestic sheep grazing allotments are located to the south and east of the KPC, including an overlapping portion within the area. While there is a substantial network of roads and OHV routes, the DTRNA has been fenced to exclude vehicle use and domestic sheep since approximately 1980, which promotes MGS conservation.

There are 13 California Natural Diversity Database (CNDDB) records of MGS in and around the DTRNA. Repeated protocol trapping of MGS conducted east and west of the unincorporated town of Mojave to the southwest have been unsuccessful, although two incidental records exist (Leitner 2014).

3.1.1.7 Boron-Kramer Junction

This KPC is situated primarily north-northeast of Kramer Junction, extending south across State Route 58 into EAFB and east of U.S. Highway 395. Fremont Peak and Gravel Hills occur to the northeast. The KPC spans the Kern-San Bernardino County line, with private lands comprising the bulk of the area in Kern County, and federal public lands as well as CDFW Ecological Reserve lands comprising the primary land ownership east of U.S. Highway 395.

The communities of Boron and Desert Lake are located along the southern boundary of the KPC, with North Edwards located to the west and California City to the northeast. The former Boron Federal Prison occurs to the north. Considerable residential and rural development surrounds all but the northeastern corner of the area. The northern extent of Rogers Dry Lake forms a portion of this KPCs southern edge.

The large Rio Tinto Borax Mine and infrastructure are in the center of the KPC along with other surface disturbance along State Route 58 and U.S. Highway 395 (Figure 31; Google Earth 2017a), which significantly impede MGS movement. Public lands and interspersed private property located west of U.S. Highway 395 and north of State Route 58 are within domestic sheep grazing allotments, with non-authorized grazing occurring frequently in spring months when ephemeral forage production is high.

Figure 31. Aerial photograph (Google Earth 2017a) of surface disturbance along U.S. Highway 395, which is extensive and in combination with regional topography, highways/towns and Rio Tinto's three plus square mile Borax Mine Facilities to the west along State Route 58, significantly impedes MGS movement within and through the North of Kramer KPC.

The Kramer Junction solar energy project, spanning roughly three-square miles, is situated in the south-central portion of the KPC and blocks MGS movement due to complete vegetation removal and a perimeter wire fence. The North of Edwards DFA (BLM 2016b, p. 47) encompasses the northern portion of the KPC, and if developed, will further impede MGS movement and population connectivity along and across the U.S. Highway 395 corridor. CDFW (2019) notes:

"*If some of the DFAs are developed to their fullest extent, the impact on important MGS habitat could be severe. For example, significant development in the DFA just north of Kramer Junction and west of U.S. 395 (known as the "Bowling Alley") could severely impact a core population center for the MGS and sever a viable north-south linkage between populations, as well as an east-west linkage between populations in the central part of the range.*"

3.1.1.8 Poison Canyon

Located between CL-NAWS Salt Wells Laboratory and Searles Dry Lake, this narrow KPC is wedged between the Salt Wells Valley, the rocky outcrops and ridgelines of the Spangler Hills and the rocky, barren badlands north of Trona Pinnacles. Mirror and Satellite Dry Lakes are located to the west.

The Ridgecrest Wastewater Treatment Plant and water pipeline are located immediately west and north. An expansion of the latter facility has been planned (City of Ridgecrest 2016, pp. ES1-2) with potential impacts to MGS habitat (Live Oak Associates 2016, p. 31). The higher elevation ridgelines of Lone Butte occur to the northwest. CL-NAWS North Range and the City of Ridgecrest occur to the west. State Route 178 East spans this KPC, which supports an MGS population of unknown size (Saphos 2006, p. 3-1).

The Spangler Hills OHV Open Area, which was expanded into MGS habitat under the 2019 Dingell Act, is located to the south. An MGS population is believed to occur in the southwestern portion of this OHV area, but degraded shrub habitat here may limit viable linkages to the Poison Canyon KPC. The Searles Valley DFA (BLM 2016b, p. 47) occurs to the east/northeast; and if developed, would impede connectivity to the northern Searles Valley MGS population.

3.1.1.9 Northern Searles Valley

This KPC is located between the rocky, higher elevation Argus Range on the west and the Slate Range on the east, with Searles Dry Lake to the south. The communities of Trona, Argus, Westend and Pioneer Point are located to the southwest on the western edge of Searles Dry Lake. Panamint Dry Lake occurs northeast of the Slate Range and the Trona Pinnacles badlands occur to the southwest. The Trona Airport in the southern portion of the KPC is situated just north of the San Bernardino-Inyo County line.

State Route 178 bisects this KPC, and an extensive dirt road network has been established. Considerable mining has occurred in both the Argus and Slate Ranges, and large-scale sand and gravel mining occurs on public land. In addition, large salt evaporators and industrial waste ponds are situated across Searles Dry Lake. The large Searles Valley DFA (BLM 2016b, p. 47; see Petition Section 1.10) encompasses the southern part of the KPC. Development of non-dry lake habitat is considered adverse to MGS connectivity (Leitner 2015a, p. 2). Considerable OHV use violations and route proliferation have occurred (AECOM 2013, p. 7; BLM 2016, p. 2; Piechowski 2015, p. 8). The extent to which this KPC is a population source or sink has been questioned (MGS Technical Advisory Group 2000, p. 3).

3.1.1.10 Fremont Valley-Spangler Hills-El Paso Mountains

Located northeast of Koehn Dry Lake and south of the Dove Spring Canyon and Jawbone Canyon OHV Open Areas, this KPC is situated between the rocky, higher elevation Rand and Lava Mountains on the southeast and the El Paso Mountains on the northwest, straddling the San Bernardino-Kern County line. The City of Ridgecrest is located northwest and the towns of Randsburg, Johannesburg and Red Mountain are located to the south-southeast. U.S. Highway 395 bisects the KPC and the Randsburg-Red Rock Road traverses the southern boundary.

The entire KPC is affected by intense OHV use on an extensive route network. MGS have been detected in the western portion of the heavily impacted Spangler Hills OHV Open Area (Leitner

2015b, p. 14), which was recently expanded into MGS habitat in the northeastern third of the KPC under the Dingell Act. Considerable OHV use violations have been documented in this area (AECOM 2013, p. 6; BLM 2016, p. 3; Piechowski 2015, p. 8). Small renewable energy DFAs have been designated to the west of the KPC (BLM 2016b, p. 47). The Fremont Valley DFA, if developed, would impede MGS connectivity to the north.

3.1.1.11 East and Northeast of Kramer Junction

This KPC is situated between U.S. Highway 395 and Hinkley and Harper Dry Lakes. The former Hawes Auxiliary Airport is located to the southwest. The fenced, four-lane State Route 58, the Union Pacific Railway and a gas pipeline and transmission line (Figure 32) bisect the KPC. The Buttes, Gravel Hills and Fremont Peak are situated to the northwest and the Kramer Hills to the southwest. Hinkley and developed agricultural lands occur to the east and the fenced Harper Lake Road bisects the eastern portion of the KPC. The Harper Dry Lake and Mojave solar projects (Figure 33; Google Map 2020) are located on the northeast edge of the KPC.

The Hinkley DFA and North of Kramer DFA (BLM 2016b, p. 47) occur to the east and northeast, respectively, of the KPC (see Petition Section 2.1). The Hawes Composting Facility with its significant daily traffic on the north-to-south oriented Helendale Road is located to the southwest.

Figure 32. A 500+ foot-wide gas pipeline and transmission line corridor, in addition to the parallel east-west Union Pacific Railway (top), are located in MGS habitat north of the tortoise-barrier fenced four-lane, high volume State Route 58 (inset), which intersects with the similarly fenced Harper Lake Road to the east; and a similar north-south utility right-of-way abuts U.S. Highway 395 (bottom) relative to the East and Northeast of Kramer KPC.

Figure 33. Aerial photograph (Google Map 2020) of the Harper Lake and Mojave solar projects, located on the northeast edge of the East and Northeast of Kramer MGS KPC. Together with Harper Dry Lake and the desert tortoise-exclusion fenced Harper Lake Road and State Route 58, these private and public land developments form impediments to MGS movement.

3.1.2 MGS Population Genetics

Esque et al. (2013) modeling predicts MGS populations will experience dramatic declines and loss of genetic diversity due to climate change and past/present land-uses. Loss of suitable habitat within and linking MGS KPCs results in smaller populations and limits MGS movement between populations, both of which contribute to loss of genetic diversity, which leads to inbreeding depression. Inbreeding depression results in offspring that exhibit reduced survival and fertility. Populations exhibiting unique genetic characteristics are usually those isolated to varying degrees from other populations by constraints to movements due barriers or loss of habitat

The Service (2011a, p. 62258) noted that gene flow appears to occur throughout the MGS range. However, Bell (2006, pp. 42-44) estimated gene flow in the past few MGS generations at Coolgardie Mesa and EAFB were low based on an analysis of mitochondrial DNA, a maternally inherited genetic marker. Reduced gene flow may have been caused by the recent drought or by limited movements of female MGS (Service 2011a, p. 62258).

Primary MGS habitat regions, corresponding to three genetically distinct populations described by Bell and Matocq (2011, p. 378), are disconnected because of narrow, compromised habitat dispersal corridors. These regions include the northern MGS KPC (i.e., Olancha, Cactus Peak, Coso Basin); the mid-western/Central MGS KPC (i.e., Freeman Gulch, El Paso Mountains); and the southern MGS KPC (i.e., DTRNA east to NTC-Fort Irwin).

Leitner and Matocq (2017, p. 12) found two round-tailed ground squirrels identified as F2 hybrids, indicating a significant MGS ancestry. These individuals were captured in desert scrub habitat north of areas converted to agriculture. Another individual was found on the western edge of Hinkley Valley and presented evidence of possible MGS genetic ancestry. Further, to the west of Hinkley Valley in relatively undisturbed desert scrub habitat, MGS appear to be dominant. However, even here, round-tailed ground squirrels may be present. Leitner and Matocq (2017, p. 12) found three individual MGS which presented evidence of genetic input from round-tailed ground squirrels. Camera studies and live trapping in this region have also revealed two instances where both species were present (Leitner 2008, p. 18-19; 2015, p. 18, 21).

Hafner & Yates (1983) identified three MGS at two sites in the presumed MGS/round-tailed ground squirrel contact zone that possessed mixtures of otherwise diagnostic alleles, which may have resulted from species' hybridization at a single, highly disturbed site along the Mojave River, likely in the vicinity of Helendale. Hafner (1992, pp. 774–776) further hypothesized that MGS may have speciated in allopatry in a "*small, isolated desert refugium in the extreme north-western Mojave Desert*."

The stability of the MGS/round-tailed ground squirrel zone of contact may have resulted from the "*low vagility (i.e., the degree to which a taxon moves/spreads within an environment) of both species; incorporation of rare immigrants from the alternate species via introgressive hybridization; and/or extreme competition following the unlikely event of populations of both species becoming established in the same locality*" (Hafner 1992, pp. 774 - 776). However, this zone of contact appears far less than stable, with round-tailed ground squirrels documented moving into former MGS habitat.

3.1.3 Climate Change

The Service (2011a) in its 12-month Petition Finding (pp. 62239-62240) stated that climate change was not a threat to MGS (emphasis in bold):

"*It is difficult with currently available models to make meaningful predictions of climate change for areas such as the range of the Mohave ground squirrel (Parmesan and Matthews 2005, p. 354). … Although climate change may have some effect on the species, at this time we cannot make meaningful projections on either how the climate within the* *range of the Mohave ground squirrel may change, or how the species may react to climate change…Therefore, based on a review of the best available scientific and commercial data, we conclude that climate change does not currently pose a threat to the Mohave ground squirrel in relation to the present or threatened destruction, modification, or curtailment of its habitat or range, nor do we anticipate it posing a threat in the future.*" In dismissing impacts of climate change on MGS habitat, it also implied that it anticipated it would have no effect on MGS populations. Petitioners challenge the Service's findings with the following information.

We argue that "*uncertainty*" associated with climate change is "*not a reason to fail to address climate change*" (United States District Court for the District of Columbia 2007). Current analyses suggest climate change is perhaps the most serious threat to the persistence of MGS populations (CDFW 2019):

- There have been steady increases in mean, maximum, and minimum temperatures within the Mojave Desert since 1890s, and temperature can adversely affect MGS activity;
- The mean temperature in Lancaster/Palmdale on the northwestern edge of MGS range has been projected to increase by about 5 °F (2.8 °C) from baseline temperatures (1981-2000) by the middle of the 21st Century (2041-2060) (Hall et al. 2012);
- The number of extremely hot days per year (over 95 °F or 35 °C) in the Lancaster area is projected to triple (Hall et al. 2012);
- Winter freezes in the western Mojave Desert are projected to decrease (Smith et al. 2009; Conservation Biology Institute (CBI) 2013). CBI (2013) models project a maximum temperature increase of up to 14 °F (7.8 °C) in parts of the western Mojave Desert by 2069.

Further, according to CDFW (2019), if overall temperatures continue to rise and warmer conditions increase throughout the day or year within the western Mojave Desert, such changes could reduce the time available for MGS to devote to essential behaviors:

"*If increased drought conditions decrease the quality of habitat, the energy and time required to seek out high-quality food resources in larger home ranges would be expected to increase (Recht, 1977; Harris and Leitner, 2004). Higher energetic demands with decreased opportunity for sufficient forage, compounded by the species' low reproduction rates, would likely increase local extirpations.*"

Esque et al. (2013, pp. 37-63) provided specific climate change effects modeling within MGS range. This research was conducted in support of BLM's (2016a) DRECP. The Esque et al. (2013) model predicts MGS populations will experience dramatic declines and loss of genetic diversity due to climate change and past/present land-uses.

When the Service (2008) issued its final decision to list the polar bear as threatened, it considered climate change effects as follows:

"*Because increases in GHGs* [greenhouse gases] *have lag effects on climate and projections of GHG emissions can be extrapolated with greater confidence over the next few decades, model results projecting out for the next 40 to 50 years (near-term climate change estimates) have greater credibility than results projected much further into the future (long-term climate change) (J. Overland, NOAA, in litt. to the Service, 2007*."

Near term (next few decades) climate change estimates were judged by the Service to have greater credibility than the much more dire results projected further out into the future with climate change. Esque et al. (2013) models indicating MGS habitat losses due to climate change appear imminent (Esque et al. 2013, p. 136), and constitute the best scientific and commercial data available on the effects of climate change on MGS. It is considerably more robust than the analysis presented by the Service (2011a, p. 62239-62240), even though it also acknowledges climate change may be impacting MGS (Service 2011, p. 62238).

A relatively short prediction timeframe (16 years) was used in these modelling studies, as were widely accepted IPCC emissions scenarios. Model projections are also based on specific anticipated adverse climate change effects upon the MGS (i.e., increased ambient temperatures, decreased annual rainfall and soil moisture; and vegetation composition/phenology changes). Esque et al. (2013) confidence in their model outputs led these researchers to state (emphasis in bold):

"*The models predicted substantial loss of current habitat by 2080, even under the least extreme of the two climatic scenarios, suggesting that* ***conservation of current habitat for this rare and endemic species is even more critical than previously thought***."

As for the Service (2011a, p. 62240) refusing to evaluate climate change effects on MGS, (i.e., "*at this time we cannot make meaningful projections"*), federal courts have also recently provided direction to the Service. This direction reinforces again, that uncertainty is "*not a reason to fail to address climate change."*

This clear direction to address climate change came from the Ninth Circuit Court of Appeals (2016) reinstatement of ESA protections established for a distinct population segment (DPS) of the Pacific bearded seal (*Erignathus barbatus*), which resulted in overturning a lower court decision. The former decision maintained the National Marine Fisheries Service (NMFS) listing of the DPS was arbitrary and capricious, but the Ninth Circuit Court found NMFS reasonably concluded that sea ice habitat loss by the year 2095 would render the DPS endangered (United States Court of Appeals for the Ninth Circuit 2016).

In response to the earlier District Court's conclusion about agency speculation, the Ninth Circuit Court of Appeals (2016) stated that the ESA "*does not require NMFS to base its decisions on ironclad evidence when it determines that a species is likely to become endangered in the foreseeable future; it simply requires the agency to consider the best and most reliable scientific and commercial data and to identify the limits of that data when making a listing determination*."

The Ninth Circuit Court of Appeals (2016) further opined that "*the ESA does not require an agency to quantify population losses, the magnitude of risk, or a projected 'extinction threshold' to determine whether a species is 'more likely than not' to become endangered in the foreseeable future*." This underscores that the best, most reliable scientific and commercial data available need be considered in agency analyses and decisions.

Annual mean temperature trends in the Mojave Desert changed significantly over the twentieth century relative to the 1949-2005 baseline (DRECP REAT 2012). Droughts are longer and rainfall has been more erratic over the last 50 years (USDA Agricultural Research Service 2021). Temperatures are anticipated to increase further with climate change; precipitation is expected to decrease and become more variable; and the frost-free season is anticipated to begin earlier and last longer.

Climate change is also expected to produce increased extreme heat events (Herring et al. 2016, p. 144). A hotter/drier future can reasonably be anticipated. Increased water stress is likely, as are declines and distributional shifts in plant species with higher water needs; prolonged periods of drought; and higher heat-sensitive species mortality. Shrub community changes detrimental to MGS population stability may already be occurring (Leitner 2016a).

Species with behavioral and physiological mechanisms for living in arid environments are vulnerable to temperature increases, rainfall reductions and variability, and distributional shifts in vegetation. The MGS is considered particularly vulnerable because it responds to drought and low food availability by failing to reproduce (Best 1995, p. 4). Mortality may occur from extended periods of low rainfall (Service 2011, p. 62220). Habitat loss and fragmentation can limit or prevent colonization of previously occupied MGS habitat lost during drought periods. Low rainfall reduces annual and perennial plant productivity, which is likely to affect the distribution of critical plants like winterfat, spiny hopsage and desert thorn relied on by MGS during drought. At some point, lower plant productivity could cause MGS to forego breeding in an increasing number of drought periods. Local population extirpation can result from an increasing number and/or duration of droughts that suppress MGS reproduction, impede dispersal or that reduces juvenile survivorship in multi-generational MGS linkage habitat.

Gustafson (1993, p. 22) noted prolonged drought may result in the loss of local populations. MGS trapping success has been positively correlated with winter rainfall (October-March) from the current and previous year (Brooks and Matchett (2002, p. 176). They identified one period of low precipitation (i.e., 1970-1977) that corresponded with relatively low MGS trapping success, and another period where increased rainfall (1978) was followed by increased trapping success in 1980. Decreased rainfall from 1984-1991 corresponded with decreased MGS trapping success in 1987-1991. However, the cycle back from low rainfall in the mid-1980s to higher rainfall in the 1990s was not followed by increased MGS trapping success. Accordingly, Brooks and Matchett (2002, p. 176) suggested a decline in MGS abundance occurred in this period.

Munson et al. (2016, p. 438) found strong precipitation deficits of 2002 and 2007 correlated with perennial vegetation cover change. However, not all variability was ascribed to rainfall anomalies alone. Warming trends in the Mojave Desert likely contributed to perennial vegetation loss, and such trends are expected to intensify (Redmond 2009, p. 11-30). MGS life history traits point to the potential severity of climate change impact and the need to carefully consider its ramifications. Individual MGS live only five years or perhaps slightly longer (Leitner and Leitner 1998, p. 28), with an active season of only February to August (Bartholomew and Hudson 1960, p. 194), with occasional late January activity.

Ambient temperature at a given elevation likely influences hibernation emergence, and varies geographically (Laabs 1998, p. 2). Following spring emergence, MGS must mate, consume nutritious forage to reproduce and store energy reserves to survive the inactive season. Burrows are in deeper soils with stabilizing perennial vegetation, with entrance plugs sometimes used (Burt 1936, p. 223). The physiological and behavioral differences between aestivating and/or hibernating MGS are matters of degree and appear to be functions of body temperature, the level of which is determined by environmental temperature (Bartholomew and Hudson 1960, p. 200).

Transition from normal activity to dormancy results in a minor change in MGS body temperature but is profound in its metabolic state (Bartholomew and Hudson 1960, p. 201). How MGS will adapt to increasing heat with limited adaptation options is unknown. Data from the Grinnell Resurvey Project indicates temperatures within its range have increased by about 3.6 ºF over the last century (Manke 2021).

MGS active season duration varies by sex, age, and food availability (Service 2011a, p. 62220). In dry years, which may be non-reproductive, MGS may enter torpor in early spring (Harris and Leitner 2004, p. 2). Entering torpor while within a burrow conserves energy and water reserves (Best 1995, p. 3). Dormancy initiation may correspond to either the absence of green vegetation or its abundance (Aardahl and Roush 1985, p. 20-21). Low body fat, which can occur due to inadequate spring foraging, likely affects MGS survivorship, especially juveniles (Leitner and Leitner 1998, p. 32).

The adult active season is shorter than that of a juvenile because adults do not need to acquire as many metabolic reserves for the inactive season. The adult female’s inactive season is longer than for a male because more energy is needed for producing young and lactation (Leitner et al. 1997). Females have high site fidelity and male home range size may not differ from females in drought years but can be much larger in ample rainfall years when reproduction occurs (Harris and Leitner 2004, p. 5).

The Southwestern U.S. is a climate change "hotspot," and MGS range may be within its epicenter. "*According to the 15-model consensus, the strongest U.S. hot spot by far stretches across the Southwest from southern California to west Texas and intensifies even more over northern Mexico*" (Wild Earth Guardians 2015, p. 26). Projected climate changes, and the subsequent range shifts of native trees and shrubs, are large (Wild Earth Guardians 2015, p. 36). "*Changes of this extent would tend to have negative consequences for species that are rare, have narrow environmental tolerances, low dispersal rates, or are less competitive than other species*" (Shafer et al., 2001, p. 212), such as MGS.

The best available scientific evidence indicates MGS faces habitat losses associated with climate change (Esque et al. 2016, p. 61). MGS reproductive success is dependent on fall and winter rainfall (Service 2010, p. 22065). Leitner and Leitner (1998, p. 29-31) positively correlated fall and winter rainfall and subsequent juvenile MGS recruitment. The species is known to forego breeding in a low rainfall year (Best 1995, p. 4; Leitner and Leitner 1998, p. 32; Harris and Leitner 2004, p. 3), likely due to low food availability (Leitner and Leitner 1991, p. 26).

A trend toward MGS population extirpations over the last few decades, rather than re-colonization, has been suggested (Brooks and Matchett 2002, p. 175). Even slight changes in MGS emergence timing, active season duration or number of suppressed reproductive years could reduce MGS reproduction and population recruitment rates. These adverse effects, along with increased rainfall variability and vegetation shifts predicted to occur with climate change pose a serious threat to the species. Climate change modeling combined with cumulative habitat loss and degradation in KPCs and linkages were not fully evaluated by the Service in its previous (1993, 2005) MGS Listing Petition Reviews. We maintain these potential adverse climate change effects, combined with cumulative habitat impacts, threaten MGS existence throughout most of its occupied range.

3.1.4 Synergistic, Interactive and Cumulative Impacts

The human population in the Southwest is expected to increase from 56 million to 94 million by 2050 (Garfin et al. 2014). Human population growth will increase resource use pressure in the western Mojave Desert. "*Severe and sustained drought will stress water sources, already over-utilized in many areas, forcing increasing competition among farmers, energy producers, urban dwellers, and plant and animal life for the region's most precious resource*" (Garfin et al. 2014, p. 463). "*Humans have also highly altered and fragmented natural landscapes, affecting plant migration*" (Neilson et al. 2005, p. 753), and increased wildfire threats within MGS core areas and linkage corridors.

Human alteration of natural landscapes and communities include extensive unregulated cannabis greenhouse development (Victor Valley News Group 2021) with extensive vegetation clearing, unchecked rodenticide/pesticide use, fertilizer application, water transport, extensive vehicle use, and indiscriminate trash and sewage dumping. This has removed and degraded hundreds of acres of

MGS habitat, and likely resulted in MGS mortality, and likely within key MGS linkage corridors. We incorporate by reference cannabis grow impacts to MGS habitat under listing Factor D: The Inadequacy of Existing Regulatory Mechanisms.

Increased renewable energy development, urban growth, military activities on three large installations and agricultural use, combined with transportation infrastructure improvements and realignments as described herein, will also severely constrain connectivity between KPCs.

Persistence of populations in individual KPCs is far less than assured when habitat impacts associated with private land development, mining, livestock grazing and increasing OHV use are considered. The predicted temperature, precipitation and vegetation shifts due to climate change are likely to result in substantial loss of suitable remaining MGS habitat. When these stressors become heightened (e.g., due to increased drought frequency (Leitner 2016b, abstract, p. ii), a tipping point may be reached where populations may not recover.

Increasing non-native plant invasion, fueled in part by auto exhaust nitrogen deposition, may further the potential for wildfire, fire impacts within MGS habitat in upcoming years (Barrows & Murphy-Mariscal, 2012, p. 30; Brooks 2003, abstract; Brooks and Matchett 2006, abstract; Service 1994, p. 8). The effects of invading non-native exotic grasses have been reviewed (D'Antonio and Vitousek 1992), indicating the conversion of shrublands into ephemeral exotic grasslands is occurring and can be detrimental to desert species (Service 1994, p. 8), particularly shrubs needing higher rainfall (i.e., *Grayia spinosa*).

Increases in plant cover due to the proliferation of non-natives have altered fire regimes (Brooks 1999; Brooks and Esque 2002; Esque et al. 2003 as cited in Service 2011b, p. 129). The interaction between increased exotic grass-fueled wildfires and a climate change-related increase in wildfire conditions threatens the long-term sustainability of MGS habitat. "*Rather than climate change alone, it is likely that the interaction of climate and other environmental stressors may hasten the decline of native species*" (Barrows & Murphy-Mariscal 2012, p. 30).

Ecological specialization and low population density act synergistically to elevate extinction risk above that expected from their additive contributions, because rarity itself imparts higher risk and specialization reduces the capacity of a species to adapt to habitat loss by shifting range or changing diet (Brook et al. 2008, p. 455). Only by treating extinction as a synergistic process will risk predictions approximate reality, with conservation actions which only tackle individual threats becoming half measures which end in failure due to uncontrolled cascading effects (Brook et al., 2008, p. 459).

4.0 Justification for the Concurrent Designation of Critical Habitat

The ESA defines critical habitat as (1) "*the geographical area which may generally be delineated around the species' occurrences*..." (Service 2016b, p. 7226) *at the time it is listed, and on which are found physical or biological features essential to species' conservation, and that may require special management considerations or protection; and (2) specific lands outside the geographic area occupied by a species at the time of listing that are essential for species' conservation*."

Here we provide information on the geographic area currently occupied by MGS, the physical and biological features that comprise its habitat and why they are essential for its conservation, and special protective measures required for the species to stabilize and recover. The best available scientific data indicates that specific unoccupied areas within this petitioned critical habitat area are also necessary to support the species' recovery and meet the definition of "*critical habitat*" (Service 2016b, p. 7226). Unoccupied but otherwise suitable habitat due to localized extinctions due to drought or other factors, may become occupied once through recolonizations by MGS when suitable conditions return (CDFW 2019, p. 63; Leitner and Leitner 1998).

- <u>The geographic area occupied by MGS and the physical and biological features that comprise its habitat</u>. The geographic area of occupied MGS habitat is presented in Figure 5. This map was prepared by Defenders and is based on the CNDDB (CDFW 2016a-b) and range maps/information reported by Gustafson (1993), Leitner (2008, 2015a-b) and the Service (2011a); habitat suitability and climate change modeling by Esque et al. 2013; and Inman et al. (2013); and lands modeled with high/very high terrestrial intactness (CBI 2014).

- <u>Suitable MGS habitat</u>. Native plant communities within this mapped area that comprise suitable MGS habitat include Mojave creosote bush/mixed woody scrub, desert saltbush scrub, blackbrush (*Coleogyne ramosissima*) scrub, Mojave wash scrub, Joshua tree woodland and shadscale (*Atriplex confertifolia*) scrub. These plant communities have been recognized (Service 2011a, p. 62221) as providing suitable MGS habitat. We specifically petition to have such native plant communities within the currently occupied range of the MGS, presented in Figure 34, designated as critical habitat.

  We include DOD installations with suitable MGS habitat in the petition for designation as critical habitat for the purpose of ensuring that INRMPs for NTC-Fort Irwin, EAFB and CL-NAWS will be reviewed and revised to ensure sufficient MGS conservation that can be concurred with by the Service and CDFW.

- <u>Unsuitable MGS habitat</u>. Areas within the occupied MGS range considered unsuitable habitat include water bodies/wetlands, sand fields/dunes, dry lakes/playas, lava flows/rocky areas, desert pavement, urban/residential areas, paved roads, active agricultural areas and fenced RE facilities. Lands exceeding 5,600 feet elevation are also considered marginal to unsuitable habitat, as there are so few MGS records from these higher elevation areas.

Protection of occupied MGS habitat as critical habitat, including habitat described as MGS KPCs and linkages, is necessary to prevent further MGS habitat degradation, loss and fragmentation, and promote the species' recovery.

Per ESA Section 4(b)(2), this Petition does not include all potential habitat within the current MGS range. Unsuitable habitat acreage and suitable habitat lands currently managed to exclude conflicting land uses have not been included. This includes: 1) lands within the DTRNA managed for conservation; and 2) designated wilderness (i.e., Black Mountain Wilderness, Grass Valley Wilderness). Critical habitat petitioned herein spans lands within Kern, San Bernardino and Inyo counties.

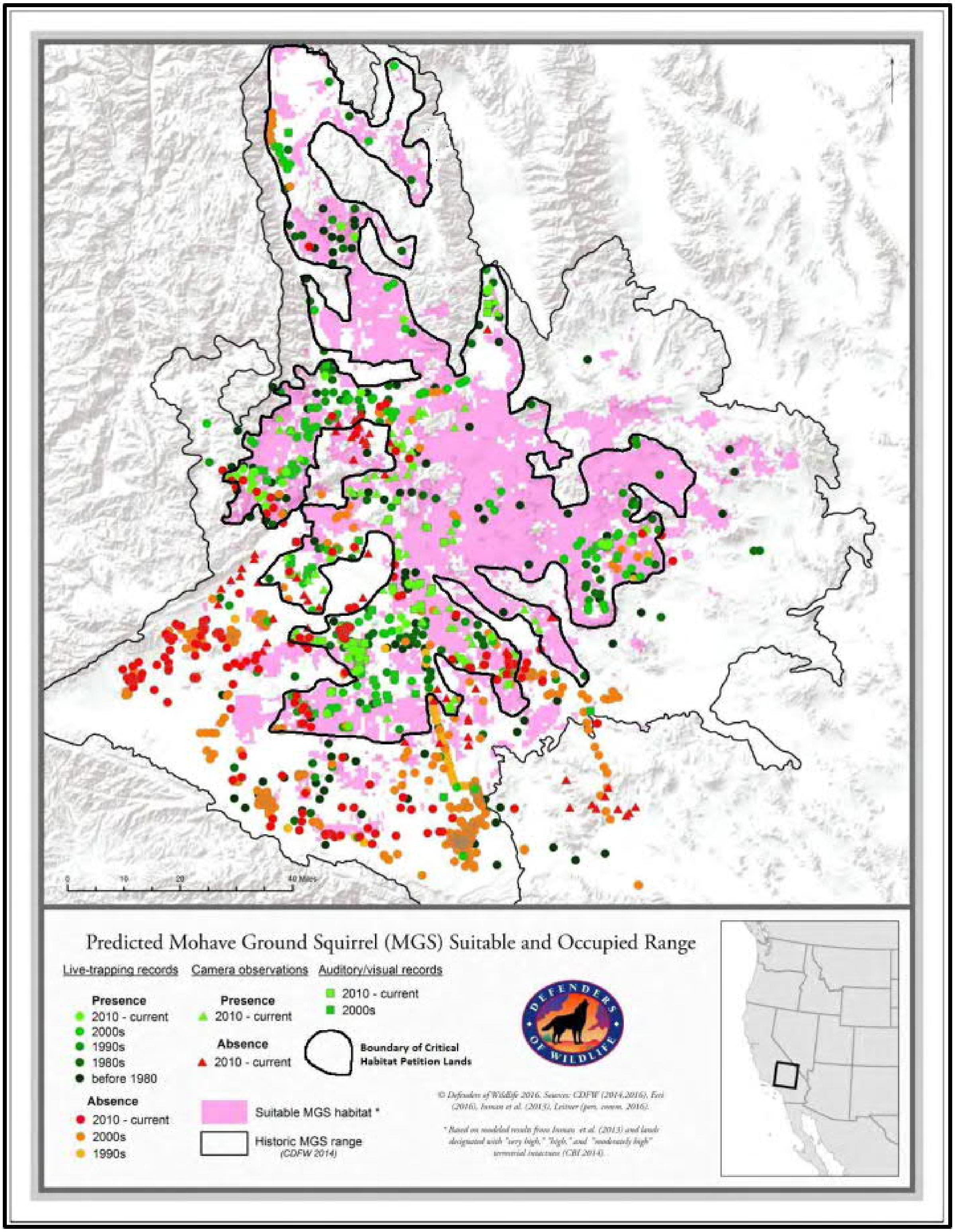

Figure 34. Currently occupied and predicted suitable MGS habitat petitioned for critical habitat designation (Defenders 2016c).

Petition Conclusion

The Service (2011a, p. 62223) acknowledges that some MGS habitat has been lost to development and that more will be lost in the future. We maintain the full extent of suitable MGS habitat, as well as the cumulative loss of this habitat, has not been accurately identified by the Service (2011a), nor has the significance of remaining habitat degradation and current threats been adequately analyzed.

MGS range extent has changed significantly since the species was discovered by Frank Stephens in 1886 (Merriam 1889, p. 15; Grinnell and Dixon 1918, p. 667) and described as a distinct, monotypic species (Merriam 1889, p. 15-16). Previously suitable MGS habitat in the southern portion of its range is no longer occupied due to activities that result in habitat degradation and loss.

While urban development may account for the highest past impacts, agriculture, mining, military training, OHV use and transportation infrastructure have also contributed and continue to impact remaining MGS connectivity throughout the species' range. Most remaining occupied habitat within the species' current range is not adequately managed or protected.

Military operations in select portions of NTC-Fort Irwin have severely impacted the northeastern most portion of MGS range, as well as crucial habitat linkages to the southwest, with such operations planned to extend into the Western Training Area. EAFB facility development has also adversely affected MGS habitat in the southern, western, and northern portions of a KPC. Military ordnance testing, training and facility development have also impacted MGS habitat at CL-NAWS, with additional impacts in portions of the recent installation expansion areas expected, including within crucial linkage habitats. Substantial acreage of undeveloped lands within all three military installations has likely never provided suitable habitat for MGS and should not be considered as occupied by the species.

Among the three large military installations within the MGS range, only EAFB has been proactive in studying MGS distribution and life history information. Most of the lands within the Precision Impact Range are pristine and protected from direct human impacts. By the nature of its mission, most habitats on CL-NAWS are protected to the benefit of MGS conservation. Excepting one recent study (Vernadero Group, Inc. 2019), failure to census MGS populations provides no baseline data for how important habitats may be and if there are unknown KPCs on CL-NAWS. NTC-Fort Irwin has not only contributed little to our scientific knowledge and protection of the species, but it now is also expanding mechanized live-fire training into what would otherwise be pristine habitats with minimal human impacts including development, OHV recreation, and grazing. The federal listing of the MGS would require all three installations to not only protect but participate in the recovery of the species, which we consider to be essential to the perpetuation of the MGS. Absent the federal listing of the species, with concomitant new protections on military and public lands managed by the BLM, we fully expect current impacts and trends to proceed unabated and foresee the extinction of the species.

Heavy OHV use is expanding on both private and public lands comprising the bulk of MGS habitat. Substantial non-compliance with designated open routes occurs on public lands, and no route designation or effective rules or enforcement exist for OHV use on interspersed private lands by local government agencies. Effective closed route restoration has yet to occur on the thousands of miles of OHV routes created in suitable MGS habitat since 1980, with no realistic timeframe established to complete even a fraction of this task on public lands.

Transportation infrastructure improvements are expected to result in additional MGS habitat loss associated with proposed State Route 58 and U.S. Highway 395 expansion and realignment, which thoroughly fragment MGS habitat. Existing renewable energy development has resulted in substantial loss of MGS habitat.

Increased renewable energy development in DFAs and private lands is expected to substantially increase due to state and federal mandates to generate electricity from renewable energy sources, which will result in additional habitat loss, particularly within crucial habitat linkages. Livestock grazing, while somewhat dispersed in the species' range, has degraded and continues to degrade MGS habitat. Within domestic sheep allotments, livestock use adversely affects MGS forage at the most critical stages of MGS life history (i.e., reproduction/rearing of young, juvenile dispersal and weight gain prior to aestivation); and may prevent re-colonization of habitat lost during dry years.

Average temperatures have been rising in the Mojave Desert, with this trend anticipated to continue due to climate change (Garfin et al. 2014, p. 463). Atmospheric carbon dioxide, a primary climate change driver, is currently 419 parts per million (ppm) in the atmosphere in 2022, up from 416 ppm a year ago[8], and up from 382 ppm a decade ago (Dlugokencky and Tans 2017). Decreased rainfall, increased drought duration/periodicity and vegetation shifts resulting from climate change are likely to adversely affect long-term MGS population persistence (Esque et al. 2013, p. 62-63).

Significant perennial vegetation loss throughout the MGS range has been noted in recent years (Munson et al. 2016, p. 435, 438). These reductions (Groffman et al. 2014, p. 200) are anticipated to exacerbate past MGS habitat degradation. Renewable energy development and other land uses in remaining habitat linkages severely constrain MGS capabilities in adapting to climate change (Inman et al. 2013, abstract; Inman et al. 2016, abstract).

Expanding protected areas and increasing habitat connectivity will become increasingly necessary to allow MGS to access suitable habitats as the climate alters its habitat over time (Griffin 2017). The

[8] https://www.co2.earth/daily-co2

importance of adequately protecting remaining MGS populations suitable habitat is clear: Over 90% of recorded MGS occurrences in the period from 1998 to 2012 have been from just eight distinct areas, representing only four KPCs (Leitner 2008, p. 22; 2015, p. 13-16). Overall MGS population numbers are unknown and significant historic habitat acreage has been permanently lost, with most remaining habitat degraded. While the Service (2011a, p. 62252) considered eight KPCs of unknown size sufficient to ensure this species' existence, MGS faces elevated threats in all these areas. Further, MGS populations and their supporting habitat loss threatens the species' resiliency, redundancy and representation, reinforcing the need for increased protection through ESA listing.

The ESA (16 U.S.C. 1533(a)(1) states that the Service must determine whether a species is threatened or endangered based on:

- Present or threatened destruction, modification, or curtailment of its habitat or range;
- Overutilization for commercial, recreational, scientific, or educational purposes;
- Disease or predation;
- Inadequacy of existing regulatory mechanisms; and
- Other natural or manmade factors affecting its continued existence

The Service (2003, p. 15113) must also consider State laws, programs, and other conservation measures. In determining whether conservation programs or policies contribute to making a listing decision, the Service (2003, p. 15114-15115) must evaluate whether conservation actions undertaken will improve a species' status. Key factors are the certainty that the conservation actions will 1) be implemented, and (2) will be effective. Neither of these factors have been sufficiently evaluated by the Service in previous MGS listing petitions.

MGS conservation actions on public lands (BLM 2005b-f, 2016a-b) are not sufficiently certain to be implemented, timely or effective in reducing known threats to the species. The cumulative nature and extent of these threats are seldom adequately known or adequately described in BLM land use and activity plans. Nor have conservation measures been shown to reduce impacts to the species. Further, the staffing, funding levels and sources, and other resources necessary to implement MGS conservation actions have not been secured as they would be for a federally listed species. Measurable objectives for achieving effective MGS conservation to determine if conservation goals are or have been met, have not been developed.

In the 41 years since the MGS was listed as rare by the CFGC, MGS habitat and its populations continue to be lost due to the land uses and activities identified in this petition.

An MGS conservation strategy was approved by CDFW (2019) in recognition of past and ongoing MGS impacts, and potential future threats to the species. However, this conservation strategy is not binding and is not being integrated into regional project permitting and planning for public and private lands as it may be if MGS is federally listed. Further, despite a wealth of data gathered over the years on adverse impacts to the species' habitat, the Service (2011, p. 62257-62258) has erroneously concluded that the MGS does not face elevated threats throughout most of its range.

Previous petitions submitted to list MGS under the ESA were deemed by the Service as not presenting information indicating that such listing was warranted, "*given the uncertainties of urban growth and other threats, as well as a lack of credible biological status studies*" (relative to the 1993 petition); and that MGS "*does not face elevated threats in most portions of its range*" and that those portions of its range "*that may have concentrated threats (the Southern and Central portions of the range) do not contribute to the resiliency, redundancy and representation of the Mohave ground squirrel such that without these portions, the species would be in danger of extinction*" (relative to the 2005 petition).

With very little supporting data, the Service has maintained that the southern as well as central portions of MGS range with known, concentrated threats, do not contribute to the resiliency, redundancy, and representation of the MGS as a species. As such, it has arbitrarily determined that protection of MGS habitat as currently practiced in the northern third of the species' range is all that is necessary to prevent MGS extinction.

Much of the habitat and populations in the southern portion of the MGS range have been lost due to cumulative human impacts and permitted projects which have cumulatively eliminated MGS habitat linkages, and that the northern portion of MGS range is increasingly at risk due to these same factors. Remaining MGS habitat in the southern and central portions of MGS range which do contribute to the resiliency, redundancy, and representation of the species are considerably degraded, with habitat quality decreasing even further over time. The northern portion of MGS range, supported by the most tenuous of habitat linkages, is similarly beset by concentrated threats that remain unaddressed. Lastly, we believe climate change threatens MGS in all remaining habitat.

Considering the information presented in this petition, we believe the MGS is threatened with endangerment within the foreseeable future throughout all its range. New information on the species' current range, suitable habitat constraints and ongoing impacts have emerged that was not previously considered by the Service (2011a) in its review of previous MGS listing petitions and is referenced in this petition.

In consideration of the above, we urge the Service to list MGS as Threatened under the Endangered Species Act and to concurrently designate critical habitat. We have provided the CDFW Director with notification of this petition in a letter dated November 9, 2023. Please contact petitioner Jeff Aardahl if you have questions or need additional information.

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