A Status Review of the Mohave Ground Squirrel

(Spermophilus mohavensis)

State of California
The Resources Agency
DEPARTMENT OF FISH AND GAME
Wildlife Management Division

REPORT TO THE FISH AND GAME COMMISSION:

A STATUS REVIEW OF THE MOHAVE GROUND SQUIRREL (*Spermophilus mohavensis*)

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EXECUTIVE SUMMARY

This report was prepared in response to a petition submitted to the Fish and Game Commission (Commission) by the Kern County Department of Planning and Development Services. The petition requested the delisting of the Mohave Ground Squirrel (*Spermophilus mohavensis*) as a Threatened species.

On April 2, 1992, the Commission accepted for consideration the petition to delist. Pursuant to Section 2074.6 of the Fish and Game Code, the Department of Fish and Game (Department) undertook a review of the petition. Based on the best scientific information available on the Mohave Ground Squirrel, the Department has evaluated whether, in fact, the petitioned action should be taken by the Commission. Information and comments on the petitioned action and on the Mohave Ground Squirrel were solicited through a public notice from interested parties, management agencies, and the scientific community.

This report presents the results of our review and analysis.

ANALYSIS OF PETITION

A petition must be in the format authorized by the Commission and specified in Section 670.1(a), Title 14, California Code of Regulations. The format is specified in Section 670.1(a) as being that of form FGC-670.1 (3/90). This form requires the supporting information to be presented under specific headings.

The petition from the County of Kern to delist the Mohave Ground Squirrel contained information under the specified or similar headings. However, the content of no section under these headings in the petition met the requirement of form FGC-670.1 (3/90). The table beginning on the next page summarizes the content of the petition.

The information deficiencies of the County of Kern petition led the Department to conclude that the petition did not satisfy the content requirements of petition form FGC-6870.1 (3/90). In addition, the petition did not contain sufficient scientific information to support the petitioned action (to delist the Mohave Ground Squirrel), as required by Section 670.1 of the California Code of Regulations (and by Section 2072.3 of the Fish and Game Code). Thus, the petition did not meet the two tests of Section 670.1 in order for the petition to be accepted by the Commission. The petition failed to meet the content requirements and failed to provide sufficient scientific information. This analysis was the basis of the Department's recommendation to the Commission in February 1992 that the petition should be rejected.

For purposes of this status review, the Department analyzed the statements made in the petition to delist the Mohave Ground Squirrel and found that many statements were inaccurate, misleading, or irrelevant to the issue as to whether the squirrel should be delisted. The petition failed to provide any substantive information to support the contention that the squirrel should be

TABLE. Comparison of Content Requirements for a Petition and Actual Contents of the County of Kern's Petition.

Section of Petition	Required Contents	Contents of County of Kern Petition
Executive Summary	A statement of why State listing is no longer warranted and why one or a combination of the following six endangerment factors no longer threatens the existence of the species to be delisted: 1. present or threatened modification or destruction of its habitat; 2. overexploitation; 3. predation; 4. competition; 5. disease; 6. other natural occurrences or human-related activities	The petition did not address or even mention these factors.
Executive Summary	A brief summary of each section of the petition	The petition did not summarize its sections
Species Description, Biology, and Ecology	Pertinent available information on the biology of the species, specifically on identification, taxonomy and systematics, seasonal activity, reproductive biology, mortality, natality, food habits, and role in the ecosystem	The petition included some information on identification, food habits, habitat, and seasonal activity. The petition did not mention reproductive biology, mortality/natality, or role in the ecosystem, even though sources of information on these topics are available. The petition misstated results of scientific work on taxonomy.
Habitat Requirements	A description of habitat features that are important to the survival of the species, specifically plant community, soil, climate, topography, natural disturbance, interactions with other species, associated species, elevation, wintering habitat, breeding habitat, foraging habitat	The petition addressed only plant community and topography, even though sources of information are available on the other topics.
Distribution	How current distribution reflects recovery of the species since listing, percentage of historic distribution that is in existence, the number of known occurrences of the species, a discussion of the degree of habitat fragmentation, and a description of the quality of existing habitats	The petition addressed none of these topics.
Distribution	Maps showing the distribution of the species: one of California, showing general distribution within the State, and a topographic map showing location of occurrences of the species and portraying historic as well as current distribution. Each map must be labeled with the base map name and scale of map	The petition contained no map of California. A map labeled "Mojave Ground Squirrel Habitat" was included; it evidently illustrates current distribution, but historic distribution and occurrences of the Mohave Ground Squirrel are not shown. There is no information on the name of the base map used or the scale of the map.

Section of Petition	Required Contents	Contents of County of Kern Petition
Abundance	Historic and current population trends; explanation of population changes relative to human-caused impacts or natural events	The petition mentioned specific studies but misinterpreted the reported results. The petition did not address human-caused impacts.
Nature and Degree of Threat	Why any one or a combination of six endangering factors (listed under Executive Summary) no longer threatens the existence of the species.	The petition does not mention or address these factors.
Current Management	A description of ongoing protective measures or existing management plans for the species or its habitat; information on land management activities that are impacting portions of the range and information on proposed land use changes.	The petition proposed several programs that purportedly would protect habitat of the squirrel in the absence of State listing. The petition did not address activities which are impacting the range of the Mohave Ground Squirrel, and did not mention proposed land use changes.
Recommended Management/Recovery Measures	A description of activities that may be necessary to ensure future survival of the species after delisting	The petition combined this section with the previous one on Current Management (see the comments therein).
Information Sources	A citation of literature, specimen collection records, and other pertinent reference materials; a list of names, addresses, and telephone numbers of persons providing unpublished information or supporting the delisting	The petition listed some sources of information on the Mohave Ground Squirrel; other sources, including several important ones, were not included. Some included sources were listed incorrectly. No list of persons supporting delisting was included.

delisted. The petition systematically and pervasively misinterpreted, misstated, and ignored factual information from the available literature which would weaken its position for delisting. This observation is not only that of the Department. It was mentioned by a number of persons who wrote to the Department in response to the public notice on the petition.

FINDINGS

Threats

The major threats to the survival of the Mohave Ground Squirrel are drought, habitat destruction, habitat fragmentation, and habitat degradation. Drought is a natural phenomenon which results in decreased productivity (quantity, quality, and diversity) of annual plants (forbs and grasses) and shrubs in local areas. A single year of low rainfall may result in decreased productivity. The Mohave Ground Squirrel seems to respond to low rainfall and the resulting decreased food-supply by failing to reproduce. The decreased quality of the habitat also affects survivorship of adult squirrels. Prolonged periods of drought result in the extinction of Mohave Ground Squirrels in local areas. When a population of the squirrel is extirpated, it may take years for the species to repopulate the vacant area. Extirpation and repopulation are natural events, but currently the ability of the Mohave Ground Squirrel to reestablish itself in areas of extirpation is impeded and often precluded by the pattern of human development in the desert.

The major cause of decline of the Mohave Ground Squirrel has been the destruction of its habitat by humans for the purpose of development for urban, suburban, agricultural, military, or other use. Habitat destruction has occurred throughout the range of the squirrel. Currently, over 165,000 acres within the range are urbanized. When the delineated spheres of influence of the urban areas are completely built out, over 750,000 acres of former habitat of the species will have been lost.

Rural development currently accounts for 215,000 additional acres of lost habitat. Current agriculture occupies almost 40,000 acres. Disturbances of the desert surface for uses other than urban, rural, and agriculture cover another 209,000 acres. The latter figure does not include paved and unpaved roads within the range of the Mohave Ground Squirrel.

Fragmentation of habitat is another cause of decline of the Mohave Ground Squirrel. The phenomenon of fragmentation occurs when blocks of habitat become separated or discontinuous by destruction of the intervening habitat. Populations of animals thus become separated, and gene flow (the transmission of inheritable characteristics) between these populations no longer occurs. If the population in an isolated block becomes extirpated, there is no natural method for other Mohave Ground Squirrels to find their way to the new unoccupied habitat.

Degradation of habitat is a third cause of the decline of Mohave Ground Squirrels. This occurs in cases in which the habitat is not destroyed but is damaged by natural or human-induced means. The primary causes of human-induced degradation of habitat are off-highway vehicles and livestock grazing.

Management Activities

The Mohave Ground Squirrel was listed as a Rare species by the California Fish and Game Commission on May 21, 1971, under authority of the State Endangered Species Act of 1970. The listing was effective on June 27, 1971. The Mohave Ground Squirrel was redesignated as Threatened when the new California Endangered Species Act (CESA) was signed into law in 1984 and became effective on January 1, 1985.

The Department conducted field studies in 1972, 1977, and 1990 to determine distribution of the squirrel. Other agencies have conducted or contracted for studies which resulted in knowledge of the habitat and distribution of the squirrel. The U.S. Bureau of Land Management (BLM) prepared the California Desert Area Conservation Plan in 1980 after conducting several years of studies. As a result of the plan, two areas to protect the Mohave Ground Squirrel and its habitat were proposed.

Survey guidelines for live-trapping were required by the Department in the period of 1988 through 1991 for consulting biologists who wished to determine the presence or absence of the Mohave Ground Squirrel on a project site within the range of the species. The Cumulative Human Impacts Evaluation Format methodology replaced live-trapping after biologists reported that Mohave Ground Squirrels at times would not enter baited live-traps even though the animals were present on the trapping site. Thus, trapping surveys which concluded that no Mohave Ground Squirrels were present because none had been captured were often suspect, even though the Department's survey guidelines had been strictly followed.

CESA prohibits the taking of a State-listed species. State lead agencies may be allowed to take a listed species under Section 2090 of CESA if the taking is incidental to carrying out an otherwise lawful project under the California Environmental Quality Act (CEQA). CESA does not authorize incidental taking for other than State lead agencies. However, Section 2081 does authorize the Department to permit take for educational, scientific, or management purposes only. Non-State development which adversely affects a listed species by taking is prohibited unless the Department issues a permit for management purposes.

The Department, the BLM, and the U.S. Fish and Wildlife Service have entered into a cooperative process to produce and implement a West Mojave Coordinated Management Plan in order to protect habitat of the Mohave Ground Squirrel and the Desert Tortoise. All agencies having land-management and/or regulatory jurisdiction affecting the target-species have been invited to participate in the planning process, but no agency will be required to participate. Both public and private lands within the planning area will be addressed by the plan.

Management zones for the Mohave Ground Squirrel will be selected to ensure long-term survival of populations distributed throughout the range of the species and to ensure corridors of contiguous habitat to allow for gene flow between zones. A-zones will be areas of high-quality and medium-quality habitat and will include as much public and military land as possible, to minimize the need to acquire private land. The A-zones for the Mohave Ground Squirrel will be fitted with A-zones designated for the Desert Tortoise to create larger zones in situations in which the zones for the two species

overlap. Only 515,000 acres currently are proposed for A-zones for both the squirrel and the tortoise within the range of the squirrel. This acreage constitutes just 10.6% of the entire range of the squirrel.

Distribution and Abundance

The Mohave Ground Squirrel is found at elevations up to about 5600 feet in an area of the western Mojave Desert generally west of the Mojave River. The map of the range of the squirrel (see Figure on page 61 of status review) has been redrawn to reflect all known records of occurrence and to exclude the portion of the Antelope Valley west of Palmdale and Lancaster. The exclusion was due to the lack of known occurrences of the squirrel and to the fact that much native vegetation has been lost to agriculture and urban development. An area retained in the revised range was Victorville-to-Lucerne Valley, although there is uncertainty about the status of the species there.

The area within the new boundary line was calculated by the BLM's geographic information system to contain approximately 4,863,000 acres. Of this total, approximately 1,800,000 acres (36%) are private land. An additional 1,692,000 acres (34%) are military lands. Almost all of the remainder is public land. The State of California, through the State Lands Commission, the Department, and other agencies, owns a relatively small portion (less than 2%). Of the public land, about 103,000 acres are in designated off-highway vehicle areas operated by the BLM.

Not all of the 4,863,000 acres within the range contain habitat for the squirrel. Dry lake beds contain about 115,000 acres. Agriculture, urban areas, rural development, and other disturbed areas cover an additional 628,000 acres. The acreage of paved and unpaved roads was not calculated due to the difficulty of measuring that linear surface area. It is known that the squirrel is not continuously distributed in habitat across its range. It is considered to have a patchy distribution.

It is not practical to calculate the density or estimate the population of Mohave Ground Squirrels throughout its range at any point in time. A calculation or estimate would be based on a density or population derived from trapping results in one or more local areas and then extrapolated to the entire geographic range. Because the squirrel is patchily distributed and is affected at least locally by rainfall patterns, accurate extrapolation of local density and population figures to the entire range is not feasible.

Even if it were practical to estimate range-wide density of the squirrel, the resulting figure would not be meaningful in influencing conservation decisions for the species. The reason is that population numbers over time fluctuate widely in small mammals, probably including the Mohave Ground Squirrel, due to environmental conditions. This natural cycling is to be expected, and therefore the number of Mohave Ground Squirrels existing at any one time is not indicative of the degree of endangerment of the species. The true indicators of the status of the species are the quantity, pattern of distribution, and quality of habitat.

Essential Habitat

The Mohave Ground Squirrel has been found to occur in all of the broadly-described plant communities of the western Mojave Desert. These collectively

are called the desert scrub communities, which have been named Alkali Sink (also called Saltbush Scrub), Creosote Bush Scrub Shadscale Scrub, Joshua Tree Woodland, and Sagebrush Scrub (part of which is known as Blackbush Scrub). The squirrel is not found on dry lake beds or in areas of rocky outcrops or desert pavement. Based on the review of studies in which sites of observation or capture of the Mohave Ground Squirrel have been described, the Department's opinion is that the squirrel occurs in all broad plant-communities within its range.

Life History

The Mohave Ground Squirrel is a medium-sized ground squirrel of about nine inches in total length, which is about half the length of the more familiar and widespread California Ground Squirrel (*S. beecheyi*). The Mohave Ground Squirrel is a member of the mammalian family Sciuridae, a large family of rodents which includes ground squirrels, marmots, chipmunks, and tree squirrels. The ground-squirrel group, to which the Mohave Ground Squirrel belongs, is comprised of sciurids which live in burrows which they dig themselves. There are seven species of the genus *Spermophilus* which have geographic ranges that include at least part of California. The Mohave Ground Squirrel is the only one whose geographic range is entirely in California (i.e., it is endemic to California). The Mohave Ground Squirrel is a distinct full species, with no subspecies.

The Mohave Ground Squirrel spends about seven months of the year, often from August through February, in its underground burrows in estivation. Chosen foods are leaves of forbs, shrubs, and grasses; fruits and flowers of forbs; seeds of forbs, grasses, shrubs, and Joshua Trees; fungi; and arthropods.

ALTERNATIVES TO THE PETITIONED ACTION

The Department's review of the status of the Mohave Ground Squirrel indicates that the continued existence of the species is likely to become endangered at least in major portions of its geographic range in the foreseeable future in the absence of special protection and management efforts required by the California Endangered Species Act (CESA) and that continued listing as a Threatened species is appropriate.

The Department is concerned that if the Mohave Ground Squirrel is delisted, it would no longer be a target-species for special consideration under the West Mojave Coordinated Management Plan. The squirrel was included along with the Desert Tortoise as one of the two target-species in that multi-agency planning process because the squirrel is State-listed as Threatened.

If the Commission retains the listing of the Mohave Ground Squirrel, the Department will assess the status of the species and report to the Commission annually. In addition, the Department will prepare another status-report on the species no later than 1998, which is consistent with the requirement of Section 2077 of the Code that the status of a Threatened species or Endangered species be reviewed every five years. At that time, if the West Mojave plan has been completed, accepted by the Department and the U.S. Fish and Wildlife Service, and implementation has begun, information on the effectiveness of the plan in protecting habitat of the squirrel will be known and will be reported to the Commission. The Department will attempt to obtain funding specifically

for a study to determine the status of the species in the southern portion of its range from Antelope Valley east to Lucerne Valley.

Without the enforcement of the take provisions of CESA, without the cooperation of local, State, and federal agencies in implementing conservation actions, and in the absence of a federal listing for the squirrel which provides the protection of the federal Endangered Species Act, the habitat of the Mohave Ground Squirrel is certain to continue to be incrementally destroyed, fragmented, and degraded. The Department must assume that all private land within the range of the squirrel, about 36% of the total, will be developed. The species will decline further until populations are no longer capable of sustaining themselves. Eventually, range-wide extinction will occur.

ECONOMIC CONSIDERATIONS

Maintaining the Mohave Ground Squirrel as a State-listed species would continue the protection of CESA and CEQA. If the squirrel is delisted as a Threatened species, then the protections of CESA would no longer apply. However, CEQA would continue to apply because the status of the species would fit the CEQA definitions of a rare or endangered species. Required mitigation as a result of lead agency actions under CEQA, whether or not the Mohave Ground Squirrel is delisted by the Commission, would continue to add to the cost of a project.

Whether or not the listing of the Mohave Ground Squirrel as a Threatened species is maintained, there may be additional expenditures of funds for purchase of privately owned habitat by the Department and other agencies. The acquisition of such habitat is considered a necessary recovery action for this species.

CONCLUSIONS

Based on this status review of available scientific information and the written comments received in response to the Department's public notice, the Department concludes that the Mohave Ground Squirrel is likely to become endangered in the foreseeable future in the absence of special protection and management efforts provided by CESA, due to habitat loss, habitat fragmentation, and habitat degradation. A species existing under such conditions is a Threatened species, according to CESA (Section 2067, Fish and Game Code).

The multi-agency West Mojave Coordinated Management Plan may provide protection of habitat throughout much of the range of the squirrel, but some years will pass after adoption of the plan, acceptance by the Department and the U.S. Fish and Wildlife Service, and implementation begins before conclusive evidence that the plan is successful can be obtained.

RECOMMENDATIONS

The Department recommends that the Commission should find that the petitioned action to delist the Mohave Ground Squirrel as a Threatened species is not warranted at this time.

The Department's objective in conservation of the Mohave Ground Squirrel is the complete protection of habitat sufficient in size, pattern of distribution, and quality to enable the Mohave Ground Squirrel to survive in the long-term. In order to achieve this objective, habitat must be protected throughout the geographic range of the species in a pattern that allows gene flow (the transmission of inheritable characteristics) from population to population, and that allows populations to be self-sustaining. Protected habitat must be free of incompatible land uses and human practices on a large scale. The Department proposes specific actions to achieve the recovery objective.

REPORT TO THE FISH AND GAME COMMISSION:

A Status Review of the
Mohave Ground Squirrel (*Spermophilus mohavensis*)

INTRODUCTION

PETITION HISTORY

On November 20, 1991, the Fish and Game Commission (Commission) received a petition (see Appendix A) from the Kern County Department of Planning and Development Services in Bakersfield, California, requesting delisting of the Mohave Ground Squirrel (*Spermophilus mohavensis*) as a Threatened species. The petition was signed by Mr. Ted James, Director of the Department of Planning and Development Services. The Department of Fish and Game (Department) reviewed the petition and recommended to the Commission on February 24, 1992 that the petition be rejected as incomplete pursuant to Section 670.1 in Title 14 of the California Code of Regulations and sections 2072.3 and 2073.5 of the Fish and Game Code (Code). This recommendation by the Department was based somewhat on the format requirements of Section 670.1 but primarily on the requirements of Section 2072.3 of the Code that "[t]o be accepted, a petition shall, at a minimum, include sufficient scientific information that a petitioned action may be warranted. Petitions shall include information regarding the population trend, range, distribution, abundance, and life history of a species, the factors affecting the ability of the population to survive and reproduce, the degree and immediacy of the threat, the impact of existing management efforts, suggestions for future management, and the availability and sources of information. The petition shall also include information regarding the kind of habitat necessary for species survival, a detailed distribution map, and other factors that the petitioner deems relevant."

On April 2, 1992, at its meeting in San Pedro, California, the Commission accepted for consideration the petition to delist. That action initiated a twelve-month review period, pursuant to Section 2074.6 of the Code, within which the Department was required to review the status of the Mohave Ground Squirrel and provide a written report to the Commission. This report contains the results of the Department's status review and contains a recommendation to the Commission, based on the best scientific information available, as to whether the petitioned action is warranted. The report also suggests management activities and includes recommendations for recovery of the squirrel.

DEPARTMENT REVIEW

During the initial review of the petition prior to making its recommendation to the Commission in February 1992, the Department determined whether the petition (as described in Petition History above) met the requirements of Section 2072.3 of the Code. The Department's finding was that the petition did not meet those requirements. The Department found that the petition did not contain any information on population trend or abundance of the Mohave Ground Squirrel. The petition did not contain sufficient scientific

information on range, distribution, life history, factors affecting the ability of the population to survive and reproduce, the degree and immediacy of the threat, the impact of existing management efforts, suggestions for future management, and the kind of habitat necessary for species survival to support the claim that the Mohave Ground Squirrel should not be listed as Threatened. The petition did not include a detailed geographic range map (a map entitled "Mojave [sic] Ground Squirrel Habitat" was included, but it inaccurately portrayed the range of the squirrel) nor did it cite all specific sources of information on the squirrel. Results from most studies mentioned in the petition were misinterpreted, and unsupported conclusions were reached. A detailed analysis of the petition, including a description of the legal points which the petition failed to address, is contained in this status review. Also included in the analysis of the petition is a discussion of the content requirements of the petition format, as specified in Section 670.1(a), Title 14, California Code of Regulations, and specific analysis of the content of the petition submitted by the County of Kern.

During the twelve-month review period after the petition was accepted by the Commission, the Department through a public notice contacted affected and interested parties, invited comment on the petition, and requested scientific information. The public notice was issued on June 10, 1992. A copy of the notice and a list of persons and organizations to whom the notice was sent are contained in Appendix D of this status review. Copies of letters received by the Department in response to the public notice are provided in Appendix E. The Department's evaluations of the received comments also are in Appendix E.

An initial draft of this status review was reviewed in January 1993 by numerous persons within the Department. A revised draft then was sent in February for inspection to the planning directors of the counties of Kern, Inyo, San Bernardino, and Los Angeles, to members of the Department's Mohave Ground Squirrel Working Group (see discussion of this group in the Management Activities section of the status review), to persons who had submitted written comments on the petition in response to the public notice, and to Department personnel.

ANALYSIS OF PETITION

FORMAT AND CONTENT OF THE COUNTY OF KERN'S PETITION

In this section of the status review the Department presents an analysis of the format and content requirements of the petition submitted by the County of Kern. The nine-page petition is in Appendix A of the status review.

In order for the Commission to accept a petition to list or delist a Threatened or Endangered species, the petition must be in the format authorized by the Commission (Section 670.1(a), Title 14, California Code of Regulations). The format is specified in Section 670.1(a) as being that of form FGC-670.1 (3/90). This form (a copy is included in this status review as Appendix B) requires the supporting information for a petitioned action to be presented under the following headings: Executive Summary; Species Description, Biology, and Ecology; Habitat Requirements; Distribution; Abundance; Nature and Degree of Threat; Current Management; Recommended Management/Recovery Measures; and Information Sources.

The petition from the County of Kern to delist the Mohave Ground Squirrel contained information under the specified or similar headings. However, the content of no section under these headings in the petition met the requirement of form FGC-670.1 (3/90).

The petition form requires that the Executive Summary contain a description of why State listing is no longer warranted and why one or a combination of six endangerment factors no longer threatens the existence of the species to be delisted. The six factors are as follows: 1. present or threatened modification or destruction of its habitat; 2. overexploitation; 3. predation; 4. competition; 5. disease; and 6. other natural occurrences or human-related activities. The Executive Summary of the County of Kern petition did not address or even mention any of these factors. A petition's Executive Summary also is required to include a brief summary of each section of the petition. The County of Kern petition did not summarize its sections.

A petition section on Species Description, Biology, and Ecology is required to include pertinent available information on the biology of the species to be listed or delisted. Specific categories are to be discussed. The County of Kern petition in its section entitled "Species Description" included some information on identification, food habits, habitat, and seasonal activity of the Mohave Ground Squirrel. No information on reproductive biology, mortality/natality, or role in the ecosystem was mentioned, although discussion of these categories is required by the petition format and sources of information are available for these topics. This County of Kern petition section did discuss the geographic range and taxonomy of the Mohave Ground Squirrel, but misstated the conclusions of the scientists (Wessman 1977 and Hafner and Yates 1983) whose work was analyzed in preparation of the petition. (See the section below on the Department's analysis of the scientific information provided by the petition.)

A petition section on Habitat Requirements must discuss appropriate factors such as plant communities and topography. The County of Kern petition in its section entitled "Habitat Requirements" addressed those factors for the Mohave Ground Squirrel but did not mention other specified categories such as climate, natural disturbance, interactions with other animals, associated

species, elevation, foraging habitat, or other habitat features. Sources of information are available for these topics.

A petition section on Distribution is required to include, in the case of a proposed delisting, a discussion of how current distribution reflects recovery of the species since listing. A petition also must indicate the percentage of historic distribution that is in existence, indicate the number of known occurrences of the species, discuss the relationship between historic and current acreage, discuss the degree of habitat fragmentation, and describe the quality of existing habitats. The County of Kern petition, in a section entitled "Disturbance [sic]/Abundance", had no discussion of any of these topics. A petition is required to be accompanied by maps showing the distribution of the species in consideration. One map must be of California, showing general distribution within the State, and another must be a topographic map showing location of occurrences of the species and portraying historic as well as current distribution. Each map must be labeled with the base map name and scale of the map. The County of Kern petition was not accompanied by a California map. A map labeled "Mojave [sic] Ground Squirrel Habitat" was included; it illustrates distribution rather than habitat, but there is no information on the name of the base map used or the scale of the map.

A petition section on Nature and Degree of Threat is required, if delisting is proposed, to state why any one or a combination of six endangering factors no longer threatens the existence of the species. These factors were listed earlier in discussing the Executive Summary of a petition. The County of Kern petition in its section entitled "Nature and Degree of Threat" did not mention or address those factors *per se*.

Some of the required information in sections of a petition on Abundance, Current Management, Recommended Management/Recovery measures, and Information Sources was provided in the County of Kern petition. However, none of these sections were complete in providing all known information on the Mohave Ground Squirrel. In the "Sources of Information" section, for example, the petition did not list the Department's 1987 five-year status report on the Mohave Ground Squirrel, nor did it list the important work at the Coso Known Geothermal Resource Area by Leitner and Leitner (1989) and Leitner *et al.* (1991). The work of other researchers (e.g., Leitner and Leitner 1990, Zembal and Gall 1980) was listed incorrectly.

These information deficiencies of the County of Kern petition discussed above led the Department to conclude that the petition did not satisfy the content requirements of petition form FGC-6870.1 (3/90). In addition, the petition did not contain sufficient scientific information to support the petitioned action (to delist the Mohave Ground Squirrel), as required by Section 670.1 of the California Code of Regulations (and by Section 2072.3 of the Fish and Game Code). Thus, the petition did not meet the two tests of Section 670.1 in order for the petition to be accepted by the Commission. The petition failed to meet the content requirements and failed to provide sufficient scientific information. Based on this analysis, the Department wrote (Gibbons 1992) to the Commission on February 24, 1992 that the petition should be rejected (See Appendix C).

SPECIFIC STATEMENTS IN THE COUNTY OF KERN'S PETITION

In this section of the status review the Department presents an analysis of statements in the County of Kern's petition which are inaccurate, misleading, or irrelevant to the issue as to whether the squirrel should be delisted. The subsection titles are those used by the petitioner.

Executive Summary

In the petition, the first paragraph of the Executive Summary stated that the petition "is being submitted in compliance with the delisting procedures specified in Section 670.1, Title 14, California Code of Regulations." As has been discussed in the preceding section of this analysis, the petition was not in compliance with Section 670.1. The petition failed to meet the content requirements of Section 670.1 and did not contain sufficient scientific information to support the petitioned action.

In the second paragraph of the Executive Summary, the petition stated that the listed Mohave Ground Squirrel "is having a significant impact on the economic growth of eastern Kern County." There may or may not be such an impact. The County of Kern has been unable to document an impact. No analysis of economic impact accompanied the petition nor could an analysis be produced when it was requested by the Department in October 1992. A letter received in March 1993 from the County of Kern (James 1993) provides no information on costs actually incurred by property owners in regard to the squirrel. (For a full discussion of economic considerations, see the section under that title in this status review.) Whether or not an economic impact has resulted from enforcement of laws protecting the Mohave Ground Squirrel, the Commission is required to consider only scientific information as specified by Section 2072.3 of the Fish and Game Code in its decision to list or delist a species.

A statement in the second paragraph was that "[e]fforts by private property owners to subdivide properties into residential homesites is being inhibited by DFG mitigation requirements that are inconsistent, unclear, cost prohibitive, and lack a clear scientific basis." That opinion was refuted by C. Uptain, a consulting biologist who has conducted research on the Mohave Ground Squirrel and who wrote to the Department in response to the public notice on the petition to delist the squirrel (see his letter in Appendix E), as follows: "I am sure that the subdividing of private properties are being delayed by the mitigation requirements for Mojave [sic] ground squirrels. However, I am not aware of a single proposed project that has not been completed due to the required mitigations. Further, the mitigation requirements established by CDFG are not inconsistent, unclear, cost prohibitive, and they do not lack a scientific basis. Although the mitigation requirements may not be identical from project to project, all projects are currently evaluated in a consistent manner. The methods used to evaluate properties and the resultant mitigation requirements have been standardized and are very clear."

Another statement was that the squirrel's Threatened status "is having an impact on a property owner's ability to use their [sic] land." It should be noted that the City of Ridgecrest has entered into a Section 2081 agreement with the Department which allows the management take of the squirrel and its habitat in urban development while providing off-site mitigation in the form of acquiring habitat. Thus, the property owner can use his/her land while

contributing to the welfare of the squirrel. A similar process with the County of Kern has broken down. The Department was "unable to reach resolution with the County since they were unwilling to provide compensation lands prior to authorizing the management take of the species" (Sarasohn 1992). (See the discussion of Section 2081 Management Permits under that title in this status review.)

The third paragraph stated that the County of Kern's petition "presents a comprehensive review of available literature and studies related to the MGS. It is clear from the scientific research conducted to date that the MGS was erroneously listed as 'rare' in 1971 in the absence of adequate and conclusive scientific evidence. To date, there is a lack of scientific research on the population, range, density, behavior, taxonomic relationships and habitat preferences of the species." If the last sentence of this quotation is taken as fact, the very lack of research and resulting information prevents the County of Kern from presenting sufficient scientific information to support its charge that the squirrel should be delisted. In addition, that last sentence's statement that "there is a lack [emphasis added] of scientific research" conflicts with the preceding sentence's statement that it "is clear [emphasis added] from the scientific research" that the squirrel was erroneously listed.

The petitioner erred in stating that there is a lack of research on the Mohave Ground Squirrel. Density and abundance information for local areas has been presented by Zembal *et al.* (1979), Leitner (1980), Aardahl and Roush (1985), Leitner and Leitner (1989, 1990), and Leitner *et al.* (1991). Information on behavior has been presented by Burt (1936), Bartholomew and Hudson (1960), Ingles (1965), Adest (1972), Hoyt (1972), Recht (1977), Wessman (1977), Zembal *et al.* (1979), Zembal and Gall (1980), and Leitner *et al.* (1991). Work on taxonomic relationships has been reported by Hafner and Yates (1982, 1983). Habitat use of the Mohave Ground Squirrel have been described by numerous authors, including Hoyt (1972), Wessman (1977), Recht (1977), Zembal *et al.* (1979), Leitner (1980), Aardahl and Roush (1985), Michael Brandman Associates, Inc. (1988), Leitner and Leitner (1989, 1990), and Leitner *et al.* (1991). Ten of the 17 authorities listed above were listed in the petitioner's Sources of Information. The ignoring of information in its cited sources and the failure to use other sources has not resulted in the "comprehensive review of available literature and studies" claimed by the petitioner. C. Uptain wrote to the Department that "[a]lthough most of the pertinent available literature has been incorporated and discussed in this petition, most of it has been misinterpreted, misquoted, or misrepresented. Clearly, the author of this petition either has a very minimal scientific background or wishes to twist the conclusions of certain studies." D. J. Hafner, a scientist who has conducted taxonomic research on the Mohave Ground Squirrel, wrote to the Department in response to the public notice on the petition to delist the squirrel (his letter is in Appendix E) that "I find the petition to be an irresponsible distortion of the available literature, while the purportedly 'scientific' arguments made in the petition to substantiate the robust health of the species display either a gross ignorance of or blatant disregard for basic biological principles."

The information presented in the petition did not make it "clear from the scientific research to date that the MGS was erroneously listed as 'rare' in 1971." In fact, no author has suggested that the listing was erroneous, and the cumulative knowledge of the last twenty years does not provide evidence

for that conclusion. Actually, the cumulative knowledge as presented or summarized in this status review provides evidence that the Mohave Ground Squirrel should retain its listing as a Threatened species. The petitioner further stated that the squirrel was listed in the absence of adequate scientific information. In 1971 the Commission had specified standards for listing a species as Rare or Endangered. (See the discussion under Listing as Rare in this status review.) Apparently the Commission believed that it did have adequate scientific information; otherwise it would not have voted unanimously to list the squirrel. As the Department described in its February 24, 1992 recommendation (Gibbons 1992) to the Commission that the petition from the County of Kern be rejected, "there is no evidence in the written record of the Commission's action in 1971 to indicate that the Mohave ground squirrel received any more or less consideration for a designation of Rare than did other species of animals which received that designation." As the western Mojave Desert has been developed over the years since 1971 and the habitat of the squirrel has become increasingly destroyed, fragmented, and degraded, it can be seen that the early action by the commission was justified.

This issue of supposedly inadequate information being available in 1971 was raised once again in the fourth paragraph of the Executive Summary. It was stated that "the species was prematurely listed without the availability of adequate population and habitat studies." The fact that the Commission acted as it did in 1971 is evidence to the contrary that a decision was premature. The Department presented evidence at the time that the squirrel and its habitat were in decline. The Department indicated to the Commission that the squirrel was confined to a small and specialized habitat and that it was so limited in range and habitat that any appreciable reduction would cause it to become endangered. Either of those factors made the squirrel eligible to be listed as Rare. (See discussion under Listing as Rare in this status review.) In any case, the squirrel currently is listed as Threatened (Rare from 1971 to 1985). The petition to delist the species provides no evidence that the protections of CESA are not necessary to allow the Mohave Ground Squirrel to survive in the long-term.

Also in the fourth paragraph were the statements that "recent studies have suggested that the range of the species and population densities are far greater than the conclusions of earlier studies. Studies conducted by the Bureau of Land Management... support the contention that large populations of MGS exist and their distribution ranges over an area which encompasses in excess of 7,000 square miles." The implication of these statements is that identification of areas in which the squirrel was not previously known to occur must mean that the species in not deserving of being listed as Threatened. Such a conclusion is incorrect. There still may be areas in which the squirrel is thought not to exist but does exist. Past and future discovery of such areas help expand knowledge of the squirrel's distribution but do not at all define the status of the species. Status, in terms of endangerment, is determined by the amount of available habitat within the range and the degree (amount, pattern, and rate) of loss of this habitat. It is the degree of loss that causes concern for the future of the Mohave Ground Squirrel. M.A. Recht, a scientist and consulting biologist who has conducted field studies of the Mohave Ground Squirrel and who wrote to the Department in response to the public notice on the petition to delist the squirrel (see his letter in Appendix E), pointed out that "the petition makes no notice of the massive loss of habitat (and squirrels) due to the development in the

Palmdale-Lancaster-Rosamond-Mohave corridor and in the Adelanto-Victorville area."

The "recent studies" which have suggested that "population densities are far greater" than had been thought were not listed in the petition, but the reference may be to the work of Aardahl and Roush (1985). Those researchers considered the Mohave Ground Squirrel to be "common" on their study sites in the northern and central parts of the range, although the term was not defined. They also found that mean relative densities of the Mohave Ground Squirrel and the White-tailed Antelope Squirrel (*Ammospermophilus leucurus*) on their 22 study sites were "similar", based on an assumption that the two species were initially captured at equal rates. There probably was not a similarity in population sizes on the study sites; recaptures of marked animals of both species indicate that the antelope squirrel was more numerous than the Mohave Ground Squirrel. (See the discussion of Aardahl and Roush's results in the subsection on Field Studies by Other Agencies and in the subsection on Abundance.) Neither the opinion of "common" status of the Mohave Ground Squirrel nor the questionable finding that the squirrel had "similar" population size with the more widespread antelope squirrel should lead to the conclusion that densities are greater or "far greater" than had been thought. In any case, it is not surprising that the Mohave Ground Squirrel could be considered common in local areas in which habitat integrity has not been compromised by human impacts. The important factor in the decline of this species is that such local areas are disappearing.

Studies by the U.S. Bureau of Land Management (BLM) have not contended that large populations of the Mohave Ground Squirrel existed. The major study of the BLM was that reported by Aardahl and Roush (1985). Those authors did not conclude that the squirrel existed in large populations or that newly discovered areas of occupation suggested that the legal status of the species should be changed.

It is true that the geographic range of the squirrel encompasses over 7000 square miles or approximately 4,863,000 acres. This may seem large in respect to the entire Mojave Desert, but a range of that size is quite small for a full species of mammal. In fact, it is the smallest range of any of the seven species of the ground-squirrel genus *Spermophilus* which occur in California (Hall 1981). D. J. Hafner wrote to the Department that the "petitioners display gross ignorance regarding the relative size of a species' range, and lack any understanding of the differences between local population density and geographic range. By any measure (comparison with other mammal species, with other rodent species, with other squirrel species), the Mojave [sic] Ground Squirrel is restricted to a tiny geographic range. While 7,000 mi^2 may appear to be a large area to a developer with a bulldozer, it is not a large area for an entire species range. Furthermore, it is well known that the Mojave [sic] Ground Squirrel colonies are very precinctive and spotty within this already small range." T. L. Yates, a scientist who worked with D. J. Hafner on the taxonomy of the Mohave Ground Squirrel, has written to the Department in response to the public notice on the petition to delist the squirrel (his letter is in Appendix E) that the "contention of the petitioners that the species occupies a large geographic range and that enough land exists on federal portions of the species range to afford protection appears as another attempt to misrepresent the truth. As species ranges go for similar sized small mammals, the range of the Mohave Ground Squirrel is extremely small." Within its range the Mohave Ground Squirrel can occupy only those areas which

are desert scrub habitat and to which it has access. Much of the area within the range is unsuitable for occupation, because it is urban and rural development, agriculture, other disturbed area, highways and roads, and dry lake beds.

The last sentence of the fourth paragraph stated that "the preponderance of public lands [within the range of the Mohave Ground Squirrel] managed by various federal agencies provides substantial management benefit to assure that continued existence of the species." This statement conveys the false impression that federal agencies indeed are managing for the squirrel. With the exception of the joint Coso Mitigation Program of the BLM and Navy (see the discussion under that title in this status review), there is no federal management for the squirrel. As the Department (Gibbons 1992) wrote to the Commission on February 24, 1992, "we believe that if benefit [to the squirrel from management on federal lands] is derived it is incidental to other purposes in land management decisions. There is little specific management consideration given to the species on Federal lands sufficient to provide benefit over the long term." The fact is that no military or other federal agency is legally obligated to protect any habitat for the squirrel. This is why the BLM, the Department, and the Fish and Wildlife Service have begun a cooperative process to develop the West Mojave Coordinated Management Plan. Voluntary participation in the plan by military and other federal agencies will provide the obligation to protect habitat designated in the plan.

M. A. Recht wrote to the Department that the "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 while off-road vehicle activity continues to dissect and dissipate habitat." D. J. Hafner wrote to the Department that the "petitioner implies that Mojave [sic] Ground Squirrels will gain protection even after delisting by virtue of the large percentage of their range that is managed by federal agencies, particularly the armed forces. My observations of bombing ranges and military lands has generally agreed with this, but only in a relative sense: repeated bombing, strafing, microwave experimentation, and pounding by tanks and ground transports are not as bad as off-road vehicle races or housing developments for native species. Explosives attacks aside, can you imagine the impact on a hibernating colony of squirrels that is overrun (literally) by hundreds of tanks on maneuver? Not only would many individuals be immediately killed and burrow systems (usually occupied sequentially by generations of squirrels) be collapsed, but the ground is compacted and vegetation scoured, making the outlook for the few survivors bleak indeed. And if migration is not really a feasible alternative [due to low vagility; see discussion in the subsection under Distribution in this status review], then another colony is extirpated. As for the BLM-administered lands, I have witnessed the effects of the large off-road vehicle races which are permitted by the BLM: the soil compaction and vegetative damage are incredible in severity and longevity."

Background to Species Listing

In the fourth paragraph of this section of the County of Kern's petition, it was stated that it "is clear from the record [of the Commission's meeting on May 21, 1971] that very little information was available in 1971 to make a quantitative scientific judgement that the MGS should be listed as 'rare'. In the same paragraph, it was written that in "the absence of comprehensive quantification studies and habitat preference analysis, it is not understood

how the 1971 Commission and its staff was able to conclude that continued existence of the species was affected to such an extent that it necessitated listing as a 'rare' species." The emphasis by the petitioner on quantification is irrelevant, because the 1971 Commission applied standards in reaching its decision which are different than would be applied today.

It must be remembered the Department had reason to believe, in making its 1971 recommendation to the Commission that the squirrel be listed as Rare, that the habitat and thus the species itself were in quantitative and qualitative decline. That belief was corroborated by the recommendations made by the scientific reviewers of the questionnaire and working list of species sent out and then evaluated prior to the Department's presentation to the Commission. Since the listing in 1971 the species often has been difficult to find, especially in the southern portion of its range. Wessman (1977) believed that the squirrel might be extirpated from the area of Victorville and eastward. M. A. Recht wrote to the Department as follows: "At the time I began my Dissertation research [in 1974] I had discussions with scientists who had worked with and/or trapped for the MGS; Bartholomew, Hudson, Pengelley, Mayhew, Hoyt, and Adest. All these individuals told of how difficult it was to find them and three of them told me that the MGS was <u>not</u> a good Dissertation project because the squirrels were not abundant, were discontinuous in distribution, limited to the selected habitats in the Mohave [sic] Desert and thus I would have a very difficult time finding enough squirrels to study for a project! As I began my Dissertation research in the western Mohave [sic] Desert I found their concerns to be valid. I found the populations to be discontinuous and small."

In the years since M. Recht conducted studies for his dissertation in 1974-1976, the human-induced growth in the western Mojave Desert has been phenomenal, with Victorville increasing 186% and Palmdale increasing 460% in population over a ten-year period. As the Mohave Ground Squirrel and its habitat have declined as a result of this growth, the 1971 action by the Commission to list the species has been vindicated.

Species Description

The third paragraph of this section of the petition noted the federal status of the Mohave Ground Squirrel as a category 2 species. According to the petition, this "means <u>conclusive data</u> on biological vulnerability and threat <u>are not available</u> to justify the federal listing as 'threatened or endangered' [emphasis is that of the petitioner]." The implication of this incomplete definition of a category 2 species in the emphasized statement is that the U.S. Fish and Wildlife Service (Service) has reviewed the status of the squirrel and decided not to list it. The petitioner's interpretation is not correct. The Service has expressed its concern about this interpretation to the Department in a letter written in response to the public notice on the petition to delist the squirrel. The letter, which is in Appendix E, was signed by J. I. Ford and stated that the Service "is concerned that misperceptions regarding the Federal listing process and the biology of the Mohave ground squirrel (*Spermophilus mohavensis*) may adversely influence the proposed delisting of the species by the California Fish and Game Commission.

"The petition from the County of Kern cites the Mohave ground squirrel's Federal status as a category 2 candidate to support its contention that there is insufficient information to justify its listing as a threatened species.

As defined at 50 CFR Part 17, category 2 candidates are those '(t)axa for which information now in possession of the Service indicates that proposing to list as endangered or threatened is possibly appropriate, but for which conclusive data on biological vulnerability and threat(s) are not currently available to support proposed rules.'

"The Service has not conducted an in-depth review of the distribution of the Mohave ground squirrel. However, because of our involvement with the desert tortoise (*Gopherus agassizii*), which is listed by both the State of California and the United States as threatened, we are well aware of the land uses and habitat loss, degradation, and fragmentation, resulting from ongoing urban development and multiple use of private and public lands, that have occurred and continue to occur in the western Mojave Desert. Simply stated, the Service is concerned that existing conditions in the western Mojave Desert are such that the long-term viability of plant and animal species whose ranges are restricted to this area, like the Mohave ground squirrel, cannot be adequately ensured. To reflect this concern, the most recent animal candidate review describes the status of the Mohave ground squirrel as 'declining.'

"Because of limited funding and staff, the Service has been unable to fully monitor and pursue listing proposals for all of the numerous candidate species in California. We have chosen to devote our efforts to the development of a large-scale management plan for the western Mojave Desert, which, if implemented, should aid the recovery of the desert tortoise, the Mohave ground squirrel, and other sensitive species in that region. If the coordinated management plan meets its biological objectives, the Service may be able to forego proposals to list individual species throughout the western desert.

"In conclusion, the Service is not aware of any information regarding the Mohave ground squirrel's range or biological vulnerability that indicates the species should be removed from the State list of endangered and threatened species, or dropped from consideration for Federal listing. We hope this letter assists you in understanding the Service's position with regard to the status of the Mohave ground squirrel." (See the discussion of Federal Candidacy in the subsection of this status review under that title.

In the fourth paragraph of this section of the petition, it is written that "inadequate and inconclusive statements regarding the continued listing of the species were used [in the Department's 1987 five-year status report]. There is [sic] no conclusive scientific studies which have documented significant MGS habitat loss, adverse effects on population status, or other life history requirements." The "inadequate and inconclusive statements" of the 1987 report were not identified. In regard to habitat loss, many authors have cited such loss; Aardahl and Roush (1985) wrote that "[s]ignficant loss of habitat for the Mojave [sic] ground squirrel has occurred on private lands due to urban and agricultural development." It is true that no study has been specifically designed to document habitat loss until planning for the West Mojave Coordinated Management Plan began. With the development of the geographic information system for this plan, planners have been able to identify the loss of over 165,000 acres of the western Mojave Desert to urban development and approximately 215,000 acres of rural development within the range of the squirrel. (See the discussion of habitat loss in the section on Threats in this status review.) The adverse effects of habitat loss on the Mohave Ground Squirrel obviously are death or displacement of individuals and permanent loss of physical space which could be occupied by the species.

Attributes of life history of the squirrel have been documented by many authors (see the Life History portion of this status review).

The fifth paragraph read as follows: "The 1977 Wessman study recognized a substantial 1,800 square mile increase in the range of the MGS, yet no mention of this significant increase in the MGS habitat was acknowledged in the [Department's 1987] Five-Year Status Report. It is wondered why this significant increase in known habitat area would not provide a reasonable basis to demonstrate sufficient available habitat to delist the species." Wessman (1977) did not discover that the range of the squirrel had increased. Rather, he found that the species existed in a previously unknown 1800-square-mile area on the northeastern edge of the range. He also noted that the Mohave Ground Squirrel might no longer exist in the southeastern portion of its original range east of Victorville. The new knowledge of the actual range in the northeast did not cause Wessman (1977) or any other researcher to recommend that the squirrel should be delisted. This may be due to the recognition by workers on the Mohave Ground Squirrel that the geographic range, even being larger by 1800 square miles than had been thought prior to the study by Wessman (1977), is still quite small compared to the ranges of other ground squirrels. Also, the cause for concern since before its listing in 1971 has been, and continues to be, the destruction, fragmentation, and degradation of the squirrel's habitat within its range.

In regard to the significance of Wessman's (1977) finding being acknowledged in the five-year status report (Gustafson 1987), the status report was prepared ten years after Wessman (1977) described the previously unknown area occupied by the squirrel. By 1987 that part of the range had long been accepted by workers with the Mohave Ground Squirrel. The discovery of this area was not considered significant even in 1977; it did not change the plight of the species, which was threatened by the habitat changes that only have accelerated since then.

The sixth paragraph had sentences which read as follows: "It is interesting to note that Hafner and Yates [1983] question whether the MGS is even a separate distinct species", "[t]he occurrence of speciation for the MGS is still unknown", and "Hafner and Yates [1983] concluded that insufficient evidence exists to substantiate conclusive scientific recognition of a separate MGS species." These statements by the petitioner are misleading and incorrect. Hafner and Yates (1983) actually concluded that retention of full species status was warranted. (See the discussion in the subsection of the status review entitled Taxonomy.) In regard to the first and third of the petition's statements above about the work of Hafner and Yates (1983), D. J. Hafner wrote to the Department that the statements are "an absolute distortion that [are] completely contrary to our stated conclusions." In regard to the statement about unknown "occurrence of speciation" for the squirrel, he wrote that "this is a clear distortion of our paper, deliberately implying that species recognition is in doubt." Further, "[w]e did not doubt that speciation had occurred [in a desert refugium]; we simply did not know where or by what mechanism. My current article [now published-Hafner 1992] identifies the glacial-maxima isolating mechanism." D. J. Hafner also wrote that the petition's "self-serving, deliberate distortions and misrepresentations of our article are deplorable."

Habitat Requirements

The second paragraph of the section of the petition under this title mentioned the "little information" on habitat preference and use by the Mohave Ground Squirrel and on the comparisons of the use of one site with others in the same plant community and in different communities. Then the petition stated that it "would seem prudent for these additional studies [to gather information on habitat] to be undertaken before a species is listed as 'threatened'." Preferential use of habitat by the squirrel is of interest to scientists and to land managers who are designing a preserve system, but it has little bearing on whether the species is deserving of Threatened status. The key to sustaining the squirrel in the long-term is the protection of habitats in a size and pattern sufficient to preserve preferred habitat and less-preferred habitat.

The third paragraph mentioned the large percentage ("over 57 percent") of Mohave Ground Squirrel habitat which is on federal property, managed by either the BLM or the military agencies. The petition then stated that "[w]ith such a small percentage [43 percent?] of private holdings, the encouragement of effective management practices by the federal government would seem to ensure substantial areas available for species [sic] propagation." Presumably, the unstated recommendation was that the Department should encourage the BLM and the military agencies to manage their properties for the squirrel. Actually, the Department is involved as a co-leader with the BLM and the Fish and Wildlife Service in the West Mojave Coordinated Management Plan. (See the discussion under that title in this status review.) The plan, when fully implemented after 20 years, should protect the squirrel and the Desert Tortoise in the long-term. The military agencies have been invited to participate in the planning process. Currently, neither the BLM nor the military agencies are obligated by law to manage habitat for the squirrel. The plan cannot be fully implemented without the participation of the counties, cities, and special districts, because the Department and the BLM have no authority to regulate uses on private land. Thus, private-property owners ultimately must share in obtaining a solution for the long-term protection of the squirrel and the tortoise.

Distribution/Abundance

In this section of the petition, which actually was mistakenly entitled "Disturbance/Abundance", the first paragraph contained the statement that Hoyt's (1972) work for the Department to gather information on the distribution of the Mohave Ground Squirrel "was cursory in nature with many of the live trappings attempted during winter MGS estivation period." Hoyt's (1972) study was limited by design to live-trapping at sites at which scientists and small-mammal trappers had captured the squirrel in the recent past. These sites numbered only eight. None of these sites were trapped by Hoyt (1972) in the winter *per se*; six sites were trapped in March, April, May, or June. The other two were trapped in mid-February; the lack of captured squirrels may have been a result of trapping before any animals present emerged from estivation. However, the Mohave Ground Squirrel is known to emerge as early as January and often is above ground in February. D. F. Hoyt, a scientist who conducted an early study of the distribution of the squirrel, has written to the Department in response to the public notice on the petition to delist the squirrel (his letter is in Appendix E) that the petitioner has misrepresented the facts in stating that "many of the [Hoyt 1972] live

trappings [were] attempted during winter MGS estivation periods." He added that the estivation period "ends sometime in February."

Another statement in the first paragraph was that Hoyt (1972) concluded that "it is not possible at this time to make any exact or quantitative statements about the animal's present distribution or abundance" and that "it is not possible at this time to decide whether the species is truly endangered." Hoyt (1972) did draw those conclusions, based on his small sample-size of eight study sites, but the petition failed to point out that Hoyt (1972) recommended the retention of the Mohave Ground Squirrel on the Rare list and the initiation of studies "to more closely identify those areas reported to be populated by the Mohave ground squirrel and how these can best be preserved."

The third paragraph stated that the study of Aardahl and Roush (1985) "noted dramatically high populations and densities of the [Mohave Ground Squirrel]. The study also noted that average relative population densities for the MGS and antelope ground squirrel...for the study sites are similar." Aardahl and Roush (1985) did not describe "dramatically high" populations of the Mohave Ground Squirrel. They viewed the squirrel as being "common", but did not define that qualitative term. "Common" certainly does not mean "dramatically high." As has been discussed in the Executive Summary portion of this section of the status review, the statement of Aardahl and Roush (1985) that average relative densities for the Mohave Ground Squirrel and the antelope squirrel were "similar" may be incorrect. Those authors based their statement on an assumption that initial capture rates of the two species were equal. Also, data on recaptures in that study indicate that the antelope squirrel was more numerous than the Mohave Ground Squirrel. D. F. Hafner wrote to the Department that "[w]hen considering massive habitat alteration and destruction (as is contemplated by the petitioners), the fact that isolated colonies display 'dramatically high population and densities' is meaningless; whether high or low densities, the population will disappear along with the habitat. Rather, it is the geographic spread of colonies (small and precinctive in nature) and the entire species range (small in comparison with other species) that is important."

The fourth paragraph stated that "BLM studies (1988 through 1990) prepared by Leitner reveal high population densities of MGS in the Coso Geothermal Resource Area." The studies at Coso by Leitner and Leitner (1989, 1990) and Leitner *et al.* (1991) were not conducted for the BLM but for California Energy Company, Inc., a private firm involved in geothermal resource development at Coso. The studies have not revealed "high population densities" of the Mohave Ground Squirrel. This error also has been pointed out by P. Leitner, a scientist who is the principal investigator in the studies at the Coso Known Geothermal Resource Area and who wrote to the Department in response to the public notice on the petition to delist the squirrel (see his letter in Appendix E), as follows: "It is misleading to state that the Coso study has documented "high population densities of MGS". Since this is the first investigation that has established population densities for the species, we have no basis for judging whether these values are 'high' or 'low' relative to past conditions or to other parts of the MGS range. The only valid conclusion is that the Coso study has shown densities to vary greatly between the four study sites in any given year and to fluctuate drastically between years at each study site."

The fourth paragraph of this section of the petition also stated that "[e]stivation periods were shown [at Coso] to change year-to-year due to environmental changes such as the drought. The studies also show that females will control their habitat by not bearing any young to compete for limited food supplies during drought years. These studies suggest that past trapping surveys showing decreased numbers of squirrels may be erroneous in their conclusions due to estivation periods of greater duration resulting from environmental factors." P. Leitner, in his letter to the Department, commented on that statement, as follows: "The Coso study has not shown that the MGS estivation period changes from year to year in response to environmental variables such as rainfall. Only in one year (1990) did we attempt to establish the timing of entry into estivation through the use of radiotelemetry. Therefore, our data do not allow valid conclusions about year to year variability in the estivation period in the Coso region. While our study suggests that adult MGS at Coso enter estivation earlier than reported by Recht (1977) for a population in the southwest corner of the range, our results should not be used to discredit trapping studies conducted at other locations."

It should be noted that female Mohave Ground Squirrels do not "control their habitat by not bearing any young to compete for limited food supplies during drought years." That statement reflects a basic lack of understanding about biological principles on the part of the petitioner. Female squirrels do not bear young in severe drought years because they must spend all of their time foraging, in order to build up adequate fat reserves to survive estivation. Reproductive activity on the part of females in suspended in those years. (See the discussion in the subsection under Effects of Drought in this status review.)

Nature and Degree of Threat

In this section of the petition, the first sentence of the first paragraph stated that the "listing of the MGS as a 'threatened species' lacks any basis in scientific fact." This theme of the petition is itself not supported by scientific information. The first paragraph went on to discuss the "little quantitative scientific information available" in 1971 when the squirrel was listed and stated that "it is not understood how the 1971 Fish and Game Commission was able to conclude that the MGS be classified as 'rare'." As was discussed in the subsection under Background to Species Listing in this analysis, the emphasis of the petition on quantitative data available to the Commission in 1971 is irrelevant. The Commission of 22 years ago had specific criteria to be used in deciding whether a species should be listed. Current criteria require a petitioner to bear a substantial burden of proof that the petitioned action is warranted. The same burden of proof is required of a petition to delist a species. The County of Kern has not offered such proof. Current criteria have been applied by the Department in its review of the status of the Mohave Ground Squirrel for this report. The available information supports the Department's view that the squirrel deserves to be listed as a Threatened species.

The last two sentences of the first paragraph stated that "the studies that were immediately subsequent to the 1971 listing were inconclusive and based on generalizations rather than scientific fact. Hoyt's [1972] study is such an example." Which other studies are inconclusive was not explained in the petition. D. F. Hoyt wrote to the Department that "I must strongly protest

the allegation that my study was not based on scientific fact. I surveyed museums and trapped animals; these are valid scientific facts."

The second paragraph stated that the studies of Wessman (1977), Aardahl and Roush (1985), and the "BLM Coso Studies" [sic - reference to the work of Leitner and Leitner (1989, 1990) and Leitner *et al.* (1991)?] "support the delisting of the species." This statement simply is not true. Neither those workers or any others who have prepared scientific reports have recommended delisting of the squirrel or have written that any scientific information warrants delisting. C. Uptain wrote to the Department that the "studies referenced do not support the delisting of the species. Although these studies have shown that MGS are relatively abundant in some restricted areas, the results cannot be broadened and used to represent the entire range of the species. In fact, the multitude of trapping surveys that have resulted in negative results gives a better indication of the relative abundance and distribution of the species throughout its range."

The petitioner also stated that the "existence of a large habitat range (in excess of 7000 square miles) also supports this conclusion [that the squirrel should be delisted]." The use of the term "habitat range" is an example of the petitioner's unfamiliarity with scientific terminology and biological concepts. Habitat and geographic range are entirely different concepts. Habitat is the aggregate environment in which a plant or animal occurs, characterized by one or more plant communities. The range is the physical area occupied by the habitat, with non-habitat interspersed. No habitat is continuous within the range of a species. In the case of the Mohave Ground Squirrel, much of the geographic range naturally is in non-habitat such as rocky areas and dry lake beds. Additional non-habitat has been "created" from habitat through human development. It is misleading to attempt to emphasize that the 7000-square-mile range of the squirrel is all habitat.

The third paragraph repeated the assertion, which was refuted by P. Leitner in the previous subsection of this analysis (Distribution/Abundance), that "the more recent studies have shown that estivation in the MGS varies from year-to-year so that trapping surveys may not be accurate." The third paragraph also asserted that the "MGS may migrate for food and may not appear at the same location year after year." In response, P. Leitner wrote to the Department as follows: "The Coso study has <u>not</u> shown migration or movement of MGS from one location to another in response to differences in food resources. However, we have documented the complete elimination of an MGS population at one of the four Coso study sites, probably as a result of drought conditions. The species was present at this location in 1988 and has not reappeared through the 1992 field season. Thus, MGS populations are susceptible to local extirpation as a result of natural environmental fluctuations."

The third paragraph pointed out that the Department no longer accepts the results of live-trapping studies which indicate that the Mohave Ground Squirrel is not present at a site (see the discussion of this change in the Department's policy in the subsection under Cumulative Human Impacts Evaluation in this status review), and that the Department believes "that any location within a wide range may be potential habitat.... If this is the case, why is the species 'threatened' if <u>any</u> location may be future habitat?" First of all, the Department has not stated that any location within the geographic range of the squirrel may be habitat. What the Department has recognized is that the squirrel may be found in every native plant-community-

type within its range. A plant community does not have to be occupied by the squirrel in order to be habitat; the squirrel is not continuously distributed across each plant community or across its range, probably due to natural phenomena (see the discussion in the subsection on Distribution in this status review). The squirrel retains its Threatened status based on the Department's 1987 evaluation (Gustafson 1987) of continuing habitat destruction and degradation.

The fourth paragraph stated that the "available information" lead the petitioner to conclude that, among other things, "with a known range exceeding 7,000 square miles, the species is not confined to a relatively small and specialized habitat". The reference is to one of four criteria developed by the Department and considered by the Commission in listing the Mohave Ground Squirrel as Rare in 1971. (See the discussion under Listing As Rare in this status review.) The squirrel was indeed confined to "a relatively small and specialized habitat", that of desert-scrub plant communities in the western Mojave Desert, in 1971 and that situation has not changed. In fact, the western Mojave Desert has been described by Hafner (1992) as a region of increased biological importance because it was a refugium (an area not directly affected by a climatological event in which animals and plants could survive during the event) for the Mohave Ground Squirrel and perhaps other animals and plants during the continuously rainy period of 25,000 to 10,000 years ago in western North America. (See the discussion of the effects of this rainy period in the Distribution subsection of this status review.) Hafner (1992) recommended that conservation efforts be directed toward protecting plant and animal communities in the western Mojave Desert because of their isolated and unique nature.

The Mohave Ground Squirrel occupies the smallest geographic range of any of the seven *Spermophilus* ground squirrels in California. A range of 7,000 square miles is exceedingly small for a full species of mammal in North America (see range maps in Hall 1981). Endemic California mammals with ranges of similar sizes all are listed as Threatened or Endangered by the Commission and the federal government or are candidates for listing. This is because in an urban state like California the degree of impact of human activities is the greatest on habitat in the smallest geographic ranges. The habitat of the Mohave Ground Squirrel is specialized. The squirrel exists nowhere other than in desert scrub habitat of several plant-community-types in the western Mojave Desert.

Two of the other conclusions in the fourth paragraph which were based on "available information" are that the squirrel was listed without scientific facts supporting the listing and that recent population studies have found "substantial" populations of the species. These are not substantive conclusions; they have been addressed earlier in this analysis.

The final conclusion, or actually a statement, was that the petitioner does not understand "with so much of the habitat range [sic] being public lands", "why private land development activity has caused imminent danger to the continued existence of the species." The answer to the question of "why" is that a disproportionate share of the destruction, degradation, and fragmentation of the habitat of the squirrel has occurred on private lands, which constitute about 36% of the range of the squirrel. Even though local lead agencies have had the authority of the of the California Environmental Quality Act (CEQA) to regulate land use since 1973, many agencies have

approved projects without choosing an alternative which would avoid or minimize impacts to the Mohave Ground Squirrel. The evidence for this can be observed on private property in the jurisdiction of each local agency within the range of the squirrel. The entire southern portion of the range, from Lucerne Valley in San Bernardino County to the western end of the Antelope Valley in Los Angeles County, which covers the jurisdictions of at least six local agencies, is so impacted by the effects of habitat loss and fragmentation from urban and rural development that the squirrel probably no longer exists in most of that area. Indeed, the County of Los Angeles believes "that there is a highly unlikely probability that the Mohave Ground Squirrel still inhabits their [sic] historical range in Los Angeles County" (Schwarze 1993). As long ago as 1977, Wessman (1977) questioned whether the squirrel still inhabited the portion of its range east of Victorville. (See the discussion of the implications of extirpation, or local extinction, of the squirrel in the south under Conclusions in this status review.)

Current and Recommended Management

This section of the petition began with the following paragraph: "The delisting of the MGS as a 'threatened' species is long overdue. It is illogical to list a species with little or no scientific fact and then spend subsequent years trying to justify the listing through piecemeal studies. It is an unwarranted burden to the public to continue to attempt to justify the listing." The first sentence in that paragraph is an opinion which is not supported by information presented in the petition. As has been noted earlier in this analysis, no scientist who has conducted studies of the squirrel has recommended delisting of the squirrel. C. Uptain wrote to the Department that "[d]elisting of MGS is not long overdue. If fact, available data and the current local political climate suggest that it would be appropriate to petition the United States Fish and Wildlife Service to also list the species. Recent studies have not been conducted to try to justify continued listing; studies have primarily been conducted to more fully understand the biology of the animal and to determine appropriate mitigation for development projects, not to determine the population status."

The BLM, even though its official position in 1986 was that continued listing of Threatened was unwarranted, has not recommended or petitioned for delisting. The BLM's position in 1986 supposedly was based on the results of its 1980 study of 22 sites occupied by the Mohave Ground Squirrel in the northern and central parts of its range. (Interestingly, the principal author of the report on that study [Aardahl and Roush 1985] did not agree that the report should be used as the basis for proposing delisting of the squirrel - J. Aardahl pers. commun.) Currently, the BLM supports the Department's recommendation in this status review that the squirrel should retain its Threatened status. A letter of support (Hastey 1993) concluded that "[l]ittle, if any, new biological data have been submitted by the petitioner in support of the petitioned action"; "[r]etention of the present threatened designation would appear to be appropriate given the existing management situation"; and "[w]ithout new data to document a change for the better in the status of the Mohave ground squirrel, we support the Department's recommendation that the petitioned delisting is not warranted at this time."

The Department has not spent years attempting to justify the listing. Periodic studies of a listed species are necessary to determine the current status. Unfortunately, as the Department wrote to the Commission on

February 24, 1992, "[f]unds have been unavailable to the Department due to established priorities for limited monies for such work, [i.e.,] for the purpose of obtaining information on life history and limiting factors, and for updating knowledge of the effect of habitat on the [squirrel]" (Gibbons 1992).

In regard to the "unwarranted burden to the public", the petitioner did not specify how the listing of the squirrel is a burden. This may be a reference to the supposed economic impact that the squirrel is having as a listed species in Kern County. No local government other than the County of Kern within the range of the squirrel has described an economic impact or burden or has recommended delisting of the squirrel. The City of Ridgecrest, in Kern County and within the range of the squirrel, has entered into a Section 2081 management agreement (see discussion of these agreements in the subsection under Section 2081 Management Permits.) with the Department in order to allow for take of the squirrel within city limits while mitigating off-site. The Department has proposed to the County of Kern that it apply for a similar permit for areas outside of Ridgecrest's city limits, but the County has not completed the process. Thus, property owners in unincorporated areas of Kern County have limited legal means of developing in habitat of the Mohave Ground Squirrel. The County of Kern cited significant impact to economic growth from the listing of the squirrel as a Threatened species in the Executive Summary of the petition. When information on this impact was requested by the Department in October 1992, the County could not produce it.

As this status review was being completed in late March 1993, the Department did receive a letter from the County of Kern (James 1993) which was accompanied by a list of projects. According to the letter, these were projects for which property owners had to incur costs or were subject to costs for biota reports or for compliance with required mitigation to address Mohave Ground Squirrel issues. There was no indication in the letter or the list which projects actually had incurred such costs or what the dollar amount of any costs were. There was no indication that any incurred costs have amounted to a "significant impact" as stated in the petition. The County of Kern routinely requires biota reports from desert property owners to address sensitive-species issues in addition to the Mohave Ground Squirrel. Also, affected property owners in Kern County must comply with mitigation requirements for the Desert Tortoise. Thus, the Department still has no information on what costs actually have been incurred for biota reports or for compliance with mitigation requirements specifically for the squirrel and no information on whether those or other incurred costs have had a "significant impact."

It is interesting to note that, of the 21 letters received to date in response to the public notice on the petition to delist the Mohave Ground Squirrel (all letters are in Appendix E), only one letter supports the delisting of the species. That letter is from the National Training Center and Fort Irwin. Of the other 20 letters, seven are from residents of Kern County. C. Panlaqui, a resident of Ridgecrest, wrote that "I have been a land and home owner in [Indian Wells] Valley for 32 years and am fully prepared to support economic costs which may be entailed by listing." Thus, it is apparent that some members of the public in Kern County do not consider the Threatened status of the squirrel to be an "unwarranted burden".

The remainder of this section of the petition consisted of the presentation of five management programs which, presumably, can suffice to protect the Mohave

Ground Squirrel after it is delisted and loses the protections of CESA. These programs and the contentions of the petitioner can be summarized as follows: 1. CEQA is sufficient to "ensure the long-term protection of the environment including wildlife", because the Department "reviews and comments on local agency CEQA documents"; 2. results of studies in the Coso Mitigation Program "will provide the basis to better manage BLM and other federal lands"; 3. land use programs in local agency general plans which designate open space or areas of nonintensive development "appear to complement the habitat requirements of the MGS"; 4. if the squirrel is listed in the future after delisting now, the endangered species element of the County's general plan "would advocate the preparation "of a habitat conservation plan to address the needs of the species; and 5. coordination and development of land management programs by the BLM and military agencies "are possible to enhance and protect habitat for MGS."

In regard to program 1, it is obvious to the Department that CEQA has not worked to the advantage of the squirrel in the past. The Department does not disagree with the contention regarding program 2, but there is no assurance and no requirement that the federal land management agencies will use the results of the studies at Coso to benefit the squirrel. In regard to program 3, it is unlikely that open space designations would be sufficient to protect habitat in the size and pattern necessary for long-term survival of the squirrel. Program 4, the endangered species element in the County of Kern's general plan has not been completed. A draft reviewed by the Department in December 1991 required many changes to ensure its adequacy to protect such species. In regard to program 5, the Department agrees that federal agencies could protect much of the squirrel's habitat, but participation of private property owners and the local-agency regulators of private land use is necessary to assure the long-term survival of the squirrel.

In summary of this section, it must be pointed out that there will be no legal incentive to protect any habitat of the Mohave Ground Squirrel if the species is delisted. Rather than delist the squirrel and then initiate programs to protect it as the petitioner suggested, the Department believes that the logical sequence is to develop and implement a program or programs of protection for the long-term and then seek delisting as a consequence of successful management and recovery. Such programs are not presently in place; those suggested by the petitioner have not proven to be adequate alone or in the aggregate. If delisting is to be proposed and considered, it seems logical that adequate protections must be in place. The County of Kern has proposed no meaningful remedial strategies or actions to achieve the goal of protecting the squirrel in the long-term.

C. Uptain wrote to the Department that the "petition claims that adequate protection measures would remain in effect if the species were delisted. This is not the case. MGS would no longer be considered in CEQA documents; many of the proposed developments would not require a review above the County level. This would not be in the best interest of MGS protection. Further, Jurisdictional Plans, General Plans, and cooperative land management programs would not be required to address this species. Additionally, military bases would not be persuaded to consider this species in their management plan (even now they are not required to consider this species because it is not federally listed). Delisting of MGS would critically affect the long-term survival of the species." P. E. Brown, a scientist and consulting biologist who has conducted research on the Mohave Ground Squirrel, has written to the

Department in response to the public notice on the petition to delist the squirrel (her letter is in Appendix E) that "[o]pen space and nonintensive land use in any general plan do not protect MGS if grazing, mining, and [off-highway vehicle] use continue. This is also true on BLM and military lands that are not managed with wildlife values as the priority."

J. B. Aardahl wrote to the Department that a "delisting action by the Commission at this time would result in an accelerated loss of habitat for the species on both private and federally managed lands due to the lifting of the restrictions that are now in place which are designed to limit the loss of the habitat through mitigation and compensation."

Sources of Information

The petition in this last section did not list the Department's 1987 five-year status report on the Mohave Ground Squirrel (Gustafson 1987), nor did it list the reports of Leitner and Leitner (1989) and Leitner *et al.* (1991) on the important work at the Coso Known Geothermal Area. Other pertinent sources on the squirrel, such as Adest (1972), Grinnell and Dixon (1918), and Howell (1938) also were not listed. The petition misidentified the work of Leitner and Leitner (1990) as "Bureau of Land Management Leitner Study". The citations for Aardahl and Roush (1985), Bartholomew and Hudson (1960), Hoyt (1972), Recht (1977), Wessman (1977), Zembal and Gall (1980), and Zembal *et al.* (1979) were incorrect and/or incomplete. The missing of a substantial portion of the literature on the Mohave Ground Squirrel and the incorrect interpretations or conclusions reached by the petitioner in its review of the included literature demonstrate that the petition is incomplete. The petitioner has selectively chosen facts which appear to support the petitioned action while ignoring or misstating information which does not support the action.

SUMMARY

The opinion of the Department is that the petition from the County of Kern to delist the Mohave Ground Squirrel as Threatened not only failed to provide the "sufficient scientific information" required by Section 670.1(a) of Title 14 of the California Code of Regulations and by Section 2072.3 of the Fish and Game Code that the petitioned action may be warranted, but also failed to provide any substantive information to support the contention that the squirrel should be delisted. The petition systematically and pervasively misinterpreted, misstated, and ignored factual information from the available literature which would weaken its position for delisting. This observation is not only that of the Department. It was mentioned by a number of persons who wrote to the Department in response to the public notice on the petition (all letters are in Appendix E).

FINDINGS

THREATS

Effects of Drought

In the western Mojave Desert, biological productivity "is driven primarily by precipitation, especially that arriving in the fall and winter" (Leitner *et al.* 1991). A single year of low rainfall may result in decreased productivity (quantity, quality, and diversity) of annual plants (forbs and grasses) and shrubs in local areas. The Mohave Ground Squirrel seems to respond to low rainfall by failing to reproduce. The decreased quality of the habitat also affects survivorship of adult squirrels. Data collected by Leitner and Leitner (1989, 1990) indicated that their study site (no. 3) with the highest number of resident Mohave Ground Squirrels in 1988 also had the highest standing crop of annual plants (expressed as grams per square foot or pounds per acre). In 1989 on that site, low precipitation and low standing crop coincided with a complete lack of reproduction of the squirrel. The work of Leitner and Leitner (1990) was the first documentation of drought-associated reproductive failure in the Mohave Ground Squirrel. After four years (1988-91) of data collection, Leitner and Leitner (1992) hypothesized that a herbaceous standing crop of approximately 1 gram per square foot is the minimum required for reproduction in the squirrel.

Prolonged periods of drought result in the extinction of Mohave Ground Squirrels in local areas. No young are born for several years, the survivability of adults is reduced by poor habitat conditions, and the remaining adults eventually die due to old age and predation. The species presumably became extinct on the Leitners' study site 1 in Rose Valley after 1988, due to low rainfall in 1988-89 and 1989-90 (Leitner *et al.* 1991). Leitner and Leitner (1990) wrote that the adaptive response of female Mohave Ground Squirrels in years of low precipitation and reduced plant growth, in order to survive through the estivation-period, is to "suspend reproductive activity and enter estivation as soon as they can build up adequate lipid [fat] reserves." Waiting until after young are weaned in dry years to begin accumulating fat would doom females which reproduced, due to lack of sufficient time to gain weight. The evolutionary strategy of suspending reproductive activity and concentrating on gaining weight ensures the survival of the species (Leitner and Leitner 1990), as long as droughts are of short duration and sufficiently large areas of habitat exist.

Because rainfall patterns are highly variable in the western Mojave Desert from site to site and from year to year on the same site, it is highly unlikely that the Mohave Ground Squirrel could become extinct across its entire range due to low rainfall alone. Some populations surely thrive through reproduction in areas of sufficient rainfall; others simply survive in poor rainfall areas while still others are extirpated. Habitat vacated by the species through extirpation may gradually be repopulated by movement of animals from adjacent areas. There is no reason to believe that this pattern of extirpation and repopulation has not occurred for thousands of years in the range of the Mohave Ground Squirrel.

When a population of the squirrel is extirpated, it may take years for the species to repopulate the vacant area (see the discussion of the implications of the squirrel's low vagility, or ability of an animal species to become

widely dispersed, in the section on Distribution and Abundance). Extirpation and repopulation are natural events, but currently the ability of the Mohave Ground Squirrel to reestablish itself in areas of extirpation is impeded and often precluded by the pattern of human development in the desert. Areas of desert vegetation which are isolated by urban development and agriculture can never be repopulated if their populations of the squirrel are extirpated.

Habitat Destruction

The major cause of decline of the Mohave Ground Squirrel has been the destruction of its habitat by humans for the purpose of development for urban, suburban, agricultural, military, or other use. As is discussed in the Essential Habitat section of this status review, virtually any native plant community within the geographic range of the Mohave Ground Squirrel provides habitat for the species. Thus, destruction of, or other damage to, any plant community in the range constitutes destruction of the squirrel's habitat. Destruction of habitat results in an immediate loss of Mohave Ground Squirrels in areas occupied by the species. Destruction of habitat in which squirrels are absent due to previous extirpation (extinction in a local area) constitutes loss of squirrels which would have occupied that habitat in a future population expansion. The long-term impact to the species of loss of habitat which could be occupied probably is much the same as loss of occupied habitat. In both cases, the use in the present or future of the physical space is lost to the squirrel.

Destruction occurs on a small scale in the building and maintenance of paved roads and highways, individual rural homes, small orchards and other agricultural plots, small developments of homes near cities, laying of pipelines, and building of power lines and canals. These small-scale, piecemeal developments are significant, however, because they incrementally increase the total amount of Mohave Ground Squirrel habitat lost in a region. No single small development threatens the squirrel's existence in the region, but the total cumulative impact is greater than the sum of the individual impacts. This is due to the effects of habitat fragmentation and the degradation of habitat which accompanies direct loss to development. The fragmentation and degradation of habitat is discussed later in this section.

Destruction occurs on a large scale in the development of large subdivisions, shopping malls, golf courses, building complexes on military bases, prisons, aircraft runways, large agricultural fields, solar energy facilities, communication facilities, sewage disposal facilities, landfills, dikes and levees, and geothermal facilities; in the testing of weapons and conducting of troop training on military bases; and in the use of designated and undesignated off-highway vehicle areas. The area at the National Training Center and Fort Irwin disturbed by military training is about 130,000 acres in the geographic range of the squirrel. Krzysik (1991) noted heavy shrub losses and disturbance due to military training at Fort Irwin. Four authorized off-highway areas operated by the BLM occupy over 103,000 acres within the range of the squirrel, although not all of the habitat in that acreage has been destroyed. No single large development or activity by itself threatens the existence of Mohave Ground Squirrels in a region, unless it destroys the last population of animals. However, the total impact of all large developments, combined with the impact of smaller developments, can result in the regional extirpation of the species. This may be what has occurred in the western triangle of the Antelope Valley, west of Highway 14, and in the region east of

Victorville (see discussion in Distribution and Abundance section of this status review) .

Habitat destruction has occurred throughout the range of the Mohave Ground Squirrel. In its first biennial report on the status of State-listed Rare and Endangered species, the Department (CDFG 1972) noted that, in regard to the Mohave Ground Squirrel, "[a]ccelerated urbanization and land use changes [primarily agriculture] taking place in the Mohave [sic] River Basin and Antelope Valley are destroying most of its habitat." The greatest loss has been in and adjacent to the cities of Ridgecrest, Victorville/Adelanto/ Hesperia/Apple Valley, and Palmdale/Lancaster, with some urban development in the towns of Little Rock, Rosamond, Mojave, California City, Inyokern, North Edwards, Boron, Kramer Junction, and other small named areas of human habitation. Vasek and Barbour (1988) noted that "Joshua tree woodland has also suffered form land clearing around new residential developments, such as California City in Kern Co." Additional human development has occurred at the headquarters area and outlying areas of each major military base within the range of the Mohave Ground Squirrel. These are the China Lake Naval Air Weapons Station, National Training Center and Fort Irwin, and Edwards Air Force Base. The extensive Joshua Tree stands of the Antelope Valley west of Highway 14 have been almost completely destroyed for agriculture, and now the agricultural land is being built upon for urban and suburban uses.

The three urban areas and smaller towns within the range of the squirrel have continued to grow since the listing of the species in 1971. Currently, over 165,000 acres within the range of the Mohave Ground Squirrel are urbanized. When the delineated spheres of influence of the three urban areas named above plus California City and Mojave are completely built out, over 750,000 acres of former habitat of the species will have been lost. M. Starr, a scientist who is conducting research on the effect of human activity on the squirrel, wrote to the Department (his letter is in Appendix E) that "[i]n the last decade, population growth in the cities of the western Mojave Desert has averaged nearly 100% (ranging from a low of 30% for Barstow and Mojave to the highest rates of Victorville at 186% and Palmdale at an incredible 460%). Associated with such growth is an increase in supporting structure as new houses (up more than 50%), shopping malls (up 30%), roads etc. Together these land uses have resulted in a greater than 50% increase in the loss of open lands (amounting to hundreds of square miles). Worse, such growth is projected to continue well into the next century, fueled in part by the net outward migration from Los Angeles...."

Rural development currently accounts for 215,000 additional acres of lost habitat. Current agriculture occupies about 39,000 acres. Disturbances of the desert surface for uses other than urban, rural, and agriculture cover another 209,000 acres. The latter figure does not include paved and unpaved roads within the range of the Mohave Ground Squirrel. All figures have been derived from computer calculations in the BLM's geographic information system and are based on the area of polygons drawn around disturbed areas plotted from aerial photographs.

Aardahl and Roush (1985) stated that "[s]ignificant loss of habitat for the Mojave [sic] ground squirrel has occurred on private lands due to urban and agricultural development. Such habitat loss has occurred in the Antelope Valley, Victorville-Apple Valley-Hesperia area, along the Mohave [sic] River between Barstow and Victorville, western Fremont Valley, Harper Lake basin and

Rose Valley." Hoyt (1972) and Hafner and Yates (1983) noted that agricultural fields had been established in (former) habitat of the Mohave Ground Squirrel.

Bury *et al.* (1977) studied the effects of off-highway vehicles on terrestrial vertebrates (reptiles, birds, and mammals) in the Western Mojave Desert at four sites south of Barstow. All study areas were in the Creosote Bush Scrub community-type. These authors found that off-highway vehicle activity had both direct and indirect negative effects on ground-dwelling animals. Direct effects were running over individual animals but also included collapsing burrows and breaking shrubs which provided cover. "Indirect effects are perhaps the most significant and result from the destruction of vegetation and disturbance of soil. Vegetation is destroyed by crushing and root exposure. Mechanical disturbance upsets the water storage, penetration capacities, and thermal structure of the soils and disrupts the germination strategies of seeds.... One result is a reduction in the number of spring annuals in areas of [off-highway] vehicle use. The loss of these annuals likely means the loss of seeds and forage as well as the loss of arthropods [which serve as food for vertebrates] that feed on these annuals..." (Bury *et al.* 1977). These authors concluded that off-highway vehicles detrimentally affect wildlife and Creosote Bush scrub habitat in the Mojave Desert.

Leitner (1980) believed that "it will be very difficult to carry out geothermal exploration and development activities [in the Coso Geothermal Study Area] without causing some adverse impacts [to Mohave Ground Squirrels]." Leitner and Leitner (1989) reported that "[d]evelopment of geothermal resources for electric power production in the Coso Known Geothermal Resource Area (KGRA) is resulting in habitat loss for the Mohave Ground Squirrel.... Up to 405 [hectares] (1,000 [acres]) of desert scrub habitat within the China Lake Naval Weapons Center... is committed to geothermal development or under consideration for planned or proposed developments...." "Biological resource studies conducted in the Coso KGRA in 1978 and 1979 [Leitner 1980] demonstrated that much of the area with the highest potential for geothermal development also supports the Mohave Ground Squirrel."

Habitat Fragmentation

Fragmentation of habitat is another cause of decline of the Mohave Ground Squirrel. The phenomenon of fragmentation occurs when blocks of habitat become separated or discontinuous by destruction of the intervening habitat. Populations of animals thus become separated, and gene flow (the transmission of inheritable characteristics) between these populations no longer occurs. If habitat blocks are separated by even a small distance, it is unlikely that Mohave Ground Squirrels would cross the intervening space in any numbers. The populations are effectively permanently separated. When fragmentation occurs on a large scale, with tens of thousands of acres in a block, the blocks may function as separate populations for many years without effect. However, the animals in isolated blocks of any size are more subject to the negative effects of environmental factors which reduce their ability to survive than are animals in the original continuous habitat throughout the geographic range. The gradual loss of genetic variation in animals occupying discontinuous habitat will eventually result in a population that may not adapt quickly enough in response to environmental conditions (Soule 1986). The result, in the long run, is extirpation of animals in that block of habitat as conditions change.

If the population in an isolated block becomes extirpated, there is no natural method for other Mohave Ground Squirrels to find their way to the new unoccupied habitat. There is no information on how large a block of habitat must be for Mohave Ground Squirrels in the block to survive without recruitment (the movement from outside the block of animals representing new genetic adaptions) for 50, 100 or, 500 years, standard lengths of time used by conservation biologists in assessing risk of extinction for a species. However, there is enough information available to allow the Department's Mohave Ground Squirrel Working Group to calculate a minimum size of protected habitat zones for the squirrel, using data on the number of breeding females per unit area. (See the discussion in the subsection under Abundance in this status review.)

A guiding premise in conservation biology is that the smaller an area of isolated habitat is, the greater the risk is that a population of animals will be extirpated due to changing environmental conditions. If these conditions are exacerbated by human-induced changes in habitat, such as garbage dumps, roads, traffic, power-line and pipeline rights-of-way, off-highway vehicles, and livestock grazing, then the risk of extirpation increases. Rempel and Clark (1990) found in the Indian Wells Valley that "[p]arcel splits and land subdivisions and the accompanying roads have resulted in extensive fragmentation of the vegetative communities.... Of the approximately 43,000 acres in the study area, only 6,300 acres are in parcels 160 acres or larger in size. Parcels less than 160 acres but greater than 20 acres in size account for 19,500 acres and the remaining 17,200 acres occur in parcels which are less than 20 acres in size."

Habitat can become fragmented on a small scale by natural means, such as through a wildfire hot enough to kill seeds in the ground, sprouting shrubs, and squirrels within their burrows. In such a case, Mohave Ground Squirrels would be unable to live in the burned area. However, the effect is temporary because the vegetation reestablishes itself and the area becomes habitat for the squirrel once again.

Habitat Degradation

Degradation of habitat is a third cause of the decline of Mohave Ground Squirrels. This occurs in cases in which the habitat is not destroyed but is damaged by natural or human-induced means. Natural degradation might occur as the result of a wildfire, sandstorm, drought, flashflooding, or heavy rain which destroys some plants in a habitat. However, the effect is temporary, and Mohave Ground Squirrels in reduced numbers can continue to use the habitat during the natural process of restoration.

Squirrels also may be able to use habitat damaged by human-induced degradation. The dumping of garbage, use of off-highway vehicles, and annual grazing by livestock are examples of human-induced degradation. Air pollution from automobile exhaust, known to damage coniferous forests in the mountains of southern California, may also damage the shrub communities in the Mojave Desert. A population of Mohave Ground Squirrels living in a degraded habitat may be smaller than that of a similar-sized non-degraded habitat, depending on the degree and extent of damage, because the resources (vegetation for food and shelter, soil) available to the population have diminished in quantity and quality. Therefore, fewer animals can be supported and litter sizes (number of young born) may be smaller than normal. The physical condition of the

remaining animals may decline, thus increasing their susceptibility to parasites, disease, and predators.

Degraded natural areas often are found adjacent to cities and towns in the range of the Mohave Ground Squirrel. These areas are notable for the dumping of garbage and unusable automobiles and appliances. Hoyt (1972) wrote that "[n]umerous local investigators have recently noticed an increasing scarcity of [the Mohave Ground Squirrel] in areas where, previously, it has been moderately easy to trap." The areas in question were not identified, but it is likely that some were in the vicinity of towns and cities which have an influence on the desert beyond the limit of buildings and homes. Recht (1989), surveying an area for Mohave Ground Squirrels near Barstow, reported that off-highway vehicles used an area near a home tract and domestic dogs roamed "freely through the area". Desert Tortoise "remains, with canine bite marks and surrounded by domestic dog paw prints, were found...." Near Victorville Recht (1989) noted that "[n]eighborhood dogs and teenagers with pellet rifles periodically roam through this area."

Bury *et al.* (1977) found that, contrary to arguments, light off-highway vehicle use in Mojave Desert plant communities had a damaging effect beyond the vehicle trail or track. Even though a trail wound its way among desert shrubs, top soil was lost and/or compacted, seeds as potential food for birds and mammals were dispersed and buried by vehicles, and the soil mantle was disrupted. Grasses in the path of vehicles were crushed. Bury *et al.* (1977) wrote that off-highway vehicles "have been extensively used for less than a decade in the Mojave Desert, but already there has been widespread negative impact on desert [plant] communities."

Grazing by sheep and cattle occurs throughout the geographic range of the Mohave Ground Squirrel, even on one military base (China Lake Naval Air Weapons Center). Currently, grazing is permitted on approximately 2,106,000 acres within the range of the squirrel. Of these acres, about 233,000 are on military lands and the rest are on public lands managed by the BLM. Of the public area, cattle are authorized on approximately 761,000 acres and sheep are authorized on approximately 1,345,000 acres. However, currently sheep are not being grazed on approximately 753,000 acres of BLM land due to a Biological Opinion issued by the U.S. Fish and Wildlife Service. (See discussion of the Biological Opinion below.) No sheep are being grazed at China Lake. Campbell (1988) wrote that "desert vegetation [in the range of the Desert Tortoise] has undergone significant changes as the result of a century or more of livestock grazing. Perennial grasses, which once dominated large areas of the desert, have disappeared. The annual grasses that have partially replaced them are often nonnative species. Shrubs have also increased." Vasek and Barbour (1988) noted that "Joshua tree woodlands tend to occur on sandy, loamy, or fine gravelly soils, usually on fairly gentle slopes. The gentle terrain is also conducive to cattle-raising activities, and most Joshua tree woodlands that we have observed have been subjected to moderate or severe grazing pressure."

Prior to beginning their analysis of the effects of cattle grazing on habitat of the squirrel at the Coso Known Geothermal Resource Area, Leitner and Leitner (1989) hypothesized that cattle "may adversely impact Mohave ground squirrel populations in one or more ways: 1) by direct competition with ground squirrels for limited forage; 2) indirectly, by browsing the shrub cover needed for ground squirrel thermoregulation and protection from

predators; or 3) by disruption of the soil cryptogamic crust [the upper layer of soil which contains the cryptogams - the fungi, algae, lichens, and mosses, which are important desert soil stabilizers], thereby diminishing primary production for the ecosystem as a whole...." Cattle also may negatively affect squirrels by trampling and collapsing burrows. Sheep may adversely affect Mohave Ground Squirrels by competing for grasses and forbs and by severely trampling local areas. Aardahl and Roush (1985) wrote that "[l]and uses which affect the availability of annual forbs and grasses, namely grazing by sheep and cattle, have the potential of influencing the long-term population [viability] of the Mohave ground squirrel. This does not necessarily mean [, however,] that properly managed livestock grazing will cause a significant negative impact on the Mohave ground squirrel." These authors did not define "properly managed" grazing or how a "significant negative impact" could be measured.

The U.S. General Accounting Office (GAO) conducted a 1991 study of the BLM's hot-desert grazing program. "The hot deserts are among the least productive grazing lands in the United States" (GAO 1991). A federal appraisal conducted in 1984 found that over 160 acres of desert land were sometimes required to support one cow for one month in the hot deserts. The average rate was 16 acres per cow per month (GAO 1991). The GAO examined grazing practices, impacts, benefits, and costs for public lands administered by the BLM in the Mojave, Sonoran, and Chihuahuan deserts. A report submitted to the U.S. Congress stated that "BLM lacks the staff resources needed to collect and evaluate data measuring the impact of livestock grazing on many desert allotments [specific parcels of public land permitted by the BLM for grazing]. Without these data, BLM is not in a position to assess livestock usage of desert allotments and change usage as needed" (GAO 1991). A specific case cited in the report was an unmonitored 450,000-acre allotment in the Mojave Desert of California which includes "large areas of habitat for the Mojave desert tortoise...." In addition to lacking staff resources, another management problem of the BLM is that livestock operators have the authority to place the maximum permitted number of animals on an allotment, regardless of the amount of forage (GAO 1991). This practice leads to overgrazed and damaged plant communities.

Two types of livestock-grazing operations on BLM lands may be impacting Mohave Ground Squirrel habitat. Sheep are placed on public lands to take advantage of the spring growth of annual grasses and forbs (called ephemeral forage by the BLM). Nine to 10 percent of California's sheep use the Mojave Desert for approximately 70 days a year (GAO 1991). The sheep move through the allotments and are removed to other lands when forage is no longer available. The Fish and Wildlife Service has written that the "ephemeral grazing program benefits private livestock producers who transport sheep, primarily from California's Central Valley, into the western Mojave Desert, to feed bands of sheep on annual plant species during the spring. Depending on the rainfall during the previous winter and spring, this ephemeral forage or production of annual plant species can be extremely lush in portions of the desert. Herdsmen graze traditional areas, following routes which allow their flocks access to the best annual vegetation. Sheep will feed on perennial species to some degree, but tend to concentrate their feeding on annuals. As grazing or rising temperatures in late spring reduce the forage base, the herders leave the desert for greener pastures. The grazing period varies greatly because of weather conditions and the availability of annual species. The sheep-use season in the western Mojave Desert has ranged from late February to the

middle of June." "No grazing occurred on Bureau land in 1990 because of lack of forage" (Plenert 1991).

The sheep are in the desert plant communities at a time when adult and juvenile squirrels are foraging throughout each day to gain weight for estivation. Another seasonal livestock-operation is that of steer and heifer grazing, which occurs on public lands for three to nine months before the animals are sold (GAO 1991). The spring, when annual grasses and forbs are in bloom, is conducive to steer and heifer operations.

In regard to Desert Tortoises, whose geographic range in the Mojave Desert overlaps much of the geographic range of the Mohave Ground Squirrel and whose habitat is much the same as the squirrel's within the squirrel's range, the GAO (1991) cited specific impacts of livestock grazing on tortoises as including "decreases in plant species important to tortoise diets, destruction of tortoise burrows through trampling, and reduction of cover needed to hide the tortoise from predators." These impacts probably also apply to Mohave Ground Squirrels. Areas within allotments where cattle and sheep tend to concentrate, such as bedding and watering sites, often are "more heavily impacted than the rest of the grazing allotment due to increased amounts of manure, trampling, and concentrated grazing" (Chambers Group, Inc. 1990).

The GAO (1991) concluded that "[h]istoric grazing practices have exacted a high environmental cost on hot desert ecosystems, and GAO found examples of lands that continue to be degraded by current grazing practices. Furthermore, research shows that livestock grazing can have a detrimental impact on certain hot desert wildlife species." The high environmental risks and budgetary costs, management problems, and low economic benefits of grazing led the GAO to offer three policy options for consideration by the Congress. One was to provide more funds for the BLM to monitor grazing and to increase grazing fees. Another option was to eliminate the authority of operators to place the maximum number of livestock on an allotment, giving the BLM an opportunity to adjust grazing on the basis of the actual forage available each season. The third option was to discontinue livestock grazing in the hot desert, giving the deserts immediate relief and the potential for recovery, and freeing BLM staff and funding for application on public lands where environmental risks are lower and productivity of plants is higher. As far as is known, Congress has taken no action.

On April 11, 1991, the Fish and Wildlife Service issued a Biological Opinion in the form of a letter (Plenert 1991) to the State Director of the BLM in California, regarding sheep grazing in the western Mojave Desert and northern Colorado Desert. The Service addressed the impacts of ephemeral grazing (grazing on annual plants) by sheep on the habitat of the Desert Tortoise. The BLM had requested a review of ephemeral grazing because drought conditions in these deserts had reduced or eliminated local production of annual plants. The BLM had proposed that the Service review a plan for reducing the impact of sheep during the spring ephemeral-grazing period. In its review of the literature on the impacts of livestock grazing on natural communities in deserts, the Service found that "livestock grazing has direct and indirect impacts on both tortoises and their habitats" (Plenert 1991). Direct impacts on tortoises included "trampling of tortoises, shelter sites, and nest sites" and "[c]onstruction and maintenance of range developments, use of watering trucks, and general site inspections [due to vehicles killing tortoises]" (Plenert 1991).

The impacts of livestock grazing on tortoise habitat included a decline of perennial grasses and shrubs and the spread of non-native annual grasses; the alteration of the structure of soils due to compaction, increased runoff, accelerated erosion, and reduction in soil moisture; the creation of steep-sided gullies due to greater erosion; and the disruption or destruction of the cryptogamic crust. Indirect impacts to tortoises and their habitat included increased public access on roads developed or maintained by livestock operators, which "generally results in increased off-road vehicle travel, shooting, vandalism and illegal collection of tortoises" (Plenert 1991).

The Service found that, in the short-term, the "direct removal of annual plants which are eaten by livestock may prevent individual desert tortoises from acquiring adequate nutrients" (Plenert 1991). In the long-term, the continued conversion of the natural plant community to one dominated by non-native species "may prohibit desert tortoises from acquiring the proper nutrients form their forage, even if there is no direct competition from livestock" (Plenert 1991). The Service concluded that the BLM's proposal for a specific pattern and number of sheep for the 1991 grazing season was not acceptable, because implementation of the plan "would result in habitat fragmentation and degradation, and take of desert tortoises over approximately 75% of the potential long-term management areas in the western Mojave Desert" (Plenert 1991). The mention of management areas was a reference to those areas of tortoise habitat called categories 1 and 2, which are the areas with greatest densities of tortoises. As a result of the Service's Biological Opinion, the BLM suspended sheep grazing for the 1991 season in category 1 and 2 habitats. Grazing continued in category 3 habitat.

In addition to grazing on public and military lands, livestock graze on lands owned by the State of California in the Mojave Desert. Grazing on these lands is administered by the State Lands Commission. However, there is only one person in that Commission assigned to overseeing grazing leases statewide. That person has headquarters in Sacramento and does not conduct any field monitoring of leases. If the grazing on State lands is not conducted according to the lease-agreement or if unauthorized grazing operations are conducted on State lands, the Commission has no way of learning that through its own program. A Commission staff-person told the author of this status review that the Commission depends on the BLM to inform it of any problems with State-land grazing leases. The Commission has ownership of approximately 68,600 acres within the western Mojave Desert, but the total grazing area leased is only 818.7 acres. Grazing on State lands is by cattle only; no sheep grazing is authorized. No new leases for grazing area being granted by the Commission.

Unauthorized grazing occurs in the Mojave Desert. One such area "of approximately 43 square miles is located northwest of Barstow, at the west end of Superior Valley" (Chambers Group, Inc. 1990).

Campbell (1988) recommended that livestock be removed from areas supporting "viable populations" of the Desert Tortoise.

Domestic Cat Depredation

In addition to the effects of habitat loss, fragmentation, and degradation, the Mohave Ground squirrel may suffer from the effect of depredation by domestic cats. These may be feral (living in the wild) animals, but most of

the cats which might capture and kill Mohave Ground Squirrels are likely to be pets. Recent studies in the United States "confirm dramatically that house cats, including those well fed at home, kill millions of small birds and mammals every year, a death toll that may be contributing to declines in some rare species" (Harrison 1992).

Pesticides

An additional factor negatively affecting the Mohave Ground squirrel may be the use of pesticides. Chemicals of various types designed to kill ground squirrels commonly are used around agricultural fields, golf courses, earthen dams, and canal-levees to reduce or eliminate populations of the California Ground Squirrel. The Mohave Ground Squirrel is not known as a serious crop depredator; however, whether or not it forages in alfalfa and/or other crops, it certainly lives in desert plant communities adjacent to planted fields (Hoyt 1972, Hafner and Yates 1983) and would be exposed to pesticides applied near the fields. Hoyt (1972) noted that Mohave Ground Squirrels seemed "to be dependent on the [alfalfa] fields [in some areas] and could be easily exterminated by the State Rodent Control Program." J. B. Aardahl wrote to the Department (his letter is in Appendix E) that "[i]n the early part of this century, ground squirrels were systematically eliminated with poison grain by the Los Angeles Agricultural Commission office in the Antelope Valley."

Shooting and Vehicles

There is no evidence to suggest or reason to believe that shooting and vehicles are significantly reducing populations of the Mohave Ground Squirrel. However, it is known that the squirrel is run over by vehicles and the shooting of wild animals is a problem of some significance in the Mojave Desert. Campbell (1988), citing the research of K. Berry and her co-workers, reported that "20 percent or more of the dead tortoises found during her research work had been killed by gunshots, vandalism [tipping tortoises over on their backs], or vehicles. Even in the center of the Desert Tortoise Natural Area, 15 percent of dead tortoises had been shot...." The Fish and Wildlife Service has written that common causes of high mortality rates or losses of Desert Tortoises include vandalism and vehicle kills (Plenert 1991). The tortoise may be an especially vulnerable target because it is relatively large and slow moving. Campbell (1988) recommended that areas containing "viable populations" of tortoises be closed to shooting and off highway vehicle use. As is discussed in this status review in the subsection under Biology-Thermoregulation, the Mohave Ground Squirrel is cryptically colored and also spends much of its time foraging in, or cooling beneath, shrubs. These attributes and its relatively quicker movements make it a less likely target than the tortoise. This is not to say that Mohave Ground Squirrels are not shot.

MANAGEMENT ACTIVITIES

Listing as Rare

The Mohave Ground Squirrel was listed as a Rare species by the California Fish and Game Commission on May 21, 1971, under authority of the State Endangered Species Act of 1970. The listing was effective on June 27, 1971. A "Rare" classification, according to the legal definition in the Fish and Game Code (State Endangered Species Act), meant that the Mohave Ground Squirrel,

"although not threatened with extinction, is in such small numbers throughout its range that it may be endangered if its environment worsens." A classification of "Endangered," a designation of a more ominous situation, would have meant that the squirrel was a species whose "prospects of survival and reproduction...are in immediate jeopardy from one or more causes, including loss of habitat, change in habitat, overexploitation, predation, competition, or disease." In 1971 the Department was aware that the Mohave Ground Squirrel was the victim of habitat loss and habitat change (degradation), but the Department could not determine that its survival was "in immediate jeopardy."

According to criteria developed by the Department and considered by the Commission, an animal deserving of Rare status had to meet at least one of the following conditions (California Department of Fish and Game 1972): 1. is the animal confined to a relatively small and specialized habitat, and is it incapable of adapting to different environmental conditions? 2. although found in other parts of the world, is the animal nowhere abundant? 3. is the animal in California so limited that any appreciable reduction in range, numbers, or habitat would cause it to become endangered? 4. if current management and protection programs were diminished in any degree, would the animal become endangered? For the Mohave Ground Squirrel, condition 2 did not apply because the species is endemic to California. Condition 4 also did not apply, because no management and protection programs were in place in 1971. Based on knowledge of the squirrel in 1971, the answers to the questions posed in conditions 1 and 3 were "yes".

The Mohave Ground Squirrel was on the first list of animals designated by the Commission as Rare or Endangered. These animals were recommended to the Commission by the Department after a review of the status of California's fishes, amphibians, reptiles, birds, and mammals. The review was mandated by the State Endangered Species Act of 1970. The process of review was described by Director P. Bontadelli in 1989, as follows: "The Department conducted a review [in 1971] by first developing a working list of species based on a list of federal species, the State's list of Fully Protected species (a category established by the Legislature), and internal knowledge of the status of certain species. The working list was sent out as a questionnaire to various cooperators in universities and state agencies. (We are using old files, rather than the memories of those retired, to develop this history).

"The questionnaires asked reviewers to designate each species on the working list as either endangered ("one whose prospects of survival and reproduction are in immediate jeopardy"); Rare ("one that, although not presently threatened with extinction, is in such small numbers throughout its range that it may be endangered if its environmental worsens"); Peripheral ("one whose occurrence in California is at the edge of its natural range and which is rare or endangered within California although not in its range as a whole"); or Unknown ("one that has been suggested as possibly rare or endangered, but about which there is not enough information to determine its status"). Reviewers took the opportunity to recommend other species for the working list or to recommend deletion of species.

"The files indicate that, of those outside reviewers who chose one of the four categories for the MGS, one reviewer recommended that the MGS be listed as Endangered, three reviewers recommended it for Rare, and one reviewer listed it as Unknown. These five reviewers were university mammalogists or

agricultural biologists with experience in pest control. One of the reviewers who recommended the Rare designation was Lloyd G. Ingles, then emeritus professor of zoology at Fresno State College and author of Mammals of California and Mammals of the Pacific States" (Bontadelli 1989).

The Mohave Ground Squirrel was included on the Department's working list and in the questionnaire in the first place because of concern by knowledgeable persons that the species could not be found in areas in which it had formerly occurred. After the review the Mohave Ground Squirrel was recommended to the Fish and Game Commission as Rare. It was so designated. The minutes of the May 21, 1971 meeting of the Commission reveal that the Commission had received 88 letters and one telegram with comments on the Department's list of proposed Endangered and Rare animals. Only one letter, that of the California Department of Agriculture, requested that the Mohave Ground Squirrel not be included as a State-listed Rare or Endangered species. According to the minutes, the Department of Agriculture alleged that the Mohave Ground Squirrel and two kangaroo rat species were involved in crop depredations in some areas.

As a Rare species, the Mohave Ground Squirrel received the protection of the State Endangered Species Act. No person could import into California, or take, possess, or sell within the State the Mohave Ground Squirrel or any part or product thereof, without a permit from the Department.

California Endangered Species Act

The new California Endangered Species Act (CESA) was signed into law in 1984 and became effective on January 1, 1985. All species of animals which had been designated as Rare prior to the passage of CESA became classified as Threatened. The replacement of "Rare" by "Threatened" brought CESA into conformance with the federal Endangered Species Act of 1973, which uses the descriptive terms Threatened and Endangered. Thus, the Mohave Ground Squirrel was redesignated as Threatened.

The terms Endangered and Threatened were redefined in CESA. An "Endangered species" is a native species or subspecies of animal or plant "which is in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, overexploitation, predation, competition or disease" (Section 2062 of the Fish and Game Code). A "Threatened species" is a native species or subspecies of animal or plant "that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of the special protection and management efforts required by this chapter [Chapter 1.5, the portion of the Code which addresses Endangered and Threatened species through sections 2050-2098]" (Section 2067 of the Code). Although the definition of a Threatened species does not delineate what constitutes "extinction," the implication is that the concept of extinction through all or a portion of the range of a species is the same in both definitions.

An important finding and declaration was included by the Legislature in CESA, as follows: "it is the policy of the state to conserve, protect, restore, and enhance any endangered species or any threatened species and its habitat..." (Section 2052 of the Code). That finding guides the Department's application of CESA's provisions for permitting the management-take of these species. The Department, under Section 2090, consults with other State agencies that

authorize, fund, or carry out projects which may impact a State-listed species. The Department prepares a Biological Opinion, which is a written finding as to whether the proposed project would jeopardize the continued existence of any State-listed species or result in the destruction or adverse modification of habitat essential to the continued existence of the species. The finding also states whether the proposed project would result in the taking of a listed species incidental to the proposed project. If jeopardy is found, the Department specifies "reasonable and prudent measures that are necessary and appropriate to minimize the adverse impacts of the incidental taking" (Section 2091).

Permits are issued under Section 2081 of the Code to entities other than State agencies to allow take for management purposes when habitat (not otherwise protected) can be protected or enhanced on-site or off-site through mitigation for projects which destroy habitat of listed species. Section 2081 permits have been issued by the Department for management-take of the Mohave Ground Squirrel in a number of projects in which habitat of the Mohave Ground Squirrel was destroyed on the project site, but other habitat of the species was protected at sites where the squirrel is more likely to survive in the long-term as a result of mitigation. The background of the Section-2081 process is discussed in a section below.

A provision of CESA (Section 2077 of the Code) is that the Department shall review the status of species listed as Endangered species and Threatened species "every five years to determine if the conditions that led to the original listing are still present. The review shall be conducted based on information which is consistent with the information [required for a petition] and which is the best scientific information available to the department." The first status report was completed in 1987 (Gustafson 1987); it is discussed in a section below. The next one was scheduled for 1992; however, the preparation of this status review has precluded the need for a separate five-year report.

Section 2079 of the Code requires the Department to prepare an annual report summarizing the status of all State-listed Endangered, Threatened and Candidate species. (A Candidate species, according to Section 2068 of the Code, is "a species of animal or plant that the commission has formally noticed as being under review by the department for addition to either the list of endangered species or the list of threatened species, or a species for which the commission has published a notice of proposed regulation to add the species to either list.") Such a report has been prepared in each year, beginning in 1986. Each annual report has contained a species account for the Mohave Ground Squirrel. The latest account for this species (Gustafson 1992) is in the 1991 report; the account is discussed in a section below.

California Environmental Quality Act

CEQA was enacted into law in 1973; it is part of California statute law as Public Resources Code Sections 21000-21177. It was enacted "as a system of checks and balances for land-use development and management decisions in California" (Governor's Office of Planning and Research, or GOPR, 1992). It has been amended a number of times since 1973. Under CEQA each of the 58 counties and 468 incorporated cities in California has authority for land use regulation. Any agency of a city or county government can act as a "lead agency", the "single agency responsible for determining the type of analysis

CEQA requires" (GOPR 1992), as can a regional agency, public district, redevelopment agency, or other political subdivision. Other public agencies subject to CEQA are state agencies, boards, and commissions. In enacting CEQA the Legislature found and declared that, among other items, the "maintenance of a quality environment for the people of this state now and in the future is a matter of statewide concern" (Section 21000(a)) and that "[e]very citizen has a responsibility to contribute to the preservation and enhancement of the environment" (Section 21000(e)). Further, it is the policy of the State to "[r]equire governmental agencies at all levels to develops standards and procedures necessary to protect environmental quality" (Section 21001(f)), and to "[r]equire governmental agencies at all levels to consider qualitative factors as well as economic and technical factors and long-term benefits and costs, in addition to short-term benefits and costs and to consider alternatives to proposed actions affecting the environment" (Section 21001(g)).

In determining whether a proposed project may have a significant effect on the environment, a public agency must find significance if, among other things, the "possible effects of a project are individually limited but cumulatively considerable. As used in this subdivision, 'cumulatively considerable' means that the incremental effects of an individual project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future project" (Section 21083(b)). A "significant effect on the environment" is a substantial, or potentially substantial, adverse change in the environment (Section 21068). "Environment" means the "physical conditions which exist within the area which will be affected by a proposed project, included land, air, water, minerals flora, fauna, noise, objects of historic or aesthetic significance" (Section 21060.5)

According to the State CEQA Guidelines prepared by the GOPR, which are binding on all public agencies in California, the basic purposes of CEQA (Section 15002(a)) are as follows: (1) Inform governmental decision-makers and the public about the potential, significant environmental effects of proposed activities; (2) Identify the ways that environmental damage can be avoided or significantly reduced; (3) Prevent significant, avoidable damage to the environment by requiring changes in projects through the use of alternatives or mitigation measures when the governmental agency finds the changes to be feasible; and (4) Disclose to the public the reasons why a governmental agency approved the project in the manner the agency chose if significant environmental effects are involved.

The Guidelines, in Section 15380, define endangered species either as those listed by the Fish and Game Commission or federal government as Endangered or Threatened or as those which meet the criteria to be listed by the Commission or federal government. The application of CEQA to endangered species is through Section 21001(c), quoted in the first paragraph of this discussion. In order to prevent such species from becoming extinct (i.e., preventing the elimination of species due to human activities, ensuring that populations do not drop below self-sustaining levels, and preserving for future generations, per Section 21001(c)), lead agencies must take steps to conduct or permit only those projects which do not contribute to extinction. Unfortunately, many projects are approved by local lead agencies without choosing the alternative which would safeguard endangered species.

Field Studies by the Department

In 1972 the Department conducted a limited study to determine whether Mohave Ground Squirrels were still found at eight localities of previous known occurrence (Hoyt 1972). The eight areas were suggested by scientists and small-mammal trappers who were familiar with occurrence of the squirrel, or were areas in which animals collected for museum specimens had been taken. The species was found in the following four areas: Boron, China Lake Naval Weapons Station near Ridgecrest, Shadow Mountain Road west of Highway 395 northwest of Adelanto (all in San Bernardino County), and at Keels Ranch near Palmdale (Los Angeles County).

Two localities at which no Mohave Ground Squirrels were found, and at which Hoyt (1972) believed the species apparently no longer existed, included Bob's Gap on 165th Street near Palmdale (G. A. Bartholomew had reported a significant population there in about 1960) and Lovejoy Butte (Los Angeles County; E. T. Pengelley had reported a significant population in the mid-1960s). However, Hoyt (1972) trapped at these sites in mid-February, which may have been prior to any squirrel's emergence from estivation. A monthly report for April submitted by D. Hoyt to the Department during this study indicated that he had unsuccessfully trapped for Mohave Ground Squirrels near the Pearblossum pumping plant. A monthly report for May indicated that he had unsuccessfully trapped for the species north of Lake Los Angeles.

Hoyt (1972) believed that "it is not possible at this time [based on the results of his study] to make any exact or quantitative statements about the [Mohave Ground Squirrel's] present distribution or abundance." However, he believed that the species was discontinuously distributed within its geographic range, and he speculated that this phenomenon might be due to competition with the White-tailed Antelope Squirrel (*Ammospermophilus leucurus*), the effect of human disturbances to habitat, or to stringent habitat requirements of the squirrel. Hoyt (1972) stated that it "is not possible at this time to decide whether the species is truly endangered", but pointed out that the squirrel was vulnerable to rodent control programs around agricultural fields and to loss of habitat in the Palmdale area. He recommended that the Mohave Ground Squirrel be retained on the Rare list and that areas populated by the species be identified and preserved.

In 1977 the Department conducted a study to determine the distribution of Mohave Ground Squirrels in the southeastern part of its range (Wessman 1977). The objectives were to identify the boundaries of the geographic range in the southeast, to establish the point at which this range contacted the range of the Round-tailed Ground Squirrel (*Spermophilus tereticaudus*), and to investigate the effects of urbanization. Wessman (1977) established three large study areas as follows: Superior Valley east to the Avawatz Mountains on Fort Irwin (all north of Barstow), the Mojave River Valley (Victorville to northeast of Yermo), and Apple Valley/Lucerne Valley. He found that Mohave Ground Squirrel range extended as far east as the Avawatz Mountains, an extension of the known range of about 1800 square miles (his calculation). He noted that "perhaps 30-50 percent of this [newly identified] area is unsuitable habitat". No new range boundaries were noted in the Mojave River Valley study area. However, in the Apple Valley/Lucerne Valley study area, Wessman (1977) believed that an apparent retraction in the range had occurred because no squirrels were observed or trapped east of Victorville. He speculated that the loss of Mohave Ground Squirrels in the area might be due

to competition with, or displacement by, Round-tailed Ground Squirrels or California Ground Squirrels (*S. beecheyi*).

Wessman (1977) stated that the range of the Mohave Ground Squirrel "borders" that of the Round-tailed Ground Squirrel in two areas in the Superior Valley study area. These areas were at the north end of the Tiefort Mountains and north of Coyote Dry Lake. The evidence for his speculation was that a Mohave Ground Squirrel was captured in a Creosote Bush-Burrobush habitat about two miles from a Creosote Bush-windblown sand habitat occupied by Round-tailed Ground Squirrels north of Coyote Dry Lake, and that a single Mohave Ground Squirrel was captured in a Creosote Bush-windblown sand habitat near the Tiefort Mountains. In the Mojave River Valley, Wessman (1977) found that Mohave Ground Squirrels "do not live in or cross the Mojave River Wash from Helendale north. In this area, Round-tailed ground squirrels are common in the sandy habitat of the wash. South of Helendale, Mohave ground squirrels cross the Mojave River and there are no Round-tailed ground squirrels." In the Apple Valley/Lucerne Valley area, Wessman (1977) could not find any point of contact of the ranges of the two species, but noted that only the Round-tailed Ground Squirrel was found at Rabbit Springs, the type locality of the Mohave Ground Squirrel.

In 1990 the Department did a study in the unincorporated areas of Indian Wells Valley of eastern Kern County to determine the status and distribution of the Mohave Ground Squirrel (Rempel and Clark 1990). Indian Wells Valley encompasses portions of Kern, San Bernardino, and Inyo counties, the city of Ridgecrest and the town of Inyokern, and a part of China Lake Naval Air Weapons Center. The project area covered approximately 75 square miles of privately-owned lands. Live-trapping was conducted on 31 trap-grids located "from approximately six miles north to approximately five miles south of Inyokern, east to the city limits of Ridgecrest and the Kern-San Bernardino County line and south to Cerro Coso Community College" (Rempel and Clark 1990). Determination of habitat quality and condition (i.e., degree of disturbance) was made for each of 82 areas. Thirty-four percent of the habitat was rated as undisturbed or lightly disturbed, 63 percent as moderately disturbed, and 3 percent as heavily disturbed.

The researchers found that 40 percent of the private lands in their study area were in parcels of less than 20 acres in size and 85 percent were parcels of less than 160 acres. The parcels of over 160 acres were not located near one another, thus "reducing the opportunity to aggregate private land parcels into a manageable...[Mohave Ground Squirrel] preserve" in the Indian Wells Valley (Rempel and Clark 1990). These authors concluded that the Mohave Ground Squirrel was "still widely distributed and occurs in both undisturbed and disturbed habitats" in Indian Wells Valley and that "[t]rapping surveys are not reliable in determining the absence or the presence of [the Mohave Ground Squirrel] (except when [one] is captured) since visual sightings of the species were made in areas where trap grids were operated and [yet] the species was not trapped" (Rempel and Clark 1990). Another conclusion was that "[b]ecause of the current and projected future fragmentation and degradation of habitat in the [valley], MGS may be extirpated from most private lands in the [valley] within the next 50 to 60 years." (Rempel and Clark 1990).

Rempel and Clark (1990) recommended that a comprehensive mitigation plan be developed for private lands in the Indian Wells Valley, with "a primary focus on preserving large tracts of [Mohave Ground Squirrel] habitat" of a minimum

10,000 acres in size each and linked by corridors of occupied habitat. The large tracts of land, called "management emphasis areas" for the squirrel, would be developed in conjunction with the BLM because the protected areas would be comprised of both BLM-managed public-domain lands and former private lands purchased with mitigation funds.

As a result of the ranking of relative disturbance done to habitat in the study, Rempel and Clark (1990) developed a rating system for impacts to habitat within the range of the Mohave Ground Squirrel. This system is now being used by the Department to determine mitigation requirements in proposed projects. In applying the rating system, the Department examines the disturbance on a project site and develops a numerical score which determines the mitigation ratio. Undisturbed sites require the highest ratio of mitigation for loss; completely disturbed sites may require no mitigation.

Since 1988 the Department has attempted unsuccessfully to obtain funding for a multiple-year study throughout the geographic range of the Mohave Ground Squirrel to determine local occurrence, relative abundance and habitat use of the squirrel and to identify areas for preserves. The 1990 study in Indian Wells Valley did answer some questions about habitat use in a local area in one field season. In 1989 the Department preliminarily estimated that a three-year field study at minimum would cost about $750,000.00. A revised estimate of closer to $1,000,000.00 was provided to Assemblyman P. Wyman, who attempted in 1991 to get Assembly Concurrent Resolution 35 passed by the Legislature. However, it failed in committee. The resolution would have directed the Department to conduct a multiple-year "review and evaluation" sufficient to determine the status of the Mohave Ground Squirrel. The resolution was initially developed by the Department at the assemblyman's request. It included a provision that funding for the study would be provided by the California Environmental License Plate Fund. The version of the resolution that reached the Assembly committee in which it failed significantly reduced the time-frame in which the review and evaluation were to be completed. Department staff had recommended that the resolution in that form be opposed unless amended to provide a longer review and evaluation period.

Field Studies by Other Agencies

Studies conducted by the BLM in 1974, 1975, 1976, and 1977 gathered information on habitat and distribution of the Mohave Ground Squirrel. Locality records of squirrels captured in those studies were presented in Aardahl and Roush (1985).

The China Lake Naval Weapons Center contracted for a 1978 inventory of the vascular plants and small mammals of the Coso Hot Springs Area. The purpose of the inventory was to establish baseline data for the environmental impact statement on the Navy's Coso geothermal development program. The written report (Zembal *et al.* 1979) contained specific information on abundance, distribution, habitat use, food habits, and interspecific interactions of the Mohave Ground Squirrel. Much of that information is presented in other sections of this status review.

The Naval Weapons Center also contracted for a similar inventory of the Randsburg Wash Test Range, a portion of the Center's Mojave Range B. The purpose was to establish baseline data for the environmental impact statement

on a specific weapons-testing project. Even though the study area was within the geographic range of the Mohave Ground Squirrel, the field work was conducted in October and November (of 1979). At that time of year, the squirrel would be in estivation and not active above ground. The written report (Phillips, Brandt, Reddick, Inc. and PRC Toups 1980) referred to the inappropriate timing of field surveys.

The BLM contracted with Rockwell International for a series of biotic surveys on the Coso Geothermal Study Area in Inyo County in 1979. The purpose of the surveys was to collect baseline information on wildlife species on lands administered by the BLM in the geothermal study area (J. B. Aardahl - pers. commun.). Survey results for small mammals (including the Mohave Ground Squirrel) and carnivores were presented by Leitner (1980) and for plant communities were presented by Henrickson (1980). Significant information on the squirrel from those reports is discussed in other sections of this status review.

The BLM conducted a 1980 study "to expand our knowledge of the geographic distribution, relative densities in various habitats, habitat preferences and seasonal activity patterns of the Mohave ground squirrel" (Aardahl and Roush 1985). Twenty-two sites within the known geographic range of the squirrel were live-trapped, and data also were collected for occurrences of the White-tailed Antelope Squirrel. However, as M. A. Recht pointed out in his letter to the Department in response to the public notice on the petition to delist the squirrel (see his letter in Appendix E), Aardahl and Roush (1985) had a lack of trap sites in the southwestern part of the Mojave Desert (i.e., Los Angeles County) and thus failed "to show the very low population levels in that part of the range." Also, Aardahl and Roush (1985) did not trap in the Victorville-Adelanto area. Thus, conclusions drawn by those workers were based on results from the northern and central parts of the squirrel's range only. Each of their study sites was trapped for three consecutive days between late April and mid-July. Study sites were located in Inyo, San Bernardino, and Kern counties. The Mohave Ground Squirrel occurred at all sites; it was considered to be "common" by Aardahl and Roush (1985), although the term was not defined. Two additional study sites suspected to be habitat of the Mohave Ground Squirrel (one each near Olancha and in the Panamint Valley, both in Inyo County) were trapped in late June. No animals of either species were captured, but a single Mohave Ground Squirrel was identified 1.5 miles north of Olancha.

Approximately equal numbers of Mohave Ground Squirrels and antelope squirrels (343 and 371, respectively) were captured/recaptured on the 22 sites. Aardahl and Roush (1985) wrote that "[a]ssuming equal rates of initial capture [in order to mark equivalent numbers of both species], the average relative population densities for the Mohave and antelope ground squirrels for the study sites are similar." However, the fact that many more Mohave Ground Squirrels were recaptured (captured more than once after being marked the first time) than were antelope squirrels (51 and 24 respectively) indicates that the antelope squirrel population actually was larger over all 22 sites as a group. Aardahl and Roush (1985) do not provide data on numbers of <u>initial</u> captures of either species, so an independent calculation of population size cannot be made. These authors interpreted a lower recapture number/rate for antelope squirrels as indicating that "the antelope squirrel is significantly more trap-shy than [is] the Mohave ground squirrel" (Aardahl and Roush 1985), rather than indicating a larger population of antelope squirrels.

The key recommendation of the report on the 1980 study was to "[e]valuate, in concert with the Department of Fish and Game, the current listing (Rare) for the Mohave ground squirrel based upon the finding of this and other investigations" (Aardahl and Roush 1985). An independent observer might conclude that the "finding" of the 1980 study which led to the recommendation was that the Mohave Ground Squirrel was "common". There was no finding or claim in the 1985 report that the geographic range of the Mohave Ground Squirrel was larger than it previously had been thought to be.

The Aardahl and Roush (1985) report was sent to the Department in May 1986 along with a letter from the BLM (Hillier 1986) which stated that "we believe an interagency review of the status of the Mohave ground squirrel is appropriate" and "[w]e have tentatively concluded that continued threatened listing is unwarranted for this species." The Department's response to the BLM letter was delayed until after our preparation of the first five-year status report (Gustafson 1987) for the Mohave Ground Squirrel. In November 1987 the Department wrote to the BLM that "we believe that the data presented in the BLM report do not support a change in classification [of the squirrel]" (Bontadelli 1987). The letter also stated that it "is apparent to us that conservation of the [Mohave Ground Squirrel] as a listed or non-listed species depends on habitat protection. This must take the form of on-site protection as a result of project review and the form of permanent habitat preservation through the establishment of a series of preserves in public ownership. In addition, the current status of the [Mohave Ground Squirrel], in terms of distribution and numbers, must be determined throughout its range during one or two field seasons" (Bontadelli 1987).

The Department's letter proposed to the BLM that the two agencies jointly develop and fund a research project to determine current status of the squirrel and identify areas in public and private ownership as sites for preserves. The BLM's response to the Department's proposal stated that "[i]n light of our strongly held convictions about this species [that it does not warrant State listing], and because of much higher priorities for our endangered species funding, we do not support the type of research proposed in your letter at this time. We will reconsider this matter upon receipt of a report [from the Department] that quantifies the threats to the Mohave ground squirrel in relation to current distribution and if such quantification truly supports your listing" (Hastey 1988).

The National Training Center and Fort Irwin contracted with Lee and Ro Consulting Engineers to conduct an endangered and sensitive species survey in 1985 at Fort Irwin and on the Goldstone Space Communications Complex. Sixteen locations were live-trapped in May and June to determine presence of the Mohave Ground Squirrel. The species was captured at three sites. The report on the survey (Lee and Ro Consulting Engineers, or Lee and Ro, 1986) stated that the "lack of captures at the remaining 13 sampling locations may or may not signify a lack of occurrence in these areas by Mohave ground squirrels." Further, "[t]wo to three days of trapping more or less randomly over a large geographic area is not sufficient when dealing with an uncommon species as seemingly specialized as S. mohavensis." Lee and Ro (1986) recommended that a management plan be prepared for the Mohave Ground Squirrel at Fort Irwin/Goldstone and stated that at least two years of field work would be required to obtain the information necessary to write a plan. In order to collect meaningful data, Lee and Ro (1986) recommended that large trapping grids "be established on at least two known locations representing divergent

habitat types", that Mohave Ground Squirrels "be radio-collared and followed throughout the active seasons [sic]" to determine habitat use, and that habitat patches used by the squirrel "be subjected to intensive quantitative habitat description including vegetation, soil, microclimate factors and changes in seasonal use [by the squirrel]." Despite these recommendations, Fort Irwin has not developed a management plan for the Mohave Ground Squirrel.

The China Lake Naval Weapons Center contracted with Michael Brandman Associates, Inc. (MBA) in 1987 to conduct the first phase of management planning for the Mohave Ground Squirrel on the Center. A report (MBA 1988) was prepared which preliminarily identified areas on the Center "that may satisfy the full requirements of protecting the threatened species and facilitating performance of the [Center's] mission." The second phase of planning would have evaluated the proposed management areas. To the Department's knowledge, phase two has not been completed. However, MBA (1988) made a number of recommendations for reducing the effects of projects on the squirrel in management areas, as follows: restrict size of, and access to project sites; leave patches of vegetation on project sites and revegetate disturbed areas with native species preferred as forage by the squirrel; stockpile topsoil, seeds, and other propagules (such as cuttings from plants) from project sites and reapply these to disturbed areas; post roadside signs which show the silhouette of a squirrel and advise a 25-mph limit in areas in which Mohave Ground Squirrels are known or suspected; minimize the size and number of pits, trenches, sumps, or drill holes during construction and leave none of these unfilled or uncapped after construction; remove waste, trash, equipment, and hazardous materials from sites after construction; and limit use of chemical rodent poisons to areas inside buildings.

The U.S. Army conducted studies at the National Training Center and Fort Irwin in the period of 1983 through 1989 to assess the effects of military training on the Mohave Ground Squirrel and other listed or sensitive animals and plants. A report on these studies was prepared by Krzysik (1991), who conducted live-trapping for the Mohave Ground Squirrel and captured this species at 10 sites. He examined the four localities at which Wessman (1977) had captured the species and found these sites had been damaged in training activities. Krzysik's (1991) findings also are discussed in the section on Threats in this status review.

The Jet Propulsion Laboratory (JPL) of the California Institute of Technology contracted with ERC Environmental and Energy Services Company (ERC) to conduct a 1988 biological survey at Edwards Air Force Base. The JPL had proposed to construct a gravity wave observatory at the northeast end of Rogers Dry Lake on the Base. A survey was necessary to determine the presence and distribution of various habitat types and species, including the Mohave Ground Squirrel. Live-trapping for the squirrel was conducted in early July on three sites; the species was captured at all sites. A report on the results of the survey prepared by ERC (1989) did not recommend that the project site be relocated or reconfigured to avoid or minimize impacts to the population of the squirrel. Rather, the report recommended that known burrows of the squirrel be avoided, if possible, during construction on the site. A further recommendation was that squirrels be captured and removed from the construction zone if their burrows would be destroyed.

The California Department of Transportation contracted for live-trapping surveys for the Mohave Ground Squirrel in 1988 and 1989, as part of the

biological assessment of the impacts of highway-widening projects in the western Mojave Desert. Fifteen sites were trapped; the squirrel was captured at six sites. A report on these surveys was prepared by Recht (1989), who wrote that the "purpose of these surveys is to determine the presence or absence of the Mohave ground squirrel, to assess the extent and affect of the loss of habitat on the affected species, and to determine a fair and equitable compensatory course of action."

The BLM contracted with Biosearch Wildlife Surveys to conduct a 1991 survey for the Mohave Ground Squirrel in the El Mirage Cooperative Management Area (San Bernardino County). The management area concept is a cooperative effort among the BLM, the County of San Bernardino, the County of Los Angeles, and the California Department of Parks and Recreation. The management area is operated by the BLM and comprises 24,400 acres, of which about 7800 acres is dry lake bed (Laabs and Allaback 1991). A management plan was prepared in 1990 (BLM 1990). A goal of the plan is to convert approximately 9000 acres of private property within the management area to public ownership through donation, purchase, condemnation, or exchange (BLM 1990). The County of San Bernardino is the acquisition-agent, using funds from the Department of Parks and Recreation's off-highway motor vehicle sticker program. A section of the plan addressed the needs of wildlife in the management area. Two action-items in that section addressed the Mohave Ground Squirrel. The first action was as follows: "Conduct an extensive random stratified inventory within the Management Area to determine if the Mohave ground squirrel is present and if so, where and in what densities." The 1991 survey was to implement that action.

Biosearch Wildlife Surveys live-trapped for the Mohave Ground Squirrel at six sites but captured no individuals of this species (Laabs and Allaback 1991). Sites were located on BLM land within the management area. At least 16,000 acres of habitat for the squirrel exist within the management area; the live-trapping on six sites sampled only a small fraction of that area. The report on the live-trapping study (Laabs and Allaback 1991) commented on the change in the Department's policy to discontinue live-trapping as a means of determining presence or absence of the squirrel and to substitute the Cumulative Human Impacts Evaluation Format (see the discussion of the latter methodology in the subsection of that title in this status review). The Department's assumption that all native plant communities within the range of the squirrel are habitat "is valid for lands within the El Mirage Cooperative Management Area with the exception of the dry lake and the shrubless peaks of the Shadow Mountains" (Laabs and Allaback 1991).

Because the Mohave Ground Squirrel was observed during field work at El Mirage, the species is known to occur on the management area. Laabs and Allaback (1991) recommended that additional field work be conducted "to determine the size and distribution of the population of Mohave ground squirrels" identified in visual surveys and to identify other populations at El Mirage. These workers also recommended removing a group camping area from the vicinity of the observed squirrels and the establishment of a program of "rotating closure and revegetation" for disturbed sites in the management area.

Surveys of the discovered population and surveys to identify other populations would meet the intent of the second action-item in the wildlife-section of the El Mirage management plan. That action was as follows: "Intensively

inventory, monitor, and take the appropriate actions to maintain populations of Mohave ground squirrel identified within the Management Area."

The JPL contracted with Battelle, Pacific Northwest Laboratory to conduct a 1991 survey for the Mohave Ground Squirrel at the National Training Center and Fort Irwin. The JPL had proposed to construct a microwave antenna research system at Fort Irwin. The biological assessment for the project included a survey to determine whether the squirrel was present at the site. Visual surveys for the squirrel were conducted in mid-April, and live-trapping was conducted in early June. The squirrel was not detected. The report of the results of the biological assessment stated that "[o]ne must assume that since the proposed site is within the geographical range of the mojave [sic] ground squirrel, the species most likely has been on the site in the past, may be there now, or may be there in the future. At best, one can only try to determine the suitability of the proposed site to the squirrels and to mitigate for the loss of potential habitat" (Fitzner *et al.* 1991). A cumulative human impacts evaluation of the site was performed; the habitat "ranked high in quality for the [Mohave] ground squirrels..." (Fitzner *et al.* 1991).

The China Lake Naval Air Weapons Station (formerly the Naval Weapons Center), using funds provided by the Department, contracted with McClenahan and Hopkins Associates, Inc. for a 1991 study of the Mohave Ground Squirrel in the Coso Known Geothermal Resources Area. This was the fourth consecutive year of surveys to measure herbaceous growth and distribution and abundance of the squirrel on four study sites. The results of this study were reported by Leitner and Leitner (1992). Certain findings are discussed in various sections of this status review.

California Desert Conservation Area Plan

In 1976 the Federal Land Policy and Management Act directed the U.S. Secretary of the Interior, through the BLM, to prepare a comprehensive long-range plan to establish guidance for management of the over 12 million acres of public-domain lands in the California Desert Conservation Area. The conservation area encompassed the Mojave Desert, the Colorado Desert, and a small part of the Great Basin Desert. The goal of the plan was "to provide for the use of the public lands and resources of the California Desert Conservation Area, including economic, educational, scientific, and recreational uses, in a manner which enhances wherever possible - and which does not diminish, on balance - the environmental, cultural, and aesthetic values of the Desert and its future productivity" (U.S. Bureau of Land Management, or BLM, 1980).

The overall management goal of the BLM for the conservation area was to have a fully operational plan in effect in 20 years after approval of the plan in 1980. For wild animals ("wildlife" in the context of the plan), this meant that "[w]ildlife habitat will have been maintained and improved so that declining wildlife populations will be showing improving trends or stabilization. The number of species on threatened, rare, or endangered lists will be decreasing" (BLM 1980).

By policy the BLM was then and is now required to manage for State-listed Threatened and Endangered species. A primary objective of the California Desert Conservation Area Plan was to manage "federally and State-listed species and their habitats to comply with existing legislation and Bureau

policies. In brief, the continued existence of these species will not be jeopardized by Bureau actions. Where possible and feasible, populations and habitats will be stabilized and/or improved. The overall objective will be to improve the status of such species so that delisting can occur. Management of these species and their habitats will occur through close coordination with other State and Federal agencies" (BLM 1980). The statement in the cited passage indicating an intent to not jeopardize State-listed species by BLM actions is at odds with a statement elsewhere in the desert plan, in a review of the multiple-uses classes for management of lands within the conservation area, that all "State and federally listed species and their critical habitat will be fully protected [emphasis added]" (BLM 1980). The inference from the second passage is that State-listed species and their critical habitats will be protected by the BLM whenever they occur, while the inference from the first passage is that no further jeopardy will be imposed. The first constitutes passive avoidance of impacts, while the second implies active management for designated habitats.

The BLM spent several years in the late 1970s conducting inventories of wildlife in the conservation area. As a result, the BLM was able to propose the establishment of 28 Areas of Critical Environmental Concern (ACECs) to solely or partially protect wildlife. "Management prescriptions for ACECs identified for wildlife resources will include aggressive management actions to halt and reverse declining trends and to ensure the long-term maintenance of these critical fish and wildlife resources" (BLM 1980). Proposed management in ACECs generally receives priority by the BLM for plan preparation, implementation, and management. Two ACECs to specifically protect the Mohave Ground Squirrel and its habitat were proposed; these were the Desert Tortoise Research Natural Area ACEC (Kern County; 24,000 acres of public and private lands) and the West Rand ACEC (Kern County; 16,000 acres of public and private lands). Habitat Management Plans (HMPs) were to be prepared for an additional 58 areas; HMPs are "detailed plans developed specifically for wildlife habitats or species which require intensive, active management programs" (BLM 1980). HMPs are generally of lower priority than ACECs in the BLM in regard to plan preparation, implementation, and funding. Three HMPs to specifically protect habitat of the Mohave Ground Squirrel were proposed for Rose Valley (Inyo County), Superior Valley (San Bernardino County), and the Western Mojave Desert Crucial Habitats (Kern and San Bernardino counties) (BLM 1980). The latter HMP was to protect crucial habitat for the Mohave Ground Squirrel and the Desert Tortoise in Indian Wells Valley area, Fremont Valley, and the Boron/Black Hills area.

Because inventories conducted during the preparation of the desert plan for State-listed species were, for most species, not comprehensive, the BLM's policy in 1980 was to complete more intensive inventories within three years of acceptance of the desert plan and to complete HMPs within two years following completion of the inventories. In furtherance of this policy, Aardahl and Roush (1985) conducted trapping for the Mohave Ground Squirrel at 22 sites in the northern and central parts of the geographic range. Specific management plans have been prepared by the BLM for the Desert Tortoise Natural Area ACEC and a new HMP area (the West Rand ACEC together with adjacent areas) named the Rand Mountains/Fremont Valley Management Area. In addition, the much larger West Mojave Coordinated Management Plan currently is under preparation. (See the discussion of the latter plan under its title in this section of the status review.)

Habitat for the Mohave Ground Squirrel was illustrated in map 4 of the desert plan as three separated areas along Highway 395 from Rose Valley south to just north of Kramer Junction and a fourth area in Superior Valley north of Barstow. The text reference to this map simply stated that habitats of "listed species" are "generally indicated on Map 4...." There was no indication in the text that the four areas shown for the squirrel were to be specially managed for the species, but the areas do correspond to mapped locations of HMPs for the squirrel and other species mentioned in the immediately preceding paragraph of this status review. Aardahl and Roush (1985) termed the four areas on map 4 "Crucial Habitat" for the squirrel.

Memorandums of Understanding

CESA (Section 2081 of Fish and Game Code) authorizes the Department, through permits or Memorandums of Understanding (MOUs), to allow "individuals, public agencies, universities, zoological gardens, and scientific or educational institutions, to import, export, take, or possess any endangered species, threatened species, or candidate species for scientific, educational, or management purposes." The primary use of MOUs by the Department is to allow take and possession for scientific and educational purposes. Because the definition of "take" includes hunt, pursue, catch, and capture (Section 86 of the Code), any capturing of live animals is considered to be taking.

In the case of the Mohave Ground Squirrel, MOUs are issued to biological consultants who are attempting to determine the presence or absence of the species, to students and researchers who are investigating aspects of life history, and to agency biologists who are conducting pre-project surveys or post-project monitoring. Any person who attempts to capture a Mohave Ground Squirrel must possess a State scientific collecting permit issued by the Department plus an MOU or a letter-permit issued in lieu of an MOU.

Each MOU specifies how the Mohave Ground Squirrel can be captured and whether animals can be marked in any way, the names of persons authorized to work under the MOU, the disposition of animals which inadvertently die in the course of field work, and how results of field work must be reported to the Department. Each MOU has specific starting and ending dates.

An updated list of current MOU-holders for work on the Mohave Ground Squirrel is maintained by the Department.

Survey Guidelines

For development projects in the western Mojave Desert within the geographic range of the Mohave Ground Squirrel which would cause the destruction or degradation of native plant communities, the Department for some years required that the presence or absence of the squirrel be determined. Biological consultants hired by project proponents or local lead agencies used several techniques and variations of the techniques to determine presence or absence. Some used visual observation alone, some used a combination of visual means and live-trapping, and others used only live-trapping. Of those who trapped, some employed traps for three consecutive days on the project site and others placed traps for five or more days. Trap size varied as did the arrangement of traps on the ground; some consulting biologists placed traps in a straight-line transect, and others used rectangular grids of various numbers of traps. Live-trapping was done in any month from February

through July, whether or not squirrels were active above ground. Thus, the Department did not have confidence in the results of some surveys which concluded that no Mohave Ground Squirrels were present on a site. We also were unable to compare the results of some surveys to others, because the procedures and techniques varied so widely.

In late 1987 the Department prepared survey guidelines for persons conducting live-trapping studies of the Mohave Ground Squirrel. The guidelines standardized procedures and conditions for trapping so that survey results for all studies could be as comparable as possible. The guidelines were required by the Department to be used on any project site at which the presence or absence of the Mohave Ground Squirrel needed to be determined. The first application of these guidelines was in the field season (March through June) of 1988. Comments were received and invited from interested parties, particularly those persons who had used the guidelines in the field, and the guidelines were revised for use in 1989. Subsequent revisions were made for the field seasons of 1990 and 1991; 1991 was the last year in which the guidelines were used. Despite the use of consistent methods for surveys, the live-trapping method was inconclusive in reliably determining presence or absence of the squirrel. In 1991 the trapping was replaced by the methodology termed Cumulative Human Impacts Evaluation Format.

Cumulative Human Impacts Evaluation Format

Rempel and Clark (1990), in their study in Indian Wells Valley, found that Mohave Ground Squirrels at times would not enter baited live-traps even though the animals were present on the trapping site. Other workers reported like situations. Thus, trapping surveys which concluded that no Mohave Ground Squirrels were present because none had been captured were often suspect, even though the Department's survey guidelines had been strictly followed (see section on Survey Guidelines above). In addition, the drought-period of approximately 1986-1992 in the Mojave Desert overlapped the years of 1988-1991 when the survey guidelines were required to be used; the drought resulted in at least a local effect on the quantity and quality of herbaceous vegetation within the geographic range of the Mohave Ground Squirrel (see discussion of the findings of Leitner and Leitner 1989, 1990, 1992, and Leitner *et al.* 1991 in the subsection on Food Habits, Foraging, and Home Range in this status review). As has been discussed in the section on Distribution and Abundance, the Mohave Ground Squirrel seems to respond locally to a season of scant precipitation and poor forage conditions by not reproducing in that year. After several years of such conditions the local population of squirrels dies out. The plant community remains habitat for the squirrel, but there are no animals of this species occupying it. Traps set out during this period would, of course, capture no squirrels.

Based on the fact that squirrels may be present but do not always enter traps and that the species may become locally extinct due to climatological conditions, the Department decided to discontinue the requirement for the use of live-trapping to determine presence or absence of the squirrel. Armed with the knowledge that the Mohave Ground Squirrel can be found in every plant community within its geographic range (see Essential Habitat section of this status review) and using the human-impact rating system developed by Rempel and Clark (1990), the Department in mid-1991 began requiring the use of the Cumulative Human Impacts Evaluation Format (CHIEF) methodology for projects which occur within the range of the squirrel.

The CHIEF system emphasizes the degree of human or human-related disturbances which have occurred in the habitat on a project site, without regard to the intrinsic value of the habitat to the Mohave Ground Squirrel. The primary assumption in using the CHIEF system is that habitat with the greatest degree of human disturbance has the least value to the species over time. Habitats in closer proximity to human activities tend to have the greatest disturbance. Since these disturbances usually increase over time, such areas probably will not support populations of the squirrel in the long term. An example is the Lancaster and Palmdale area.

Prior to adopting the CHIEF system, the Department required compensation for destruction of habitat only in areas in which Mohave Ground Squirrels had been trapped. There was no standard for compensating loss of habitat in areas in which the squirrel occurred but had not been trapped or observed. The Department now considers compensation when development within the range of the species results in loss of habitat. No compensation is required if development occurs in areas which the Department determines are not habitat.

The CHIEF methodology was not designed or intended to be used for determining presence or absence, or habitat requirements, of the squirrel. It is strictly intended to evaluate habitat for degree of disturbance and derive a numerical score as a rating for the site. The score then is used to determine a compensation ratio. The goal of the Department is to consolidate management areas (preserves) for the Mohave Ground Squirrel by acquiring, or directing the acquisition of, parcels in a pattern which results in protection of large areas. These should contain the different plant communities of the western Mojave Desert, be located throughout the range of the squirrel, and be of sufficient size to sustain the species in perpetuity.

A workshop to train consulting and agency biologists in the CHIEF methodology was held in Barstow in August 1991. The workshop was sponsored by the San Joaquin Valley Chapter of The Wildlife Society, an international organization of professional wildlife biologists, and the Department. In 1992 the Department revised and improved the methodology, and a refresher workshop for biologists was held in Barstow in September 1992. A companion workshop for planners, to inform them of the regulatory steps required for project approval, was held concurrently in Barstow. The 1992 workshops were sponsored by the Department and the Southern California Chapter of The Wildlife Society.

Biennial Report on State-listed Species: 1972-1983

The State Endangered Species Act of 1970 required the Department to submit to the Governor and Legislature a biennial report on the status of animals listed as Rare and Endangered, with recommendations for preserving, protecting, and enhancing those species. Each of the reports had the primary title of "At The Crossroads". The first report was issued in 1972, and others followed in 1974, 1976, 1978, and 1980. The last report in the series was a 1983 supplement and amendment to the 1980 report.

Each report other than the 1983 amendment contained a summary of legislative and conservation actions for listed species and an account with a map for each species, including the Mohave Ground Squirrel. Maps illustrating the geographic range of the squirrel were included in the 1972 and 1980 reports, but the maps in the 1974, 1976, and 1978 reports only displayed sites of known occurrence since 1972.

Five-year Status Report

CESA requires the Department to review the status of each State-listed Endangered species and Threatened species every five years, and to submit a written report to the Commission. In 1987, the Department prepared the first report (Gustafson 1987) on the status of the Mohave Ground Squirrel and recommended to the Commission that the "Threatened" classification be retained. The basis of our recommendation was the knowledge that the habitat of the squirrel continued to be destroyed, fragmented, and degraded, particularly in the three urban areas described in the Threats section of this status review. However, we did not have complete knowledge about the extent of, or the impacts to the squirrel of, habitat changes occurring in the southern portion of the geographic range. Therefore, we were unable to judge whether the species was in danger of extinction in that portion of its range and, thus, whether it was deserving of a classification of Endangered rather than Threatened. Also, as the 1987 report stated, "[b]ecause uncertainty does exist (in the absence of studies which would provide information) about the vulnerability of the [Mohave Ground Squirrel] to extirpation within [certain] portions of its range, the [Department] will not propose that the [species] be classified as a federal Endangered or Threatened species at this time" (Gustafson 1987).

The status report pointed out that the "chief management needs in conservation of the [Mohave Ground Squirrel] are protection of habitat by public agencies, intensive field studies to discover unknown aspects of the life history of the species, and a program of habitat preservation" (Gustafson 1987). The report also stated that restoration of degraded habitat, through the control of livestock grazing and off-highway vehicle use and the planting of vegetation preferred by the squirrel, was needed. The report recommended that a recovery plan be prepared, that studies to determine unknown aspects of the squirrel's life history be conducted, and that the impacts of rodenticides on the squirrel be investigated.

The Commission accepted the Department's recommendation and the Mohave Ground Squirrel was retained on the State list of Threatened species. The next status report for the squirrel was due in 1992, but the preparation of this status review has precluded the need for a separate report.

Annual Report on State-listed Species: 1986-Present

CESA (Section 2079 of Fish and Game Code) requires the Department to prepare an annual report summarizing the status of all State-listed species of animals and plants. The most recent report is for the calendar year of 1991. Among the species-accounts is one for the Mohave Ground Squirrel (Gustafson 1992). In the account the management needs for the squirrel were listed as follows: protection of habitat by local, State, and federal agencies in project review; permanent protection of habitat by establishing a series of preserves in public ownership; a one-time determination of the status of the squirrel (local distribution and relative abundance) in portions of its range; periodic surveys to repeat the status determination; studies to determine various aspects of life history; preparation of a management plan; restoration of degraded habitats through the control of livestock grazing and off-highway vehicles and through revegetation; and investigating impacts of rodenticides on the squirrel.

The concluding statement of the account is that the "population trend [of the Mohave Ground Squirrel] is considered to be declining due to loss of habitat to urban and agricultural development, overgrazing by livestock, highway construction and [off-highway vehicles]" (Gustafson 1992).

Published Book on State-listed and Federally Listed Animals

In 1990 the Sierra Club, in cooperation with the Department and the California Academy of Sciences, published a soft-cover book (Steinhart 1990) on all California animals listed as Threatened or Endangered by the State and federal governments. Preparation of the book was financed by the California Endangered Species Tax Check-off Program. The book contains a short account and a color photograph of each species, including the Mohave Ground Squirrel. The species accounts are presented by geographic region of California, including one entitled "Desert Regions." Each species account was reviewed in draft form by a Department biologist. The book contains an essay on evolution and biodiversity in California by R. Bowman. The author of the book, P. Steinhart, discusses in an introduction to the species accounts past and present conservation efforts, obstacles to protection of species, funding efforts, and involvement by citizens.

Federal Candidacy

Periodically the U.S. Fish and Wildlife Service publishes in the Federal Register a notice that the Service is reviewing the status of certain species of native United States animals for possible addition to the federal list of Endangered and Threatened wildlife. Each notice includes a list of those species under review. Species which are in categories 1 and 2 on the list are considered to be candidates for listing as Endangered or Threatened. Category 1 species are those "for which the Service has on file enough substantial information on biological vulnerability and threat(s) to support [federal] proposals to list them as endangered or threatened species. Proposed rules have not yet been issued because this action is precluded at present by other listing activity" (U.S. Fish and Wildlife Service, or FWS, 1991). Category 2 species are those "for which information now in the possession of the Service indicates that proposing to list as endangered or threatened is possibly appropriate, but for which conclusive data on biological vulnerability and threat are not currently available to support proposed rules" (FWS 1991). Candidate species do not receive substantive or procedural protection of the federal Endangered Species Act. However, development and publication in the Federal Register of proposed rules on Category 1 candidates are anticipated by the Service, which encourages other federal agencies to give consideration to such species in environmental planning (FWS 1991). A feature of the most recent notice of review is a designation of status trend. The status of each species is identified as either Improving, Stable, Declining, or Unknown.

The most recent notice and list, which reflect the Service's current judgment about the possible vulnerability and status trends of native animals in the United States, were in the Federal Register of November 1991 (FWS 1991). Among the mammals on the list is the Mohave Ground Squirrel. It is designated as a Category 2 species. The status trend for the squirrel is "Declining", which was defined as indicating "decreasing numbers and/or increasing threats" (FWS 1991). Because there is no information on numbers of squirrels (numbers are not meaningful in any case for a small mammal such as the squirrel; see discussion in the section of this status review on Distribution and

Abundance), the Service evidently is concerned about increasing threats to the species.

Coso Mitigation Program

A comprehensive mitigation plan to address impacts to the Mohave Ground Squirrel resulting from geothermal development in the Coso Known Geothermal Resource Area (KGRA) at China Lake Naval Weapons Center has been developed. This is a joint plan by the BLM, the U.S. Navy, and the Department and is known as the Coso Mohave Ground Squirrel Mitigation Program. The Program consists of several elements, including rehabilitation of degraded vegetation throughout approximately 43,500 acres of the KGRA, thereby improving the quality of habitat for the Mohave Ground Squirrel. "The Program proposes to accomplish this goal by eliminating grazing pressure by domestic cattle" (Leitner and Leitner 1989). The Program also requires a long-term monitoring study to evaluate the success of eliminating grazing. The specific components of the study are to "improve the quality of remaining habitat for the Mohave Ground Squirrel within the geothermal development area", to "evaluate the effectiveness of the habitat improvement program", and to "develop information about habitat requirements of the Mohave ground squirrel" (Leitner and Leitner 1989).

Baseline studies were conducted on four permanent study sites, two within the planned cattle exclosure and two outside, in 1988 (Leitner and Leitner 1989) and 1989 (Leitner and Leitner 1990) to determine distribution and abundance of the Mohave Ground Squirrel and to characterize the shrubby and herbaceous vegetation. In addition, studies were done in 1988 and 1989 to document cattle and feral burro use and to collect and analyze fecal samples from Mohave Ground Squirrels, antelope squirrels, Black-tailed Hares, cattle, and burros to determine their respective diets.

The four study sites were chosen from a field of 16 sites which met the following criteria: "no geothermal development or other surface disturbance planned through the year 2000; habitat likely to support adequate numbers of Mohave ground squirrels to allow useful between-year comparisons; habitat generally typical of basin and bajada areas in the Coso KGRA in terms of topography, soils, and natural communities; presently receiving use by livestock; readily accessible by vehicle [for research purposes]; acceptable to surface management agencies [the Navy and BLM]...; two of the sites must lie within the proposed boundaries of the grazing exclosure and two located outside these boundaries" (Leitner and Leitner 1989).

After two years of collecting baseline data, a fence was built in the fall of 1989 around the perimeter of the Coso Grazing Exclosure. Cattle were excluded beginning in December 1990. Monitoring studies continued in 1990 for a third consecutive year (Leitner *et al.* 1991). Further monitoring is scheduled for 1992, 1994, 1996, and 2001. However, the Department funded a limited continuation of studies in 1991 (Leitner and Leitner 1992). A popular account of the field studies at Coso was written by Roberts (1990).

Workshop in Ridgecrest

In April 1990 the City of Ridgecrest and the China Lake Naval Weapons Center co-sponsored a two-day workshop in Ridgecrest entitled "High Desert Growth and Development and Mohave Ground Squirrel Management Workshop: A Cooperative

Approach". Invited participants were professional wildlife biologists from State and federal agencies, academic institutions, and consulting firms; planners from public agencies; and developers. The goal of the workshop was to provide a forum for sharing information on the life history and habitat requirements of the squirrel and for discussing how management of the species could be achieved by cooperative parties.

The four workshop-sessions each consisted of a series of speakers followed by a question-and-answer period. Over the two days there were speakers representing the following groups: Naval Weapons Center, the Department, U.S. Fish and Wildlife Service, BLM, California State University - Dominguez Hills, Maturango Museum, St. Mary's College, California Energy Commission, County of Kern, Luz Development Corporation, ENSR Consulting and Engineering, County of Inyo, The Nature Conservancy, Regional Environmental Consultants, City of Ridgecrest, and private developers.

Section 2081 Management Permits

The description of the Section 2081 process in this section of the status review is taken largely from a draft manuscript prepared by D. Showers of the Department's Environmental Services Division, Sacramento and from personal communication with R. Rempel of the Department's Region 4, Fresno.

CESA has two provisions which relate to the taking of State-listed Endangered and Threatened species. Taking in the context of endangered species is not only the traditional take (to "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill" - Section 86, Fish and Game Code) but also is the destruction (complete loss of use to a species) of essential habitat. Section 2080 of the Code prohibits taking of listed species. However, State lead agencies may be allowed to take a listed species under Section 2090 of CESA if the taking is incidental to carrying out an otherwise lawful project under CEQA. The taking must be approved by the Department after issuing findings in a Biological Opinion. The Biological Opinion specifies to the State lead agency which reasonable and prudent measures the agency must adopt to minimize the adverse impacts of the incidental taking.

CESA does not authorize incidental taking for other than State lead agencies. However, Section 2081 does authorize the Department to permit take for educational, scientific, or management purposes only. (The application of this Section for educational and scientific purposes is discussed in the section of this status review on Memorandums of Understanding.) Non-State development which adversely affects a listed species by taking is prohibited unless the Department issues a permit for management purposes. The Department has developed procedures by which a Section 2081 management permit may function similarly to an incidental-take permit under the federal Endangered Species Act. The permittee must meet strict provisions and standards in an implementing agreement; the permittee signs the agreement as a promise to carry out the provisions. In order to meet the requirements of Section 2052 (to conserve, protect, restore, and enhance listed species and their habitat), the Department must permit only those projects which will have a <u>net benefit</u> to a species. Note that this requirement differs from the requirement that State lead agencies need to show only that they have <u>minimized</u> the adverse impacts of the taking.

It is the responsibility of the party causing the taking to ensure full mitigation for the loss of individual animals or plant populations. Full mitigation includes the setting aside of habitat to replace the lost habitat, enhancement of the set-aside habitat, and providing for the long-term management of the habitat. At the time the implementing agreement is signed by the Department and the other party the permit goes into effect. The project may proceed even if all of the mitigation is not in place.

The Department began applying the concept of management permits under Section 2081 to private projects in 1987. Since that time, there have been 19 applications to the Department for permits on projects which will take the Mohave Ground Squirrel; as a result of these applications 11 permits have been issued by the Department.

West Mojave Coordinated Management Plan

The description of the West Mohave Coordinated Management Plan in this section of the status review is derived from an October 1991 Preparation Guide issued by the BLM, the Department, and the Fish and Wildlife Service for the planning process.

In 1990 the BLM, concerned about inconsistent approaches to conserving the Desert Tortoise on public and private lands, initiated discussions with the Department and the Fish and Wildlife Service seeking ways to deal with tortoise-related issues in a more consistent manner. The discussions led to the concept of a multi-agency planning effort that would establish direction for tortoise management on all lands in the western Mojave Desert region. The benefits of the effort were envisioned as follows: finding a regional solution for protecting the tortoise while allowing development, establishing equitable and consistent conservation measures, establishing a coordinated approach to tortoise management among the involved agencies and groups, and finding the best solution for managing tortoise populations within the region. The Department, the Service, and other entities suggested that the Mohave Ground Squirrel be included in the planning effort as a major element because it is a State-listed species. The inclusion of the squirrel and other species in the plan fits with the intent of an agreement recently signed by the BLM, the Department, the Service, and other entities to conserve biological diversity in California through protection of ecosystems. Thus, the plan will be a multi-species document with benefits for more than a single species.

The region for which the management plan is being prepared is the "West Mojave Desert". The boundary of the planning area was derived from the known geographic ranges of the tortoise and Mohave Ground Squirrel in the western Mojave Desert and is a general representation of the habitat limits of the two species which roughly follows major topographic features and federal-agency management-boundaries. The boundary encompasses approximately 8.6 million acres, extending from Rose Valley on the north to the San Gabriel and San Bernardino mountains on the south, and the Antelope Valley on the west to Twentynine Palms on the east. The planning area includes portions of five counties (Inyo, San Bernardino, Riverside, Los Angeles, and Kern), of eleven incorporated cities and towns (Barstow, Adelanto, Apple Valley, Hesperia, Victorville, Yucca Valley, Twentynine Palms, Palmdale, Lancaster, California City, and Ridgecrest), of numerous unincorporated communities, of four military bases (China Lake Naval Air Weapons Center, National Training Center and Fort Irwin, and Twentynine Palms Marine Corps Base and Edwards Air Force

Base), and of two national monuments (Death Valley and Joshua Tree). The geographic range of the tortoise includes practically all of the planning area, but the range of the squirrel is only in the western-most portion of the planning area from the vicinity of Fort Irwin, Barstow, and Apple Valley/Victorville/Hesperia westward.

Although the tortoise and the squirrel are the target-species in the planning process, other sensitive species of plants and animals are found within the planning area. Some, but not all, of these species may be identified for special management.

All agencies having land-management and/or regulatory jurisdiction affecting the target-species have been invited to participate in the planning process, but no agency will be required to participate. Both public and private lands within the planning area will be addressed by the plan. A multi-agency planning effort is appropriate in the western Mojave Desert because 1. the geographic ranges of the two target-species extend over a wide area of intermixed public, military, and private lands; 2. without proper coordination, the regulatory agencies often produce conflicting and contradictory decisions affecting these species; and 3. appropriate long-term management of these species can only be accomplished by focusing on all of the habitat and by including all of the applicable regulatory agencies. By addressing the issues of species protection and human development/uses in the western Mojave Desert on a habitat-wide basis with the participation of all affected agencies, the range of options for protection and development are greatly increased over the options available on a species-by-species or project-by-project basis. It is intended that the plan will meet the needs of, and be adopted by, the participating agencies.

The plan will contain a comprehensive set of decisions directing long-term management of the target-species. The plan will be designed to meet the requirements of a Section 2081 (Fish and Game Code) management-permit application and an application for a federal incidental-take permit. If the Department accepts the plan, Section 2081 management permits would be issued to the participating non-federal agencies. Additional Section 2081 permits and federal permits for incidental take of the tortoise and Mohave Ground Squirrel would not be required for projects of the participating non-federal and federal agencies, as long as future activities, land-use decisions, and proposed mitigation/compensation packages are consistent with the terms of the State and federal permits. It is anticipated that, upon approval of the plan by the participating agencies and acceptance by the Department and the Service, existing land-use plans and policies of the participating agencies would be modified to conform to the West Mojave plan. It also is anticipated that any future planning or permitting by participating agencies that affects the two target-species would not be approved unless the planned or permitted activity is in conformance with the West Mojave plan.

Products of the plan will include the identification of management zones, as well as defined compatible uses and management prescriptions in these zones, for the Mohave Ground Squirrel and the tortoise. The zones will represent habitat essential to the survival of one or both of the target-species. The category of zoning (A or B) will indicate the degree of management intensity needed to maintain long-term survival and genetic diversity of these species. The specific number and nature (i.e., permitted uses in the habitat) of the management categories will be defined in the planning process.

Other identified products of the plan will be uniform mitigation and compensation requirements, management actions needed to enhance recovery of the two species, resource monitoring requirements needed to ensure that management goals are being met, sources of implementation funding, and implementing schedules and responsibilities.

The BLM, in cooperation with the Department and the Service, is serving as the lead in the planning process. These agencies are being advised at several levels by a variety of agencies and non-governmental advocacy groups. A draft plan and accompanying environmental documents are proposed for public review in June 1993.

The working concept by the BLM, the Department, and the Service is that A-zones for the Mohave Ground Squirrel will be selected to ensure long-term survival of populations distributed throughout the range of the species and to ensure corridors of contiguous habitat to allow for gene flow between A-zones. A-zones will be areas of high-quality and medium-quality habitat. An area of high-quality habitat is defined as having either a large number of records of occurrence and much undisturbed habitat; a large number of records around the perimeter of the area with contiguous undisturbed habitat throughout the area; or records over a long period of time with continued undisturbed habitat. An area of medium-quality habitat is defined as having either numerous records of occurrence but with habitat somewhat degraded by human-induced impacts or some records over a long period but with relatively undisturbed habitat.

Since it is conceivable that populations of the Mohave Ground Squirrel might decline until they occur only on A-zones, then A-zones must be adequate in quality and quantity of habitat as well as pattern of distribution to ensure survival of the species. Human uses in A-zones will be restricted to those with a net benefit or no net negative impact to survival of the squirrel.

Each A-zone should be at least 60,000 acres in size. This acreage is based on general population biology theories, using data on the density of female Mohave Ground Squirrels reported by Recht (1977), Leitner and Leitner (1989, 1990), and Leitner *et al.* (1991). A description of the theories and of the calculations used to derive 60,000 acres as a minimum A-zone size are in the Abundance subsection of this status review.

Five A-zones tentatively have been selected, representing the northern, western, eastern, central, and southern portions of the range of the Mohave Ground Squirrel. A-zones will include as much public and military land as possible, to minimize the need to acquire private land. The A-zones for the Mohave Ground Squirrel will be fitted with A-zones designated for the Desert Tortoise to create larger zones in situations in which the zones for the two species overlap. Only 515,000 acres currently are proposed for A-zones for both the squirrel and the tortoise within the range of the squirrel. This acreage constitutes just 10.6% of the entire range of the squirrel. The West Mojave planning staff of the BLM has calculated that only 53,000 acres (1% of the squirrel's range) currently are protected on lands meeting A-zone criteria.

Surrounding all A-zones will be B-zones, in which restricted human uses will be fewer but in which the management goal will be to protect the squirrel and the tortoise. The concept is that the establishment and maintenance of B-zones is necessary to protect the integrity of the enclosed A-zones. The West Mojave plan currently proposes to designate 2,415,000 acres within the range of the squirrel as B-zones. This acreage is 49.7% of the total range.

The remainder of the land in the West Mojave planning area will be designated as the C-zone, in which land uses are not further restricted. The C-zone, as tentatively defined, constitutes about 1,933,000 acres of the range of the Mohave Ground Squirrel. This is 39.7% of the range and is an area that may be almost completely developed as the human population increases in the western Mojave Desert. This acreage is almost entirely private land, although about half of Edwards Air Force Base is in the proposed C-zone. Thus, it can be seen that A-zones and B-zones primarily will be on non-private lands, while most private lands in the desert may be developed without further restrictions on the protection of habitat. The Department's assumption is that all private land within the range of the squirrel not acquired for A-zones and B-zones will be developed. No other assumption is feasible.

Mohave Ground Squirrel Working Group

In late 1991 the Department formed a group of non-agency biologists and Department biologists to serve as a technical advisory team on issues regarding the biology and conservation of the Mohave Ground Squirrel. The team's formal title is Mohave Ground Squirrel Working Group. The non-agency participants are persons who have field and research experience with the Mohave Ground Squirrel. The Department participants include those biologists who have field management responsibility for the squirrel, those who conduct project review and develop recommendations for avoiding or minimizing impacts to the squirrel, those who are participating in the BLM's West Mojave planning process, and those in Sacramento who have responsibility for overall policy development and direction on conservation and mitigation issues regarding the squirrel. Other participants in the working group meetings are BLM and Fish and Wildlife Service personnel.

The first working-group meeting was held in Barstow in January 1992. Other meetings have followed in Barstow in 1992 and 1993. In an August 1992 gathering, the working group revised the boundary of the geographic range of the Mohave Ground Squirrel, using information collected by the Department and the BLM. Both agencies now accept this boundary as encompassing the current range of the squirrel.

DISTRIBUTION AND ABUNDANCE

Distribution

The first statement about the geographic range of the Mohave Ground Squirrel was by Merriam (1889), who wrote that "[s]o far as known the present species is confined to the arid desert in which the Mojave River sinks. At all events enough is known of the mammals of the surrounding region to justify the statement that it does not occur to the west, south, or east of the Mojave desert - hence the only direction in which it may yet be found is to the northward, in the desert region of southern Nevada." Grinnell and Dixon (1918) stated that the range of the species was in the "western parts of the Mohave [sic] Desert, from Haiwee, Inyo County, south to Rabbit Springs, San Bernardino County...." A map in Grinnell and Dixon (1918) illustrated the range of the squirrel as an exaggerated "L", with the angle of the L appearing to encompass the Antelope Valley. Howell (1938) described the range of the squirrel as "Mohave [sic] Desert, Calif., west to Palmdale, Los Angeles

County; north to Haiwee Meadows, Inyo County; south to Rabbit Springs, San Bernardino County...." A map in Howell (1938) showed the range to be approximately triangular in shape, with the southwestern angle (or "toe") appearing to encompass the Antelope Valley west of Palmdale and Lancaster.

Hall and Kelson (1959) portrayed the range of the squirrel on a map without the extension into the Antelope Valley west of Palmdale and Lancaster. A map of the range of the Mohave Ground Squirrel prepared by the BLM in 1977 prior to the work of Wessman (1977) also did not illustrate the toe extending west of these cities. Wessman (1977) found that the Mohave Ground Squirrel existed further to the east than had been known in the vicinity of Fort Irwin and near the Avawatz Mountains. Aardahl and Roush (1985) attempted to capture the squirrel near Olancha and in the southern end of the Panamint Valley, both in Inyo County, but they were unsuccessful. They did identify a Mohave Ground Squirrel 1.5 miles north of Olancha. The BLM's 1977 map, the work of Wessman (1977), and the map presented by Howell (1938) provided the basis for the map of the range of the squirrel in the fifth biennial report by the Department on the status of State-listed animals (CDFG 1980).

An examination of museum records compiled by the Department reveals several collection-locations cited simply as "Palmdale". It is not possible to determine how far, or in which direction, from Palmdale these specimens were collected. However, the toe of the Antelope Valley almost certainly contained the Mojave Desert scrub and Joshua Tree habitat of adjacent still-vegetated areas. Indeed, remnants of these communities still exist in the western-most Antelope Valley although agriculture long ago claimed most of this area. Thus, it is likely that Mohave Ground Squirrels existed in the Antelope Valley as far west as plant-community distribution and topography allowed.

Hoyt (1972) commented that the Mohave Ground Squirrel "has one of the most restricted distributions of any species of ground squirrels." Indeed, of the seven species in the genus *Spermophilus* which are found in California, the smallest geographic range belongs to the Mohave Ground Squirrel. This is true despite the fact that Wessman (1977) found the range to extend approximately 40 miles further to the east than had been previously known. Field work by the BLM in 1973-1975 in the eastern part and along the northwestern edge of the known distribution had helped flesh out the boundary.

Curiously, Chesemore and Carroll (1976) reported a "first record" of the Mohave Ground Squirrel in Kern County for March 1975 near California City. These authors noted that Hoyt (1972) had reported no current record of the species for Kern County. However, Hoyt (1972) did not trap in Kern County. Hoyt (1972) did list records of at least four museum specimens of the squirrel from Kern County, but he did not give dates for collection of the specimens. A compilation of museum specimens by the Department listed at least 12 Mohave Ground Squirrels collected in Kern County prior to March 1975.

Elevations within the range of the Mohave Ground Squirrel exceed 6000 feet in the north. E. Wessman trapped a squirrel at 4900 feet in Bird Spring Canyon in Kern County in March 1975. Leitner and Leitner (1989, 1990, 1992) and Leitner *et al.* (1991) captured the species at 4840 feet and 4920 feet in Inyo County. Hafner (1992) noted that the Mohave Ground Squirrel has been found at 1525 meters (5000 feet) near Walker Pass, at the northwestern edge of its range. Wessman (1977) stated that the species had been found in "rich Joshua tree and monotypic blackbrush (*Coleogyne ramosissima*) habitats at elevations

over 5000 feet...." Aardahl and Roush (1985) provided five records from 5000 feet near Little Lake in Inyo County for BLM work in June 1979. Michael Brandman Associates, Inc. (1988) reported the observation of a Mohave Ground Squirrel along the road to Straw Peak in the China Lake Naval Weapons Center at an elevation of approximately 5520 feet. Based on that record, the squirrel is considered to exist at elevations up to at least 5600 feet.

The Mohave Ground Squirrel appears to have been confined to the western Mojave Desert generally west of the Mojave River, although it was found east of the river in the Victorville area at least as far as Rabbit Springs in Lucerne Valley. What factors influence this distribution? On the southern and western edges of the range are the foothills of the San Bernardino, San Gabriel, Tehachapi, and Sierra Nevada mountain ranges. The species does not seem to be found in the foothills in the south. M. Recht (pers. commun.) stated that, although desert plant communities continue up the slopes, the squirrel seems to be limited to the desert floor and alluvial fans at the base of the hills. His experience with the squirrel in Los Angeles County suggests that, at the edge of the range, the species is found a mile to a mile and a half away from the hills at sites in which the soil may be more suitable for digging. However, he speculated that elevation may be the controlling factor limiting the range in the south as it influences temperature and rainfall.

Temperature is critical to the survival of the squirrel inasmuch as it affects the conditions in the estivation burrow. At some level of increasing elevation, determined locally, overwinter air temperatures and associated soil temperatures would be low enough to inhibit the Mohave Ground Squirrel's ability to maintain its body temperature at a survival level. Rainfall is critical to the survival of the squirrel to the extent that it affects the quantity and quality of vegetation as food for the species. At some level of increasing rainfall, determined locally, plants important to the squirrel may not be able to survive in the abundance necessary to support a reproducing population of squirrels.

Further north, in Kern County, the BLM found the squirrel well into the Sierra Nevada foothills at elevations up to 4900 feet. At Walker Pass, Mojave Desert vegetation extends westward out of the Desert itself into the Kern River drainage on Canebrake Creek. However, no Mohave Ground Squirrels have been found west of Walker Pass. In the Sierra foothills, elevation and its influence on temperature and rainfall may ultimately determine the limit of the squirrel's distribution. On the northern edge of the squirrel's range in the vicinity of Olancha, there is not a dramatic increase in elevation as the vegetative communities continue to the north but the range of the squirrel ends. M. Recht (pers. commun.) speculated that the Mojave Desert there may experience a rainfall pattern which is different from that to the immediate south as the rainshadow of the Sierra Nevada changes. Winter temperatures may become colder in the Olancha area. M. Recht (pers. commun.) also pointed out that the water table of the Owens Valley has been lowered over the past half-century by pumping for the city of Los Angeles, which may have affected the original range of the squirrel by changing the plant communities in subtle ways. Perhaps not coincidentally, the northern extent of the geographic range of the Joshua Tree along the base of the Sierra Nevada also is near Olancha.

In the northeastern part of its range, the squirrel may be limited by subtle or large changes in habitat due to rainfall and/or topographical barriers such as mountain ranges, major washes, dune systems, and dry lakes. On the eastern

edge of the range, in the vicinity of the Mojave River, there has been speculation that distribution of the Mohave Ground Squirrel may be limited by greater competitive abilities of the Round-tailed Ground Squirrel. There is little evidence for accepting this idea. As is discussed in the sections of this status review on Field Studies by the Department and on Life History-Taxonomy, the geographic ranges of the two species abut but do not overlap along a broad front of approximately 240 kilometers in length from Fort Irwin south to the Victorville area. There may be some interbreeding near Helendale, but it is likely that Helendale is one of only several isolated cases caused by the breakdown of ecological and behavioral barriers that normally would keep these species from interbreeding.

The question of competition between the two species was addressed by Hafner (1992)., who believed that it was unlikely that populations of both species would become established in the same locality and thus become competitive. He stated that two factors probably function together to limit the opportunities for populations of both species to co-occur. These factors are low vagility (the capacity or tendency to become widely dispersed) on the part of both species and the incorporation of rare migrants of one species into the gene pool of the other. Hafner's (1992) belief was that the zone of range abutment between the Mohave Ground Squirrel and the Round-tailed Ground Squirrel may simply represent a neutral (non-competitive) zone of secondary contact following a period of thousands of years in which two populations of a single species of desert ground squirrel were physically isolated and became differentiated from one another through adaptation to different habitats. When the isolating mechanism no longer existed, the now two separate species began to extend their separate distributions into suitable habitat elsewhere. Low vagility meant that geographic range extensions occurred at a rate of an average five meters per year (Hafner 1992). As the ranges began to grow closer, occasionally an individual of one species came into contact with a population of the other species and interbreeding occurred. However, the offspring of such a mating would remain in the population and mate there; eventually, the genetic contribution of the original lone individual from the other species would be absorbed and not reflected in physical appearance, behavior, or genetic component of the population.

"Appropriate habitat exists for each species far beyond their common distributional boundary. The preference for gravelly soils in *S. mohavensis* and for sandy soils in *S. tereticandus*...is apparent at sympatric sites [where both species are found] such as Coyote Dry Lake.... However, both soil types are found throughout the Mojave Desert. Similarly, there are no differences in potential natural vegetation..., temperature, or moisture gradients... that correspond even broadly with the [common] boundary. If this boundary represents some environmental limit for both species, the underlying basis is unknown" (Hafner 1992).

The isolating mechanism which separated the two populations of a single species of ground squirrel which differentiated into two species was believed by Hafner (1992) to be the Pleistocene-period network of lakes and rivers in the Mojave Desert area. This network is known to have continuously existed in the rainy period of 25,000 to 10,000 years ago. At the end of the rainy period, the lakes began to dry until complete desiccation occurred 6000 years ago. Hafner (1992) pointed out that the current zone of parapatry (the contiguous but not overlapping geographic ranges of the two species) is never beyond 9.6 miles (30 kilometers) from the old network of lakes and rivers. In

the 6000 years since the network completely dried, the ranges of the two species have gradually come together. Each species is moving into habitat suitable for itself but not the other. Some areas such as around Coyote Dry Lake seem to contain habitat for both squirrels. The Coyote Dry Lake area is not disturbed for agriculture, as is the Helendale site; Hafner (1992) stated that a detailed analysis of populations of both species in contact at an undisturbed site was necessary to better understand the genetic and ecological interactions of the two species.

The concept of a network of lakes and rivers as an isolating mechanism also may help explain the limitation of the Mohave Ground Squirrel's northern distribution at or near Olancha. The Pleistocene Lake Owens at its highest level may have precluded expansion of the squirrel to the north. As the lake level receded, the squirrel's low vagility may have meant that expansion of the range to the north has been very slow. To the east, in the vicinity of the present China Lake Naval Air Weapons Center and Panamint Valley, other large lakes existed at the north-northeastern edge of what is now the current range.

Hafner (1992) wrote that the inherently low vagility of both the Mohave Ground Squirrel and the Round-tailed Ground Squirrel "may result from limited annual aboveground activity. This activity is limited to only 3-4 months, as they estivate to escape both the heat of summer and harshness of winter from August to March.... During this brief period of activity, attention is focused on reproduction and fat storage prior to estivation, perhaps physiologically precluding long-range dispersal". In other words, the energy and reproductive needs of individuals of each species limit their activities to a local area, and even short-distance movements for purposes other than meeting these needs may not be made.

Grinnell and Dixon (1918), Wessman (1977), and other workers have noted that the Mohave Ground Squirrel is not continuously distributed within its range, even in apparently suitable habitat. Although Hafner (1992) did not address the topic of patchy distribution of the squirrel in the context of vagility, it appears this species' low vagility may help explain that distribution. If a population becomes extirpated (locally extinct) and the habitat remains suitable, then it may take many years for the species to reestablish itself in that area. D. F. Hafner has written to the Department (his letter is in Appendix E) that if "migration is indeed [as low as an average five meters per year, as he has proposed], then extirpation of a colony could require many years before recolonization, underscoring the spotty and uneven distribution of colonies within the available range."

The Department has considered the distribution of the Mohave Ground Squirrel to be as generally illustrated on the map in the 1980 biennial report on State-listed species (CDFG 1980). As discussed above in this section, that distribution included the western extent of the Antelope Valley, even though the native vegetation largely has been removed from the area, and included the Victorville-to-Lucerne Valley area, even though Wessmann (1977) found no Mohave Ground Squirrels in that area. The BLM also has accepted the 1980 depiction as representing the geographic range of the species. In participating in the preparation of the West Mojave Coordinated Management Plan (see the section of this status review under that title), the Department attempted in 1992 to compile all known records of occurrence of the Mohave Ground Squirrel. A new geographic range boundary was developed by drawing a

line around the known occurrences portrayed on a map and fitting the line topographically to include native vegetation-types used by the species in the region of known occurrences and to exclude mountain ranges on the periphery of the range. An area excluded from the revised geographic range (see Figure) was the portion of Antelope Valley west of Palmdale and Lancaster. This exclusion was due to the lack of known occurrences of the squirrel and to the fact that much native vegetation has been lost to agriculture and urban development. An area retained in the revised range was Victorville-to-Lucerne Valley, although there is uncertainty about the status of the species there. The revised geographic range was presented to the Department's Mohave Ground Squirrel Working Group in August 1992. The group recommended that the new boundary line be adopted as portraying the current knowledge of the distribution of the Mohave Ground Squirrel. The new boundary line drawn east of the towns of Rosamond and Mojave to reflect the lack of recent records around and west of those towns was not without controversy, because native vegetation still exists in those areas and thus still provides habitat for the Mohave Ground Squirrel.

In redrawing the geographic range to exclude the western portion of the Antelope Valley, the Department was aware that the lack of records of occurrence did not mean that areas still in native vegetation provide no habitat for the squirrel or that the western portion of the Antelope Valley never was within the range. Records of occurrence are useful in contributing to the knowledge of distribution only to the extent that they reflect where researchers have worked and reported their results. This situation probably is applicable to the Antelope Valley. Reports of the work of a number of biologists and trappers around Palmdale are available, but no workers have reported captures of the Mohave Ground Squirrel for the area west of Palmdale.

7500 mi.2

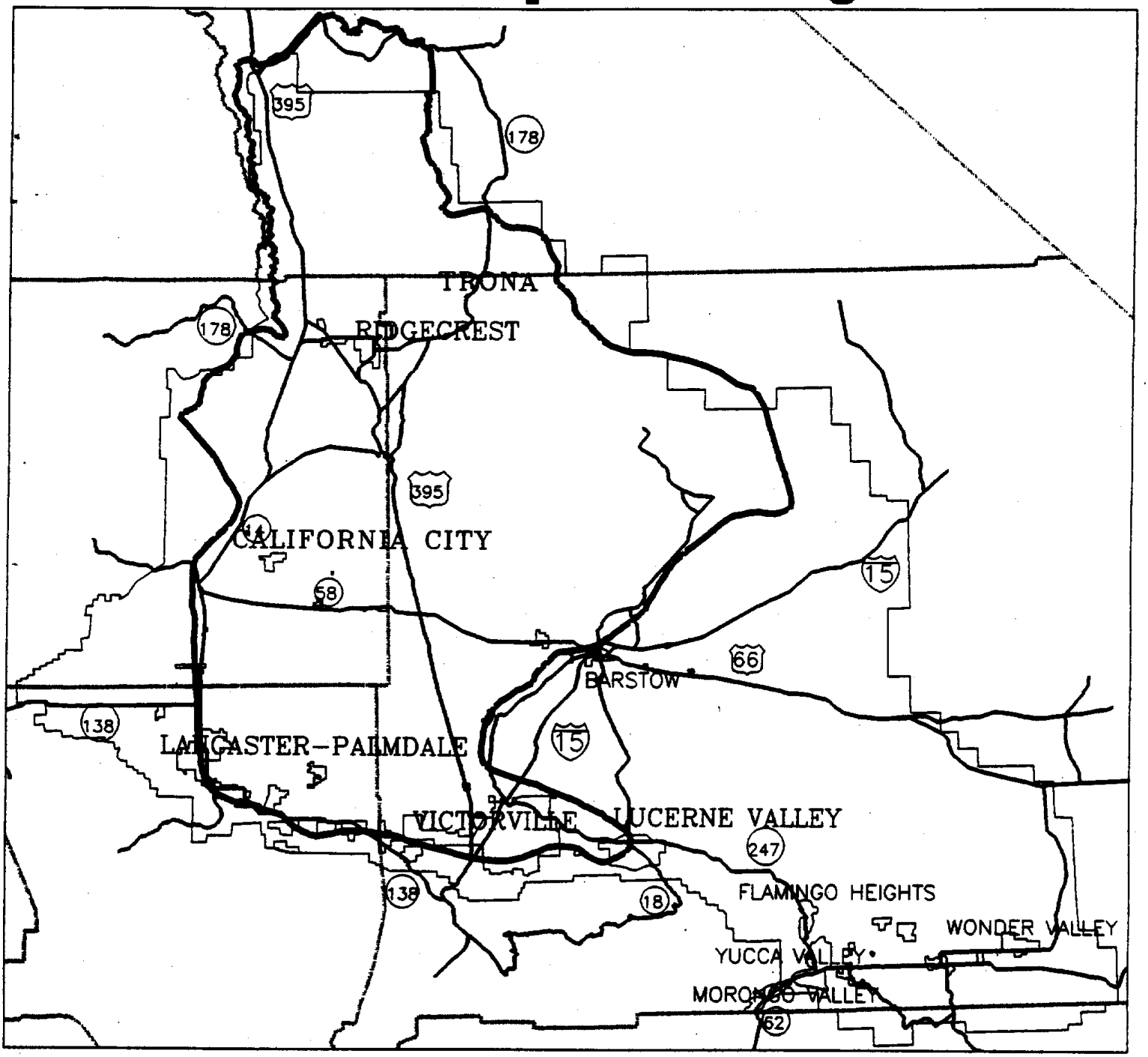
The area within the new boundary line was calculated by the BLM's geographic information system to contain approximately 4,863,000 acres. Of this total, approximately 1,800,000 acres (36%) are private land. An additional 1,692,000 acres (34%) are military lands. Almost all of the remainder is public land. The State of California, through the State Lands Commission, the Department, and other agencies, owns a relatively small portion (less than 2%). Of the public land, about 103,000 acres are in designated off-highway vehicle areas operated by the BLM.

It is important to note that not all of the 4,863,000 acres within the range contain habitat for the squirrel. Dry lake beds contain about 115,000 acres, agriculture occupies about 39,000 acres, urban areas cover approximately 165,000 acres, and rural development covers about 215,000 acres. Other surface disturbances such as off-highway vehicle areas and fallow fields cover an additional 209,000 acres. The acreage of paved and unpaved roads was not calculated due to the difficulty of measuring that linear surface area. As has been discussed in this subsection, it is known that the squirrel is not continuously distributed in habitat across its range. It is considered to have a patchy distribution.

The acreage figures for habitat loss discussed above do not by themselves portray the magnitude of the impact in the habitat of the Mohave Ground Squirrel. These direct losses of habitat have been cumulative in their effect on the status of the squirrel through combination with the effects of fragmentation and degradation which accompany the actual loss. These causes have been magnified by the effect of the drought in the Mojave Desert. The

March 1993

Mohave Ground Squirrel Range



1:1 500 000

- Mohave Ground Squirrel Range
- West Mojave Conservation Planning Region
- County Boundaries
- Major Roads

Source :

Bureau of Land Management

result is, or may soon be, the large-scale absence of the species from a significant portion of its range in the south, from the Antelope Valley east to Lucerne Valley. The lack of current trapping records and observations in this area is evidence of absence or very low population levels due to drought and loss and change in habitat, which may qualify the squirrel to be listed an Endangered species.

The recent period of growth of urban areas in the Mojave Desert has largely corresponded to a period of drought which probably has caused the extirpation (local extinction) of Mohave Ground Squirrels in sites throughout the range. As is discussed in the section on Cumulative Human Impacts Evaluation Format, the Department has suspected the accuracy of reports on trapping results which indicated that no squirrels were present and concluded that the trapped areas were not habitat for the species. This is because the squirrel appears to react to prolonged drought conditions (low rainfall and reduced plant growth) by failing to reproduce. The remaining animals in the local area eventually die and the Mohave Ground Squirrel is no longer found in the habitat. (See the discussion in the Threats section of this status review.) However, the habitat does remain, and it is the habitat for the squirrel existing within the boundary of the squirrel's range that must be protected. Squirrel populations will become established and then extirpated across the range due to natural causes as they undoubtedly have in the past, but the species as a whole will persist and perhaps increase in numbers if habitat is protected in sufficient pattern, quantity, and quality.

Abundance

Two terms commonly are used by biologists to describe the size of animal or plant populations. One is the qualitative term "abundance", which describes how common a species is throughout the geographic range. The Mohave Ground Squirrel is in low abundance throughout its range. Relative abundance denotes a comparison between the abundance of one species and that of another. The relative abundance of the Mohave Ground Squirrel in relation to the antelope squirrel is low. The other term is the quantitative "density", which is expressed as number of a species over a given area (usually acres, hectares, square kilometers, or square miles). Density can be an index of abundance. Relative density denotes a comparison of densities between populations of a species or between populations of two or more species. In addition to describing abundance and calculating density, an actual population estimate can be made for a local area, using actual counting of plants or capturing, marking, and recapturing of animals. A population estimate can be an index of abundance.

It is not practical to calculate the density or estimate the population of Mohave Ground Squirrels throughout its range at any point in time. A calculation or estimate would be based on a density or population derived from trapping results in one or more local areas and then extrapolated to the entire geographic range. Because the squirrel is patchily distributed and is affected at least locally by rainfall patterns, accurate extrapolation of local density and population figures to the entire range is not feasible.

Even if it were practical to estimate range-wide density of the squirrel, the resulting figure would not be meaningful in influencing conservation decisions for the species. The reason is that population numbers over time fluctuate widely in small mammals, probably including the Mohave Ground Squirrel, due to

environmental conditions. This natural cycling is to be expected, and therefore the number of Mohave Ground Squirrels existing at any one time is not indicative of the degree of endangerment of the species. The true indicators of the status of the species are the quantity, pattern of distribution, and quality of habitat.

The only existing population data for the Mohave Ground Squirrel have been reported by Recht (1977) for an area near Saddleback Butte in Los Angeles County (in the southern portion of the geographic range) and by Leitner and Leitner (1989, 1990) and Leitner *et al.* (1991) for an area in the Coso Known Geothermal Resource Area in Inyo County (in the northern part of the range). These workers found generally that the density of female squirrels in non-drought years averaged about one per six acres of habitat. Using the general rule of population biologists that an average 1000 breeding females are required for sustaining a population of a species in the long-term, the Department's working group for the squirrel calculated the minimum size of preserves which should be established to protect the squirrel. The calculation considered the fact that rodent populations can fluctuate by an order of magnitude (i.e., ten-fold) on either side of the mean. In other words, a Mohave Ground Squirrel population could fall as low as 100 breeding females in poor-reproduction years and still sustain itself, as long as the habitat existed in good-reproduction years to allow the population to expand to 10,000 breeding females. This latter number of females would require 60,000 acres of habitat at one female per six acres. (Evidently, home range size does not increase during poor years; there simply are fewer animals per acre - P. Leitner pers. commun.) Thus, the minimum preserve size should be 60,000 acres.

This calculation is being applied in the development of the West Mojave Coordinated Management Plan to the design of management zones. Theoretically, several zones of at least 60,000 acres each should be established throughout the geographic range of the Mohave Ground Squirrel. Each zone may need to be larger than 60,000 acres to ensure that at least that amount of suitable habitat is included; dry lake beds and extensive areas of rock outcrop within a habitat zone would not be suitable. Other factors such as the plant community-types present will influence the configuration and location of habitat zones.

Determination of relative densities of the Mohave Ground Squirrel is a useful tool in comparing the value to the species of several habitats. It is important to know which habitats are preferred by the squirrel, as shown by relative densities determined through live-trapping. (See recommendation for field studies in Recovery and Management Actions section of this status review.)

Various observations of abundance and estimates of local density have been made for the Mohave Ground Squirrel. Burt (1936) wrote that, in the spring before young were evident, the Mohave Ground Squirrel was "not at all numerous in the vicinity of Palmdale. I never saw more than 3 or 4 to the mile, and often none for 2 or 3 miles. I estimated roughly the number to comprise between 15 and 20 individuals per square mile, although I feel that this figure is rather high. They were distinctly less numerous than either [the California Ground Squirrel] or [the antelope squirrel], both of which were found in the same territory. As far as I could learn there had been no poisoning activities in this particular locality for some time. These

squirrels apparently do not live in close colonies, but are well scattered over the area where they occur. During the mating season two squirrels may be found close together, but I never saw more than this number within a radius of one-quarter mile."

Recht (1989) captured 19 Mohave Ground Squirrels and 846 antelope squirrels in 20,000 trap-days in 1988 and 1989. The abundance of antelope squirrels was dramatically higher than that of the Mohave Ground Squirrel. Zembal *et al* (1979) and Leitner (1980) also found that the Mohave Ground Squirrel was less abundant than the antelope squirrel in their studies. Aardahl and Roush (1985) concluded that mean relative densities of the Mohave Ground Squirrel and the antelope squirrel on their study sites were "similar", based on a key assumption that the two species were initially captured at equal rates. Numbers of initial captures were not provided by these authors, so an independent calculation of population size of either species cannot be made. However, the fact that many more Mohave Ground Squirrels were recaptured (captured more than once after being marked the first time) indicates that the antelope squirrel population actually was larger over the grouped study sites.

Leitner and Leitner (1989, 1990) and Leitner *et al*. (1991) found the antelope squirrel to be considerably more abundant than the Mohave Ground Squirrel on three of four study sites in 1988 and on all sites in 1989 and 1990, using the total number of individuals captured as the basis for this finding. The density of animals on each study site also was calculated. The density of resident Mohave Ground Squirrels and antelope squirrels, respectively in number per hectare in 1988 were as follows: 0.44 and 0.68 on site 1, 0.52 and 0.64 on site 2, 1.32 and 0.88 on site 3, and 0.36 and 0.60 on site 4 (Leitner and Leitner 1989). In 1989 the densities were as follows: 0.00 and 0.76 on site 1, 0.04 and 0.08 on site 2, 0.08 and 1.08 on site 3, and 0.00 and 0.80 on site 4 (Leitner and Leitner 1990). No animals of either species were captured on site 1 in 1990, but densities were calculated for the other sites as follows: 0.08 and 0.20 on site 2, 0.28 and 0.12 on site 3, and 0.12 and 0.16 on site 4 (Leitner *et al*. 1991).

Population estimates were made for the four study sites in 1988, using a method which assumed that a closed population (no gains or losses during the period of measurement) was being measured. The estimates for the actual numbers of Mohave Ground Squirrel and antelope squirrel were as follows: 20 and 38 on site 1, 19 and 29 on site 2, 47 and 46 on site 3, and 24 and 44 on site 4 (Leitner and Leitner 1989). Results were similar in 1989 using a method which allowed for the movement of animals. Too few Mohave Ground Squirrels were captured in 1989 to derive estimates (Leitner and Leitner 1990). In 1990 on site 3, estimates of the number of Mohave Ground Squirrels using three different methods were 19, 21, and 21, in the March-April period (Leitner *et al*. 1991).

ESSENTIAL HABITAT

Merriam (1889) was the first to provide a statement about the habitat of the Mohave Ground Squirrel. It was non-specific, as follows: "So far as is known [*Spermophilus mohavensis*] is confined to the arid desert in which the Mojave River sinks." Burt (1936) provided some details of the habitat, as follows: "In its more or less restricted range the Mohave ground squirrel usually is found in the lower desert, but penetrates the Joshua tree belt in certain places. Its preferred habitat in this part of the range seems to be where the

soil is sandy or of sand mixed with gravel, with a rather sparse growth of sage brush. Near the town of Palmdale, where these squirrels were seen, the general topography is fairly level, with a few ravines of just sufficient depth for drainage. The soil is of sand mixed with coarse gravel and is fairly easy to excavate. The area is covered with sage brush and other small bushes, but is fairly open. The small bushes are 20 or 30 feet apart and not more than 2 feet in height. I never saw the squirrels in the foothills."

Ingles (1965) described the habitat of the Mohave Ground Squirrel as "[s]andy desert floor in the Alkali Sink and Creosote Bush Scrub of the Lower Sonoran Life Zone in the Mojave Desert...." Life zones are an ecological concept developed by C. H. Merriam nearly a century ago (Ingles 1965). A life zone is an area characterized by distinct physical conditions, determined largely by temperatures, and populated by communities of certain kinds of plants and animals. The Lower Sonoran Life Zone occupies the lower altitudes in California, such as in the San Joaquin Valley, Mojave Desert, and Colorado Desert. The life-zone concept has been replaced in ecological thinking by the concept of plant communities as representative ecological types.

Alkali Sink is a plant community described by Munz and Keck (1959) as occurring on "[p]oorly drained alkaline flats and playas in floor of Great Central Valley and of arid regions east of the Sierra Nevada, and in such sinks as Panamint and Death valleys, mostly at less than 4000 feet elevation. Average rainfall 1.5 to 7 inches; frost-free days 200 to 335; highly variable seasonal and diurnal temperatures, mean summer maxima 106°-116°[F], mean winter minima 28°-37°F. Low scattered gray or fleshy halophytes [plants of salty or alkaline soils] where there is poor or no drainage, as about dry lakes; under this community are grouped several associations that are perhaps more distinct and cover larger areas in the deserts of Nevada and Utah."

Holland (1986) described several community-types which subdivide the Alkali Sink of Munz and Keck (1959). These types were Desert Saltbush Scrub, Desert Sink Scrub, and Desert Greasewood Scrub. The Desert Saltbush Scrub has been described as containing usually low, grayish, microphyllous [small leaves] shrubs, 0.3-1 m tall, with some succulent species. The total ground cover often is low, with much bare ground between the widely spaced shrubs. Stands typically are strongly dominated by a single *Atriplex* species. Desert Saltbush Scrub typically grows on fine textured, poorly drained soils with high alkalinity and/or salinity, usually surrounding playas on slightly higher ground; thus, this type is somewhat drier than the adjacent Desert Sink Scrub (Holland 1986). The community is widely scattered on margins of dry lake beds (Holland 1986).

The Desert Sink Scrub is similar to Desert Saltbush Scrub, but plants often are more widely spaced and most are succulent shrubs or herbs. This community grows on poorly drained soils with extremely high alkalinity and/or salt content, and often with a high water table and with salt crust at the surface. The community is found in moist valley bottoms and lake beds and nearby areas, usually below about 4000 feet (Holland 1986).

The Desert Greasewood Scrub also is similar to Desert Saltbush Scrub, but the plants are more widely scattered, most species are succulent, and the diversity of plant-species is lower. This community grows on heavy, fine-textured, poorly drained soils with a high osmotic potential and often with a high water table and a salty soil-surface crust. The community is found on

valley bottoms and dry lake beds, scattered widely through the Mojave Desert (Holland 1986).

The Saltbush Scrub of Vasek and Barbour (1988) is equivalent to the Alkali Sink of Munz and Keck (1959). "This vegetation usually occurs in basins and valleys throughout the Mojave Desert region but sometimes is found on slopes (e.g., west of Inyokern...).... Extensive stands of *Atriplex confertifolia* [Shadscale - a saltbush] occur with *A. polycarpa* [Allscale - a saltbush] and other species on the open rolling terrain south and west of Fremont Peak and toward Kramer Junction" (Vasek and Barbour 1988).

Creosote Bush Scrub is a plant community described by Munz and Keck (1959) as occurring on "[w]ell-drained soils of slopes, fans, and valleys, usually below 3500 feet, in deserts from southern end of Owens Valley to Mexico. Average rainfall mostly 2 to 8 inches, some as summer showers; frost-free days 180 to 345; highly variable seasonal and diurnal temperatures, mean summer maxima 100°-100°[F], means [sic] winter minima 30°-42°F. Shrubs 2 to 10 feet tall, widely spaced, largely dormant between rainy periods."

Holland (1986) described the Mojave Creosote Bush Scrub community as having "[s]hrubs, 0.5-3 m tall, widely spaced, usually with bare ground between. Growth occurs during spring (or rarely in summer or fall) if rainfall is sufficient. Growth is prevented by cold in winter and limited by drought at other seasons. Many species of ephemeral herbs may flower in late March and April if the winter rains are sufficient. Other, less numerous species of annuals appear following summer thundershowers. This is the basic creosote scrub of the Mojave Desert, dominated by *Larrea tridentata* and *Ambrosia dumosa*." This community typically grows on "[w]ell-drained secondary soils with very low available water holding capacity on slopes, fans, and valleys rather than upland sites with thin residual soils or sites with high soil salinity. Winter temperatures often below freezing. Intergrades at higher elevations with Shadscale Scrub...or Joshua Tree Woodland; at lower elevations or more osmotic sites with Desert Chenopod Scrub..." (Holland 1986). The Creosote Bush Scrub of Vasek and Barbour (1988) "occurs on well-drained sandy flats, bajadas, and upland slopes...."

Hoyt (1972) found that all Mohave Ground Squirrels which he captured "were located within or immediately adjacent to Creosote Scrub. With the exception of areas immediately associated with dry lake beds, this plant community is nearly ubiquitous in the Mohave Desert; but, it shows considerable variability in its composition and density. The localities where the Mohave ground squirrels were trapped represented the same range in composition and density of the Creosote Scrub Community as the Western Mohave Desert as a whole. It is not possible, therefore, to specify any distinctive habitat requirements other than the moderately variable Creosote Scrub." At one of his trapping sites (this one in San Bernardino County), Hoyt (1972) found that the plant community included Creosote Bush, Joshua Tree, *Atriplex canescens* (a saltbush), and *Hymenoclea salsola* (a shrub).

Wessman (1977) had three general study areas (all in San Bernardino County) in his live-trapping for the Mohave Ground Squirrel. One was an area from the Superior Valley to the Avawatz Mountains which had broad flat valleys above 3000 ft in elevation. "Valleys are dominated by diverse creosote and shadscale scrub communities. The dominant plant species are creosote (*Larrea tridentata*), burrobush (*Ambrosia dumosa*), shadscale (*Atriplex confertifolia*),

winterfat (*Eurotia lanata*), hop sage (*Grayia spinosa*), Nevada Mormon-tea (*Ephedra nevadensis*), and two perennial grasses, Indian rice grass (*Oryzopsis hymenoides*) and galleta grass (*Hilaria rigida*). Joshua tree (*Yucca brevifolia*) occurs in the Superior Valley region, but gradually disappears to the east in the Fort Irwin Military Reservation. A number of dry lakes occur here in the form of small playas, all of which have some aeolian sand deposits associated with them. Elsewhere, soils tend to be gravelly to rocky. Desert pavement is common in some areas, particularly near the Avawatz Mountains" (Wessman 1977). Mohave Ground Squirrels were found at 15 of 27 sites in this study area. Habitat types at these sites ranged from high-diversity Creosote Bush Scrub and Shadscale Scrub to low-elevation Creosote Bush on wind-blown sand and Creosote-Burrobush. Elevations ranged from 2030-3800 ft. Creosote Bush and Burrobush were the predominate plants at most sties.

The Shadscale Scrub community occurs in "heavy soil, often with underlying hardpan, of mesas and flats at 3000 to 6000 feet, about the Mojave Desert, Owens Valley, etc. Average rainfall 3 to 7 inches; growing season limited by water; frost-free days 150 to 250; temperatures similar to those in Joshua Tree Woodland. Plants largely 1 to 1.5 feet tall, shallow-rooted, and covering large monotonous areas between Creosote Bush Scrub and Joshua Tree Woodland" (Munz and Keck 1959).

The Shadscale Scrub of Holland (1986) has "[l]ow, intricately branched, often spiny shrubs, 0.3-0.6 m tall, usually well-spaced with bare ground between dominant *Atriplex confertifolia* and *Artemisia spinescens*. Growth, flowering, and dormancy sequence similar to Blackbush Scrub..., but usually a little earlier because of slightly higher temperatures and/or greater aridity" (Holland 1986). This community grows "[o]ften on poorly-drained flats with heavy, somewhat alkaline soil, adjacent to Desert Chenopod Scrub.... Also on well-drained slopes at higher elevations, intergrading at its upper limits with Blackbush Scrub..., Great Basin Sagebrush Scrub...or Joshua Tree Woodland.... May occur above Creosote Bush Scrub...on well-drained slopes or below it in poorly-drained basins with cold air accumulation" (Holland 1986). The Shadscale Scrub of Vasek and Barbour (1988) is "a community of low, more or less spinescent, microphyllous shrubs of uniform physiognomy [aspect and character of the community]...."

Another study area of Wessman (1977) was in the Mojave River Valley between Coyote Dry Lake in the north to Victorville in the south. "Between Coyote Dry Lake Valley and Helendale the [river] wash is wide and sandy, with dune[s] and blowsand common around the south end of Coyote Dry Lake, Barstow, and Lenwood. Vegetation in this area is mostly creosote, burrobush, and honey mesquite (*Prosopsis glandulosa*). Near Helendale, the character of the wash changes. Soils remain sandy and fine, but riparian vegetation in the form of cottonwood (*Populus fremontii*), willow (*Salix sp.*), arroweed (*Pluchia sericea*), and four-wing saltbush (*Atriplex canescens*) becomes the dominant feature, stabilizing the soils. Water flows in the river here part of the year. The riparian habitat is continuous between Helendale and Victorville. Agriculture dominates much of the Mojave River Valley. Alfalfa and wheatgrass fields are common at the south end of Coyote Dry Lake and between Barstow and Victorville. Barstow (pop. 18,000), is the main population center in the area, with resultant urban development. The small towns of Yermo, Lenwood, Helendale, Silver Lakes, and Oro Grande are stretched along the river at intervals of five to ten miles..." (Wessman 1977). Mohave Ground Squirrels were found at two of 12 sites. The habitat at one site was high diversity

Creosote Bush Scrub, and at the other site was Creosote-Burrobush. The elevation at both sites was 2500 ft. The sites were adjacent to alfalfa fields.

Wessman's (1977) third study area was in the Apple and Lucerne valleys. "This area includes lands between Victorville and Lucerne Dry Lake.... Large, flat valleys at elevations from 2,800 to 3,500 feet predominate, with rocky mountain ranges dividing the valleys. Soils in the valleys are gravelly. Aeolian sand deposits ring Lucerne Dry Lake and generally dominate Lucerne Valley, which forms the eastern boundary of the survey area. The desert side of the San Bernardino Mountains form[s] the steep southern boundary, while the Ord and Stoddard Mountains rise along the northern boundary.... The dominant plant species include Joshua tree, creosote, Mormon tea (*Ephedra sp.*), hop sage, Indian rice grass, galleta grass, and desert needle grass (*Stipa speciosa*). The cities of Victorville, Hesperia, Apple Valley, and Lucerne Valley are interspersed throughout the region; Victorville is the largest with a population of 15,000.... Many housing tracts are spread throughout the area, and some agriculture in the form of alfalfa fields is present, particularly around Lucerne Dry Lake and Hesperia" (Wessman 1977). Mohave Ground Squirrels were found at two of 12 sites. The habitat at one site was Creosote Bush-Burrobush with a few Joshua Trees. The other site was a high-diversity Creosote Bush community. Elevations were 2840 and 3180 ft., respectively. Soils at both sites were of a gravelly-sandy type.

Recht (1977) did not define the vegetation of his study near Lancaster as belonging to a specific community-type, but wrote that the "vegetation is composed of scattered creosote bushes (*Larrea divaricata* [= *L. tridentata*]) Joshua trees (*Yucca brevifolia*), and the annuals typical of the Mohave [sic] Desert." As has been shown in the section of this status review on food habits, foraging, and home range, Mohave Ground Squirrels on Recht's study area selected *Lycium* sp., *Coreopsis* sp., *Amsinckia* sp., and *Salsola* sp. Other plants present on the study area were *Ambrosia* sp. (ragweed, a perennial), *Atriplex* sp., *Eriogonum* sp. (wild buckwheat, a shrub), *Malacothrix* sp. (annual forb), and *Stephanomeria* sp. (annual or perennial forb). These species may be found in either the Creosote Bush Scrub or Joshua Tree Woodland of Munz and Keck (1959) or in the Mojave Creosote Bush Scrub or Joshua Tree Woodland of Holland (1986).

The Joshua Tree Woodland of Munz and Keck (1959) is a plant community occurring on "[w]ell-drained mesas and slopes 2500 to 4000 feet or higher, from southern Owens Valley to Little San Bernardino Mountains and southern Nevada and Utah. Average rainfall about 6 to 15 inches, with summer showers; growing season on the deserts limited by water rather than by temperature; frost-free days 200 to 250; mean summer maximum temperatures 95°-100°[F], mean winter minima 22°-32°F. Trees 10 to 30 feet high, scattered, with shrubs and herbs between."

The Joshua Tree Woodland of Holland (1986) is "[a]n open woodland with *Yucca brevifolia* usually as the only arborescent species (to 12 m high) and numerous shrub species between 1 and 4 m tall. Little or no herbaceous understory during most of the year. The dominant species display a diversity of life forms: sclerophyllous evergreen trees and shrubs (*Yucca* spp.), microphyllous evergreen shrubs (*Juniperus* spp.), semideciduous shrubs (*Eriogonum, Tetradymia*), semisucculents (*Lycium* spp.), and succulents (*Opuntia* sp.). The main growing season is spring, with most growth limited by cold in winter and

[d]rought in summer and fall. Many species of ephemeral herbs may germinate following sufficient late fall or winter rains and flower in mid-spring." This community typically grows "on sandy, loamy, or gravelly, well-drained gentle alluvial slopes. Transitional climatologically and biologically between low and high elevation desert regions. Intergrades at lower elevations with Mojave Creosote Bush Scrub...(poorer soil drainage, colder winters from cold air drainage). At higher elevations, intergrades with Mojavean Pinyon-Juniper Woodland...(cooler and moister, but better drained)" (Holland 1986).

The Joshua Tree Woodland of Vasek and Barbour (1988) "is a desert scrub vegetation consisting of a Joshua tree overstory (*Yucca brevifolia*) and an understory of various shrubs and perennial herbs. The Joshua tree is an extremely conspicuous plant and therefore lends a unique appearance to any vegetation in which it occurs. Limited to the Mojave Desert, it occurs at elevations ranging between the creosote bush scrub and piñon and juniper woodlands." Also, "[r]elative to other desert vegetation Joshua tree woodland occurs in the same elevational zones as blackbush scrub and shadscale scrub. But the Joshua tree woodland usually occurs on loose soils and gentle substrates.., whereas blackbush scrub and shadscale scrub are often found on heavy or rocky soils. Nevertheless, some of the same species occur in the three communities. Gradations occur toward creosote bush scrub at low elevations, where *Yucca brevifolia* may be in codominance with *Larrea tridentata* [Creosote Bush].

Zembal *et al.* (1979) conducted their studies in Creosote Bush Scrub and Shadscale Scrub in the Coso Hot Springs Area of Inyo County. They found Mohave Ground Squirrels in Saltbush Scrub, Creosote Bush Scrub, and Desert Shrub plant "formations." These authors considered "Saltbush Scrub" to be a plant association dominated by *Artemisia spinescens* (Bud Sagebrush), *Atriplex confertifolia*, and *Hymenoclea salsola* or by *Atriplex canesens* and *Hymenoclea salsola*. These species are characteristic of the Shadscale Scrub of Munz and Keck (1959) and of Vasek and Barbour (1988).

The "Desert Shrub" association of Zembal *et al.* (1979) was one in which co-dominants included *Haplopappus cooperi* (Cooper Goldenbush), *Hymenoclea salsola*, *Salazaria mexicana* (Bladder-sage), *Eriogonum fasciculatum polifolium* (California Buckwheat), *Grayia spinosa*, *Ephedra nevadensis* ("Nevada Joint Fir"), and *Lycium andersonii*. Some of these perennials are characteristic of Creosote Bush Scrub and of the Blackbush Scrub of Holland (1986). However, Henrickson (1980) named this association in the Coso area "Mixed Desert Scrub" and described it as "a broad mosaic of species that are more tolerant of low mean winter temperatures than is *Larrea*" and that occur at a higher elevation than Creosote Bush Scrub. Neither *Larrea* nor *Coleogyne ramosissima* (Blackbush) are present, so the association cannot be included as part of Creosote Bush Scrub or Blackbush Scrub communities, according to Henrickson (1980). Munz and Keck (1959) did not name this association. This may be the Mojave Mixed Woody Scrub described by Holland (1986) as a "complex scrub, open enough to be passable," usually characterized by Joshua Tree, California Buckwheat, and a bladderpod, which occurs on "[v]ery shallow, overly-drained, often rolliing to steep soils, usually derived from granitic parent materials. These sites have extremely low water holding capacity, mild alkalinity, and are not very saline." The community intergrades on deeper soils (with higher water holding capacity) or at cooler elevations with Blackbrush Scrub and various Great Basin Scrubs or pinyon woodlands and at warmer elevations with

Creosote Bush Scrub. The community typically occurs at elevations between 2000 and 5000 feet (Holland 1986). Vasek and Barbour (1988) also did not apply a name, but described it as a "vegetation of low dark shrubs [which] bear a physiognomical resemblance to the blackbush community and therefore is considered a phase of blackbush scrub, even though *Coleogyne* may be absent." Mohave Ground Squirrels were found "mostly in the low-lying flats and valleys, areas with a minimum degree of rockiness" in all of the three plant associations (Zembal *et al.* 1979). An "exception was an individual observed in a Joshua tree, located on a little flat that was isolated by steep relief on all sides...." As reported earlier in this status review, all Mohave Ground Squirrel burrows found by Zembal *et al.* were in "non-rocky situations." Perennial plant cover in habitats occupied by Mohave Ground Squirrels varied from 10 to 19%.

Leitner (1980) conducted live-trapping for Mohave Ground Squirrels at eight sites in Creosote Bush Scrub (3 sites), Saltbush Scrub (3 sites), and Joshua Tree Woodland (2 sites) at the Coso Geothermal Study Area in Inyo County. Squirrels were captured at all sites except one in Saltbush Scrub. Leitner (1980) did not see or capture any squirrels in steep or rocky habitats. He concluded that Mohave Ground Squirrels occurred in almost all habitats in the geothermal study area and preferred relatively level terrain.

Aardahl and Roush (1985) found Mohave Ground Squirrels in the following plant communities: Creosote Bush Scrub, Joshua Tree Woodland, Mohave Saltbush, and Creosote Bush Scrub - Mojave Saltbush. The "Mojave Saltbush" community-type was not defined by these authors. Predominate plants at four study sites in this type were *Atriplex* sp., with *Ambrosia dumosa* a prominent species at one site and *Acamptopappus sphaeocephalus* (Goldenhead, a shrub) prominent at another. "Mojave Saltbush" may be synonymous with, or a part of, the Shadscale Scrub community of Munz and Keck (1959). It also may be synonymous with the Shadscale Scrub community of Holland (1986).

Aardahl and Roush (1985) determined that desert pavement as a physical feature of habitat lessened the abundance of Mohave Ground Squirrels. These authors concluded that "availability of annual grasses and forbs is likely an important factor in reproduction and ultimately population stability in the Mohave and antelope squirrels." They reported that their lowest live-capturing rate for Mohave Ground Squirrels, in the four community-types in which they worked, was on two of four sites in Joshua Tree Woodland. They concluded that "[l]arge alluvial-filled valleys with deeper fine to medium textured soils, absence of rocks (desert pavement) and vegetation classified as Creosote Bush Scrub, Shadscale Scrub, and Alkali Sink appear to be the best habitat for both the antelope and Mohave ground squirrels. Within these areas, reproduction and survival rates are likely dependent on the availability of annual grasses and forbs. Rainfall naturally affects these food supplies, and can have a significant effect on year-to-year population levels" (Aardahl and Roush 1985).

Michael Brandman Associates, Inc. (MBA), a biological consulting firm in Santa Ana, CA, conducted a field study on the China Lake Naval Weapons Center in 1987 and prepared a management plan for the Mohave Ground Squirrel (MBA 1988). The plan defined probable habitat for the squirrel at China Lake as "sandy areas where appropriate vegetation exists on valley floors, alluvial plains, and bajadas that generally lack desert pavement" and possible habitat as "areas of generally sandy conditions that are somewhat rockier, steeper, or

both, as compared to the more favorable habitat" (MBA 1988). The plan concluded that the "majority of potential Mohave ground squirrel habitat on the NWC [Naval Weapons Center] is apparently located on alluvial fans adjacent to various mountains and hillocks protruding from the desert floor. These alluvial fans normally bear deep sandy soils that have various layers of clay in their lower horizons. Creosote bush scrub typifies the vegetation supported on these expansive alluvial fans" (MBA 1988).

The studies conducted from 1988 through 1991 at the Coso Known Geothermal Resource Area by Leitner and Leitner (1989, 1990, 1992) and Leitner *et al.* were on four sites. The Mohave Ground Squirrel has been captured at all sites. Site 1 ("Rose Valley") was at an elevation of about 3370 feet "and nearly level with a very gradual slope to the south and west. The soils present are in the Dunmovin series, deep, sandy alluvial soils of valley floors. The vegetation is Desert Saltbush Scrub, a low-growing, homogeneous mixture of two saltbush species, allscale (*Atriplex polycarpa*) and shadscale (*A. confertifolia*). The herbaceous layer was relatively sparse and of low diversity" (Leitner and Leitner 1989). Site 2 ("Coso Basin") was at an elevation of about 3600 feet. "The site slopes gently to the southwest toward Coso Wash. The western side of the study site is bordered by an active wash that carries runoff from the lava plateau to the northeast. The shrubby vegetation within the wash is quite diverse, owing to availability of groundwater at depth. Soils in the wash are very loose and sandy, and the herbaceous vegetation is sparse and uniform. The wash occupies about one-tenth of the study site along the western edge. The remainder of the study site is composed of Dunmovin-Lavic-Wasco variant soils, very deep, nearly level sandy and loamy soils which appeared to include a cemented hardpan at depth. The vegetation here is composed of Mohave Mixed Woody Scrub, a diverse mixture including goldenhead (*Acamptopappus sphaerocephalus*), Mormon-tea (*Ephedra nevadensis*), and shadscale, among other species" (Leitner and Leitner 1989).

Coso study site 3 ("Cactus Peak") was at an elevation of about 4800 feet. "It is contained within a large upland basin which slopes gradually to the east, eventually draining into Coso Basin. The soils are in the Maynard Lake series, cobbly, sandy and loamy soils formed over or in alluvium from rhyolotic tuff and volcanic ash deposits. The vegetation here consist of the bajada phase of Mohave Mixed Woody Scrub grading into Desert Saltbush Scrub in the lowest portions of the basin. Important shrub species here are spiny hopsage (*Grayia spinosa*), fourwing saltbush (*Atriplex canescens*) and shadscale with a scattering of Joshua trees (*Yucca brevifolia*)" (Leitner and Leitner 1989). Study site 4 ("Pumice Mine") was at an elevation of about 4900 feet, in a valley with a northwest-southeast orientation. As in site 3, "the soils are of the Maynard Lake series, with a slightly higher proportion formed over the parent material rather than in alluvium, resulting in somewhat shallower soils. The vegetation at Study Site 4 resembles that found at Study Site 3, but is richer in species composition and more strongly dominated by a single shrub species, spiny hopsage" (Leitner and Leitner 1989).
Wessman (1977) commented that the "Mohave ground squirrel exists in a wide variety of habitats, from creosote-burrobush and saltbush communities at low elevations to rich Joshua tree and monotypic blackbrush (*Coleogyne ramosissima*) habitats at elevations over 5,000 feet." This reference to the squirrel occurring in Blackbush communities is the only one known to the author of this status review. Holland (1986) described Blackbush Scrub as having "[l]ow, often intricately branched shrubs, 0.5-1 m tall, with crowns

usually not touching and with bare ground between plants. Most growth and flowering occurs in late spring. Dormant in winter (from cold) and probably in summer and fall (from drought)." This community typically grows on "dry, well-drained slopes and flats with shallow often calcareous soils of very low water holding capacity, often intergrading with Great Basin Sagebrush Scrub..., Joshua Tree Woodland..., or Pinyon-Juniper Woodlands..., but typically at somewhat lower elevations, warmer, and drier" (Holland 1986).

Munz and Keck (1959) included Blackbush communities as part of their Sagebrush Scrub community-type, which was described as occurring on "[d]eep pervious soil along the east base of the Sierra Nevada from Modoc County south to the San Bernardino Mountains, mostly at elevations of 4000 to 7500 feet; occasional in Siskiyou and San Diego counties. Average precipitation 8 to 15 inches mostly as winter snow; growing season 3.5 to 6 months, with 70 to 130 frost-free days; mean summer maximum temperatures 83°-95°, mean winter minima 8°-27°F. Low silvery-gray shrubs 2 to 7 feet tall, interspersed with greener plants." Vasek and Barbour (1988) commented that Blackbush scrub is "a vegetation of low dark shrubs" which lies above Creosote Bush Scrub in the western Mojave Desert. According to these authors, Blackbush Scrub may exist in combination with Joshua Tree Woodland and/or California Juniper woodland.

In summary of the discussion of the essential habitat of the Mohave Ground Squirrel, it has been demonstrated that the squirrel has been found to occur in all Mojave Desert scrub communities described by Munz and Keck (1959) and Vasek and Barbour (1988), and most of those described by Holland (1986). These include all of the broad community-types named by Munz and Keck (1959) as Alkali Sink, Creosote Bush Scrub, Shadscale Scrub, Joshua Tree Woodland, and Sagebrush Scrub. Vasek and Barbour (1988) also used most of these names for their broad community-types but substituted Saltbush Scrub for Alkali Sink. Vasek and Barbour (1988) also described Blackbush Scrub as a community separate from the Sagebrush Scrub of Munz and Keck (1959).

Holland (1986) subdivided several of the broad community-types described by Munz and Keck (1959) and Vasek and Barbour (1988) and named the Mojave Desert scrub communities as Desert Saltbush Scrub, Desert Sink Scrub, Desert Greasewood Scrub, Mojave Creosote Bush Scrub, Shadscale Scrub, Joshua Tree Woodland, Mohave Mixed Woody Scrub, and Blackbush Scrub. No occurrence of the Mohave Ground Squirrel has been reported specifically from Desert Sink Scrub or Desert Greasewood Scrub, but these community-types along with Desert Saltbush Scrub are specific divisions of the broader Alkali Sink of Munz and Keck (1959) and Salt-bush Scrub of Vasek and Barbour (1988). The squirrel has been reported to occur in those latter broad communities. Holland (1986) also described one other community of the Mojave Desert, the Mojave Wash Scrub, which is a "low, shrubby, open community with a scattered to locally dense overstory of microphyllous [small-leafed] trees." It occurs on "[s]andy bottoms of wide canyons, incised arroyos of upper bajadas, and sandy, braided, shallow washes of the lower bajadas, usually below about 5,000 feet" (Holland 1986). The Mohave Ground Squirrel has not been reported to occur specifically from this community, but this type is included without it being named in the Creosote Bush Scrub and higher broad communities of Munz and Keck (1959).

Based on the review of studies in which sites of observation or capture of the Mohave Ground Squirrel have been described, the Department's opinion is that the squirrel occurs in all broad plant-communities within its range. Also, there is reason to believe that the squirrel occurs in all of the specific plant-communities within its range.

LIFE HISTORY

Physical Appearance

The Mohave Ground Squirrel is a medium-sized ground squirrel of about nine inches in total length (Grinnell and Dixon 1918, Ingles 1965), which is about half the length of the more familiar and widespread California Ground Squirrel (*S. beecheyi*). The underparts of the Mohave Ground Squirrel are white, as is the undersurface of the tail. The upper parts of the pelage have been described as being a "uniform grizzled grayish-brown or drab-brown" (Merriam 1889), "pinkish gray" (Hall and Kelson 1959, Hall 1981), "cinnamon-gray" (Burt and Grossenheider 1976), and as "pinkish cinnamon without stripes or fleckings" with cheeks being "brownish" (Ingles 1965). M. Recht (pers. commun.) states that juveniles have cinnamon-colored pelage and molt to a gray pelage as they mature. He further comments that Mohave Ground Squirrel hairs are multi-banded at the tips, to help adjust energy uptake or loss via absorbance/albedo of the animal. The skin is darkly melanistic to assist in thermoregulation. The tail is relatively short at about 2.5 inches. The Mohave Ground Squirrel is relatively short-legged. Its eyes are fairly large and set high in the head.

Taxonomy

The Mohave Ground Squirrel is a member of the mammalian family Sciuridae, a large family of rodents which includes ground squirrels, marmots, chipmunks, and tree squirrels. The ground-squirrel group, to which the Mohave Ground Squirrel belongs, is comprised of sciurids which live in burrows which they dig themselves. There are seven species of the genus *Spermophilus* which have geographic ranges that include at least part of California (Ingles 1965, Hall 1981, Tomich 1982). The Mohave Ground Squirrel is the only one whose geographic range is entirely in California (i.e., it is endemic to California). Of the seven species, four are found in the Mojave Desert and three are in the western Mojave Desert. Only the California Ground Squirrel has a geographic range that truly overlaps the range of the Mohave Ground Squirrel; it is not a desert-dwelling species *per se*, being found around agricultural fields and other human-disturbed areas.

The Mohave Ground Squirrel is a distinct full species, with no subspecies. It was discovered by F. Stephens in early June 1886. It was first described by Merriam (1889), using a specimen of an adult male collected by F. Stephens on 29 June 1886. The type locality (site at which the first known specimen was collected by Stephens) is near Rabbit Springs, about 15 miles east of Hesperia (San Bernardino County) (Grinnell and Dixon 1918). The Mohave Ground Squirrel's closest relative, genetically speaking, is the Round-tailed Ground Squirrel (*S. tereticaudus*). The geographic ranges of these two species do not overlap, although the ranges are very close together on the eastern side of the Mohave Ground Squirrel's range; the two species are considered to be parapatric (the ranges are contiguous but not overlapping). Elliot (1904; not examined, but cited by Hafner and Yates 1983) believed that the two species intergraded in the vicinity of Daggett (San Bernardino County). "However, Grinnell and Dixon (1918) and Howell (1938) disagreed, stating that only *S. tereticaudus* occurred at Daggett, and that the two taxa were full biological species. In a survey of the distribution and habitat preference of *S. mohavensis*, Wessman (1977) identified several areas of contact between the two sibling species. He indicated that one of these, near Helendale [San

Bernardino County], along the Mojave River wash...might represent a zone of hybridization" (Hafner and Yates 1983).

Hafner and Yates (1982, 1983) investigated the systematic status of these two species through electrophoretic analysis using kidney and liver tissues and through karyotypic analysis using bone marrow tissue. Evidence of hybridization was found only at a single site near Helendale. The authors detected a high level of genetic similarity between the two species in their study and stated that "these taxa may be in the process of diverging and not reproductively isolated from one another" (Hafner and Yates 1983). Further, "ecological factors may serve as prereproductive isolating mechanisms in *S. mohavensis* and *S. tereticaudus*. Significantly, Helendale (the single hybrid site) is an extremely disturbed site, subject to extensive agricultural development and ecologically unlike the other study localities. The two specimens [of ground squirrels] from this site were collected immediately adjacent to fields of alfalfa and wheatgrass; despite extensive searching, we found no *Spermophilus* away from these fields. Due to artificially elevated food supply along agricultural fields in this area, ecological and ethological (premating) isolating factors may break down, allowing hybridization" (Hafner and Yates 1983). These authors concluded that, in light of the chromosomal and electrophoretic evidence and in lieu of more detailed examination of genetic interactions of the two species, retention of full species status for the Mohave Ground Squirrel was warranted.

Hafner (1992) reexamined the issue of hybridization in light of new findings about physical barriers which probably separated these two species for thousands of years until relatively recently. He made cranial and dentary measurements of adult specimens of both species from within 18.6 miles (30 kilometers) of the contact zone to determine whether patterns of cranial morphology would reflect positive contact between the species (evidence of hybridization or intergradation), negative contact (evidence of intense competition), or neutral contact (no evidence of either intergradation or competition). He concluded that "[m]orphological patterns within and between the two species are consistent with neutral secondary contact [re-contact after separation] with limited or insignificant competition or intergradation along the contact boundary" (Hafner 1992). Some of the examined specimens could not be assigned to either species because they possessed intermediate cranial characteristics, but Hafner (1992) stated that such specimens "may reflect similarity between the taxa [the two species] rather than hybridization." However, these specimens were from known or suspected sites of hybridization, suggesting that these individual squirrels did result from intergradation. Hafner (1992) believed that no large degree of intergradation was indicated from his interpretation of the morphological measurements.

Krzysik (1991) captured a ground squirrel on the National Training Center and Fort Irwin in 1989 which he described as a "hybrid" between the Mohave Ground Squirrel and the Round-tailed Ground Squirrel. No details were given by Krzysik (1991) about this animal. The site of capture was described as being "seriously impacted" by vehicles in military training exercises. No true Mohave Ground Squirrels were found at the site by Krzysik (1991). However, D. Clark (pers. commun.) reported the captures of three Mohave Ground Squirrels within several kilometers of this site. If the site is in an area of hybridization, the ecological damage in the vegetative communities may have resulted in both species being present and in premating behavior break-down.

Biology

General. Some descriptive statements generally may be made about ground squirrels of the genus *Spermophilus*, most of which apply to the Mohave Ground Squirrel. They are open-country animals, not found in areas of dense forest. They are diurnal animals (active in the day-time only). They have large internal cheek pouches in which to carry food. Some species become torpid when food is scarce. Most use body-stored fat for energy during the period of torpidity. This period is termed "estivation" if it occurs during the heat of summer and "hibernation" if it occurs during the extremes of winter. The terms often are used interchangeably to describe the torpid period of species such as the Mohave Ground Squirrel, which sleeps from mid-summer through the winter (Bartholomew and Hudson 1960). Ground squirrels may store food in their burrows, but there is no evidence that they use it until awakening from torpidity in the spring. (Nowak (1991) stated that some species living in the more southerly parts of their ranges "may be active nearly throughout the year, though they will remain in their burrows during inclement weather as green food disappears.") Some species store food in surface caches (Ingles 1965). "The diet [of ground squirrels] consists of seeds [Spermophilus means "seed-loving"], nuts, grains, roots, bulbs, mushrooms, green vegetation, insects and other small invertebrates, and occasionally small vertebrates and birds' eggs" (Nowak 1991).

Estivation. The Mohave Ground Squirrel spends about seven months of the year (Ingles 1965), often from August through February (Bartholomew and Hudson 1960, Tomich 1982), in its underground burrows in estivation. This behavior, presumably, is to avoid a period when food is scarce (Bartholomew and Hudson 1960, Ingles 1965). M. Recht (pers. commun.) states that entrance into estivation may begin from June to September; in a good food-year, adults may enter estivation in late June and juveniles go in late July. In a poorer year, adults may not go underground until mid-July, and juveniles may not go until mid- to late August. One juvenile was discovered above ground in mid-September. Adult squirrels are more likely than juveniles (i.e., young of the year) to enter estivation early, because adults must gain less weight from the beginning value at the start of the above-ground season in order to survive the long estivation underground, and they usually have better (more food-rich) home ranges (Recht 1977). Leitner and Leitner (1990) predicted that adult males are the first to enter dormancy, followed by adult females. Females are later probably because they do not begin to acquire fat reserves until lactation (milk production) has ceased and the young are weaned (Leitner and Leitner 1992).

Adults emerge from the previous year's estivation weighing 70-80 grams and will enter the next estivation weighing about 165-175 grams (Recht 1977). At three weeks of age, juveniles still weigh less than 60 grams (M. Recht pers. commun.). As the Mohave Ground Squirrel becomes torpid in estivation, "its temperature drops nearly to that of the environmental temperature, breathing is suspended for long periods, and the heartbeat is greatly reduced. Its stored fat is doubtless the major source of its energy" (Ingles 1965). It is not known whether the squirrel awakens during the estivation period to eat, but the species is known to take food into its burrow. Zembal *et al.* (1979) observed a squirrel feeding on fruits and seeds of a Joshua Tree (*Yucca brevifolia*) for four straight hours in July 1978 and making trips to a burrow at the base of the tree every 15 to 20 minutes. "The animal remained in the burrow for an average of four minutes each time. This animal's behavior and

similar displays by others suggested hoarding" (Zembal *et al.* 1979). However, only two Mohave Ground Squirrels "were observed at close enough range to discern the carrying of seeds into burrows" (Zembal and Gall 1980).

Leitner *et al.* (1991) found that, of six adult Mohave Ground Squirrels known to begin estivation in a 1990 study at the Coso Known Geothermal Area in Inyo County, all animals "entered estivation between mid-May and mid-July, with five initiating summer dormancy during the five-week period between May 16 and June 21. Three began estivation in the last two weeks of May, two during the third week of June, and the last during the first two weeks of July." These authors believed that adult squirrels at Coso "may regularly enter estivation as early as late May or June." Leitner *et al.* (1991) also inferred from their data on dates of first captures of Mohave Ground Squirrels in the early spring of 1990 that most squirrels had emerged from their torpid period in the last week of March and/or the first week of April.

Burrows. Burt (1936) found that the "burrows of these squirrels enter the ground at an angle of about 35 degrees. The dirt taken from the burrow apparently is scattered, for little or none is to be found at the entrance. A burrow system excavated one-half mile east of Palmdale had two openings. One of these was nearly round, but the other was slightly oval. They measured 2 inches in the smaller and two and one-half inches in the greater diameter. The openings were 54 inches apart and the simple tunnel was 12 inches below the surface at the deepest point. Above the tunnel was an enlarged chamber, but there was no nest material. It is possible that the burrow as yet was incomplete, as a female did some digging near the entrance while I watched her. On April 12, I followed a female squirrel from 9:00 A.M. to 3:30 P.M. I remained at a sufficient distance to avoid startling her and she went about her business in an apparently normal way. During the six and one-half hours that she was under observation she entered 4 different burrow systems, remaining but a few minutes in each. The last burrow entered (entirely on her own volition) had been partially plugged and it was necessary for her to remove some loose earth from the entrance. As she entered the burrow she kicked back loose earth with her hind feet and partially plugged the hole from within."

Hoyt (1972), upon releasing a Mohave Ground Squirrel after it was live-trapped in San Bernardino County, noted that the animal entered a burrow under a Creosote Bush (*Larrea tridentata*). In another trapping locality near Boron (San Bernardino County), Hoyt (1972) stated that burrows of the squirrel "appeared to be located at the bases of Creosote bushes."

Recht (1977) found that Mohave Ground Squirrels on his study area near Saddleback Butte (Los Angeles County) used three types of burrows, as follows: a home burrow, an estivation burrow, and an accessory burrow. The home burrow was the one in which a single squirrel spent the night. At entering the burrow for the last time each day, the squirrel pushed up a soil plug to close the opening. The plug was removed each morning. Home burrows usually were located on the edge of a home range. A change to a new home burrow usually occurred as a result of a shift in the home range. The estivation burrow was the one in which the squirrel spent approximately seven months underground. A squirrel might dig a new estivation burrow or enlarge an existing burrow. Estivation burrows seemingly were located in areas which have the latest succulent vegetation in a season. Recht (1977) speculated on the possible reasons for such a location. It is known that squirrels are drawn to, or

remain in, these relatively rich areas as vegetation elsewhere dries out. If they estivate in those areas, then in spring they would emerge in the (presumably) most vegetated part of the habitat. Also, males and females "would be near one another, probably facilitating mate selection." It is possible that the higher moisture content of the soil in areas which support late-season vegetation helps to stabilize soil temperature, due to the high specific heat of water. Squirrels estivating in burrows dug in more thermally-stable soil may use less energy in maintaining body temperatures. The accessory burrow may be an existing burrow or a freshly dug one. It may serve several functions, particularly in providing a refuge from predators or other Mohave Ground Squirrels and in thermoregulation. "The most frequent use of these burrows was for thermoregulation. The squirrels would use these burrows extensively [frequently, rather than continuously - M. Recht pers. commun.] at midday [in summer] to cool off.... The use of the burrows as heat sinks permitted activity to continue despite extremely high above-ground ambient temperatures" (Recht 1977).

Zembal *et al.* (1979) noted that "[a]ll of the burrows found to be utilized by Mojave [sic] ground squirrels were located in very nonrocky situations and at the bases of perennial plants." The only specific burrow mentioned by these authors was at the base of a Joshua Tree.

At their study area in Inyo County, Leitner *et al.* (1991) found the concept of a home burrow, to which a squirrel returned for the night, did not apply to most of their radio-collared animals. "Only one...used the same nocturnal burrow every night. All others used two or more different nocturnal burrows during the course of the study. "Nocturnal burrows were consistently located at the bases of large shrubs. Most were found under *Lycium* bushes, especially the very large *L. cooperi* with its spreading thorny branches that droop almost to ground level, presumably affording excellent protection from predators. Nocturnal burrows were also located under relatively dense shrubs of the somewhat smaller species *Grayia spinosa*" (Leitner *et al.* (1991). Of six radio-collared Mohave Ground Squirrels thought to have entered estivation in the 1990 study, in "almost every case, the estivation burrow was a new [newly dug?] one that had not been routinely utilized during the animal's active period" (Leitner *et al.* 1991).

Food habits, foraging, and home ranges. Burt (1936) observed that in "early spring" the food of the Mohave Ground Squirrel "is composed almost entirely of the tender green vegetation then just beginning growth." He described the foraging activity of a squirrel observed on 12 April 1936 in a patch of green alfilaria (= storksbill or filaree, *Erodium*) as follows: While feeding she would crawl along among the vegetation, bite off a green stem or leaf, hold it in her front feet, and eat it while sitting half erect. She would then crawl a bit further and repeat the process." Later "[f]ive or 6 times she was observed to climb into small bushes and to eat some of the green buds, but never did she ascend higher than a foot from the ground. During this time (two and one-half hours) she covered an area within a radius of about 25 yards...." (Burt 1936). Another squirrel observed on 29 March 1936 for 45 minutes confined its activities "to a small area not more than 10 yards in diameter." When this squirrel was captured, "her cheek pouches were filled with finely chewed green vegetation" (Burt 1936).

Hoyt (1972) set live-traps for Mohave Ground Squirrels adjacent to alfalfa fields near Palmdale. He noted "numerous" Mohave Ground Squirrels "running

back and forth between the alfalfa fields, and their burrows on the desert side of the dirt road" which bordered the fields. He believed that "the animals were closely associated with the alfalfa fields and probably were deriving their food from the fields, and not the desert" (Hoyt 1972). Wessman (1977) captured Mohave Ground Squirrels in Creosote Bush communities near alfalfa fields, but did not comment on any use of the fields by the squirrels. A rancher near Helendale told Wessman (1977) that "many small, white squirrels" were around his haystacks. Wessman speculated that these were Mohave Ground Squirrels, since Round-tailed Ground Squirrels were not found south of Helendale. However, there is no report of whether the squirrels were foraging on or living in the haystacks. M. Recht (pers. commun.) has questioned the identification of "small, white squirrels" as Mohave Ground Squirrels and has suggested that the squirrels around the haystacks were more likely antelope squirrels.

Recht (1977) found in his 1974 study of Mohave Ground Squirrel foraging near Saddleback Butte that four plants comprised the major food resources for the squirrel. These plants were *Lycium* sp. (box-thorn, a shrub), *Coreopsis* sp. (coreopsis or tickseed, an annual or perennial forb or sometimes a shrub), *Amsinckia* sp. (fiddleneck, an annual forb), and *Salsola* sp. (salsola, an annual or perennial forb). Salsola is the only non-native in this group. The use of these plants by Mohave Ground Squirrels was not simultaneous but separated in time over the foraging season (Recht 1977). Recht (1977) wrote that "[m]ost desert plants in this region do not survive the entire season, but rather only a portion of it. At any given time, from late winter through summer, the vegetation appears as a crop, varying from few to many species. The abundance of these species, their succulence, and their time of bloom can vary locally. From this variable resource, the squirrels select a given plant for extensive use." The species of plant selected by the squirrel at any one time generally had two properties which distinguished it from other available plants. These properties were having a higher water content and, except for *Lycium*, being more abundant (Recht 1977).

The water content of each species, at the time of its use by Mohave Ground Squirrels, was greater than the mean content of the other available species, with one exception. For about a week in July 1974, Creosote Bush had fruits with a water content within 4% of that of *Salsola* (Recht 1977). The plant of choice (*Lycium* excepted) "provided some 60 to 90 per cent of the total vegetation cover. *Lycium sp.* was only 10% of the vegetation; at this time in the season [that *Lycium* was being selected by Mohave Ground Squirrels] very tiny grasses comprised the bulk of the vegetation cover, but these were not observed to be eaten by the squirrels" (Recht 1977). As the water content of each species declined, Mohave Ground Squirrels switched to another species.

Recht (1977) concluded from the results of the 1974 study that, "[b]ecause high water content correlates with high plant density, *S. mohavensis* is able to select plants which provide adequate nutrition and maximum water uptake, and which require minimum energy expenditure in their acquisition. This is an optimal foraging pattern." Recht (1977) considered the Mohave Ground Squirrel to be neither a foraging generalist, which accepts a wide variety of food items, or a specialist, which accepts only a narrow range of items. Rather, he described the squirrel as a facultative specialist, which specializes for short periods of time, but changes from one food resource to another throughout the season. The squirrel "uses periodic comparison sampling at low utilization levels to recognize better forage" (Recht 1977).

Recht (1977) found that, despite using the same foraging patterns, adult Mohave Ground Squirrels gained weight at a faster rate than most juveniles. This is because adults usually had a greater share of the available food resources in better home ranges. These home ranges were smaller in area and had more abundant vegetation. "Under these conditions the adults enjoyed a reduced cost of nutrient acquisition. Their exploratory foraging and commuter (travel to established foraging sites) movements were reduced. A reduction in the absolute amount of these locomotor movements would reduce energy expenditures, reduce exposure to the thermal stress of the desert day, and enhance accumulation of energy surplus, i.e., fat" (Recht 1977). Aardahl and Roush (1985) also found that juvenile Mohave Ground Squirrels had larger home ranges than did adults. A home range is a geographic area in which a single Mohave Ground Squirrel forages but which the squirrel may not defend against other squirrels. Home ranges of different squirrels may overlap. Adest (1972), based on observations of Mohave Ground Squirrels in a laboratory, believed that this species exhibited "extreme intraspecific aggression" and suggested that it may be territorial (defending a geographic area) in natural conditions. He also offered the possibility that the species is "not territorial, but possess[es] an interpersonal distance, a small inviolable space surrounding an animal which releases fighting behavior if crossed by a member of the same species...."

Recht (1977) classified these smaller, richer home ranges as Class I. Subordinate animals occupied Class II home ranges, which were much larger in area and had much less abundant vegetation than Class I home ranges. Although Recht (1977) did not define just what is a subordinate animal, except to state that a squirrel found on a Class II home range was a subordinate, presumably most subordinates were juveniles. In his study area, Recht (1977) found that home ranges of juveniles were in a cluster around the central home ranges of adults. Adults occupied areas nearest to roads, which, due to soil compaction, acted as dams and trapped soil moisture. This resulted in more abundant and succulent vegetation. Juveniles were excluded from the better areas by adults, which used agonistic (combative) behavior toward the juveniles. As the season advanced and vegetation in the desert dried out, the vegetation along the roads was the only usable forage on the study area. Adult squirrels shifted their home ranges only slightly, but home ranges of juveniles began to collapse toward the road. Some juveniles invaded the home ranges of other juveniles. The greatest change in habitat use by juveniles came after adults entered estivation and the former adult home ranges were "released" for use by juveniles. "These new areas were rapidly exploited by the juveniles; within two days of vacancy the juveniles had taken possession" (Recht 1977).

Zembal and Gall (1980) observed 20 different Mohave Ground Squirrels harvesting seeds of Joshua Trees. The squirrels "engaged in this harvest for hours at a time. Individuals were observed high in the tops of Joshua trees almost continuously during daylight hours, from about 3 h[ours] after sunrise to 1 h[our] before sunset" (Zembal and Gall 1980). "Never was more than one *S. mohavensis* observed at a time in a single Joshua tree..." (Zembal and Gall 1980). These authors point out that, in their study at the Coso Hot Springs Area (Inyo County) in 1978, nearly half of the observed Mohave Ground Squirrels were far from the nearest Joshua Tree. These trees were scarce in the study area. "However, wherever seeds of the Joshua tree were available, they were heavily utilized [by Mohave Ground Squirrels] and appeared to be a preferred food. In one small area of approximately 0.39 km² (a belt just less

than 3.2 km by 122 m), 30 fruiting Joshua Trees were found; 16 *S. mohavensis*...were counted at fruit clusters there on 3 July 1978, between 1445 and 1550 [hours]. It appeared that Mohave ground squirrels were concentrated in this area because a highly prized food resource was also concentrated here" (Zembal and Gall 1980).

A determination of Mohave Ground Squirrel food habits at the Coso Known Geothermal Resource Area in May and June 1988 was made by Leitner and Leitner (1989). The diets of the squirrel and four other mammalian herbivores on four study sites were determined through microscopic examination of undigested food material in fecal samples. Samples were obtained for individual squirrels by collecting fecal pellets from the live-traps in which the squirrels were captured. At the Leitners' study site 1, forbs (non-woody plants other than grasses) comprised almost 83% of the Mohave Ground Squirrel diet. Percentage of diet is "the percent relative density of each food item averaged over the number of fecal samples for each study site. The average percent relative density of a food item approximates its dry weight in the diet..." (Leitner and Leitner 1989). At site 1, notable individual food items were locoweed (*Astragalus lentiginosus*, a perennial forb) - both leaves and fruits, White Mallow (*Eremalche exilis*, an annual forb) - both leaves and fruits, and various composite flowers and seeds. One fecal sample contained 62% mycorrhizal fungi.

At the Leitners' study site 2, forbs comprised 53% of Mohave Ground Squirrel diet. Notable individual items were the foliage of Arabian Schismus (*Schismus arabicus*) and Desert-marigold (*Baileya pleniradiata*) and the seeds of Desert Calico (*Langloisia matthewsii*). One fecal sample contained 45% Creosote Bush. Grasses averaged almost 25% relative density overall at Coso Basin.
At study site 3, forbs made up nearly one-half of the diet. "In contrast to the other three sites, seeds rather than leaves were the dominant component of the diet here, averaging almost 62% relative density. Seed of desert calico was the most important single item..." (Leitner and Leitner 1989).

At study site 4, forbs were the single most important food category. "Gilia (*Gilia* sp.) foliage averaged 30% relative density, the highest ranking for a single food item on any study site." Further, "[c]omposite flowers were the second most important food item, comprising almost 14% of relative density and making up the majority of one sample. Boxthorn seed and saltbush [*Atriplex* sp. - shrubs] leaves were also significant items in the diet here" (Leitner and Leitner 1989).

On all study sites, individual fecal samples for the Mohave Ground Squirrel tended to be dominated by a single item. This was the case for 35 of 47 samples. This suggests that individual Mohave Ground Squirrels frequently concentrate foraging on one or a few foods. However, Leitner and Leitner (1989) found that there was great variation among individual animals in the use of diet-dominant food items, even on a single study site. Thirteen different food items comprised 50% or more of relative density in individual samples, but only two (Desert Calico and composite flowers) had this distinction on more than one study site. Overall, forbs were the most important, "providing significant amounts of foliage to the diet, as well as some seed. Grasses and shrubs made much smaller contributions. Arthropods (chiefly grasshoppers, ants, and beetles) were a small but consistent component of the diet, averaging 5-8% of relative density across the four study sites. They were present in 45% of all samples, the highest frequency

of any food item" (Leitner and Leitner 1989). Although fruiting Joshua Trees were present in abundance on study sites 3 and 4, that species was not an important food source for the Mohave Ground Squirrel.

Although the sample size for adult squirrels was small and no firm conclusions about any differences in diet between adults and juveniles could be reached, "there is a suggestion that adults consume a greater proportion of forb leaf material and juveniles [consume] more seed" (Leitner and Leitner 1989).

In 1988 at their study area, Leitner and Leitner (1989) found that the "pattern of home range distribution was quite similar for resident MGS [Mohave Ground Squirrel] on study sites 1, 2, and 4.... There was little overlap of home ranges of individuals living in close proximity. Only about 42-57 percent of available habitat within the study sites was occupied by home ranges of resident animals. In [s]tudy site 3, however, there was substantial overlap of home ranges, and more than 90 percent of the study site was occupied by resident animals." Mean home range size for all study sites was 0.71 hectares.

Based on their 1988 work, Leitner and Leitner (1989) concluded that "[f]ood habits results and vegetation sampling indicated that MGS populations are found in a range of environments, and that MGS utilize available resources flexibly, foraging both on common and uncommon plant materials. The MGS show a fair degree of specificity in their food preferences, but there is much variation in food habits results between sites and between individuals at a single site."

In 1989 the Leitners collected additional food habits information for the Mohave Ground Squirrel at the Coso Known Geothermal Area (Leitner and Leitner 1990). No Mohave Ground Squirrels were captured at site 1 in 1989, so food-habits data were available only for sites 2, 3, and 4. Trapping at site 3 was done specifically in March and April to obtain fresh fecal samples in the early part of the active period for the squirrel. The results from site 3 showed a change in food selection over the active period. In late March the diet was over 95% *Grayia spinosa* (Hopsage, a shrub) leaves. In April the diet was 68% forbs with *Monardella exilis* (Mohave Pennyroyal) and the closely related *Gilia* sp. and/or *Linanthus aureus* (Golden Gilia) each contributing about 30% of relative density. In June *Lycium* sp. seed was nearly 74% of the diet. The Hopsage may have represented the most widely available and palatable food item in early spring before major growth of the annual forbs. By April the forbs were widely available, and by June they were largely dry. In June the *Lycium* had a high output of seed.

On study site 2 in May and June 1989, Mohave Ground Squirrels ate over 90% *Lycium* seed, with some *Eurotia lanata* (Winterfat, a shrub) and grasses but no forbs at all. That diet reflected the nearly complete lack of forbs on site 2. On site 4 in May and June, forbs were more abundant and diverse than on site 2, and Mohave Ground Squirrel diet was 56% Desert Calico seed and 32% leaves and seed of *Bromus* sp. (grasses).

In comparison with 1988, the 1989 overall diet of the Mohave Ground Squirrel in the Coso study sites was less diverse, reflecting a paucity of available food items. In both years, a single item tended to comprise the majority of a single fecal sample. In 1988 and at site 3 in April 1989, several different food items were available to squirrels. However, the May and June 1989

samples indicated that there was only one item sufficiently palatable and abundant to comprise the majority of the diet. No juvenile squirrels were captured in 1989; thus, no fecal samples were available and no comparison can be made between adult and juvenile diets. For 1989, home range sizes for the few Mohave Ground Squirrels captured were described as "quite small" (Leitner and Leitner 1990).

In comparing the 1988 and 1989 results, Leitner and Leitner (1990 wrote that in "1988, we had the highest number of resident MGS at Study Site 3, the site having the highest annual standing crop. The low precipitation and standing crop in 1989 coincided with a complete cessation of reproduction in the MGS population. Food habits results showed that MGS consumed a high proportion of green forage, mostly from herbs. If there is a direct link between low annual plant production and the lack of reproduction in MGS, it might be possible to estimate the threshold standing crop of annual herbs required for MGS to successfully produce young. Since all mean between- and under-shrub standing crop values in 1989 were below 0.84 g per square foot (equal to about 80 lbs per acre), this may indicate that the minimum standing crop required for MGS reproduction is above this level."

In the third year of study at Coso, Leitner *et al.* (1991) collected Mohave Ground Squirrel fecal samples on sites 2-4 in March and April 1990 and in a single late May-early June period. As in 1989, no Mohave Ground Squirrels were captured at site 1. Sample sizes were small at each site. At site 2, two species of shrub leaf were predominant (*Eurotia lanata* at 54% of relative density and *Grayia spinosa* at 37%) in March and April. At sites 3 and 4, shrub leaves also dominated the diet in March and April. Site 3 diets showed 51% *Grayia* and 35% *Atriplex*, and site 4 showed almost 82% *Grayia* and 10% other shrub-leaves. By May/June 1990, diets indicated some use of forbs. At site 2 leaves of the forbs *Gilia* and *Linanthus* comprised 41% of the diet. The shrubs *Larrea tridentata* and *Ephedra nevadensis* made up 41% and 15%, respectively. The samples from site 3 averaged 51% *Gilia/Linanthus* leaves, 29% *Grayia* and *Atriplex* leaves, and 19% pollen. Site 4 had 52% *Grayia* leaves and 45% *Atriplex* leaves. The 1990 results indicated that shrubs were more important in the Mohave Ground Squirrel diet than had been the case in 1988 or 1989.

In 1990 the mean home range size of 12 radio-collared Mohave Ground Squirrels was 1.92 hectares, using the minimum-convex-polygon method of calculation. There was little overlap of home ranges, and "even the small areas of overlap shown [by this method] were usually not occupied simultaneously by two animals" (Leitner *et al.* 1991). Home range estimation using the results of live-trapping was a mean 0.43 hectares.

From radio-telemetry results in 1990, Leitner *et al.* (1991) learned that the "nocturnal burrow was sometimes far from the area in which an animal would regularly spend the day feeding and nesting." One squirrel traveled about 400 meters between its nocturnal burrow and the area in which it was usually found during the day. This area had a relatively dense stand of Joshua Trees, and the squirrel may have traveled this relatively long way to feed on Joshua Tree fruits. Two other squirrels regularly moved 200-250 meters from their nocturnal burrows to daily feeding areas. Another animal moved as much as 250 meters from its nocturnal burrow.

Leitner *et al.* (1991) did not find that the Mohave Ground Squirrel switched food preferences in broad patterns during the above-ground period as had Recht

(1977). Local populations of squirrels did not specialize on single food items in sequence and in concert, but had "a diversity of preferences among individual animals in a population when a variety of food items was available" (Leitner *et al* 1991).

The fourth consecutive year of study at Coso was 1991, and dietary information for Mohave Ground Squirrels was derived from analysis of fecal samples as in previous years (Leitner and Leitner 1992). Samples were obtained in a single period of late May/early June at sites 2 and 3. No Mohave Ground Squirrels were captured at sites 1 and 4, and sample sizes at 2 and 3 were very small. "The two most important food items were arthropod parts and *Opuntia* (beavertail and/or cholla cactus) seed, which together made up 70-85 percent of the relative density of each sample. The arthropod parts were mainly larvae of the order Lepidoptera, or caterpillars. The large proportion of caterpillars in the MGS diet was consistent with the availability of this high-protein food source. We observed exceptional numbers of caterpillars, representing several species, on all of the study sites during the trapping period. Checkerspot butterfly and sphinx moth larvae were especially numerous" (Leitner and Leitner 1992). Although forb leaves and seeds were abundant by May 1991, Mohave Ground Squirrels selected caterpillars and cactus seeds, both uncommon in the squirrels diet in previous years. Leitner and Leitner (1992) concluded that this selection of food items by the squirrel "underscores [its] flexibility in exploiting available high-quality food resources, even though these resources may change from one year to the next." The "*Opuntia* seeds and caterpillars may have been the highest nutritional-value food available and therefore were selected in preference to the forb material."

Leitner *et al*. (1991) commented on the significance of Joshua Tree seeds in the food habits of the Mohave Ground Squirrel. Their data "provided little evidence that these seeds are a consistent or substantial part of the MGS diet. There may be several possible explanations. Yucca [brevifolia] has one of the largest seeds found on our study sites. The size of the seed or thickness of the seed coat may make it possible or necessary for MGS to open the seed and eat the endosperm while discarding the seed coat, the portion which is identifiable in microhistological analysis. Another possibility is that MGS may store the seeds and consume them at a season for which we have no food habits data" (Leitner *et al*. 1991).

In summary, studies of the food habits of the Mohave Ground Squirrel have shown that the species may follow a pattern of specializing on single food items or a pattern of individual preferences. Abundance and water content of food items appear to be important factors in selection. Chosen foods are leaves of forbs, shrubs, and grasses; fruits and flowers of forbs; seeds of forbs, grasses, shrubs, and Joshua Trees; fungi; and arthropods.

Reproduction. Little is known about reproduction (processes or behavior) of the Mohave Ground Squirrel. Burt (1936) noted that a "female taken March 29, 1931, contained 6 embryos measuring from 31 to 36 mm. in length. Another female, taken April 12, was suckling young. Her uterus showed that she had but recently given birth to young ones." Recht (pers. commun.) has described his observation on the reproductive behavior of the squirrel, based on a small sample size. He found that males typically emerged from estivation in February up to two weeks before females. Some males each established a defended territory against other males. Three to four females individually

entered a male's territory and occupied burrows close to the burrow of the male. The male and one female entered his burrow, in which they remained for up to half a day. Presumably, copulation occurred therein. After they emerged from the burrow, the female remained another day or so in the male's territory and then left to establish a home range. Other females repeated the sequence of individually entering the male's burrow and spending a short period of time with him before departing. After a gestation period of 29-30 days, the young were born in the female's burrow. The young animals appeared above ground at the age of 10 days to two weeks. There appeared to be no agonistic (combative) behavior between males and females during the short time that they were together; after this period each female had established her own home range and all animals were solitary.

Leitner *et al.* (1991), citing unpublished information from M. Recht, stated that Mohave Ground Squirrels "mate soon after emergence from hibernation and that litters of 4-6 young are born after a gestation period of 28-30 days. The juveniles are active above ground and can be captured in live traps by early May. In late May and June 1988, we [Leitner *et al.* 1991] captured large numbers of juvenile MGS on all four study sites [in the Coso Known Geothermal Area] and noted that adult females showed evidence of recent lactation. In the two following years, we captured no pregnant or lactating MGS females in March and April and found no juvenile MGS present in late May and June. It seems likely that the low levels of fall and winter precipitation and the resulting poor production of annual plants led to reproductive failure in the MGS populations of the Coso region during 1989 and 1990. While reproduction of AGS occurred in 1989, the more severe conditions of 1990 were accompanied by lack of reproduction in this species as well."

Citing reproductive data for ground squirrels (genus *Spermophilus*) generally, Nowak (1991) stated that "females are monestrous [having one period of receptivity to males each year] and normally bear only one litter per year; mating takes place shortly after emergence [from hibernation/estivation]...; the gestation period is 23-31 days; litter size is 2-15...; the young are weaned at about 4-6 weeks and emerge from the burrow shortly hereafter; and full size and sexual maturity are attained at about 11 months." "Reynolds and Turkowski (1972) [not examined] found litter size in *S. tereticaudus* to average 9.0 following a relatively heavy winter rainfall but only 3.3 after a dry winter." Nowak (1991) also wrote that "Dunford (1977) [not examined] reported *S. tereticaudus* to be sociable and nonterritorial from January to March but to become unsociable and territorial during the breeding season. Females tended to dominate males subsequent to mating. Young males dispersed from their mother's territory, but young females maintained a close relationship with the mother and eventually took over part of her territory."

Interactions with antelope squirrels. The geographic range of the Mohave Ground Squirrel also is occupied by another ground squirrel of the genus *Ammospermophilus*, the White-tailed Antelope Squirrel (*A. leucurus*). The two species have similar habitat requirements and food habits. Zembal *et al.* (1979) believed that Mohave Ground Squirrels and antelope squirrels in their study area near Coso Hot Springs both demonstrated "a high preference for seeds of the Joshua Tree." These authors described interaction between the species as follows: "Antelope ground squirrels were...highly active in the harvesting of Joshua tree seeds but subordinate in this pursuit to the Mojave [sic] ground squirrel in each of the 27 antagonistic encounters witnessed. As many as seven antelope ground squirrels were observed in a single tree at the

same time. Both species of ground squirrels were frequently observed in a single tree but without aggression only when they were in large trees with several widely separated fruit clusters available. Antelope ground squirrels seldom closely approached a Mojave [sic] ground squirrel. In one small tree (approximately 8 feet tall) with a single trunk and one cluster of fruits, an antelope ground squirrel managed to feed only while the Mojave [sic] ground squirrel actively utilizing the tree was in its burrow. The sight of the Mojave [sic] ground squirrel coming upon the tree elicited a hasty retreat out of the tree by the antelope ground squirrel. This same antelope ground squirrel attempted many times to enter the tree, appearing unaware that the Mojave [sic] ground squirrel was perched at the fruit cluster. In the span of 1 hour and 42 minutes, the antelope ground squirrel retreated upon sighting the Mojave [sic] ground squirrel nine different times, four of these after a foot or two ascent into the tree, then was chased clear to the ground after climbing unaware within a foot of the Mojave [sic] ground squirrel five different times; it was displaced with only a slight move by the Mojave [sic] ground squirrel at close quarters in the tree four different [times]" (Zembal *et al.* 1979).

Adest (1972) described the interspecific behavior of the Mohave Ground Squirrel and antelope squirrel, as recorded in a laboratory-setting. Interaction between two awake animals of both species almost always consisted of a charge by the Mohave Ground Squirrel and a retreat by the antelope squirrel. On other occasions the Mohave Ground Squirrel assumed a threatening posture without charging.

Leitner and Leitner (1989) found in 1988 at their study area in the Coso Known Geothermal Area that antelope squirrels preferred forbs on study sites 1, 2, and 3. As was shown earlier in this status review, Mohave Ground Squirrels preferred forbs on the four study sites in 1988. The mean home range size of the antelope squirrel over all four study sites in 1988 was 1.43 hectares, twice that of the Mohave Ground Squirrel (Leitner and Leitner 1989). These authors concluded that the "diets of the two ground squirrel species were broadly similar, with forbs providing the majority of their food. Shrubs and grasses made much smaller contributions, while arthropods were a minor but consistent component. [The diets] differed in the relative proportions of foliage and seeds taken, however. The MGS consumed a high percent of forb foliage, with seeds of forbs and shrubs the next most important food category. Seeds, primarily from forbs and shrubs, were the dominant component of the AGS [antelope ground squirrel] diet, followed by forb foliage" (Leitner and Leitner 1989).

In March 1989 Leitner and Leitner (1990) found on site 3 that antelope squirrels took 45% *Grayia* leaves, 25% arthropod parts, and 19% forbs, while Mohave Ground Squirrels took 90% *Grayia* leaves. In April 1989 on site 3, antelope squirrels took 56% forb foliage and seeds, 17% arthropod parts, 13% roots, and 10% shrub leaves and seeds. In the same period Mohave Ground Squirrels took 68% forbs, 16% shrub leaves and seeds, and nearly 10% roots. In June 1989, the diet of the antelope squirrel on site 3 shifted again, largely to shrub seeds. *Lycium* seeds (35%), *Opuntia* stems (27.5%), *Opuntia* seeds (17%) and arthropod parts (9.5%) were the predominate items. In the same period on site 3, Mohave Ground Squirrels used nearly 74% *Lycium* seeds. Leitner and Leitner (1990) believed that the patterns of antelope squirrel food-selection in 1989 showed "some similarities to the patterns found for MGS during the same period: shrub leaf was the most important early spring

forage, followed by forbs in the mid-spring and seeds in the early summer. The predominant food item, *Grayia* leaf, was the same for both species in March, *Monardella* and *Gilia/Linanthus* leaf were important to both in April, and *Lycium* fruits were important in June. This suggests more forage overlap than was found in 1988; again, the extremely limited variety of forbs and seeds may force more dietary overlap between AGS and MGS during poor forage years." Mean home range size for antelope squirrels at Coso in 1989 was 1.74 ha. "So few data on home range size were available for MGS in 1989 that interspecific comparisons cannot be made" (Leitner and Leitner 1990).

In their 1990 study, Leitner *et al.* (1991) found that antelope squirrels at site 3 in March and April took nearly 75% shrub leaves, nearly 14% arthropod parts, and over 10% forb seeds and leaves. Mohave Ground Squirrels took over 92% shrub leaves in March and nearly 89% shrub leaves in April at site 3. In 1990 Leitner *et al.* (1991) found for their study sites at Coso that mean home-range size for antelope squirrels was 1.52 ha. This is consistent with the findings for 1988 and 1989, and is almost four times the mean home-range size for Mohave Ground Squirrels in 1990. The data for both species were based on captures using live-traps, as were data for 1988 and 1989. The 1990 number of 0.43 ha for the Mohave Ground Squirrel is less than 25% of the mean size calculated for the same year using the minimum-convex-polygon method (1.92 hectares). Leitner *et al.* did not speculate as to which method of estimation might reflect the more accurate home range size, but noted that "given the small number of locations available from trapping data, this method [of estimating a home range by drawing an ellipse around all trap stations at which an animal was captured] was expected to produce significantly smaller estimates of home range than those derived from the radio-tracking technique" (the polygon method).

The studies at Coso over several years indicate that the Mohave Ground Squirrel and the antelope squirrel have similar food habits, although the Mohave Ground Squirrel tends to specialize over a season's time while the antelope squirrel is more general in food selection. This dependence on similar food resources is evident only in the spring and early summer, because the Mohave Ground Squirrel enters estivation as vegetation dries out and food becomes scarce (Ingles 1965). The antelope squirrel evidently does not enter torpidity; it can be active above ground all year (Bartholomew and Hudson 1960). During the time of year when both species are active, the smaller antelope squirrel seemingly is dominated in local foraging situations by the Mohave Ground Squirrel. While the Mohave Ground Squirrel is a solitary animal (Bartholomew and Hudson 1960), the antelope squirrel is colonial. The antelope squirrel's daily activity in maintaining social bonds within the colony and in foraging as a generalist requires a higher food-energy intake than the Mohave Ground Squirrel (M. Recht pers. commun.). The higher energy requirement probably accounts for the larger home range in which to find food. In the 1989 study at Coso, Leitner and Leitner (1990) noted that, while the Mohave Ground Squirrel completely ceased reproduction, the antelope squirrel showed a decrease in the number of juveniles from 1988 only at one site. The paucity of annual herbs "appeared to affect overall AGS populations surprisingly little. Data from the food habits study suggest that AGS largely depend on seeds as a food resource", which "carries over from year to year and can be harvested long after it is produced...." The Mohave Ground Squirrel, "on the other hand, depend[s] primarily on the current year's growth of green foliage and fruits from both herbs and shrubs. In the Mohave Desert, this food supply is quite erratic because of great year-to-year variation in

precipitation. The species shows adaptation to a highly variable food supply by estivation and hibernation during those periods of the year when green forage is less available, and by cessation of reproduction during extremely unfavorable years."

Thermoregulation. Recht (1977) found that Mohave Ground Squirrels were active throughout the day in the heat of summer. However, a sharp decrease of activity in direct sunlight was noted in the morning when soil and air temperatures receiving direct sunlight reached 46.5°C and 35.5°C, respectively. "In the morning the transition from activities in the sun to those in the shade involves the use of the behavior termed 'cooling-in-shade'. Initially the squirrels use this behavior only occasionally, running quickly back into the sun to continue their previous activity. As the morning progresses and ambient temperatures increase, these trips into the sun decrease and eventually the transition of their activities from sun to shade is complete" (Recht 1977). The "cooling-in-shade" behavior results after a squirrel had been active in direct sunlight. Recht (1977) stated that a squirrel typically ran into the shade of a shrub and initially lay prone with the forelimbs extended forward. The animal then dug briefly, creating a small depression into which it pushed its lower jaw. The neck was pushed through the depression and the chest came to rest in it. The forelimbs were extended forward, the head rested on the ground in between the forelegs, and the hindlegs were either extended rearward or flexed under the animal.

By mid-day the availability of shade was almost non-existent due to the sun's position overhead, and the temperature "in the little shade that exists is at or just beyond the upper limit of [the Mohave Ground Squirrel's] thermal neutral zone. To avoid being heat[-]stressed by the sun[,] the animals must continue their activities inside bushes or in their burrows" (Recht 1977). The shrubs (= bushes) provided protection from direct sunlight, and the air temperature within them was up to 2°C cooler than in the air of open shade. Burrows were even cooler. In the afternoon the morning's behavior of the squirrels was reversed; squirrels increased the amount of time spent in open shade and then in direct sunlight. Recht (1977) commented that casual observation of Mohave Ground squirrels during a summer day might lead an observer to conclude that this species had morning and afternoon periods of activity, with no activity in midday. However, the squirrels were active in midday, but not in the open. They are cryptically colored [camouflaged by having a fur color very similar to the background color of the desert surface] and easily obscured by vegetation; burrow entrances were beneath shrubs, so squirrels could pass from burrow to shrub without being seen.

Mohave Ground Squirrels also used a specific behavior to warm their bodies during the cooler parts of its above-ground period. Recht (1977) called the behavior "basking" and described it. The squirrel either sat just outside the burrow entrance on its rump with the head held horizontally or (later) lay flat with forelimbs extended forward and the head horizontally between the forelimbs. During basking, the squirrel changed its orientation to the sun to fully expose one side, the back, or the other side. When a squirrel emerged from a burrow to begin basking, the fur on the sides, back, and rump was fully piloerected (the hairs were standing straight out from the body), exposing the darkly melanistic skin. As the squirrel warmed by sequentially presenting its sides and back toward the sun, the degree of piloerection decreased. When an animal presented one side of its body toward the sun, it was that side which had piloerected fur. The non-exposed side was not erected. In spring when

the sun was lower in the sky, the length of time spent in basking was greater. Hoyt (1972) observed a Mohave Ground Squirrel in June 1972 "sitting upright and motionless with its back to the sun for 45 minutes one morning. The air was cool, the sun quite warm, and a slight breeze was blowing. The back of the animal appeared darker than normal, and the animal may have been 'basking'."

Predators. Natural predators of the Mohave Ground Squirrel are not well documented, but most likely include the common diurnal avian and mammalian predators of the Mojave Desert. These are the Golden Eagle, Prairie Falcon, Red-tailed Hawk, American Badger, Bobcat, and Coyote. Leitner *et al.* (1991) found circumstantial evidence that six of 12 radio-collared Mohave Ground Squirrels were taken by predators. The collars of three squirrels "were found on the ground with evidence of predation in the form of blood or tooth marks. Signals from the radiocollars of two other [squirrels] were located about 3 [kilometers] north of the study area near a prairie falcon eyrie. In addition, the radiocollar of [a sixth squirrel] was found on the ground with coyote tracks in the vicinity" (Leitner *et al.* 1991). M. Recht (pers. commun.) believes that rattlesnakes also are predators of Mohave Ground Squirrels. He found a dead squirrel with puncture wounds lying adjacent to a snake's track that he states were consistent with the track of a Mojave Rattlesnake.

ALTERNATIVES TO THE PETITIONED ACTION

The Department's review of the status of the Mohave Ground Squirrel indicates that the continued existence of the species is likely to become endangered at least in major portions of its geographic range in the foreseeable future in the absence of special protection and management efforts required by CESA and that continued listing as a Threatened species is appropriate.

If the Commission should choose to delist the Mohave Ground Squirrel as a Threatened species, this mammal would be deprived of the protections provided by CESA, especially the provisions for consultations between the Department and State lead-agencies on State projects and the provision prohibiting taking in private projects without a management permit from the Department. (See the discussion of CESA in the section of this status review entitled California Endangered Species Act.) If the squirrel is delisted, the Department would place it on the list of birds and mammals of special concern. That list has no legal standing but demonstrates the Department's concern about the status of those species in California. For some animals on the list, there is enough information to support the Department's opinion that these species should be listed as Threatened or Endangered species. The Mohave Ground Squirrel would fit into that category. As an endangered or rare species by definition (CEQA, Guidelines, Section 15380), the squirrel would continue to have the consideration of CEQA in the project-review process. However, species that are not State-listed do not have the recognition and stature of those which are formally listed, and that lesser status may mean that the squirrel would receive less consideration by CEQA lead agencies. In any case, it is apparent that project-planning under CEQA within the geographic range and habitat of the squirrel has given little consideration to the cumulative effects on the species of development over the years since enactment of CEQA in 1973. (See discussion of CEQA in the section entitled California Environmental Quality Act.)

The Department is concerned that if the Mohave Ground Squirrel is delisted, it would no longer be a target-species for special consideration under the West Mojave Coordinated Management Plan. The squirrel was included along with the Desert Tortoise as one of the two target-species in that multi-agency planning process because the squirrel is State-listed as Threatened. (See the discussion of this planning process under Management Activities in this status review.) In the event that the squirrel is retained as an equal target-species in the plan after delisting, the absence of a State listing could result in the increased opposition of advocacy groups to land-use restrictions in management areas designated for the squirrel. If the squirrel remains as a target-species in the plan and land-use restrictions in management areas are maintained as proposed in the plan, a period of evaluation of some years after implementation of the plan has begun will be necessary in order to determine whether the provisions of the plan actually are succeeding to protect habitat of the squirrel.

The results of biological monitoring programs established throughout the range of the squirrel as part of the plan's implementation must be known before a conclusion can be reached about the plan's effectiveness. In addition, the ability of the land-management and regulatory agencies to enforce the plan's prescribed restricted land-uses must be known. The record of participating cities and counties in achieving consistent conformity with the plan must be known.

If the Commission retains the listing of the Mohave Ground Squirrel, the Department will assess the status of the species and report to the Commission annually. In addition, the Department will prepare another status-report on the species no later than 1998, which is consistent with the requirement of Section 2077 of the Code that the status of a Threatened species or Endangered species be reviewed every five years. At that time, if the West Mojave plan has been completed, accepted by the Department and the U.S. Fish and Wildlife Service, and implementation has begun, information on the effectiveness of the plan in protecting habitat of the squirrel will be known and will be reported to the Commission.

The Department intends to obtain funding for a study to determine whether and in which locations the Mohave Ground Squirrel still exists in the southern portion of its range from Antelope Valley east to Lucerne Valley. Depending on the availability of funds, this study will be done even if the listing of the squirrel is not retained.

In the event that the West Mojave plan is not completed or fully implemented, or that the Department does not accept the plan as providing for the long-term protection of the Mohave Ground Squirrel and its habitat, the Department believes the species will continue to decline. If the plan is accepted and implementation begins, it will be some years before interested parties can reach a conclusion about whether habitat loss, fragmentation, and degradation have been arrested. In the meantime, it is important that the Mohave Ground Squirrel continue to receive the protection of CESA.

If the Commission retains the listing of the Mohave Ground Squirrel but the West Mojave plan is not completed, accepted, or implemented by all participating agencies, the Department will establish a recovery team and prepare a recovery/management plan for the squirrel. Such a team and plan will not be necessary if the listing is retained and the West Mojave plan is accepted by the Department and implemented by all participating agencies, because management actions required by the Department in the West Mojave plan would be sufficient to protect the species after full implementation. Thus, a separate recovery plan would duplicate the West Mohave plan.

Without the enforcement of the take provisions of CESA, without the cooperation of local, State, and federal agencies in implementing conservation actions, and in the absence of a federal listing for the squirrel which provides the protection of the federal Endangered Species Act, the habitat of the Mohave Ground Squirrel is certain to continue to be incrementally destroyed, fragmented, and degraded. (See discussion of these factors in the section on Threats.) The Department must assume that all private land within the range of the squirrel, about 36% of the total, will be developed. The species will decline further until populations are no longer capable of sustaining themselves. Eventually, range-wide extinction will occur.

An argument advanced by those in favor of delisting the squirrel is that the species surely will benefit wherever the Desert Tortoise is protected by federal actions on a project-by-project basis or in an implemented West Mojave plan. Because the squirrel and the tortoise share some of the same habitat in the geographic range of the squirrel, it is conceivable that some squirrel populations would benefit if tortoise habitat is protected in local areas. However, the tortoise is patchy (not continuous) in distribution within its range as is the squirrel; the probability that a local protected area for the

tortoise on a project site would also overlap a population of squirrels may be small. Protection of tortoise habitat on a large scale, as in the West Mojave plan, provides a much better chance that significant habitat of the squirrel also would be protected. However, this is true only in the central portion of the squirrel's range. The northern portion of the range does not overlap with the geographic range of the tortoise. In the West Mohave plan, management areas with restricted land uses being designed for the squirrel and the tortoise do not always overlap. These areas, called A-zones, are being designed separately for each species, using specific criteria on occurrence and quality and quantity of habitat. Thus, A-zones established specifically for the tortoise will not provide the pattern, number, and quality of preserves (management areas) necessary to protect the Mohave Ground Squirrel in the long-term.

In summary, the only alternative at present to the petitioned action which would provide protections equivalent to those of CESA is the continued listing of the Mohave Ground Squirrel. Eventually the West Mojave Coordinated Management Plan may provide these protections, but success of the plan will be measured by biological monitoring programs over time and by the degree of cooperation demonstrated by participating agencies over time. In the period before a conclusion can be reached about success of the plan's management prescriptions for the species, the Mohave Ground Squirrel must continue to receive the protection of CESA through its legal standing as a State-listed species.

ECONOMIC CONSIDERATIONS

Maintaining the Mohave Ground Squirrel as a State-listed species would continue the protection of CESA and CEQA. If the squirrel is delisted as a Threatened species, then the protections of CESA would no longer apply. However, CEQA would continue to apply because the status of the species would fit the CEQA definitions of a rare or endangered species. The Department also would place the Mohave Ground Squirrel on its list of birds and mammals of special concern (a working list without legal standing) and recommend that local and state agencies, in their capacity as lead agencies under CEQA, consider the conservation needs of the squirrel.

Required mitigation as a result of lead agency actions under CEQA, whether or not the Mohave Ground Squirrel is delisted by the Commission, would continue to add to the cost of a project. Such costs may include, but are not limited to, preparation of an economic impact report, development of a management plan, purchasing or restoring additional habitat, and long-term monitoring of mitigation sites. Project modification to avoid impacts may be a less costly alternative than implementing other required mitigation. Avoidance of impacts is the Department's preferred recommendation in project review whenever possible. The total expenses incurred in hiring consultants, preparing management plans, purchasing or restoring habitat, and long-term monitoring may be more costly than setting aside Mojave Desert habitat for the squirrel. Lead agencies may also require additional measures to be employed should the project mitigation fail, resulting in additional expenditures of funds by the project proponent.

Whether or not the listing of the Mohave Ground Squirrel as a Threatened species is maintained, there may be additional expenditures of funds for purchase of privately owned habitat by the Department and other agencies. The acquisition of such habitat is considered a necessary recovery action for this species.

The petition to delist the Mohave Ground Squirrel stated that the listing of the species "is having a significant impact on the economic growth of eastern Kern County," in regard to the development of private lands inhabited by the animal. The petition claimed, without documentation, that "[e]fforts by private property owners to subdivide properties into residential homesites is being inhibited by DFG mitigation requirements that are inconsistent, unclear, cost prohibitive, and lack a clear scientific basis. Other forms of development activity which are important to the economic prosperity of eastern Kern County have also been delayed or stopped as a result of the State listing and resultant mitigation requirements." The petition also mentioned that, during the proceedings in 1971 in which the Commission considered classifying the Mohave Ground Squirrel as Rare, there had been expressed concern about the squirrel being involved in crop depredation.

As is discussed in the Petition History section of the Introduction in this status review, only scientific information as specified by Section 2072.3 of the Code must be considered in any recommendation by the Department, or any decision by the Commission, to list or delist a species. Economic factors are not a consideration under CESA. However, it is the Department's policy in the preparation of a status review to include a section on economic considerations. Thus, the Department requested in an October 13, 1992 letter to Ted James that the County of Kern provide "specific information about which

projects have been [affected] by the listing of MGS, the amount of acreage involved, the location of these projects, and the time scale in which these projects would be completed were MGS not a factor" (Woodward 1992). The Department's letter also asked for "specific information and data about crop losses in Kern County due to MGS and any efforts for controlling such losses" (Woodward 1992).

In response to the Department's request for information on economic impacts and crop depredation, we received the following statements in a letter from the County of Kern (James 1992): "We will not be able to easily answer your inquiry on which projects have been affected by the MGS. Detailed data had been researched for the original submittal of the delisting petition, and considerable time, effort, and expense would have to be expended to duplicate our original inventory. We will continue to look into your request for this material.

"Data regarding crop losses in Kern County due to MGS are not available through our local Agriculture Department. The statement appearing in the delisting petition was not referring strictly to Kern County but to other jurisdictions as well as the statement came from the California Department of Agriculture at the May 2, 1971, Fish and Game Commission hearing in Sacramento for the original listing of the MGS. The minutes of this meeting indicated that the Agriculture Department submitted correspondence requesting omittance [sic] of the MGS (et al.) from the listing process as 'they [MGS et al.] are allegedly involved in crop depredation in some areas.'"

It is interesting to note the County of Kern's statement that detailed information of financial impacts on projects by the Mohave Ground Squirrel had been gathered in the preparation of the petition. The information was not submitted with the petition in November 1991, although the petition claims "a significant impact on the economic growth of eastern Kern County," nor, apparently, can it be easily gathered now (see next paragraph). The Department believes that the County's claim of significant impacts is exaggerated. We acknowledge that some property owners have been required to mitigate for destroying Mohave Ground Squirrel habitat in the course of project development. The mitigation agreements have been prepared as part of CEQA review and the Section 2081 permit-process. Section 2080 of the Fish and Game Code prohibits the take of the Mohave Ground Squirrel and other State-listed species. It is the responsibility of the private party doing the taking to provide for compensation for the loss of a State-listed animal or plant through implementing the provisions of a management agreement with the Department.

As this status review was being completed in late March 1993, the Department did receive from the County of Kern a letter (James 1993) accompanied by a list of projects in which, according to the letter, property owners had to incur costs or were subject to costs related to the Mohave Ground Squirrel. The costs were for biota reports (reports on biological resources occurring on a project site, which are required by the local lead agency) or for compliance with required mitigation. The letter stated that "226 land development projects totaling over 11,000 acres have been affected by mitigation requirements" (James 1993). Neither the letter nor the attached list indicated which of these projects had actually incurred the proposed costs or what the dollar amounts of any costs were. There was no indication that any incurred costs have amounted to a "significant impact" as stated in the

petition. The County of Kern requires biota reports from property owners in the desert for sensitive-species issues other than for the Mohave Ground Squirrel. Also, affected property owners must comply with mitigation requirements for the Desert Tortoise. Thus, the Department has no information on what costs actually have been incurred specifically because of the squirrel and no information on whether these costs have had a "significant impact."

If taken as fact, the County's claim that many property owners are proposing to develop their properties is evidence of the threat in the squirrel's habitat and underscores the need for continued legal protection of the species. Also, property owners are being required to mitigate for destruction of habitat of the Desert Tortoise, a State- and federally listed species; the mitigation has an economic impact separate from that for the Mohave Ground Squirrel but it may be confusing the issue as to which mitigation really is having a major economic impact.

The petition stated that CEQA is an existing program that "can adequately manage species habitat until such time that scientific studies actually merit the species listing." This overstates the limitations of CEQA, which primarily requires that impacts to an endangered species be identified and avoided if possible. There is no management function in CEQA given to the Department. Enforcement of the provisions of CEQA is left to the lead agency, which in the case of most development in the range of the Mohave Ground Squirrel is the county or city government. As the petition further stated, the Department "reviews and comments on local agency CEQA documents. This program provides an opportunity for the DFG to review project-specific effects on wildlife such as the MGS." These are true statements, but the Department has no authority under CEQA to require that the local lead agency fully consider alternatives to a proposed project, choose the best alternative for wildlife, deny the project, or implement specific mitigation recommendations. In fact, the local lead agency has the authority under CEQA to make findings of "overriding considerations" (CEQA Guidelines Section 15093).

The Department began applying the Section-2081-permit provisions of CESA to habitat of the Mohave Ground Squirrel in 1987. (See discussion under Section 2081 Permits in this status review.) Property owners and developers had not been required by local lead agencies to seriously consider the conservation of the squirrel in eastern Kern County up to that time, despite the fact that CEQA had been in effect since 1973.

CONCLUSIONS

Based on this status review of available scientific information and the written comments received in response to the Department's public notice, the Department concludes that the Mohave Ground Squirrel is likely to become endangered in the foreseeable future in the absence of special protection and management efforts provided by CESA, due to habitat loss, habitat fragmentation, and habitat degradation. A species existing under such conditions is a Threatened species, according to CESA (Section 2067, Fish and Game Code). The squirrel is adapted to the desert scrub habitat of virtually all plant community types in the western Mojave Desert. The quality and quantity of habitat have declined despite the squirrel's being listed as a Threatened (Rare before 1985) species since 1971. However, certain current management practices such as the Coso Mitigation Program and the issuing of Section 2081 management permits by the Department (see the discussions of these programs in the Management Activities section of this status review) indicate that it may be possible to forestall much further decline if these and similar activities are applied successfully across the geographic range of the squirrel.

The multi-agency West Mojave Coordinated Management Plan may provide protection of habitat throughout much of the range of the squirrel, but some years will pass after adoption of the plan, acceptance by the Department and the U.S. Fish and Wildlife Service, and implementation begins before conclusive evidence that the plan is successful can be obtained. The plan is in the conceptual stage; a draft soon will be reviewed by the participating agencies. The military bases and the County of Los Angeles have not yet committed to formally participate in the planning effort. Without the participation of all agencies which have jurisdiction for permitting land-uses, the plan cannot be fully implemented. This is because the Department and the BLM have no authority to regulate uses on private land. The participation of local agencies is necessary to implement the plan on private land. The participation of the military bases is especially critical, because much unfragmented habitat of the Mohave Ground Squirrel exists on military lands as well as on public lands administered by the BLM; yet, no military or other federal agency is legally obligated to protect any of that habitat for the squirrel. Participating in the plan and signing a Memorandum of Understanding which defines the responsibilities of participating agencies will establish a legal obligation for each signatory agency.

The geographic range boundary for the Mohave Ground Squirrel recently has been redrawn to reflect the situation that the species seems no longer to exist in the western part of the Antelope Valley in Los Angeles County. (See discussions in the sections on Threats and Distribution and Abundance.) The species also may no longer be found in substantial portions of the Victorville area. Between these two areas in Los Angeles and San Bernardino counties, the pattern of urban and rural development gives great cause for concern about the continued existence of the squirrel in a broad band across the southern portion of is range. Continued destruction, fragmentation, and degradation of habitat may cause the extirpation (local extinction) of the Mohave Ground Squirrel in that region. The definition in CESA (Section 2062 of the Code) of an Endangered species is one which is "in serious danger of becoming extinct throughout all, or a significant portion, of its range". The Department does not have sufficient information at this time to form a judgment about the ultimate effect of habitat loss, fragmentation, and degradation on the

continued existence of the squirrel in the southern portion of its range. Therefore, we are unable to conclude at this time that the species deserves Endangered status. However, in the Department's professional judgment, the Mohave Ground Squirrel's situation clearly fits the definition of a State Threatened species.

RECOMMENDATIONS

PETITIONED ACTION

The Department recommends that the Commission should find that the petitioned action to delist the Mohave Ground Squirrel as a Threatened species is not warranted at this time.

RECOVERY AND MANAGEMENT ACTIONS

The Department's objective in conservation of the Mohave Ground Squirrel is the complete protection of habitat sufficient in size, pattern of distribution, and quality to enable the Mohave Ground Squirrel to survive in the long-term. In order to achieve this objective, habitat must be protected throughout the geographic range of the species in a pattern that allows gene flow (the transmission of inheritable characteristics) from population to population, and that allows populations to be self-sustaining. Protected habitat must be free of incompatible land uses and human practices on a large scale. Achievement would be measured by a program which monitors the biological status of the squirrel and of its habitat, and which tracks the success of restricting incompatible land-uses. When the Department finds that significant progress toward recovery of the squirrel has been achieved through habitat protection, a recommendation to the Commission in a status report regarding reclassifying or delisting the species will be made.

In order to achieve the recovery objective (that of protecting habitat in which the Mohave Ground Squirrel can live in self-sustaining populations over the long-term), the following actions (not in priority) must be taken:

1. Continued participation by the Department in the multi-agency West Mojave Coordinated Management Planning process to aid in the design of management areas or zones for the squirrel and to develop a list of compatible land uses for these areas.

2. Participation by the U.S. Navy, U.S. Army, U.S. Air Force, and all appropriate State and federal agencies, counties, cities, and special districts in the West Mojave Coordinated Management Plan.

3. In the event that the West Mojave plan is not completed, accepted by the Department and Fish and Wildlife Service, and implemented:

    a. Identification by the BLM, in cooperation with the Department, of existing large areas of desert scrub vegetation under its control which can have land-use restrictions put in place for protection of the squirrel and other animals and plants, and formal establishment of these protected areas.

    b. Identification, in cooperation with the BLM and the Department, by the Navy at China Lake Naval Air Weapons Center, the Army at the National Training Center and Fort Irwin, and the Air Force at Edwards Air Force Base of existing large areas of desert scrub vegetation on each base which can be set aside for the squirrel and other animals and plants while meeting the mission of the base, and formal establishment of the protected areas.

c. Establishment by the Army at the National Training Center and Fort Irwin of its proposed expanded troop-training area on public lands which do not have populations of the squirrel. The BLM, which controls the public lands, should deny any proposal by the Army to expand its troop-training area to lands which contain such populations.

d. Management for the squirrel and co-existing animals and plants by the BLM on lands which it receives in fee-title as mitigation for non-governmental projects on public lands.

e. Continued application of CESA by the Department in minimizing the impacts of projects by State lead-agencies, and consistent, equitable application of CESA by the Department in the use of Section 2081 management permits to achieve a net benefit for the species in each project.

f. Establishment by the Department of a recovery team and preparation of a recovery/management plan for the squirrel.

4. Modification of livestock grazing practices in essential habitat within the geographic range of the squirrel on public lands managed by the BLM, on military land managed by the Navy, and on State lands managed by the State Lands Commission, to eliminate the grazing of sheep where now permitted and reduce the level of cattle grazing if it is found to negatively affect squirrel habitat in the studies at the Coso Known Geothermal Area.

5. Elimination of off-highway-vehicle activities in undesignated areas on public and State lands within the range and in habitat of the squirrel.

6. Restoration of disturbed native vegetation on the periphery of each new project site within the range and in the habitat of the squirrel on public and State lands as a condition of the permit for the project, and follow-up inspection by the permitting agency to determine whether the condition was met.

7. Restoration by the permitting agencies of disturbed native vegetation on the periphery of each former project site within the range and in the habitat of the squirrel on public and State lands for which restoration was not a condition of the permit.

8. Continuation by the Department and federal agencies of field studies throughout the range of the squirrel to determine preferred habitats (plant species, soils, slope, aspect), size and distribution of populations, and life history elements such as juvenile dispersal.

9. Development by the Department of a population viability analysis for the squirrel to confirm minimum population size necessary for self-sustaining populations and, therefore, the minimum size of habitat areas.

10. Restriction by the counties of the use of rodenticides within the range of the squirrel to areas not adjacent to, or within a mile of, desert scrub vegetation.

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APPENDIX A: Petition From Kern County Department of Planning and Development Services to Delist the Mohave Ground Squirrel as a Threatened Species.

FGC - 760.1 (3/90)

A PETITION TO THE STATE OF CALIFORNIA FISH AND GAME COMMISSION

For action pursuant to Section 670.1, Title 14, California Code of Regulations (CCR), and Sections 2072 and 2073 of the Fish and Game code, relating to listing and delisting endangered and threatened species of plans and animals,

I. SPECIES BEING PETITIONED:

Common Name: Mohave ground squirrel

Scientific Name: Spermophilus mohavensis

II. RECOMMENDED ACTION:
(Check the appropriate categories)

_____ List

_____ as Endangered
_____ as Threatened

_____ Change Status

from _____
to _____

__X__ Delist

III. AUTHOR OF PETITION:

Name: Kern County Department of Planning and Development Services

Address: 2700 "M" Street, Suite 100

Bakersfield, California 93301

Telephone Number: (805) 861-2615

I hereby certify that, to the best of my knowledge, all statements made in this petition are true and complete.

Signature: Ted Jan

Date: 11-19-(91)

PETITION TO THE STATE OF CALIFORNIA FISH AND GAME COMMISSION

SUPPORTING INFORMATION FOR SPECIES DELISTING

MOHAVE GROUND SQUIRREL (SPERMOPHILUS MOHAVENSIS)

(1) EXECUTIVE SUMMARY

The County of Kern is requesting the delisting of the Mohave ground squirrel (MGS) as a "threatened species" under the provisions of the California Endangered Species Act. This petition is being submitted in compliance with the delisting procedures specified in Section 670.1, Title 14, California Code of Regulations.

The California Endangered Species Act listing of the species as threatened is having a significant impact on the economic growth of eastern Kern County. The State Department of Fish and Game (DFG) has stated that the development of private lands inhabited by MGS will adversely affect the species (May 23, 1989, correspondence to the Kern County Department of Planning and Development Services). Efforts by private property owners to subdivide properties into residential homesites is being inhibited by DFG mitigation requirements that are inconsistent, unclear, cost prohibitive, and lack a clear scientific basis. Other forms of development activity which are important to the economic prosperity of eastern Kern County have also been delayed or stopped as a result of the State listing and resultant mitigation requirements. Since 1988, DFG began to actively comment on the potential loss of MGS habitat. Over 200 projects alone in Kern County have been recently affected by the listing. This listing is having an impact on a property owner's ability to use their land. These concerns were expressed by Supervisor Roy Ashburn in testimony presented at the Palm Springs Fish and Game Commission meeting on January 8, 1991.

This petition for delisting presents a comprehensive review of available literature and studies related to the MGS. It is clear from the scientific research conducted to date that the MGS was erroneously listed as "rare" in 1971 in the absence of adequate and conclusive scientific evidence. To date, there is a lack of scientific research on the population, range, density, behavior, taxonomic relationships and habitat preferences of the species.

A review of the history of the MGS listing process within the context of the scientific data available to the Fish and Game Commission in 1971, clearly shows that the species was prematurely listed without the availability of adequate population and habitat studies. The available scientific studies have yet to substantiate through comprehensive quantification research that the MGS and its habitat is threatened or in danger of extinction. In fact, recent studies have suggested that the range of the species and population densities are far greater than the conclusions of earlier studies. Studies conducted by the Bureau of Land Management (BLM) support the contention that large populations of MGS exist and their distribution ranges over an area which encompasses in excess of 7,000 square miles. This petition concludes that the preponderance of public lands managed by various federal agencies

provides substantial management benefit to assure the continued existence of the species.

(2) BACKGROUND TO SPECIES LISTING

In the absence of any public notice procedure other than the publication of a forthcoming meeting agenda, the Fish and Game Commission approved the adoption of Section 670.5 of the Fish and Game Code on May 21, 1971. This action listed the MGS as "rare." The "rare" classification denotes that while a species is not threatened with extinction, it is in such small numbers that it may become endangered if its environment is worsened.

It was noted in the May 21, 1971, Fish and Game Commission Minutes by Commissioner Fletcher that federal listing criteria were generally used in determining state listed species. These criteria were as follows:

(a) The destruction, drastic modification or severe curtailment of a species habitat;
(b) Over utilization for commercial or sporting purposes;
(c) Effect on disease of predation; or
(d) Other natural or manmade factors affecting the species continued existence.

Correspondence from the California Department of Agriculture was included as part of the record for this hearing which requested that the MGS and other specified rodents be omitted from listing since they are involved in crop depredation.

It is clear from the record that very little information was available in 1971 to make a quantitative scientific judgement that the MGS should be listed as "rare." The scientific reports available prior to the 1971 Fish and Game Commission meeting included only excerpts from general guides to squirrels or piecemeal observations on the behavior of ground squirrels (Merriam, 1889; Burt, 1936; Bartholomew and Hudson, 1960; Ingles, 1965). In the absence of comprehensive quantification studies and habitat preference analysis, it is not understood how the 1971 Commission and its staff was able to conclude that continued existence of the species was affected to such an extent that it necessitated listing as a "rare" species.

On January 1, 1985, all species listed as "rare" were classified as "threatened," pursuant to Fish and Game Code Section 2067. "Threatened" species are not presently threatened with extinction, but are likely to become endangered in the foreseeable future in the absence of special protection and management efforts.

(3) SPECIES DESCRIPTION

The MGS (Spermophilus mohavensis) is one of several species of desert ground squirrels which inhabit the western Mojave Desert region of California. The MGS is a member of the mammalian Family Sciuridae, a large family which includes ground squirrels, marmots, chipmunks, and tree squirrels. The MGS

is cinnamon-gray in color with white underparts. The species lives in underground burrows in which it spends approximately seven months of the year (usually from August to February) in estivation (underground hibernation). The skin is darkly melanistic to assist in thermoregulation.

The MGS eats fruits and seeds of desert plants. It is also known to feed on crops associated with farming activities. The species is known from available studies to occur in a widespread area including southwestern Inyo County, eastern Kern County, northwestern San Bernardino County, and northeastern Los Angeles County. This range encompasses an area in excess of 7,000 square miles. The MGS inhabits the creosote, Joshua tree, and shadscale plant communities which are widely dispersed in this region.

The MGS is a State-listed "threatened" species pursuant to the California Endangered Species Act. It is designated as a Category 2 species by the U.S. Fish and Wildlife Service. This means conclusive data on biological vulnerability and threat are not available to justify the federal listing as "threatened or endangered."

The first DFG Five-Year Status Report for MGS was prepared in 1987 as required by the California Endangered Species Act. In the report, DFG recommended to the Fish and Game Commission that the "threatened" classification be retained. Although some MGS studies were acknowledged during the preparation of the status report (Hafner and Yates, 1982; Aardahl and Roush, 1985), inadequate and inconclusive statements regarding the continued listing of the species were used. There is no conclusive scientific studies which have documented significant MGS habitat loss, adverse effects on population status, or other life history requirements.

The 1977 Wessman study recognized a substantial 1,800 square mile increase in the range of the MGS, yet no mention of this significant increase in the MGS habitat was acknowledged in the Five-Year Status Report. It is wondered why this significant increase in known habitat area would not provide a reasonable basis to demonstrate sufficient available habitat to delist the species.

It is interesting to note that Hafner and Yates question whether the MGS is even a separate distinct species. These scientists conducted genetic research which compared the round tail squirrel (Spermophilus tereticaudus) and the MGS. They share the same subgenus (Xerospermophilus) and the occurrence of speciation for the MGS is still unknown. In areas of contiguous habitat, these two squirrel families have interbred. Hafner and Yates concluded that insufficient evidence exists to substantiate conclusive scientific recognition of a separate MGS species. In the absence of conclusive scientific studies, the recognition of the MGS as a "threatened" species is premature and inappropriate.

(4) HABITAT REQUIREMENTS

As previously noted, the MGS inhabits a large desert region of California in excess of 7,000 square miles. The MGS occupies plant communities which are

dominated by either creosote (Larrea tridentata), Joshua tree (Yucca brevifolia), or shadscale (Atriplex confertifolia). In each of these community types, the habitat is characterized by much open ground among the perennial shrubs or Joshua trees. Aardahl and Roush state that "large alluvial filled valleys with deeper fine to medium texture soils, absence of rock and vegetation classified as creosote bush scrub, shadscale scrub, and alkali sink appear to be the best habitat for the MGS."

Although field work has been accomplished to describe the habitat and local food habits of the MGS, there is little information on habitat preference and aboveground use. Little information exists on the comparisons of the use of one site with others in the same plant community or in different communities. It would seem prudent for these additional studies to be undertaken before a species is listed as "threatened."

In reviewing the habitat requirements of this species, it is important to note that much of the habitat range is under federal management by the Navy, Army, Air Force, or the Bureau of Land Management. For the entire known 7000 square mile habitat area, over 57 percent of the land is under federal management (see attached habitat range map). Within the unincorporated area of the Indian Wells Valley of Kern County, over 83 percent of the land or 237,730 acres is under federal management while the remaining acreage is under private ownership. With such a small percentage of private holdings, the encouragement of effective management practices by the federal government would seem to ensure substantial areas available for species propagation.

(5) DISTURBANCE/ABUNDANCE

Little scientific research has been conducted on the distribution and abundance of the MGS (Hoyt, 1972; BLM, 1974, 1989, 1990; Wessman, 1977; Aardahl and Roush, 1985). Hoyt's 1972 study on the abundance of the species was largely based on secondary information gained from interviews and museums with minimal live trapping. Hoyt is consistently referenced in the literature as noting a restricted species distribution yet the scope of his study was cursory in nature with many of the live trappings attempted during winter MGS estivation periods. Even Hoyt must conclude, "it is not possible at this time to make any exact or quantitative statements about the animal's present distribution or abundance . . . nor to decide whether the species is truly endangered (Hoyt, 1972. p. 7-8)." In 1974, the BLM Desert Planning Staff conducted biological surveys in the El Paso and Red Mountain Regions of eastern Kern and northern San Bernardino Counties. During these surveys, the known range of the MGS was extended west into the foothills of the southern Sierras and east to the vicinity of Harper Dry Lake and Searles Dry Lake.

Wessman's 1977 study of the distribution and habitat preferences of the MGS determined that the MGS occupied a range 1,800 square miles greater than the previous known MGS range. Zembal (1979) also noted significant populations of MGS in the Coso Hot Springs area and noted that the species utilized a variety of habitats.

A more contemporary comprehensive study of distribution and abundance was Aardahl and Roush's 1985 study which noted dramatically high populations and densities of the species. The study also noted that average relative population densities for the MGS and antelope ground squirrel (nonlisted species) for the study sites are similar. At nine of the 22 trapping sites, the total adjusted captures for the MGS exceeded those of the antelope ground squirrel.

BLM studies (1988 through 1990) prepared by Leitner reveal high population densities of MGS in the Coso Geothermal Resource Area. These studies are part of BLM's Coso Mohave Ground Squirrel Mitigation Program. These studies have provided some of the best data related to MGS hibernation habits. Estivation periods were shown to change year-to-year due to environmental changes such as the drought. The studies also show that females will control their habitat by not bearing any young to compete for limited food supplies during drought years. These studies suggest that past trapping surveys showing decreased numbers of squirrels may be erroneous in their conclusions due to estivation periods of greater duration resulting from environmental factors. These studies suggest that natural decreases in MGS populations may have nothing to do with habitat loss resulting from private development.

(6) NATURE AND DEGREE OF THREAT

The listing of the MGS as a "threatened" species lacks any basis in scientific fact. It is important to note that when the species was first listed in 1971, there was little quantitative scientific information available to make a judgement as to the nature or degree of threat to the species and its habitat. Prior to 1971, only excerpts from general guides to squirrels and behavioral studies were available (Bartholemew and Hudson, 1960; Ingles, 1965). In the absence of comprehensive population studies and evidence regarding historic numbers and preferred habitat, it is not understood how the 1971 Fish and Game Commission was able to conclude that the MGS be classified as "rare." Even the studies that were immediately subsequent to the 1971 listing were inconclusive and based on generalizations rather than scientific fact. Hoyt's study is such an example.

The more contemporary MGS studies of Wessman, Aardahl, and Roush and the recent BLM Coso Studies reference greater habitat ranges, increased population densities and greater habitat types than previously noted. The available research has yet to substantiate the need for species listing. The more recent studies support the delisting of the species. The existence of a large habitat range (in excess of 7000 square miles) also supports this conclusion.

As previously indicated, the more recent studies have shown that estivation in the MGS varies from year-to-year so that trapping surveys may not be accurate. The MGS may migrate for food and may not appear at the same location year after year. This has resulted in DFG no longer accepting trapping studies and indicating that any location within a wide range may be potential habitat (DFG correspondence dated, July 3, 1991). If this is the

case, why is the species "threatened" if any location may be future habitat? Could this be taken to mean that the MGS habitat area just expanded again?

Once again, the available information leads one to conclude that (1) the species was prematurely listed as rare without adequate scientific fact; (2) with a known range exceeding 7,000 square miles, the species is not confined to a relatively small and specialized habitat; (3) recent population studies have noted substantial populations of the MGS; and (4) with so much of the known habitat range being public lands, it is not understood why private land development activity has caused imminent danger to the continued existence of the species.

(7) CURRENT AND RECOMMENDED MANAGEMENT

The delisting of the MGS as a "threatened" species is long overdue. It is illogical to list a species with little or no scientific fact and then spend subsequent years trying to justify the listing through piecemeal studies. It is an unwarranted burden to the public to continue to attempt to justify the listing.

A variety of existing and proposed programs can adequately manage species habitat until such time that scientific studies actually merit the species listing. These programs include the following:

(a) The California Environmental Quality Act (CEQA) is intended to ensure the long-term protection of the environment including wildlife. As the trustee agency for fish and wildlife resources, DFG reviews and comments on local agency CEQA documents. This program provides an opportunity for the DFG to review project-specific effects on wildlife such as the MGS.

(b) The BLM is actively involved in the Coso MGS Mitigation Program. The studies developed by this program will provide a better understanding of the population, diversity, and behavior of the MGS. This program will provide the basis to better manage BLM and other federal lands.

(c) Local Agency General Plan Land Use Programs provide another means to help in the management of MGS habitat. Much of the area within the four-county known habitat range of the MGS is designated for nonintensive development or open space use on the various jurisdiction's general plans. A jurisdiction's general plan provides a blueprint for future land uses. Open space and nonintensive land use designations would appear to complement the habitat requirements of the MGS.

(d) If future comprehensive studies warrant the listing of the MGS, the County is preparing an Endangered Species Element of the General Plan which would advocate the preparation of comprehensive Habitat Conservation Plans to address State and federally listed endangered species.

(e) Future coordination and development of land management programs with the BLM and military are possible to enhance and protect habitat for MGS. BLM is in the process of updating their management plans to address MGS habitat issues. The West Mojave Tortoise Plan will complement the effective management of MGS habitat. Edwards Air Force Base is initiating a joint land use study that could address habitat management practices for the MGS.

(8) SOURCES OF INFORMATION

Aardahl, J.B. and Rosh, "Relative Density Habitat Preference and Seasonal Activity Levels of the Mohave Ground Squirrel and White-tailed Antelope GS in Western Mohave Desert, California" Bureau of Land Management Riverside, CA (1985 Distribution)

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Bureau of Land Management Leitner Study, "Coso Geothermal Resource Area" (1990)

Brown Berry, P., "Baseline and Monitoring Study of Mohave Ground Squirrel Habitat Buffer for Cerro Coso Community College" (1988)

Burt, W.H., "Notes on the Habits of the Mohave Ground Squirrel" J. Mamm 17:221-224 (1936)

Burt, W.H., "A Field Guide to the Mammals" Houghton Mifflin Company, Boston 289 pp. (1976)

Hafner, D.J. and T.C. Yates, "Systematic Status of the Mohave Ground Squirrel" J. Mamm 64(3): 397-404 (1983)

Hall, E.R., "Mammals of N. America" John Wiley and Sons, New York 1:1-600+ 90 (1976, 1959 reprint)

Hoyt, D.F., "Mohave Ground Squirrel Survey Department of Fish and Game Spec Wildlife Inventory Final Report" Project No. S-54-R-4 (1972)

Ingles, L.G., "Mammals of California and Its Coastal Waters" Stanford University Press, Stanford, California, 396 pp. (1961)

Recht, M.A., "The Biology of Mohave Ground Squirrel" Ph.D. dissertation UCLA (1977)

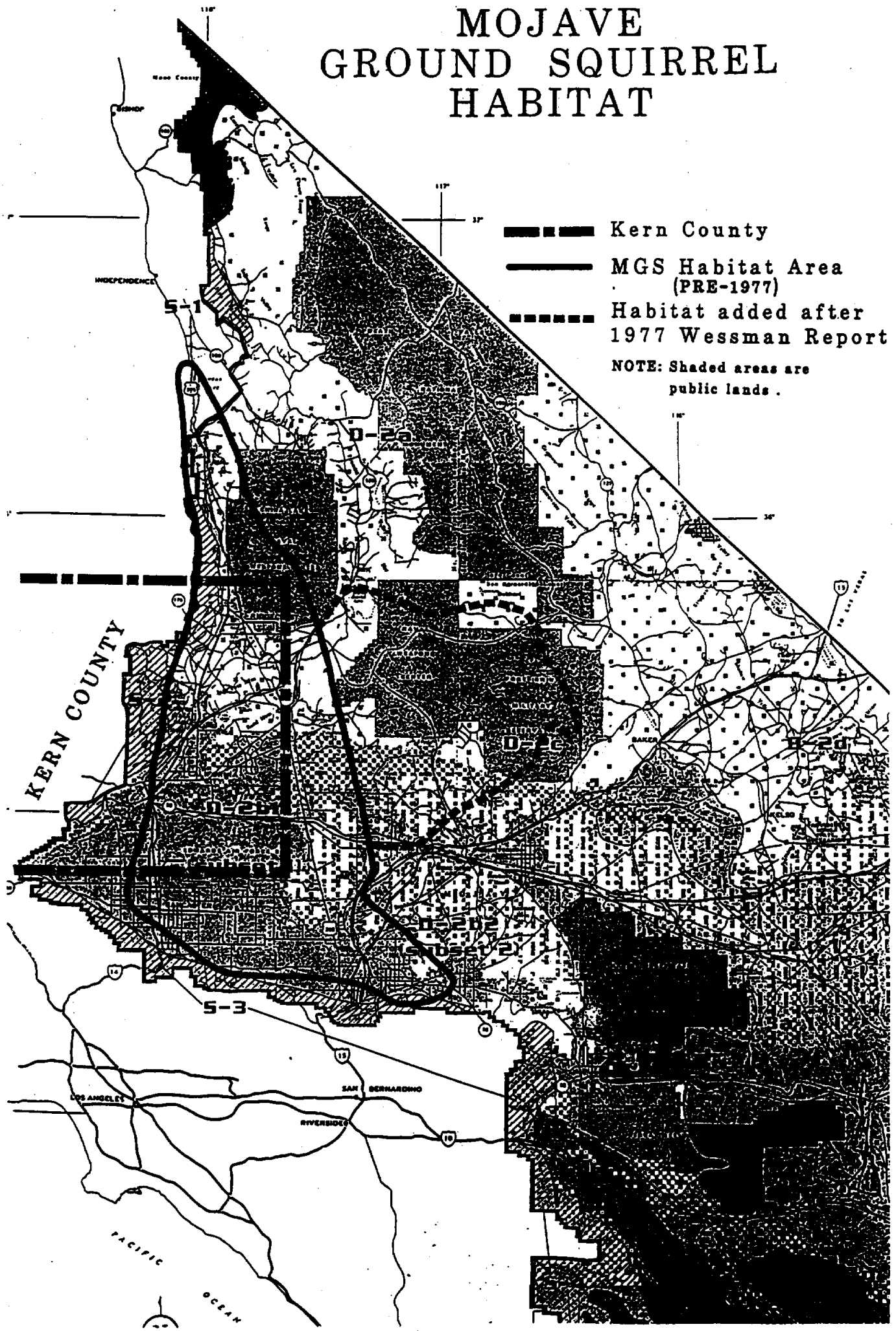
Wessman, E.V., "Distribution and Habitat Preferences of Mohave Ground Squirrel" Department of Fish and Game Wild Management Branch Administrative Report 77-5 (1977)

Zembal, R.C. et al., "Inventory of the Vascular Plants and Small Mammals of the Coso Hot Springs Area, China Lake" NWC ADPUB 79-202 (1979)

Zembal, R.C., "Observations on Mohave Ground Squirrel in Inyo County" J. Mamm 61(2):345-347 (1980)

11/6/91
F:TED:MGS91

MOJAVE GROUND SQUIRREL HABITAT



APPENDIX B: Petition Form FGC-670.1 (3/90).

The specified format and content of this form must be included in any petition to list or delist a Threatened or Endangered species.

FGC - 670.1 (3/90)

A PETITION TO THE STATE OF CALIFORNIA FISH AND GAME COMMISSION

For action pursuant to Section 670.1, Title 14, California Code of Regulations (CCR), and sections 2072 and 2073 of the Fish and Game Code, relating to listing and delisting endangered and threatened species of plants and animals.

I. SPECIES BEING PETITIONED:

Common Name: _____

Scientific Name: _____

II. RECOMMENDED ACTION:

(Check appropriate categories)

_____ List

_____ as Endangered
_____ as Threatened

_____ Change Status

from _____
to _____

_____ Delist

III. AUTHOR OF PETITION:

Name: _____

Address: _____

_____

Phone Number: _____

I hereby certify that, to the best of my knowledge, all statements made in this petition are true and complete.

Signature: _____

Date: _____

PETITION TO THE STATE OF CALIFORNIA FISH AND GAME COMMISSION

SUPPORTING INFORMATION FOR

_____ (_____)

Common Name **Scientific Name**

1. EXECUTIVE SUMMARY

Provide a brief statement explaining why the petitioned action is being recommended. Include a brief summary of each section of the petition. If a species is being petitioned for listing, state why any one or a combination of the following factors (listed in Section 670.1, Title 14, CCR) threatens its survival.

(1) Present or threatened modification or destruction of its habitat;

(2) Overexploitation;

(3) Predation;

(4) Competition;

(5) Disease; or

(6) Other natural occurrences or human-related activities.

If a species is being recommended for delisting, indicate why State-listing is no longer warranted, and state why any one or a combination of the aforementioned factors no longer threatens its existence.

2. SPECIES DESCRIPTION, BIOLOGY AND ECOLOGY

Include pertinent information that is available on species identification, taxonomy and systematics, seasonal activity or phenology, reproductive biology, mortality/natality, longevity, growth rate, growth form, food habits, habitat relationships and ecological niche or ecological attributes, interactions with other species or special habitat requirements that may increase vulnerability of the species to certain natural or human-caused adverse impacts (e.g., obligate wetland or riparian habitat species, low birthrate, colonial species).

3. HABITAT REQUIREMENTS

Describe habitat features that are thought to be important to the species' ability to maintain viable population levels. Any or all of the following features may be included, as appropriate:

Plant community; edaphic conditions; climate; light; topography/microtopography; natural disturbance; interactions with other plants or animals; associated species; elevation; migration or movement corridors; wintering habitat; breeding habitat; foraging habitat; other habitat features.

For aquatic organisms, the following features may be included in addition to the above:

Water temperature; water flow patterns; stream gradient; water chemistry (dissolved oxygen, salinity, etc.); water depth; bottom type; cover type and availability; fish assemblage/community; aquatic plant abundance; other habitat features.

4. DISTRIBUTION

Delineate on appropriate maps the historic and present distribution (estimated if not known). Include one map of California showing general distribution, and U.S. Geological Survey topographical maps (or equivalent) of appropriate scale, for more detailed distribution information, including locations of occurrences, populations or portions of populations, as appropriate. Include historic and current distribution as documented by literature, museum records, Natural Diversity Data Base and other Department of Fish and Game records and testimony of knowledgeable individuals. all maps must be suitable for black and white reproduction and fully labeled, including borders, base map name, map scale and species name, and should not exceed 11" x 14" in size.

In the text indicate the percentage of historic distribution that is in existence and the rate of loss. If appropriate, indicate the number of extant occurrences, populations or portions of populations in California. Indicate whether the rate of loss is accelerating, and estimate when extinction would occur if current trends continue. Discuss the relationship between historic and current acreage and degree of habitat fragmentation. Describe the quality of the existing habitats in terms of ability to maintain viable populations with or without enhancement. For delisting, indicate how current distribution reflects recovery of the species since listing.

5. ABUNDANCE

Provide available historic and current population estimates/trends, densities, vigor, sex and age structures, and explanation of population changes relative to human-caused impacts or natural events. Compare current and historic abundance in terms of overall population size or size of occurrences, populations or portions of populations, as appropriate. Describe current population trends (with numbers and rate) and relate these to viable population numbers. Explain survey methodology used to arrive at numbers or estimates and what assumptions, if any, were involved.

6. NATURE AND DEGREE OF THREAT

Discuss the basis for the threats to the species or subspecies, or to each population, occurrence or portion of range (as appropriate) due to one or more of the following factors:

(1) Present or threatened modification of destruction of its habitat;

(2) overexploitation;

(3) predation;

(4) competition;

(5) disease; or

(6) other natural events or human-related activities.

Identify the direct, indirect and cumulative adverse impacts and discuss how these are contributing to the decline of the species. Indicate the immediacy of the threat and the magnitude of loss or rate of decline that has occurred to the present or is expected to occur without protective measures. Indicate whether or species is vulnerable to random catastrophic events. For delisting, state why any one or a combination of the aforementioned factors no longer threatens the existence of the species.

7. CURRENT MANAGEMENT

Describe any ongoing protective measures or existing management plans for the species or its habitat. Information on species or land management activities that are impacting populations or portions of the range and knowledge of proposed land use changes should be included. This may be best accomplished by discussing populations or portions of the range. A chart may be useful.

Include available information on any or all of the following:

(1) Property ownership/jurisdiction for known populations or portions of the range;

(2) current land use;

(3) protective measures being taken, if any, and effectiveness of current management activities;

(4) current research on the species;

(5) existing management/recovery plans and the extent of their implementation;

(6) proposed land use changes (include knowledge of forthcoming California Environmental Quality Act documents that may or should address impacts, and lead agencies involved); or

(7) county general plans, federal and State agency plans/actions or other plans/actions that do address or should address the species.

8. RECOMMENDED MANAGEMENT/RECOVERY MEASURES

Describe activities that may be necessary to ensure future survival of the species after listing or delisting. Include recommendations for any or all of the following:

(1) Activities that would protect existing populations (site maintenance, preserve design, establishment, etc.);

(2) monitoring programs and studies;

(3) needed amendments to existing management and land use plans, including county general plans;

(4) agencies/organizations that should be involved in planning and implementing management and recovery actions;

(5) other activities that would help protect existing habitat or ensure survival of the species;

(6) how other sensitive species (listed and unlisted) may benefit from protection of this species;

(7) how other species/habitats may be impacted by management and recovery activities for this species; or

(8) at what point this species would be considered stable and sustainable.

9. INFORMATION SOURCES

Cite literature, available specimen collection records and other pertinent reference materials. Attach documents critical to the recommended action. Be sure to include recent status surveys. List names, addresses and telephone numbers of persons providing unpublished information and supporting the recommended action.

APPENDIX C: Memorandum From Department of Fish and Game to Fish and Game Commission Presenting the Recommendation on Petition to Delist the Mohave Ground Squirrel.

This recommendation was based on the Department's initial review to determine only whether the petition contained sufficient scientific information to demonstrate that the petitioned action was warranted.

State of California

Memorandum

To : Mr. Robert R. Treanor
Executive Director
Fish and Game Commission

Date : February 24, 1992

From : Department of Fish and Game

Subject : Commission Agenda Item — April 2, and 3, 1992 Commission Meeting Re: Petition to Delist the Mohave Ground Squirrel as Threatened

The Department of Fish and Game has reviewed the petition transmitted with your memorandum of November 22, 1991 to delist the Mohave ground squirrel as Threatened. Pursuant to sections 2072.3 and 2073.5 of the Fish and Game Code and based upon the information contained in the petition, we have determined that the petition is not complete. It does not include sufficient scientific information to indicate that the petitioned action may be warranted. The petition should be rejected.

Section 2072.3 of the Fish and Game Code requires that a petition include sufficient scientific information on the following factors as the basis for its petitioned action: population trend, range, distribution, abundance, and life history of the species, the factors affecting the ability of the population (the species) to survive and reproduce, the degree and immediacy of threat, the impact of existing management efforts, suggestions for future management, and the availability and sources of information. A petition also must include information regarding the kind of habitat necessary for survival of the species and must include a detailed map showing distribution of the species.

The petition to delist the Mohave ground squirrel does not include any scientific information on population trend for the Mohave ground squirrel. The petition to delist the Mohave ground squirrel does not include sufficient scientific information on the following factors to indicate that the petitioned action may be warranted: range, distribution, abundance, factors affecting the ability of the species to survive and reproduce, degree and immediacy of threat, and impact of existing management efforts. The petition to delist the Mohave ground squirrel includes a range map, but it is not sufficiently detailed to accurately depict the range of the species.

The petition fails to fully satisfy the content requirements of petition form FGC 670.1 (3/90) as specified in Section 670.1(a), Title 14, California Code of Regulations. The content of the petition is incomplete, pursuant to Section 670.1(a), in that it does not include sufficient information to indicate that the petitioned action may be warranted. There is no discussion in the petition of changes in population of the Mohave ground squirrel over all or a portion of its range. There is no discussion of the effects of human-induced habitat fragmentation on the ability of the species to reoccupy habitat from which it has been extirpated. The impact of Federal land-use activities on Mohave ground squirrel populations is not presented in the petition. We found no discussion of the effects of highways and their

rights of way (current or proposed) as barriers to movement of populations or as negative impacts to local population densities. There is no mention in the petition of whether the Mohave ground squirrel has been found to occupy soils, plant communities, or elevations not previously known. These and other aspects of the life history of the species, as well as known or potential impacts, must be described and quantified in any attempt to demonstrate that the status of the Mohave ground squirrel has changed.

Section 670.1(c), Title 14, California Code of Regulations provides that a species may be delisted "if the Commission determines that its continued existence is no longer threatened by any one or any combination" of the following factors: present or threatened modification or destruction of its habitat, overexploitation, predation, competition, disease, or other natural occurrences or human-related activities. The petition to delist the Mohave ground squirrel does not provide sufficient information to demonstrate that none of these factors continue to threaten the continued existence of the Mohave ground squirrel.

It is useful at this time to address some points presented in the petition to delist the Mohave ground squirrel. The petition presents three major points of view. These are as follows: 1) that the Mohave ground squirrel erroneously was listed as Rare in 1971; 2) that there has been a lack of scientific research on the population, range, density, behavior, taxonomic relationships, and habitat preferences of the species since 1971 to justify its listing; and 3) that the large amount of Federal land within the range of the Mohave ground squirrel provides substantial management benefit to assure the continued existence of the species.

In regard to the supposed erroneous listing, this argument is not relevant to the single issue at hand in the Department's review. That issue is whether the petition includes sufficient scientific information to indicate that delisting of the Mohave ground squirrel is warranted. However, we believe that it is important to note that there is no evidence in the written record of the Commission's action in 1971 to indicate that the Mohave ground squirrel received any more or less consideration for a designation of Rare than did other species of animals which received that designation.

In regard to the supposed lack of scientific research on the Mohave ground squirrel since 1971 which would justify its original listing, most of the field work that has been done over the years has had the primary purpose of documenting presence or absence of the species prior to the development of habitat. Research on aspects of life history or to determine factors which limit Mohave ground squirrel distribution or populations has not been the focus of this work. The petition itself reflects the lack of results from field research. Funds have been unavailable to the Department due to established priorities for limited monies for such work, for the purpose of obtaining information on life history and limiting factors, and for updating knowledge of the effects of habitat loss on the species.

In regard to the point of view that Federal agencies provide substantial benefit to the Mohave ground squirrel in their management, we believe that if benefit is derived it is incidental to other purposes in land management decisions. There is little specific

management consideration given to the species on Federal lands sufficient to provide benefit over the long term. In addition, there are several proposed land-use actions or changes which could be detrimental to the continued existence of the Mohave ground squirrel. One of these is the western expansion of the troop training area of Fort Irwin.

The U.S. Fish and Wildlife Service is considering whether the Mohave ground squirrel may be deserving of protection under the Federal Endangered Species Act. In the Federal Register of November 21, 1991, the Service presented an updated compilation of animals that are being considered for possible addition to the Federal list of Endangered and Threatened species. The Mohave ground squirrel is included among the presented species. A designation of status trend for each species has been added to the compilation for the first time. The designation for the Mohave ground squirrel is "Declining," which is defined as "decreasing numbers and/or increasing threats."

The Department has determined, based on the best available biological information, that the Mohave ground squirrel continues to be threatened by modification and destruction of its habitat. The modification of habitat primarily is human-related, although the drought of the past five years is a natural occurrence which has contributed to diminishing the quality of habitat in much of the range of the Mohave ground squirrel. The rapid growth in the urban areas of Palmdale, Victorville, and Ridgecrest in recent years, and the lack of coordinated planning to provide for the continued existence of the species in or near these areas during this growth, is the major cause for our position that Threatened status should be retained.

Original Signed By
Howard A. Sarasohn for
Boyd Gibbons
Director

APPENDIX D: Copy of Public Notice Distributed by Department of Fish and Game Inviting Comment on Petition to Delist the Mohave Ground Squirrel and Requesting Scientific Information.

List of Parties To Whom Public Notice Was Sent.

STATE OF CALIFORNIA—THE RESOURCES AGENCY PETE WILSON, Governor

DEPARTMENT OF FISH AND GAME
P.O. BOX 944209
SACRAMENTO, CA 94244-2090

(916) 324-8348

June 10, 1992

PUBLIC NOTICE

TO WHOM IT MAY CONCERN:

Pursuant to Section 2074.4 of the California Fish and Game Code (FGC), **NOTICE IS HEREBY GIVEN** that on April 2, 1992, the California Fish and Game Commission accepted a petition from the Kern County Department of Planning and Development Services to amend the official State list of endangered and threatened species (Section 670.2, 670.5, Title 14, California Code of Regulations) as follows:

Species	Proposal
Mohave Ground Squirrel (*Spermophilus mohavensis*)	Delist from Threatened

The California Endangered Species Act (FGC, Chapter 1.5; Section 2050 et seq.) requires that the Department of Fish and Game notify affected and interested parties that the Commission has accepted the petition for the purpose of receiving information and comments that will aid in evaluating the petition and determining whether or not the above proposal should be adopted by the Commission. The Department has 12 months to review the petition, evaluate the available information, and report back to the Commission whether the petitioned action is warranted (FGC 2074.6). The Department's recommendation must be based on the best scientific information available to the Department.

Therefore, **NOTICE IS FURTHER GIVEN** that anyone with data or comments on the taxonomic status, ecology, biology, life history, management recommendations, distribution, abundance, threats, habitat that may be essential for the species or other factors related to the status of the above species, is hereby requested to provide such data or comments to:

Natural Heritage Division
California Department of Fish and Game
1416 Ninth Street
Sacramento, California 95814

Responses received by October 1, 1992 will be included in the Department's final report to the Commission. If the Department concludes that the petitioned action is warranted, it will recommend that the Commission adopt the proposal. Following receipt of the Department's report, the Commission will allow a 45-day public comment period prior to taking any action on the Department's recommendation.

NOTICE IS FURTHER GIVEN that the Mohave Ground Squirrel continues to receive the full protection of the California Endangered Species Act as a threatened species pursuant to FGC Section 2085 and does not undergo a candidacy period.

Sincerely,

COPY Original
Signed by
Susan A. Cochrane

Susan A. Cochrane, Chief
Natural Heritage Division

PUBLIC NOTICE LIST

Mr. Richard Zembal
U.S. Fish and Wildlife Service
2730 Loker Avenue West
Carlsbad, California 92008

Mr. Steven Chambers
U.S. Fish and Wildlife Service
2140 Eastman Avenue, Suite 100
Ventura, California 93003

Mr. Dale Hall
U.S. Fish and Wildlife Service
911 N.E. 11th Avenue
Portland, Oregon 94232-4181

Mr. Jeffrey Aardahl
Death Valley National Monument
Death Valley, California 92328

Mr. Gerald Hillier
U.S. Bureau of Land Management
6221 Box Springs Boulevard
Riverside, California 92507

Mr. Lee Delaney
U. S. Bureau of Land Management
300 South Richmond Road
Ridgecrest, California 93555

Area Manager
U. S. Bureau of Land Management
150 Coolwater Lane
Barstow, California 92311

Mr. Tom Clark
U. S. Bureau of Land Management
150 Coolwater Lane
Barstow, California 92311

Mr. Ed Hastey
U. S. Bureau of Land Management
2800 Cottage Way
Sacramento, California 95825

Mr. Mark Sazaki
Environmental Office
Environmental Protection Division
California Energy Commission
1516 Ninth Street
Sacramento, California 95814

Ms. Karen Pluff
California Department of Parks and Recreation
8885 Rio San Diego Drive, Suite 270
San Diego, California 92108

Chief
Land Management and Conservation Division
State Lands Commission
1807 13th Street
Sacramento, California 95814

Mr. Thomas J. McGill
Environmental Project Office
Naval Air Weapons Station
U.S. Department of the Navy
China Lake, California 93555-6001

Major David E. Schnabel
Directorate of Engineering and Housing
National Training Center and Fort Irwin
Fort Irwin, California 92310-5000

Dr. Richard Friesen
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2530 Red Hill Avenue
Santa Ana, California 92705

Dr. Daniel A. Guthrie
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Claremont College
Claremont, California 91711

Dr. Phillip V. Brylski
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Newport Beach, California 92660

Dr. David Germano
3520 Sewell Street
Bakersfield, California 93312

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The Planning Center
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Ms. Deborah J. Clark
28972 Spadra Street
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Mr. Stephen P. Tabor
4209 Lantados Street
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Chief Planner
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Chief Planner
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Chief Planner, Planning Department
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100 W. California
Ridgecrest, California 93555

Chief Planner, Planning Department
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Director, District 7
California Department of Transportation
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Los Angeles, California 90012

Director, District 8
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San Bernardino, California 92401

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Mr. J. Paul Robinson, Chairman
Regional Planning Commission
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Mr. Jeff Van Ee
Toiyabe Chapter
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Mr. Richard Spotts
Defenders of Wildlife
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Conservation Chair
Desert Protective Council
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Conservation Chair
Desert Tortoise Council
P.O. Box 1738
Palm Desert, California 92210

Conservation Chair
Desert Tortoise Preserve Committee
P.O. Box 453
Ridgecrest, California 93556

Conservation Chair
Natural Resources Defense Council
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Mr. Steve McCormick
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Mr. Bruce Hamilton
Sierra Club
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San Francisco, California 94109

Conservation Chair
Sierra Club Legal Defense Fund
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The Trust for Public Land
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San Francisco, California 94105

Mr. David Schaub
Resource Protection Division
California Department of Parks and Recreation
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Mr. Lloyd Brubaker, President
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San Bernardino Valley Audubon Society
P.O. Box 1954
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Mr. Ken Green, President
Pomona Valley Audubon Society
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Mr. James Wilson, Conservation Chair
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Ms. Terry Middlemiss, Conservation Chair
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Ms. Dana Bell
Principal Legislative Officer
American Motorcycle Association, District 7
5764 Campo Way
Long Beach, California 90803
Ms. Shelia Massey
California Cattlemen's Association
1221 H Street
Sacramento, California 95814-1910

Mr. Glenn Roushe, Executive Director
California Mining Association
1010 11th Street
Sacramento, California 95814

Mr. Jay Wilson, Executive Vice-President
California Wool Growers Association
1221 H. Street, Suite 101
Sacramento, California 95814-1910

Environmental Control
Southern Pacific Railroad
1 Market Plaza
San Francisco, California 94105

Environmental Control
Union Pacific Railroad Company
5500 Ferguson
San Francisco, California 90022

Mr. E. J. Kuchinasky, Director
Santa Fe Railway
P.O. Box 7931
San Francisco, California 94120

Mr. Henry Hearns, Chief
Office of Environmental Planning,
Management and Compliance
AFFTC/DEV
Edwards AFB, California 93523-5000

Mr. Jack C. Parnell, Director
Department of Food and Agriculture
1220 N Street
Sacramento, California 95814

Mr. W. E. Schaefer, Deputy Director
California Department of Transportation
1120 N Street
Sacramento, California 95814

Dr. Glenn R. Stewart
Biological Sciences Department
California State Polytechnic University
Pomona, California 91768

County Board of Supervisors
San Bernardino County
County Government Center
385 North Arrowhead Avenue
San Bernardino, California 92415-0110

County Board of Supervisors
Inyo County
168 North Edwards
Independence, California 93526

County Board of Supervisors
Kern County
1415 Truxtun Avenue
Bakersfield, California 93301

APPENDIX E: Responses to Public Notice Regarding Petition to Delist the Mohave Ground Squirrel and Letters Sent to Fish and Game Commission.

The Department's Summaries of the Responses and Letters.

The Department received written responses from 19 individuals or organizations. These were as follows:

1. National Training Center and Fort Irwin
2. Curt Uptain
3. Michael A. Recht
4. George E. Lawrence
5. Joan R. Callahan
6. Michael Starr
7. Donald F. Hoyt
8. David J. Hafner
9. Patricia E. Brown
10. Michael J. O'Farrell
11. Philip Leitner
12. Denise L. LaBerteaux
13. The Desert Protective Council, Inc.
14. Jeffrey B. Aardahl
15. Kern-Kaweah Chapter, Sierra Club
16. Terry L. Yates
17. U.S. Fish and Wildlife Service
18. Thomas and Kathleen Stephens
19. California Energy Commission

In addition, the Department received copies of two letters sent to the Commission with comments on the petition. These were from the following:

20. Kerncrest Chapter, National Audubon Society
21. Carol Panlaqui

Rec'd NHD

JUL 2 1 1992

DEPARTMENT OF THE ARMY
HEADQUARTERS, NATIONAL TRAINING CENTER AND FORT IRWIN
FORT IRWIN, CALIFORNIA 92310-5000

REPLY TO
ATTENTION OF

JUL 17 1992

Director of Public Works

Susan A. Cochrane
Chief, Natural Heritage Division
California Department of Fish and Game
1416 Ninth Street
Sacramento, California 95814

Dear Ms. Cochrane:

Reference Section 2074.4 for Mohave Ground Squirrel (Spermophilus mohavensis). While circumstantial evidence has been drawn from the fact that the Mohave Ground Squirrel (Spermophilus mohavensis) species habitat is suffering from increased development, this does not constitute scientific proof of its impending demise.

Additionally, sightings and captures of Mohave Ground Squirrel have given inconclusive evidence relative to the species status. Sightings on the National Training Center and Fort Irwin, have traditionally been infrequent and populations highly patchy, with low densities. Since this area constitutes the Northeast boundary of Spermophilus mohavensis range, environmental and ecological pressure could be expected to be greater. However, these same characteristics of highly patchy distribution with low density appear even in the center of the range.

It is the position of this command that evidence does not exist to support the continued listing of this species as "threatened".

If you require additional information, please contact me or Mr. Stephen Ahmann at (619) 386-3740.

Sincerely,

David E. Schnabel

David E. Schnabel
Lieutenant Colonel,
Corps of Engineers
Director of Public
Works

1. Summary of letter from National Training Center and Fort Irwin, U.S. Army:

This letter cites the fact that the Mohave Ground Squirrel has "highly patchy distribution with low density" at Fort Irwin and "even in the center of the range", but then contradictorily concludes that "evidence does not exist to support the continued listing of this species as 'threatened'.

CWESA

CONSULTANTS IN WILDLIFE AND ENVIRONMENTAL SERVICES AGENCY

(209) 875-5104

1758 N. ACADEMY • SANGER, CALIFORNIA 93657

4 September, 1992

John Gustafson
Nongame Wildlife Division
California Department of Fish and Game
1416 Ninth Street
Sacramento, CA. 95814

Dear John,

This letter constitutes my review of the Mojave ground squirrel delisting petition submitted to the California Department of Fish and Game on November 19, 1991. I have referenced specific statements that appear in the text and commented on these individually. Then, I have provided an evaluation of the merit of this petition. Please feel free to use this letter, or any excerpts, as you deem appropriate.

Page 1, Paragraph 2, Sentence 3. "Efforts by private property owners to subdivide properties into residential home sites is being inhibited by DFG mitigation requirements that are inconsistent, unclear, cost prohibitive, and lack a clear scientific basis."

Comment - I am sure that the subdividing of private properties are being delayed by the mitigation requirements for Mojave ground squirrels. However, I am not aware of a single proposed project that has not been completed due to the required mitigations. Further, the mitigation requirements established by CDFG are not inconsistent, unclear, cost prohibitive, and they do not lack a scientific basis. Although the mitigation requirements may not be identical from project to project, all projects are currently evaluated in a consistent manner. The methods used to evaluate properties and the resultant mitigation requirements have been standardized and are very clear.

Page 1, Paragraph 3, Sentence 1. "This petition for delisting presents a comprehensive review of available literature and studies related to the MGS."

Comment - Although most of the pertinent available literature has been incorporated and discussed in this petition, most of it has been misinterpreted, misquoted, or misrepresented. Clearly, the author of this petition either has a very minimal scientific background or wishes to twist the conclusions of certain studies.

Sentence 2. "It is clear from the scientific research conducted to date that the MGS was erroneously listed as "rare" in 1971 in the absence of adequate and conclusive evidence."

Comment - It is not "clear" that the MGS was erroneously listed. Given the information available at the time, the decision to list this species was a prudent one.

Sentence 3. "To date, there is a lack of scientific research on the population, range, density, behavior, taxonomic relationships and habitat preferences of the species."

Comment - This species has not been extensively studied. However, there is much more data available now than when the animal was first listed; much of the data were collected as a direct result of the species being listed. Information on behavior, population age structure, density, and survivorship is currently being gathered by Dr. Phillip Leitner at the Coso geothermal area; MGS behavior has been studied in the southern portion of its range by Dr. Tony Recht; the status of its taxonomic relationships with other squirrels is well known, and trapping conducted throughout its range as a result of its listing has increased our knowledge of its current distribution. There is a lack of knowledge relating to MGS habitat preferences on a specific basis. An accumulation of existing data is being prepared jointly between CDFG and BLM.

Page 1, Paragraph 4, Sentence 1. "A review of the history of the MGS listing process within the context of the scientific data available to the Fish and Game Commission in 1971, clearly shows that the species was prematurely listed without the availability of adequate population and habitat studies."

Comment - Although there were few studies available, all persons knowledgeable of the species were contacted and asked for their recommendations for listing of the species; much of the information known was not documented. In most, if not all cases, the Mojave ground squirrel experts agreed that the animal should be listed.

Sentence 2. The available scientific studies have yet to substantiate through comprehensive research that the MGS and its habitat is threatened or in danger of extinction."

Comment - Although there is a lack of robust research on this species, all available data support the contention that the species should be listed. Current information being prepared by the CDFG and BLM on the relative abundance of this species and the loss of its habitat since listing should support the continuation of listing.

Sentence 3. "In fact, recent studies have suggested that the range of the species and population densities are far greater than the conclusions of earlier studies."

Comment - This is not so. The known range has been modified since the original listing, but it has not been greatly expanded. In fact, a review of the current accepted range map may reveal a decrease in the known range of the MGS.

Sentence 4. "Studies conducted by the Bureau of Land Management (BLM) support the contention that large populations of MGS exist in excess of 7,000 square miles."

Comment - Although there may be some large populations of MGS which exist within a range of approximately 7,000 square miles, the more typical situation is small isolated, scattered populations.

Sentence 5. "This petition concludes that the preponderance of public lands managed by various federal agencies provides substantial management benefit to assure the continued existence of the species."

Comment - Although there are some relatively large blocks of public lands within the MGS range, most are small scattered parcels. Much of this land is not necessarily managed to the benefit of MGS. These public lands, as they now exist, will not provide the quality and expanse of relatively undisturbed lands necessary to support the species in perpetuity without isolating populations which could lead to local extirpations, the loss of genetic diversity and, eventually, potential speciation, if not complete extinction.

Page 2, Paragraph 2, Sentence 5. "Correspondence from the California Department of Agriculture was included as part of the record for this hearing which requested

that the MGS and other specified rodents be omitted from listing since they are involved in crop depredation."

Comment - Although MGS are involved in crop depredation, they do not cause any great damage to crops because of their limited numbers and patchy distribution.

Page 2, Paraghraph 3. Entire paragraph. "It is clear...as a "rare" species."

Comment - As previously stated, there was little information available on MGS prior to 1971. However, the data that were available did support the listing of the MGS. However, this point is really mute. The situation now is that appropriate information currently exists to support the continued listing of MGS.

Page 3, Paragraph 3, Sentence 4. "There is no conclusive scientific studies which have documented significant MGS habitat loss, adverse effects on population status, or other life history requirements."

Comments - Although there are no documents available which identify this, all one needs to do is overlay the MGS range map with current aerial photographs and land use maps to see that a significant portion of the range has been lost or is in danger of being lost to development. This type of information should be available from the CDFG and BLM in the near future.

Page 3, Paragraph 4, Entire Paragraph. "The 1977 Wessman study...to delist the species."

Comments - Although the Wessman study recognized an increase in the MGS range, it did not constitute a significant increase given the broad approach used to produce range maps; they are best estimates determined by "connecting the dots" of outlying observation points. There are portions of the original range map that have been delineated as MGS habitat, which are probably not occupied by the species. An updated version of the MGS range is being prepared by the CDFG and BLM which will more accurately reflect what MGS experts consider to be its range. This is largely based upon recent trapping information and habitat types occupied by the species and is, again, a best estimate. It is interesting to note that whenever a previously unreported population of a listed species is found, some draw the immediate conclusion that the species is no longer in jeopardy or should no longer be protected.

Page 3, Paragraph 5, Sentences 1, 5, and 6. "It is interesting to note that Hafner and Yates question whether the MGS is even a separate distinct species. .... Hafner and Yates concluded that insufficient evidence exists to substantiate conclusive scientific recognition of a separate MGS species. In the absence of conclusive scientific studies, the recognition of the MGS as a "threatened" species is premature and inappropriate."

Comments - I seem to have misplaced my copy of Hafner and Yates, but from what I recall, they did not conclude that these two animals were inseparable. In fact, I believe that only a few genetic loci were identical and only in a few specimens examined. This must lead one to conclude that the two squirrels are separate species. Even if the two squirrels are more closely allied, the MGS is behaviorally and physiologically different from the round-tailed ground squirrel and should at least be considered a separate taxon (subspecies). There has been a precedent set with the San Joaquin kit fox where a subspecies has been listed, so the same could hold true for the MGS.

Page 4, Paragraph 1, Sentence 3. "It would seem prudent for these additional studies to be undertaken before a species is listed as "threatened"."

Comment - While it would be nice to have information available concerning habitat preferences and comparisons of site use within habitats and between habitats, this

information is not a prerequisite to determining if a species should be considered threatened. In fact, that type of information is more important when assessing appropriate habitat management techniques for a species.

Page 4, Paragraph 2, Entire Paragraph. "In reviewing the habitat...for species propagation."

Comments - Although there is a large amount of federally owned lands that are inhabited by MGS, these lands are not necessarily managed for the species. These public lands, as they now exist, will not provide the quality and expanse of relatively undisturbed lands necessary to support the species in perpetuity without isolating populations that could lead to local extirpations, the loss of genetic diversity and, eventually, potential speciation if not complete extinction.

Page 4, Paragraph 3, Sentence 4. "Even Hoyt must conclude...nor to decide whether the species is truly endangered."

Comments - Although Hoyt did conclude that available information was not adequate to make exact quantitative statements about the animals present distribution or abundance, he also recommended that "The Mojave ground squirrel be retained on the rare species list" and that "Studies be initiated immediately to more closely identify those areas reported to be populated by Mojave ground squirrel and how these can best be preserved (Hoyt 1972 pg. 8)." These statements reveal Hoyts interpretation of the MGS situation at the time of his studies.

Page 5, Paragraph 1, Sentence 5. "The studies also show that females will control their habitat by not bearing any young to compete for limited food supplies during drought years."

Comments - This statement made by the author of the petition exhibits a very poor understanding of underlying biological principles. The females do not "control" their environment. Instead, they are responding to environmental conditions that are not favorable to the reproduction strategies of this species.

Page 5, Paragraph 1, Sentence 7. "These studies suggest that natural decreases in MGS populations may have nothing to do with habitat loss resulting from private development."

Comment - This is exactly correct. There are two factors to be considered here. One is the decrease in density or local extirpations of populations caused by environmental factors. It is presumed that as environmental factors once again become favorable in these areas, the animals will repopulate the areas. The other factor to be considered is the permanent loss of habitat due to development. This causes the local extirpation of populations with no chance for repopulation. These two factors are not related except as they combine to further threaten the species with extinction.

Page 5, Paragraph 2, Sentence 1. "The listing of the MGS as a "threatened" species lacks any basis in scientific fact."

Comments - This just isn't so. Although there is not a voluminous collection of data supporting the necessity of listing this species, the information that is available points to the need for listing. The simple lack of information related to the amount of effort expended to gather it supports the conclusion that the species is rare.

Page 5, Paragraph 3, Entire Paragraph. "The more contemporary studies...also supports this conclusion."

Comments - The studies referenced do not support the delisting of the species. Although these studies have shown that MGS are relatively abundant in some restricted areas, the results cannot be broadened and used to represent the entire range of the species. In fact, the multitude of trapping surveys that have resulted in negative results gives a better indication of the relative abundance and distribution of the species throughout its range.

Page 5, Paragraph 4, Entire Paragraph. "As previously indicated...area just expanded again?"

Comments - Again, this paragraph indicates that the author of the petition does not adequately understand the biology of the MGS. Dr. Leitner's studies have shown that MGS aestivation periods are tuned to environmental conditions, which may have affected the results of some trapping surveys. However, most of the trapping survey results are still probably valid. It has not been shown that MGS migrate for food! Additionally, local extirpations caused by environmental factors are responsible for MGS not appearing at the same location year after year, not that they are migrating. Where MGS persist, the same individuals are generally present (except for young, dispersing animals). CDFG no longer accepts trapping studies for several reasons. First, local extirpations may cause negative results in otherwise suitable, and typically inhabited habitat. This does not mean that the amount of habitat has increased when these areas are repopulated. Trapping studies are also not accepted any longer because of the patchely distributed nature of MGS. It is impossible to sample 100 percent of an area proposed for development and with the patchy distribution of MGS, animals may not be captured when, in fact, they inhabit an area in low numbers.

Page 6, Paragraph 1, Entire Paragraph. "Once again, the...existence of the species."

Comments - The species was not prematurely listed; all available information indicated that the MGS was threatened. Although MGS are not restricted to small specialized habitats, it does exist in isolated areas within its range. Further, populations tend to be low in density and small in size. Recent studies have not noted substantial increases in populations of MGS. They have just provided better information for several restricted sites in areas where MGS were previously known to occur. The development of private lands within the range of MGS will cause extirpations of some populations and isolate other populations. This would cause a decrease in genetic diversity and potentially cause speciation; it may also contribute to absolute extinction.

Page 6, Paragraph 2, Entire Paragraph. "The delisting of...to justify the listing."

Comments - Delisting of MGS is not long overdue. In fact, available data and the current local political climate suggest that it would be appropriate to petition the United States Fish and Wildlife Service to also list the species. Recent studies have not been conducted to try to justify continued listing; studies have primarily been conducted to more fully understand the biology of the animal and to determine appropriate mitigation for development projects, not to determine the population status.

Page 6, Paragraph 3, Entire Paragraph. "A variety of existing and proposed programs can adequately manage species habitat...These programs include..."

Comments - This entire paragraph is misleading. It suggests that the MGS (or its habitat) will be protected if delisting occurs. This is simply not the case. Most, if not all, of the protection measures listed in the paragraph would be eliminated if MGS were delisted. Contrary to what this paragraph states in its opening sentence,

there are no programs that have been proposed to help protect the MGS if it is delisted.

This petition has been prepared based upon economic considerations alone. It contains absolutely no relevant biological information that would substantiate delisting. While it is true that there is a general lack of information concerning this species, it is not due to a lack of effort by wildlife agencies or biologists. The fact is that the animals are rare and information is, therefore, difficult to obtain. Most of the recent information that has been collected on MGS has been the direct result of the species being listed; if it is delisted, the accumulation of information would virtually cease. The petition proposes to delist the species until more information has been collected. Where will the resources come from to conduct those studies? Certainly not from the private sector. Private developments occurring within MGS habitat have a responsibility to assume part of the burden to protect this species, including conducting information gathering studies. The delisting of the MGS would release private developers of this responsibility.

The petition claims that adequate protection measures would remain in effect if the species were delisted. This is not the case. MGS would no longer be considered in CEQA documents; many of the proposed developments would not require a review above the County level. This would not be in the best interest of MGS protection. Further, Jurisdictional Plans, General Plans, and cooperative land management programs would not be required to address this species. Additionally, military bases would not be persuaded to consider this species in their management plans (even now they are not required to consider this species because it is not federally listed). Delisting of MGS would critically affect the long-term survival of the species.

If I can be of any further assistance, please let me know.

Sincerely,

Curt Uptain

Curt Uptain
Endangered species biologist

cc:MSE/ceu

2. Summary of letter from Curt Uptain:

This letter refutes many statements made in the petition to delist the Mohave Ground Squirrel and concludes that the petition "has been prepared based upon economic considerations alone. It contains absolutely no relevant biological information that would substantiate delisting."

Dr. John Gustafson
Nongame Bird and Mammal Section
Wildlife Management Division
California Department of Fish and Game
P.O. Box 944209
Sacramento, CA 94244-2090

September 7, 1992

Dear John:

I have read the petition from the County of Kern Department of Planning and Developmemt Services concerning the Delisting of the Mohave Ground Squirrel (*Spermophilus mohavensis*) and I have the following comments to offer. My comments are given in reply by section heading.

(1) EXECUTIVE SUMMARY

The species was not "erroneously" listed as rare. Biologists trapping in the Mohave Desert rarely caught or saw this species. Few museums have adequate sample sizes because of this. See (2) BACKGROUND TO SPECIES LISTING below.

The statement that there is a lack of scientific research on the population, range, density, behavior, taxonomic relationships, and habitat preferences of the MGS is both misleading and patently false. Population and density estimates exist from work done by Leitner, myself and others. Behavior has been extensively addressed by Pengelley, Bartholomew, Adest, and myself. The taxonomic relationship of the subgenus *Xerospermophilus* has been addressed by Nadler and, more recently, Hafner and Yates (more on this later). Habitat preferences have been reported by Aardhal, Burt, Wessman, Leitner, myself and others.

The statement that the range and population densities are greater than the conclusions of previous studies is innaccurate. Although an increase in range has been reported the petition makes no notice of the massive loss of habitat (and squirrels) due to the development in the Palmdale-Lancaster-Rosamond-Mohave corridor and in the .Adelanto-Victorville area. Recent studies by Leitner and myself suggest that population levels vary dramatically from north to south across the species range. It rains more in the northern part of the range than in the south. I have always maintained, based on field observations, that rainfall is a key factor in food productivity and hence population size because the squirrel will vary (as Smith and Johnson found with the Townsend Ground Squirrel, *Spermophilus townsendi*).

The study conducted by the BLM (Aardahl) has many flaws: insufficient trap days yields inaccurate ratios of Mohave to Antelope Ground Squirrels and the lack of trap sites, in the sothern and western part of the Mohave Desert where development has been extensive, fails to show the very low population levels in that part of the range.

The conclusion of the petition that the preponderance of public lands managed by various federal agencies provides substantial benefit to assure the continued existence of the species is false. The 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 while off-road vehicle activity continues to dissect and dissipate habitat. The petition ignores the extensive loss of habitat and damage to existing habitat in the western Mohave Desert due to massive population infux and the attendant construction and off-road and other recreational activities of man.

(2) BACKGROUND TO SPECIES LISTING

At the time I began my Dissertation research I had discussions with scientists who had worked with and/or trapped for the MGS; Bartholomew, Hudson, Pengelley, Mayhew, Hoyt, and Adest. All these individuals told of how difficult it was to find them and three of them told me that the MGS was not a good Dissertation project because the squirrels were not abundant, were discontinuous in distribution, limited to the selected habitats in the Mohave Desert and thus I would have a very difficult time finding enough squirrels to study for a project! As I began my Dissertation research in the western Mohave Desert I found their concerns to be valid. I found the populations to be discontinuous and small; when the sociobiologist Sherman called my major professor, Kavanau, to ask it it were possible to obtain several hundred squirrels for an experiment, Kavanau told him that I had not yet seen that manyl Sherman, used to studying hundreds to thousands of aniamls at a time found this hard to believe and flew out here to have a look for himself. I showed him around; we found four squirrels that day. He went home unable to study the sociobiology of the MGS due to lack of sufficient numbers of the squirrels.

I believe that, given the current and future massive development of the Mohave Desert, and, given the reasons stated above, the Department's listing of the Mohave ground squirrel was a proper, justified, and appropriate course of action which should be maintained in place today.

Delisting Petition Comments-Cont.

(3) SPECIES DESCRIPTION

The statement that the U.S Fish and Wildlife Service Listing as a Category 2 species means that conclusive data are not available to justify a federal listing is not wholly correct. The listing in this category means that sufficient justification exists to draw our attention to a species which is under threat.

The dramatic incursion of human development on the Mohave Desert is staggering. The loss of habitat due to housing development, roads, and recreational activities in the Palmdale-Lancaster-Rosamond-Mohave corridor and the Adelanto-Victorville areas is known to those of us who have worked on the desert for the last twenty years; documentation from the Landsat program will bear this out. Those of us who have worked on the desert have seen the effect of local rainfall on local populations. Rainfall is discontinuous and therefore productivity will vary accordingly. Populations of squirrels, lacking rainfall and subsequent productivity, will fail to reproduce. After several years the local population, small to begin with, may dissappear. Under normal circumstances the return of rainfall within a few years would restore the local population. Development, if left unchecked, will usurp the habitat cutting off and isolating populations reducing repatriation and gene flow thus dramatically increasing the potential for extirpation.

The petition states that Hafner and Yates concluded that insufficient evidence exists to substantiate conclusive scientific recognition of a separate MGS species; that is a patently, outrageously, criminally false statement. Both the Nadler and Hafner and Yates reports state that the species is valid. The people who wrote the petition either cannot read english or are liars!

Hafner and Yates reported finding two loci shared by the MGS and the RTGS. This argument of hybrydization does not invalidate the species. It only suggests a level of relatedness. When you consider that domestic dogs, coyotes, and wolves hybridize to a much greater extent than the MGS (the canids share some 70+ loci and are obviously closely related but recently separated-and nobody is suggesting that these three are the same species) the low level of hybridization reported for the MGS and RTGS supports Hafner and Yates (and Nadler's) conclusions that these are separate species.

Electrophoretic data are but one means of species determination.

Morphology and behavior are two others. The morphology is very distinct between these two species as is their behavior: The MGS is solitary whereas the RTGS is a social-colonial species. The behavioral differences between these two act as barriers which reduce contact and therefore separate them. (As an outside example, one could look at the relationships of the various species of *Epidonax* fly catchers. These birds cannot be discerned by humans using morphology or electophoretics; the birds use reproductive behavior and song and do quite well, thank you!)

(4) HABITAT REQUIREMENTS

It is very difficult to compare different population estimates of the MGS in Shadscale, Creosote, and Joshua tree habitats because there has never been a concerted trapping program across the entire Mohave Desert. Trapping studies reveal some areas with viable populations, while others show no populations in existence. The distribution of MGS is clearly not uniform across its range on a year to year basis. Rainfall patterns vary; although somewhat more stable in the northern part of the range (Coso area) the southern parts are experiencing a severe drought and populations have become locally extinct. Even the Coso area appears to have had a local population become extirpated. It appears that the species depends on surviving local "seed" populations to re-establish broader distributions. It is imperative that the habitat remain contiguous to avoid isolation of gene flow!

The petition points out the extensive lands under federal "protection". The lack of BLM management of lands has been discussed previously; much of the military land is for training purposes. The land used for bombing, missile, or ground exercises may not be ideal habitat.

(5) DISTURBANCE/ABUNDANCE

Although studies conducted by Leitner suggest good population of MGS in the Coso area (where there is relatively abundant rainfall) he also reported that in one of his trapping areas the population dissappeared apparently due to the drought! I have seen this happen at my own study site at Blue rock Butte. In the Luz MGS study that I conducted (with ERT) near Kramer Junction, the ratio of MGS to AGS, after 3,500 trap/days, was 1:8. Studies I conducted at a variety of sites across the Mohave Desert for the Department of Transportation suggest population numbers that were very low to none in the southern and western Mohave Desert (where the impact of the drought has been more significant).

Delisting Petition Comments-Cont.

After 22,500 trap/days the ratio of captured MGS to AGS was 1:45! Another way to look at this is to compare the number of days it took to capture a given (one) individual of a squirrel species: RTGS took 15 days, AGS took 26 days, and MGS took 1184 Days!!

Once again, although Wessman reported range extensions he did not report of the loss of habitat in the Palmdale-Mohave and Adelanto-Victorville areas.

(6) NATURE AND DEGREE OF THREAT

The listing of the species was completely appropriate given the nature of the findings of scarcity of those scientists who worked on local desert species. Their experience parallels my own.

Our current understanding is that rainfall patterns, which are unpredictable in nature, ultimately determine the plant productivity of population levels and existence of the MGS. However, The Mohave Desert is not similar to other types of ecosystems such as forests or grasslands (which have relatively uniform rainfall patterns). Uniform rainfall produces (all things being equal) uniform stable plant productivity which, in forests and grasslands, is observable to the eye. The Mohave desert is not like that; when there is no rain for several years populations may become locally extirpated. Given the vagaries of the weather in the fragile ecosystem of the Mohave Desert it is not possible to determine with pinpoint accuracy (especially in the southern and western Mohave Desert) the condition of local populations on a long term basis. A study done three years ago may not be valid depending on what has happened in the intervening years. Thus it becomes difficult to point to population status of the various areas with accuracy on a decade to decade basis: With the evidence of local extirpations before us a conservative approach is warrented.

(7) CURRENT AND RECOMMENDED MANAGEMENT

I believe that the evidence supports a maintenance of the current listing.

(a) The DFG continuously reviews the status of the MGS and feels that the listing is valid.

(b) The BLM Coso program supplies information only on the MGS status in the Coso area where the rainfall pattern is different than in the

southern Mohave Desert. Information on habitat loss, rainfall, and population levels in the southern and western portions of the Mohave Desert are not being addressed.

(c) The western Mohave has been and continues to be extensively developed. How are we to maintain genetic viability of the species as the desert becomes fractionated by development?

(d) By the time Kern County prepares an Endangered Species Element of the General Plan there will be no habitat left to protect.

(e) The BLM is already understaffed and does not monitor adequately the activities on lands in its care. Livestock grazing and human recreational activities have taken their enormous toll on the habitat.

Michael A. Recht, PhD.

3. Summary of letter from Michael A. Recht:

This letter refutes a number of statements made in the petition to delist the Mohave Ground Squirrel and concludes that "I believe that the evidence supports a maintenance of the current listing [as a Threatened species]."

PRUETT, LAWRENCE & ASSOCIATES
BIOLOGICAL ASSESSMENTS

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Susan A. Cochrane, Chief, Natural Heritage Div.
California Department of Fish and Game
Sacramento, CA94244

Sept.8 1992

Dear Susan,

With respect to the request for data on the Mohave Ground Squirrel I have included the following comments that cover the period of Sherman trap live trapping from 1979 thru 1991. I am a former faculty member of Bakersfield College and did my graduate work at the MVZ. at U.C. Berkeley.

Home Range: Clearly the current distribution map of this species should be redrawn to reflect the absence of the species in the southwest part of the former range. Some 8000 trap days of daytime live trapping;& the modified map of the species distribution is included, but my records apply only to the Kern county segments.

Habitat reduction: Urbanization has significantly reduced the range of this species in the vicinity of Palmdale, Lancaster, Rosamond, Mojave, California City and Actis. Both residential growth and toxic waste disposal sites have displaced thisCT. squirrel during the past several decades.

Management recommendation: Rather than delisting the Mojave Ground Squirrel, I would strongly urge the CDF&G staff to request that the species be moved up to the endangered status as it is currently experiencing a comparable population decline with the Desert tortoise in this part of the state. Biologically, the threats to these tetrapods are reducing the population numbers at a rate faster than the sporadic field workers are able to accurately keep up with local shifts in the current numbers.

Sincerely,

George E. Lawrence PhD.

George E. Lawrence

19669 Banducci,Tehachapi

93561

MOHAVE GROUND SQUIRREL TRAPPING RECORDS

List below the locations, dates and numbers of any Mohave ground squirrels (MGS) you have captured or seen. (If any have trapped in numerous locations and have several records, it may be easier to copy sections of your reports or record forms.) For locations, please include township, range and section.
FOLD PAPER SO MY ADDRESS SHOWS ON THE OUTSIDE AND TAPE OR STAPLE CLOSED.

DATE	LOCATION	TRAPPED/SIGHTED/ROADKILL	NUMBER
May 24, 1981	Sec. 28,T9N.,R8W. EAFB. San Bernardino Co.	Sighted	2 MGS.

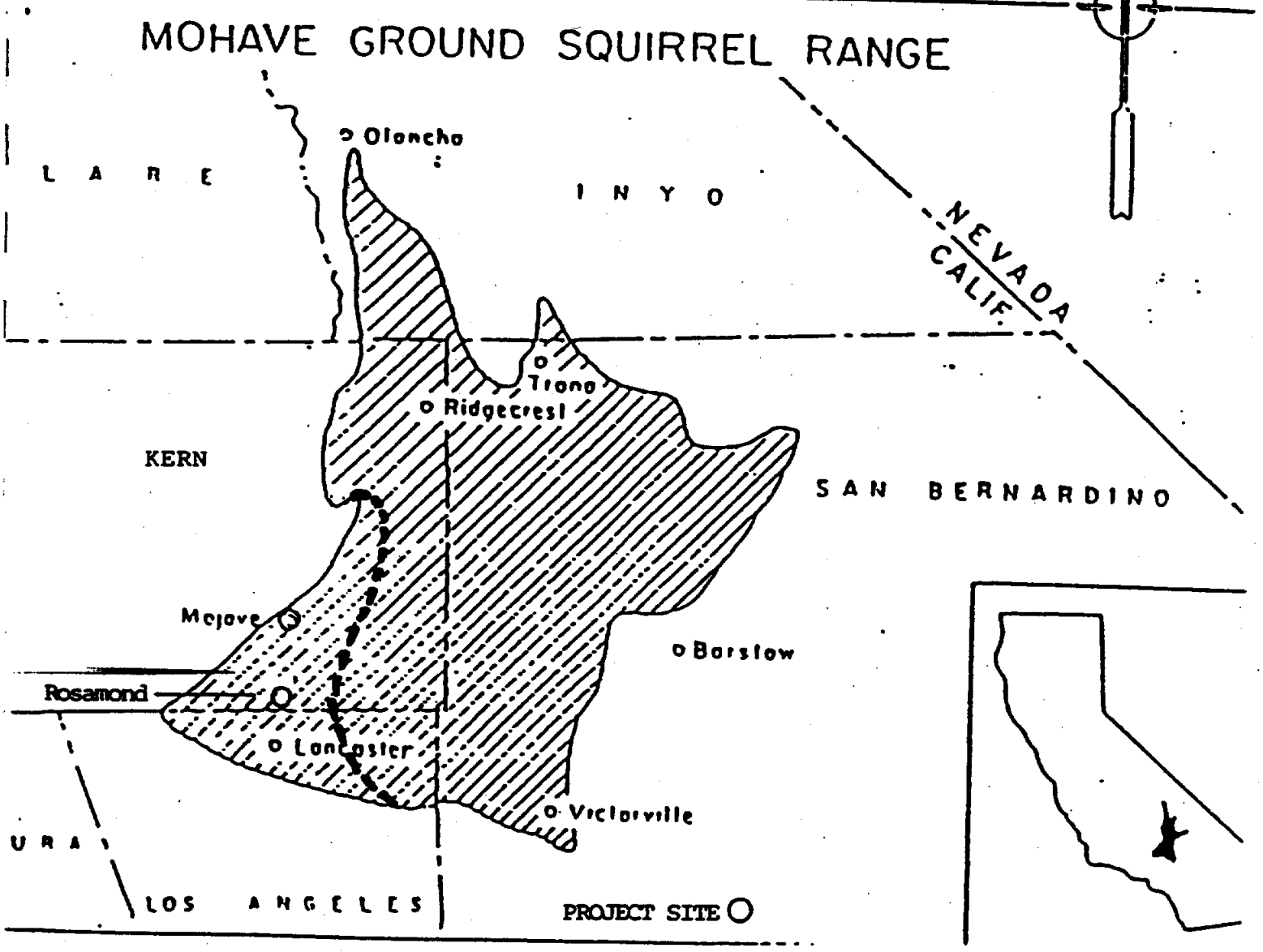
TRAPPING CONDUCTED, NO MOJAVE GROUND SQUIRRELS CAPTURED

DATE	LOCATION		TRAP Days
Nov. 1979	Sec. 18 T10N.,R10W.	EAFB. GE. site	5.
June 1980	Sec. 19 T1oN.,R12W.	EAFB. Target site	5.
May 1987	Sec. 6. T31S.,R38E.	Cantil area	3
March 1988	Sec 29. T11N.,R14W.	Mojave Camelot	10.
Apr. May 1989	Sec 15. T10N.,R12W.	Soledad Mtn area	10
Mar-May 1989	Sec 17 T9N., T13 W.	North Rosamond	10
Mar-May1990	Sec 12.T10N., R13W.	South of Mojave	10
Mar-May 1991	Sec 8. T32S.,R38N.	California City North	10
Mar-May 1990	Sec 22. T9N.,R13W.	Rosamond east	10
Mar-May 1990	Sec 25 T9N.,R14W.	Rosamond west	10

~~TRAPPED CONDUCTED, NO MGS OCCURRED~~

DATE LOCATION TRAP-DAYS

Figure 8.. Distribution area of the CT. Mojave Ground Squirrel range.



4. Summary of letter from George E. Lawrence:

This letter states that "the current distribution map of this species should be redrawn to reflect the absence of the species in the southwest part of the former range." It points out that "[u]rbanization has significantly reduced the range of this species in the vicinity of Palmdale, Lancaster, Rosamond, Mojave, California City and Actis." The letter concludes that, rather than delisting the Mohave Ground Squirrel, the species should be "moved up [reclassified] to the endangered status as it is currently experiencing a comparable population decline with the Desert tortoise [sic]...."

P.O. Box 3140
Hemet, CA 92546
14 September 1992

Rec'd NHD
SEP 18 1992

Natural Heritage Division
California Department of Fish and Game
1416 Ninth Street
Sacramento, CA 95814

To Whom It May Concern:

I wish to comment on the Kern County Planning Department's recent petition to delist the Mohave ground squirrel (*Spermophilus mohavensis*).

The CDFG public notice dated 10 June 1992 did not include a copy of the petition, nor did it say where copies were available. The notice just asked for information on the Mohave ground squirrel. It's the petition itself that requires comment, however, so I obtained a copy from the Kern County Planning Department. I was interested in the petition because its very existence seemed to imply that a new study had been done. If someone was able to prove that the species isn't really threatened after all, it would be welcome news.

As it turns out, the petition package contains no new data at all. It is an impressive document if evaluated by the pound, but the actual petition is only eight pages long. The rest consists of copies of familiar publications and reports on the Mohave ground squirrel (apparently reproduced without permission of the copyright holders). The petition implies that those publications somehow support delisting, but they do not. For example:

- A paper by Hafner and Yates is cited as evidence that the Mohave ground squirrel is not a separate species from the round-tailed ground squirrel (*Spermophilus tereticaudus*). In fact, the paper reached just the opposite conclusion! (I re-read the paper and also telephoned Dr. Yates, just to make sure.) But this argument makes no difference anyway, because the Endangered Species Act treats subspecies the same as full species.

- The petition cites various population studies as evidence that the species is common. Of course, there were lots of Mohave ground squirrels on the sites described in those reports. The studies were done on those sites *because* the squirrels were there, and *because* they were amenable to trapping and observation. This proves nothing about the status of the species elsewhere. The petition could have cited hundreds of (very brief) reports on sites where the species was *not* found.

- The petition complains that the 1987 Five-Year Status Report on the MGS did not mention the range extension reported by Wessman. On the contrary, the 1987 report cited Wessman's study, and the 1988 Annual Report included the expanded range map. But a species can occupy a fairly large geographic range and still be threatened, as witness the desert tortoise. (Will the tortoise be the target of the next petition?)

Despite these and other factual errors, I do not believe that the petition was intended to be misleading. The person who wrote it was not a biologist, and simply did not understand certain issues. But other statements in the petition are less easily explained. It claims, for example, that the proposed delisting would do no harm, because CEQA and various local programs would continue to protect the Mohave ground squirrel. Anyone versed in the CEQA process can tell you this is not true. If CEQA would effectively protect the species (and thereby limit development within its range), then who would benefit from delisting, and what is the purpose of the petition? Hundreds of nonlisted species meet the criteria in CEQA Article 20, Section 15380, Subsection (d); but in actual practice this has no effect. The biology section of an EIR normally contains a table of species in this category which could be impacted by the project--and that's it. For all but the largest and most controversial projects, the table is basically an obituary notice. And even if CDFG chose to protest such an EIR, wasn't there some recent ruling that bars them from filing suit?

The petition offers just one real argument for delisting--namely, the economic benefit to Kern County. I realize that California has economic problems, and it would be nice if these problems could be solved simply by pulling the plug on one species. But there is a lot more at stake here. If present trends continue, the majority of wildlife species in this State will one day qualify for the threatened and endangered list. The best way to avoid this scenario is to protect large areas as multi-species preserves, and *then* stop fiddling around with single-species clearance surveys. Yes, I know, this is hardly an original idea--but I don't see it happening, not on a large scale. The MSHCP concept is like the weather, in that (to coin a phrase) everybody talks about it but nobody does anything about it.

The petition alludes to a future HCP which will protect desert wildlife, including the Mohave ground squirrel--but on the implied condition that delisting must happen *first*. I have heard this reasoning before, and I didn't understand it then, either. This future world of sensitive wildlife management, with man and nature working hand in hand, sounds suspiciously like the Rapture. Maybe it's coming, and maybe it isn't; but meanwhile we must all take responsibility for our own actions, or face the consequences. If nobody wants to pay for an HCP now, why would this level of motivation increase, once the species is delisted and the legal requirement is removed? And if the Mohave ground squirrel is as common as the petition claims, why would it need this protection anyway?

Whether the Mohave ground squirrel is threatened today makes absolutely no difference. It's getting there; everything is. If the only mechanism available to protect large areas of the western Mojave desert is the threatened status of this one squirrel, then that status must be retained. But in case the law does not recognize such convoluted reasoning, I should add that, in my opinion, the Mohave ground squirrel *is* sufficiently threatened to warrant its continued listing. Although there is strong evidence for direct human impacts, these need not be proven in order to define a species as threatened. Biogeographic data suggest that the Mohave ground squirrel is succumbing to competitive exclusion, perhaps hastened by changes in climate and land use patterns. (Some of the authors cited in the Kern County petition reached this same conclusion.) This trend alone qualifies the species for listing under the fourth criterion stated in the petition, i.e., "other natural or man-made factors affecting the species' continued existence."

I have not done any MGS work for the private sector, so I cannot be accused of having a major financial stake in the outcome of this debate. I am, however, fully qualified to offer a biological opinion, and will forward my curriculum vitae on request. I maintain that it would set a dangerous precedent to delist a threatened species solely for economic reasons, and I urge the California Fish and Game Commission to reject this petition.

I am not quite finished. As the Commission surely knows, there is a serious problem with enforcement. If the effect of the California Endangered Species Act is simply to delay some projects, without ultimate benefit to the Mohave ground squirrel or to the people of California, then it makes no difference whether any species is listed or delisted. But this is *not* the fault of the law, nor justification for repealing it (or its Federal counterpart). The fault lies with the people who break it, and the ones who fail to enforce it. Biologists also must accept a share of the blame, to the extent that we have failed to develop adequate survey methods. Articles in recent APA newsletters have actively encouraged land owners to defy CDFG (see, for example, the September 1992 issue of *California Planner*). It is rumored that some developers, following this advice, have told CDFG to jump in the lake, and have gone ahead with their projects, but have not been prosecuted.

The MGS has well-known habits that make trapping studies difficult and unreliable, so biologists often cannot tell whether this species is present on a given project site or not. Developers who do not understand this problem often assume that we are being deliberately vague, when in fact we are being honest. One or two consultants have met this challenge by claiming that they can just look at a site and tell whether any Mohave ground squirrels live there, but this is not science; these people should be selling vacuum cleaners. A more constructive response to the dilemma was CDFG's new Cumulative Human Impact Evaluation procedure, which is a step in the right direction. But the CHIE method has received, at best, mixed reviews from biologists and developers alike.

The main problem is that no one really knows the habitat requirements of this species, so the Cumulative Impact Rating has no known relationship to the appropriate level of mitigation. Many people (notably the membership of APA and BIA) feel that, in order to ask for mitigation, you need some rational method of quantifying impacts. For the Mohave ground squirrel, we have only a circular definition: MGS habitat is desert land that has MGS living on it. And this leads us back to trapping surveys, which don't work. We need a better method.

(N.B. While I was writing this letter, I received a notice that the revised Cumulative Human Impact Evaluation method will be taught in a two-day workshop later this month, and that I must attend if I want to "retain my status as an evaluator." Maybe the new method is better than the old one. I'll find out, if my boss lets me miss two days of work.)

I will conclude my letter with two anecdotes. Biological consultants often are treated to rare glimpses of human nature. In the interest of fairness, these insights must be shared, not only with the Commission but with the public--particularly those members of the public who use the term "balanced environmental perspective" more than once a week. You understand the anger on one side of the debate, but not the other. You have the right and the responsibility to know both sides.

1. A couple of years ago, I attended a Mohave ground squirrel workshop sponsored by one of the desert cities. A developer spoke to the audience and explained that he would like to do MGS surveys on his property, and he was perfectly willing to pay mitigation fees, but he just couldn't find a qualified biologist who was available, or anyone who could tell him what he should do, because we were all booked up for months in advance. He said he was just about ready to abandon his projects altogether, which would be bad for the County, etc. This sounded reasonable, so I decided to relieve the obvious strain on my colleagues by applying for my own MOU. My application was approved, and my name was added to the list of MOU holders. I then called the developer who had given the talk, introduced myself, and said I would be pleased to do his MGS surveys on short notice and at competitive rates. He said he had never needed such a survey, but would keep my name in case he ever did. I then figured out that I had missed the whole point of his talk. He didn't want a solution, he wanted a problem. Problems often are more useful than solutions.

2. The head of a well-known Orange County consulting firm once called and asked me to write a negative MGS survey report, on desert property I had never seen, so that his friend could build some sort of factory. He promised to "make it worth my while," and eventually offered me the magnificent sum of $100. (An MGS clearance survey, at that time, typically cost about $4,000 and the result was never specified in advance.) I asked why he had selected me for this signal honor, and he replied that I sounded like an intelligent person who would listen to reason. After discussing the offer at sufficient length to be certain that I understood what he wanted, I hung up. Did I turn him in? *Moi?* How would I prove what he said, and what agency would be willing to prosecute him anyway? My name would be mud, and the guy would probably turn around and sue me for defamation of character or something.

I have one more thing to say to the building industry, and to the Kern County Planning Department, and to everyone who thinks the Mojave Desert would be a perfect place for a really big mall. We biologists do *not* spend our days strolling through daisy fields, having fun at your expense, finding new ways to take away your money and your property and your God-given right to destroy the ecosystem. We work hard to support our families, and we take a lot of crap from people who don't understand what we are doing; and as a result, sometimes we get tired, and sometimes we are guilty of tunnel vision. These same statements apply to you. With so much in common, can't we talk?

Sincerely,

Joan R. Callahan

Joan R. Callahan, Ph.D.
(AKA Joan Callahan-Compton)

5. Summary of letter from Joan R. Callahan:

This letter comments that "the petition package contains no new data at all", refutes a number of statements made in the petition, and offers the opinion of the writer that "the Mohave ground squirrel is sufficiently threatened to warrant its continued listing."

NATURE BUFFS
ENVIRONMENTAL SERVICES

Michael Starr & Valerie Vartanian
8820 Odessa Avenue
Sepulveda, CA 91343
(818) 892-0418

September 26, 1992

To: Natural Heritage Division
California department of Fish and Game
1416 Ninth Street
Sacramento, CA 95814

Subject: **Petition to delist the Mohave ground squirrel (*Spermophilus mohavensis*)**

Introduction

I am a Ph.D. student in the Department of Geography at the University of California at Los Angeles. In conjunction with this institution, I hold a Memorandum of Understanding (MOU) with the California Department of Fish and Game (CDFG) to study the Mohave ground squirrel (MGS). In addition, I am an instructor for the CDFG's Cumulative Human Impact Evaluation (CHIE) of MGS habitat. As a result, during the last 3 years, I have conducted pilot trapping surveys at 10 locations and conducted 5 CHIE surveys within the western Mojave desert. The results of this field work, coupled with my research of the literature and regular contact with other biologists currently conducting MGS research, support the conclusion that the Mohave ground squirrel should not be delisted at this time.

With regard to the petition itself, the points made within the document that are intended to support the argument to delist the MGS fall into 3 main categories. The first is that protection of this species has negatively affected both economic growth in Kern County and individual property owner's ability to utilize their lands. This category is clearly irrelevant according to both the criteria of California's Endangered Species Act (CESA) and the California Fish and Game Commission's guidelines for the delisting process (FGC

760-1). The second category is that the MGS was "erroneously" listed as rare in 1971. In addition to the fact that this is not a relevant issue (their present condition is what must determine their current listing), the scientific studies cited by the petition have generally been misinterpreted and/or misrepresented. The third category is that "recent" studies suggest that MGS range and population densities have increased (or been shown to be larger than previously thought) and that as a consequence, the current amount of lands presently managed by public agencies is ample to protect MGS habitat. This argument is also flawed because the data cited are at best misleading or at worst incorrect and most of the work cited is over 10 years old. Further, less than 50% of MGS range is on public lands. Therefore, the petition itself does not adequately make the case for delisting the MGS.

The Petition's Use of Scientific Studies

The petition cites from a number of studies on the MGS to make 2 main points. The first is that given the lack of information on MGS range, population densities, habitat preference, etc., the species was "erroneously" listed in 1971. Though many would argue this premise (in fact all the MGS researchers responding at the time recommended listing), the issue is not relevant. Second, the petition uses the same argument, supplemented with more recent studies to support the contention that the problem of insufficient knowledge to list the MGS persists and that recent studies suggest that the species is in better shape than previously thought. However, these studies have either been misrepresented or misinterpreted to support this contention.

An example of the latter in support of the "erroneous" listing contention is the petition's citation of Hafner and Yates (1983). The petition states that based on these scientists genetic research, and their discovery that the MGS has interbred with round tail ground squirrels (*Spermophilus tereticaudus*) the petition concludes that "insufficient evidence exists to substantiate conclusive scientific recognition of a separate MGS species" (p. 3). This is both a misrepresentation of their work and a misstatement of their conclusion. In fact, Hafner and Yates found only one site of interbreeding with no species overlap along their shared boundaries ("a broad front of parapatry" p. 403). With regard to the issue of one vs two separate species, Hafner and Yates conclude: "In light of the chromosomal and electromorphic divergence observed between the

two taxa, and in lieu of a more detailed analysis of the genetic interactions of the taxa ... we retain full species recognition of *S. mohavensis*" (p. 403).

Another example of such misrepresentation is the petition's use of Hoyt's (1972) study to "show" that the apparent rareness and limited distribution of MGS is due to poor and/or limited study methods. The petition states that Hoyt utilized "minimal live trapping" during his survey with "many of the live trappings occurring during winter MGS estivation periods" (Petition p. 4). In fact, all of his trapping was done between March and June, 1972 and while it was limited in scope, the purpose was solely to survey sites known to have high populations (according to MGS researchers Bartholomew and Pengelly) previously. The very low number of animals trapped, leads Hoyt to recommend that the MGS "be retained on the rare species list" (p. 8).

Similarly, the petition cites the Wessman (1977) study that added 1800 sq mi to the known MGS range as proof that the species are in better condition with lesser threats to their habitat than the "rare" listing suggests. However, the petition fails to note that Wessman also suggested the removal of the area between the Lucerne Valley and the Victorville from the MGS range map and further suggested that this and additional habitat loss may be due to "agriculture and urban development" (p. 13). It should also have been noted that of the 24 new sites, 10 of them had only one MGS capture (total of 37 individuals at all 24 sites), suggesting low population densities. These facts (left out of the petition) led Wessman to also recommend that the MGS "should be retained on the state Rare Species List" (1977 p. i).

The petition goes on to cite Aardahl & Roush (1985) as a "more contemporary" study, not mentioning the fact that all the trapping was done in 1980 making population range and density data at least 12 years old (more on this point below). The petition notes that many of the sites had high MGS capture rates, in some cases exceeding those of the sympatric antelope ground squirrel (*Ammospermophilus leucurus*) captures (AGS), suggesting that since the latter aren't listed, the MGS should not be either. This, of course, ignores the fact that the AGS range throughout the Mojave, Sonoran, Great Basin and Chihuahuan Deserts, thus overlapping with the ranges of many other ground squirrels (as the round tail and the Townsends -- *S. tereticaudus*) while the MGS occurs only in the

western Mojave Desert and do not appear to overlap at all with the others. The petition also fails to note that these surveys were conducted after a number of wet seasons (good for annuals which would increase the MGS densities) and that Aardahl and Roush note a continuing "significant" loss of MGS habitat due to agriculture and urban development (p. 1).

The most recent work cited by the petition in this context is the ongoing research of Leitner and Leitner (1988 to present) in the Coso Basin. The petition states that these studies "reveal high population densities of the MGS" (p. 5) in this area suggesting again that the species is not threatened. Yet the petition fails to note the tremendous decrease in MGS captures at all 4 sites during the study period with a local extinction of MGS occurring at one site (and not recovering after last seasons rains; Leitner, pers comm to M. Starr). The petition also suggests that poor trapping protocol (mis-timing due to variable estivation cycles) may account for low numbers of MGS captured in other studies (again suggesting that the species is not rare). The petition fails to note that shorter trapping periods are due in large part to the lack of juvenile MGS activity in early summer, which in turn results from reduced reproduction by the MGS adults because of poorer environmental conditions. Therefore, poor trapping success continues to be an important indicator of reduced MGS numbers, especially in areas where previous MGS population data exists (as Coso Basin).

The Current Condition of the MGS: Recent Field Results and Continuing Threats to the Habitat.

More relevant to the delisting question is the current condition of the MGS throughout its range and of the current threat to its habitat. Most MGS researchers and biologists conducting small mammal trapping surveys for EIR's in the western Mojave Desert have reported very limited success regarding the MGS in recent years. Some question the significance of such results, citing the apparent trap-shyness of the MGS. However, such results become quite significant in areas that have previously been trapped successfully. One example is the work of Leitner and Leitner discussed above which showed no MGS reproduction on their sites in 1990 & 1991 and local extinction on one study plot.

Our spring 1990 trapping survey showed similar results. We trapped 8 different sites that season, 6 of which were follow-up surveys of

sites previously trapped successfully by Aardahl and Roush in 1980. We choose these sites because they represented 3 different vegetation communities and all 6 sites had had high MGS population densities (in 1980). However, during our surveys (which followed their methodology), we did not catch a single MGS (and only averaged one AGS per site) on any of the 8 sites and none were observed in any of these areas during the 3-day surveys. Like Hoyt in 1972, we found that areas with previously large MGS populations were no longer occupied. These results, when coupled with similar negative results, suggest that MGS populations throughout their range have been severely reduced (probably due in part to the recent drought), thus warranting continued listing.

One of my research questions is the effect of continued human activity on the MGS, especially in areas adjacent to urban development. While my research continues in this area, it is certainly clear that the rapid pace of development poses a significant threat to the MGS simply by the removal of potential and/or occupied habitat. In the last decade, population growth in the cities of the western Mojave Desert has averaged nearly 100% (ranging from a low of 30% for Barstow and Mojave to the highest rates of Victorville at 186% and Palmdale at an incredible 460%). Associated with such growth is an increase in supporting structures as new houses (up more than 50%), shopping malls (up 30%), roads etc. Together these land uses have resulted in a greater than 50% increase in the loss of open lands (amounting to hundreds of square miles). Worse, such growth is projected to continue well into the next century, fueled in part by the net outward migration from Los Angeles (see Allen 1990, Anderson 1990, U.S. Census Bureau). Clearly, such a continuing loss of habitat, particularly for a species endemic to this island-like area, poses a serious threat to its long term survival therefore warranting continued listing.

One final point needs to be made with regard to the range of the MGS. The petition suggests that the more than 7000 sq miles "occupied" by the MGS is more than enough to assure its long term viability. Unfortunately, the petition does not include the amount of land that has been lost due to agriculture and urban development, nor does it consider the potential future losses of this finite habitat. In addition, the petition seems to assume that the MGS are more or less evenly spread throughout this range. However, this species appears to only occupy a small percentage of this area at any given time (perhaps due to the uneven distribution of rainfall according to Dr.

Recht) and in relatively low population densities. As a consequence, large areas must be protected in order to assure that the critical combination of good habitat, minimum precipitation and the presence of MGS has a greater likelihood of continuously occurring at some point within the range. While public lands could address this need, the fact that less than 50% of the MGS range lies within such boundaries suggests that more needs to be protected.

Conclusion.

The Petition has not presented a well documented case in support of its desire to delist the MGS. All of the studies cited have been misrepresented to "support" this desire and yet a careful reading clearly shows that all of the studies concerned with population and distribution of this species support continued listing of the MGS and/or the fact that the MGS range continues to be threatened by agriculture and urban development. Current field studies suggest that the recent drought has severely reduced the already rare MGS throughout its range, a range that has been significantly reduced over the last 20 years (since the original listing) by the continuing onslaught of development. Given the island-like nature of the range of the MGS (surrounded by inhospitable habitat), and their wide but disjunct distribution, a large area must be preserved to protect them from further loss and to assure their long-term viability. This can only occur if the listing is maintained.

If I can be of further assistance in this matter, please feel free to contact me.

Sincerely,

Michael Starr

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Wessman, E.V. 1977. The distribution and habitat preferences of the Mohave Ground Squirrel in the southeastern portion of its range. Calif. Dept of Fish and Game, Wildlife Mgmt. Branch, Rep. 77-5.

6. Summary of letter from Michael Starr:

This letter comments on the legal irrelevance of the contention in the petition to delist the squirrel that the status of the Mohave Ground Squirrel as a Threatened species is causing a negative economic impact and that the squirrel was erroneously listed as Rare in 1971. The letter refutes many statements in the petition regarding the results of scientific studies and points out that the petition did not address the considerable loss of habitat in the last decade within the range of the squirrel.

The letter concludes that the petition "has not presented a well documented case in support of its desire to delist the MGS. All of the studies cited have been misrepresented to 'support' this desire and yet a careful reading clearly shows that all of the studies concerned with population and distribution of this species support continued listing of the MGS and/or the fact that the MGS range continues to be threatened by agriculture and urban development. Current field studies suggest that the recent drought has severely reduced the already rare MGS throughout its range, a range that has been significantly reduced over the last 20 years (since the original listing) by the continuing onslaught of development."

3801 West Temple Avenue
Pomona, California 91768-4032
Telephone (714) 869-4038

October 1, 1992

Biological Sciences
College of Science

Susan A. Cochrane, Chief
Natural Heritage Division
California Department of Fish and Game
1416 Ninth Street
Sacramento, CA 95814

Dear Ms. Cochrane,

I am writing in response to your Public Notice of June 10, 1992 requesting comments on the proposed delisting of the Mohave Ground Squirrel (MGS). In 1972 I was employed by the California Department of Fish and Game to conduct a study of the status of the MGS. My report of that study ("Mohave Ground Squirrel Survey, DFG) is referred to in the Petition to the Fish and Game Commission to delist MGS. I have two comments to make.

In the petition (page 4) it is stated "...the scope of his study was cursory in nature *with many of the live trappings attempted during winter MGS aestivation periods.*" (Italics mine). I think this is a misrepresentation of the facts. As the Petition states, the aestivation period ends sometime in February. The trapping dates in my study were: Feb. 12, Feb. 19, Mar. 29, May 21, June 14, June 25. Additionally, the Petition states on Page 5 "Even the studies that were immediately subsequent to the 1971 listing were inconclusive and based on generalizations rather than scientific fact. Hoyt's study is such an example." I must strongly protest the allegation that my study was not based on scientific fact. I surveyed museums and trapped animals; these are valid scientific facts.

Secondly, I think that the total "habitat area" of 7,000 square miles referred to in the Petition could be a very serious over estimate of the potential habitat of the MGS. The survey of museum specimens which I reported in my study revealed that most of the animals that had been collected came from the perimeter of the species range. Rainfall isopleths for the Mohave Desert show that much more rain falls around the perimeter of the desert than falls in the central area. If the success of the species is causally liked to rainfall, perhaps via the production of annual plants, then the species will have a very patchy distribution and much of the "habitat area" will not be available to them because of insufficient rainfall.

I would like to suggest that there may be an unexploited source of useful information on this species which is available to your department. If you have issued collection permits for Antelope Ground Squirrels in the Mohave Desert, then these people should, at least occasionally, catch MGS if they are present in the same localities. If you were to write to these people, they might be able to supplement our understanding of the abundance of MGS. If I can be of any further assistance in addressing this issue, please contact me immediately.

Sincerely,

Donald F. Hoyt, Ph.D.
Professor of Biological Sciences

cc: J. Gustafson

7. Summary of letter from Donald F. Hoyt:

This letter is from a scientist who has conducted field studies of the Mohave Ground Squirrel and whose work (Hoyt 1972) was discussed in the petition to delist the squirrel. The letter refutes the analysis of Hoyt (1972) in the petition as well as the contention of the petition that the squirrel occupies 7000 square miles of habitat.

9 October 1992

NEW MEXICO MUSEUM OF NATURAL HISTORY

Office of Cultural Affairs, State of New Mexico

Post Office Box 7010 Albuquerque 87194-7010

(505) 841-8837

FAX: (505) 841-8866

Dr. John Gustafson
Nongame Bird and Mammal Section
Wildlife Management Division
Department of Fish and Game
P.O. Box 944209
Sacramento, CA 94244-2090

Dear Dr. Gustafson:

I appreciate this opportunity to comment upon the petition submitted by the Kern County Department of Planning and Development Services to delist the Mojave Ground Squirrel, *Spermophilus mohavensis*, which is currently listed as Threatened by your department, and is being considered for protection under the Federal Endangered Species Act. I find the petition to be an irresponsible distortion of the available literature, while the purportedly "scientific" arguments made in the petition to substantiate the robust health of the species display either a gross ignorance of or blatant disregard for basic biological principles.

I concur completely with the initial response from your department (dated 24 February 1992) to this petition. The petition lacks scientific information and credibility, and should have been rejected out of hand. I must seriously question the Fish and Game Commission's judgement in accepting this petition, and thereby shifting the burden of proof to your Department. I would hate to think that a commission charged with such an important responsibility would be politically or economically motivated. The motives of the petitioner are quite clear: this species is blocking economic development. In effect, acceptance of this petition begins to pull the teeth from the entire purpose of state and federal Endangered Species Acts by declaring that protected status ends when endangered or threatened species stand in the path of economic gain.

In addition to comments on specific aspects of the petition, I have enclosed a copy of my most recent manuscript (currently in press in the *Journal of Mammalogy*). This paper documents the small geographic range and probable low vagility of this species, and further indicates that there may well be other unique populations of plants and animals (as yet undiscovered) in this small corner of the Mojave Desert. It appears that the range of the Mojave Ground Squirrel marks the site of a cool, mesic desert refugium during the latest glacial-pluvial maximum, which ended 6,000 to 10,000 years

ago. The system of lakes and interconnecting rivers that defined and delimited this refugium certainly isolated other species in addition to the Mojave Ground Squirrel, and wider-ranging surveys are necessary to detect these possibly cryptic forms before they are scoured from the desert by rapidly expanding urban development.

Specific Status of the Mojave Ground Squirrel.--The petition states (p. 3) that "Hafner and Yates question whether the MGS is even a separate distinct species" and that "Hafner and Yates concluded that insufficient evidence exists to substantiate conclusive scientific recognition of a separate MGS species." This is an absolute distortion that is completely contrary to our stated conclusions. We documented a consistent diploid number difference between *S. mohavensis* and *S. tereticaudus* (the Roundtailed Ground Squirrel), and found that the small amount of hybridization was restricted to a narrow, ecologically disturbed site. We concluded (1983:403) that " the degree of genetic intermixing documented here... is considered insufficient to substantiate full genetic introgression between the two species" and therefore recommended to "retain full species recognition of *S. mohavensis*."

We also noted in our paper that premating isolating mechanisms (ecological or behavioral) may keep the two species separate, and that the observed hybridization may be directly due to the severe disturbance of the Helendale site. Similar breakdown of premating isolating mechanisms have been observed in other mammals that have been displaced from their natural habitat and artificially forced together in and around agricultural fields.

The petitioners further "summarize" our 1983 paper as "occurrence of speciation for the MGS is still unknown." Again, this is a clear distortion of our paper, deliberately implying that species recognition is in doubt. Instead, we stated (1983:403) that "the limited geographic range of *S. mohavensis*...is [not] delineated by obvious orographic features" and that "if speciation in *S. mohavensis* and *S. tereticaudus* occurred via isolation in different desert refugia during glacial maxima, the locations of these refugia are unclear." We did not doubt that speciation had occurred; we simply did not know where or by what mechanism. My current article (in press) identifies the glacial-maxima isolating mechanism.

These self-serving, deliberate distortions and misrepresentations of our article are deplorable. Are the other "citations" similarly twisted to the petitioner's point of view? I hope that in the future the Commission relies on the expertise already available in your department to screen out such obvious attempts to sabotage environmental protection for personal gain.

Size of Geographic Range.--The petitioners display gross ignorance regarding the relative size of a species' range, and lack any understanding of the differences between local population density and geographic range. By any measure (comparison with other mammal species, with other rodent species, with other squirrel species), the Mojave Ground Squirrel is restricted to a tiny geographic range. While 7,000 mi^2 may appear to be a large area to a developer with a bulldozer, it is not a large area for an entire species range. Furthermore, it is well known that the Mojave Ground Squirrel colonies are very precinctive and spotty within this already small range.

When considering massive habitat alteration and destruction (as is contemplated by the petitioners), the fact that isolated colonies display "dramatically high population and densities" is meaningless; whether high or low densities, the population will disappear along with the habitat. Rather, it is the geographic spread of colonies (small and precinctive in nature) and the entire species range (small in comparison with other species) that is important.

Vagility?.--The petition inferentially cites a Department of Fish and Game correspondence that may state something to the effect that the Mojave Ground Squirrel "may migrate for food and may not appear at the same location year after year." (I am not certain if the petitioners were intending to cite this information from that correspondence, or, if so, if this is another distortion; frankly, I have no reason to accept the veracity of anything the petitioners state.) My most recent study indicates an extremely low vagility for this species (an average movement of about 5 *meters* per year). If migration is indeed this low, then extirpation of a colony could require many years before recolonization, underscoring the spotty and uneven distribution of colonies within the available range.

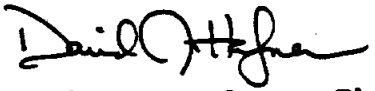
Protection(?) on Federal Land.--The petitioner implies that Mojave Ground Squirrels will gain protection even after

delisting by virtue of the large percentage of their range that is managed by federal agencies, particularly the armed forces. My observations of bombing ranges and military lands has generally agreed with this, but only in a relative sense: repeated bombing, strafing, microwave experimentation, and pounding by tanks and ground transports are not as bad as off-road vehicle races or housing developments for native species. Explosives attacks aside, can you imagine the impact on a hibernating colony of squirrels that is overrun (literally) by hundreds of tanks on maneuver? Not only would many individuals be immediately killed and burrow systems (usually occupied sequentially by generations of squirrels) be collapsed, but the ground is compacted and vegetation scoured, making the outlook for the few survivors bleak indeed. And if migration is not really a feasible alternative, then another colony is extirpated. As for the BLM-administered lands, I have witnessed the effects of the large off-road vehicle races which are permitted by the BLM: the soil compaction and vegetative damage are incredible in severity and longevity.

In closing, I sincerely hope that the Commission simply made a mistake in accepting this petition in the first place, and that your Department will be able to reject the petition for delisting. Further, I encourage your Department to use what meager funding is available to conduct surveys in this small corner of the Mojave Desert in order to detect other, possibly cryptic unique populations and species that are deserving and in dire need of protection from land developers. When I conducted field work at the Helendale site, where the two species of ground squirrels were hybridizing, I worked around cultivated fields and patches of tumbleweed, next to tract housing and sprinkler-fed bluegrass lawns. Most native vegetation was gone, replaced by blowing sand, weeds, or crops. I certainly hope that this is not the fate of the Mojave Desert.

If I can be of any further assistance, please do not hesitate to call or write to me. Again, thank you for this opportunity to comment on the petition.

Sincerely,



David J. Hafner, Ph.D.
Curator, Vertebrate Zoology

8. Summary of letter from David J. Hafner:

This letter is from a scientist who has conducted field studies of the Mohave Ground Squirrel and has made a determination about its taxonomy. His work (Hafner and Yates 1983) was discussed in the petition to delist the squirrel. The letter finds the petition "to be an irresponsible distortion of the available literature" and refutes the analysis of Hafner and Yates (1983) in the petition as well as other statements from the petition.

October 30, 1992

Dr. John Gustafson
Nongame Bird and Mammal Section
Wildlife Management Division
California Department of Fish and Game
1416 Ninth Street
Sacramento, Ca 95814

Dear Dr. Gustafson,

I was shocked that the Fish and Game Commission voted in April to accept a delisting petition for the Mojave ground squirrel based upon economic needs rather than scientific information. I was further appalled to learn that the burden of proof for the delisting petition has been placed on the overworked Fish and Game staff rather than the petitioners. After reading the petition, I realized that they have misquoted the scientific literature and taken portions out of context. As a scientist that has studied the squirrel since 1978, I feel the need to comment on the petition. I imagine that some of the following comments have already surfaced in CDFG staff meetings, but please excuse any redundancy.

1. The subjective opinion of a "widespread" or "large" range of 7,000 square miles is small in a biological sense for a rodent. Only a percentage of that area is occupied habitat, as rocky hillsides, flat playas, roads and developed areas are not suitable.

2. Since the listing in 1971, the range of the species has been reduced, principally through development in the Indian Wells and Antelope Valleys and the Hesperia/ Victorville areas. Furthermore, this development has splintered the range of the squirrel, so that breeding populations are isolated and may be in jeopardy. It should be noted that the flat land with loose soil most preferred by developers is also prime MGS habitat. This loss of viable habitat is not compensated for by the 1977 study of a "substantial 1800 square mile increase in the range of the MGS", of which only a fraction is occupied habitat.

3. Whether or not the listing of "rare" was valid in 1971, the MGS is definitely "threatened" now due to "the destruction, drastic modification, or severe curtailment of a species habitat". They are "likely to become endangered in the foreseeable future in the absence of special protection and management efforts". The petitioners state that the listing of the MGS lacks any basis in "scientific fact", however their evidence is based on generalizations rather than "scientific fact". The burden of proof for delisting should rest with the petitioners and require them to fund the critical studies to substantiate their claims.

Any recent trapping studies including those at Cerro Coso College and Coso Hot Springs show a decline in MGS populations. The studies called for in page 4, paragraph 2 should be undertaken before any delisting is considered.

4. Only two rather than "several" species of ground squirrels do not inhabit the Western Mojave Desert, the Mojave and the antelope ground squirrels. The round-tailed and the Mojave overlap slightly near the eastern edge of MGS range, but even the finding of a hybrid does not mean that the species are not distinct. The hybrid was probably infertile, and the round-tailed and MGS are both physically and behaviorally distinctive.

5. The main concern of the petitioners is that the MGS listing restricts the right of property owners to use their land and is inhibiting the economic growth of east Kern County. Actually the current economic picture is not conducive to development and the MGS has been a scapegoat. They fail to note that MGS habitat is also desert tortoise habitat. Will they next take on the tortoise? Biological issues should not be settled on economic expediencies.

6. The petitioners state that if the MGS were delisted it would still receive legal protection. Under current management recommendations, if the MGS were delisted, it would not be protected by CEQA, or need to be addressed in any mitigation requirements or HCPs. Open space and nonintensive land use in any general plan do not protect MGS if grazing, mining and ORV use continue. This is also true on BLM and military lands that are not managed with wildlife values as the priority.

In closing, it is chilling indeed to consider that the fate of the Mojave ground squirrel or any of our native wildlife should depend on decisions based on short-term economic gain for relatively few people. I realize that some development is inevitable, but it should proceed with constraints based on knowledge of the environmental impacts. A stewardship ethic for the land and its wildlife is necessary, so that future generations do not inherit an impoverished ecosystem. Man can build many things on the land, but he cannot create species that have been extinguished. Please contact me if I can be of any further assistance.

Sincerely,

Patricia E Brown

Patricia E. Brown, Ph.D.
Research Associate
Department of Biology
U.C.L.A.

9. Summary of letter from Patricia E. Brown:

This letter points out that the petition to delist the Mohave Ground Squirrel has "misquoted the scientific literature and taken portions out of context." The letter refutes a number of statements made in the petition.

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23 December 1992

Dr. John Gustafson
Wildlife Management Division
Department of Fish and Game
1416 Ninth Street
Sacramento, CA 95814

RE: DELISTING PETITION -- MOHAVE GROUND SQUIRREL

Dear John:

As per your request, I am providing my professional opinion on the Petition to Delist the Mohave ground squirrel (MGS) and the memo from Department of Fish and Game to the Fish and Game Commission. First, with respect to the memo to the Commission, I concur with the conclusion that the petition should be rejected. Indeed, there was not a huge body of knowledge concerning the biology of MGS at the time of listing. In fact, there is a paucity of information extant to date. However, certain facts are known that would imply that a correct decision to list was made in the past and overwhelmingly speaks for the continued listing.

This species occurs over a wide variety of habitats within its range and appears to be behaviorally dominant over the sympatric, more widespread antelope ground squirrel. Having examined a number of populations within the geographic and habitat range of the species, I began to suspect in 1988 that species might be less limited in occupied acreage and numbers than previously thought. Inasmuch as the species is physiologically restricted to a narrow time window for above ground activity, I felt that the timing and generally superficial nature of past surveys simply missed occupied habitat. Since 1988, southern California has experienced a record drought which appears to have had a significant deleterious effect on MGS populations.

Pipeline related surveys yielded spotty information that past populations, specifically in the Kramer Hills area, were no longer extant. However, timing of the checks made the results questionable.

The drought has effectively been ended for native biota for most of southern California with the intense rains of March 1991 and the

subsequent wet winter of 1991-92. As part of a trap comparison study for small mammals in general, I wished to include information on diurnal species and hoped to include the sensitive MGS. An intensive trapping effort was conducted at a known locality at Edwards AFB in April 1992, after the base biologist confirmed that MGS had been sighted above ground. This specific locality was selected because of the large number of MGS found in 1988; the habitat was the most diverse examined during that time. It was felt that although MGS had been found in all habitats examined for the Gravity Wave project, the most diverse site would probably act as the best refuge under inclement conditions. No MGS were trapped or observed during the April 1992 effort. Temperature and plant phenology suggested that MGS should be above ground and in an active reproductive state.

In retrospect, I believe that large extirpations have occurred during the recent drought throughout the species range. Desert ground squirrels appear to have a limited reproductive potential and as environmental conditions improve, it may take a prolonged period of time to recover and recolonize previously occupied habitat. Public lands that experience ORV and sheep grazing will be in poor state for native species even under good weather conditions. I suspect that some areas experiencing localized extirpation may never be recolonized because of expanding human impacts to historically occupied habitat.

There is no question that we know very little about the biology of this species but all indications point to increasing loss of habitat and fragmentation within the occupied range. No one has sufficient biological information to conclude otherwise.

If I may provide further information, please contact me.

Sincerely,

Michael J. O'Farrell

Michael J. O'Farrell, Ph.D.
Principal/Terrestrial Ecologist

10. Summary of letter from Michael J. O'Farrell:

This letter primarily describes the writer's field experiences in the habitat of the Mohave Ground Squirrel which resulted in his concluding that "large extirpations have occurred during the recent drought throughout the species [sic] range" and that "some areas experiencing localized extirpation may never be recolonized because of expanding human impacts to historically occupied habitat." The letter states that "certain facts are known that would imply that a correct decision to list [the squirrel as Rare] was made in the past and overwhelmingly speaks for the continued listing." Further, "all indications point to increasing loss of habitat and fragmentation within the occupied range. No one has sufficient biological information to conclude otherwise."

SAINT MARY'S COLLEGE OF CALIFORNIA

P.O. Box 4507 • Moraga, California 94575 • 510-631-4050 • FAX 510-376-4027

Biology

December 26, 1992

Natural Heritage Division
California Department of Fish and Game
1416 Ninth Street
Sacramento, CA 95814

Gentlemen:

I wish to provide the California Department of Fish and Game (CDFG) with scientific information regarding the status of the Mohave ground squirrel (Spermophilus mohavensis), a species currently listed as "Threatened" by the State of California. This information is presented in response to the Public Notice dated June 10, 1992 requesting input for the preparation of a CDFG recommendation on the petition from Kern County Department of Planning and Development Services proposing that the Mohave ground squirrel be removed from the official State list of endangered and threatened species.

I am a Professor of Biology at Saint Mary's College of California. I have conducted research on the ecology and population biology of California mammals for the past 30 years. I have had the opportunity to study the biology of the Mohave ground squirrel (MGS) since 1979. My field studies have been conducted in the Coso region of southwestern Inyo County, in the northwest corner of the geographic range of this species. I attach a complete list of the reports that my co-workers and I have prepared which present data regarding the biology of the MGS.

I will first comment on the "Supporting Information" submitted by Kern County Department of Planning and Development Services with its delisting petition dated Nov. 19, 1991. Sections (5) and (6) of this document contain a number of inaccurate and inappropriate references to the studies carried out under my direction since 1988 in the Coso region. I would like to provide clarification as follows:

(1) The Coso MGS investigations are misidentified as "BLM studies" and the annual reports are not listed under "Sources of Information" in Section (8). In fact, the Coso Grazing Exclosure Monitoring Study has been funded by California Energy Company, Inc. under terms of an agreement among three agencies: U. S. Navy China Lake Naval Air Weapons Station, Bureau of Land Management Ridgecrest Resource Area, and CDFG.

(2) It is misleading to state that the Coso study has documented "high population densities of MGS". Since this is the first investigation that has established population densities for the species, we have no basis for judging whether these values are "high" or "low" relative to past conditions or to other parts of the MGS range. The only valid conclusion is that the Coso study has shown densities to vary greatly between the four study sites in any given year and to fluctuate drastically between years at each study site.

(3) The Coso study has not shown that the MGS estivation period changes from year to year in response to environmental variables such as rainfall. Only in one year (1990) did we attempt to establish the timing of entry into estivation through the use of radiotelemetry. Therefore, our data do not allow valid conclusions about year to year variability in the estivation period in the Coso region. While our study suggests that adult MGS at Coso enter estivation earlier than reported by Recht (1977) for a population in the southwest corner of the range, our results should not be used to discredit trapping studies conducted at other locations.

(4) The Coso study has not shown migration or movement of MGS from one location to another in response to differences in food resources. However, we have documented the complete elimination of an MGS population at one of the four Coso study sites, probably as a result of drought conditions. The species was present at this location in 1988 and has not reappeared through the 1992 field season. Thus, MGS populations are susceptible to local extirpation as a result of natural environmental fluctuations.

(5) In general, I would like to emphasize that the Coso Grazing Exclosure Monitoring Study was not designed to investigate whether the MGS should or should not appear on the State of California list of endangered and threatened species. The study was designed to test the hypothesis that elimination of livestock grazing can result in improvement of the carrying capacity of MGS habitat. Since this is a long-term study, it can document variation in the abundance of MGS over several years in natural habitat, but these data are not directly relevant to the delisting question.

Finally, I would like to comment on the delisting issue itself. It is clear from existing data and particularly from the results of the Coso Grazing Exclosure Monitoring Study, that MGS abundance in natural habitats can vary greatly from year to year. On a given site, a population can decline drastically and even become locally extirpated under severe drought conditions. Given a period of years with adequate rainfall, the species will presumably re-establish itself on the site. This kind of fluctuation in abundance has been going on for thousands of years. Field studies that focus on temporal changes in MGS numbers in

relatively undisturbed natural habitats are unlikely to help determine whether the species should or should not be listed as "Threatened".

I would be happy to respond to any further questions or data requests regarding the Mohave ground squirrel and its biology. Please contact me if you require additional information.

Sincerely,

Philip Leitner

Philip Leitner
Professor of Biology
Saint Mary's College

(510) 631-4441

LIST OF REPORTS

Leitner, Philip. 1980. Survey of small mammals and carnivores in the Coso Geothermal Study Area. Report IV in Field Ecology Technical Report on the Coso Geothermal Study Area, a Rockwell International Environmental Monitoring & Services Center (Newbury Park, CA) report submitted to the U.S. Bureau of Land Management, Bakersfield District (Bakersfield, CA) under Contract No. YA-512-CT8-216.

Leitner, Philip and Barbara Malloch. 1989. First year baseline report, Coso Grazing Exclosure Monitoring Study, Coso Known Geothermal Resource Area, Inyo County, California. Prepared for McClenahan and Hopkins Associates, San Mateo, CA. 69 pp. + appendices.

Leitner, Philip and Barbara Malloch. 1990. Second year baseline report, Coso Grazing Exclosure Monitoring Study, Coso Known Geothermal Resource Area, Inyo County, California. Prepared for McClenahan and Hopkins Associates, Bethesda, MD. 96 pp. + appendices.

Leitner, Philip, Barbara M. Leitner, and John Harris. 1991. Third year baseline report, Coso Grazing Exclosure Monitoring Study, Coso Known Geothermal Resource Area, Inyo County, California. Prepared for McClenahan and Hopkins Associates, Bethesda, MD. 73 pp. + appendices.

Leitner, Philip and Barbara Malloch. 1992. Mohave ground squirrel study in the Coso Grazing Exclosure, Coso Known Geothermal Resources Area, Inyo County, California. Prepared for McClenahan and Hopkins Associates, Inc., San Mateo, CA, under contract to U.S. Navy, China Lake Naval Air Weapons Station, China Lake, CA, with funding provided by California Department of Fish and Game.

LITERATURE CITED

Recht, Michael Anthony. 1977. The biology of the Mohave ground squirrel, Spermophilus mohavensis; home range, daily activity, foraging and weight gain and thermoregulatory behavior. University of California, Los Angeles, Ph.D. dissertation. 117 pp.

11. Summary of letter from Philip Leitner:

This letter is from a scientist who has conducted field studies of the Mohave Ground Squirrel, beginning in 1979. One report on his work (Leitner and Leitner 1990) was miscited in the petition to delist the squirrel as "Bureau of Land Management Leitner Study 1990" and was discussed in the petition. The letter points out that the petition contains "a number of inaccurate and inappropriate references to the studies [on the squirrel] carried out under my direction since 1988 in the Coso region." The letter refutes the analysis of Leitner and Leitner (1990) in the petition and points out that "the Coso grazing Exclosure Monitoring Study was not designed to investigate whether the MGS should or should not appear on the State of California list of endangered and threatened species." Finally, the letter emphasizes that changes in numbers of the squirrel over time do not determine whether the species should be listed as Threatened.

Denise L. LaBerteaux
10375 Los Piños Street
Onyx, CA 93255
(619) 378-3021

30 December 1992

Dr. John Gustafson
Nongame Bird and Mammal Section
Wildlife Management Division
Department of Fish and Game
P. O. Box 944209
Sacramento, CA 94244-2090

Dear Dr. Gustafson:

I would like to take this opportunity to comment on the petition to delist the Mohave Ground Squirrel (Spermophilus mohavensis) as a State-threatened species.

First, from paragraph 2 of the Executive Summary, the County of Kern's motivation to delist the Mohave Ground Squirrel (MGS) is not based on biological information, but is based solely on economic concerns in the eastern portion of the County. The County of Kern has not clearly demonstrated that the threats to the MGS populations have slowed or that the abundance of MGS has increased since the species was listed in 1971. On the contrary, the threats have dramatically increased over the last 20 years. The threats to MGS are destruction, drastic modification, and severe curtailment of its habitat primarily due to human encroachment into the range of MGS. Biologists who petitioned Fish and Game Commission to list MGS saw these threats to the habitat 20 years ago. As long as human population growth rate remains above zero, encroachment into its habitat will proceed. Populations of MGS may have already disappeared in the extreme southern portion of its range (i. e., Lucerne Valley area), and populations between Lancaster/Palmdale area east to Adelanto/Victorville area are in intimate danger of disappearing as human populations centers expand. If this species is not continued to be protected under the California Endangered Species Act, long term survival of MGS will be in serious jeopardy through severe habitat loss and fragmentation.

The petition points out (Section 1, Paragraph 4) that "public lands managed by various federal agencies provide substantial management benefit to assure the continued existence of the species." To date, federal agencies managing lands within the range of MGS, that is, Bureau of Land

Management and Department of Defense, have no formal management policies regarding California State-listed species. The Department of Defense (DOD) has not studyed the cumulative impacts of its projects on MGS, but DOD continues to destroy pieces of its habitat while carrying out its primary mission of national defense. Even federally listed species aren't totally protected on military lands; in time of war, DOD needs not comply with the National Environmental Policy Act. In addition, future federal land management practices may severely impact MGS. For example, National Training Center at Ft. Irwin proposes to "take over" a large portion of Naval Air Weapons Station (NAWS), China Lake. Current land practices in this area under NAWS management may not be significantly impacting MGS habitat. However, Ft Irwin's land practices (tank maneuvers) will severely impact MGS habitat in this area. County of Kern is naive in stating that federal management practices provide substantial management benefit to assure the continued existence of the species when the future of public lands is so uncertain.

The petition describes MGS (Section 3, Paragraph 1) as being one of several species of ground squirrels inhabiting the western Mojave Desert. On the contrary, MGS is one of only three ground squirrels native to the western Mojave, the others being Antelope ground squirrel and round-tailed ground squirrel. In fact, the round-tailed ground squirrel is primarily an eastern Mojavean species. Beechey ground squirrels occasionally occur in the West Mojave, invading from areas west of the Sierra Nevada. More importantly to note, however, is the fact that the Mohave ground squirrel is the only ground squirrel species endemic to the western Mojave Desert. MGS's endemic status warrants its continued protection.

The petition states (Section 5, Paragraph 1) that little scientific research has been conducted on the distribution and abundance of MGS. The Department of Fish and Game issues Memoranda of Understanding to biologists to conduct research on MGS. Hence, it should have records on the number of scientific (trapping) studies that have been conducted over the last 20 years. In addition to those areas where MGS were captured, the Department should identify those areas where no MGS were captured, especially during non-drought years. This information may show a patchy distribution of MGS and can be used to refine the range map of MGS. In the studies cited in the petition (Section 5), areas chosen to trap ground squirrels were not randomly selected; some sites were chosen on basis of proximity to known Mohave ground squirrel range and habitat while others were chosen because they potentially supported good populations of MGS (Leitner's studies, for example). Hence, to ever imply that there are high population densities throughout its range is not substantiated.

The petition states (Section 5, Paragraph 4) that Leitner's studies "suggest that natural decreases in MGS populations may have nothing to do with habitat loss resulting from private development." Leitner's studies are conducted in a human-restricted, undeveloped area. Hence, one cannot compare his populations with those in developed areas.

Two important factors are influencing the existence of the Mohave ground squirrel. One is natural, the other is not. First, this species is endemic to the West Mojave Desert, occurring no where else in the world. The range is small compared to other species in the Mojave and to similar species in California. According to Hafner (Hafner, D. J. 1992. Speciation and persistence of a contact zone in Mojave Desert ground squirrels, subgenus Xerospermophilus, Journal of Mammalogy 73:770-778.), the northwestern Mojave Desert may be viewed as a unique desert refugium; may harbor several endemic species, such as the Mohave ground squirrel; and, thus, may, in itself, warrant protection. Hence, Mohave ground squirrels are confined to a relatively small and unique area. Second, the range of the Mohave ground squirrel is shrinking everyday as habitat is destroyed by human influences. Cities continue to expand into the range of MGS. Just as cities expand, rural communities expand as more and more people escape city living. But the destruction of habitat is not just confined to city limits or the boundary of one's property. There is a zone of influence around each city and dwelling where habitat is modified or destroyed and where Mohave ground squirrels are killed by off-road vehicles, feral dogs and cats, illegal garbage dumping, and illegal dumping of toxic substances. Hence, nonintensive development or open space use designation on cities' general plans will not compliment habitat requirements for MGS, as suggested by the petition (Section 7, Subsection C). Such "small island" habitats will not insure the continued existence of the Mohave ground squirrel over time.

The following is a list of human-related factors threatening the Mohave ground squirrel:

1) The increasing human population centers of

Adelanto	Helendale	Oro Grande
Apple Valley	Hesperia	Palmdale
Baldy Mesa	Inyokern	Phelan
Barstow	Lancaster	Quartz Hill
Boron	Lenwood	Ridgecrest
California City	Lucerne Valley	Rosamond
Desert Lake	Mojave	Silver Lakes
El Mirage	North Edwards	Victorville

2) military activities on Naval Air Weapons Station, China Lake; National Training Center, Ft Irwin; and Edwards Air Force Base;

3) small and large scale ore mining operations;

4) geothermal development;

5) off-highway vehicles;

6) roads and highways;

7) utility corridors;

8) solar and wind energy farms; and

9) private land development in unincorporated areas.

The Department of Fish and Game should compile or request the following information:

1) map range of MGS in 1971 (calculate acres);

2) map range of MGS in 1991 (calculate acres);

3) calculate acres of habitat lost since 1971;

4) map predicted range of MGS in 2011 if growth rate remains identical to 1971-1991 rate;

5) map areas where MGS were not trapped in scientific studies, as well as where they were trapped, to show possible patchy distribution;

6) request official policies regarding State-listed species on the three military bases within MGS range; and

7) request acres of habitat lost during the last 20 years on military facilities.

I would now like to propose a question to the Fish and Game Commission. If you vote to delist the Mohave ground squirrel in 1993, as human encroachment into the West Mojave Desert continues (and it will continue),

at what point will the Mohave ground squirrel again warrant protection? Will it be when the habitat is so fragmented that the chance of finding and establishing a preserve for its long term survival slim to none? Isn't it the policy of the State of California that "state agencies, boards, and commissions shall seek to conserve endangered species and threatened species...[Fish and Game Code 2055]" and to "...protect, restore, and enhance any endangered species or any threatened species and its habitat...and to acquire lands for habitat for these species [Fish and Game Code 2052]?" If the habitat is reduced and severely fragmented, where will the State find land suitable for the continued existence of Mohave ground squirrels?

If you have any questions regarding these comments, please feel free to call me at (619) 378-3021. Thank you for your attention.

Sincerely,

Denise L. LaBerteaux

Denise L. LaBerteaux

12. Summary of letter from Denise L. LaBerteaux:

This letter states that "the County of Kern's motivation to delist the Mohave Ground Squirrel (MGS) is not based on biological information, but is based solely on economic concerns in the eastern portion of the County. The County of Kern has not clearly demonstrated that the threats to the MGS populations have slowed or that the abundance of MGS has increased since the species was listed in 1971. On the contrary, the threats have dramatically increased over the last 20 years." Further, "[i]f this species is not continued to be protected under the California Endangered Species Act, long term survival of MGS will be in serious jeopardy through severe habitat loss and fragmentation." The letter goes on to refute a number of statements made in the petition to delist the squirrel and to list "human-related factors" which threatened the squirrel.

THE DESERT PROTECTIVE COUNCIL INC.

A NON-PROFIT ORGANIZATION

To safeguard for wise and reverent use by this and succeeding generations those desert areas of unique scenic, scientific, historical, spiritual and recreational value and to educate by all appropriate means children and adults to a better understanding of the desert.

Elden Hughes
14045 Honeysuckle Lane
Whittier, CA 90604

310 941-5306

January 6, 1993

Dr. John Gustafson
Nongame Bird and Mammal Section
Wildlife Management Division
California Department of Fish and Game
1416 Ninth Street
Sacramento, CA 95814

Dr. Dr. Gustafson:

Reference is made to the petition to delist the Mojave Ground Squirrel. We were not on the mailing list for comments and we ask that we be put on distribution for any such comments in the future and that you accept our comments at this time.

The Kern County petition to Delist the Mojave Ground Squirrel is deeply flawed. The arguments are economic and not scientific and repeatedly acknowledge their lack of science. The statement that distribution is over 7,000 square miles is grossly misleading. It is equivalent to saying that the distribution of palm trees found on a few islands in the ocean include all the square miles of ocean between the islands.

The petition ignors the cummulative effects of offroad vehicles, mining, grazing and other "uses" of the habitat. Literally, the habitat is being cut into islands that may well be too small to remain viable habitat. Continued and unmitigated development can be a major factor cutting the habitat into smaller and smaller islands. Without the listing, unmitigated development would be automatic.

The petition assumes that public lands managed by federal agencys are managed to benefit the Mojave Ground Squirrel. This simply is not true. Example: The habitat map includes the tank training areas on Ft. Irwin. Tank training is not management to benefit the Mojave Ground Squirrel.

The 1990 federal listing of the desert tortoise described loss of habitat as a major influencing factor. Most of the habitat of the Mojave Ground Squirrel is shared by the tortoise.

The petitioners have presented no reasonable basis for delisting the Mojave Ground Squirrel.

Sincerely,

Elden Hughes
Executive Director

13. Summary of letter from The Desert Protective Council, Inc.:

This letter states that the petition to delist the Mohave Ground Squirrel is "deeply flawed. The arguments are economic and not scientific and repeatedly acknowledge their lack of science." The letter refutes several statements made in the petition and points out that the "1990 federal listing of the desert tortoise described loss of habitat as a major influencing factor. Most of the habitat of the Mojave [sic] Ground Squirrel is shared by the tortoise." The letter concludes that the "petitioners have presented no reasonable basis for delisting" the squirrel.

United States Department of the Interior

NATIONAL PARK SERVICE
DEATH VALLEY NATIONAL MONUMENT
DEATH VALLEY, CALIFORNIA 92328

IN REPLY REFER TO:
N16

January 7, 1992

Dr. Roy A. Woodward
Nongame Section Coordinator
Wildlife Management Division
Department of Fish and Game
P.O. Box 944209
Sacramento, CA 92444-2090

Dear Dr. Woodward:

I apologize for the delay in responding to your request for my comments on the petition to delist the Mohave ground squirrel. At the same time I appreciate the opportunity to offer my opinion on the petition to delist based on knowledge I have of the distribution and habits of this species.

I believe the petition to delist resulted from the experiences of some land owners/developers in a relatively small area of eastern Kern County when they proposed land development within the range of the Mohave ground squirrel. I am not aware of widespread support for the delisting of this species. A delisting action by the Commission at this time would result in an accelerated loss of habitat for the species on both private and federally managed lands due to the lifting of the restrictions that are now in place which are designed to limit the loss of the habitat through mitigation and compensation.

The range of this species is the smallest of any of the ground squirrels in North America. There is sufficient evidence to state that a considerable amount of the former habitat of this species has been lost due to development in the Antelope, Fremont, Indian Wells and Victor Valleys. In the early part of this century, ground squirrels were systematically eliminated with poisoned grain by the Los Angeles Agricultural Commission office in the Antelope Valley. An accurate account of the total loss of habitat for this species should be developed and taken into consideration when responding to the petition to delist.

I have reviewed both the petition to delist the species and the Department of Fish and Game review of the petition. I find statements in each document that I support as well as those that I disagree with.

The petition to delist is generally accurate regarding the administrative history concerning this species. The petition also properly documents the recent findings regarding the range occupied by this animal that were the result of studies by Wessman in 1977 and Aardahl and Roush in 1980. However, the petition does not contain any scientific or factual information regarding the present day population

levels of the Mohave ground squirrel, nor the trend in habitat condition since the 1971 listing.

A major weakness in the petition argument for delisting is the absence of any factual information regarding the amount of suitable habitat within the geographic range of the species. Another weakness lies in the fact that there is no evaluation of the future losses of habitat that may occur within important habitat due to community growth, mining, utility projects, military uses, etc.

I believe the Department should have recognized the significant studies of the distribution of this species conducted by the Bureau of Land Management in the California Desert Conservation Area in the review of the petition to delist, as well as in the periodic reviews made of the species. These investigations greatly expanded our basic knowledge of this species. They were conducted by biologists of the Bureau of Land Management beginning with the wildlife inventories in the Red Mountain and El Paso Planning Units in 1974 and 1975, the studies by Wessman in 1977 which documented the species occupied a range 1800 square miles greater than what was known at the time of the 1971 listing, and those by Aardahl and Roush in 1980 that documented the abundance and widespread occurrence of the species in the western Mojave between Ridgecrest, California City and Barstow. To be specific, it is not true that most of the field work conducted since the listing in 1971 has been related to determining the presence or absence of the species prior to development projects. The level of effort and amount of useful data gathered by the Bureau of Land Management in the above distribution and abundance studies was not related to development projects; it was obtained to enhance agency understanding of the distribution of a State-listed species for conservation purposes.

The Department, in reviewing the petition, could have rejected the petition on the grounds that it did not present a convincing case for delisting due to the absence of supporting data or factual information. The author of the petition simply referred to studies conducted by others. Again, I emphasize the technical weaknesses of the petition as described in the above paragraphs.

Land managers and biologists participating with the Bureau of Land Management in the conservation of habitat for the desert tortoise in the Western Mojave Coordinated Resource Management Plan would agree that the Mojave ground squirrel, which occupies habitat within much of the area occupied by the tortoise, will benefit from the protection that will be provided the tortoise when the plan is implemented. Such long term protection for this species within a majority of its range can only come about through implementation of the plan. Implementation will take a very long time and the degree of success in conserving the habitat cannot be predicted at this time.

Subsequent to the 1985 report prepared by Aardahl and Roush on the distribution and abundance of the Mohave ground squirrel, the Bureau of Land Management requested that the Department of Fish and Game review the report and data presented and formally meet with the

agency's managers and biologists to jointly determine if the listing status of the species was proper in light of the new information gathered. To the best of my recollection, the Department responded in writing to the Bureau and, unfortunately, there never was a cooperative, interagency review of the status of the squirrel.

I believe a cooperative evaluation of the status of this animal with the federal land managing agencies is a high priority. I don't believe the biological status of the animal in addition to the petition to delist can be properly addressed with the current level of understanding of this species. Answers to the following questions would be key to understanding the true status of this species:

1. How much of the original habitat of this species has been lost due to development, impacts from multiple land uses (recreation, grazing, etc.)?

2. What areas within the species range are suitable habitat, and what areas are essential to the perpetuation of this species (i.e., what are the most important habitat areas and are they large enough to support minimum viable populations in times of drought, disease, competition with other species and livestock, predation, etc.?)

3. To what degree have habitat areas been isolated from main populations through habitat fragmentation?

4. Are land management uses, plans and decisions that affect the essential habitats and populations throughout the range of this species compatible with its long term survival?

Some critics of the listing suggest that I advocated delisting in the report I prepared along with Paul Roush. This is not the case. I was a strong advocate of a cooperative evaluation of the listing by the Department of Fish and Game and the Bureau of Land Management because of the new findings in the distribution and abundance of the Mohave ground squirrel based on studies by Wessman and Aardahl and Roush. In my opinion a critical review of the listing was in order because the new data revealed the range and abundance was so much greater than what was known in 1971.

My recommendations to the Department and the Commission in this matter are:

1. Maintain the current listing to conserve the species and its habitat until a more thorough, interagency review is completed.

2. Conduct a critical, professional review of the status of the species based on all data. This review should be conducted by biologists and managers from the Department of Fish and Game and the Bureau of Land Management.

3. Determine what data needs to acquired to properly determine the biological status of this species; fund and implement studies

to provide the needed information.

4. Provide the Commission with a thorough status review and make a final recommendation regarding the petition to delist after the necessary studies are completed.

5. If the listing is upheld, designate critical habitat for conservation of the species in cooperation with the federal land managing agencies and local governments controlling large blocks of undeveloped habitat within the specie's range (e.g., California City).

In summary, I believe there is insufficient biological information at this time for the Department and the Commission to act on the petition to delist the Mojave ground squirrel. A proper decision can be made when the essential information is in hand.

If you have any questions regarding my opinions and recommendations do not hesitate to contact by telephone. I can be reached at (619) 786-3250. Thank you for the opportunity to participate in this matter.

Sincerely,

Jeffrey B. Aardahl
Chief, Resources Management Division

cc: BLM - Ridgecrest and Barstow Area Offices

14. Summary of letter from Jeffrey B. Aardahl:

This letter is from a scientist who has conducted field studies of the Mohave Ground Squirrel and whose work (Aardahl and Roush 1985) was discussed in the petition to delist the squirrel. The letter states that "I believe the petition to delist resulted from the experiences of some land owners/developers in a relatively small area of eastern Kern County when they proposed land development within the range of the Mohave ground squirrel. I am not aware of widespread support for the delisting of this species. A delisting action by the Commission at this time would result in an accelerated loss of habitat for the species on both private and federally managed lands due to the lifting of the restrictions that are now in place which are designed to limit the loss of the habitat through mitigation and compensation."

The letter further states that a "major weakness in the petition argument for delisting is the absence of any factual information regarding the amount of suitable habitat within the geographic range of the species. Another weakness lies in the fact that there is no evaluation of the future losses of habitat that may occur within important habitat due to community growth, mining, utility projects, military uses, etc."

The writer notes that he found statements with which he agrees and with which he disagrees in both the petition and the Department's February 1992 recommendation to the Commission on the petition. In regard to a statement by the Department, he writes that "it is not true that most of the field work conducted since the listing in 1971 has been related to determining the presence or absence of the species prior to development projects. The level of effort and amount of useful data gathered by the Bureau of Land Management in the above distribution and abundance studies was not related to development projects; it was obtained to enhance agency understanding of the distribution of a State-listed species for conservation purposes."

The letter recommends that a cooperative State/federal effort be undertaken to establish the "true status" of the squirrel by addressing specific questions on amount of habitat loss, suitable habitat, essential habitat, fragmentation of habitat, and land uses. The letter further recommends that the current listing of the squirrel be maintained until a "thorough, interagency review is completed" by the Department and the BLM, that studies be implemented to determine the "biological status" of the squirrel, that a final recommendation on delisting be made to the Commission after studies are completed, and that critical habitat be designated if the listing if maintained.

The writer concludes that "there is insufficient biological information at this time" for making a decision to delist the squirrel.

SIERRA CLUB KERN-KAWEAH CHAPTER

Printed on 100% Recycled Paper

Georgette Theotig
P.O. Box 49
Tehachapi, Calif. 93581

January 8, 1993

Susan A. Cochran, Chief
Natural Heritage Division
California Department of Fish and Game
1416 Ninth Street
Sacramento, Calif. 95814

Dear Ms. Cochran:

The following are the comments of the Kern-Kaweah Chapter of the Sierra Club regarding the status of the Mohave Ground Squirrel (Spermophilus mohavensis). We are aware that on April 2, 1992, the California Department of Fish and Game Commission accepted a petition from the Kern County Department of Planning and Development Services to amend the State endangered and threatened species list to read as follows: "Mohave Ground Squirrel (Spermophilus mohavensis)- Delist from Threatened." While our comments are being presented after the October 1, 1992 deadline, we hope they can be accepted into the Department's final report to the Commission.

After reading the Memorandum (February 24, 1992) presented by Boyd Gibbons, and based upon our own information, we must strongly oppose the acceptance of this petition to delist the Mohave Ground Squirrel as threatened. The submitted petition is incomplete and must be rejected for the following reasons:

1) The petition does not include sufficient scientific information on several factors required from Section 2072.3 of the Fish and Game Code: population trend, range, distribution, abundance, factors affecting the ability of the population to to survive and reproduce, degree and immediacy of threat, and the impact of existing management efforts.

2) The petition fails to fully satisfy the content requirements of petition form FGC 670.1, as specified in Section 670.1(a), Title 14, California Code of Regulations, which requires sufficient information to indicate that the petitioned action may be warranted. There is no discussion of changes in population, effects of human-induced habitat fragmentation on the ability of the species to reoccupy habitat from which it has been extirpated, the impact of Federal land-use activities on populations, the effects of highways and their rights of way (current or proposed) as barriers to population movements or as negative impacts to local population densities, and whether this species has been found to occupy soils, plant communities, or elevations not previously known.

3) The petition fails to address the requirements of Section 670.1 (c), Title 14, California Code of Regulations, which provides that a species may be delisted "if the Commission determines that its continued existence is no longer threatened by any one or any combination" of several factors.

4) We are aware of the several points presented in the petition to delist the Mohave Ground Squirrel. One in particular was that great areas of Federal land within the range of the Mohave Ground Squirrel already provide substantial management benefit to assure the continued successful existence of the species. There is insufficient management consideration given to this species to provide benefit over the long term.

5) Last, the U.S. Fish and Wildlife Service, in their updated compilation of animals that are being considered for possible addition to the Federal list of Endangered and Threatened species in the Federal Register of November 21, 1991, included the Mohave Ground Squirrel as a candidate, with a designation of "Declining."

We believe that the Mohave Ground Squirrel continues to be a threatened species due to modification and destruction of habitat. Rapid growth on a grand scale in the Western Mojave region, especially in the Palmdale, Victorville, and Ridgecrest areas, is a major contributing factor to the decline of this species.The continued protection of the Mohave Ground Squirrel equates to a healthy and intact desert ecosystem, of which this species is an integral part. The successful existence of each plant and animal strengthens the rich biodiversity of the Mojave Desert. Therefore, we strongly urge the Fish and Game Commission members to reject the petition and retain the threatened status of the Mohave GRound Squirrel.

We very much appreciate this opportunity to comment on this important issue.

Sincerely,

Georgette Theotig

Georgette Theotig,
Chairwoman

cc: Congressman William Thomas

15. Summary of letter from Kern-Kaweah Chapter, Sierra Club:

This letter states that "we must strongly oppose the acceptance of this petition to delist the Mohave Ground Squirrel", and points out that the petition does not meet the requirements of the Fish and Game Code and Title 14, California Code of Regulations that sufficient scientific information must be presented in a petition to support the petitioned action. The letter concludes that the squirrel "continues to be a threatened species due to modification and destruction of habitat. Rapid growth on a grand scale in the Western Mojave region, especially in the Palmdale, Victorvile, and Ridgecrest areas, is a major contributing factor to the decline of this species."

The University of New Mexico

Department of Biology
Albuquerque, NM 87131
Telephone 505: 277-3411

10 January, 1993

Dr. John Gustafson
Nongame Bird and Mammal Section
Wildlife Management Division
Department of Fish and Game
P.O. Box 944209
Sacramento, California 94244-2090

Dear Dr. Gustafson:

I have read the arguments submitted by the Kern County Department of Planning and Development Services in support of delisting the threatened Mohave Ground Squirrel, Spermophilus mohavensis, in California. As far as I am able to assertain from the petition, the major reasons for requesting that the species be delisted are that 1) the species was incorrectly listed, 2) scientific data on the species are lacking, and 3) sufficent federal land exists within the species range to provide ample protection. I find none of these arguments compelling , and in fact think that their reason number two argues against such a conclusion.

Determination of when to list a species as threatened is never easy, especially if the goal is to afford protection early enough to avoid extinction. In the case of the Mohave Ground squirrel, it appears to me that your department made the appropriate decision to list when you did. None of the "evidence" provided by the petition to delist provides evidence

that your decision to list this species was erroneous. On the contrary, the authors of this petition appear to be unaware of what constitutes a threat to evolutionary units and it is threrefore not surprising that they see protection of this ground squirrel as nothing more than an obstical to further development of this region. The fact is that they lack a case based on any new information, and they have misinterpreted previous published data. For example, they cite a paper by Hafner and Yates (1982) as evidence that S. mohavensis may not be a "good" species. This paper, in fact, suggests just the opposite. The two nominal species examined in that study maintain genetic distinctness throughout their ranges and only hybridize along a narrow zone of disturbed habitat in California. Those data argue against introgressive hybridization and suggest that the Mohave Ground Squirrel is a distinct species even using the more conservative Biological Species concept. It should be noted, however, that the endangered species act, does not require biological species status to afford full protection under the act but frequently protects endangered subspecies as well. The Mohave Ground Squirrel is clearly a distinct evolutionary unit compared to the Roundtailed Ground Squirrel, and should be protected if it is threatened as is suggested by all data currently available.

The fact that information is lacking on many aspects of the basic biology of this species is also not valid grounds for delisting the species. This is probably the only reason it has not been transferred to federal listing but does not provide logical support for the argument that is implied by the petitioners that this is evidence supporting an erroneous listing. In fact, most species that are now listed federally as endangered were in this same category of needing further population level studies. The current listing by California of this species simply provides protection so that more information can be obtained, an effort that may well prevent the species from becoming endangered. The argument that more information is needed, at this point, argues for, not against, continued protection.

The contention of the petitioners that the species occupies a large geographic range and that enough land exists on federal portions of the species range to afford protection appears as another attempt to misrepresent the truth. As species ranges go for similar sized small mammals, the range of the Mohave Ground Squirrel is extremely small. In addition, no data are provided to support the contention that reducing the

range of the species even further to support development will ensure survival of the species. The data that are available from other successful species of ground squirrels suggests that more space, not less, are needed to ensure the success of the species.

In conclusion, I recommend rejection of this petition but agree that further study of the species would be valuable. I would further recommend that more survey and inventory work should be conducted ASAP in this region. My suspicion is that the reduced range and threatened status of this ground squirrel is indicative of a greater problem and may suggest that the entire ecosystem is endangered. The lack of concern for the loss of biological diversity in this region by those wanting to exploit it suggests that conservation efforts should be greatly enhanced. Your decision to list this this species is correct and should remain in effect until substantial compelling, scientific evidence to the contrary are found. I hope these comments will be useful in your appraisal of this situation.

Sincerely,

Dr. Terry L. Yates
Curator of Mammals
University of New Mexico

16. Summary of letter from Terry L. Yates:

This letter is from a scientist who has conducted field studies of the Mohave Ground Squirrel and has made a determination about its taxonomy. His work (Hafner and Yates 1983) was discussed in the petition to delist the squirrel. The letter refutes the analysis of Hafner and Yates (1983) in the petition and points out that lack of information on many aspects of the basic biology of the squirrel is "not valid grounds for delisting the species." The letter recommends rejection of the petition by the Commission and concludes that the "reduced range and threatened status of this ground squirrel is indicative of a greater problem and may suggest that the entire ecosystem is endangered. The lack of concern for the loss of biological diversity in this region by those wanting to exploit it suggests that conservation efforts should be greatly enhanced."

United States Department of the Interior

FISH AND WILDLIFE SERVICE

FISH AND WILDLIFE ENHANCEMENT
Ventura Field Office
2140 Eastman Avenue, Suite 100
Ventura, California 93003

January 19, 1993

Dr. Roy Woodward
Wildlife Management Division
California Department of Fish and Game
1416 Ninth Street
Sacramento, California 95814

Subject: Status of the Mohave Ground Squirrel

To whom it may concern:

This letter has been prompted by recent conversations with California Department of Fish and Game (Department) staff and other participants in the development of the coordinated management plan for the western Mojave Desert. The Fish and Wildlife Service (Service) is concerned that misperceptions regarding the Federal listing process and the biology of the Mohave ground squirrel (*Spermophilus mohavensis*) may adversely influence the proposed delisting of the species by the California Fish and Game Commission.

The petition from the County of Kern cites the Mohave ground squirrel's Federal status as a category 2 candidate to support its contention that there is insufficient information to justify its listing as a threatened species. As defined at 50 CFR Part 17, category 2 candidates are those "(t)axa for which information now in possession of the Service indicates that proposing to list as endangered or threatened is possibly appropriate, but for which conclusive data on biological vulnerability and threat(s) are not currently available to support proposed rules."

The Service has not conducted an in-depth review of the distribution of the Mohave ground squirrel. However, because of our involvement with the desert tortoise (*Gopherus agassizii*), which is listed by both the State of California and the United States as threatened, we are well aware of the land uses and habitat loss, degradation, and fragmentation, resulting from ongoing urban development and multiple use of private and public lands, that have occurred and continue to occur in the western Mojave Desert. Simply stated, the Service is concerned that existing conditions in the western Mojave Desert are such that the long-term viability of plant and animal species whose ranges are restricted to this area, like the Mohave ground squirrel, cannot be adequately ensured. To reflect this concern, the most recent animal candidate review describes the status of the Mohave ground squirrel as "declining."

Because of limited funding and staff, the Service has been unable to fully monitor and pursue listing proposals for all of the numerous candidate species

in California. We have chosen to devote our efforts to the development of a large-scale management plan for the western Mojave Desert, which, if implemented, should aid the recovery of the desert tortoise, the Mohave ground squirrel, and other sensitive species in that region. If the coordinated management plan meets its biological objectives, the Service may be able to forego proposals to list individual species throughout the western desert.

In conclusion, the Service is not aware of any information regarding the Mohave ground squirrel's range or biological vulnerability that indicates the species should be removed from the State list of endangered and threatened species, or dropped from consideration for Federal listing. We hope this letter assists you in understanding the Service's position with regard to the status of the Mohave ground squirrel. If you have any questions, please contact Ray Bransfield of my staff at (805) 644-1766.

Sincerely,

John I. Ford
Acting Field Supervisor

17. Summary of letter from U.S. Fish and Wildlife Service:

This letter refutes the contention in the petition to delist the Mohave Ground Squirrel that the squirrel's federal status as a category 2 candidate species means there is insufficient information to justify its State listing as Threatened. The letter points out that the Fish and Wildlife Service views the status of the squirrel as declining, but that the Service has chosen to pursue efforts for development of a large-scale management plan for the western Mojave Desert (a reference to the West Mojave Coordinated Management Plan) rather than to propose the squirrel as a federal Threatened or Endangered species at this time. The letter concludes that "the Service is not aware of any information regarding the Mohave ground squirrel's range or biological vulnerability that indicates the species should be removed from the State list of endangered and threatened species, or dropped form consideration for Federal listing."

2817 Owens Peak Road
Inyokern, CA 93527
February 7, 1993

Dr. John Gustafson
Nongame Bird and Mammal Section
Wildlife Management Division
Department of Fish and Game
P. O. Box 944209
Sacramento, CA 94244-2090

Dear Dr. Gustafson:

As a resident and property owner of the Mojave Desert, I would like to comment on the Kern County Department of Planning and Development Services petition to delist the Mojave Ground Squirrel (MGS). We urge the Commission not to delist the MGS.

The petition states that "conclusive data on biological vulnerability and threat are not available to justify the federal listing as 'threatened or endangered'". The California Department of Fish and Game has the data which shows that the MGS is threatened. There is no data to suggest that the species is any less threatened now than when it was listed.

This petition is the product of a few short-sighted, ignorant people who are not willing to put forth the effort to properly plan land use. The ~~Mojave~~ West Mojave Coordinated Management Plan will allow use of private land while preserving enough of our desert wildlands to allow unique species like the MGS to survive. But it will require work to complete and implement this plan.

The fact that a unique species, endemic to the Mojave Desert is threatened with extinction indicates that a

unique habitat is being severely damaged. This is obvious to local residents. Even with the recent recession, desert habitat continues to be destroyed or damaged by development, roads, off-highway vehicles, mining, utility corridors, and military operations. These threats will continue, and many will increase. How many species of animals and plants will we use if we fail to protect them? It is in the interest of Californians (including those of us who own land) to protect the wildlife of our state. We have entrusted ~~this~~ the California Department of Fish and Game with the responsibility to provide this protection. To delist the MGS would be to violate public trust and to fail to perform the Department's duty. Do not delist the MGS until data demonstrates that it is no longer threatened.

Sincerely,

Thomas and Kathleen Stephens

Inyokern, CA

Copies to:

Fish and Game Commission
P.O. Box 944209
Sacramento, CA 942244-2090

Roy Ashburn
Kern County Supervisor
400 N. China Lake Blvd.
Ridgecrest, CA 93555

18. Summary of letter from Thomas and Kathleen Stephens:

This letter urges the Commission to not delist the Mohave Ground Squirrel and deplores the motivation of the petitioner in submitting the petition. The letter cites the concern of residents in the western Mojave Desert that "a unique habitat is being severely damaged" by human activities.

State of California — The Resources Agency of California

Memorandum

Date : March 19, 1993

Telephone: ATSS ( )
( )

To : Natural Heritage Division
California Department of Fish and Game
1416 Ninth Street
Sacramento, CA 95814

From : California Energy Commission
1516 Ninth Street
Sacramento 95814-5512

Subject :

PETITION TO DELIST THE MOHAVE GROUND SQUIRREL AS THREATENED

The California Energy Commission's (CEC) Energy Facilities Siting and Environmental Protection Division Biology Staff have reviewed the request for comments on the delisting of the Mohave ground squirrel (Spermophilus mohavensis) as Threatened. Our views which follow are based upon experience we have gained while evaluating the effects of power plant and transmission line projects on the Mohave ground squirrel and the monitoring of impact mitigation.

The known range of the Mohave ground squirrel is approximately 7,000 square miles and that over 57 percent of that area is under federal management by the Navy, Army, Air Force, or the Bureau of Land Management. During the CEC's licensing of four energy development projects affecting the range of the Mohave ground squirrel, it does not appear that federal lands were being managed with consideration focused on long-term conservation and benefit to the Mohave ground squirrel. Any management action or consideration directed toward Mohave ground squirrels appear to be incidental to other mandated federal management plans, probably because the squirrel is not a federally protected species.

The CEC Biology Staff has found there is a lack of scientific research on the population, range, density, behavior, taxonomic relationships, and habitat preferences of the species. We are unaware of sufficient new scientific information to indicate that changes in the population of the Mohave ground squirrel over all or over a portion of its range have improved. There is minimal information concerning the increasing effects of human-induced habitat fragmentation, habitat losses and degradation and that these effects will be slowed, eliminated, or rectified in the

future to allow the species to reoccupy habitat from which it has been extirpated. This lack of information does not support changing its listing at this time. We encourage and recommend aggressive scientific investigation and the implementation of habitat conservation plans that will assure the continued existance of the Mohave ground squirrel throughout its range.

ROBERT L. THERKELSEN, Deputy Director for
Energy Facilities Siting and
Environmental Protection

RLT/RLA:nwb

cc: John Gustafson, CDFG

19. Summary of letter from California Energy Commission:

This letter refutes the contention in the petition to delist the Mohave Ground Squirrel that federal lands provide substantial long-term management and benefit to the squirrel. The letter states that "[a]ny management action or consideration directed toward Mohave ground squirrels appear to be incidental to other mandated federal management plans, probably because the squirrel is not a federally protected species." Further, "[w]e are unaware of sufficient new scientific information to indicate that changes in the population of the Mohave ground squirrel over all or over a portion of its range have improved. There is minimal information concerning the increasing effects of human-induced habitat fragmentation, habitat losses and degradation and minimal [information] that these effects will be slowed, eliminated, or rectified in the future to allow the species to reoccupy habitat from which it has been extirpated. This lack of information does not support changing its listing at this time."

Kerncrest Chapter
National Audubon Society
P.O. Box 984
Ridgecrest, CA 93555

January 27, 1993

Fish & Game Commission
P.O. Box 944209
Sacramento CA 94244-2090

Re: Mojave Ground Squirrel de-listing

Gentlemen;

We urge you to not de-list the MGS. It's Threatened status is warranted and should not be changed.

We are especially concerned that the effort to de-list is based on economics, not scientific data. You are mandated to consider only scientific data, not anything else, and especially not something as short-sighted as economic gain for a a few individuals.

To prove that alternate protections exist, the petition quotes that "public lands managed by various federal agencies provide substantial management benefit to assure the continued existence of the species." They do not. Military bases by and large ignore environmental needs, and are exempt from any such consideration in time of war. Ground activities, especially tanks at Ft. Irwin are especially destructive to any ground dweller, animal or plant. BLM has, until quite recently, promoted human use and abuse type activities, not the protection of native species.

The rapid cumulative effects of rural development, even when homes are seemingly widely spaced on acreage has a widespread ripple effect on surrounding natural desert. New desert dwellers blade clear their acreage, their children play and move dirt and ride bikes and ATVs on a wide area of land adjacent to their own. Pet cats and dogs root out and kill wildlife as well as disturb habitats. New and wider dirt roads are created along with bypasses and short cuts that create either no more desert, or small islands of surviving vegetation that has no use to native species. Noise and the presence of humans and their attendant influences disturb the more sensitive species like MGS, burrowing owls, Le Conte thrashers and kit foxes, as well as destroying the delicate top soil and plant communities. The MGS is losing habitat at a greater and greater rate.

This species is endemic to the western Mojave Desert. That means, if you have forgotten, that it is found nowhere else in the world. And not the whole Mojave, the Western part only. Implications of high population densities in the petition are just that, implications. Guesswork, speculation. That is not very scientific.

So, if you de-list, then what happens in the near future when it becomes abundantly clear that it needs listing again? Will there be suitable habitat still available? Will there be money available to mount a costly recovery campaign?

Scientific data is the key. Where is the petitioner's new scientific data to substantiate their claim? All they are doing is using someone else's data and mis-interpreting it, as you are no doubt receiving letters about.

De-listing is not warranted and is not the cure-all it seems to be to the petitioners. There are other, broader matters to be dealt with here and MGS is only one of the first to test these. There are other species already feeling the effects of rapid, willy-nilly development and human disregard and they will be joining the MGS with needs of their own to be protected. The more fragmented the the habitat, the more tedious and costly the recovery. Start now to plan for future needs of the native desert inhabitants. The handwriting is on the wall.

Thank you for your consideration,

Sincerely,

Terri Middlemiss

Terri Middlemiss, Conservation Chair

cc; Roy Ashburn, National Audubon - Western Regional Office

20. Summary of letter from Kerncrest Chapter, National Audubon Society:

This letter urges the Commission to not delist the Mohave Ground Squirrel and expresses concern that "the effort to de-list is based on economics, not scientific data." The letter refutes the contention in the petition that federal lands provide substantial long-term management and benefit to the squirrel. The letter cites the cumulative effects of rural development in the desert on animals, plants, and soils, and deplores the lack of sufficient scientific information in the petition. The letter concludes that delisting is not warranted and that the squirrel is only one of many species of the desert which will need to be specially protected.

Feb. 9, 1993

Fish & Game Commission
P.O. Box 944209
Sacramento, CA 94244-2090

Dear Sirs,

I would like to express my strong support for continued listing of the Mojave ground squirrel. Until the developers, business interests and city governments will provide the money necessary to fund the research necessary to de-list the animal, I see no reason not to continue its status.

I have been a land and home owner in this Valley for 32 years and am fully prepared to support economic costs which may be entailed by listing. I would like to point out that your duty is to make your decision based on biological grounds not economic.

Sincerely,

Carol Paniagua

C. Paniaqui
748 West Dolphin
Ridgecrest CA 93555

21. Summary of letter from Carol Panlaqui:

This letter expresses "strong support for continued listing of the Mojave [sic] ground squirrel" and states that, as a landowner in the Ridgecrest area, the writer is "fully prepared to support economic costs which may be entailed by [the continued] listing [of the species]."