Giant kangaroo rat
(*Dipodomys ingens*)

5-Year Review:
Summary and Evaluation

Photo courtesy of John Roser.

U.S. Fish and Wildlife Service
Sacramento Fish and Wildlife Office
Sacramento, California

February 2010

5-YEAR REVIEW
Giant kangaroo rat (*Dipodomys ingens*)

I. GENERAL INFORMATION

Purpose of 5-Year Reviews:

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act (Act) to conduct a status review of each listed species at least once every 5 years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed (or since the most recent 5-year review). Based on the 5-year review, we recommend whether the species should be removed from the list of endangered and threatened species, be changed in status from endangered to threatened, or be changed in status from threatened to endangered. Our original listing of a species as endangered or threatened is based on the existence of threats attributable to one or more of the five threat factors described in section 4(a)(1) of the Act, and we must consider these same five factors in any subsequent consideration of reclassification or delisting of a species. In the 5-year review, we consider the best available scientific and commercial data on the species, and focus on new information available since the species was listed or last reviewed. If we recommend a change in listing status based on the results of the 5-year review, we must propose to do so through a separate rule-making process defined in the Act that includes public review and comment.

Species Overview

The giant kangaroo rat is a small burrowing rodent with large hind limbs, long tail and large fur-lined cheek pouches adapted for bipedal locomotion (two-footed hopping) (Grinnell 1922; Eisenberg 1963). Giant kangaroo rats are primarily seed eaters, but also eat green plants and insects and inhabit annual grassland communities with few or no shrubs, well drained, sandy-loam soils located on gentle slopes (less than 11 percent) in areas with about 6.3 inches or less of annual precipitation (Grinnell 1932; Shaw 1934; Hawbecker 1951). The kangaroo rats form colonies of burrows called precincts (Braun 1985) in which multiple individuals reside (Randall 1997). They are primarily nocturnal and are active all year in all types of weather (Williams and Tordoff 1988). The giant kangaroo rat, by its relative abundance and burrowing activity, is considered a keystone species in grasslands and shrub communities (Schiffman 1994; Goldingay *et al.* 1997). When abundant locally, giant kangaroo rats are significant prey items for many species, including the Federal and State listed endangered San Joaquin kit fox (*Vulpes macrotis mutica*). In addition, their burrows are used by blunt-nosed leopard lizards (*Gambelia sila*) (federally and State endangered) and the San Joaquin antelope squirrel (*Ammospermophilus nelsoni*) (State threatened) (Williams 1992). *Caulanthus californicus* (California jewelflower) (federally endangered) grows primarily on the burrow systems of the giant kangaroo rat (Cypher 1994). Historically, (up to the 1950s) colonies of giant kangaroo rats were found from the base of the Tehachapi Mountains in the south; to 10 miles south of Los Banos, Merced County in the north; the Carrizo Plain and San Juan Creek watershed west of the Temblor Range to the west; and the floor of the San Joaquin Valley to the East. This area encompasses an estimated 1,561,017 acres (Grinnell 1932; Shaw 1934; Hawbecker 1944, 1951; Williams 1992). Currently, the

population is found on less than 5 percent of this historic range and is fragmented into six major geographic units: (1) the Ciervo-Panoche Region in western Fresno and eastern San Benito Counties; (2) Kettleman Hills in southwestern Kings County; (3) San Juan Creek Valley in eastern San Luis Obispo County; (4) the Lokern area, Elk Hills previously known as the National Petroleum Reserve Number One (NPR-1), that includes Buena Vista and McKittrick Valleys, National Petroleum Reserve Number Two (NPR-2), Taft, and Maricopa in western Kern County; (5) the Carrizo Plain in eastern San Luis Obispo County; and (6) the Cuyama Valley along the eastern Santa Barbara-San Luis Obispo County line (U.S. Fish and Wildlife Service [USFWS] 1998).

I.A. Methodology used to complete the review: This review was conducted by staff biologists within the Sacramento Fish and Wildlife Office of the U.S. Fish and Wildlife Service (USFWS), using the *Recovery Plan for Upland Species of the San Joaquin Valley, California* (Recovery Plan) (USFWS 1998) and published literature, agency reports, biological opinions, completed and draft Habitat Conservation Plans (HCPs), and interviews with the species experts. No previous status reviews have been conducted for this species.

I.B. Contacts

Lead Regional or Headquarters Office – Diane Elam, Deputy Division Chief for Listing, Recovery, and Habitat Conservation Planning, Region 8, Southwest Pacific Region, (916) 414-6464.

Lead Field Office – Kirsten Tarp, Recovery Branch, Sacramento Fish and Wildlife Office, (916) 414-6600.

Cooperating Field Office(s): Mike McCrary, Ventura Fish and Wildlife Office, (805) 644-1766.

I.C. Background

I.C.1. FR Notice citation announcing initiation of this review: 71 FR 16584, April 3, 2006

I.C.2. Listing history
Original Listing
FR notice: 52 FR 283
Date listed: January 5, 1987
Entity listed: Species – Giant kangaroo rat (*Dipodomys ingens*), a listed mammal
Classification: Endangered

I.C.3. Species' Recovery Priority Number at start of review: The Recovery Priority Number for the giant kangaroo rat is 2C according to the Service's 2006 Recovery Data Call for the Sacramento Field Office. This is based on a 1-18 ranking system where 1 is the highest-ranked recovery priority and 18 is the

lowest (Endangered and Threatened Species Listing and Recovery Priority Guidelines, 48 FR 43098, September 21, 1983). This number indicates that the taxon is a full species that faces a high degree of threat and has a high potential for recovery. The "C" indicates conflict with construction or other development projects or other forms of economic activity.

I.C.4. Recovery Plan or Outline

Name of plan: Recovery Plan for Upland Species of the San Joaquin Valley, California
Date issued: September 30, 1998

II. REVIEW ANALYSIS

II.A. Application of the 1996 Distinct Population Segment (DPS) policy

II.A.1. Is the species under review listed as a DPS?

____ ***Yes***
__X_ ***No***

II.A.2. Is there relevant new information for this species regarding the application of the DPS policy?

____ ***Yes***
__X_ ***No***

II.B. Recovery Criteria

II.B.1. Does the species have a final, approved recovery plan containing objective, measurable criteria?

__X_ ***Yes***
_____ ***No***

II.B.2. Adequacy of recovery criteria.

II.B.2.a. Do the recovery criteria reflect the best available and most up-to-date information on the biology of the species and its habitat?

__X_ ***Yes***
_____ ***No***

II.B.2.b. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)?

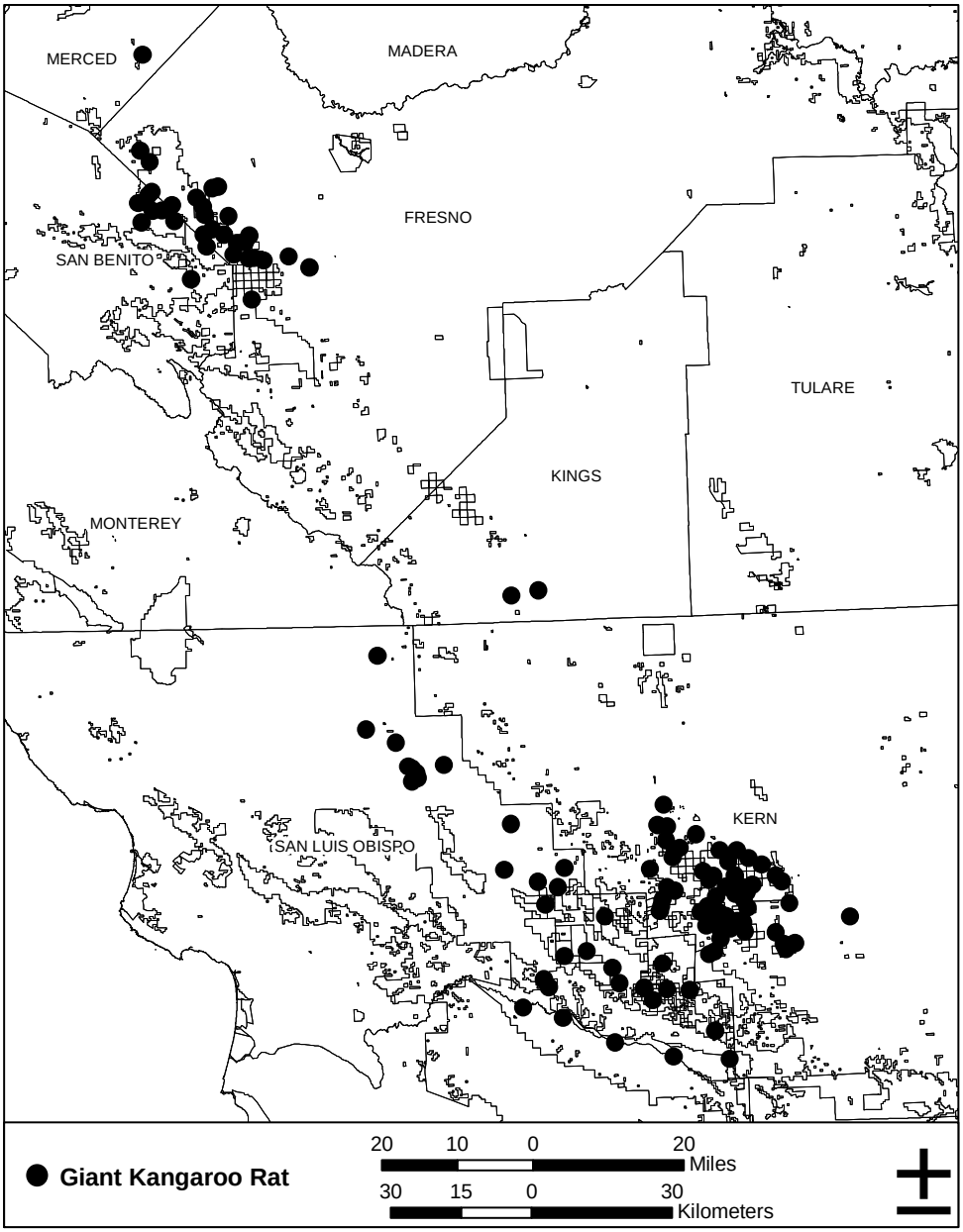
_____ ***Yes***
__X__ **No**

II.B.3. List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information. For threats-related recovery criteria, please note which of the 5 listing factors* are addressed by that criterion. If any of the 5-listing factors are not relevant to this species, please note that here.

The downlisting and delisting criteria for the giant kangaroo rat in the Recovery Plan are described below. Overutilization for commercial, recreational, scientific, or education purposes was not considered a threat to recovery of the giant kangaroo rats. Figure 1 maps the distribution records of the giant kangaroo rat.

*A) Present or threatened destruction, modification or curtailment of its habitat or range;
B) Overutilization for commercial, recreational, scientific, or educational purposes;
C) Disease or predation;
D) Inadequacy of existing regulatory mechanisms;
E) Other natural or manmade factors affecting its continued existence.

Giant Kangaroo Rat



California Natural Diversity Database
Wildlife and Habitat Data Analysis Branch
Department of Fish and Game
October 2009

Figure 1. Distribution Records of the Giant Kangaroo Rat (*Dipodomys ingens*).

Downlisting Criteria

Reclassification to threatened status will be evaluated when the species is protected in specified recovery areas from incompatible uses, management plans have been approved and implemented for recovery areas that include survival of the species as an objective, and population monitoring indicates that the species is stable. Downlisting criteria include:

1) Secure and protect specified recovery areas from incompatible uses. (Addresses Listing Factor A: Present or threatened destruction, modification, or curtailment of habitat or range.) :
    A) All occupied lands in Carrizo Plain Natural Area and Ciervo-Panoche Natural Area
    B) Western Kern County areas
        1. 90 percent of the existing natural land in the Lokern area of western Kern County (bounded on the east by the California Aqueduct, on the south by Occidental of Elk Hills, on the west by State Highway 33, and on the north by Lokern Road), and
        2. Naval Petroleum Reserves in California
            a. 90 percent of the natural land in Elk Hills (Naval Petroleum Reserve No. 1 [NPR-1]) in western Kern County, and
            b. 80 percent of the natural land in Naval Petroleum Reserve No. 2 (NPR-2) in western Kern County including all in the Buena Vista/McKittrick Valley between Elk Hills Road on the southeast and State Highway 33 on the northwest, and
        3. 80 percent of other occupied habitat in western Kern County.
2) Approve and implement management plans for all protected areas identified as important to the continued survival of the giant kangaroo rat (including the Carrizo Plain Natural Area that includes survival of the species as an objective. (Addresses Listing Factor A: Present or threatened destruction, modification, or curtailment of habitat or range.)
3) Population monitoring shows during a 5-year period no greater than a 20 percent change in population size: (Addresses Listing Factor E: Other natural or manmade factors affecting its continued existence.)
    A) During years without drought, or
    B) When annual precipitation is greater than 35 percent above average.

The current level of protection is evaluated below and in Table 1 for each of the recovery areas listed in the downlisting criteria. Within Table 1 are areas identified in the recovery plan as important for downlisting or delisting of the giant kangaroo rat. However in several of these identified areas, such as Kettleman Hills, Elk Hills, Naval Petroleum Reserve 2, San Juan Creek Valley, and Upper Cuyama Valley, the current amount of suitable or occupied habitat is not known and recovery efforts in these areas have not occurred (B. Cypher, Endangered Species Recovery Program, pers. comm. 2009; L. Saslaw Wildlife Biologist, Bureau Land Management, pers. comm. 2009).

Table 1. Summary of land protection recovery criteria for the federally-listed giant kangaroo rat.

Recovery Area (protection goal)	Recovery Step	Total Habitat Available	Total Habitat Protected	Total GKR Occupied Habitat Protected	Method of Protection	Adjacent/Residual Threats
Carrizo Plain Natural Area (protect 100% of occupied habitat)	Downlist to threatened	78,000 acres	68,000 acres (87%)	68,000 acres	BLM National Monument, private easements	solar energy development, dryland farming, residential development
Lokern Area (protect 90% occupied habitat)	Downlist to threatened	43,870 acres	13,160 acres (30%)	1,316 acres (3%)	Federal and State lands, private easements	oil and gas extraction
Elk Hills –(NPR-1) (1) (protect 90% natural lands)	Downlist to threatened	Unknown	7,801 acres	Unknown	Occidental Petroleum Conservation Management Area	oil and gas extraction
Naval Petroleum Reserve - 2 (protect 80% natural lands) (protect 100 % of Buena Vista and McKittrick Valleys, see next row)	Downlist to threatened	Unknown	None	None	private easements	Oil and gas extraction
Buena Vista and McKittrick Valleys (protect 100% natural lands) (Part of NPR-2)	Downlist to threatened	22,176 acres	3,770 acres (17%)	Unknown	Occidental Petroleum Conservation Management Area	oil and gas extraction
Other Western Kern County (protect 80% other occupied habitat)	Downlist to threatened	Unknown	None	None	private easements	urban/residential development
San Juan Creek Valley (protect 100% occupied habitat)	Delist	Unknown	None	None	Federal and State lands	solar energy development, urban/suburban development
Upper Cuyama Valley (protect 100 % occupied habitat)	Delist	Unknown	None	None	Federal and State lands	solar energy development, dryland farming, urban/suburban development

* BLM-Bureau of Land Management, ACEC – Area of Critical Environmental Concern, NPR – Naval Petroleum Reserve.

(1) In the Recovery Plan for Upland Species of the San Joaquin Valley in Table 2, Elk Hills is incorrectly identified as NPR-2; the Elk Hills are in NPR-1. Additionally, the 10, 380 acres identified as on-site mitigation lands in Elk Hills is an estimate. As of 2009, 7, 801 acres of land in the Elk Hills (NPR-1) have been set aside as conservation acres in the form of easements. No lands have been set aside for species in NPR-2 except for in Buena Visa and McKittrick Valleys.

Table 1 continued. Summary of land protection recovery criteria for the federally-listed giant kangaroo rat.

Ciervo-Panoche Natural Area (protect 100% occupied land)	Downlist to threatened	95,000 acres	16,048 acres (17%)	Unknown	BLM ACEC and private easements	solar development, dryland farming, urban/residential development
Kettleman Hills (protect 100% occupied land)	Delist	Unknown	Unknown	Unknown	BLM, private easements	solar development, urban/residential development, oil and gas extraction, urban/residential development

* BLM-Bureau of Land Management, ACEC – Area of Critical Environmental Concern, NPR – Naval Petroleum Reserve.

1. Secure and protect specified recovery areas from incompatable uses:

A. Carrizo Plain Natural Area and Ciervo-Panoche Natural Area
Criterion: Protection of all occupied lands
On January 17, 2001, the Carrizo Plain National Monument was established under the authority of Bureau of Land Management. The Carrizo Plains National Monument was established on 250,000 acres of the area previously known as the Carrizo Plains Natural Area (Bureau of Land Management 2009). The Carrizo Plains National Monument consists of protected lands and encompasses 204,107 acres of Federal land. Other landowners include California Department of Fish and Game, The Nature Conservancy, and other private landholders (e.g., farmers) (Bureau of Land Management 2009). As of 2009, there are 78,000 acres of suitable habitat for giant kangaroo rat in the Carrizo Natural Area. All of the suitable habitat is occupied (L. Saslaw, Bureau of Land Management, *in litt*. 2009). The Recovery Plan for Uplands Species of the San Joaquin Valley, California, referencing Williams (1992) estimates total occupied habitat over the range of the giant kangaroo rat as 27,450 acres with 6,877 acres occupied on the Carrizo Plain. This 11-fold increase in available and occupied habitat between the Recovery Plan and the 2009 estimate is explained below in Section II C.1 A. Updated information on species biology and habitat abundance.

Of the78,000 acres of available and occupied habitat on the Carrizo Plain, 68,000 (87 percent) is protected. The remaining 10,000 acres of suitable and occupied habitat is privately owned and is not protected (Saslaw, *in litt.* 2009). The downlisting criteria is for 100% of occupied habitat to be protected. Therefore although progress has been made toward recovery of the giant kangaroo rat on the Carrizo Plain, the downlisting criterion has not yet been met.

Ciervo-Panoche Natural Area (Northern Range)
Criterion: Protection of all occupied lands
The downlisting criterion for the northern range includes the protection of all giant kangaroo rat habitat in the Ciervo-Panoche Natural Area (i.e., Silver Creek Ranch and existing habitat along the eastern bases of Monocline Ridge and the Tumey Hills, between Arroyo Ciervo on the south and Panoche Creek on the north). The Ciervo-Panoche Natural Area is an area of natural habitat appropriate for giant kangaroo rat, and potentially other species of concern that is owned by Federal and State land management agencies such as the Bureau of Land Management and California Department of Fish and Game. In the Ciervo-Panoche area, the Bureau of Land Management owns about 60 percent of the lands that are considered to be giant kangaroo rat habitat (J. Lowe, Bureau of Land Management, *in litt.* 2006). However, only the Areas of Critical Environmental Concern (ACECs) are protected for species preservation by Bureau of Land Management. The ACECs protect about 11,260 acres (12 percent) of the 95,000 acres of natural lands within the Ciervo-Panoche area between Panoche Creek to the north and Arroyo Ciervo to the south. The ACECs range in size from 150 to 2,350 acres. Due to funding constraints at the Bureau of Land Management Hollister Office, there is no available information on occupation of the ACEC lands or private lands by giant kangaroo rat in the Panoche region (M. Westphal, Ecologist, Bureau of Land

Management, pers. comm. 2009). Additional giant kangaroo rat habitat is protected by the 4,788-acre ACEC/California Department of Fish and Game Ecological Reserve located about 4.5 miles northeast of Panoche Creek. However, the majority of the Panoche Valley, the primary source of regional expansion of the giant kangaroo rat within the northern range (Good *et al.* 1997; Loew *et al.* 2005), remains unprotected. In September 2006, 1,200 acres of rangeland in the Panoche Valley were sold to private interests, another 9,000 acres of rangeland are currently for sale (Schuil and Associates 2009, and another 10,000 have been optioned but not yet permitted for an industrial solar development project (see section II.C.2a. for details on the development). Panoche Creek and Silver Creek were identified as important dispersal corridors within the northern range of the giant kangaroo rat (Loew *et al.* 2005); however, the majority of these areas are also currently unprotected.

In summary, with the protection of only 17 percent of giant kangaroo rat habitat between Panoche Creek and Arroyo Ciervo, the downlisting criterion for protection of all occupied habitat in the Ciervo-Panoche area has not been met.

B. Western Kern County areas

1. Lokern

Criterion: Protection of 90 percent of the existing natural land bounded on the east by lands just east of the California Aqueduct, on the south by Occidental of Elk Hills, on the west by State Highway 33, and on the north by Lokern Road.

Giant kangaroo rats occur in scattered colonies across the Lokern area. Currently, 13,160 acres (30 percent) of the Lokern area is protected on Federal or State lands or under conservation easements (Saslaw, pers. comm. 2009). Of these protected suitable habitats currently only 10 percent are occupied by giant kangaroo rats, but the reason for the low occupancy is unknown (Saslaw, pers. comm. 2009). The protected Lokern lands include Bureau of Land Management lands (3,858 acres), Center for Natural Lands Management (CNLM) lands (3,332 acres), California Department of Fish and Game lands (968 acres), Plains Exploration & Production Company (PXP; 840 acres), and Occidental of Elk Hills, Inc. (Occidental Petroleum; 4,162 acres) conservation lands. Therefore, the downlisting criterion for the protection of 90 percent of occupied habitat in the Lokern area has not yet been met.

2. Naval Petroleum Reserves in California

a. Elk Hills (Naval Petroleum Reserve No. 1 (NPR-1))

Criterion: Protection of 90 percent of natural land.

When NPR-1 was sold to Occidental Petroleum, Occidental Petroleum entered into a Conservation Management Agreement on November 6, 1998, with the U.S. Fish and Wildlife Service and the California Department of Fish and Game for the establishment of a 7,801-acre conservation area along the northern (North Flank) and southern (Buena Vista Valley) flanks of the Elk Hills. The North Flank consists of 4,162 acres at the south end of Lokern, and the Buena Vista Valley portion consists of 3,770 acres. The

remaining 132 acres of the conservation area are maintained and held as conservation lands for future Occidental Petroleum projects. The total area of Elk Hills is over 47,409 acres. Therefore, less than 20 percent of the Elk Hills are protected and the downlisting criterion for the protection of 90 percent of natural land in the Elk Hills has not yet been met.

b. Naval Petroleum Reserve No. 2 (NPR-2)

Criterion: Protection of 80 percent of the natural land.

The largest landowners on NPR-2 are Bureau of Land Management (about 5,760 acres) and Crimson (about 7,680 acres). The Bureau of Land Management lands are not protected; however, the Oil and Gas Programmatic Biological Opinion for Kings and Kern Counties (USFWS 2001, 2003a) currently limits disturbance of high-quality giant kangaroo rat habitat to less than 10 percent per 640-acre section and lower-quality giant kangaroo rat habitat to less than 25 percent per section. Several sections within NPR-2, however, had already exceeded the disturbance thresholds when the Bureau of Land Management acquired the properties. The Bureau of Land Management Oil and Gas Programmatic Biological Opinion currently limits the total permanent disturbance of giant kangaroo rat habitat on Bureau of Land Management lands throughout Kings and Kern Counties to 180 acres. This Biological Opinion only covers oil and gas projects and does not imply that these lands are protected for the giant kangaroo rat. None of NPR-2 is protected. Therefore, the downlisting criterion for the protection of 80 percent of natural land in NPR-2 excluding Buena Vista and McKittrick Valleys (see below) has not yet been met.

Buena Vista and McKittrick Valleys

Criterion: Protection of all natural land between Elk Hills Road on the southeast and State Highway 33 on the northwest.

The downlisting criterion in the Buena Vista and McKittrick Valleys states that all natural land in the Buena Vista and McKittrick Valleys be protected. The largest landowners there are the Bureau of Land Management (about 2,880 acres), and the petroleum companies Chevron (about 4,480 acres), Occidental Petroleum (about 3,770 acres), Crimson Resources Management (Crimson) (about 2,560 acres), and PXP (about 3,200 acres). About 5,286 additional acres are in smaller allotments owned by private landowners. The Occidental Petroleum conservation lands (Occidental Petroleum Conservation Management Agreement, November 6, 1998) currently protects about 3,770 acres (17 percent) of the Buena Vista and McKittrick Valleys (Saslaw, pers. comm. 2009). The Bureau of Land Management 2,880 acres are not formally protected; however, the Bureau of Land Management Oil and Gas Programmatic Biological Opinion for Kings and Kern Counties (USFWS 2001, 2003a) currently limits total disturbance of giant kangaroo rat habitat on Bureau of Land Management lands from oil and gas projects to 180 acres. However, this biological opinion only protects these Bureau of Land Management lands from disturbance caused by oil and gas exploration and oil and gas activities. Other activities such as development of solar fields on these Bureau of Land Management lands are not currently restricted.

Less than 18 percent of the natural lands in the Buena Vista and McKittrick Valleys are fully protected and an additional 7.4 percent of Bureau of Land Management land is partially protected under an existing programmatic biological opinion. Therefore, the downlisting criterion for the protection of all natural land in the Buena Vista and McKittrick Valleys has not yet been met.

c. Other Western Kern County

Criterion: Protection of 80 percent of other occupied habitat.

Currently, no giant kangaroo rat habitat in the areas not already specifically discussed in western Kern County are protected. This land is mostly privately held. Therefore, the downlisting criterion for the protection of 80 percent of occupied habitat in western Kern County has not yet been met.

2. Management Plans

Currently protected lands that are covered by management plans include only Bureau of Land Management, Occidental Petroleum, PXP, and Lokern Natural Area lands. These plans are described below in section II.C.2.a. Therefore, the downlisting criterion requiring the approval and implementation of management plans for all protected areas that includes the survival of the giant kangaroo rat as an objective has only partly been met.

3. Population Monitoring

a. Population stability in the Carrizo Plain Natural Area, Ciervo-Panoche Natural area, and western Kern County areas.

Criterion: Population monitoring shows during a 5-year period no greater than a 20 percent change in population size during years without drought, or when annual precipitation is greater than 35 percent above average.

Annual monitoring studies of the giant kangaroo rat in the Carrizo Plain Natural Area (Williams and Germano 1994; Kelly *et al.* 2004; P. Kelly, ecologist, Endangered Species Recovery, pers. comm. 2006), the Lokern area (Germano *et al.* 2005; L. Saslaw, Wildlife Biologist, Bureau of Land Management, pers. comm., 2006), and the Elk Hills (NPR-1) (Quad Knopf, Inc. 2006) show that the populations in the Carrizo Plain, and western Kern County are currently stable. After a several year period of drought, and subsequent population decline in giant kangaroo rats, numbers have rebounded to pre-drought levels (Saslaw, pers. comm. 2009).

The estimated range of the giant kangaroo rat on the Carrizo Plain has increased significantly between 2001 and 2006 (R. Stafford, Wildlife Biologist, California Department of Fish and Game, pers. comm. 2006; Bidlack 2007). In 2001 and 2006 aerial surveys were conducted of giant kangaroo rat precincts in Carrizo Plain National Monument. Precincts are highly visible from the air as these areas surrounding kangaroo rat burrows have been grazed nearly bare by the rodents. GPS locations of the boundaries of precinct aggregations were mapped in a GIS and the points were used to delineate an approximate range for giant kangaroo rats in the Carrizo. Giant kangaroo rat precinct area expanded 83 percent between 2001 and 2006 (Bidlack 2007).

There are no long-term studies of the population trend of giant kangaroo rats in the northern range (Ciervo-Panoche) because of lack of funding (J. Lowe, Wildlife Biologist, Bureau of Land Management, pers. comm., 2006). Therefore, the downlisting criterion for population stability in all specified recovery areas has only partly been met.

Delisting Criteria

Delisting will be considered when, in addition to the criteria for downlisting, all of the following conditions have been met:

1) 100 percent of occupied habitat on public lands in the Cuyama Valley, San Juan Creek Valley, and Kettleman Hills is protected, and
2) Populations are stable or increasing in the Carrizo, Panoche, and western Kern County metapopulations through one precipitation cycle.

Due to the lack of protection of sufficient habitat in specified recovery areas, the downlisting criteria for the giant kangaroo rat have not been met. Therefore, the delisting criteria for the giant kangaroo rat have also not been met. Most of the giant kangaroo rat habitat in the satellite populations mentioned in the delisting criteria is unprotected on private lands; giant kangaroo rat populations have not been monitored and their status is unknown. The status of the giant kangaroo rat and its habitat in the satellite populations is discussed below, in section II.C.2.a.

II.C. Updated Information and Current Species Status

II.C.1. Biology and Habitat

II.C.1.a. Abundance, population trends, and spatial distribution

Currently, existing populations on protected lands on the Carrizo Plain are considered to be stable (Stafford, pers. comm. 2006; Saslaw, 2009). However, giant kangaroo rat populations are dependent on weather patterns and vegetation structure and therefore the amount of occupied habitat will fluctuate with variation in these two parameters (Saslaw, pers. comm., 2009).
Remaining natural lands with suitable habitat for giant kangaroo rat continue to decline (Service files, 2009).

Before the 1950s, colonies of giant kangaroo rats were spread over hundreds of thousands of acres of continuous habitat in the western San Joaquin Valley, Carrizo Plain, and Cuyama Valley (Grinnell 1932; Shaw 1934; Hawbecker 1944, 1951). In the listing rule, the estimated historical range of the giant kangaroo rat ranged from 1,300,000 to 2,500,000 acres. In 1992, Williams estimated the historic habitat to be approximately 1,600,000 acres (Williams 1992). After the completion of surveys throughout the potential geographic area between 1979 and 1987, Williams (1992) reported the distribution of giant kangaroo rats was restricted to approximately 27,450 acres. The reduction in giant kangaroo rat distribution was due to widespread agricultural development of natural habitat in the San Joaquin Valley beginning in the 1960s. The remaining habitats are highly fragmented and mostly located on suboptimal terrain (Grinnell 1932; Williams

1992; Williams *et al.* 1993, 1995; Goldingay *et al.* 1997). There have been no subsequent range-wide surveys of giant kangaroo rats since the late 1980s.

The original distribution of the giant kangaroo rat is known to have extended from southern Merced County, through the San Joaquin Valley, to southwestern Kern County and northern Santa Barbara County (Hall 1981). At the time of listing we stated that many populations of the giant kangaroo rat in Fresno, Kern, and San Luis Obispo Counties had been extirpated or had experienced recent precipitous declines (Williams 1985). The giant kangaroo rat apparently had been completely exterminated in Merced County, and only a few small, isolated colonies survived in San Benito, Fresno, and Kings Counties. In the final listing rule, we identified that the last relatively large blocks of suitable habitat were located at the southern edge of the historic range of the species, in the upper Buena Vista Valley of western Kern County, the Carrizo Plains of eastern San Luis Obispo County, and the Cuyama Valley of northern Santa Barbara County. Surveys made in 1985 documented precipitous declines in populations present on the Carrizo Plains while the current status of the Cuyama Valley population was not known (Williams 1985).

The Recovery Plan for Uplands Species of the San Joaquin Valley, California (1998), referencing Williams (1992) estimated total occupied habitat over the range of the giant kangaroo rat at 27,450 acres with 6,877 acres occupied on the Carrizo Plain. These values are estimates from range-wide surveys conducted between 1979 and 1987. Since 1987, additional surveys have expanded the available giant kangaroo rat habitat through out the species range (Stafford, pers. comm., 2006; Bidlack 2007). In the Carrizo Plain, 100,000 acres of private land were purchased by the Nature Conservancy and deeded to the Bureau of Land Management to become part of the Carrizo Plain National Monument. These acres were retired from cultivation and reverted to natural habitat. Of this 100,000 acres of restored natural lands, 40,000 acres were suitable habitat for giant kangaroo rats and are now occupied by the giant kangaroo rat. (Saslaw, pers. comm., 2009). This action combined with the expanded field surveys conducted by the California Department of Fish and Game on the Carrizo Plain, resulted in the increase of giant kangaroo rat habitat on the Carrizo Plain from 6,877 acres in 1992 to 78,000 acres by 2009.

Giant kangaroo rat habitat is currently fragmented into six major geographic units: (1) the Ciervo-Panoche Region in western Fresno and eastern San Benito Counties; (2) Kettleman Hills in southwestern Kings County; (3) San Juan Creek Valley in eastern San Luis Obispo County; (4) the Lokern area, Elk Hills (NPR-1), that includes Buena Vista and McKittrick Valleys, NPR-2, Taft, and Maricopa in western Kern County; (5) the Carrizo Plains in eastern San Luis Obispo County; and (6) the Cuyama Valley along the eastern Santa Barbara-San Luis Obispo County line (USFWS 1998).

Genetic researchers group the giant kangaroo rat into two major populations: western Kern and eastern San Luis Obispo Counties (southern range), and western Fresno and eastern San Benito Counties (northern range) (Loew *et al.* 2005). These researchers also identify three satellite populations near the southern range: Cuyama Valley, San Juan Creek Valley, and Kettleman Hills. Several long-term annual studies (discussed below) research the population trends of subpopulations of the southern range of giant kangaroo rats (Williams and Germano 1994; Germano *et al.* 2001; Kelly *et al.* 2004; Germano *et al.* 2005; Quad Knopf 2006; Kelly, pers. comm. 2006; Warrick 2006; D. Germano, Professor, Department of Biology, California State University, Bakersfield, California, pers. comm. 2006). There are no long-term studies of population trends in the northern range (Lowe, pers. comm. 2006), but several reports have estimated the population and areal coverage of the giant kangaroo rat within the northern range (Williams 1992; Williams *et al.* 1995; Loew *et al.* 2005). For the satellite populations, some surveys for the giant kangaroo rat have been conducted in Taylor Canyon in the western Cuyama Valley (Stafford, pers. comm. 2006), but no surveys have been conducted in the San Juan Creek Valley, Kettleman Hills, or other areas of Cuyama Valley.

Southern Range

The southern range of the giant kangaroo rat consists of the core populations in the Carrizo Plain in eastern San Luis Obispo County and in the Lokern area, the Elk Hills (NPR-1), the Buena Vista and McKittrick Valleys, and NPR-2 in western Kern County. Based on burrow, food-cache counts, as well as capture-mark/recapture methods, Loew *et al.* (2005) estimated the subpopulations of the giant kangaroo rat within eastern San Luis Obispo County to be about 21,800 in the Carrizo Plain divided into three subpopulations; 20,000 in the Elkhorn Plain portion of the Carrizo Plain, 500 at Painted Rock in the Carrizo Plain, and 1,300 in the translocated population at Soda Lake in the Carrizo Plain. No estimates were given for the giant kangaroo rat subpopulations in western Kern County. Aerial surveys of active giant kangaroo rat precincts in 2006 reported an increase in the range of the giant kangaroo rat on the Carrizo Plain by 40 percent since 2001, where giant kangaroo rats have expanded northward to Painted Rock in the Carrizo Plain and eastward onto the ridge tops and steeper slopes of the Temblor Range (Stafford, pers. comm. 2006; Bidlack 2007).

The populations of giant kangaroo rats fluctuate widely in response to inter-annual variations in precipitation (Single *et al.* 1996). The Endangered Species Recovery Program has tracked population trends of giant kangaroo rats on grazed and ungrazed plots surveyed biannually since 1987 on the Carrizo Plain (Williams and Germano 1994; Kelly *et al.* 2004; Kelly, pers. comm. 2006). The largest population decline occurred in 1991 after several years of drought without successful seed production of plants used as food source by the giant kangaroo rat. The drought ended with a heavy rainfall the last week of March 1991, resulting in flooding which probably contributed to the precipitous decline in numbers of giant kangaroo rats to less than 1 individual per acre during the April

1991 census. Subsequently, densities increased to 49 to 57 per acre in 1992 and remained at 24 to 49 per acre through 1997. An unusually wet year in 1998 resulted in a significant decrease in the density of giant kangaroo rats on ungrazed plots to 8 per acre while densities on grazed plots remained high near 40 per acre. Subsequently, population densities on the ungrazed plots increased but did not reach that observed on the grazed plots until 2001. During the dry years 2001 to 2004, the number of individuals per acre on both the grazed and ungrazed plots remained relatively high at 28-52 (Kelly *et al.* 2004). The number of giant kangaroo rats on Carrizo Plain peaked in 2005 before declining again in 2006 (S. Phillips, Geographic Information Specialist, Endangered Species Recovery Program, pers. comm. 2006; Saslaw, pers. comm. 2006). The positive relationship between population numbers, rainfall, and grazing is further discussed in section II.C.2.e.

From 1993-2005, giant kangaroo rat densities were determined by conducting capture-mark / recapture studies in the North Lokern area on a single 493 feet x 493 feet plot. The number of giant kangaroo rats captured on this plot ranged from a high of 110 (20 giant kangaroo rats per square acre) in 1994 and 1996, to a low of zero giant kangaroo rats per square acre during the wet year of 1998. From 2002-2005, the number of giant kangaroo rats at the North Lokern site was moderately high, from 40-75 (7-14 giant kangaroo rats per square acre). In 2006, the number of giant kangaroo rats captured at the North Lokern site increased to 94 (17 giant kangaroo rats per square acre) (Saslaw, pers. comm. 2006).

Warrick (2006) compared the number of kangaroo rats on shrubland and grassland plots in the Lokern area from 2001 to 2006. Giant kangaroo rats were only 3 to 5 percent of the total number of small mammals trapped. On grassland plots, the number of giant kangaroo rats increased from a low of 2 individuals in 2001 to a high of 8 individuals in 2005. On shrubland plots, the number of giant kangaroo rats increased from a low of zero individuals in 2001 to a high of 7 individuals in 2005. The number of giant kangaroo rats on the grassland plots was higher than on the shrubland plots during all five years of the study. In 2006, Warrick (2006) trapped a combined total of 9 giant kangaroo rats on the Lokern grassland and shrubland plots; this was down from the 15 giant kangaroo rats trapped in 2005 but more than the 2-6 giant kangaroo rats trapped annually in 2001-2004.

Quad Knopf (2006) surveyed the number of active giant kangaroo rat precincts on the northern (i.e., Lokern) and southern (i.e., Buena Vista Valley) flanks of the Elk Hills (i.e., NPR-1) from 2001-2005. In 2005, active giant kangaroo rat precincts were reported in 11 out of 13 640-acre sections surveyed. A total of 275 active giant kangaroo rat precincts were observed in 2005 compared to 199 reported in 2004. The majority of the active precincts (85 percent) in 2005 occurred along the northwest portion of Elk Hills and adjacent properties. In Buena Vista Valley, a total of 40 active precincts were observed in 2005 compared to 84 in 2004 (but greater than in 2001 and 2002).

Northern Range

The northern range of the giant kangaroo rats consists of several disjunct populations in the Panoche Valley, Tumey Hills, Ciervo Hills, and Monocline Ridge of eastern San Benito County and western Fresno County (Loew *et al.* 2005). No long-term population surveys exist for the giant kangaroo rats in the northern range because of lack of funding (Lowe, pers. comm. 2006; Westphal, pers. comm. 2009); however, several short-term studies have estimated the population and areal coverage of the giant kangaroo rats there (e.g., Williams 1992; Williams *et al.* 1995; Loew *et al.* 2005). From 1980-1985, the population of the giant kangaroo rats in the northern range was estimated at only 2,000 over 709 acres (2.8 individuals per acre) (Williams 1992). Beginning in summer 1991, the population of the giant kangaroo rats increased dramatically at the end of a 5-year drought. In 1992-1993, the population of the giant kangaroo rats in the northern range was estimated to be 37,125 over an area of 4,653 acres (8.0 per acre) (Williams *et al.* 1995). More recently, Loew *et al.* (2005) estimated the population of the giant kangaroo rats in the northern range to be about 12,375 based on burrow and food-cache counts, as well as capture-mark/recapture methods. The authors further estimated the subpopulations of the giant kangaroo rat within the northern range to be about 80 in the Ciervo Hills, 1,194 in Tumey Hills, 5,480 in Monocline Ridge, and 5,621 in the Panoche Valley.

Satellite Populations

Little is known about the status of the small satellite populations of giant kangaroo rats in the Cuyama Valley, San Juan Creek Valley and Kettleman Hills. A small population of about 100 giant kangaroo rats was reported on a juniper woodland bench in Taylor Canyon of the western Cuyama Valley within the protected Carrizo Plain Ecological Reserve. Surveys of active precincts in 2005 showed that the occupied acreage of giant kangaroo rats there had doubled in size since 2001 (Stafford pers. comm. 2006). Much of the rest of Cuyama Valley, however, is farmed and no longer provides habitat for the giant kangaroo rat.

The status of the giant kangaroo rat in the San Juan Creek Valley and Kettleman Hills is unknown. The latest reported sighting of giant kangaroo rats in the San Juan Creek Valley was in the late 1980s, 1.5 miles southeast of the mouth of Camatta Canyon (CNDDB 2009). More recently, biologists of Wildlands, Inc. surveyed the San Juan Creek Valley as a potential site for a San Joaquin kit fox conservation bank, but did not observe any giant kangaroo rat precincts (S. Moss, Central California Regional Manager, Wildlands, Inc., pers. comm. 2006). Wildlands, Inc., considered the site low priority for conservation due to the complex topography. The giant kangaroo rat, however, is still presumed extant in San Juan Creek Valley (CNDDB 2009). In June 1999, 3-4 giant kangaroo rat adults were observed about 0.4 mile southeast of the State Highway 41/46 interchange in the Cholame Valley, northeastern San Luis Obispo County, about 10 miles north-northeast of the San Juan Creek Valley sighting (CNDDB 2009).

The latest reported sightings of the giant kangaroo rat in the Kettleman Hills were 30 precincts over 2-3 acres at Avenal Gap in 1985 and an unspecified number of colonies 0.5 mile northeast of Las Perillas Pumping Plant in the early 1980s (CNDDB 2009). In August 2006, about 2,000 acres of native saltbush habitat along Interstate 5 north of the Kings-Kern County line was disked for cultivation of melons. The site was less than 5 miles east of reported sightings of the giant kangaroo rat in the Avenal Gap of the Kettleman Hills (CNDDB 2009), and therefore, could have been potential giant kangaroo rat habitat.

In summary, long-term population studies in the southern range on the Carrizo Plain (Williams and Germano 1994; Kelly *et al.* 2004; Kelly, pers. comm. 2006; Stafford, pers. comm. 2006); the Lokern area (Germano *et al.* 2005; Saslaw, pers. comm. 2006), and the Elk Hills at Naval Petroleum Reserve No. 1 (NPR-1) (Quad Knopf 2006) show the species' status on protected lands to be stable. Potential unsurveyed habitat continues to be lost to unpermitted activity. Project impacts to giant kangaroo rat habitat have not been minimized with in-kind habitat protection (as discussed further in II.C.2.a Five-factor Analysis Factor A).

The species' status within the northern range (Ciervo-Panoche, eastern San Benito County, and western Fresno Counties) and the satellite populations (Cuyama Valley, eastern Santa Barbara-San Luis Obispo County line; San Juan Creek Valley, eastern San Luis Obispo County; and Kettleman Hills, southwestern Kings County) is unknown, as no long-term studies have been conducted there (Lowe, pers. comm. 2006; Stafford, pers. comm. 2006; Westphal, pers. comm. 2009).

II.C.1.b. Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):

Historically, and at the time of listing the giant kangaroo rat was believed to inhabit annual grassland communities with few or no shrubs and sandy-loam soils on gentle slopes (approximately 10 percent) and in areas receiving 6 to 7 inches of rain per year but free from flooding (Grinnell 1932; Shaw 1934; Hawbecker 1951). Currently, the giant kangaroo rat inhabits areas of both annual grasslands and shrub communities with various soil types and slopes up to 22 percent. This broader concept of habitat suggests that current populations are found on suboptimal lands now that optimal grassland habitats on which were found historic populations are under cultivation.

Changes in annual rainfall totals (Single *et al.* 1996) are the major natural ecosystem process occurring in giant kangaroo rat habitat. This process was not specifically identified in the listing rule, but within the Recovery Plan for Upland Species of the San Joaquin Valley, changes in weather patterns were linked to expansion and declines in giant kangaroo rat populations (USFWS 1998). Changes in annual rainfall can affect forage availability (Williams 1992; Williams and Germano 1994), the development of pathogenic toxic molds (Frank 1988;

Single *et al.* 1996; Germano *et al.* 2001), and the availability of fuels for fire (Germano *et al.* 2001; Sugihara *et al.* 2006; Warrick 2006).

An ongoing grazing study reported the effects of cattle grazing on giant kangaroo rats and other listed species in the Lokern area (Germano *et al.* 2005). The annual grazing study analyzes the total number of small mammals captured on four grazed and four ungrazed plots. During the eight-year study, a total of 15 giant kangaroo rats were trapped on the ungrazed plots while 33 were caught on the grazed plots, and the number of giant kangaroo rats caught each year also was greater on grazed plots than ungrazed plots. Giant kangaroo rats, however, represented less than 3 percent of the total number of small mammals trapped on the Lokern grazing study plots, which likely indicates that this is suboptimal habitat for giant kangaroo rats (Braun 1985). As this is an ongoing study, statistical tests of significance have not been performed on the data.

II.C.1.c. Genetics, genetic variation, or trends in genetic variation

Two research studies have analyzed the genetic structure and diversity of populations of giant kangaroo rats in their northern and southern ranges (Good *et al.* 1997; Loew *et al.* 2005). Good *et al.* (1997) analyzed mitochondrial DNA (mtDNA) variation from nine naturally occurring populations throughout the species' range. Loew *et al.* (2005) examined genetic variation at six microsatellite DNA loci in individuals from six populations in the northern and southern populations.

These studies found that the overall genetic diversity as a surrogate for genetic health of the giant kangaroo rats was high for endangered animals (Good *et al.* 1997; Frankham *et al.* 2002; Loew *et al.* 2005) despite the biologically recent reduction in the animals range. High genetic diversity may benefit species by providing a framework for species adaption to changing environmental conditions. Good *et al.* (1997) found that within the southern range, the populations of giant kangaroo rat on the Carrizo Plain act effectively as one large population although fluctuations in size may affect their genetic structure (Good *et al.* 1997). However, in the northern range although the between group genetic diversity of subpopulation remains high, the topographic complexity, isolation and small size of these subpopulations has reduced the amount of within group genetic diversity. Thus the individuals within a subpopulation are genetically very alike but genetically different (diverse) from their neighboring populations. Low within group genetic diversity increases the risk that random environmental events such as disease may eliminate these small subpopulations. Loss of any of these small unique subpopulations will reduce the overall high genetic diversity of the northern range populations (Good *et al.* 1997; Loew *et al.* 2005).

These studies did find evidence of some historical connectivity between Panoche Valley and the Ciervo Hills and Tumey Hills via long-distance migrants or stepping stone populations Good *et al.* (1997). Additionally, Loew *et al.* (2005)

showed that the populations at Monocline Ridge and Tumey Hills in the northern range were not completely isolated from each other and noted the importance of the Panoche Creek as a northern dispersal corridor between the two populations. Furthermore, Loew *et al.* (2005) found two genetically distinct populations in close geographic proximity that could be linked.

Within the Tumey Hills, Loew *et al.* (2005) found a small genetically isolated population of 79 giant kangaroo rats with relatively large within-group genetic diversity which makes this population an important contributor to the overall genetic diversity of species. The small population size places this population at risk of extinction. However, the geographic proximity of this small population to another population within Tumey Hills, and the local topography, suggest that habitat along Silver Creek could be managed to provide a suitable dispersal corridor between the two populations, hence reducing the genetic isolation of this Tumey Hills population and reducing the risk of extinction of this unique subpopulation. The genetic work in the Ciervo Hills and Tumey Hills highlight the importance of small stepping stone populations and dispersal corridors such as Panoche Creek and Silver Creek to the continued genetic health of the northern population of giant kangaroo rats.

II.C.2. Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

II.C.2.a. Factor A, Present or threatened destruction, modification or curtailment of its habitat or range

When the giant kangaroo rat was listed as endangered in 1987 (52 FR 283), the Service identified land conversion to agriculture as the major threat to the species habitat. Other threats in the listing rule included conversion of habitat due to mining; construction of a rifle range; road widening activities; urban and residential development; and habitat alteration from concentration of livestock; and off-road vehicle use. (USFWS 1987). The final listing rule stated that the effects of oil and gas development on this species were unknown but the Recovery Plan identifies destruction of natural communities to develop petroleum exploration and extraction infrastructure as contributing to giant kangaroo rat decline (USFWS 1998). Habitat loss in general remains the greatest factor negatively affecting giant kangaroo rat existence.

Land conversion to agriculture is no longer a major threat to giant kangaroo rat. Conversion of native habitat in the San Joaquin Valley to agricultural lands beginning in the 1960s resulted in the reduction of giant kangaroo rat habitat to less than 2 percent of its historic range by 1992 (Williams 1992). However, the remaining natural lands are too rugged for agriculture practices other than grazing (B. Cypher, Endangered Species Recovery Team, *in litt.* 2009), highly fragmented, and mostly located on suboptimal terrain (Grinnell 1932; Williams

1992; Williams *et al.* 1993, 1995; Goldingay *et al.* 1997). Therefore, as there are few additional natural lands in giant kangaroo rat range available to convert to agriculture, agricultural conversion is no longer a threat to existing giant kangaroo rat habitat.

The mining activity and construction of a rifle range, mentioned in the listing rule do not currently threaten additional habitat as these were individual projects of limited area. Livestock grazing effects on giant kangaroo rat will be discussed in section II.C.2.e.

Giant kangaroo rat habitat continues to be destroyed or disturbed. The U.S. Fish and Wildlife Service has authorized nearly 6,340 acres of permanent disturbance and over 2,945 acres of temporary disturbance in giant kangaroo rat habitat through various biological opinions and HCPs from the time of listing in 1987 through 2008. Permanent disturbance is defined as a permanent change in the land use such as conversion of native grasslands to orchards or a parking lot. Temporary disturbance is disturbance to the landscape that is transitory in time, where the landscape is expected to be of equal value to the listed species after the end of the disturbance and an undetermined recovery period. An example of temporary disturbance would be an equipment laydown area for a period of two months. However, these figures account for only those projects that were reviewed under the Act; the estimations do not include any loss of habitat or adverse effects from habitat conversion that were not reported to the Service.

Currently, the major threats to habitat arise from multiple sources. These sources include the development of large scale renewable solar energy projects and construction of large transmission lines, both of these are new threats throughout the species range; potential increases in oil and gas development in the southern range and Kettleman Hills (Cypher *in litt.*, 2009); increased off-road vehicle use throughout the species range but particularly in the southern range (Saslaw, *in litt.* 2009); and urban and residential development in western Kern County (Service files). Road-widening projects continue to be a threat to the giant kangaroo rat but road projects currently affect less habitat area than the other threats listed above (Service files).

Habitat Threats from Solar Power Development

Solar power development projects pose potential threats to giant kangaroo rats and may impact vast amounts of habitat. These projects can destroy, fragment, or impact giant kangaroo rat habitat by; altering landscape topography, vegetation, and drainage patters; and reducing habitat quality through interception of solar energy normally reaching the ground surface, affecting ambient air temperatures through habitat shading, and altering soil moisture regimes (Smith 1984; Smith *et. al.* 1987). Moreover, recently proposed solar projects tend to be large contiguous blocks of disturbance in undeveloped habitat lands, ranging from hundreds to several thousand acres. Currently eight solar power farms have been proposed in giant kangaroo rat habitat (Table 2).

Table 2. Solar power projects that have been proposed within giant kangaroo rat habitat.

Project Name (Applicant)	Location (Region/County/Protected Area)	Proposed Habitat Disturbance (acres)[1]	Status
SunGen (Complete Energy Holdings, Inc., and La Paloma Generating Company LLC)	Valley Floor/Kern	270-290 (P)	Informal consultation has been initiated.
Cymric	Valley Floor/Kern	Unknown	Informal consultation has been initiated.
California Valley Solar Ranch (High Plains Ranch II, LLC, Sun Power Corporation, Systems)	San Luis Obispo/Carrizo Plain	4,365 (P)	Informal consultation has been initiated.
Topaz Solar Farm (First Solar, Inc.)	San Luis Obispo/Carrizo Plain	6,200 (P)	Informal consultation has been initiated.
Carrizo Thermal Solar Farm (Ausra, Inc.)	San Luis Obispo/Carrizo Plain	640 (P); 380 (T)	Formal consultation has been initiated; Ausra, Inc. was purchased by First Solar, Inc. in 2009.
San Joaquin Solar 1 & 2 (San Joaquin Solar, LLC)	Foothills/Fresno/Coalinga	640 (P)	Informal consultation has been initiated.
Sun City and Sun Drag	Foothills/Kings/Avenal	approximately 1000 (P)	Informal consultation has Not been initiated
Solargen Solargen Energy, Inc.	Foothills/Fresno/Panoche Valley	total amount not determined but will be between 7,000 and 29,000 (P)	Informal consultation has been initiated.
Notes: [1] Permanent Impacts denoted as (P), Temporary Disturbance denoted as (T).			

Habitat threats from Large Scale Transmission Lines

Large scale transmission towers destroy, fragment, or impact giant kangaroo rat habitat by; construction of towers through natural lands, maintenance of the lines and towers, the construction of roads and right-of ways along the power lines, and the potential for trespass by off-road vehicles along the maintenance roads.

The construction of the new Pacific Gas and Electric (PGE) Path 15 Transmission line from Los Banos in Merced County to the Gates substation in Fresno County (USFWS 2003b) permanently disturbed 289.89 acres of giant kangaroo rat and

blunt-nosed leopard lizard habitat and 299.72 acres of San Joaquin kit fox habitat in the Panoche and Ciervo Hills. PGE compensated for the impacts to species by purchasing 574.78 acres at the Wildlands, Inc., Kreyenhagen Hills Conservation Bank southwest of Coalinga in Fresno County. At that time, the Kreyenhagen Hills Conservation Bank was the only conservation bank in the area. The closest reported sightings of the giant kangaroo rats (CNDDB 2009 to the Kreyenhagen Hills Conservation Bank lands are 27 miles to the north in the Ciervo Hills of western Fresno County, 24 miles to the south in the Cholame Valley in northeastern San Luis Obispo County and 27 miles to the southeast in Avenal Gap of the Kettleman Hills in southwestern Kings County. The soils of the Kreyenhagen Hills Conservation Bank are friable and contain a number of Heerman's kangaroo rats (*Dipodomys heermanni*) and a few short-nosed kangaroo rats (*Dipodomys nitratoides brevinasus*), but no giant kangaroo rats or blunt-nosed leopard lizard have been found there (Moss, pers. comm. 2009).

In 2009, PGE began informally consulting with the US Fish and Wildlife Service on a proposal to construct a new approximately 200 mile 500 kV transmission line from Kern County to northern Fresno County. Although the route for this transmission line has not bee finalized, one of the top three alternative routes is along the western edge of the San Joaquin Valley. If this is the selected route for this project is has the potential to impact giant kangaroo rat habitat along the entire length of the project (Service files).

The potential development of solar power facilities such as those listed in Table 2 will require as yet unproposed transmission lines in order to move the electricity generated at the remote solar facilities to markets. The amount and location of these transmission lines are unknown.

Habitat Threats from Oil and Gas Exploration.

Oil and gas exploration and development continue to degrade giant kangaroo rat habitat in western Kern, Kings and Fresno Counties. The construction of facilities related to oil and natural gas production, such as well pads, wells, storage tanks, sumps, pipelines, and their associated service roads degrade habitat (Cypher, *in litt.*, 2009). However, some of this disturbance on lands under control of the Bureau of Land Management is offset by standard avoidance and minimization measures for giant kangaroo rat and other listed species that reduce the effect of these activities (Saslaw, *in litt.*, 2009).

In the Panoche-Ciervo area, the U.S. Fish and Wildlife Service authorized through the Bureau of Land Management's Oil and Gas Leasing Hollister Resource Management Plan (USFWS 1994) the permanent disturbance of 55 acres and temporary disturbance of 195 acres of giant kangaroo rat habitat and harassment of up to 30 individual giant kangaroo rats. Although there have been no projects authorized under this authority as of August 2009 (Westphal, pers. comm. 2009) there is the potential for this development in the future. The Bureau of Land Management completed the Hollister Resource Management Plan (Hollister

RMP) in 2007 (BLM 2007). The Hollister RMP sets aside an Area of Critical Environmental Concern in the Ciervo-Panoche Natural Area for the conservation of habitat and protection of listed species, but other Bureau of Land Management lands within the Ciervo-Panoche area are open to disturbance by oil and gas exploration and other activities.

In the Naval Petroleum Reserve No. 1 Elk Hills (NPR-1), 47,409-acres have been highly disturbed by petroleum extraction activities. About 9,500 acres were disturbed by the Federal government and Department of Energy prior to the 1995 Elk Hills NPR-1 biological opinion (USFWS 1995). That biological opinion authorized the permanent disturbance of an additional 2,525 acres, temporary disturbance of 318 acres, and harm of up to 900 individual giant kangaroo rats (30 per year for 30 years). The Department of Energy (DOE) has protected 7,075 acres on the north side of the Elk Hills as compensation for their activities. They have also restored 899 acres, and they estimate that 920 acres revegetated naturally in the 1980s (USFWS 1995).

In the Naval Petroleum Reserve No. 2 (NPR-2), Crimson owns over 12,000 acres which are not currently protected. In the past, Crimson received incidental take authorization through the Bureau of Land Management Oil and Gas Programmatic Biological Opinion for its petroleum extraction activities on Bureau of Land Management lands. Pre-construction biological surveys have found no signs of giant kangaroo rats on any of the Crimson petroleum exploration sites that have gone through the Bureau of Land Management Oil and Gas Programmatic Biological Opinion (D. Mitchell, Crimson Resource Management, *in litt.* 2005, 2006). At this time, Crimson is seeking to develop an HCP to expand its petroleum exploration activities in NPR-2 (B. Taylor, Crimson Resource Management, *in litt.* 2006a, b). The HCP is not yet completed.

In August 2006, Berry Petroleum through the Bureau of Land Management was authorized through section 7 formal consultation process to permanently disturb up to 575 acres of predominately San Joaquin kit fox (*Vulpes macrotis mutica*) habitat near Derby Acres in NPR-2 (USFWS 2006). Only 10 acres of the disturbance was considered to be giant kangaroo rat habitat due to the steepness of the terrain. Berry Petroleum will compensate for impacts to the federally endangered San Joaquin kit fox, giant kangaroo rat, and blunt-nosed leopard lizard (*Gambelia sila*) by acquiring 1,725 acres of high quality conservation lands in Lokern, Buena Vista Valley, Midway Valley, and NPR-2. As of 2009, the Berry Petroleum project have not begun nor has the compensation lands been set aside.

Habitat Threats from Off-road Vehicle Use

Off-road vehicles degrade habitat by destroying burrows and vegetation in giant kangaroo rat precincts. Off-road vehicle use has increased on private and public lands, particularly in the area around the City of Taft (Saslaw, *in litt.*, 2009). The Bureau of Land Management allows off-road vehicle use on designated trails;

however, off trail impacts are proliferating and enforcement is difficult (Saslaw, *in litt.*, 2009). The proliferation of service roads in oil fields and along transmission lines provide access to areas previously unavailable to off-road vehicle users and thus increase the potential for impacts to giant kangaroo rat habitat. Some oil company lands are being fenced to reduce illegal trespass by off-road vehicles. These actions offer some protection to giant kangaroo rats that occur on oil company lands (Saslaw, *in litt.*, 2009).

Habitat Threats From Urban and Residential Development.
Giant kangaroo rat habitat near the growing communities of Taft and Maricopa is currently threatened by urban and residential development. The draft Kern County Valley Floor HCP (County of Kern, in prep 2009) is proposed to protect giant kangaroo rat habitat on private lands by limiting disturbance of high-quality giant kangaroo rat habitat to less than 10 percent per 640-acre section and lower-quality giant kangaroo rat habitat to less than 25 percent. If permitted, this HCP may aid in reaching the recovery goal of the protection of 80 percent of other giant kangaroo rat habitat in western Kern County. The draft HCP, however, is in its fifteenth year of development. Until such time as the HCP is completed and the U.S. Fish and Wildlife Service is able to fully evaluate the proposed project and issue an incidental take permit for the proposed activities, the habitat loss and protection associated with the proposed HCP is uncertain.

The construction of the new units for the Kettleman Hills hazardous waste facility by Chemical Waste Management, Inc. (USFWS 1989) permanently disturbed 26.8 acres of giant kangaroo rat, San Joaquin kit fox, and blunt-nosed leopard lizard habitat 3.5 miles southwest of Kettleman City, Kings County. During two years of trapping in 1988-1990, no giant kangaroo rats were found at the site; however, the area was considered to be potential habitat (C. Carollo, Environmental Manager, Chemical Waste Management, Inc., pers. comm. 2006). The closest sighting of giant kangaroo rat was about 8 miles south at Avenal Gap in the Kettleman Hills (CNDDB 2009). Chemical Waste Management, Inc., compensated for the impacts to the giant kangaroo rat, San Joaquin kit fox, and blunt-nosed leopard lizard by purchasing 80.4 acres of conservation lands at Semitropic Ridge in northwestern Kern County (R. Hewitt, The Nature Conservancy, *in litt.* 1989). No giant kangaroo rats, however, have been observed at Semitropic Ridge, and their occurrence there is highly unlikely as these lands are to the east of the historic range of giant kangaroo rat, within the flood zone of the Kern River, and composed of alkali sink habitats not traditionally associated with the giant kangaroo rat (G. Warrick, Lokern Natural Area Manager, Center for Natural Lands Management, pers. comm. 2009).

In September 2006, the real estate company Schuil and Associates sold a 1,200-acre parcel of rangeland in the Panoche Valley to private interests, and another 9,000 acres of Panoche Valley rangeland are on sale for potential home sites zoned for agricultural rangeland 40-acre minimum site size (Schuil Associates 2009).

Habitat Threats from Road Development Projects

Road-widening projects destroy giant kangaroo rat habitat; fragments habitat; alters vegetation; and increase mortality from vehicle strikes.

The movement and expansion of Highway 41/46 in northeastern San Luis Obispo County near Cholame Valley resulted in the permanent loss of 342 acres of giant kangaroo rat habitat and temporarily disturbance of an additional 214 acres (USFWS 2009). The proposed expansion of Highway 119 (Cherry Avenue) may result in the loss of an additional 190 acres and an as yet indeterminate amount of temporary disturbance. California Transportation (Caltrans) proposes to offset these effects by payment of an unspecified amount into a giant kangaroo rat fund for future purchase of giant kangaroo rat habitat. (Service files).

Conservation Efforts and Habitat Conservation Plans.

Through the actions of land management agencies, compensation acreage for disturbance, and the development of Habitat Conservation Plans (HCPs) approximately 92,731 acres of habitat lands have been conserved (68,000 acres in Carrizo Plain; 13,136 acres in Lokern Area; 7,801 acres in Elk Hills; and 3,770 acres in NPR-2). There are efforts to conserve an additional 51,678 acres through management plans and in progress HCPs (Chevron Lokern HCP, 11,143 acres; Occidental Petroleum Elk Hills HCP, 38,780 acres; Berry Petroleum Management Plan 1,725 acres). There are no conservation banks established for giant kangaroo rat.

The establishment of the 250,000-acre Carrizo Plain National Monument in 2001 was important in protecting contiguous giant kangaroo rat habitat in the Carrizo Plains. Prior to the establishment of the Monument about 20 to 40 percent of giant kangaroo rat habitat on the Carrizo Plain had been lost to dry land farming (Williams 1992). The Bureau of Land Management is currently updating the Carrizo Plain National Monument Resource Management Plan (RMP) (L. Saslaw, Wildlife Biologist, Bureau of Land Management, pers. comm. 2008). The conservation of habitat and survival of giant kangaroo rat and other listed species is stated as one of the primary objectives in the draft Carrizo Plain National Monument RMP (Service files 2009).

In 2001, California Department of Fish and Game acquired the 30,000-acre Chimineas Ranch of the western Cuyama Valley in southeastern San Luis Obispo County, which was added to the Carrizo Plain Ecological Reserve. A small population of about 100 giant kangaroo rats was found in the juniper woodland of Taylor Canyon area (CNDDB 2006; Stafford, pers. comm. 2006). Surveys of active precincts in the area show that since 2001 the range of the giant kangaroo rat there has doubled (Stafford, pers. comm. 2006). However, the size of the suitable giant kangaroo rat on the preserve is unknown. Most of the rest of the Cuyama Valley, however, is unprotected on private lands and has been degraded by farming activities.

The PXP HCP, which includes conservation lands in the Lokern area, is the only completed and permitted HCP that includes the survival of the giant kangaroo rat as an objective (Nuevo Energy Company and Torch Operating Company 1999). Chevron and Occidental Petroleum are currently preparing HCPs for their lands in the Lokern area and Elk Hills, respectively; however, until such time as the HCPs are completed and approved, no management plans have been implemented that include the survival of the giant kangaroo rat as an objective. Additionally, no management plans have been implemented for giant kangaroo rat habitat on private lands in western Kern County.

Lokern Natural Area is the collective name for lands of natural habitat suitable for the giant kangaroo rat and other species of concern, for which there is a concerted effort among conservation organizations and landowners to manage for the benefit of endangered and threatened species (Saslaw, pers. comm. 2009). An interagency cooperative acquisition and management plan for the conservation of the 44,000-acre Lokern Natural Area is in draft form. Participants include Federal agencies (Bureau of Land Management, U.S. Fish and Wildlife), State agencies (California Department of Fish and Game, California Energy Commission, California State University Bakersfield), private environmental groups and biological consulting firms (The Nature Conservancy, Center for Natural Lands Management, Endangered Species Recovery Program, McCormick Biological, Inc.), and private oil companies (Chevron; Occidental Petroleum; Aera Energy, LLC [Aera]; PXP) (USFWS 1998). The parties periodically meet to coordinate their efforts, but there is no estimate for when the Lokern Natural Area management plan will be approved and implemented.

Chevron, the largest landowner in the Lokern area (17,329 acres), states in the draft Chevron Lokern Habitat Conservation Plan (HCP) (Chevron, in prep, 2009.) that it intends to protect 11,143 acres in the Lokern area and limit disturbance of its undeveloped Lokern lands to 15 percent per 640-acre section. If approved by U.S. Fish and Wildlife Service and implemented, the addition of the proposed Chevron conservation lands will result in the protection of 24,303 acres of contiguous habitat in the Lokern area, or 55 percent of the Lokern Natural Area but still short of the 90 percent recovery criterion for downlisting the giant kangaroo rat. We understand that it is Chevron's intent to complete the proposed HCP and protect its conservation lands (G. Scott, Land and Endangered Species Specialist, Chevron, pers. comm. 2006). Still, until such time as the HCP is completed and the U.S. Fish and Wildlife Service is able to issue an incidental take permit for the proposed activities, the habitat loss and protection associated with the proposed HCP is uncertain.

Occidental Petroleum is currently managing 7,801 acres of conservation lands in Lokern and the Buena Vista Valley for the survival of the giant kangaroo rat in accordance with the Elk Hills biological opinion (USFWS 1995). Berry Petroleum agreed to manage 1,725 acres of conservation lands in Lokern, Buena

Vista, and Lokern Valley for the survival of the giant kangaroo rat as part of the minimization measures in the North Midway Sunset biological opinion (USFWS 2006). The management plan for the 1,725 acres is still in progress (A. Kuritsubo, Biologist, Bureau of Land Management, pers. comm. 2009).

Currently, Occidental Petroleum is preparing the draft Occidental Petroleum Elk Hills HCP (Live Oaks Associates, Inc., in prep 2009) that, if permitted, will allow an additional permanent disturbance of up to 4,000 acres and temporary disturbance of up to 3,000 acres within the Elk Hills. The HCP would result in a final disturbance of 18.2 percent of Elk Hills due to oil and gas development and the protection of 81.8 percent of the 47,409-acre Elk Hills NPR-1 (Appendix C, Live Oaks Associates, Inc., in prep., dated January 6, 2006); this falls short of the downlisting criterion for protection of 90 percent of natural land in the Elk Hills. Compensation for the mostly moderate-use giant kangaroo rat habitat in the Elk Hills (Hopkins *et al.* 2004) is proposed to be at a ratio of 2:1 if replaced in kind or 1:1 if replaced with high-use giant kangaroo rat habitat. We understand that it is Occidental Petroleum's intent to complete the HCP and that the disturbance estimates for the HCP are likely overestimates. The disturbance will also be concentrated on the steeper slopes of the Elk Hills, which are lower quality habitat for the giant kangaroo rat (B. Dixon, Environmental Manager, Occidental Petroleum, pers. comm. 2006). The U.S. Fish and Wildlife Service has yet to evaluate if the proposed compensation ratios are sufficient for the potential impacts of the proposed project. Until such time as the HCP is completed and the U.S. Fish and Wildlife Service is able to issue an incidental take permit for the proposed activities, the habitat loss and protection associated with the proposed HCP is uncertain.

Summary of Factor A Threats

In summary, since listing, broad-scale land conversion of natural habitat has resulted in substantial reduction of available giant kangaroo rat habitat (approximately 98 percent of giant kangaroo rat habitat lost before 1987). Between 1987 and 2008 authorized habitat loss has resulted in an additional loss of roughly 6,340 acres and the temporary deterioration of 2,495 acres. Several proposed projects including solar development and additional oil and gas development, if approved could increase the loss of habitat by more than an additional 10,000 acres. However, the retirement of private agricultural lands deeded to the Carrizo Plain National Monument increased giant kangaroo rat habitat by over 40,000 acres, all of it protected. Approximately 51,000 acres of additional protected habitat are proposed through HCPs in development**.**

II.C.2.b. Factor B, Overutilization for commercial, recreational, scientific, or educational purposes

Overutilization for any purpose was not identified as a threat to the giant kangaroo rat in the 1987 final listing rule (52 FR 283). There is no current known threat from overutilization of the giant kangaroo rat.

II.C.2.c. Factor C, Disease or predation

When the giant kangaroo rat was listed as endangered in 1987 (52 FR 283), we stated that many extant colonies were small in population size and vulnerable to single catastrophic events. Additionally, we mentioned that predation could be a factor in the decline or even extirpation of small isolated populations, but that disease had not been documented as a cause of decline. Currently, predation is not considered to be a threat unless giant kangaroo rat numbers are reduced to very low numbers (Cypher, *in litt.* 2009). Disease, however, has been identified as a potential new threat to kangaroo rats (Germano, pers. comm. 2006).

The colonial living structure of the giant kangaroo rat makes them potentially susceptible to disease epidemics and especially vulnerable to catastrophic events and places colonies at the risk of local extirpation. Although there has been no research on disease in giant kangaroo rat colonies, research on several related kangaroo rat species have documented susceptibility to fatal diseases such as; encephalitis in the San Joaquin kangaroo rat and the Heerman's kangaroo rat (Hardy *et al.* 1974), rabies (Cockrum 1997), and tularemia in the Ord kangaroo rat (Vest and Marchette 1958). Abnormally wet periods may cause some kangaroo rats to develop fatal respiratory problems, as was seen in captive Tipton kangaroo rats during an abnormally rainy February in 1995 (Germano, pers. comm. 2006). Most recently, during the 2008 annual survey on giant kangaroo rats in grazed and ungrazed plots on the Carrizo Plain, researchers discovered a genital fungus or disease on 16 percent of individual giant kangaroo rats examined (192 out of 1210 individuals). The infection rates for juveniles was the same as that for adults but females were infected at a higher rate than males (females 20 percent, males 12 percent) (Prugh 2008). However, it is unknown if this infectious agent has potential effects on giant kangaroo rat mortality, or recruitment. Per D. Germano, vaginal fungus occurred on kangaroo rats but not pervasively. He has not noted any decline in kangaroo rat numbers associated with the fungus and suspects it is not a problem but suggests the issue bears monitoring (D. Germano, California State University, Bakersfield, California, *in litt.* 2009)

II.C.2.d. Factor D, Inadequacy of existing regulatory mechanisms

When the giant kangaroo rat was listed as endangered in 1987 (52 FR 283), we identified the inadequacy of State law to curtail habitat loss, secure high density population sites, or arrest declines and extirpation of remaining colonies from a variety of causes. Additionally, we stated that a joint program in effect between the California Department of Fish and Game, the California Department of Food and Agriculture and various county agencies had been ineffective in reducing the decline of the giant kangaroo rat. At the time of listing, regulatory mechanisms thought to have some potential to protect giant kangaroo rat included the listing of the species under the California Endangered Species Act (CESA); the listing rule (52 FR 283) provides an analysis of the level of protection that was anticipated from those regulatory mechanisms. This analysis appears to remain currently valid. As explained in the listing rule (52 FR 283) joint efforts between the State

and counties to protect the giant kangaroo rat are not successful in securing extant habitat and preventing the further decline of the species.

California Endangered Species Act (CESA) The CESA (California Fish and Game Code, section 2080 *et seq*.) prohibits the unauthorized take of State-listed threatened or endangered species. The CESA requires State agencies to consult with the California Department of Fish and Game on activities that may affect a State-listed species and mitigate for any adverse impacts to the species or its habitat. Pursuant to CESA, it is unlawful to import or export, take, possess, purchase, or sell any species or part or product of any species listed as endangered or threatened. The State may authorize permits for scientific, educational, or management purposes, and to allow take that is incidental to otherwise lawful activities.

The California Environmental Quality Act (CEQA) The CEQA (chapter 2, section 21050 *et seq.* of the California Public Resources Code) requires review of any project that is undertaken, funded, or permitted by the State or a local governmental agency. If significant environmental effects are identified, the lead agency has the option of requiring mitigation through changes in the project or to decide that overriding considerations make mitigation infeasible (CEQA Sec. 21002). In the latter case, projects may be approved that cause significant environmental damage, such as destruction of listed endangered species or their habitat. Protection of listed species through CEQA is, therefore, dependent upon the discretion of the lead agency involved.

Natural Community Conservation Planning Act: The Natural Community Conservation Program is a cooperative effort to protect regional habitats and species. The program helps identify and provide for area wide protection of plants, animals, and their habitats while allowing compatible and appropriate economic activity. Many Natural Community Conservation Plans (NCCPs) are developed in conjunction with Habitat Conservation Plans (HCPs) prepared pursuant to the Federal Endangered Species Act.

Federal Laws and Regulations

National Environmental Policy Act (NEPA): NEPA (42 U.S.C. 4371 *et seq*.) provides some protection for listed species that may be affected by activities undertaken, authorized, or funded by Federal agencies. Prior to implementation of such projects with a Federal nexus, NEPA requires the agency to analyze the project for potential impacts to the human environment, including natural resources. In cases where that analysis reveals significant environmental effects, the Federal agency must propose mitigation alternatives that would offset those effects (40 **CFR** 1502.16). These mitigations usually provide some protection for listed species. However, NEPA does not require that adverse impacts be fully mitigated, only that impacts be assessed and the analysis disclosed to the public.

Clean Water Act: Under section 404, the U.S. Army Corps of Engineers (Corps or USACE) regulates the discharge of fill material into waters of the United States, which include navigable and isolated waters, headwaters, and adjacent wetlands (33 U.S.C. 1344). In general, the term "wetland" refers to areas meeting the Corps's criteria of hydric soils, hydrology (either sufficient annual flooding or water on the soil surface), and hydrophytic vegetation (plants specifically adapted for growing in wetlands). Any action with the potential to impact waters of the United States must be reviewed under the Clean Water Act, National Environmental Policy Act, and Endangered Species Act. These reviews require consideration of impacts to listed species and their habitats, and recommendations for mitigation of significant impacts.

Although the giant kangaroo rat is an upland species typically found in landscapes with limited jurisdictional waters under the Clean Water Act, the Corps has frequently assumed the role of the Federal nexus for both large and small projects in their entirety, even though these projects may only impact a minor amount of jurisdictional water. This approach by the Corps has facilitated numerous consultations under section 7 of the Act that would have otherwise likely required a section 10 permit.

Historically, the Corps interpreted "the waters of the United States" expansively to include not only traditional navigable waters and wetlands, but also other defined waters that are adjacent or hydrologically connected to traditional navigable waters. However, recent Supreme Court rulings have called into question this definition. On June 19, 2006, the U.S. Supreme Court vacated two district court judgments that upheld this interpretation as it applied to two cases involving "isolated" wetlands. Currently, Corps regulatory oversight of such wetlands (e.g., vernal pools) is in doubt because of their "isolated" nature. In response to the Supreme Court decision, the Corps and the U.S. Environmental Protection Agency (USEPA) have recently released a memorandum providing guidelines for determining jurisdiction under the Clean Water Act. The guidelines provide for a case-by-case determination of a "significant nexus" standard that may protect some, but not all, isolated wetland habitat (USEPA and USACE 2007). The overall effect of the new permit guidelines on loss of isolated wetlands, such as vernal pool habitat, is not known at this time.

Endangered Species Act of 1973, as amended (Act): The Act is the primary Federal law providing protection for this species. The Service's responsibilities include administering the Act, including sections 7, 9, and 10 that address take. Since listing, the Service has analyzed the potential effects of Federal projects under section 7(a)(2), which requires Federal agencies to consult with the Service prior to authorizing, funding, or carrying out activities that may affect listed species. A jeopardy determination is made for a project that is reasonably expected, either directly or indirectly, to appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing its reproduction, numbers, or distribution (50 **CFR** 402.02). A non-jeopardy opinion

may include reasonable and prudent measures that minimize the amount or extent of incidental take of listed species associated with a project.

Section 9 prohibits the taking of any federally listed endangered or threatened species. Section 3(18) defines "take" to mean "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." Service regulations (USFWS 2003) define "harm" to include significant habitat modification or degradation which actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. Harassment is defined by the Service as an intentional or negligent action that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. The Act provides for civil and criminal penalties for the unlawful taking of listed species. Incidental take refers to taking of listed species that results from, but is not the purpose of, carrying out an otherwise lawful activity by a Federal agency or applicant (50 **CFR** 402.02). For projects without a Federal nexus that would likely result in incidental take of listed species, the Service may issue incidental take permits to non-Federal applicants pursuant to section 10(a)(1)(B). To qualify for an incidental take permit, applicants must develop, fund, and implement a Service-approved Habitat Conservation Plan (HCP) that details measures to minimize and mitigate the project's adverse impacts to listed species. Regional HCPs in some areas now provide an additional layer of regulatory protection for covered species, and many of these HCPs are coordinated with California's related Natural Community Conservation Planning program.

Sikes Act: The Sikes Act (16 U.S.C. 670) authorizes the Secretary of Defense to develop cooperative plans with the Secretaries of Agriculture and the Interior for natural resources on public lands. The Sikes Act Improvement Act of 1997 requires Department of Defense installations to prepare Integrated Natural Resource Management Plans (INRMPs) that provide for the conservation and rehabilitation of natural resources on military lands consistent with the use of military installations to ensure the readiness of the Armed Forces. The INRMPs incorporate, to the maximum extent practicable, ecosystem management principles and provide the landscape necessary to sustain military land uses. While INRMPs are not technically regulatory mechanisms because their implementation is subject to funding availability, they can be an added conservation tool in promoting the recovery of endangered and threatened species on military lands.

Federal Land Policy and Management Act of 1976 (FLPMA): The Bureau of Land Management is required to incorporate Federal, State, and local input into their management decisions through Federal law. The FLPMA (Public Law 94-579, 43 U.S.C. 1701) was written "to establish public land policy; to establish guidelines for its administration; to provide for the management, protection, development and enhancement of the public lands; and for other purposes."

Section 102(f) of the FLPMA states that "the Secretary [of the Interior] shall allow an opportunity for public involvement and by regulation shall establish procedures … to give Federal, State, and local governments and the public, adequate notice and opportunity to comment upon and participate in the formulation of plans and programs relating to the management of the public lands." Therefore, through management plans, the Bureau of Land Management is responsible for including input from Federal, State, and local governments and the public. Additionally, Section 102(c) of the FLPMA states that the Secretary shall "give priority to the designation and protection of areas of critical environmental concern" in the development of plans for public lands. Although the Bureau of Land Management has a multiple-use mandate under the FLPMA which allows for grazing, mining, and off-road vehicle use, the Bureau of Land Management also has the ability under the FLPMA to establish and implement special management areas such as Areas of Critical Environmental Concern, wilderness, research areas, etc., that can reduce or eliminate actions that adversely affect species of concern (including listed species).

National Wildlife Refuge System Improvement Act of 1997: This act establishes the protection of biodiversity as the primary purpose of the National Wildlife Refuge system. This has lead to various management actions to benefit federally listed species.

Summary of Factor D

In summary, the Endangered Species Act is the primary Federal law that provides protection for this species since its listing as endangered in 1987. Other Federal and State regulatory mechanisms provide discretionary protections for the species based on current management direction, but do not guarantee protection for the species absent its status under the Act. Therefore, we continue to believe other laws and regulations have limited ability to protect the species in absence of the Endangered Species Act.

II.C.2.e. Factor E, Other natural or human made factors affecting its continued existence

When the giant kangaroo rat was listed as endangered in 1987 (52 FR 283), we identified rodent control programs, the marginality of habitat in which remaining populations were located, concentration of livestock grazing, and demographic and random catastrophic events for the smaller and isolated populations of Cuyama Valley, Kettleman Hills, and San Juan Creek Valley as major threats to the species. The Recovery Plan identified the additional threat of a lack of appropriate habitat management on conservation lands, especially lack of grazing or fire to control density of vegetation as a threat to giant kangaroo rats (Williams and Germano 1993 as cited in USFWS 1998). These threats are still factors across the range of the giant kangaroo rat and are discussed below. Climate change is an

additional factor that may affect the recovery of giant kangaroo rats. All of these factors are ongoing and all are of relatively equal magnitude.

Rodenticides

The U.S. Fish and Wildlife Service has identified the following vertebrate control agents as detrimental to the existence of giant kangaroo rats: aluminum phosphide, magnesium phosphide, chlorophacinone, potassium nitrate, sodium nitrate, and zinc phosphide (USFWS 1993). During the 1960s through the early 1980s, rodenticides were often broadcast over large areas by airplane. Now these areas such as, in the Sunflower Valley (western corners of Kings and Kern Counties), Kettleman and Tent Hills in Kings County, and the eastern foothills of the Panoche Hills, Fresno County, show characteristic features of giant kangaroo rat precincts, but these precincts are unoccupied by kangaroo rats (USFWS 1998). Williams (1992) believes that populations in these areas may have been eliminated by use of rodenticides.

The current application of rodenticides on private grazing lands and agricultural fields neighboring giant kangaroo rat habitat is a potential hazard for giant kangaroo rats. However, limited reporting is required for rodenticide and therefore the amount of effect on giant kangaroo rats is difficult to measure

Grazing

Grazing occurs over the entire range of the giant kangaroo rat. Earlier studies have reported the negative affects of overgrazing on habitat quality through competition for food between the cattle and the giant kangaroo rat and the potential collapse of burrows by livestock (USFWS 1985; Williams 1989; USFWS 1992).

However, more recent long-term grazing studies have reported declines in the number of kangaroo rats (including the giant kangaroo rat) on ungrazed relative to grazed plots during wet years (Williams and Germano 1994; Germano *et al.* 2001; Kelly *et al.* 2004; Germano *et al.* 2005; Kelly, pers. comm. 2006). The actual cause of decline in kangaroo rats during wet years is unknown, but a possible factor is dense grass growth, which inhibits foraging; increases the risk of predation by providing cover for hunting animals; and increases soil moisture which may lead to fatal respiratory problems, or the infestation of kangaroo rat seed caches with toxic molds (Frank 1988; Single *et al.* 1996; Germano *et al.* 2001). Livestock grazing is thought to control the dense growth of nonnative grasses that threaten giant kangaroo rats during wet years (Williams and Germano 1994; Germano *et al.* 2001; Kelly *et al.* 2004; Germano *et al.* 2005; Kelly, pers. comm. 2006). Therefore, while overgrazing may disturb individual giant kangaroo rat precincts, the cessation of grazing may lead to a significant decline in giant kangaroo rat numbers particularly during wet years.

The status of concentration of livestock grazing on private lands is unknown. On many conservation lands, livestock grazing is highly restricted (Lowe, pers,

comm. 2006; Saslaw, pers. comm. 2006). Public lands managed by Bureau of Land Management are subject to grazing restrictions as described in resource management plans (BLM 2007, BLM in prep 2009). The Hollister Resource Management Plan (BLM 2007) states that livestock grazing will be used as a tool to improve habitat for special status species. The Hollister Resource Management Plan further states that if new information, such as that uncovered during yearly rangeland health evaluations, demonstrates that such grazing is not compatible with conservation or preservation of endangered, threatened, candidate or special status species, grazing shall be discontinued in those allotments so affected (BLM 2007). However, the Hollister Bureau of Land Management office has been understaffed, and did not monitor giant kangaroo rat populations in 2007 or 2008 (Westphal, pers. comm. 2009) as required by their grazing biological opinion. The preferred alternative for the Caliente Resource Management Plan for the Carrizo Plan (BLM 2009 in prep.) states that the Bureau of Land Management intent is to manage habitat with an emphasis on ecosystems to ensure self-sustaining populations and natural abundance and diversity of wildlife, fish, and plant resources on public lands. Additionally, the proposed Caliente Resource Management Plan directs the Bureau of Land Management to maintain an inventory of threatened and endangered wildlife species; and monitor ongoing management actions to determine if habitat management objectives for these species are being met.

Demographic and Random Catastrophic Events including Genetic Isolation
Small isolated populations are at risk of extinction through random catastrophic or demographic events. Several populations of giant kangaroo rats, particularly those in the Tumey Hills and Ciervo Hills of the northern population of giant kangaroo rats are small and fragmented. Additionally, populations with low genetic diversity are at increased risk that random environmental events such as disease will eliminate them.

Good *et al.* (1997 and Loew *et al.* (2005) showed that the population of northern range giant kangaroo rats is fragmented, and particularly the populations in the Tumey Hills and Ciervo Hills are genetically isolated and at an increased risk of extinction (Good *et al.* 1997, Loew *et al.* 2005). Although these researchers found a low level of genetic diversity within each population, there was a high degree of genetic among population. Therefore, loss of any of these small unique subpopulations will reduce the overall high genetic diversity of the northern range metapopulations (Good *et al.* 1997; Loew *et al.* 2005).

Loew *et al* (2005) identified Panoche Creek and Silver Creek as important dispersal corridors for alleviating the genetic isolation and risk of extinction of subpopulations within the northern range. However, these corridors remain unprotected and subject to residential, agricultural or solar facility development. Both Good *et al* (1997) and Loew *et al* (2005) identified the Panoche Valley as an important source of regional expansion of the giant kangaroo rat within the northern range highlighting the importance of protecting the populations in this

valley. However, to date the majority of the Panoche Valley is unprotected private lands. Habitat loss in areas that link subpopulations magnify the threats of genetic isolation by reducing the opportunities for immigration between subpopulations.

Fire

Unlike most other regions of California, little is known about the fire regime in the San Joaquin Valley including the areas with giant kangaroo rat habitat (Sugihara *et al*. 2006). Bureau of Land Management, however, has assessed the use of prescribed fire as an alternative habitat management tool that may benefit giant kangaroo rat habitat by reducing dense nonnative grass cover. In one case, however, the prescription fire was less effective than grazing at controlling nonnative grasses, and the positive effects of reduction of heavy nonnative grass cover lasted for less than one year (Saslaw pers. comm. 2006). Additionally, another prescribed burn had the unintended negative consequences of permanently removing native saltbush (*Atriplex* sp) (Germano *et al.* 2001; Warrick 2006) and asphyxiating giant kangaroo rats and other listed species (Saslaw, *in litt.,* 2009; Germano, *in litt.*, 2009).

There is no information on the effect of current or historic wildfires in giant kangaroo rat habitat (Sugihara *et al.* 2006; Germano, pers. comm. 2009). However, increased dominance of exotic annual grasses may have raised the frequency of fires in this system (Brooks 2003). The increase in exotic grasses is partially attributed to elevated levels of atmospheric nitrogen deposition in the San Joaquin Valley, a naturally nitrogen-limited system (Brooks 1999; Brooks and Pyke 2001; Brooks 2003). Dry nitrogen deposition estimates for Bakersfield, Kern County, are 8.8 – 17.6 pounds nitrogen per acre per year (Blanchard *et al.* 1996). Nitrogen-limited natural ecosystems of the western United States, such as the arid/semi-arid San Joaquin Valley, are adversely affected by nitrogen deposition as low as 1.1 – 3.2 pounds nitrogen per acre per year (Fenn *et al.* 2003). The majority of airborne nitrogen in the San Joaquin Valley is in reduced form as ammonia (NH_3) and particulate ammonium (NH_{4+}) primarily from the dairy, poultry, and beef industries (Gaffney and Shimp 1999; California Air Resources Board 2009). Predicted NH_3 emissions in 2010 for the San Joaquin Valley Air Basin are 465.4 tons per day (San Joaquin Valley Air Pollution District 2003). Nitrogen deposition rates dramatically increase in fog and there are frequent fog events that occur in the southern San Joaquin Valley during the winter (Pandis 1990; Fenn *et al.* 2003).

Traffic is often another source of wildfire in arid lands, with dramatic effects on ecosystem processes. Vehicle sparks, overheating engines and brakes, arson, and accidental ignition all contribute to increased fire frequency. In some landscapes where lightning strikes traditionally were rare, anthropogenic wildfires have dramatically altered vegetation, reducing vertical structure and creating conditions that are suitable for invasive species. The effect of fire upon giant kangaroo rat

ecology and life history is currently unknown, but significant impacts are to be expected as these relationships are investigated (Sugihara *et al.* 2006).

Climate Change

Other potential threats to the giant kangaroo rat include both increased drought and increased winter rainfall conditions that may be associated with future climate change. The population trend of the giant kangaroo rat is highly correlated with inter-annual variations in precipitation. Years of successive drought lead to dramatic declines in the numbers of giant kangaroo rats as observed on the Carrizo Plain in 1991 (Williams and Germano 1994) and in the Ciervo-Panoche area in the late 1980s (Williams 1992). Additionally, years of above normal precipitation also result in significant declines in giant kangaroo rat populations, particularly in areas that are not grazed (Germano *et al.* 2001; Kelly *et al.* 2004; Germano *et al.* 2005; Kelly, pers. comm. 2006). Climate models predict an overall warming trend for California by 2100 (Cayan *et al.* 2006) but vary in their predictions for precipitation. VanRheenen *et al.* (2004), however, predict a decrease in precipitation in the southern San Joaquin. Drought and changes in rainfall patterns may result in changes in the vegetative communities of giant kangaroo rat habitat. These changes may include increased densities of nonnative plant species which can reduce available food sources, and increased incidence of toxic molds which can be fatal to the giant kangaroo rat. However, there are insufficient data available at this time to predict specific effects of climate change on the giant kangaroo rat.

Summary

In summary, the effects of rodenticide, overgrazing, cessation of grazing, climate change, fire, genetic isolation and demographic and catastrophic events are well documented, the severity of these effects is difficult to quantitatively measure. These factors however, exacerbate the continued stressors of habitat degradation and destruction.

II.D. Synthesis

When the giant kangaroo rat was listed as endangered in 1987 (52 FR 283), the major threats to the species were land conversion, predation, rodent control programs, and the inadequacy of existing regulatory mechanisms (USFWS 1987). Today, land conversion continues to be the largest threat to the giant kangaroo rat although the mechanisms responsible for habitat destruction and degradation have changed from agricultural conversion to development.

While progress has been made within the southern range of the giant kangaroo rat, the majority of the recovery criteria outlined in the Recovery Plan have not been met. The establishment of the 250,000-acre Carrizo Plain National Monument was significant in protecting populations of the giant kangaroo rat on the Carrizo Plain and in the western Cuyama Valley. Additionally, long-term population studies show populations of the giant kangaroo rat on protected lands in the Lokern area, the Buena Vista Valley, and on the Carrizo Plain to be increasing or stable

(Williams and Germano 1994; Kelly *et al.* 2004; Germano *et al.* 2005; Kelly, pers. comm. 2006; Quad Knopf 2006; Saslaw, pers. comm. 2006).

Giant kangaroo rats remain unprotected and threatened by oil and gas exploration activities, solar projects, and urban and suburban development. Approximately 50 percent of giant kangaroo rat lands in western Kern County, and 80 percent of the giant kangaroo rat habitat in the Ciervo-Panoche area remain unprotected and on private lands (Cypher, *in litt.* 2009). Several HCPs and management plans to protect giant kangaroo rats in western Kern County have yet to be completed (i.e., Kern County Valley Floor HCP, Occidental Petroleum HCP, Chevron Lokern HCP, and Lokern Natural Area management plan).

No long-term studies have been done to determine the stability of giant kangaroo rat populations within the northern range; however, genetic research shows that isolated populations of giant kangaroo rat within the Tumey and Ciervo Hills continue to be at risk of local extirpation due to habitat fragmentation and the lack of protection of core areas and dispersal corridors (Loew *et al.* 2005).

In summary, based on the restriction of giant kangaroo rats to less than 5 percent of their historical range on highly fragmented, suboptimal habitat; the continuation of threats from oil and gas extraction; urban and residential development; the new development threat of large solar power plants; the genetic isolation of populations in the Tumey Hills and Ciervo Hills; the lack of protection of the populations in the Panoche Valley; and the protection of less than 20 percent of populations in western Kern County, we conclude that the giant kangaroo rat continues to meet the definition of endangered, and is in danger of extinction throughout its known range.

III. RESULTS

III.A. Recommended Classification: Given your responses to previous sections, particularly Section II.D. Synthesis, make a recommendation with regard to the listing classification of the species (briefly summarize the reasons for this recommendation). Also refer to 50 CFR 424.11 Factors for listing, delisting, or reclassifying species:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist (*Indicate reasons for delisting per 50 CFR 424.11):*
____ *Extinction*
____ *Recovery*
____ *Original data for classification in error*
__X__ No change is needed

III.B. New Recovery Priority Number __N/A__

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

Locations that should be targeted for protection

- Dispersal corridors within the northern range along Panoche Creek and Silver Creek in western Fresno County (Loew *et al.* 2005)
- The Panoche Valley in eastern San Benito County as an important source of regional expansion within the northern range (Loew *et al.* 2005)
- Buena Vista Valley in western Kern County
- Co-locate the conservation lands acquired for San Joaquin kit fox and blunt-nosed leopard lizard with giant kangaroo rat habitat

Kern County – completion of HCPs and issuance of incidental take permits

- Draft Kern County Valley Floor HCP
- Draft Chevron Lokern HCP
- Draft Occidental Petroleum of Elk Hills HCP
- Encourage Crimson Resource Management to start an HCP or section 7 formal consultation to protect lands in Buena Vista Valley, NPR-2, and Buena Vista Hills

Approval and implementation of habitat management plans

- Establishment of the 44,000-acre Lokern Natural Area in western Kern County
- Include in all habitat management plans (including the Carrizo Plain National Monument) the flexibility to alter the dates and stocking rates of livestock to respond to annual plant production to prevent the dominance of exotic grasses in giant kangaroo rat habitat (Germano *et al.* 2001)

Future research and monitoring

- Continued long-term monitoring in western Kern County and Carrizo Plain
- Begin long-term monitoring of populations within the Ciervo-Panoche area of western Fresno and eastern San Benito Counties
- Census and monitor giant kangaroo rats in the satellite populations in the Cuyama Valley (eastern San Luis Obispo and eastern Santa Barbara Counties), San Juan Creek Valley (eastern San Luis Obispo County), and Kettleman Hills (southwestern Kings County)

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW

Giant Kangaroo Rat (*Dipodomys ingens*)

Current Classification Endangered

Recommendation resulting from the 5-Year Review

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
__X_ No change is needed

Review Conducted By Sacramento Fish and Wildlife Office Staff

FIELD OFFICE APPROVAL FOR REGION 8:

Lead Field Supervisor, Sacramento Fish and Wildlife Office, U.S. Fish and Wildlife Service

Approve _____Date_____

Cooperating Field Supervisor, Ventura Fish and Wildlife Office, U.S. Fish and Wildlife Service

Concur _____Date_____

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW

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__X__ **No change is needed**

Review Conducted By Sacramento Fish and Wildlife Office Staff

FIELD OFFICE APPROVAL FOR REGION 8:

Lead Field Supervisor, Sacramento Fish and Wildlife Office, U.S. Fish and Wildlife Service

Approve _____ Date 2·16·10

Cooperating Field Supervisor, Ventura Fish and Wildlife Office, U.S. Fish and Wildlife Service

Concur _____ Date 2/12/10