San Bernardino kangaroo rat
(Dipodomys merriami parvus)

5-Year Review:
Summary and Evaluation

San Bernardino kangaroo rat, Photo by Art Davenport

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

August 14, 2009

5-YEAR REVIEW

San Bernardino kangaroo rat (*Dipodomys merriami parvus)*

I. GENERAL INFORMATION

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act (Act) to conduct a 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 San Bernardino kangaroo rat (*Dipodomys merriami parvus*) is one of 19 recognized subspecies of Merriam's kangaroo rat (*D. merriami*) which is a widespread species distributed throughout arid regions of the western United States and northwestern Mexico (Hall 1981, p. 586; Williams et al. 1993, p. 62). Historically, the SKBR occupied alluvial floodplains and adjacent upland habitats within the San Bernardino, Menifee, and San Jacinto valleys and the typical vegetation type associated with this subspecies is Riversidean alluvial fan sage scrub (USFWS 1998b, p. 51005). The SKBR is a small, burrowing rodent, capable of dispersing up to 0.3 miles (0.4 kilometers) (Braden 2001, pp. 1-3). We considered that the range of this animal had been reduced by up to 96 percent at the time the species was emergency listed (USFWS 1998a, p. 3835). Since listing, new information obtained as a result of pre-project surveys and studies indicate that the subspecies is able to colonize a greater diversity of habitats than originally thought (Braden and McKernan 2000, p. 17). Because the distribution of this animal appears to be driven by soils type rather than any other habitat conditions, the hydrologic regime in the alluvial fans supporting the SBKR is of critical importance to the recovery of this subspecies. Particularly in areas where the channel is deeply entrenched, maintaining habitat connectivity between upland terrace habitat and the channel for the movement of animals between upland and instream habitat is critical to support animals in both locations (USFWS 1998b, p. 51008).

Methodology Used to Complete This Review:

This review was prepared by the Carlsbad Fish and Wildlife Office, following the Region 8 guidance issued in March 2008. We used information from available literature, office files, biological opinions, the final listing rule for the species, proposed and final critical habitat

packages, survey information and discussions with experts who have been monitoring various localities of this species, and the California Natural Diversity Database (CNDDB) maintained by the California Department of Fish and Game. Survey reports, literature reviews, and personal communications with experts were our primary sources of information used to update the species' status and threats. We received one letter from the State of California Attorney General regarding global climate change impacts to federally listed species in response to our *Federal Register* notice initiating this 5-year review; however, there were no statements in the letter that specifically addressed the SKBR. This 5-year review contains updated information on the species' biology and threats, and an assessment of that information compared to that known at the time of listing or since the last 5-year review. We focus on current threats to the species that are attributable to the Act's five listing factors. The review synthesizes all this information to evaluate the listing status of the species and provide an indication of its progress towards recovery. Finally, based on this synthesis and the threats identified in the five-factor analysis, we recommend a prioritized list of conservation actions to be completed or initiated within the next 5 years.

Contact Information:

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Lead Field Office: Samantha N. Marcum and Nancy Ferguson, Carlsbad Fish and Wildlife Office; (760) 431-9440.

Federal Register (FR) Notice Citation Announcing Initiation of This Review:

A notice announcing initiation of the 5-year review of this taxon and the opening of a 60-day period to receive information from the public was published in the *Federal Register* on March 5, 2008 (USFWS 2008a, p. 11945). We received one letter in response to our Federal Register notice initiating this 5-year review.

Listing History:

Original Listing
FR Notice: 63 FR 51005
Date of Final Listing Rule: September 24, 1998
Entity Listed: San Bernardino kangaroo rat (*Dipodomys merriami parvus*), a mammal subspecies
Classification: Endangered

Associated Rulemakings:

The San Bernardino kangaroo rat (*Dipodomys merriami parvus*, "SBKR") was emergency listed on January 27, 1998 (USFWS 1998a, pp. 3835-3843). Initial proposed and final critical habitat rules were published in the *Federal Register* on December 8, 2000, and April 23, 2002,

respectively (USFWS 2000, pp. 77178-77208; USFWS 2002, pp. 19812-19845). As part of a settlement agreement, the Service agreed to submit to the *Federal Register* a proposal to revise critical habitat. We published a proposed rule to revise critical habitat in the *Federal Register* on June 19, 2007 (USFWS 2007, pp. 33808-33842). A revised final critical habitat rule was published on October 17, 2008 (USFWS 2008b, pp. 61936-62002).

Review History: No comprehensive reviews have been conducted for this subspecies.

Species' Recovery Priority Number at Start of 5-Year Review:

The recovery priority number for the SBKR is 6C according to the Service's 2008 Recovery Data Call for the Carlsbad Fish and Wildlife Office, based on a 1-18 ranking system where 1 is the highest-ranked recovery priority and 18 is the lowest (USFWS 1983, pp. 43098-43105). This number indicates that the taxon is a subspecies that faces a high degree of threat and has a low potential for recovery. The "C" indicates conflict with construction or other development projects or other forms of economic activity.

II. REVIEW ANALYSIS

Application of the 1996 Distinct Population Segment (DPS) Policy:

The Act defines "species" as including any subspecies of fish or wildlife or plants, and any distinct population segment (DPS) of any species of vertebrate wildlife. This definition of species under the Act limits listing as distinct population segments to species of vertebrate fish or wildlife. The 1996 Policy Regarding the Recognition of Distinct Vertebrate Population Segments under the Act (USFWS 1996, pp. 4722-4725) clarifies the interpretation of the phrase "distinct population segment" for the purposes of listing, delisting, and reclassifying species under the Act. The SBKR is not listed as a DPS, and there is no new information to suggest that this subspecies should be listed as a DPS.

Information on the Species and its Status:

Species Biology and Life History

There are three recognized subspecies of Merriam's kangaroo rat within California: *Dipodomys merriami merriami, D. m. collinus*, and the SBKR. The SBKR is yellowish-brown and has a body length of about 95 millimeters (3.7 inches) and a total length of 230 to 235 millimeters (9 to 9.3 inches). It is darker and smaller than either of the other two subspecies of Merriam's kangaroo rat in southern California and is the only species of kangaroo rat with four toes on both of its hind feet. Morphologically, it is the most highly differentiated subspecies of *D. merriami* which may be due to SBKR's nearly complete geographic isolation from other members of *D. merriami* (Lidicker 1960, p. 190).

SBKR reside in burrow systems, which appear to be occupied by a single adult. The burrow systems of adults are often clustered in a given area and individuals typically emerge from their burrows after sunset; they may be active at any time during the night. Typical of kangaroo rats, Merriam's kangaroo rats are primarily granivorous and often store large quantities of seeds in

surface caches (Reichman and Price 1993, p. 543). Although seeds are the primary food source, green vegetation and insects appear to be important seasonal food and water sources (Reichman and Price 1993, p. 540). Seed caching may enable them to endure temporary shortages of food, as has been documented for other species of *Dipodomys* (Reichman and Price 1993, p. 543; Brown and Harney 1993, p. 624).

Although reproductive activities peak in June and July, SBKR appear to have a prolonged breeding season. Pregnant or lactating females have been captured between January and November while males in reproductive condition have been captured between January and August (McKernan 1997, p. 50). Females are capable of having more than one litter per year, and litter sizes probably average between two and three young (MEC Analytical Systems 2000, p. 77). In a mark-recapture study conducted between 1978 and 1984, Zeng and Brown (1987, pp. 1332-1333) found that 75 percent of adult male and 59 percent of adult female Merriam's kangaroo rats dispersed more than 197 feet (60 meters) from their initial capture sites, and that some individuals of both sexes moved over 787 feet (240 meters) before they were no longer found by researchers. In a similar study, male SBKR reproductive age routinely moved up to 131 feet (40 meters); a conservative estimate based upon distance between locations where they were trapped which is not necessarily the total distance an animal may have actually travelled (Braden 2001, p. 3). Long-range dispersal and population expansion by the SBKR is likely hampered by the presence of other rodents. Outlying areas of the home ranges of neighboring kangaroo rats may overlap, but adults actively defend small core areas near their burrows (Jones 1993, p. 583). Overlap between the home ranges of neighboring male kangaroo rats is often extensive while that of neighboring females is usually slight (Jones 1993, p. 584).

Kangaroo rat populations typically exhibit large fluctuations in density in response to temporal variability in plant productivity (Brown and Harney 1993, p. 624; Goldingay et al. 1997). Reproduction appears to be timed to coincide with high food-availability, but the rate of population growth is limited by the relatively small size of litters and long intervals between litters (Brown and Harney 1993, p. 625). Even during favorable times, adults tend to promote their own survival at the expense of reproduction and unlike other Heteromyids, *Dipodomys* does not have the ability to use stored foods (i.e., enter a state of torpor) which would help ameliorate population decreases during periods of drought and/or low resource abundance (Brown and Harney 1993, p. 625).

The areas which the SBKR occupy are subjected to periodic flooding and hence, the dominant vegetation type (alluvial fan sage scrub) is described in general terms as having three successional phases: pioneer, intermediate, and mature as determined by elevation and distance from the main channel and time since previous flooding (Hanes et al. 1989, p. 187). Hence, flood activity also affects population persistence and temporal changes in abundance. When major floods occur, the actions of moving water and sediment scour out vegetation and rework the sediment deposition patterns within the floodplain. During these events, burrows within the flowpath are destroyed, likely drowning animals within them. Hence, local survival of SBKR is dependent upon the presence of animals in nearby occupied habitat (a 'refugia' population) that is not scoured out during storms; this refugia population typically occurs within alluvial terraces or benches in areas elevated above the main channel and supporting a vegetation community

comprised to a large degree of shrubs and short-lived perennial plant species (USFWS 2002, p. 19811).

Spatial Distribution

Prior to emergency listing of the SBKR, the San Bernardino County Museum determined the distribution of the SBKR and estimated its historical range (McKernan 1997, p. 62). Based on aerial photography, museum records, field surveys, and literature, the historical range is thought to have encompassed roughly 28,000 acres (11,331 hectares) of alluvial floodplain habitat (McKernan 1997, pp. 4, 47). This historical range of the SBKR was thought to include the extensive alluvial fan terraces at the bases the San Gabriel, San Bernardino, and San Jacinto mountain ranges in San Bernardino and Riverside Counties, California. The northern extent of this subspecies range was likely the Cajon Pass San Bernardino County and the southernmost extent in Menifee in Riverside County (USFWS 1998b, p. 51005; Figure 1). At the time the SBKR was emergency listed, we estimated that the species occupied 3,247 acres (1,299 hectares) of habitat within its historical range as follows: 1,725 acres (690 hectares) in the Santa Ana River and 20 acres (8 hectares) in City Creek and 5 acres (2 hectares) in Reche Canyon (both tributaries to the Santa Ana River); 1,140 acres (456 hectares) in the Lytle Creek and Cajon Creek, 5 acres (2 hectares) in the Etiwanda alluvial fan, an isolated 2 acres (0.8 hectares) area in South Bloomington; and 350 acres (140 hectares) in the San Jacinto River (USFWS 1998a, p. 3835).

In the final listing rule, we considered that the current range more likely encompassed 9,797 acres (3,919 hectares) of habitat with the appropriate soils and vegetative cover to be occupied to some degree by the subspecies as follows: 3,861 acres (1,545 hectares) in the Santa Ana River; 5,161 acres (2,065 hectares) in Lytle and Cajon Creeks; and 775 acres (310 hectares) in the San Jacinto River (USFWS 1998b, pp. 51005-51006). We did not reassess the status of the SBKR in the areas containing 20 or fewer acres (8 hectares) initially considered occupied.

We recently revised critical habitat for the SBKR and determined that the current range of the species encompasses at least 10,696 acres (4,328 hectares). While these acres do not encompass all habitat occupied by or suitable for the SBKR, we believe that they do represent much of the remaining occupied habitat (USFWS 2008b, p. 61936).

Through the regulatory process associated with listing, we are accumulating a database to evaluate the distribution of the SBKR (e.g., pre-project surveys). At this time, we consider that the SBKR has likely been extirpated from South Bloomington and Reche Canyon and within the Etiwanda alluvial fan. It is likely confined to remaining suitable habitat within the San Bernardino County Flood Control District's Etiwanda Debris Basin Lower Spreading Grounds and associated facilities, as habitat is maintained within this facility for the SBKR (Reinitiation of section 7 Consultation on the San Sevaine Creek Water Project, FWS-SB-1743.5). Hence we now consider that the animal persists primarily within those areas where the greatest extent of suitable habitat occurred at listing; namely, in the floodplains of the Santa Ana River and tributaries, Lytle and Cajon Creeks, and in the San Jacinto River and its tributary, Bautista Creek (USFWS 2002, p. 19812).

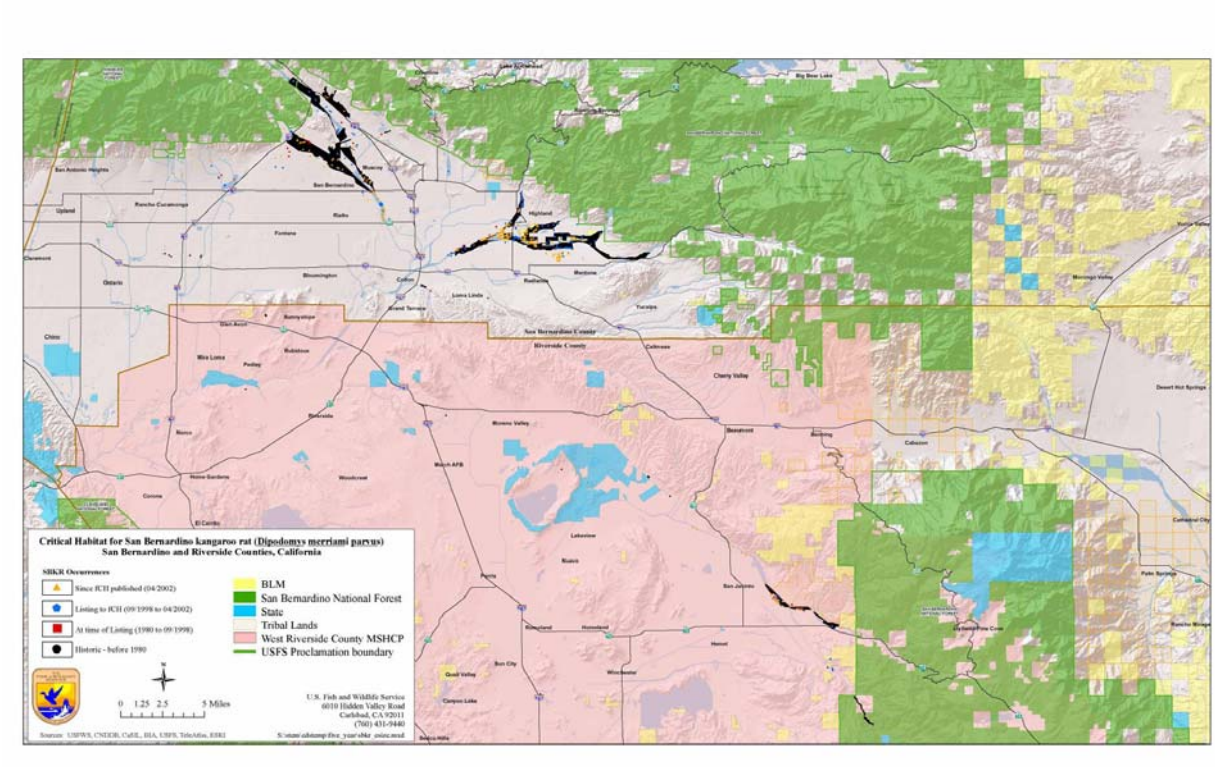

Figure 1. All known occurrences and designated critical habitat areas for the San Bernardino kangaroo rat, San Bernardino and Riverside counties, prepared for 5-year review, 2009. See Figures 2, 3, and 4 for more detail.

Although we do consider that it has been extirpated in some portions of its historical range since listing, we now have a more accurate understanding of its actual distribution. The relationship between distribution and abundance is as yet unclear because this species lives much of its life underground; an area may be occupied by the species, but information regarding the actual status of the occurrence or population can only be elucidated through research targeted to address this question. Please see the Species-specific Research and/or Grant-supported Activities section of this review (below).

Santa Ana River (San Bernardino County)

The SBKR occurs within the upper reaches of the Santa Ana River from the confluence of Mill Creek and the Santa Ana River to the vicinity of Tippecanoe Avenue (USFWS 2008b, p. 61954; McKernan 1997, pp. 20-24) (Fig. 2). Occupied habitat within the Santa Ana River floodplain exists within a mosaic of developed areas that do not support the animal (e.g., roads, flood control facilities and aggregate mining areas) and undeveloped, but disturbed, habitat areas that support the animal in limited numbers; specifically, water spreading grounds, airports (i.e., the Redlands Municipal Airport and the San Bernardino International Airport), sand and aggregate mining operations, and citrus groves. The SKBR also occupies the lower reaches of Mill Creek immediately upstream from its confluence with the Santa Ana River and in Plunge and City

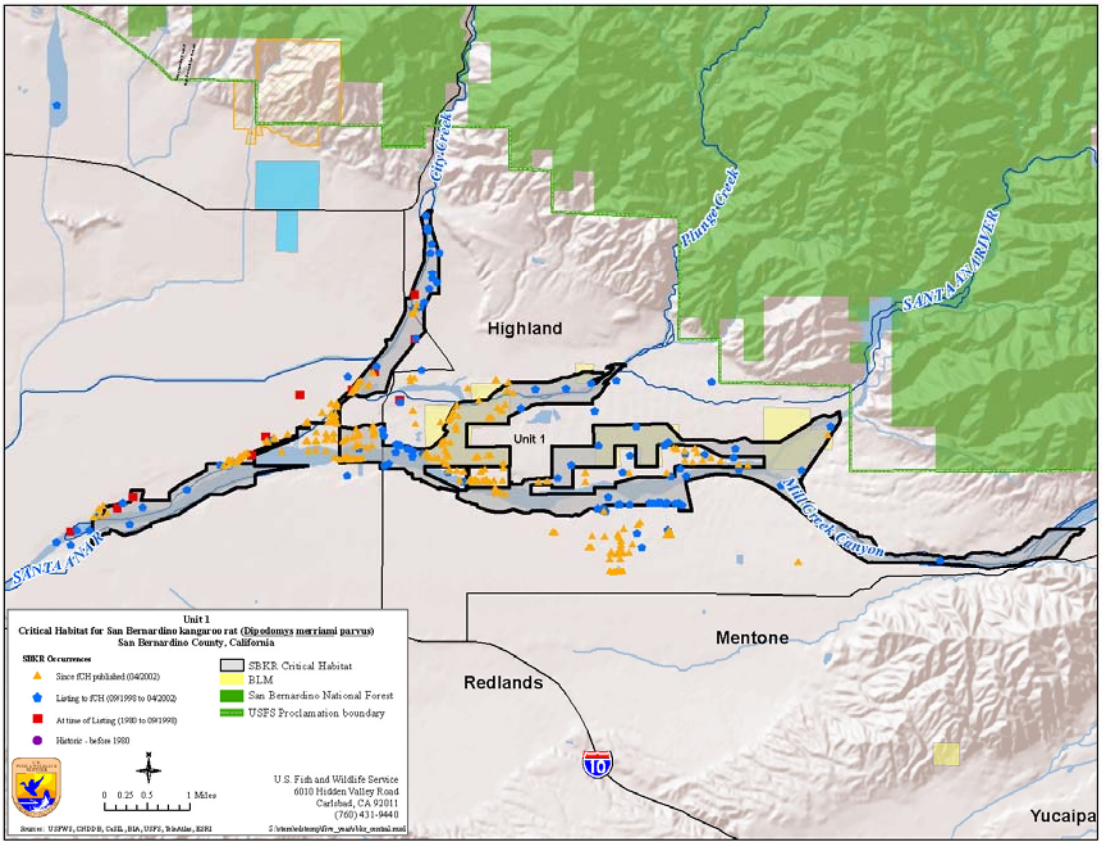

Figure 2. San Bernardino kangaroo rat occurrences and critical habitat unit along the Santa Ana River, San Bernardino County, prepared for 5-year review, 2009.

Creeks, both tributaries to the Santa Ana River in the vicinity of the City of Highland. SBKR have been able to persist in now-isolated portions of the Santa Ana Wash alluvial floodplain behind the existing levee along the southern border of Mill Creek, which extends below its confluence with the Santa Ana River. We presume that the SBKR can still occupy this area in large part, because the levee is staggered, rather than continuous, in this area allowing for movement of animals between upland and wash habitat areas. The extent of habitat within Plunge Creek is limited by urban development and flood control facilities. Above its confluence with the Santa Ana River, Plunge Creek was channelized and re-directed into a detention basin to avoid mining operations and hence, although of high-quality, this habitat is fragmented and largely isolated from other areas known to support the more robust occurrences of the SBKR. However, we anticipate that Plunge Creek and habitat between the creek and the Santa Ana River may be conserved and managed for the SBKR through the Upper Santa Ana Wash HCP. City Creek flows unimpeded from the San Bernardino Mountains to the Santa Ana River.

Lytle, Cajon, and Cable Creeks (San Bernardino County)

The SBKR occurs in discrete locations within Lytle Creek just upstream of the Interstate 15 Freeway where it crosses the creek to the confluence of Lytle and Cajon creeks (Figure 3).

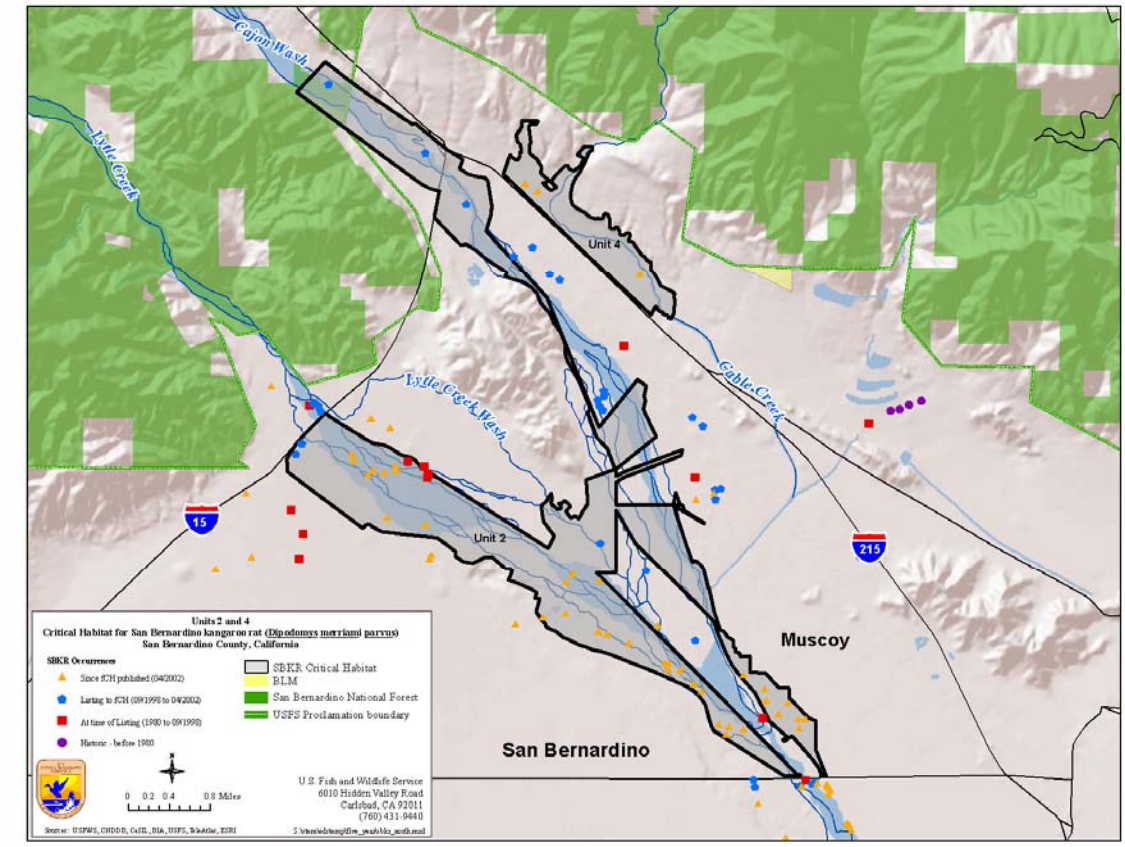

Figure 3. San Bernardino kangaroo rat occurrences and critical habitat unit along Lytle, Cajon, and Cable Creeks, San Bernardino County, prepared for 5-year review, 2009.

Intermittently-spaced groin levees and continuous hard-sided levees have been constructed along most of Lytle Creek. Lytle Creek is deeply incised between the Interstate 15 Freeway and the upstream end of hard-sided levees on both sides of the creek which protect the aggregate mining operations. Hence, all remaining occupied habitat within Lytle Creek is fragmented to some degree. The largest block of occupied habitat occurs upstream of the aggregate mining operations. Here the Creek does meander between the deeply-incised banks, creating alluvial benches which are high-quality habitat for the SBKR. Although there are some elevated terraces remaining between the banks in this area, they are subjected to the full force of any flooding which is confined between the incised banks and levees; occupied and managed habitat within this area has washed out during storms. Remaining upland terrace habitat outside of the 100-year floodplain has largely been developed and known occupied habitat is isolated from the creek by past development. The incised, armored banks and hard-sided levees along much of Lytle Creek increase the velocity of flows within the creek and hence, favor the process of sediment scouring over deposition. Lytle Creek is occupied by the SBKR for a linear distance of approximately 3 miles (4.8 kilometers) (Figure 3).

Downstream from the confluence of Cajon and Lytle Creeks, the creek becomes completely channelized; after which waters are carried through a concrete channel and ultimately discharged

into the Santa Ana River. Because the floodplain is so wide in this area and there are no upstream dams to preclude the natural flow of storm waters and sediment, the Cajon Creek floodplain experiences the normal fluvial processes necessary to maintain suitable habitat for the SBKR. Although instream mining has occurred within this creek, mined areas are being restored and over 1,000 acres have been conserved and are managed for the benefit of the SBKR in this area; at this time, all remaining aggregate removal and processing is being done outside of the 100-year floodplain.

Few roads cross Cajon Creek and we are working with the Federal Highway Administration and California Department of Transportation to replace an at-grade crossing with a bridge that we anticipate will be designed to facilitate the passage of sediments in this area. The other roadway crossing Cajon Creek, Institution Road, is at-grade and high flow-volumes, velocities, and sediment loads cause significant damage to the existing road and create safety problems by isolating facilities in the Devore area (i.e., the County Sheriff's training and detention facilities) during high-flows. The County of San Bernardino and local jurisdictions would like to improve this road; however the costs of spanning such a wide active channel area are prohibitive. Cajon Creek is occupied by the SBKR for a linear distance of approximately 8 miles (12.9 kilometers) (Figure 3).

Since listing, the SBKR has been documented within Cable Creek, which historically, was part of the larger Cajon Creek floodplain (USFWS 2008b, p. 61936). Cable Creek is now isolated from Cajon Creek by development and its associated infrastructure (primarily the Interstate 215 Freeway). Habitat suitability varies within this area based upon levels of past and current disturbance (trash dumping and off-highway vehicle (OHV) use).

San Jacinto River and Bautista Creek (Riverside County)

In Riverside County, the SBKR occurs along the San Jacinto River and in Bautista Creek (Figure 4). The species occurs in within the San Jacinto River floodplain along a linear distance of approximately 13 miles in the upper reaches of this river; the animals having been extirpated from all downstream habitat by agriculture, development and its associated infrastructure, and flood control facilities (USFWS 2008b, p. 61936). The SBKR also occurs in Bautista Creek, a tributary of the San Jacinto River Bautista Creek enters a concrete box-channel several miles upstream from its confluence with the San Jacinto River and most intervening upland habitat is developed to some extent. Therefore, if there is a habitat corridor between populations of SBKR in the San Jacinto River and Bautista Creek, it is highly fragmented and we do not expect that animals move between these areas.

However, the SBKR within Bautista Creek appear to be a self-sustaining population distinct from that in the San Jacinto River (USFWS 2008b, p. 61954). From its headwaters, Bautista Creek flows within a deep canyon within the boundaries of the Cleveland National Forest and within these boundaries the creek is unmodified (no levees, diversions or other structures) and 2-lane road without heavy traffic. Few surveys for the SBKR have been conducted within Bautista Creek outside of the boundaries of the Cleveland National Forest, but alluvial soils that support the SBKR remain along roads, the base of the foothills and through existing citrus groves and

could be occupied to some extent. Based upon survey information and habitat conditions, we estimate that the SBKR occurs within approximately 4 miles (6.4 kilometers) of Bautista Creek.

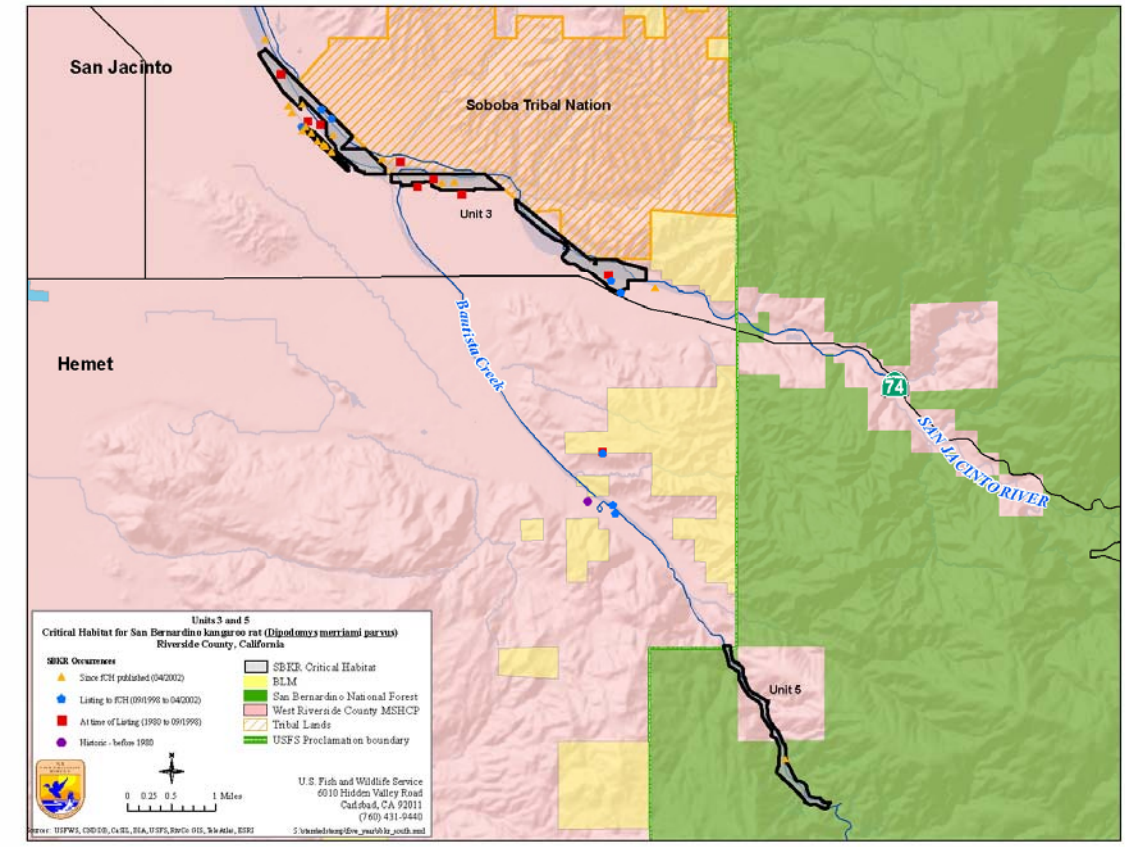

Figure 4. San Bernardino kangaroo rat occurrences and critical habitat unit along the San Jacinto River, Riverside County, prepared for 5-year review, 2009.

Abundance

Prior to listing, staff of the San Bernardino County Museum captured, marked, and released animals during studies conducted between 1987 and 1996 at six, permanent study-sites (McKernan 1997, pp. 1-62). Quantitative data regarding substrate and vegetation were also obtained to gain information on relative abundance of animals across habitat types (McKernan 1997, pp. 6-8). The relative abundance of animals within these sampling areas varied tremendously with 1-5 SBKR/acre considered low abundance; 5-15 SBKR/acre moderate abundance, and 20-30 SBKR/acre indicative of a relatively high abundance of animals (McKernan 1997, pp. 50-51). These differences were attributed to differences in percent vegetation cover and vegetation type as well as variations in substrate (percent sand, gravel, and cobble). Sites with larger proportions of the pioneer and intermediate phases of alluvial fan sage scrub had higher relative abundance of the SBKR than did sites in which fluvial actions were suspended either through time since natural flooding or artificial changes to the hydrologic regime. In these areas of low relative abundance, mature alluvial fan sage scrub or nonnative

annual grasses comprised a higher proportion of the vegetation cover (McKernan 1997, pp. 41-43).

Live-trapping done to determine the presence of absence of the SBKR does not provide information about abundance of animals within a surveyed area. We do know that animals have been found in habitat conditions we would not think favorable to the species, but information regarding abundance and demography (i.e., age and gender distributions) can only be obtained from long-term monitoring efforts. Two scientifically based management and monitoring efforts are underway and in the initial stages; the Seven Oaks Dam Multi-species Habitat Management Plan and the Lytle Creek North Master-planned Community Conservation Management Plan. Data collection over time will allow us to better-assess abundance of SBKR within its range.

Given the dynamic nature of the ecosystem in which the SBKR occurs, populations are subjected to irregular, catastrophic events when flooding scours occupied habitat, presumably killing most animals within severely flooded areas. When this occurs, persistence of the animal in scoured areas depends upon a sufficient population of animals in unflooded, adjacent habitat (refugia) from which to recolonize recently scoured habitat. Hence, occupied habitat that is infrequently scoured or eroded by flooding is necessary as a source of animals to repopulate areas where animals were lost during natural flood processes (USFWS 1998a, p. 3835). Conversely, as alluvial fan scrub vegetation ages in the absence of flooding, the suitability of this habitat for the SBKR declines (McKernan 1997, p. 58).

Habitat and Ecosystem

Within the alluvial fan habitat, active (or low-flow) channels meander and braid throughout the fan and channels range from decimeters to several meters deep. The location of these low-flow channels is established by water and sediment flows during storms and is subsequently altered by successive storms. Over time, flooding can become primarily confined to large trenches (e.g., Lytle Creek, San Jacinto River) or can occur as sheetflooding (e.g., Cajon Creek, the Santa Ana River).

Major floods rework habitat for the SBKR, scouring out vegetation, moving massive amounts of streambed sediments and depositing fresh alluvium from upstream parent rock material in the streambed and overbank flow areas. Within this dynamic alluvial fan system, the dominant vegetation type (alluvial fan sage scrub) occurs in the three successional phases previously described. The distribution of these phases is determined by elevation, distance from the main channel, and the time since previous flooding (Hanes et al. 1989, p. 187). Vegetation cover generally increases with distance from the active stream channel. The pioneer phase is subject to frequent flood disturbance (Smith 1980, p. 133; Hanes et al. 1989, p. 187). The intermediate phase, defined as the area between the active channel and mature terraces, is subject to periodic flooding at longer intervals. The vegetation on intermediate terraces is relatively open.

Changes in Taxonomic Classification or Nomenclature

There have been no changes to taxonomic classification or nomenclature since the species was listed as endangered.

Genetics

There have been no studies conducted on the genetics of the SKBR; therefore, we have no information about the current status or trends in genetic variation. Lidicker (1960, p. 190) noted that the SKBR is one of the most highly differentiated subspecies of *Dipodomys merriami* and therefore, considered that it had achieved nearly species rank. This differentiation is likely due to its apparent isolation from other members of *D. merriami* and suggests that the subspecies has diverged genetically, as well as morphologically, from other Merriam's kangaroo rats.

Species-specific Research and/or Grant-supported Activities

As part of the conservation measures proposed for the construction and operation of the Seven Oaks Dam on the Santa Ana River, the U.S. Army Corps of Engineers (Corps) is funding the long-term management of a 764-acre conservation area known as the Woolly Star Preserve Area (WSPA), located in the Santa Ana River Wash in San Bernardino County (Section 7 Consultation for Operations of Seven Oaks Dam, San Bernardino County, California; USFWS 2008c, FWS-SB-1000.10). We are working with the Corps and the local sponsors of the Seven Oaks Dam on the preparation of a Multi-species Habitat Management Plan (MSHMP) for the benefit of the SKBR and two plants federally-listed as endangered: *Dodecahema leptoceras* (Slender-horned Spineflower) and *Eriastrum densifolium* ssp. *sanctorum* (Santa Ana Woolly-star). As part of both plan development and eventual implementation of a final management plan, the Corps is conducting long-term demographic monitoring of the SBKR and will implement management measures in the future as they are determined to be necessary through long-term monitoring. In cooperation with our agency, the Corps has already conducted 4 years of live-trapping of SBKR in order to obtain a baseline distribution and abundance information within the Wooly-star Preserve Area and to acquire information about habitat conditions relative to this distribution and abundance. The Corps plans to initiate preliminary habitat restoration activities within the next year. The level of live-trapping conducted by the Corps in conjunction with repeated sampling of vegetative and edaphic habitat parameters is allowing us to compile a sufficient database from which to better-understand SBKR population dynamics and hence, assist in recovery of the subspecies. The Corps and our agency are working cooperatively with the stakeholders in the Upper Santa Ana Wash Habitat Conservation Plan (HCP) so that they may apply the information already gained about the SBKR to the development of the habitat management plan proposed in as part of the HCP.

Five-Factor Analysis: The following five-factor analysis describes and evaluates the threats attributable to one or more of the five listing factors outlined in section 4(a)(1) of the Act.

FACTOR A: Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

At listing, we considered that the long-term subsistence of SBKR is impacted by sand and gravel (aggregate) mining, flood control structures and operations, agricultural activities, urban and industrial development, water conservation activities, and off-road activity (USFWS 1998a, p. 3837). Because these activities are associated with an increasing human population within San

Bernardino and Riverside counties and because the populations of these counties were projected to continue growing, we considered these threats imminent (USFWS 1998a, p. 3837). To some extent, listing has helped to ameliorate the threats to the SBKR from aggregate mining; however, construction and operation of flood-control facilities continue to threaten the SBKR. A description of these threats are provided below, including those within the three largest core populations - Santa Ana River, Lytle, Cajon, and Cable Creeks, and San Jacinto River and Bautista Creek.

Mining Operations

Sand and aggregate mining activities degrade habitat that supports the San Bernardino kangaroo rat. At listing, aggregate mining operations occurred on approximately 1,381 acres (552 hectares) and water recharge operations (e.g., spreading basins, roads) on approximately 350 acres (140 hectares) of habitat in the Santa Ana River wash in the cities of Redlands and Highland (USFWS 1998a, p. 3837). Since then, we have worked cooperatively with the local jurisdictions and County government, the San Bernardino Valley Water Conservation District, Robertson's Ready Mix, CEMEX, the Bureau of Land Management (BLM), and the California Department of Fish and Game on a comprehensive plan to concentrate aggregate mining and water recharge within certain portions of the wash and to address flood control operations and maintenance activities and future growth (primarily infrastructure improvements such as roads). The development of a Habitat Conservation Plan pursuant to section 10 of the Act is underway for numerous sand and gravel operators in the upper Santa Ana River floodplain

Impacts to the SBKR from aggregate mining operations in Cajon Creek were addressed through consultation immediately following the listing of the SBKR and the 1,265-acre (512-hectare) Cajon Creek Habitat Management Area and the 567- acre (229-hectare) Cajon Creek Conservation Bank were established by Vulcan Materials, Inc. (then CalMat) to help conserve the SBKR and other species associated with alluvial fan sage scrub habitat. Mining within alluvial habitat in Cajon Creek is still occurring downstream of the Interstate 210 Freeway. In the absence of a Federal nexus for this mining operation, we have been unable to work successfully with the landowner regarding potential unauthorized incidental take of the SBKR as a result of this activity.

There are no active aggregate mining operations within the SBKR-occupied stretch of the San Jacinto River; however, an approximately 73-acre (30-hectare) in-stream aggregate mining operation was recently abandoned and an approximately 35-acre (14-hectare) pit remains. This earlier mining operation severely degraded SBKR habitat, and the abandoned pit now acts as a detention basin, disrupting flows and sediment deposit patterns downstream and resulting in upstream erosion of suitable and occupied habitat for the SBKR (KCT Consultants, Inc. 1998, p. 2). The central location of the mining operation within the San Jacinto wash and the impacts of the mining pit coupled with disturbance in adjacent habitat have effectively bisected the remaining SBKR into two disjunct populations with minimal opportunity for movement of individuals (Mark Pavelka, 2009, USFWS, pers. obs.).

No new aggregate mining operations have been proposed within Lytle Creek since the SBKR was listed.

Flood Control Structures and Operations
Flood control structures often confine, isolate, or fragment populations of the SBKR, thereby predisposing these populations to catastrophes and other risks inherent to small populations. Historically, the SBKR occupied floodplains and adjacent upland habitat areas containing appropriate physical and vegetative characteristics. Animals from the upper terraces of the floodplain and adjacent uplands were historically available to recolonize extirpated areas that were flooded and scoured during storm events. However, conversion of floodplains into narrow, monotypic channels has removed the physical structure (i.e., terracing) as well as areas of the active floodplain.

Upland refugia is also affected by the conversion of SBKR habitat to agricultural fields, residential sites, and industrial developments and by berms and levees, which further isolate populations. Therefore, remaining populations of the San Bernardino kangaroo rat within the channelized portions of rivers are at risk due to confined flooding, and recolonization of the subspecies following local extirpation has often been precluded. Channelization also predisposes local populations of the San Bernardino kangaroo rat to extirpation during large floods because animals may drown within channelized areas that confine flood waters. Channelization may also eliminate or isolate upland terraces essential for recolonization.

Flood control structures (rip-rapped banks and hard-lined flood control channels), and the levees which protect existing aggregate mining in the Lytle Creek area have contributed to increased velocity of flows through this area and increased scour and channel incision with less deposition of the alluvial material necessary to support burrows for the SBKR and associated vegetation. Thus, much of the habitat for the SBKR within Lytle Creek is either in the early pioneer stage of succession or, where outside of the steep banks, in the later, mature stages of succession with predominantly senescent vegetation. Neither condition is anticipated to support a robust population of the SBKR.

Agricultural Activities
Agricultural (e.g., citriculture) and fuel reduction activities occasionally result in the discing of patches of suitable or occupied habitat for the SBKR. Discing destroys the animals' burrows and degrades remaining vegetation. These activities have greatly increased the susceptibility of this population to extinction during a catastrophic event (e.g., 100-year flood) by restricting it to areas most vulnerable during floods.

Because alluvial fan soils are particularly well-suited to citriculture, much of the upland alluvial fan habitat within the extant range of the subspecies consists of citrus groves. The open nature of these groves and farm access roads encourage occupancy by the SBKR where groves are located in proximity to alluvial fan areas (Service GIS internal database 2009). Although the distribution of SBKR within groves is limited by irrigation, ongoing grove maintenance, harvesting and any practices that result in crushing, discing, or excavation of burrows likely results in mortality of animals. As residential development continues, areas previously devoted to citriculture have been left un-irrigated and SBKR, which appear to have occupied these lands in some low densities when the groves were in operation, have now increased their distribution and abundance as these areas have been made available to them (CFWO Listing and Recovery unpublished internal database 2009).

Extensive citrus groves still exist adjacent to the San Jacinto River and Bautista Creek. In the vicinity of the San Jacinto River, groves are separated from the River by steep embankments, roads, and low-density urban development and it is unlikely that SBKR are attracted to, or resident in, these groves. In the Bautista Creek area, however, there are no physical barriers to movement of animals between undeveloped habitat areas and citrus groves and SBKR likely occupy existing groves to some extent. We anticipate that development will eventually occur within these areas currently being farmed. These areas are within the Mammal Species Survey Area with Criteria Area boundaries of the Western Riverside County Multiple Species HCP (MSHCP)/NCCP and we anticipate occupied habitat would be addressed under this plan.

Urban and industrial development
Continued urban development and fragmentation of habitat is also likely to promote a higher level of predation by urban-associated animals, as the interface between natural habitat and urban areas increases (Churcher and Lawton 1987, p. 453). Domestic or feral cats are known to be predators of native rodents, and predation by cats has been documented for the SBKR (R. McKernan, 1994, San Bernardino Natural History Museum, Redlands, California, unpublished data). Extensive urban development has already occurred in western Riverside County. However, expanding development within the Vail Lake Area and the cities of Winchester, Hemet, Redlands, Highland, and San Bernardino are introducing new urban areas within or adjacent to alluvial fan habitat historically or currently occupied by SBKR (USFWS GIS internal database, 2004).

Two road-widening and bridge-replacement projects (i.e., the Boulder and Baseline Bridge projects) are anticipated over City Creek, a tributary to the Santa Ana River. Both will increase habitat fragmentation as the roads will be improved over current conditions by the construction of curb and gutter and installation of street-lighting. The roads will handle a greater volume and velocity of traffic increasing the threat of vehicle-strikes as these roadways cross through SBKR-occupied habitat. Although we will address these impacts to the SBKR through the section 7 consultation process, overall, existing habitat fragmentation is anticipated to increase as these projects are implemented, residential development intensifies, and human use of habitat areas increases.

Approximately 213 acres (86 hectares) of the remaining habitat for the SBKR in Lytle Creek is within a Conservation Area set aside in 2004 by Lytle Creek North Development as part of their residential/commercial development in that area (Formal Section 7 Consultation on the Lytle Creek North Master planned Community, FWS-SB-1640.11). The long-term persistence of SBKR in the in-stream Conservation Area will depend largely upon a sufficient remnant of the population within the banks of the Creek persisting following very large (e.g., bank-to-bank) floods in this area.

Water Conservation Activities
Decades of groundwater pumping have severely depleted ground water reserves within western Riverside County and have resulted in an ever-increasing need to recharge groundwater supplies by percolating either imported or local water supplies into the local groundwater basins (October 13, 2000, Draft Program Environmental Impact Report for the San Bernardino Valley Municipal

Water District Proposed Regional Water Facilities Master Plan). Groundwater recharge areas are generally unsuitable for the SBKR because of the periodic presence of standing water and the degradation of alluvial scrub communities. These activities were considered threats at the time of listing, and they are ongoing in the Santa Ana and San Jacinto rivers as well as Bautista, Cajon, City, and Lytle creeks.

Off-road Activity
Off-highway vehicle use directly damages plant communities, the soil crust, and the burrow systems of SBKR thereby degrading its habitat. If SBKR populations remain at City Creek, Etiwanda, Reche Canyon, and/or South Bloomington, the lack of suitable habitat suggests the populations would be extremely small, isolated, subject to the indirect effects of urban development (e.g., predation due to house cats), and therefore have little chance of long-term survival without intensive management. The three largest remaining populations (i.e., Santa Ana River, Lytle and Cajon washes, and the San Jacinto River) are also at risk and the threats to these populations are described below.

Unauthorized OHV use continues to degrade alluvial fan sage scrub habitat areas within the Santa Ana River wash and parts of City Creek. Control of these activities rests with local landowners and jurisdictions. We anticipate that some of these impacts will be ameliorated through active management as part of Upper Santa Ana Wash HCP (HCP) and implementation of the Seven Oaks Dam MSHMP.

Habitat degradation continues to occur as a result of trespass by off-highway vehicles that negatively impacts SBKR habitat in the San Jacinto River. Trampling by recreationalists in Bautista Creek is ongoing due to target and "paint-ball" shooting that are also common activities in this area (N. Ferguson, 1994-present, U.S. Fish and Wildlife Service, personal observations). The most recent trapping effort showed that SBKR densities are lowest where OHV use is most prominent, near the confluence of the San Jacinto River and Bautista Creek.

Summary of Factor A:

At the time that the SBKR was listed, we considered that aggregate mining constituted a primary threat to the subspecies. As a result of listing, we worked cooperatively with other Federal agencies and local aggregate mining operators to conserve and manage habitat for the SBKR, and as a result, the direct threats posed to SBKR from aggregate mining are being addressed. The indirect threat of upstream habitat degradation (headcut migration) as a result of instream aggregate removal remains, but it is not possible to isolate any single aggregate operation as being causal; other conditions such as existing drop-structures, dam operations, and aggregate removal to maintain flood capacity affect sediment transport and geomorphology of the floodplains occupied by the SBKR.

Development within floodplain habitat will increase as a result of population growth within western San Bernardino County, re-zoning of floodplain habitat for development uses by local jurisdictions, and the demand for a larger water supply in southern California. As a result of these combined pressures, we anticipate the construction of new roads and expansion of existing roads and bridges and the additional construction of pipelines, reservoirs and pumping stations

primarily within the Santa Ana and San Jacinto River floodplains. Although we anticipate that these impacts will be offset through conservation and/or management of conserved habitat for the benefit of the SBKR (e.g., the proposed Upper Santa Ana Wash HCP, the proposed expansion of the Cajon Creek Conservation Bank), an overall reduction in the amount of habitat available to the SBKR and greater habitat fragmentation will occur.

The permanent alteration of floodplain dynamics affects the conservation of the SBKR especially in the Santa Ana River (and its tributary, City Creek), the San Jacinto River, and Lytle Creek. Preliminary attempts to re-create habitat for the SBKR in Lytle Creek have met with mixed success due to natural floodplain dynamics which cannot be controlled. In cooperation with the Corps we hope to develop and test management practices that will conserve the SBKR in an altered hydrologic system. Hence, conservation and recovery of the SBKR is likely to depend heavily upon successful management of all conserved habitat.

Because there are no other approved mitigation banks for the SBKR or alluvial fan sage scrub habitat in other habitat areas, most project proponents rely on the Cajon Creek Conservation Bank to offset their impacts to the SBKR, its critical habitat, and to alluvial fan sage scrub habitat (e.g., pursuant to CEQA or streambed alteration agreements). Because of the limited amount of undeveloped habitat remaining that is suitable for the SBKR within the floodplains of the Santa Ana and San Jacinto Rivers and because to date, no proposals to create mitigation banks of other conserved areas, project-related impacts in all remaining occupied or suitable alluvial fan habitat areas are being offset primarily in only one alluvial fan system (Cajon Creek). Because all remaining occupied habitat is largely in close proximity to active channels and little upland, refugia habitat remains for the SBKR, the subspecies remains vulnerable to catastrophic events such as flooding if the scale of such flooding scours our much of the occupied habitat remaining for the animal in any of the four remaining, occupied floodplains.

FACTOR B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Overutilization for commercial purposes was not known to be a factor in the 1998 final listing rule (USFWS 1998b, p. 51011). Overutilization for any purpose does not appear to be a threat at this time.

FACTOR C: Disease or Predation

Disease was not known to be a factor in the final listing rule (USFWS 1998b, p. 51012), nor is it known to be a threat at this time. However, the final listing rule stated that fragmentation of habitat likely promotes higher levels of predation by urban-associated animals (e.g., domestic cats) as the interface between occupied habitat to developed areas is increased (USFWS 1998b, p. 51012).

Competition, predation, and disease could threaten remnant populations of kangaroo rats by limiting population growth rates. Competition occurs when individuals of the same or different species utilize common resources (food, space, burrows) that are in short supply; or, if the resources are not in short supply, competition occurs when organisms seeking the resources

actively defend territories. Although we expect that urban development introduces new predators into adjacent areas (specifically, domestic cats), we are unaware of any studies specific to changes in predation as a result of urban development.

FACTOR D: Inadequacy of Existing Regulatory Mechanisms

The majority of known populations of the SKBR occur on non-Federal land. At the time of listing, the decline of the SKBR was partially due to the inherent weakness of the existing laws and regulations that could serve to protect the animal and its habitat. Existing regulatory mechanisms that were identified that may have provided some protection for the SKBR included: (1) California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA); (2) the California Natural Community Conservation Planning Program (NCCP); (3) the Surface Mining Control and Reclamation Act (SMCARA); (4) the Act in those cases where the SKBR occurred in habitat occupied by other listed species; (5) the California Endangered Species Act (CESA); (6) conservation provisions under the Federal Clean Water Act; (7) land acquisition and management by Federal, State, or local agencies or by private groups and organizations; and (8) local laws and regulations. In addition to the regulatory mechanisms described in the final listing for the SBKR, the California Lake and Streambed Alteration Program may currently provide some additional protection for the subspecies.

State Protections

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 SBKR is not listed under CESA, so protection under this act does not apply.

California Environmental Quality Act

The CEQA requires review of any project that is undertaken, funded, or permitted by the State or a local governmental agency. If significant 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 section 21002). Protection of listed species through CEQA is, therefore, dependent upon the discretion of the lead agency involved.

Natural Community Conservation Planning Program

The NCCP program is a cooperative effort involving the State of California and numerous private and public partners to protect habitats and species. NCCPs identify and provide for the

regional or area-wide protection of plants, animals, and their habitats, while allowing compatible and appropriate economic activity. The program began in 1991 under the State's NCCP Act (California Fish and Game Code 2800-2835). The primary objective of the NCCP program is to conserve natural communities at the ecosystem scale while accommodating compatible land use (http://www.dfg.ca.gov.NCCP/). Regional NCCPs may provide protection to federally listed species, such as the SBKR, by conserving native habitats upon which the species depend. Many NCCPs are developed in conjunction with Habitat Conservation Plans (HCPs) prepared pursuant to the Act.

Surface Mining and Reclamation Act (SMCRA)

Reclamation of mined areas in the State of California is required under the Surface Mining and Reclamation Act (SMCRA). The County of San Bernardino also requires that mining companies submit a reclamation plan for County approval. The primary purpose of these ordinances is to provide for erosion-control measures and to restore slopes to a moderate slope. However, reclamation is not likely to resolve the problem of maintaining or mitigating for the loss of species or ecosystem functions in a biologically-meaningful way because of change in soil composition, topography, and altered hydrology. The feasibility of re-creating alluvial fan sage scrub habitat that would support the SKBR has not yet been determined.

South Coast Resource Management Plan (RMP)

Through the South Coast Resource Management Plan (RMP), the BLM designated an Area of Critical Environmental Concern (ACEC) in the Santa Ana River in 1994. The ACEC is composed of three parcels of land that total approximately 760 acres (304 hectares) for the purpose of protecting and enhancing the habitat of federally listed plant species occurring in the area, such as the Santa Ana River woolly-star and the SKBR, while providing for the administration of existing valid rights (BLM 1994, p. 145). Although the establishment of the ACEC is important in regard to conservation of sensitive habitats and species in this area, the administration of valid, pre-existing rights may conflict with conservation intentions in this area. Existing rights include a withdrawal of Federal lands in this area for water conservation through an act of Congress, February 20, 1909 (Public, No. 248). The entire ACEC is included in this withdrawn land and may be available for water conservation measures such as the construction of groundwater recharge basins, subject to compliance with the Act. As part of the South Coast RMP and we anticipate that some areas that are currently considered ACEC will become privately owned and other areas currently in private ownership will become public lands and designated as ACEC within the revised South Coast RMP (BLM 2007, pp. 44173-44174).

California Lake and Streambed Alteration Program

The Lake and Streambed Alteration Program (California Fish and Game Code sections 1600-1616) may promote the recovery of State listed species in some cases. This program provides a permitting process to reduce impacts to fish and wildlife from projects affecting important water resources of the State, including lakes, streams, and rivers. This program also recognizes the importance of riparian habitats to sustaining California's fish and wildlife resources, including State listed species, and helps prevent the loss and degradation of riparian habitats.

Federal Protections

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 Federal 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 C.F.R. 1502.14(f)). These mitigations can provide some level of protection for listed species. However, NEPA does not require that environmental impacts be avoided, only that effects be assessed and the analysis disclosed to the public. Therefore, this regulatory mechanism may not be adequate to fully protect the species.

Endangered Species Act of 1973, as amended (Act)

Since listing, the Act is the primary Federal law that provides protection for this species. The Service's responsibilities include administering the Act, including sections 7, 9, and 10. Section 7(a)(2) of the Act requires Federal agencies, including the Service, to ensure that actions they fund, authorize, or carry out do not "jeopardize" a listed species or result in the "destruction or adverse modification" of habitat in areas designated by the Service to be "critical." 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 C.F.R. § 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. Critical habitat was revised and the final rule was published on October 17, 2008 (USFWS 2008b).

Section 9 prohibits the taking of any federally 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 (50 CFR 17.3) 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 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 NCCP program. The Western Riverside County MSHCP (MSHCP) is an example and is described below.

Western Riverside County Multiple Species Habitat Conservation Plan (MSHCP)

On June 22, 2004, a section l0(a)(l)(B) permit was issued for the MSHCP (Dudek and Associates 2003; USFWS 2004). The MSHCP encompasses a 1.2 million-acre plan area and establishes a multiple species conservation program to minimize and mitigate habitat loss and the incidental take of covered species in association with activities covered under the permit. The SBKR is an MSHCP covered species and is subject to impacts associated with development and other covered activities conducted by the Permittees outside of the defined MSHCP Conservation Area. The plan contains specific management and minimization measures intended to protect existing populations of the subspecies. The known SBKR locations and habitat along the San Jacinto River and Bautista Creek were anticipated to be incorporated within the MSHCP Conservation Area as either new reserve lands or existing Public/Quasi Public Lands (USFWS 2004); however, Public/Quasi Public Lands include land owned by agencies that are not signatories to the plan, and we have received project proposals that would impact the SKBR along the San Jacinto River that are not subject to the protections afforded by the MSHCP. The MSHCP was designed to address the impacts of urbanization on covered species, including the SBKR, within Riverside County; however, dozens of acres of occupied SBKR habitat that were proposed for conservation in the MSHCP application process now have existing or pending approvals for development.

Critical habitat is defined in section 3 of the Act and receives protection under section 7(a)(2) of the Act through the prohibition against destruction or adverse modification of critical habitat with regard to actions carried out, funded, or authorized by a Federal agency. Section 7(a)(2) of the Act requires consultation on Federal actions that are likely to result in the destruction or adverse modification of critical habitat. The designation of critical habitat does not affect land ownership or establish a refuge, wilderness, reserve, preserve, or other conservation area. Such designation does not allow government or public access to private lands. Section 7(a)(2) of the Act is a purely protective measure and does not require implementation of restoration, recovery, or enhancement measures.

Approximately 7,779 acres (3,148 hectares) of habitat in San Bernardino and Riverside counties, California, are designated as critical habitat for the SKBR as follows: 3,258 acres (1,318 hectares) in the Santa Ana River Wash (Unit 1; see Figure 2 herein) which includes portions of its tributaries Mill, City and Plunge Creeks; 3,421 acres (1,384 hectares) in Lytle and Cajon Creeks (Unit 2; see Figure 3 herein); 506 acres (205 hectares) within the San Jacinto River Wash (Unit 3, see Figure 4 herein); 485 acres (195 hectares) within Cable Creek (Unit 4; see Figure 3 herein); and 111 acres (45 hectares) in Bautista Creek (Unit 5; Figure 2 herein) (USFWS 2008b, pp. 61936-62002). We excluded lands considered essential to conservation of the SBKR within these areas from designation as critical habitat as follows: the 751-acre (304-hecatre) WSPA and 267 acres (108 hectares) within the boundaries of the San Bernardino International Airport (former Norton Air Force Base) in Unit 1; 1,265 acres (512 hectares) of lands owned by Vulcan Materials Inc. in Unit 2; and 39 acres (16 hectares) of lands within the boundaries of the Hemet/San Jacinto Integrated Recharge Recovery Project and 263 acres (106 hectares) of land

under the jurisdiction of the Western Riverside County MSHCP/NCCP in Unit 3; and 332 acres (134 hectares) of land under the jurisdiction of the Western Riverside County MSHCP/NCCP within Bautista Creek in Unit 5 as explained in the "Exclusions Under Section 4(b)(2) of the Act" within the final designation of critical habitat (USFWS 2008b, pp. 61969–61983).

Clean Water Act

Under section 404, the U.S. Army Corps of Engineers (Corps) 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, NEPA, and the Endangered Species Act. These reviews require consideration of impacts to federally listed species and their habitats, and recommendations for mitigation of significant impacts.

The SBKR could potentially be affected by projects requiring a permit from the Corps under section 404 of the Clean Water Act. The objective of the Clean Water Act is to ''restore and maintain the chemical, physical, and biological integrity of the Nation's waters'' (Pub. L. 92–500). A majority of the remaining populations occur outside areas delineated as waters of the United States and, therefore, are not regulated. Moreover, numerous activities for which the Corps potentially has jurisdiction, including sand and gravel mining and flood control projects, have proceeded without their overview. As a result of Fish and Wildlife Coordination Act activities, the Corps, in 1988, initiated a section 7 consultation on the Santa Ana River woolly-star for the proposed Seven Oaks Dam project on the Santa Ana River. About 775 ac (310 ha) of alluvial scrub habitat has been designated for preservation as mitigation for impacts to the Santa Ana River woolly-star resulting from the construction of the dam. Approximately 200 acres (80 hectares) of this appears to be currently suitable for the SKBR (USFWS unpublished GIS maps, 1997). However, the preserved area represents less than 7 percent of the alluvial scrub found in the entire Santa Ana River basin and approximately 12 percent of the basin habitat occupied by the SKBR. Thus, the mitigation preserve, while providing some benefit, is likely not adequate to conserve the subspecies.

Summary of Factor D:

While State and other Federal regulations may provide some discretionary conservation benefit to the SKBR, the Act is the primary regulatory mechanism mandating SKBR conservation and ensuring that the SKBR is addressed during planning efforts that may impact the subspecies or its habitat. Section 10 of the Act is the primary Federal process for addressing both the economic development needs and the conservation needs of the species on private lands within Riverside County. The SBKR is an MSHCP covered species and is subject to impacts associated with development and other covered activities conducted outside of the defined MSHCP Conservation Area. The MSHCP was designed to address the impacts of urbanization, within Riverside County and the plan contains specific management and minimization measures intended to protect existing populations of SBKR. Thus, it is primarily through the Act that we

continue to work with our Federal and State partners, local jurisdictions, and private landowners to implement actions to reduce ongoing threats to this subspecies.

FACTOR E: Other Natural or Manmade Factors Affecting Its Continued Existence

As identified in the final listing rule, habitat for the SKBR has been severely reduced and fragmented by development and related activities in the San Bernardino and San Jacinto valleys (USFWS 1998b, p. 51013). Habitat fragmentation results in loss of habitat, reduced habitat patch size, and an increasing distance between patches of habitat. As noted by Andrén (1994, p. 359) in a discussion of highly fragmented landscapes, reduced habitat patch size and isolation will exacerbate the effect of habitat loss on a species' persistence. That is, the loss of species, or decline in population size, will be greater than expected from habitat loss alone. In the listing rule, we indicated that all remaining populations are at risk due to their small size and isolation (USFWS 1998b, p. 51013).

Small Population Size

All remaining populations of the SKBR continue to be at risk due to their small size. Small populations have a higher probability of extinction than larger populations because their low abundance renders them susceptible to inbreeding, the loss of genetic variation, demographic problems like skewed variability in age and sex ratios, and stochastic (random, naturally occurring) events such as floods, droughts, or disease epidemics (Lande 1988; Frankham and Ralls 1998; Saccheri et al. 1998). These chance events can affect small populations with devastating results. Extirpation can even occur when the members of a small population are healthy because population increases or decreases are less dependent on the age-specific probabilities of survival and reproduction than on raw chance (sampling probabilities). Owing to the probabilistic nature of extinction, some small populations will survive when faced with these demographic, environmental, and genetic stochastic risks; however, many will eventually go extinct (Caughley and Gunn 1996).

Isolation

Another factor that renders populations of the SKBR vulnerable to stochastic events, such as floods and drought, is isolation. Isolation often acts in concert with small population size to increase the probability of extinction for endangered populations. Altered fluvial processes, urbanization, and land conversion have fragmented the historical range of the SKBR such that the remaining blocks of occupied habitat may now function independently of each other. Isolated populations are more susceptible to extirpation by accidental or natural catastrophes because their re-colonization may be precluded. Hence, the extirpation of remnant populations during local catastrophes will continue to become more probable as land development further constricts remaining populations. The San Jacinto River and Bautista Creek populations are especially vulnerable to extirpation due to the limited range of the SKBR in those drainages.

Storm Events and the Santa Ana River

A watershed-scale fire in the San Bernardino Mountains in 2002 followed by large storms in 2003 and 2004 created unprecedented debris flows into the Santa Ana River and its tributaries.

In City Creek in particular, these flows and the sediment and debris removal needed to protect roads, bridges, and properties have removed much of the suitable and occupied habitat within the creek which previously supported the highest relative abundance of SBKR within the Santa Ana River floodplain (MEC Analytical Systems 2000, pp. 79-94). Occupancy of City Creek by the SBKR is considered essential for its conservation (USFWS 2008b, p.61954). City Creek is now heavily incised as a result of modifications to its bed and has experienced a significant drop in bed elevation (e.g., up to 20 feet in one location) over the winters of 2004-2005 (Black & Veatch Corporation 2006, p. 2; USFWS 2008d, pp. 1-3). Recent reports indicate that the Creek will continue to scour, aided by headcut migration, and will only stabilize once an armor layer has formed throughout its 3.9 mile (6.3 kilometer) reach (Engineering & Hydrosystems Inc. 2006, p. 38). Restoration and recovery actions to improve habitat conditions for the SKBR in City Creek have not occurred. We are working with the Corps, the Los Angeles Municipal Water District, the San Bernardino Valley Municipal Water District and the City of Highland to try to address the dramatic change in habitat conditions, but no solutions are readily apparent.

Climate Change

Global climate change was not addressed in the final listing rule for the SBKR and possible impacts to the species under predicted future climate change are unclear. Current climate change predictions for terrestrial areas in the Northern Hemisphere indicate warmer air temperatures, more intense precipitation events, and increased summer continental drying (Field et al. 1999, pp. 1-63; Cayan et al. 2005, pp. 1-47; IPCC 2007). A trend of warming in the mountains of western North America is expected to decrease snowpack, hasten spring runoff, and reduce summer stream flows, and increased summer heat may increase the frequency and intensity of wildfires (IPCC 2007). However, predictions of climatic conditions for smaller sub-regions such as California remain uncertain. It is unknown at this time if climate change in California will result in a warmer trend with localized drying, higher precipitation events, or other effects. While we recognize that climate change is an important issue with potential effects to listed species and their habitats, we lack adequate information to make accurate predictions regarding its effects to the SBKR at this time.

III. RECOVERY CRITERIA

There is no approved final or draft recovery plan for the San Bernardino kangaroo rat.

IV. SYNTHESIS

As identified in the final listing rule, habitat for the San Bernardino kangaroo rat has been severely reduced and fragmented by development, aggregate mining, and related activities in the San Bernardino and San Jacinto valleys (USFWS 1998b, p. 51013). As a result of listing, the Service is working cooperatively with other Federal agencies and local aggregate mining operators to conserve and manage habitat for the SBKR, and as a result, the direct threats posed to SBKR from aggregate mining are being addressed. Development within floodplain habitat will continue to increase as a result of population growth within western San Bernardino County and the demand for a larger water supply in southern California. An overall reduction in the amount of habitat available to the SBKR and greater habitat fragmentation will continue to

occur. Because of the high level of habitat loss (habitat already reduced by 96% by the time the SBKR was emergency listed), our conservation and recovery strategy is to conserve as much remaining habitat as possible. Management and coordination with Federal, State, and local government agencies and mining operations will be needed to protect SBKR from habitat fragmentation and loss due to urban development, OHV use, trash dumping, aggregate mining, and an increase in predators such as domestic and feral cats associated with urban development. The SBKR faces a high degree of threat with a low recovery potential. We recommend that the status of SBKR, as endangered, remain unchanged at this time.

V. RESULTS

Recommended Listing Action:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist (indicate reason for delisting according to 50 CFR 424.11):
    ____ *Extinction*
    ____ *Recovery*
    ____ *Original data for classification in error*
__X__ No Change

New Recovery Priority Number and Brief Rationale: No change

VI. RECOMMENDATIONS FOR ACTIONS OVER THE NEXT 5 YEARS

1. Work with partners and identify opportunities through the Service's Partners for Fish and Wildlife Program to seek habitat management, restoration, and enhancement opportunities for SBKR. A goal of habitat restoration projects and management actions should be to determine more specific habitat requirements for this species.

2. Work with partners to protect additional SBKR habitat, including upland refugia habitat to support SBKR during flood events. Occupied floodplains and adjacent upland habitat should be conserved to ensure protection of populations large enough to remain viable in the long term.

3. Monitor SBKR populations throughout known and potentially occupied sites to track its recovery. Systematic sampling efforts for a minimum of 5 years at each occupied site would provide basic data to estimate occupancy and relative abundance through time. Standard survey protocols for SBKR population abundance or density trends need to be developed.

4. Develop a recovery plan for the SBKR.

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

San Bernardino kangaroo rat (*Dipodomys merriami parvus*)

Current Classification: Endangered

Recommendation Resulting from the 5-Year Review:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
_X_ No change needed

Review Conducted By: Carlsbad Fish and Wildlife Office

FIELD OFFICE APPROVAL:

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

ACTING

Approve _____ Date AUG 14 2009

Scott A. Sobiech