U.S. Fish and Wildlife Service

RECOVERY PLAN

for the San Bernardino Kangaroo Rat (*Dipodomys merriami parvus*)

Photo courtesy of Art Davenport (*Davenport Biological Services*)

U.S. Fish and Wildlife Service
Pacific Southwest Region 8
Carlsbad Fish and Wildlife Office

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An electronic copy of this recovery plan[1] is available.

Additional copies may be obtained from:

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[1] http://ecos.fws.gov/ecp0/profile/speciesProfile?sId=2060.

RECOVERY PLAN
SAN BERNARDINO KANGAROO RAT

DISCLAIMER

Recovery plans delineate reasonable actions that may be necessary, based upon the best scientific and commercial data available, for the conservation and survival of listed species. Plans are published by the U.S. Fish and Wildlife Service (Service), sometimes prepared with the assistance of recovery teams, contractors, State agencies, and others. Recovery plans do not necessarily represent the view, official positions or approval of any individuals or agencies involved in the plan formulation, other than the Service. They represent the official position of the Service only after they have been signed by the Regional Director. Recovery plans are guidance and planning documents only; identification of an action to be implemented by any public or private party does not create a legal obligation beyond existing legal requirements.

Nothing in this plan should be construed as a commitment or requirement that any Federal agency obligate or pay funds in any one fiscal year in excess of appropriations made by Congress for that fiscal year in contravention of the Anti-Deficiency Act, 31 U.S.C. 1341, or any other law or regulation. Approved recovery plans are subject to modification as dictated by new finding, changes in species status, and the completion of recovery actions.

INTRODUCTION

Section 4(f) of the Endangered Species Act (Act) requires the Secretary to develop and implement recovery plans for the conservation and survival of listed species. The Act defines "conserve" as to use all methods and procedures which are necessary to bring a listed species to the point where the protections of the Act are no longer necessary.

This document presents the U.S. Fish and Wildlife Service's (Service) plan for the conservation and recovery of the San Bernardino kangaroo rat (*Dipodomys merriami parvus*). The goal of this recovery plan is to provide guidance on how to control or ameliorate impacts from threats to the San Bernardino kangaroo rat such that the taxon no longer requires protections afforded by the Act and therefore, warrants delisting. Pursuant to section 4(f) of the Act, a recovery plan must, to the maximum extent practicable, include (1) a description of site-specific management actions as may be necessary to achieve the plan's goals for the conservation and survival of the species; (2) objective, measurable criteria which, when met, would support a determination under section 4(a)(1) that the species should be removed from the List of Endangered and Threatened Species; and (3) estimates of the time and (4) costs required to carry out those measures needed to achieve the plan's goal and to achieve intermediate steps toward that goal. This recovery plan provides these elements, preceded by a description of the overall recovery strategy. In developing these plan components, we recognize that continued coordination with our partners is needed to ensure long-term protections are afforded to the San Bernardino kangaroo rat and its habitat.

The recovery plan is based on the Species Status Assessment Report (SSA Report) for the San Bernardino kangaroo rat (*Dipodomys merriami parvus*), which describes the life history and biology of the species, the current status of the species, and the threats that impact the species.

The SSA Report is summarized below to provide context to the species distribution, needs, and threats impacting the species. Those specific activities necessary for implementing this plan's recovery actions are described in the Recovery Implementation Strategy. Both the SSA Report and the Recovery Implementation Strategy are available at https://ecos.fws.gov/ecp/species/2060 and will be updated as necessary.

SUMMARY OF SPECIES STATUS ASSESSMENT REPORT

The San Bernardino kangaroo rat (*Dipodomys merriami parvus*) was historically found in extensive alluvial fan terraces at the bases of the San Gabriel, San Bernardino, and San Jacinto Mountain ranges in San Bernardino and Riverside counties, California. Their historical range is thought to have encompassed roughly 28,000 acres [11,331 hectares (ha)] with the northern extent of this subspecies at the Cajon Pass in San Bernardino County and the southernmost extent in Menifee in Riverside County. By the time the species was emergency listed, in 1998, we estimated that the species occupied 3,247 acres (1,299 ha) of habitat within its historical range.

In the SSA Report, we evaluated threats impacting the San Bernardino kangaroo rat and its habitat. These threats included habitat loss (development, agricultural activities, and mining activities), habitat degradation [groundwater recharge, and flood control activities, off highway vehicles (OHV) use, nonnative grasses], climate change effects, and predation.

Species needs, current conditions, and future conditions were evaluated and are summarized in the SSA Report (Service 2024, Table 8-7) as they relate to resiliency, redundancy, and representation. To maintain population resiliency, the species needs adequate upland habitat and an effective population size sufficient to withstand changing environmental conditions. Effective population sizes are currently relatively small in each of the three watersheds. If current trends continue, the threats that limit habitat availability (especially upland refugia) may result in further declines. The three extant populations all exhibit low to moderate resiliency. The San Jacinto River population has a lower ability to rebound from threats, due in part to the lack of adequate upland refugia. In the future, this population is at risk of extirpation from expected stochastic events (flooding) that would reduce species redundancy.

Currently San Bernardino kangaroo rats occupy the last remaining habitat patches that contain the necessary elements to support the species. Although genetic variation is being maintained, the effects of inbreeding could have negative impacts in the future, especially in the smallest and most genetically distinct population (San Jacinto population). In the future, deleterious effects from inbreeding depression could contribute to lost representation such as reduced genetic diversity or the complete loss of a population. It is therefore important to retain occupancy and gene flow throughout the current range to maintain both redundancy and representation to help ensure species viability.

Development and subsequent fragmentation of habitat puts increasing strain on the San Bernardino kangaroo rat, making it imperative to protect and prioritize connectivity within each of the three current populations. Working cooperatively with other Federal agencies and partners,

it is important to determine population trends and occupancy throughout its current distribution. Continued efforts should be prioritized to prevent extirpation of small populations, expand the area available to all existing populations, and reconnect subpopulations to ultimately recreate local metapopulation dynamics.

RECOVERY STRATEGY

Since listing, habitat loss continues to be the primary threat and efforts have been made to conserve habitat in the three remaining populations (Lytle/Cajon Creeks, Santa Ana River, San Jacinto River). Research is needed to better understand dispersal behavior and develop better strategies to connect occurrences within isolated subpopulations. Restoring and conserving high quality habitat are important steps to expand the current distribution of San Bernardino kangaroo rats to aid in species recovery.

In order to recover the species, it is imperative to expand the distribution and increase population growth at all three remaining populations. The biggest hurdle in recovery is conserving and managing large tracts of suitable habitat (both upland refugia and lowland areas), so all three populations are self-sustaining and have the resiliency to withstand stochastic events associated with their alluvial habitat (flooding). Better connectivity is needed within each population in order for kangaroo rats to recolonize suitable lowland habitat after flooding, minimize impacts from inbreeding, and maintain genetic diversity within the population. Restoration and conservation of historical habitat is needed to expand the amount of potentially suitable habitat and improve this connectivity. This will allow for natural dispersal and occupation, though translocations may also be used to reestablish the occupancy in extirpated areas if needed. To better understand current conditions and success of recovery efforts, extensive and standardized sampling methods need to be implemented to better assess the number and location of San Bernardino kangaroo rats in occupied areas.

We envision recovery for San Bernardino kangaroo rats as three separate self-sustaining populations with contiguous habitat to allow for continuous gene flow and maximum dispersal of individuals at each location. Populations will need to be monitored and managed to track population trends to ensure sufficient resiliency, redundancy, and representation. Threats to the species will need to be sufficiently understood and abated to ensure enough habitat is conserved for long-term use. A range-wide monitoring and adaptive management approach will be needed to address unforeseen events and threats.

RECOVERY CRITERIA

An endangered species is defined in the Act as a species that is in danger of extinction throughout all or a significant portion of its range. A threatened species is one that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range. When we evaluate whether or not a species warrants downlisting or delisting, we consider whether the species meets either of these definitions. A recovered species is one that no longer meets the Act's definitions of threatened or endangered due to amelioration of threats.

Determining whether a species should be downlisted or delisted requires consideration of the same five categories of threats, which were considered when the species was listed and which are specified in section 4(a)(1) of the Act.

Recovery criteria are conditions that, when met, are likely to indicate that a species may warrant downlisting or delisting. Thus, recovery criteria are mileposts that measure progress toward recovery. These recovery criteria are our best assessment at this time of what needs to be completed so that the species may be removed from the list of threatened and endangered species. Because we cannot envision the exact course that recovery may take and because our understanding of the vulnerability of a species to threats is very likely to change as more is learned about the species and its threats, it is possible that a future status review may indicate that delisting is warranted before all recovery criteria are met.

DOWNLISTING CRITERIA

In order to reclassify the San Bernardino kangaroo rat from endangered to threatened status, threats to the species due to degraded or limited habitat must be reduced. This will have been accomplished if the following two criteria have occurred:

1. Sufficient habitat is conserved to maintain connectivity between upland and wash habitat in each of the three systems and management is implemented to restore sediment transport and maintain appropriate soils:

    - Lytle/Cajon Creeks – 3,500 acres (1,416 hectares).
    - Santa Ana River – 3,000 acres (1,214 hectares).
    - San Jacinto River – 1,500 acres (607 hectares).

2. Monitoring shows that each population has a stable or increasing effective population size of at least 100 adults for 10 years that includes at least one drought cycle.

Justification: The acreages listed above were estimated using the total amount of modeled habitat available for the San Bernardino kangaroo rat (as reported in the SSA), with about half in the wash and half in the upland areas. A total of 8,000 acres (3,237 ha) of conserved habitat will ensure that future habitat loss from land-use activities (urban and agricultural development, mining) is effectively minimized or managed to levels that support viable San Bernardino kangaroo rat populations. The conserved area contains approximately equal proportions of wash habitat and upland habitat that is connected to the floodplain to provide refuge from stochastic events (i.e., flooding events or fire). Due to alterations of hydrologic processes, most notably significantly reducing sediment transport during flooding, restoration efforts need to mimic these processes that are necessary to create and restore habitat. The habitat could be reset to an earlier successional stage by increasing water flow to move sediment or by bringing in appropriate soils suitable for the San Bernardino kangaroo rat. A significant portion of conserved and managed

habitat needs to be upland habitat that is connected to the floodplain to increase resiliency against flooding, a stochastic event that naturally occurs in these occupied areas.

Populations with a minimum effective size of 100 adults will provide sufficient resiliency to sustain populations through a natural range of environmental conditions and stochastic events (i.e., flooding events or fire). Increased population resiliency will also contribute to species redundancy across the range and provide protection from catastrophic events; a timeframe of 10 years was selected to include a complete drought cycle.

Delisting Criteria

In order to delist the San Bernardino kangaroo rat, the following additional criteria must be met:

1. At least 8,500 acres (3,440 hectares) of suitable San Bernardino kangaroo rat habitat are conserved among the three populations, and we have assurance that management will continue for the next 60 years.

2. Effective management will be implemented to control nonnative grasses and ensure that impacts to habitat due to recreational activity are avoided or minimized (this includes OHV activities and other recreational trail use).

3. Effective management will ensure that the threat of predation is minimized such that there are not population-level impacts.

4. Management for all three populations is assured over the next 60 years through the implementation of a genetic management plan such that we believe genetic diversity, including Ne, will be stable or increasing during this time. There is connectivity within each population and all three populations are large enough to ensure representation is retained long-term to maintain evolutionary potential into the future.

Justification: Increasing the amount of conserved lands that is memorialized with a Conservation Agreement is necessary to ensure recovery of the San Bernardino kangaroo rat without the protection afforded by the Act. Securing funding and properly managing conservation areas is also necessary to minimize or manage impacts from ongoing threats. Maintaining connectivity between habitat types, especially upland and lowland habitat, is necessary to facilitate recolonization of lowland areas after flooding events. A 60-year time frame would ensure management throughout the term of the permit for the Western Riverside County Habitat Conservation Plan.

Managing genetic diversity is particularly important for the San Bernardino kangaroo rat, which is thought to be currently experiencing a low level of inbreeding. Stable or increasing genetic diversity would need to be observed for 10 years, which would cover the natural fluctuation of environmental conditions (i.e., drought cycle).

RECOVERY ACTIONS

Recovery actions are the prioritized, site-specific interventions that need to be taken to conserve, manage, restore, and enhance the current condition of San Bernardino kangaroo rat and its habitat to meet the recovery criteria. Priority 1 actions are defined as those actions that current available information suggests must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future. Priority 2 actions are those that must be taken to prevent a significant decline in population size or habitat quality or some other significant negative impact. Priority 3 actions are all other actions necessary to provide for full recovery of the species. The assignment of priorities does not imply that some recovery actions are of low importance, but instead implies that lower priority items may be deferred while higher priority items are being implemented. The specific operational tasks and activities required to implement the proposed recovery actions outlined within this plan are presented in the San Bernardino kangaroo rat RIS, which is a separate document that can be easily adjusted, therefore maximizing the flexibility of species recovery implementation. Table 1 lists the threats under each of the five listing factors, the downlisting and delisting criteria, and the recovery actions that are needed for recovery of the San Bernardino kangaroo rat.

1. **Conduct research to inform management actions where appropriate throughout the range of the species (Priority 2).** There are numerous gaps in our understanding of San Bernardino kangaroo rat biology and ecology. Additional information will help us make informed management decisions throughout the range of the subspecies, including in the planning and implementation of subsequent recovery actions below. Research is needed to determine population genetics (examine possible inbreeding depression, outbreeding depression), determine impacts from climate change, create optimal upland refugia habitat conditions, improve translocation methods, and identify how to best minimize impacts caused by recreation.

2. **Create and implement a protocol for range-wide surveys and monitoring (Priority 1).** A range-wide protocol will allow for comparison of the relative status of the subspecies within and among populations. This information will help to identify population sizes and densities throughout the species' range and inform development of a population viability analysis (PVA).

3. **Conserve and restore occupied habitat throughout the range of the species (Priority 1).** Conserving suitable habitat and restoring previously suitable habitat is required for healthy resilient populations that contribute to species redundancy and representation. Much of the remaining suitable habitat is pressured or impacted by development or mining. Therefore, it is important to focus our efforts to conserve and/or restore the remaining suitable habitat that is adjacent to occupied areas, particularly upland habitat. In the absence of natural processes (flooding), the early successional habitat requirements for the San Bernardino kangaroo rat can transition into unsuitable habitat that requires manmade restoration to reset to the suitable early successional habitat type.

4. **Restore and protect other potentially suitable habitat including upland refugia habitat throughout the range of the species (Priority 2).** In order to retain representation and to improve resiliency and redundancy, it is necessary to restore and protect undeveloped upland refugia habitat.

5. **Increase population abundance at extant occurrences and expand distribution in the wild using reestablishment and augmentation as recovery tools (Priority 2).** Small, isolated populations inhabiting fragmented and flood prone habitat are not currently resilient or redundant. If necessary and effective methods are developed, translocation or captive rearing could be used for augmentation and/or reintroduction, allowing managers to move animals into restored or low productivity areas to improve the viability of the San Bernardino kangaroo rat.

6. **Use management tools to improve connectivity within populations (Priority 2).** Because the populations occupy highly fragmented and disturbed habitat, the remaining populations require a variety of management techniques to increase connectivity so that resiliency increases, and representation is retained.

7. **Utilize outreach and other techniques to limit recreational threats and improve public awareness and support (Priority 3).** Off-road activities, trespass, encampments, and other recreational activities are putting additional stress onto San Bernardino kangaroo rats and degrading habitat where they occur. Limiting impacts from trespass and recreational activities while also improving outreach and public awareness will help improve human interactions and impacts to the subspecies.

Table 1. Crosswalk table to Compare Threats, Criteria, and Actions.

Listing Factor	Threat Description	Downlisting/Delisting Criteria	Recovery Actions
Factor A The present or threatened destruction, modification, or curtailment of its habitat or range	Habitat degradation, disruption to hydrologic processes, habitat loss, drought, OHV activities and other recreational trail use	Downlisting: 1 Delisting: 1, 2, 4	1, 3, 4, 6, 7
Factor C Disease or Predation	Feral cat predation	Delisting: 3	1, 4
Factor E Other natural or manmade factors affecting its continued existence	Flooding	Downlisting: 2 Delisting: 4	1, 2, 5, 6

ESTIMATED TIME AND COST OF RECOVERY ACTIONS

We estimate that the cost of completing the recovery actions such that the criteria have been met and the San Bernardino kangaroo rat may be considered for removal from the list of endangered and threatened species is $7.13 million (Table 2). We estimate that completion of these actions could be accomplished by 2084, assuming effective coordination and cooperation among necessary partners and stakeholders.

Table 2. Recovery Actions and Estimated Costs.[1]

Recovery Action	Estimated Cost	Priority Number
1. Conduct research to inform management actions where appropriate throughout the range of the species.	$500,000	2
2. Create and implement a protocol for range-wide surveys and monitoring.	$600,000	1
3. Conserve and restore occupied habitat throughout the range of the species.	$2,000,000	1
4. Restore and protect other potentially suitable habitat including upland refugia habitat throughout the range of the species.	$1,500,000	2
5. Increase population abundance at extant occurrences and expand distribution in the wild using reestablishment and augmentation as recovery tools.	$2,000,000	2
6. Use management tools to improve connectivity within populations.	$500,000	2
7. Utilize outreach and other techniques to limit recreational threats and improve public awareness and support.	$30,000	3
Total estimated cost	**$ 7,130,000**	

[1] Each action likely includes costs that could not be reasonably estimated at this time.

References

U.S. Fish and Wildlife Service. 2024. Species Status Assessment for San Bernardino kangaroo rat. U.S. Fish and Wildlife Service, Pacific Southwest Region, Sacramento, California. ix + 102 pp.