BEFORE THE SECRETARY OF INTERIOR

PETITION TO DESIGNATE CRITICAL HABITAT FOR THE ENDANGERED SAN JOAQUIN KIT FOX (*Vulpes macrotis mutica*) UNDER THE ENDANGERED SPECIES ACT

Photo: Joseph Terry, USFWS

LOS PADRES FORESTWATCH

and

CENTER FOR BIOLOGICAL DIVERSITY

August 5, 2010

NOTICE OF PETITION

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Los Padres ForestWatch is a non-profit environmental organization dedicated to protecting wild places and wildlife in the Los Padres National Forest, the Carrizo Plain National Monument, and other public lands along California's central coast. Los Padres ForestWatch submits this petition on its own behalf and on behalf of its members and staff with an interest in protecting the San Joaquin kit fox and its habitat.

The Center for Biological Diversity ("the Center") is a non-profit, public interest environmental organization dedicated to the protection of native species and their habitats through science, policy, and environmental law. The Center has over 225,000 members and online activists throughout the United States. The Center and its members are concerned with the conservation of endangered species, including the San Joaquin kit fox, and the effective implementation of the Endangered Species Act.

ACTION REQUESTED

Los Padres ForestWatch and the Center for Biological Diversity (collectively "Petitioners") hereby petition the Secretary of the Interior, through the U.S. Fish and Wildlife Service ("USFWS" or "Service"), to designate the critical habitat for the endangered San Joaquin kit fox (*Vulpes macrotis mutica*) under the Endangered Species Act of 1973 (ESA), 16 U.S.C. §§ 1531-1544. This petition is filed under Section 4 of the Administrative Procedure Act, 5 U.S.C. § 553 and 50 C.F.R. § 424.14, and is within the Secretary's jurisdiction and among the duties delegated to the Service, 16 U.S.C. § 1532(5)(B). This petition initiates the process set forth at 50 C.F.R. § 424.14 and places definite response requirements on the Service.

The areas proposed for critical habitat designation in this Petition meet the requisite criteria as defined at 16 U.S.C. § 1532(5)(A) and 50 C.F.R. §§ 424.02, 424.12. There may be additional essential habitat that meets the criteria for designation of critical habitat as well. In the event that Service concludes that any portion of the proposed critical habitat does not satisfy the requirements for designation, we request that the Service consider whether the remaining proposed habitat, and/or other essential habitat, should be designated as critical habitat.

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EXECUTIVE SUMMARY

This petition seeks the designation of critical habitat for the endangered San Joaquin kit fox, *Vulpes macrotis mutica,* under the federal Endangered Species Act, 16 U.S.C. §§ 1531-1544. The kit fox has been federally listed as an endangered species since March 11, 1967, and is also listed as a threatened species under the California Endangered Species Act. Cal. Fish & Game Code §§ 2050-2089. Agricultural, urban, and industrial development have consumed a majority of the kit fox's native habitat and continue to expand in the San Joaquin Valley and adjacent habitat. Habitat destruction and fragmentation have been identified as the most significant cause of the kit fox's decline and threatens the species' continued viability. If current management practices continue, it has been predicted that the San Joaquin kit fox could become extinct within as few as 24 years (McDonald-Madden et al. 2008). Although the kit fox has been federally listed as endangered since 1967, critical habitat has not yet been established. This petition seeks to remedy that omission pursuant to the statutory language which states that critical habitat "may be established for those . . . threatened or endangered species for which no critical habitat has heretofore been established." 16 U.S.C. § 1532(5)(B).

Critical habitat is fundamental to the purpose and efficacy of the Endangered Species Act, which was enacted to protect both endangered species and their habitats. Designation of critical habitat provides for the conservation of ecosystem qualities that are "essential to the conservation of the species" and "may require special management considerations or protection." 16 U.S.C. § 1532(5)(A). Critical habitat affords listed species more substantial protection than that which is available through listing and endangered status alone. Upon the designation of critical habitat, federal agencies must ensure that actions that they authorize, carry out, or fund do not jeopardize the continued existence of the species *and do not* destroy or adversely modify its critical habitat. While the jeopardy standard requires some consideration of recovery, *see Nat'l Wildlife Fed'n v. Nat'l Marine Fisheries Serv.*, 524 F.3d 917, 931-32 (9th Cir. 2008), the prohibition on destruction or adverse modification of critical habitat goes further and can serve to limit actions that diminish the value of critical habitat for the recovery of a listed species. *Gifford Pinchot Task Force v. U.S.*, 378 F.3d 1059, 1069-71 (9th Cir. 2004),

This petition reviews the biology, behavior, and habitat needs of the San Joaquin kit fox, threats to the species' continued viability, and the factors that the Service must consider in evaluating and designating critical habitat. The remaining habitat areas that appear to best conform to the Act's definition of critical habitat for the San Joaquin kit fox were initially identified in the Recovery Plan and are found on the map in Section III.D.2 at page 25. The proposed critical habitat areas include, but are not limited to: habitat within the core habitat areas in the San Joaquin Valley including Western Kern County, the Carrizo Plain, and Ciervo-Panoche Valley; linkage corridors; and habitat of satellite populations. Because much of the San Joaquin kit fox's historic habitat has been extensively fragmented, the continued survival and recovery of the species will require conservation of the remaining intact native habitat, restored habitat, as well as suitable habitat providing connectivity between core habitat areas. Critical habitat for the kit fox includes remaining saltbush scrub, alkali sink scrub, or red brome-dominated grassland with an average slope of less than 10%, located in the Cuyama Valley, Carrizo Plain region, Panoche Valley, and San Joaquin Valley. Several regions with these characteristics are of particular importance to the continued viability of the kit fox, including

portions of Kern, Fresno, San Benito, Kings, and Merced Counties (B. Cypher, personal communication, July 27, 2009). The boundaries of the proposed critical habitat units are illustrated in the map found on page 25 and are described in greater detail in this petition.

I. INTRODUCTION

San Joaquin kit fox populations, which once thrived throughout the San Joaquin Valley of California, have been decimated as the result of agriculture, urban development, and other human activities in the Valley. Grinnell et al. (1937) predicted that prior to 1930, the kit fox's range stretched from southern Kern County to Tracy, San Joaquin County and La Grange, Stanislaus County. As a result of intensive agriculture and urbanization in the region, however, more than 90% of this land has been developed in various ways and the kit fox now occupies a much more limited and highly fragmented range (USFWS 1998).

Extensive research has been conducted on the kit fox's behavior, biology, and habitat, and the data necessary to inform critical habitat identification is readily available. Although some conservation measures have been adopted to protect the kit fox, populations continue to decline largely as a result of continuing habitat degradation and fragmentation, which have been identified as the most significant threats to the kit fox's continued viability. Designation of critical habitat would provide for an ecosystem-scale approach to the species' survival and recovery, and would directly address the greatest threats to the kit fox's continued existence.

Because the San Joaquin kit fox is an "umbrella species," the degradation of its habitat threatens not only this species itself, but the ecosystem as a whole, including numerous other threatened and endangered species such as the giant kangaroo rat, the blunt-nosed leopard lizard, the mountain plover and the tiger salamander. Despite the ESA's requirement that the Secretary of the Interior identify critical habitat upon listing a species as threatened or endangered, *see* 16 U.S.C. § 1533(a)(3)(A), only two of the endangered and threatened species that were included in the Recovery Plan for the Upland Species of the San Joaquin Valley have designated critical habitat (the Fresno kangaroo rat and the Buena Vista Lake Shrew). Because the kit fox is wide-ranging and its habitat overlaps and coincides with that of other listed animal species, protecting its habitat will contribute to the conservation and recovery of other listed species. For example, designation of critical habitat for the San Joaquin kit fox could also provide substantial conservation benefits to many of the 33 other endangered, threatened, candidate, and of-concern species included in the Recovery Plan for Upland Species of the San Joaquin Valley (USFWS 1998).

The kit fox's continuing decline illustrates the need for increased protection, not only for individual kit foxes, but also for the land and natural resources essential to their continued survival. Once critical habitat has been designated, the consultation provisions of the ESA will require federal agencies to consult with the Service to consider whether activities funded or permitted by those federal agencies will destroy or adversely modify that habitat. The adverse modification standard provides the listed species with an additional layer of protection, and impairing the value of critical habitat for either survival *or recovery* of the listed species is within its scope. The kit fox's continuing decline indicates that conservation measures developed based solely on the likelihood of extinction are inadequate to fulfill the purpose of the ESA and

illustrates the need for increased protection. Impacts to kit fox habitat in the San Joaquin Valley and other core habitat areas continue to grow and future development pressures threaten the remaining islands of intact kit fox habitat and the connectivity between those areas, therefore, protecting the best remaining habitat and restoring degraded habitat will be essential to the species' survival and recovery.

II. STATUS AND BEHAVIOR OF THE SAN JOAQUIN KIT FOX

A. Taxonomy and Physical Description

The San Joaquin kit fox, *Vulpes macrotis mutica*, is the larger of two kit fox subspecies (USFWS 1998, Mercure et al. 1993). Male kit foxes are, on average, approximately 80.5 centimeters in total length, while females are slightly smaller, with an average length of 76.9 centimeters (*Id*., Grinnell et al. 1937; Brown et al. 2006). Kit foxes are typically around 30 centimeters in height at the shoulder, and males and females have been found to differ in mass by approximately 20% (Warrick and Cypher 1999), with average weights of 2.3 kilograms and 2.1 kilograms, respectively (USFWS 1998, Morrell 1972). Warrick and Cypher (1999) observed that the foxes gain approximately 90% of their adult mass by the age of 10 months, and found no significant changes in body mass after 22 months of age. The coloration of the kit fox' fur coat varies geographically and seasonally, and is generally tan in the summer and silver-gray in the winter (Morrell 1972). Among the species' most distinguishable characteristics are its large ears, which measure 8.6 centimeters on average (USFWS 1998).

B. Behavior

San Joaquin kit foxes rely on dens for protection from harsh climatic conditions and predators, and use "pupping dens" for birthing and raising pups (Seton 1925, Grinnell et al. 1937). The kit foxes either construct dens by digging or use existing dens and structures created by other animals or humans (USFWS 1998, Jensen 1972, Morrell 1972, Hall 1983, Berry et al. 1987). Kit foxes occupy multiple dens throughout the year, spending a median of two days at each site and using an average of 11.8 individual dens per year (USFWS 1998, Koopman et al. 1998). These frequent transitions have been attributed to several factors including depletion of prey, increases in parasites, and avoidance of coyotes (USFWS 1998).

C. Population Trends

1. Abundance

Kit foxes were historically abundant in the San Joaquin Valley and surrounding areas, but their populations have been reduced as a result of urban and agricultural development, oil and gas development, as well as predator and rodent control programs (USFWS 1998). Estimates of the total number of San Joaquin kit foxes that occupied its historic range vary, ranging from 1,000 to 3,000 (Laughrin 1970) to 14,000 (Morrell 1975) (*Id*.). Population size has proven difficult to evaluate due to its annual fluctuation and the kit foxes' nocturnal habits (Gerrard 2001). The original species recovery plan estimated that prior to 1930 total kit fox population

was between 8,667 and 12,134 individuals (USFWS 1983). In 1975, the population was estimated to be 6,961 foxes (USFWS 1983), which suggests a possible decline of 20% to 43% (USFWS 1998). While the Carrizo Plain is currently thought to have the largest kit fox population remaining in California (USFWS 2010 citing B. Cypher pers. comm., as cited in Moonjian 2007), the "only estimate for the Carrizo Plain provides an estimated population size of between 251 and 610 individuals although the estimate may be high (Bean and White 2000)." (USFWS 2010).

The range-wide abundance of kit foxes varies annually and depends largely on climatic cycles (White et al. 2000, EPA 2008). Drought conditions significantly reduce plant seed production, which leads to a decline in populations of nocturnal rodents that serve as the kit fox's main source of prey (Dennis and Otten 2000, Cypher et al. 2000). "Consumption of small rodent species and leporids occurred concurrently with population increases in those species, suggesting to the authors that the ability to exploit a variety of resources on an opportunistic basis would enable kit fox to persist in altered environments, and in areas subject to drought-related fluctuations in prey." (USFWS 2010.)

Despite some flexibility in prey base, the kit fox population appears to be positively correlated with the abundance of native prey species such as kangaroo rats. "Cypher *et al*. (2000) documented that annual finite growth rates were positively correlated with consumption of kangaroo rats and negatively correlated with consumption of other prey items, suggesting that kit fox in the area feed preferentially on kangaroo rats and that declines in kangaroo rat densities negatively affect kit fox survival." (USFWS 2010). During drought the resulting scarcity of prey reduces the kit foxes' reproductive success, so that adults are able to reproduce but pups are often unable to survive to weaning (USFWS 1998, White and Ralls 1993, White et al. 1996, Brown et al. 2006). Populations remain depressed while drought conditions persist, and begin to recover when rainfall increases (USFWS 1998, Ralls and White 1995). Excessive rainfall, however, is thought to negatively affect kit fox populations by reducing small mammal populations as well, and has been found to reduce reproductive success (White et al. 2000, EPA 2008).

2. Distribution

The Service has noted the absence of comprehensive surveys of the San Joaquin kit fox's historical range (USFWS 1998). According to the species' recovery plan, the kit foxes currently inhabit certain regions of the San Joaquin Valley floor and the surrounding foothills, from southern Kern County north to Contra Costa (*Id*.). The projected historic range is bounded by San Joaquin and Alameda counties on the west and Stanislaus County on the east (*Id*.). Kit foxes are also found on uncultivated parcels of land in Kern, Tulare, Kings, Fresno, Madera, and Merced counties, as well as portions of Monterey, San Benito, Santa Clara, Santa Barbara, Ventura, and San Luis Obispo counties, and are found within Bakersfield city limits (*Id*.). Three core kit fox populations are found in the Carrizo Plain, Western Kern County, and the Ciervo-Panoche Natural Area (USFWS 1998). The kit foxes are most abundant in western Kern County and the Carrizo Plain Natural Area (USFWS 1998) now a part of the Carrizo National Monument. In 1975, it was estimated that over half the population inhabited Kern and San Luis Obispo Counties (Id., Morrell 1975). In 2010, the Service found that "both the western Kern

County and Carrizo populations appear to be subject to marked population fluctuations that put them at risk of population loss in less than 10 years in unfavorable environmental and demographic situations." (USFWS 2010). Further, noting that "[s]ome researchers have concluded that the kit fox currently has relatively low abundance, that the kit fox might be absent in portions of their historic range, and that robust kit fox populations occur in only a few locations, which is a pattern that decreases overall population viability and increases risk of local extinction (Smith et al. 2006)." (USFWS 2010).

According to the Service, the kit foxes are also found in six wildlife refuges managed by the Service, including Bitter Creek, Kern, Merced, Pixley, and San Luis National Wildlife Refuges, as well as Grasslands Wildlife Management Areas. (USFWS 2009b). In addition, according to the U.S. Forest Service, San Joaquin kit fox potentially occurs on the Los Padres National Forest in the upper Cuyama Valley watershed and along the eastern slope of the La Panza Range. (USFS 2005).

Population density varies throughout the kit fox's range. Population surveys conducted at two research sites in California indicated densities ranging from 0.15-0.24 per square kilometer over three years (White et al. 1996) and 0.2-1.7 kit foxes per square kilometer over 15 years (Cypher et al. 2000), respectively. The size of home ranges and the degree to which they overlap are dependent upon the availability of resources (USFWS 1998, White and Ralls 1993), and have been reported to encompass between 2.6 and 31 square kilometers (USFWS 1998, Morrell 1972, Knapp 1978, Zoellick et al. 1987, Spiegel and Bradbury 1992, White and Ralls 1993, Paveglio and Clifton 1988; Koopman et al. 2001). In habitats with abundant prey, home ranges are typically smaller and less exclusive than those which are observed during times of resource scarcity. (USFWS 1998, White and Ralls 1993, Zoellick et al. 2002). Kit foxes occupying urban environments such as Bakersfield, California typically establish home ranges that are smaller than those of their rural counterparts, which is likely a response to the accessibility of food resources in urban areas (Frost 2005).

Kit foxes typically begin to disperse from the home range at the age of four to five months, relocating an average distance of eight kilometers (Scrivner et al. 1987), although much greater distances have been reported (USFWS 1998). Koopman et al. (2000) monitored 209 kit foxes on the Naval Petroleum Reserves and found that 33% of the foxes dispersed from their natal territory. Among the foxes that dispersed, the majority left the home range within the first year, and dispersal peaked in July (*Id*.). The average age of dispersal for foxes that left the natal range was eight months, and dispersal was observed more commonly among males (49.4%) than females (23.8%). Dispersal exposes kit foxes to risks such as increased competition and exposure to predation, as well as the challenge of capturing prey in unfamiliar habitats, and over 50% of the foxes monitored died within ten days of dispersal (*Id*.). The study examined demographic and ecological factors, including: adult male, adult female, and total adult survival probabilities; the proportion of new individuals in the population; adult sex ratio; juvenile sex ratio; average litter size; leporid density and indices of total prey abundance; small mammal abundance; kit fox population density; and coyote abundance (*Id*.). Although none of these factors were strongly related to dispersal, the authors observed patterns suggesting that other demographic and ecological factors might affect kit fox dispersal patterns (*Id*.).

Between 2001 and 2003, Smith et al. conducted scat surveys on a total of 539 square kilometers of public and private land in the San Joaquin Valley, but identified kit fox only in the Santa Nella area in Merced County (Smith et al. 2006). Previous surveys, however, detected numerous kit fox scats in the southern part of the fox's range, including Kern and San Luis Obispo counties (*Id*.). The authors found that kit foxes were rare or absent in the central and northern portions of the range and predict that the species is unlikely to recolonize the region, even under favorable conditions, due to population fragmentation and habitat loss (*Id*.). The limited number of kit fox populations and their concentration in the southern part of their range increases the risk of local extinction and threatens the species' overall viability (*Id*.). Schwartz et al. (2005) examined eight kit fox populations and found that two of them were at "extreme risk" of isolation, which creates a substantial obstacle to the populations' maintenance of genetic diversity. Overall, spatial distribution has become increasingly fragmented since listing (USFWS 2010).

D. Feeding and Prey Selection

The San Joaquin kit fox's diet varies regionally and seasonally, according to the availability of prey. In the southern portion of the fox's range, common prey include kangaroo rats, pocket mice, white-footed mice, and other nocturnal rodents, as well as California ground squirrels, black-tailed hares, San Joaquin antelope squirrels, desert cottontails, ground-nesting birds, and insects (USFWS 1998). In the central portion of the geographic range, including Kings, Tulare, Fresno, Madera, San Benito, Merced, Stanislaus, and Monterey Counties, kit foxes consume white-footed mice, insects, California ground squirrels, kangaroo rats, San Joaquin antelope squirrels, black-tailed hares, and chukar (USFWS 1998). In the northern part of their range, including San Joaquin, Alameda and Contra Costa Counties, the foxes prey on California ground squirrels, cottontails, black-tailed hares, pocket mice, and kangaroo rats (USFWS 1998). The foxes are nocturnal and typically hunt at night, although some populations hunt during daylight hours when necessary, as illustrated by their consumption of the diurnal ground squirrel (*Id*. Balestreri 1981, Hall 1983, Orloff et al. 1986).

E. Reproduction

Kit foxes can reproduce at the age of one year, and mating occurs between late December and March, although adult pairs share a home range year-round. Litters are born in February and March, and typically consist of two to six pups (USFWS 1998). The pups remain in the den with the female until they are just over a month old, and begin to disperse at four to five months of age (USFWS 1998). Reproductive success is affected by the availability of prey, and typically declines in times of drought or other extreme environmental conditions (USFWS 1998).

F. Natural Mortality

Kit foxes of up to eight years of age have been identified in their natural range, and individuals have lived for up to ten years in captivity, although such a life span is rare; one study observed that the average age of foxes in a particular population was two years (USFWS 1998). The mortality rate for juvenile kit foxes may approach 70% (*Id.*, Berry et al. 1987), with annual survival rates varying by region and ranging from 0.21 to 0.41 (*Id*., Ralls and White 1995).

Adult mortality rates are typically around 50% (*Id*., Morrell 1972, Egoscue 1962, Berry et al. 1987, Ralls and White 1995, Standley et al. 1992).

III. CRITICAL HABITAT FOR THE ENDANGERED SAN JOAQUIN KIT FOX

A. The Benefits of Establishing Critical Habitat under the Endangered Species Act

The purpose of the ESA is "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved . . . " 16 U.S.C. § 1531(b). Critical habitat designation supports this objective by preventing the loss of listed species' habitat, which is identified as the primary threat to many listed species.

The ESA defines critical habitat at 16 U.S.C. § 1532(5)(A) as:

> (i) the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of section 1533 of this title, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and
> (ii) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 1533 of this title, upon a determination by the Secretary that such areas are essential for the conservation of the species.

The designation of critical habitat supplements the ESA's Section 7 protections by establishing a more stringent conservation standard. Section 7 prohibits federal agency actions that are "likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species . . ." 16 U.S.C. § 1536(a)(2). This prohibition applies to actions which "reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species[,]" as well as habitat modification "that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species." 50 C.F.R. § 402.02. Prohibited habitat modifications "include, but are not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical." *Id*. Discussing the language of the regulations, the Service has emphasized that the purpose of critical habitat is to contribute to a species' recovery and, accordingly, the prohibition on destruction or adverse modification of critical habitat "provid[es] a regulatory means of ensuring that Federal actions within critical habitat are considered in relation to the goals and recommendations of a recovery plan." 59 Fed. Reg. 65256, 65265.

Critical habitat designation also provides guidance for the allocation of federal, state, and private conservation resources and clarifies Section 9's prohibition on unlawful "take" of listed species. Adversely impacting a species through habitat destruction qualifies as taking for purposes of the ESA, and such takings are more readily identifiable where the habitat at issue has already been identified as essential to a species' continued viability.

B. The Importance of Critical Habitat to Conservation of the San Joaquin Kit Fox

1. The San Joaquin Kit Fox is an "Umbrella Species"

The San Joaquin Kit Fox is an "umbrella species" for purposes of the Recovery Plan for Upland Species of the San Joaquin Valley. An umbrella species is defined as a species that lives in many biotic communities or has broad habitat requirements that if provided for and protected will protect the habitat of many other species (USFWS 1998). According to the U.S. Fish and Wildlife Service, these species play "pivotal roles" in conservation and "provide an umbrella of protection for many other species" (*Id*.). Because kit fox populations are broadly distributed and occupy relatively large areas, the kit fox's range overlaps with the more restricted ranges of numerous other species. Establishing critical habitat for the kit fox will protect these other threatened and endangered species from habitat destruction and is consistent with the Service's conclusion that "fulfilling the San Joaquin kit fox's habitat management . . . needs also meets those of many other species" (*Id*.). Such habitat protection is particularly important in the San Joaquin Valley and surrounding area because critical habitat has been designated for only two of the 34 endangered, threatened, candidate, or of-concern species included in the recovery plan. Establishing critical habitat for the kit fox would simultaneously protect the habitats of other species, as suggested by the umbrella species concept. The recovery plan discusses the advantages of the umbrella species approach, concluding that "[i]mplementation of this strategy retains the advantages of ecosystem-level conservation: involving all segments of society in recovery actions; preserving all or most species simultaneously; saving effort and money; and increasing the chances that recovery efforts will succeed." *Id*.

2. Threats to the Endangered San Joaquin Kit Fox

a. Habitat Destruction

Habitat destruction and fragmentation have been identified as the most significant contributors to the decline of the San Joaquin kit fox, and continuing habitat loss is expected to remain the most significant threat to the species' continued viability (B. Cypher, personal communication, July 27, 2009). Agriculture, industry, fossil fuel extraction, and urban development have overtaken more than half of the kit fox's historical range (USFWS 1998). Laughrin (1970) estimated that 34% of the fox's range was converted between 1959 and 1969, and a decade later the Service speculated that more than 90% of the Valley south of Stanislaus County had been developed (USFWS 1980). It is estimated that hundreds of acres of kit fox habitat are developed annually, largely as a result of agricultural and urban development (B. Cypher, personal communication, July 8, 2009). New large-scale habitat impacts now threaten kit fox habitat from multiple proposals for industrial scale solar development within core habitat in the Carrizo Plain and Panoche Valley and additional proposals are expected soon in areas of the San Joaquin Valley. While some of the proposals are on lands that have been converted to irrigated agriculture, others are proposed in areas of rangeland and dry farming that still provide significant habitat values for kit fox. All of these proposals will increase habitat fragmentation as well.

i. Agriculture

The prevalence of agriculture in the San Joaquin Valley was a significant factor causing the endangerment of the San Joaquin kit fox (USFWS 1998). "Conversion of natural habitat to intensive agriculture continues to be the primary cause of habitat loss for the San Joaquin kit fox in the San Joaquin, Salinas, and associated valleys, and in adjacent foothill areas (Cypher et al. 2007)" (USFWS 2010). Water diversion projects that support irrigation systems in the San Joaquin Valley, including the Central Valley Project and the State Water Project, prompted additional agricultural development (USFWS 1998) and further fragmented habitat. The remaining uncultivated land is fragmented by these agricultural operations and other projects, and the gene flow among kit fox sub-populations is increasingly dependent upon the foxes' ability to inhabit or traverse farmland (Warrick et al. 2007). Warrick et al. (2007) found that kit foxes entered agricultural lands at night but generally did not occupy farmland during the day, which is likely a response to the lack of den sites and prey. Kit foxes may also have limited mobility on certain annual croplands due to the density of crops like cotton (*Id*.). Although kit foxes may utilize the edges of agricultural lands for foraging, the long term suitability of agricultural land for kit fox habitat is limited (USFWS 2010). While foxes enter orchards and vinyards these areas may not provide appropriate prey base and some prey may be poisoned in orchards, such as almond orchards (USFWS 2010 citing Heintz 2000).

In contrast, livestock grazing is not considered to be directly detrimental to kit fox but it may affect the availability of prey species depending on the intensity of grazing, The loss of such grazing lands to orchards and irrigated pasture for example in Merced County threatens potential kit fox linkages in remaining grassland habitat and remaining kit fox populations on the eastern side of the valley (USFWS 2010). However, intensive grazing and feedlots may destroy vegetative cover and reduce the availability of the kit fox's prey (USFWS 1998), and may be having a detrimental impact on kit fox populations in Alameda, El Dorado, Kern, Kings, Merced, and Monterey counties (Lewandrowski and Ingram 2002).

Although agriculture remains the predominant land use in developed portions of the San Joaquin kit fox's range, conversion of kit fox habitat for agricultural purposes has slowed in recent years, giving way to urban and industrial development (List and Cypher 2004). On land that has already been converted to farmland, establishment of artificial dens and strips of improved habitat along irrigation canals could facilitate kit fox dispersal and partially mitigate the habitat fragmentation that has accompanied development in the San Joaquin Valley (Warrick et al. 2007).

ii. Urban Development

Urban centers in the San Joaquin Valley are rapidly expanding, and it is predicted that the Valley's human population will reach eight million by 2050 (Boyd et al. 2007). Urban development is expected to encroach on both undeveloped and agricultural land, and it is projected that this growth will lead to a further decline in the region's kit fox populations (*Id*.). Cypher and Frost (1999), however, emphasize that urban environments may provide some habitat for kit foxes, as demonstrated by the species' ability to thrive in urban Bakersfield, California. The Bakersfield population has been monitored since 1997 and it is estimated that

there are between 200 and 400 kit foxes occupying the metropolitan area (B. Cypher, personal communication, July 8, 2009). A comparison of kit foxes occupying urban (Bakersfield) and exurban (Naval Petroleum Reserves in California, NPRC) land revealed that urban foxes were characterized by higher body mass than exurban foxes, and hematological data indicated greater exposure to environmental stressors among exurban foxes (Cypher and Frost 1999). Drought conditions limited the availability of food to exurban foxes during the study, whereas the urban foxes had access to anthropogenic food and abundant water, which allowed them to maintain consistent body mass and nutrition (*Id.*). Studies suggest that Bakersfield kit foxes have adjusted to an urban setting without losing their natural behavior or becoming dependent on anthropogenic foods, and have experienced lower mortality than exurban populations despite increased exposure to vehicles and domestic dogs (USFWS 1998, Ralls and White 1995, Cypher et al. 2000, Frost 2005), which suggests that this urban environment may provide certain advantages to the kit fox.

Despite the kit fox's successful occupancy of Bakersfield, urban development remains a significant threat to the species' continued viability. Bakersfield and three small towns located near the city are among the only urban habitats in which viable kit fox populations have been established; these populations may be anomalies and should not obscure the importance of preserving undeveloped habitat in the fox's range. Among the urban areas occupied by kit foxes, the common landscape feature seems to be connectivity with natural land; it is unclear whether the kit fox populations would survive increased sprawl and development (B. Cypher, personal communication, July 8, 2009). Even infill projects can negatively affect kit fox populations where they cut off the few remaining corridors between existing sub-populations or access to conservation lands or increase traffic and other threats (USFWS 2010). It is also unknown whether kit fox populations could subsist in other urban areas; it is possible that urban populations may be successful in certain locales but not in others, which further reinforces the importance of protecting the fox's natural habitat (*Id*.).

iii. Energy and Fossil Fuel Development

Oil field development in the southern San Joaquin Valley and Cuyama Valley has encroached on the San Joaquin kit fox's historical range. Oil operations degrade surrounding habitat through the construction of roads, pipelines, settling ponds, and other infrastructure, as well as through the introduction of increased noise, toxic and noxious gases, petroleum-based water pollutants, and the threat of vehicle strikes (USFWS 1998). Despite these substantial habitat modifications which result in lost habitat and additional fragmentation, research suggests that the remaining habitat in some oil fields can support kit fox populations. Berry et al. (1987) examined kit foxes' patterns of spatial use on the Elk Hills Naval Petroleum Reserves and compared them to characteristics of kit foxes on undeveloped land. They found that the kit foxes at the two sites had similar population densities, reproduction and dispersal patterns, and mortality (*Id*.). Zoellick et al. (2002) conducted a similar analysis of kit foxes' movements and home ranges on developed (30% of native habitat lost) and undeveloped (3% of native habitat lost) habitat on the Naval Petroleum Reserves in California (NPRC) in the San Joaquin Valley. Distances traveled nightly by kit foxes, mean size of home ranges, and overlap of home ranges on the developed and undeveloped sites did not differ. The authors suggest that prey remained sufficiently abundant to support relatively small home ranges at both locations (Zoellick et al.

2002). While low density oil development areas may provide some habitat value, moderate and high density oil fields decrease carrying capacity for kit fox through habitat loss and changes in the characteristics of the remaining habitat over time (USFWS 2010). Some areas with robust kit fox populations are also slated for expansion of oil extraction activities. As a result the Service recently found it "reasonably certain that oil field development will continue to threaten the kit fox into the foreseeable future, while increased development in the arid oil lands of Kern County may present exceptional threats to critical kit fox localities" (USFWS 2010).

Although direct mortality resulting from oil operations is believed to be rare (USFWS 1998, Berry et al. 1987, Disney and Spiegel 1992, Warrick and Cypher 1998), oil infrastructure poses certain risks to kit foxes, which commonly occupy developed portions of oilfields. Some foxes have been entrapped in well cellars and plugged pipes, while others have drowned in spilled oil (Cypher et al. 2000). Kit foxes commonly rely on the drainages in which spilled oil collects for both traveling and foraging, which places the foxes at risk of drowning or becoming covered in tar-like residue (BLM 2008).

Serological data suggest that direct mortality may not be the only risk to kit fox populations occupying oilfields. Charlton et al. (2001) conducted a comparative analysis of kit foxes living on oilfields and undeveloped land. Blood samples from kit foxes inhabiting the Midway-Sunset oil field exhibited a significantly higher incidence of immature red blood cell circulation relative to that of foxes occupying the Lokern Natural Area in Kern County (Charlton et al. 2001). A comparison of deer mice, one of the kit fox's prey species, from the two sites revealed that a significantly higher proportion of the mice from the oil field exhibited extramedullary hematopoiesis and adrenocortical vacuolation (*Id.*). However, no differences between the deer mice populations' survival and reproductive success were observed, and the authors note that additional variables must be considered before any conclusions are established based upon the pathological data (Charlton et al. 2001). Oil fields may also lead to shifts in small mammal communities from the primarily granivorous (seed-eating) native species (including kangaroo rats) that are a staple prey of kit fox, to species adapted to disturbed areas (murid, or old world rodents) (Spiegel et al. 1996) which may result in lower kit fox density (USFWS 2010).

Suter et al. (1992) also carried out a comparative analysis in an effort to determine the impact of oil operations on kit fox populations. A comparison of element concentrations in kit fox fur from oilfields (Naval Petroleum Reserves No. 1 and 2) and from areas with no oil development (Camp Roberts and Elkhorn Plain) revealed elevated levels of arsenic in the oilfield samples (*Id.*). Some oilfield fur samples had arsenic concentrations in excess of the threshold for toxic effects in humans, and one sample indicated a concentration of arsenic that has caused human mortality although the kit foxes from which the samples were taken did not display toxic effects (*Id.*).

iv. Industrial Scale Solar Energy Projects

Within the last year, industrial scale solar energy development projects have emerged as a new landscape level threat to kit fox habitat. At this time, there are proposals for over 12,000 acres of photovoltaic solar energy development in the Carrizo Plain and over 10,000 acres of photovoltaic solar energy development in the Panoche Valley. *See* San Joaquin Kit Fox Habitat

Suitability map with proposed solar sites below at page 25 . The projects in the Carrizo Plain will increase habitat fragmentation by impeding the linkages between core population areas – the Carrizo Plain Core Area, Western Kern Core Area and other northern and western core and satellite areas (USFWS 2010). Preliminary maps of the Panoche Valley projects suggest considerable restrictions on the kit fox's range due to development on the most suitable habitat in the region (USFWS 2010). In addition, we understand that there are new proposals for similarly large-scale solar development projects in western San Joaquin Valley. Many of these developments are proposed on lands that provide significant habitat values for the kit fox including rangelands and dry farmed agricultural fields and also provide connectivity and dispersal corridors adjacent to core protected habitat in the Carrizo National Monument. While it is too early to evaluate the extent of this threat to the kit fox, it has the potential to significantly impact core habitat and increase fragmentation of habitat by blocking movement corridors.

b. Rodenticides and Agricultural Chemicals

Rodenticides and agricultural chemicals contribute to kit fox mortality both by direct poisoning and by limiting the availability of prey. Kit foxes have been poisoned by technical grade Compound 1080 (sodium monofluoroacetate) and strychnine alkaloid, which were historically used to control coyote, jackrabbit, ground squirrel, pocket gopher, and mouse populations (Schitoskey 1975). In 1925, seven kit foxes were poisoned by strychnine-based coyote bait within a mile of one another in Kern County, and Grinnell et al. (1937) speculate that hundreds more may have been poisoned within a single season (USFWS 1998). Application of Compound 1080 to federal lands was prohibited in 1972, and above-ground application of strychnine was banned in 1988 (USFWS 1998). However, 28 pounds of strychnine was reportedly applied to kit fox habitat in Alameda and Contra Costa Counties for pest control purposes in 2003 (Miller 2006).

Kit foxes have also been secondarily poisoned by consuming prey that has been exposed to rodenticides, and are further threatened by the elimination of prey as a result of rodent eradication efforts (USFWS 1998, Orloff et al. 1986, Sachs 2003, Miller 2006). The ground squirrel, for instance, was believed to have been eliminated throughout Contra Costa County by rodenticides in 1975, where it served as the kit fox's main prey (USFWS 1998, Bell et al. 1994). Studies suggest that the elimination of prey is particularly threatening to kit fox populations because the foxes do not switch to alternate, more abundant prey when their preferred sources of prey become scarce (Id., White et al. 1996).

According to the Service, the U.S. Environmental Protection Agency's issuance of county bulletins governing use of rodenticides has reduced the risk of kit fox mortality resulting from state and county pest control efforts (USFWS 1998). However, agricultural operations on private land in the San Joaquin Valley continue to expose kit foxes to pesticides and rodenticides that are widely available to the public (Miller 2006). These chemicals include burrow fumigants, anticoagulant rodenticides, and gas cartridges (*Id*.). Over 22,000 pounds of the burrow fumigant aluminum phosphide was applied within the kit fox's range between 1999 and 2003 (*Id*.). Both aluminum phosphide and magnesium phosphide are used to control ground squirrel populations, but may be erroneously applied to kit fox dens because they are similar to ground squirrel dens in appearance and dimensions. The Service has concluded that the fumigants could have

"significant adverse effects" on kit fox populations due to their high toxicity, the overlap of ground squirrel and kit fox habitat, and the potential for bottleneck effects in portions of kit fox habitat where the species is geographically restricted (USFWS 1993). As a result, the Service concluded that these phosphide compounds are likely to jeopardize the continued existence of the San Joaquin kit fox (*Id*.).

San Joaquin kit foxes have been poisoned in the Central Valley and East Bay by rodenticides like brodifacoum, an active ingredient in rodent baits, as well as chlorophacinone and bromadiolone (USFWS 1998, USEPA 2004, USEPA 2008, Miller 2006). The Pesticide Investigations Unit of the California Department of Fish and Game and the U.S. Fish and Wildlife Service examined 32 dead kit foxes between 1999 and 2003, and detected brodifacoum in the liver of 27 (84%) foxes. Screenings also indicated the presence of other anticoagulant rodenticides such as bromadiolone which was detected in two of the foxes, as well as chlorophacinone, pival, coumatetralyl, and chlorophacinone (USEPA 2004). Chlorophacinone has been found to cause kit fox mortality in the past (Stradley et al. 1992) and the USFWS has concluded that both chlorophacinone and diphacinone are likely to jeopardize the continued existence of the San Joaquin kit fox (USFWS 1993). The effectiveness of measures limiting the use of chlorophacinone and other restrictions limiting general consumers' use of other rodenticides is uncertain. Kit foxes may still be exposed to such products, whether used legally or illegally, and even after they cease to be used (USFWS 2010).

c. Hunting and Trapping

Hunting is a relatively minor threat to kit fox populations (List and Cypher 2004). While hunting kit fox is unlawful, kit foxes may be caught in traps intended for other fur-bearing species (*Id*.). In addition, kit foxes may experience occasional mortality from varmint hunters who mistake kit foxes for coyotes.

d. Predation and Competition

The San Joaquin kit fox is threatened by both predation by and competition with coyotes, badgers, domestic dogs *(Canis familiaris),* nonnative red foxes, bobcats *(Felis rufus),* raptors, and possibly gray foxes (*Urocyon cinereoargenteus*) (USFWS 1998, Hall 1983, Berry et al. 1987, CDFG 1987, O'Farrell et al. 1987b, White et al. 1994, Ralls and White 1995). Predation by larger canids is believed to be the dominant cause of kit fox mortality, accounting for 75-85% of kit fox mortalities on the Carrizo Plain, Lokern Natural Area, and the Naval Petroleum Reserve (Disney and Spiegel 1992, USFWS 1998, Ralls and White 1995, Spiegel 1996, Cypher and Spencer 1998). Coyotes are the kit foxes' primary predator (USFWS 1998, Ralls and White 1995, Spiegel 1996, Kitchen et al. 1999, Cypher et al. 2000, Olson and Lindzey 2002, Kamler et al. 2003, Clark et al. 2005), but rarely consume fox carcasses, suggesting that this predation is motivated by competition rather than consumption (Nelson et al. 2007). Nelson et al. (2007) found that coyotes also displace kit foxes from shrublands to grassland habitats, which in turn affects the kit foxes' range and diet. Their results suggest that the threat of predation by coyotes has a greater influence on kit fox habitat selection than the availability of prey, which is more abundant in shrublands (Nelson et al. 2007). These observations indicate that establishing a heterogeneous landscape with different levels of cover available to facilitate partitioning of

habitat between kit fox and coyotes may be an effective approach to preservation of kit fox populations by reducing interactions (USFWS 2010).

Increases in coyote abundance may be a factor in local kit fox declines (USFWS 2010; USFWS 1998, Cypher and Scrivner 1992, Ralls and White 1995, White et al.1996; Warrick and Cypher 1998; Cypher et al. 2000). However other studies indicate that coyote abundance did not significantly affect kit fox abundance, an experimental coyote-control program at the Elk Hills Naval Petroleum Reserves in California did not result in decreased kit fox mortality (USFWS 1998, Scrivner and Harris 1986, Cypher and Scrivner 1992; White and Garrot 1997, Dennis and Otten 2000).

Coyotes may provide some benefit to kit fox populations because they kill nonnative red foxes (*Vulpes vulpes*), which may threaten kit foxes by engaging in both interference and exploitative competition (USFWS 1998, Ralls and White 1995, Clark et al. 2005). Interference competition consists of direct mortality and possible spatial partitioning, and exploitative competition results from red foxes' use of kit fox dens and habitat and reliance on similar prey (Jurek 1992, Cypher et al. 2001, Clark et al. 2005). Kit foxes are also susceptible to diseases carried by red foxes because the species are congeneric (Clark et al. 2005). It has been suggested that red foxes pose a greater threat to kit foxes than coyotes in certain regions. Although it is unknown whether coyotes affect the red fox's invasion into kit fox habitat (USFWS 1998, White et al. 1994, Ralls and White 1995), they have been introduced elsewhere to control nonnative red fox populations (USFWS 1998, Sargeant and Arnold 1984, Jurek 1992, Clark et al. 2005). Studies have suggested that the presence of coyotes significantly influences red fox distribution and might be beneficial to kit foxes (Dekker 1983, Voigt and Earle 1983, Major and Sherburne 1987, USFWS 1998, Sargeant et al. 1987, Cypher et al. 2001, Clark et al. 2005).

e. Disease

Although serological data indicates kit fox are exposed to a number of bacterial and viral diseases (McCue and O'Farrell, 1988), disease is believed to be a minor cause of kit fox mortality (USFWS 1998). Kit foxes surveyed in 1981, 1982, and 1984 at the Elk Hills Naval Petroleum Reserve in Kern County and the Elkhorn Plain in San Luis Obispo County had antibodies against pathogens including: canine parvovirus (100% in 1981-1982 and 67% in 1984); infectious canine hepatitis virus (6% in 1981-1982 and 21% in 1984); canine distemper virus (0% in 1981-1982 and 14% in 1984); *Francisella tularensis* (8% in 1981-1982 and 31% in 1984); *Brucella abortus* (8% in 1981-1982 and 3% in 1984); *Brucella canis* (14% in 1981-1982 and none in 1984); *Toxoplasma gondii* (6% in 1981-1982); and *Coccidioides immitis* (3% in 1981-1982) (McCue and O'Farrell, 1988). Despite the presence of antibodies, the foxes did not display any symptoms of clinical disease. However, rabies was identified as a cause of kit fox mortality at the California Army National Guard Training Site at Camp Roberts and may have contributed to the population's decline in that area (USFWS 1998, Standley et al. 1992, White et al. 2000). Both ectoparasites and endoparasites have been detected in kit foxes, including fleas, ticks, lice, cestodes, and nematodes, but they are not believed to be a cause of mortality (List and Cypher 2004).

f. Roadways and Vehicle Strikes

Roads are considered to be among the greatest causes of San Joaquin kit fox mortality in certain regions of California (Meaney et al. 2006). Roadways have been constructed in much of the kit fox's range, and additional roads are being planned (Bjurlin 2004). The addition of roadways to the kit fox's habitat threatens the population's viability by introducing and increasing risks such as vehicle strikes, habitat loss associated with road construction and any accompanying urban development, habitat fragmentation, environmental contamination, introduction of non-native species to the ecosystem, variations in predator and prey populations, and wildfires (*Id*.).

Vehicle strikes most commonly occur at night, and although they are believed to be responsible for fewer than 10% of adult kit fox mortalities throughout most of the fox's range, they account for a greater proportion of mortalities than does any other cause in urban habitats such as Bakersfield, California (*Id*.). Roadways also cause habitat fragmentation, which interferes with the kit fox's home range establishment and gene flow. Kit foxes rarely cross large roads and, as a result, such roads serve to isolate subpopulations and increase the risk that they will be eliminated (*Id*., Knapp 1978).

The construction and use of roadways further threatens kit foxes by damaging the dens on which the foxes rely (Bjurlin 2004). Because construction activities generally take place during daylight hours, they have the potential to entomb and kill the nocturnal foxes by damaging their dens (*Id*.). Although road construction may create new denning opportunities, the establishment of dens near roadways increases the incidence of vehicle strikes, which is believed to offset any benefit provide by newly available den sites (*Id*., Egoscue 1962).

Development of roadways may also affect the availability of prey and the risk of predation to the kit fox. The habitat disturbance associated with roads provides conditions suitable for the California ground squirrel, which can displace other common prey, such as kangaroo rats (*Dipodomys ingens*) and San Joaquin antelope squirrels (*Ammospermophilus nelsoni*) (USFWS 1998, Balestreri 1981, Hall 1983, Harris and Stearns 1991; Bjurlin 2004). Nitrogen emissions produced by vehicles further threaten kit foxes' access to prey by supporting the growth of invasive grasses such as brome (*Bromus madritensis rubens*), which may reduce the availability of quality habitat for kangaroo rats and other common prey species ((USFWS 1998, Goldingay et al. 1997, Weiss 1999, Cypher 2000, Bjurlin 2004). Shrub density may also increase along roadways after construction, which creates conditions favorable for predators such as coyotes (*Canis latrans*) and bobcats (*Lynx rufus*) (USFWS 1998, Ralls and White 1995, White et al. 1995, Cypher and Spencer 1998, Warrick and Cypher 1998, Bjurlin 2004). In addition, the utility lines that often accompany roadways provide nesting sites for raptors, which may kill kit foxes or compete with them for prey (USFWS 1998, Briden et al. 1992; Knight et al. 1995, Bjurlin 2004).

The construction, maintenance, and use of roads further threatens the kit fox by introducing contaminants into the ecosystem, including: heavy metals (lead, aluminum, iron, cadmium, copper, manganese, titanium, nickel, zinc, and boron); organic pollutants (dioxins, polychlorinated biphenyls); ozone; and other hazardous substances (lubricants, antifreeze)

(Benfenati et al. 1992, Trombulak and Frissell 2000, Bjurlin 2004). Little information about the impact of these contaminants on kit fox populations is available because their effects may be delayed, and are typically expressed through symptoms more subtle than direct mortality (Bjurlin 2004).

3. Inadequacy of Existing Habitat Protections

Measures designed to protect San Joaquin kit fox habitat have been implemented on both public and private lands. Habitat conservation plans, a Safe Harbor agreement, reserves, and other protected areas on public lands have been established with the kit fox's conservation as an objective. However, very little evaluation of these efforts' efficacy has been conducted, and it is difficult to estimate their impact, if any, on the kit fox's recovery. The analytical challenges resulting from the lack of data are compounded by the relatively vague recovery criteria set forth in the recovery plan itself (B. Cypher, personal communication, July 27, 2009). Even where the plan recommends specific core areas as the focus of conservation efforts, it does not define the boundaries of those areas or the minimum amount of habitat necessary for conservation in each core area and, as a result habitat conservation efforts have not been undertaken at a large enough scale or for a long enough time to determine whether they have had any positive impact on conservation and recovery. Moreover, because very little population monitoring is being conducted, information on the relative success of current conservation measures is generally unavailable (*Id*.). While it is unclear whether existing measures have had or will have any positive impact on kit fox populations, the loss of habitat remains the greatest threat to the fox's viability and land conversion continues to consume its historic range. Therefore, it is clear that critical habitat designation and providing a legal mechanism for the protection of core areas of essential habitat will significantly benefit the remaining San Joaquin kit fox populations and aid in recovery of the species.

a. Public Lands

San Joaquin kit fox populations are protected by a variety of measures according to their location. The Carrizo Plain population, for instance, benefits from the National Monument designation that covers a portion of the Plain. The Carrizo Plain National Monument is managed by the Bureau of Land Management (BLM) as an element of the National Landscape Conservation System (NLCS), and 204,107 of its 246,048 acres are federally owned. The Bureau has actively worked to support kit fox populations on the Monument, and has purchased land from private owners for the fox's benefit. In 2007, BLM purchased 222 acres of land occupied by kit foxes from private owners. These acquisitions are funded through a program that collects mitigation fees from developers whose work disturbs kit fox habitat. Between 2003 and 2007, the fund provided $250,000, with which the BLM has purchased privately-owned in-holdings to become part of the Monument. The BLM has recently released a Proposed Resource Management Plan for the Monument that could increase some protections for the kit fox in this area.

The BLM, in collaboration with a non-profit conservation organization, plans the purchases according to the location of high-quality kit fox habitat in order to make the most of its conservation spending. These acquisitions are consistent with the 1998 recovery plan, which

repeatedly identifies land acquisition as a means of protecting kit fox habitat by transferring it into public ownership. The acquisition plan includes areas outside of the Monument as an element of the kit fox recovery strategy and natural land and farmland with drainage problems. The acquisition plan is intended to: expand and connect refuges and reserves in the Pixley-Allensworth and Semitropic Ridge natural areas; enhance movement of kit foxes through agricultural land between the Lost Hills area and the Semitropic Ridge Natural Area; maintain movement of kit foxes between the Mendota area in Fresno County, natural lands in western Madera County, and natural lands along Sandy Mush Road and in the wildlife refuges and easement lands of Merced County (USFWS 1998).

Where kit foxes occupy federally-managed land that is not itself protected, including a large expanse of checkerboard lands and split estate parcels throughout the kit fox's range, the primary source of protection for the kit fox is the ESA's take and consultation provisions, which protect the kit foxes themselves without providing any safeguard to the surrounding ecosystem. The designation of critical habitat could help shift the focus of consultation from impacts to individuals of the species, to recovery of the species as a whole and the habitat on which it depends. Emphasizing the value of critical habitat designation as an ecosystem-scale conservation strategy, Yagerman (1997) explained, "[b]iologists know that species are part of a larger biotic and abiotic whole; the relationship between an individual and its habitat is one of mutual interdependence. Ultimately, we cannot preserve species without preserving habitat. Congress has acknowledged this truth in its design of the ESA." The kit fox's role as an umbrella species in its range further reinforces the significance of designating critical habitat, not only to individual kit foxes, but to the entire ecological community of the San Joaquin Valley and throughout the kit fox's range.

b. Private Lands

The recovery plan currently in place for the San Joaquin kit fox focuses heavily on conservation strategies applicable to private land. Cypher et al. (2009) noted that "[i]n areas such as the San Joaquin Valley, where the land is mostly in private ownership, inclusion of private lands in the conservation of listed species is not only beneficial, but may be essential . . . Public lands by themselves may not be sufficient for conserving rare species and preventing extinctions." The success of these programs is critical to the kit fox's viability because its range is heavily fragmented by private lands used for agriculture and other development.

i. Private Conservation Lands

There are a small number of privately owned preserves which contain habitats potentially suitable for the kit fox. The Wind Wolves Preserve, for instance, is a 97,000 acre preserve covering an ecologically unique region where the Transverse Ranges, Coast Ranges, Sierra Nevada, western Mojave Desert and San Joaquin Valley converge. The Preserve includes 30 square miles on the San Joaquin Valley floor, east of Maricopa and southwest of Bakersfield. The preserve is managed by the Wildlands Conservancy, a non-profit land conservation organization. The kit fox is a target species for protection at the site, and although the Service does not have specific estimates of the amount of kit fox habitat available, there is believed to be enough to "assist in Recovery efforts" (USFWS 1998). For some of the other privately protected

lands however, the Service has indicated that they are likely too small or disjointed to actually support kit fox populations (USFWS 2010).

ii. Habitat Conservation Plans

Section 10(a)(1)(B) of the Endangered Species Act (ESA) provides for the issuance of incidental take permits (ITP) to non-federal entities, which allow for the non-purposeful, incidental taking of an endangered species while performing otherwise legal activities. In order to obtain an ITP, a landowner must submit a habitat conservation plan (HCP) to the U.S. Fish and Wildlife Service (USFWS), which will in turn review the plan and make it available to the public for comment. *See* 16 U.S.C. § 1539(c). The proposal must set forth mitigation measures to minimize the anticipated detrimental impact of their activities on the species, and must include an analysis of alternative activities and an explanation of why those alternatives were not included in the plan (16 U.S.C. §1539(a)(2)). Section 7 requirements remain in place, so an ITP will not be issued unless the Secretary concludes that the incidental take will not reduce the species' overall viability.

The use of HCPs has expanded rapidly in recent decades, and according to USFWS, 21 HCPs have been established allowing take of kit foxes on private lands, ranging from two to 75 years in duration (USFWS 2009b).[1] Landowners' extensive reliance on HCPs to reconcile economic and environmental interests on private land and the lack of adequate survey data and monitoring raises serious concerns regarding the actual impact to the species from these projects and, particularly, the cumulative effects to the kit fox species as a whole. For example, Harding et al. (2001) examined 43 HCPs and discovered that a significant portion of the plans had been approved despite a lack of data on important species characteristics. Litter size was known for only 67% of the species, while lifespan was known for 46%, lifetime reproduction was known for 19%, and population trend estimates had been developed for fewer than 10% (*Id*.). The authors concluded that analysis was insufficient for 42% of the HCPs included in the study, and found that over 40% of the HCPs did not even include quantitative estimates of incidental take (*Id*.).

There are several advantages to designating critical habitat prior to developing habitat conservation plans and the ecological benefits resulting from HCPs can be amplified when the plans are developed in the context of critical habitat. Issuance and revocation of incidental take permits (ITPs) under HCPs may be subject only to the ESA's jeopardy standard. Where critical habitat has been established, in contrast, the protected species receives an additional layer of security because such designation triggers the adverse modification standard. *See Spirit of Sage Council v. Kempthorne*, 511 F. Supp. 2d 31, 43 (D.D.C. 2007). Lin (1996) identified obstacles to effective habitat conservation planning and concluded that "designation of critical habitat . . . would enable USFWS field staff to provide better guidance to applicants, help to address the lack of biological knowledge, and reduce the likelihood that draft HCPs will be rejected, because both applicants and the USFWS will have clearer ideas of what measures will be acceptable." Accordingly, critical habitat designation would "reduce developer uncertainty and encourage

[1] Habitat Conservation Plan documents are available at: http://ecos.fws.gov/speciesProfile/profile/displayAllDocuments!hcp.action;jsessionid=BAD6E69EEAEFA4D12C86220474CE8468?spcode=A006.

increased consideration of protected species' needs in project design and land use planning" (*Id*.). Webster (1987) expressed a similar view, explaining the disadvantages of HCPs and suggesting that "because one of the purposes of the ESA is to 'provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved,' presence of any critical habitat should be a vital planning tool in the preparation of a *Habitat* Conservation Plan."

Moreover, HCPs may be particularly poorly suited to the conservation of the San Joaquin kit fox. If a HCP allows development adjacent to the protected land, habitat fragmentation, which has been identified as one of the most significant threats to kit fox populations, could negate any benefit resulting from the HCP (U.S. Congress 1993). HCPs also generally fail to account for ecosystem-scale conservation, focusing on a single species and a single parcel of land in isolation from the species' habitat and other surrounding land uses. Acknowledging the disadvantages of this localized, single-species focus, a congressional report advised that a HCP "is not a substitute for the development of an overall recovery plan for a species or for the designation of its critical habitat" (*Id*.).

iii. Safe Harbor Agreements

Safe Harbor Agreements (SHA), which are identified as a tool to be used in kit fox recovery efforts (USFWS 1998), are voluntary agreements between private landowners and the Service in which the private landowner agrees to adopt practices designed to contribute to the recovery of an endangered species for a stated period of time, and in return, the federal agency guarantees that the landowner will not be bound by ESA requirements beyond maintaining the property's initial conditions (USFWS 2009a). At the end of the agreed-upon time period, the landowner may return the land to its former condition, and is not responsible for maintaining the practices, structures, or other obligations imposed by the terms of the SHA (USFWS 2009a).

A landowner is not required to develop a HCP and obtain an incidental take permit in order to establish a Safe Harbor agreement. The combination of Safe Harbor agreements with HCPs, in fact, raises substantial questions about the programs' effectiveness when used together. The Safe Harbor agreement has the potential to create false confidence in the species' recovery, which may lead to the approval of excessive habitat destruction resulting from multiple HCPs (SELS 2001). Agricultural interests, in contrast, have criticized the Safe Harbor program independently because agricultural operations adjacent to Safe Harbor properties are not protected from the ESA's "take" prohibition. As a result, neighboring producers are subject to the requirements and consequences set forth in the ESA if the endangered species supported by habitat protections under the agreement also utilizes neighboring properties.

The Service has identified 17 areas, including both farmland and natural land, within the kit fox's range to target for purposes of the safe harbor program. One safe harbor agreement has been developed for the benefit of the kit fox. Paramount Farming Company of California signed the agreement in 2003, pledging to adopt land management practices consistent with kit fox recovery on 1,668 acres of the company's Kern County property (EDF 2003). Paramount installed 21 artificial, above-ground kit fox dens and four subterranean dens with chambers to allow kit foxes occupying the land east and west of the farm to traverse the land on which the

company produces cotton, pistachios, almonds, barley, wheat, and safflower. The purpose of the dens was to provide kit foxes with refuge from coyotes on agricultural land, where the foxes would not otherwise have any protection from predation (EDF 2003). The dens were made accessible to kit foxes in February 2002, and were later modified to exclude coyotes and adult red foxes (ESRP 2006). Track stations and spotlight surveys, along with box traps and scat surveys, were used to monitor kit fox activity and revealed that the foxes were in fact using the artificial dens (ESRP 2006). However, because there were no dens on the farm at the time the agreement was established, Paramount was not required to maintain the dens beyond the agreed-upon three-year term.

Few kit foxes were detected during the study, probably as a result of low kit fox abundance in the area, and the study did not determine whether kit foxes used the dens to traverse the farm (Cypher et al. 2009, B. Cypher, personal communication, July 8, 2009). Nonetheless, the authors speculate that the dens are likely beneficial to the foxes because any habitat improvements that increase the probability of successful passage could contribute to the maintenance of connectivity and gene flow among populations, which are increasingly fragmented by agriculture and other types of development. Although they represent a potentially beneficial conservation tool, a single SHA has been implemented within the kit fox's range, and monitoring provided minimal insight into the results that could be expected from other agreements.

C. The San Joaquin Kit Fox Recovery Plan

Designating critical habitat for the San Joaquin kit fox as proposed in this petition is consistent with the recovery plan for the species. The Fish and Wildlife Service developed a recovery plan for the San Joaquin kit fox and other Upland Species of the San Joaquin Valley pursuant to 16 U.S.C. § 1533(f)(1). If implemented successfully, a recovery plan "stops or reverses the decline of a species and neutralizes threats to its existence" such that the species may be delisted. *Fund for Animals v. Babbitt***,** 903 F. Supp. 96, 103 (D.D.C. 1995). Development and implementation of recovery plans is consistent with the Service's obligation to "do far more than merely avoid the elimination of protected species" and to "bring these species back from the brink so that they may be removed from the protected class . . . us[ing] all methods necessary to do so." *Defenders of Wildlife v. Andrus,* 428 F. Supp. 167, 170 (D.D.C. 1977).

Among the goals of the kit fox recovery plan is the "establishment of a viable kit fox metapopulation through protection and management of a system of core and satellite populations on public and private lands throughout its range" (USFWS 1998). The plan focuses on conservation of habitat range and character, explaining that "[t]he areas these [kit fox] populations inhabit need to encompass as much of the environmental variability of the historical range as possible" (*Id*.). It also emphasizes the unique ecological features of the core populations' respective habitats, and the need to conserve those features in each habitat range in order to sustain the species. Each of the three core ranges is characterized by an environmental regime unique from those of the others. The plan calls not only for habitat conservation measures, but also for the acquisition of title to or easements on private land in the San Joaquin Valley. The plan explains that "[i]f large blocks…of drainage-problem lands are retired from irrigated agriculture, the retired farmland can be converted to habitat for kit foxes …[and] reduce

isolation and its detrimental effects," concluding that "[s]trategic irrigated land retirement and subsequent establishment as habitat conservation areas is the most cost effective and rapid route to recovery of kit foxes" (*Id*.). Unfortunately, the potential of the Land Retirement Program has not been realized and has provided limited recovery value for the species to date (USFWS 2010). Currently, some of these "drainage problem lands" are being considered for large-scale industrial solar developments, which may prove incompatible with conservation opportunities for the kit fox on site. However, the establishment of critical habitat could provide guidance for the prioritization of land for acquisition and retirement, thereby promoting the efficient use of agency time and resources and improving the fox's likelihood of recovery while allowing essential renewable energy projects to be developed.

D. Proposed Critical Habitat

Because much of the San Joaquin kit fox's historical habitat had been extensively fragmented, the species' continued survival and recovery will depend on the conservation of remaining areas suitable habitat and restoration of degraded habitat. Critical habitat for the kit fox includes remaining saltbush scrub, alkali sink scrub, or red brome-dominated grassland with an average slope of less than 10%, located in the San Joaquin Valley, Cuyama Valley, Carrizo Plain, and Panoche Valley. Several regions with these characteristics are of particular importance to the continued viability of the kit fox, including portions of Kern, Fresno, San Benito, San Luis Obispo, Kings, and Merced Counties (B. Cypher, personal communication, July 27, 2009).

In Kern County, the establishment of critical habitat would be most beneficial in the Buena Vista Valley, the Lokern Natural Area region, the Coles Levee Ecopreserve-Kern Water Bank areas, the Antelope Plain region, the Kern National Wildlife Refuge-Semitropic Ridge region, the Pixley NWR-Allensworth Ecological Reserve region, the Comanche Point-Tejon Ranch region, and the Kern Front region northeast of Bakersfield down to and including Tejon Ranch. Suitable habitat also spans western Fresno County and eastern San Benito Counties, and the Panoche Valley area and the Silver Creek Ranch area constitute critical habitat. Land bounded by I-5 and the Coast Ranges in western Fresno and western Kings counties, reaching from the Panoche region in the north to Kern County in the south, is also important kit fox habitat, as is similar land in western Merced County between Little Panoche Road and State Route 152. Because these areas contain "physical and biological features that are essential to the conservation" of the San Joaquin kit fox, they meet the definition of critical habitat and should be designated as such. 50 C.F.R. § 424.12(b).

1. Critical Habitat Characteristics; Primary Constituent Elements

Pursuant to 50 C.F.R. § 424.12(b), the Secretary of the Interior, when designating critical habitat, must identify and consider the physical and biological features that are essential to the conservation of the species and that may require special management considerations or protection. These features include, but are not limited to:

(1) Space for individual and population growth, and for normal behavior;

(2) Food, water, air, light, minerals, or other nutritional or physiological requirements;
(3) Cover or shelter;
(4) Sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal; and generally,
(5) Habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species.

The regulations also require that when delineating critical habitat, the Secretary focus on biological and physical elements of a defined area that are essential to the conservation of the species. Known primary constituent elements form the basis of delineation of essential habitat and the critical habitat description.

a. Space for Population Growth and Normal Behavior

San Joaquin kit foxes historically occupied a relatively large range, which explains in part, the species' sensitivity to habitat loss and fragmentation. The proposed critical habitat includes areas of sufficient size and connectivity, with the requisite ecological features, to permit kit foxes to establish home ranges, to establish dens (including natal dens), and for juvenile kit foxes to disperse successfully.

b. Nutritional requirements

The areas proposed as critical habitat for the San Joaquin kit fox also provide habitat for the kit fox's preferred prey including kangaroo rats, ground squirrels and other prey species. Sufficient prey is critical to survival and reproductive success and recovery of kit foxes which is influenced by the availability of prey. Large areas of critical habitat are also necessary to ensure some resilience against declines in prey due to drought or other extreme environmental conditions (USFWS 1998).

c. Shelter

San Joaquin kit foxes rely on dens for protection from harsh climatic conditions and predators, and the absence of dens in certain areas, such as farmlands, creates a barrier to kit fox passage. The proposed critical habitat provides sufficient areas for dens (including natal dens) outside of farmlands and other heavily and repeatedly disturbed areas.

d. Sites for breeding, reproduction, and rearing of offspring

San Joaquin kit foxes occupy natal dens or "pupping dens" while birthing and raising pups, which remain in the den with the female parent until they are just over a month old (USFWS 1998,Grinnell et al. 1937, Seton 1925). Like the species' shelter needs, reproductive success requires that appropriate dens be accessible and are in habitat with sufficient prey base.

e. Habitat is representative of the San Joaquin kit fox's historic range and provides for essential movement corridors between core populations and other populations

The proposed critical habitat represents a small portion of the San Joaquin kit fox's historic range, much of which has been lost to agricultural and urban development and fragmentation. The kit fox once occupied most of the San Joaquin Valley and many areas in the surrounding foothills. The areas recommended for critical habitat designation include the few best remaining habitat areas, habitat in core recovery areas identified in the recovery plan, areas where habitat restoration can provide conditions suitable to sustain significant kit fox populations, and essential movement corridors between core populations and other known populations distributed throughout the historic range (e.g. Monterey area, Alameda, Tejon, Windwolves).

2. Critical Habitat Boundaries

Petitioners have identified lands that contain essential habitat and we believe meet the criteria for critical habitat designation within the core areas, satellite areas, and linkage corridors identified in the Recovery Plan and the five year review (USFWS 2010). This proposed critical habitat encompasses all remaining suitable habitat in core areas, satellite areas, and key linkage corridors. In addition, the proposal encompasses habitat in each of these areas where habitat restoration activities could significantly increase the value of those areas as well as the overall value of the surrounding and connected habitat to the species and its long-term conservation.

In identifying the proposed critical habitat Petitioners prepared a map of using the core, satellite and linkage habitat delineations found in the Recovery Plan and the 2010 Five Year Review (USFWS 2010) and. a recent habitat suitability modeling (Phillips and Cypher 2010, draft).

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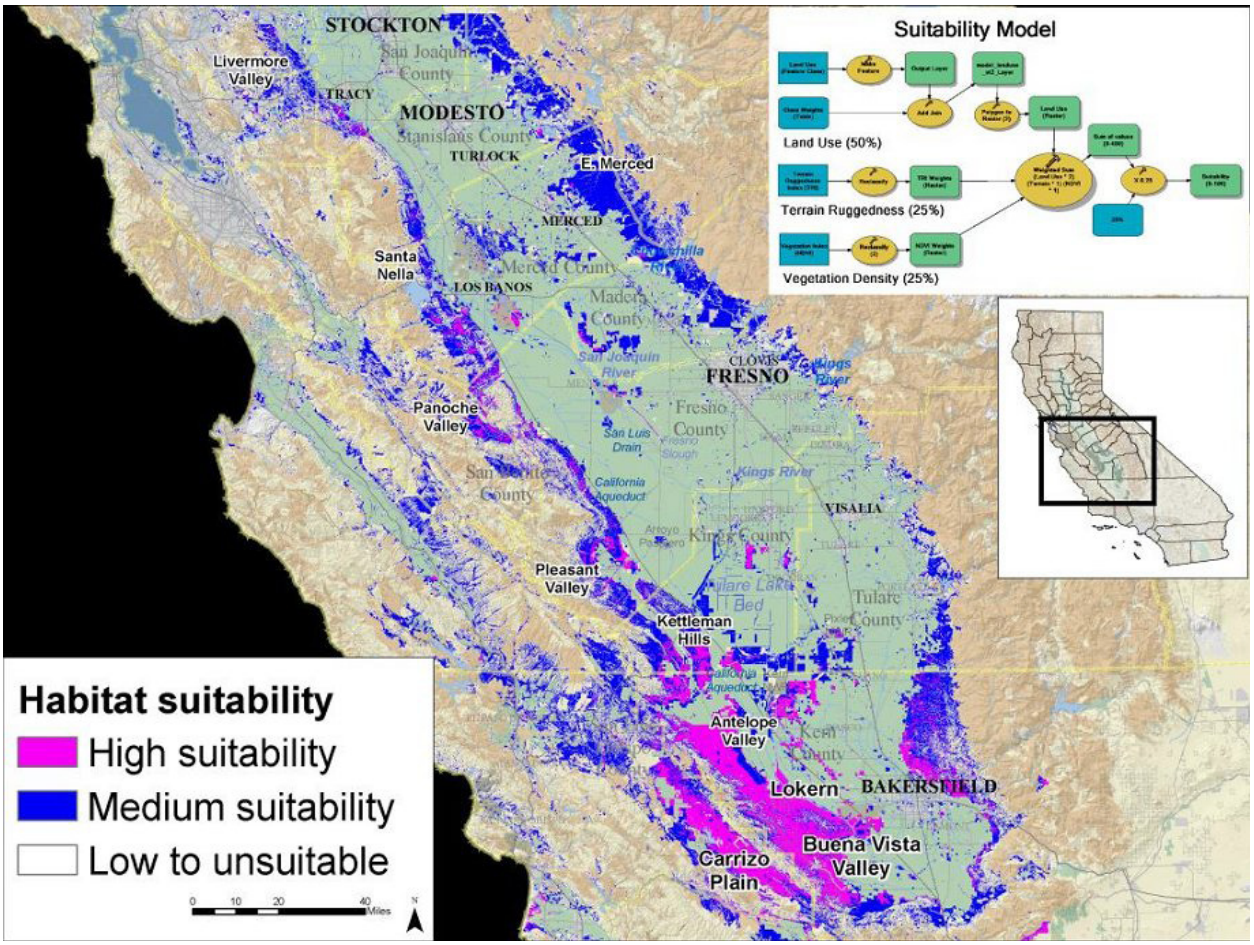
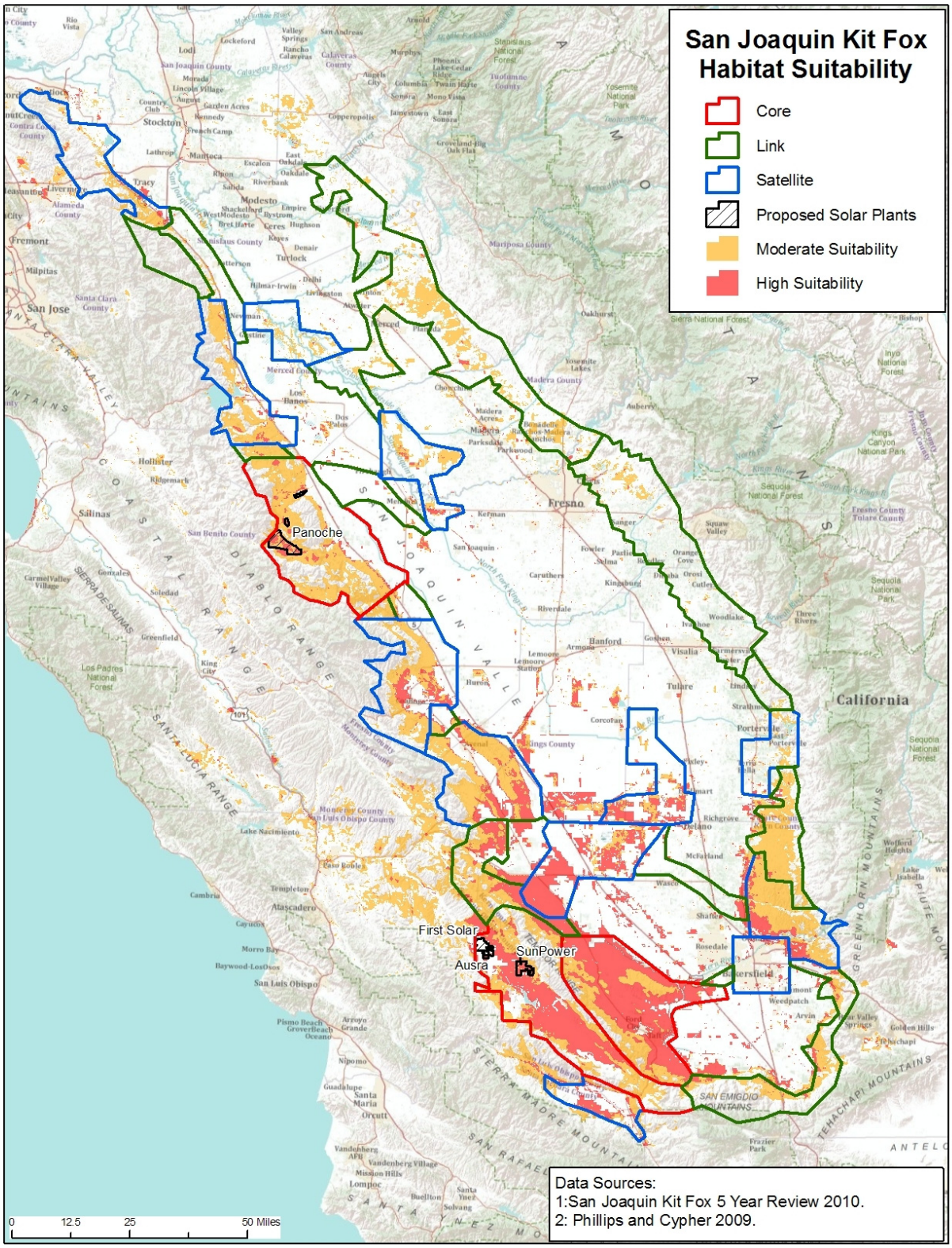


Phillips and Cypher 2010, draft



Map of proposed critical habitat areas prepared by Center for Biological Diversity from Data Sources listed.

The proposed critical habitat areas include, but are not limited to: habitat within the core habitat areas in the San Joaquin Valley including Western Kern County, the Carrizo Plain, and Ciervo-Panoche Valley; linkage corridors; and habitat of satellite populations.

3. Critical Habitat Designation is both Prudent and Determinable at This Time

a. Critical Habitat Designation is Prudent

Critical habitat designation is prudent under 50 C.F.R. § 424.12 unless:

(i) The species is threatened by taking or other human activity, and identification of critical habitat can be expected to increase the degree of such threat to the species; or
(ii) Such designation of critical habitat would not be beneficial to the species.

The imprudence exception is construed narrowly. The imprudence exception to the habitat designation requirement is applicable only to "cases in which the possible adverse consequences would outweigh the benefits of designation of critical habitat[.]" 49 Fed. Reg. 38900, 38903.

Designation of critical habitat for the San Joaquin kit fox is prudent because neither of the circumstances described at 50 C.F.R. § 424.12 is applicable to the species. Kit fox mortality resulting from human activities is generally indirect; hunting does not pose a significant threat to kit foxes (List and Cypher 2004). The most significant anthropogenic threats to the species are indirect effects of human activities that are not intended to harm kit foxes. Moreover, the kit fox's range has been identified and descriptions have repeatedly been published in the form of both textual descriptions and visual maps; the recovery plan itself includes a map and a detailed description of the kit fox's range and distribution, as well as references to numerous sources with similar information. Because extensive research on the kit fox has been conducted and reported, and is easily accessible through a variety of media, it can be inferred that data made available as a result of critical habitat designation would not create any new threats to the species. Accordingly, designating critical habitat would not make the foxes susceptible to any new threats or intensify existing threats.

Most importantly, the designation of critical habitat will be beneficial to the San Joaquin kit fox. When it has been determined that critical habitat designation will not increase threats to a species, as with the kit fox, critical habitat designation is prudent if it would provide *any* benefits. *See* 65 Fed. Reg. 6114, 6117. The San Joaquin kit fox clearly satisfies this standard, as habitat loss has repeatedly been identified as the most significant threat to the species' viability. Because kit foxes are broadly distributed and occupy relatively large areas, the species will benefit from the protection of its habitat that is not provided by the ESA's other provisions. Designating critical habitat would extend the authority of the Service to protect habitat from projects that pose a risk of destruction or adverse modification to the kit fox's critical habitat. Because the remaining suitable habitat is directly threatened by development, habitat protections are particularly important at this time. Furthermore, because the San Joaquin kit fox is an umbrella species, conservation of its habitat will benefit a number of other rare and endangered upland species in the San Joaquin Valley.

b. Critical Habitat Designation is Determinable

Designation is determinable for purposes of 50 C.F.R. § 424.12 unless:
(i) Information sufficient to perform required analyses of the impacts of the designation is lacking, or
(ii) The biological needs of the species are not sufficiently well known to permit identification of an area as critical habitat.

Critical habitat designation is determinable because there is adequate information on the biology, behavior, and range of the kit fox to identify the proposed areas as essential to the species' continued viability. The recovery plan itself includes a general map identifying core and satellite kit fox populations, as well as written descriptions of high-priority recovery areas as does the 2010 50-year review. The ecological characteristics of each of these areas have been documented extensively. This information is sufficient to determine that the areas delineated in this petition constitute essential habitat for the San Joaquin kit fox that should be designated as critical habitat.

IV. PROCESSING OF THIS PETITION

This petition is submitted under the provisions of the ESA 16 U.S.C. §§1531 *et seq*., 50 C.F.R. §424.14, and the APA, 5 U.S.C. §533. In 1976, Congress highlighted the importance of critical habitat: "[i]t is the Committee's view that classifying a species as endangered or threatened is only the first step in insuring its survival. Of equal or more importance is the determination of the habitat necessary for the species' continued existence." *Ctr. For Biological Diversity v. Norton*, 240 F. Supp. 2d 1090, 1098 (D. Ariz. 2003), quoting H.R. Rep. No. 94-887, at 3 (1976). The legislative intent to designate critical habitat is unambiguous: critical habitat is necessary for species conservation.

In receiving a petition to revise a critical habitat designation, "the Secretary shall make a finding as to whether the petition presents substantial scientific information indicating that the revision may be warranted." 16 U.S.C. § 1533(a)(3)(D)(i). For species such as the San Joaquin kit fox listed prior to the time when Congress amended the ESA to require critical habitat designation concurrent with listing a critical habitat petition should be processed in the same way as a petition to revise critical habitat. Therefore, in responding to this petition to designate critical habitat for the San Joaquin kit fox, the Secretary must make a finding "[t]o the maximum extent practicable, within 90 days after receiving the petition." 16 U.S.C. § 1533(a)(3)(D)(i). If the Secretary finds that Petitioners have presented substantial information indicating that designation of critical habitat is warranted, then the Secretary must determine how to proceed with the requested revision within 12 months. 16 U.S.C. § 1533(a)(3)(D)(ii). The substantial scientific information provided in this Petition shows that designation of critical habitat for the San Joaquin kit fox is clearly warranted. Therefore, the Service should promptly make a positive initial finding on the Petition and commence preparation of proposed rulemaking to designate critical habitat.

V. CONCLUSION

For the reasons set forth above, Petitioners request that the Service fulfill its statutory duty by issuing a proposed rule designating critical habitat for the San Joaquin kit fox.

This PETITION TO DESIGNATE CRITICAL HABITAT FOR THE ENDANGERED SAN JOAQUIN KIT FOX (*VULPES MACROTIS MUTICA*) UNDER THE ENDANGERED SPECIES ACT is hereby submitted to the Secretary of the Interior.

Respectfully submitted this 5th day of August, 2010.

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