MAMMALIAN SPECIES SURVEYS IN THE ACQUISITION AREAS ON THE TEJON RANCH, CALIFORNIA

PREPARED FOR THE TEJON RANCH CONSERVANCY

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EXECUTIVE SUMMARY

During autumn 2009 and spring 2010, surveys were conducted for mammal species in 4 areas on Tejon Ranch in central California. These "acquisition areas" are available for possible conservation and include the White Wolf, Old Headquarters, Bi-Centennial, and Tri-Centennial areas. Survey methods included automated digital camera stations, live-trapping, spotlighting, and opportunistic observations. Despite the relatively short-term nature of the surveys, 28 mammal species were documented on the acquisition areas: 12 on White Wolf, 17 on Old Headquarters, 12 on Bi-Centennial, and 13 on Tri-Centennial. Included among those detected were 3 special status species: San Joaquin kit fox, Tehachapi pocket mouse, and badger. Kit foxes were confirmed on the White Wolf area from camera station images, spotlight observations, tracks, and scats. Kit fox scats also were collected on the Old Headquarters area, and an individual and a potential den were observed by other field biologists. Five individual Tehachapi pocket mice were captured during live-trapping: 2 on the Bi-Centennial area and 3 on the Tri-Centennial area. Badger diggings were observed in the White Wolf area, although this species likely is wide-spread on Tejon Ranch. The Ranch clearly supports a diversity of mammal species and because of its size, habitat diversity, and habitat quality, the Tejon Ranch can contribute significantly to the conservation of special status mammal species as well as regional biological diversity. Recommendations include (1) conducting additional surveys for additional special status species, (2) conserving habitat in the White Wolf and Old Headquarters areas for San Joaquin kit foxes, (3) managing and enhancing habitat for kit foxes through vegetation management and artificial den installation, (4) gathering demographic and ecological data on kit foxes on the Ranch to further conservation of this species, (5) conserving habitat in the Bi-Centennial and Tri-Centennial areas for Tehachapi pocket mice, and (6) gathering demographic and ecological data on Tehachapi pocket mice to further conservation of this species.

INTRODUCTION

The privately owned Tejon Ranch comprises 109,571 ha (270,750 ac) of contiguous land in Kern and Los Angeles Counties in Central California (Figure 1). The Ranch is situated at the convergence of the Sierra Nevada, Coast Ranges, Mojave Desert, and San Joaquin Valley, and therefore encompasses an immense diversity of habitats, animals, and plants (White et al. 2006). Because of its considerable size, diversity of biological resources, habitat quality, and location, Tejon Ranch is of considerable importance to the conservation of regional biodiversity and ecosystem connectivity.

Figure 1. Location of Tejon Ranch in central California.

Under the Tejon Ranch Conservation and Land Use Agreement adopted in 2008 (Tejon Ranch Company 2008), approximately 72,035 ha (178,000 ac) of the Ranch will be permanently preserved through conservation easements. Furthermore, another approximately 25,090 ha (62,000 ac), referred to as acquisition areas, were made available for preservation, contingent upon externally raised funds to purchase conservation easements on these lands. The acquisition lands consist of 5 areas

(Table 1), with 2 areas occurring on the northern side of the Ranch in the San Joaquin Valley and the other 3 areas occurring on the south side (Figure 2).

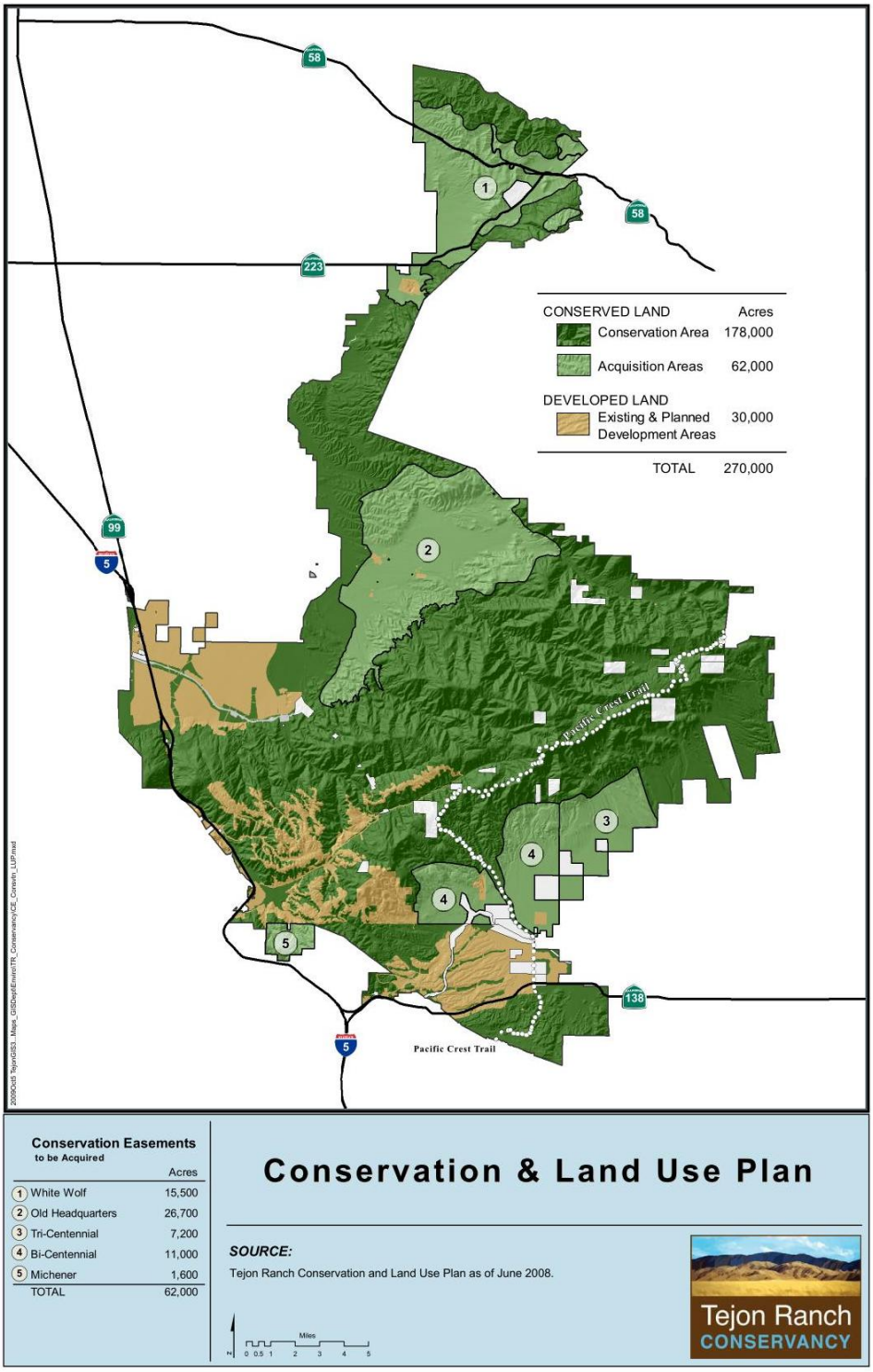

Figure 2. Locations of the 5 acquisition areas on the Tejon Ranch, California (figure courtesy of Tejon Ranch Conservancy).

Table 1. Acquisition areas on the Tejon Ranch, California, available for preservation through the purchase of conservation easements.

Acquisition Areas	Hectares (Acres)
White Wolf	6,475 (16,000)
Old Headquarters	10,725 (26,500)
Tri-Centennial	2,914 (7,200)
Bi-Centennial	4,330 (10,700)
Michener Ranch	648 (1,600)
Total	25,090 (62,000)

A further action under the Tejon Ranch Conservation and Land Use Agreement was the establishment of the Tejon Ranch Conservancy. The Conservancy was charged with stewardship of the conserved lands on the Ranch, including the eventual preparation of a conservation/management plan for these lands. In order to more effectively maintain, enhance, and restore the conservation values of these lands, the Conservancy is coordinating systematic surveys to document the natural resources on these lands, particularly the occurrence of any rare species.

The Conservancy contracted with the California State University-Stanislaus, Endangered Species Recovery Program (ESRP) to conduct surveys for mammal species on the acquisition lands. Objectives of these surveys were to (1) document the occurrence of all mammal species detected in the acquisition areas, (2) conduct more focused efforts to detect the presence of rare species (federal or state listed species and species of special concern), and (3) provide any recommendations for the long-term conservation of mammal species occurring in the acquisition areas and elsewhere on the ranch. Surveys only were conducted for terrestrial species and therefore did not include bats.

STUDY AREAS

Surveys were conducted on the 4 largest acquisition areas: White Wolf, Old Headquarters, Tri-Centennial, and Bi-Centennial. The White Wolf and Old Headquarters acquisition areas are located on the San Joaquin Valley side of Tejon Ranch (Figure 2). Grasslands comprising a diversity of native and non-native grasses and forbs are the dominant habitat in these areas. Oak (*Quercus spp.*) woodlands are present, mostly at the slightly higher eastern margins of the areas. Limited riparian communities occur along some of the major creek drainages.

The Tri-Centennial and Bi-Centennial acquisition areas are located on the Antelope Valley side of the Ranch (Figure 2). These 2 areas are contiguous with pronounced north-south and east-west habitat gradients. Grasslands comprising a diversity of native and non-native grasses and forbs dominate the southern portions, which are lower in elevation. The northern portions of the areas are higher in elevation and support oak woodlands, juniper woodlands, and chaparral habitats. The eastern portion of the 2 areas is markedly more arid with a trend toward more mesic conditions in the western portion.

Notably, Joshua tree (*Yucca brevifolia*) woodlands cover considerable areas in the eastern portion. Riparian communities occur along the major creek drainages.

Almost all of the lands within the acquisition areas are grazed by cattle. Cattle production historically and currently is a primary source of revenue for Tejon Ranch. Some game harvests are conducted within the acquisition areas during the appropriate seasons. Otherwise, public access to the Ranch is highly restricted.

METHODS

TARGET SPECIAL STATUS SPECIES

The purpose of the surveys was to document mammal species occurring on the acquisition areas (except for bats), but particular effort was directed toward detecting special status species that might occur on the areas (Table 2).

Table 2. Special status mammal species potentially occurring on the acquisition areas of Tejon Ranch, California.

Common name	Scientific name	Federal status[1]	California status[2]	Notes
San Joaquin kit fox	*Vulpes macrotis mutica*	Endangered	Threatened	Potential habitat on White Wolf and Old Headquarters
Badger	*Taxidea taxus*	-	Species of Special Concern	Potential habitat on all areas
Ringtail	*Bassariscus astutus*	-	Fully protected species	Potential habitat in upper elevations of all areas
Giant kangaroo rat	*Dipodomys ingens*	Endangered	Endangered	Potential habitat on White Wolf and Old Headquarters
Short-nosed kangaroo rat	*Dipodomys nitratoides brevinasus*	Species of Concern	Species of Special Concern	Potential habitat on White Wolf and Old Headquarters
San Joaquin antelope squirrel	*Ammospermophilus nelsoni*	Species of Concern	Threatened	Potential habitat on White Wolf and Old Headquarters
Tehachapi pocket mouse	*Perognathus alticolus inexpectatus*	Species of Concern	Species of Special Concern	Potential Habitat on Tri-Centennial, Bi-Centennial, and Michener
Tulare grasshopper mouse	*Onychomys torridus tularensis*	Species of Concern	Species of Special Concern	Potential habitat on White Wolf and Old Headquarters
Buena Vista Lake Shrew	*Sorex ornatus relictus*	Endangered	Species of Special Concern	Potential Habitat on Tri-Centennial, Bi-Centennial, and Michener

1 From U.S. Fish and Wildlife Service 1998.

2 From California Department of Fish and Game 2009.

CAMERA STATION SURVEYS

Automated digital field cameras (Stealth Cam 3.0 MP Digital Scouting Cameras, Stealth Cam LLC, Bedford, TX; Cuddeback 3.0 MP Digital Scouting Camera, Non Typical, Park Falls, WI) were deployed in an effort to detect the presence and relative abundance of

medium to large sized mammals. The cameras were secured to 1.2-m (4-ft) U-posts with zip-ties. A can of cat food was staked to the ground approximately 2 m in front of each camera using tent stakes. Camera stations were distributed throughout the acquisition areas (Appendix A), and each station was left in place for approximately 2-4 weeks. On the San Joaquin Valley acquisition areas, camera stations were established in locations that that appeared to comprise suitable habitat for San Joaquin kit foxes and badgers. On the Antelope Valley acquisition areas, stations were established in locations that appeared to comprise suitable habitat for badgers or ringtails. We measured camera success as the total number of visits by distinct individuals (as tallied on a per-night basis) divided by the number of camera-nights (one camera operational for one night = one camera-night).

LIVE-TRAPPING

Live-trapping was conducted to assess the presence and abundance of small mammals on the acquisition areas (Appendix A). We used aluminum Sherman box traps (7.5 x 9.5 x 30 cm) modified to avoid injury to long-tailed animals such as kangaroo rats. Traps were deployed along transects and were spaced approximately 10-m apart. The traps were opened in the evening, baited with white millet seed, and provisioned with synthetic batting to provide insulation. All animals captured were identified to species, aged, sexed, belly-marked with a felt-tipped non-toxic marker, and released at the capture site.

On the White Wolf and Old Headquarters areas, 4 pairs of trapping transects were established with each transect consisting of 25 traps. Thus, a total of 200 traps was set on each area and trapping was conducted for 3 nights. Locations for transects were chosen to sample a diversity of habitats, but also to increase the probability of detecting short-nosed kangaroo rats.

A different approach was employed on the Tri-Centennial and Bi-Centennial areas so that more areas could be sampled. On the Tri-Centennial area, 8 pairs of transects were established with each transect consisting of 10 traps. Due to inclement weather, trapping was only conducted for 2 nights. On the Bi-Centennial area, 8 pairs of transects were established, but trapping was conducted for 3 nights on 6 transects, 2 nights on the 7th transect, and 1 night on the 8th transect. On the Tri-Centennial and Bi-Centennial areas, locations for transects were chosen to sample a diversity of habitats, but also to increase the probability of detecting Tehachapi pocket mice.

SPOTLIGHT SURVEYS

Spotlight surveys were conducted by driving slowly (10-15 km/hr) along roads throughout the acquisition areas while the driver and a passenger shined 2-million-candlepower spotlights out opposite sides of the vehicle. Upon observing an animal or its eye-shine, the vehicle was stopped while the observer attempted to identify the species using binoculars. Surveys were conducted for approximately 2 hours and routes varied nightly. Generally, survey routes covered 15-25 km.

OPPORTUNISTIC OBSERVATIONS

Opportunistic observations of mammal species occurring on the acquisition areas also were recorded. Such observations were recorded during reconnaissance visits and during the conduct of the survey and trapping efforts described above. These observations

included direct observations of species and also of diagnostic sign associated with a given species (e.g., scats, tracks, burrows, etc.). GPS coordinates were recorded for locations of any special status species observed.

RESULTS

CAMERA STATION SURVEYS

Camera stations were deployed from 22 December 2009 to 14 January 2010 on the White Wolf area, 24 November to 17 December 2010 on the Old Headquarters area, and 12-28 April 2010 on the Bi-Centennial and Tri-Centennial areas. By far, most images recorded by the cameras were of cows. Coyotes, striped skunks, and feral pigs were the wildlife species most commonly detected by the cameras (Table 3). San Joaquin kit fox was detected on 2 nights in the White Wolf area (Figure 3). Five species were detected on White Wolf, 9 species on Old Headquarters, 3 species on Bi-Centennial, and 7 species on Tri-Centennial.

Table 3. Wildlife species detected at automated digital camera stations on the acquisition areas of Tejon Ranch, California.

	Acquisition Area							
	White Wolf (138 nights)		Old Headquarters (138 nights)		Bi-Centennial (104 nights)		Tri-Centennial (90 nights)	
Species[1]	No. Obs.	No. per night	No. Obs.	No. per night	No. Obs.	No. per night	No. Obs.	No. per night
Coyote	7	0.05	20	0.14	2	0.02	10	0.11
Kit fox	2	0.01	-	-	-	-	-	-
Gray fox	-	-	8	0.06	1	0.01	-	-
Red fox	-	-	1	0.01	-	-	-	-
Bobcat	-	-	2	0.01	-	-	1	0.01
Striped skunk	9	0.07	12	0.09	-	-	-	-
Spotted skunk	-	-	1	0.01	-	-	-	-
Raccoon	3	0.02	4	0.03	-	-	-	-
Unidentified canid	1	0.01	-	-	-	-	-	-
Antelope squirrel	-	-	-	-	-	-	7	0.08
Ground squirrel	-	-	-	-	3	0.03	1	0.01
Kangaroo rat	-	-	-	-	-	-	1	0.01
Jackrabbit	2	0.01	2	0.01	-	-	5	0.06
Feral pig	-	-	11	0.08	-	-	-	-
Bird	-	-	-	-	-	-	2	0.02

1 Coyote – Canis latrans; Kit fox (San Joaquin) – *Vulpes macrotis mutica*; Gray fox – *Urocyon cinereoargenteus*; Red fox – *Vulpes vulpes*; Bobcat – *Lynx rufus*; Striped skunk – *Mephitis mephitis*; Spotted skunk – *Spilogale gracilis*; Raccoon – *Procyon lotor*; Antelope squirrel (white-tailed) – *Ammospermophilus leucurus*; Ground squirrel (California) – *Spermophilus beechyi*; Jackrabbit – *Lepus californicus*; Feral pit – *Sus scrofa*; Birds were California quail (*Callipepla californica*) and unidentified sparrow.

2 One night = 1 camera-station deployed and operational for 1 night.

Figure 3. San Joaquin kit fox images from automated digital camera stations on the White Wolf acquisition area, Tejon Ranch, California, December 2009.

LIVE-TRAPPING

Live-trapping for small mammals was conducted during 2-4 December 2009 on the White Wolf area, 4-6 November 2009 on the Old Headquarters area, 27-29 April 2010 on the Bi-Centennial area, and 14-15 April 2010 on the Tri-Centennial area. Across all areas, 12 different rodent species were captured with 3 caught on White Wolf, 4 on Old Headquarters, 5 on Bi-Centennial, and 7 on Tri-Centennial (Table 4). Heermann's kangaroo rats (*Dipodomys heermanni*) were the most frequently captured species on the White Wolf and Old Headquarters areas, while deer mice (*Peromyscus maniculatus*) were the most frequent on Bi-Centennial and Panamint kangaroo rats (*Dipodomys panamintinus*) were the most frequent on Tri-Centennial. Five individuals of one sensitive species, the Tehachapi pocket mouse (*Perognathus alticolus inexpectatus*), were captured on the Bi-Centennial and Tri-Centennial areas (Figure 4).

Figure 4. Tehachapi pocket mice captured in the Bi-Centennial and Tri-Centennial acquisition areas, Tejon Ranch, California, April 2010.

Table 4. Small mammals captured during live-trapping on the acquisition areas of Tejon Ranch, California.

	Acquisition Area							
	White Wolf (600 trapnights)		Old Headquarters (600 trapnights)		Bi-Centennial (318 trapnights)		Tri-Centennial (419 trapnights)	
Species[1]	No.	No. per 100 TN	No.	No. per 100 TN	No.	No. per 100 TN	No.	No. per 100 TN
Heermann's kangaroo rat	40	6.7	9	1.5	-	-	-	-
Panamint kangaroo rat	-	-	-	-	14	4.4	52	12.4
San Joaquin pocket mouse	2	0.3	3	0.5	-	-	-	-
Little pocket mouse	-	-	-	-	-	-	1	0.2
Tehachapi pocket mouse	-	-	-	-	2	0.6	3	0.7
California pocket mouse	-	-	3	0.5	-	-	-	-
Deer mouse	5	0.8	3	0.5	31	9.7	41	9.8
Brush mouse	-	-	-	-	-	-	1	0.2
Grasshopper mouse	-	-	-	-	1	0.3	-	-
White-tailed antelope squirrel	-	-	-	-	-	-	1	0.2
Desert woodrat	-	-	-	-	-	-	2	0.5
Dusky-footed woodrat	-	-	-	-	1	0.3	-	-
Total	47		18		49		101	
Total per 100 TN	7.8		3.0		15.4		24.1	

1 Heermann's kangaroo rat – *Dipodomys heermanni*; Panamint kangaroo rat – *Dipodomys panamintinus*; San Joaquin pocket mouse – *Perognathus inornatus*; Little pocket mouse – *Perognathus longimembris*; Tehachapi pocket mouse – *Perognathus alticolus inexpectatus*; California pocket mouse – *Chaetodipus californicus*; Deer mouse – *Peromyscus maniculatus*; Brush mouse – *Peromyscus boylii*; Grasshopper mouse – *Onychomys torridus*; White-tailed antelope squirrel – *Ammospermophilus leucurus*; Desert woodrat – *Neotoma bryanti*; Dusky-footed woodrat – *Neotoma macrotis*..

SPOTLIGHT SURVEYS

Three spotlight surveys were conducted on the White Wolf and Old Headquarters areas, and 1 was conducted on the Tri-Centennial area. None were conducted on the Bi-Centennial area. Spotlight survey efforts were limited on the Bi-Centennial and Tri-Centennial areas because the probability of observing special status species was considered low. Instead, efforts were redirected to deploying additional camera stations and additional small mammal trap lines.

During spotlight surveys, 9 species were observed (Table 5). Of particular note, 2 kit foxes were observed on the White Wolf area.

OPPORTUNISTIC OBSERVATIONS

The presence of a number of other species was recorded through opportunistic observations of animals or their sign. In general, most of these observations were of species considered to be common. However, several observations of kit fox scats and tracks (Figure 5) on the White Wolf and Old Headquarters areas helped to confirm the presence of this species in those areas. Also, badger diggings were observed in the White Wolf area. A list of all mammalian species detected on the acquisition areas by any means is provided in Appendix B.

Table 5. Species observed during spotlight surveys on the acquisition areas of Tejon Ranch, California.

Species[1]	Acquisition Area		
	White Wolf (3 surveys)	Old Headquarters (3 surveys)	Tri-Centennial (1 survey)
Coyote	3	1	-
Kit fox	2	-	-
Unidentified canid	1	-	-
Bobcat	2	-	-
Striped skunk	2	-	-
Raccoon	-	1	-
Jackrabbit	9	1	5
Feral pig	-	28	-
Burrowing owl	2	-	-
Long-eared owl	2	-	1
Unidentified owl	4	-	-

1 Coyote – *Canis latrans*; Kit fox (San Joaquin) – *Vulpes macrotis mutica*; Bobcat – *Lynx rufus*; Striped skunk – *Mephitis mephitis*; Raccoon – *Procyon lotor*; Jackrabbit – *Lepus californicus*; Feral pit – *Sus scrofa*; Burrowing owl – *Athene cunicularia*; Long-eared owl - *Asio otus*.

Figure 5. Kit fox scat and track from the White Wolf acquisition area, Tejon Ranch, California, November 2009.

DISCUSSION

The surveys conducted by ESRP were essentially "rapid assessment" in nature. Thus, all mammal species present in the acquisition areas were not likely detected, and the lists of species presented in this report should not be considered exhaustive. Further survey efforts will undoubtedly detect additional species. Despite the relatively short-term nature of the surveys, 28 mammal species were documented on the acquisition areas (Appendix B): 12 on White Wolf, 17 on Old Headquarters, 12 on Bi-Centennial, and 13 on Tri-Centennial. Most species were known or suspected to occur in the acquisition areas. Included among those detected were 3 special status species: San Joaquin kit fox, Tehachapi pocket mouse, and badger.

SAN JOAQUIN KIT FOX

Detections of San Joaquin kit foxes (i.e., spotlight observations and tracks) were relatively common in the White Wolf area (Figure 6), particularly in the northwest portion of this area where the vegetation structure is shorter with areas of exposed ground and where kangaroo rats appear to be abundant. Kit foxes are adapted to arid environments and a relatively short, open vegetation structure facilitates mobility and predator detection. Furthermore, kangaroo rats, which also are adapted to arid environments, are a preferred prey item for kit foxes, and fox abundance generally is positively related to kangaroo rat abundance (Grinnell et al. 1937, McGrew 1979, Cypher 2003). Other portions of the White Wolf area are characterized by tall, relatively dense grass, and therefore are less optimal for kit foxes. For example, the 2 southern-most small mammal traplines in this area (Appendix A) were in dense grassland, and no kangaroo rats were captured on these lines and no kit fox sign was detected near these lines. Kit foxes may still use these less optimal areas, but probably more intermittently or for dispersal. Based on current habitat conditions, 2 to 5 kit fox pairs might be using the White Wolf area.

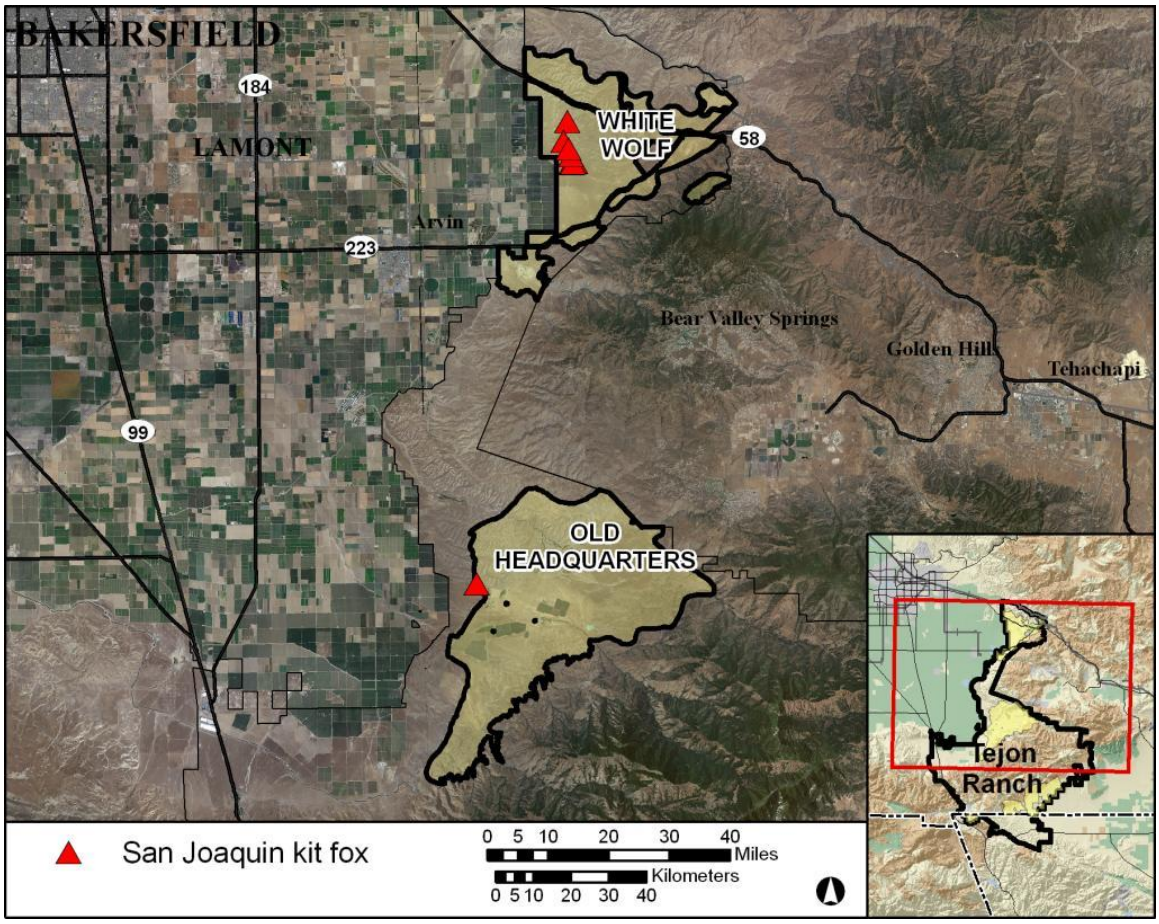

Figure 6. Locations of kit fox observations and sign on the White Wolf and Old Headquarters acquisition areas, Tejon Ranch, California, 2009.

Kit foxes also appear to be present in the Old Headquarters area. Two kit fox scats were found during small mammal trapping efforts (Figure 6). Also, a potential kit fox den and a possible sighting of a kit fox both were reported in this area during the past year (M.

White, Tejon Ranch Conservancy, personal communication). The kit fox scats and the possible sighting all were located in the vicinity of the Tejon Hills in the northwest portion of the Old Headquarters area. The Tejon Hills are characterized by a relatively low, open vegetation structure, and kangaroo rats are abundant in this area based on small mammal trapping efforts. Thus, habitat suitability for kit foxes is good. Much of the rest of the Old Headquarters area is characterized by tall, relatively dense grass and may be less suitable. As in the White Wolf area, kit foxes might still use this less optimal habitat, but probably more intermittently or for dispersal.

The frequency of kit fox detections in the White Wolf area indicates that foxes likely are resident there and not just transient. Foxes also may be resident in the Tejon Hills portion of the Old Headquarters area. Based on current habitat conditions, 2 to 5 kit fox pairs potentially might be using each area. If so, then these areas may support small "satellite" populations of kit foxes, which could contribute significantly to range-wide conservation and recovery. Such populations increase the size of the overall metapopulation thereby further buffering the species against catastrophic or stochastic declines and reducing extinction risk. Thus, conservation of both areas to benefit San Joaquin kit foxes is warranted. Also, conserving these areas would contribute to Recovery Task 2.2.20 in the recovery plan for kit foxes which specifically calls for protecting habitat in the Comanche Point and Tejon Hills areas for kit foxes (U.S. Fish and Wildlife Service 1998). The Tejon Ranch has already committed to conserving the Comanche Point area (Tejon Ranch Company 2008).

Furthermore, kit foxes also appear to be present in the Comanche Point area of Tejon Ranch, which is located between the White Wolf and Old Headquarters acquisition areas (K. Babcock, DUDEK, personal communication) and is an extension of the Tejon Hills. The presence of kit foxes in these 3 areas is significant from the perspective of region habitat connectivity for this species. Recovery Task 5.3.8 in the recovery plan for kit foxes (U.S. Fish and Wildlife Service 1998) calls for maintaining a linkage area for kit foxes and other species along the southern edge of the San Joaquin Valley from McKittrick over to the Kern River. The presence of kit foxes on the White Wolf, Comanche Point, and Old Headquarters areas indicates that Tejon Ranch lands currently constitute a viable linkage along the southeastern edge of the San Joaquin Valley, and maintaining this linkage through conservation of these areas will contribute to recovery efforts for this species.

The presence of San Joaquin kit foxes on Tejon Ranch constitutes a positive situation that could benefit the range-wide conservation of the species, as described above. Habitat management and enhancement potentially could increase the security and persistence of kit foxes on the Ranch, and could facilitate the expansion of suitable habitat for foxes possibly resulting in an increase in abundance. Currently, some portions of the acquisition areas and other areas on the Ranch have suitable terrain for kit foxes (e.g., flat to gently rolling), but have a relatively tall, dense vegetation structure. Commonly, this structure is a product of community invasion by non-native grasses (e.g., *Avena* spp., *Bromus* spp.). Management strategies that reduce the vegetation height and density to produce a shorter, sparser structure could increase predator detection and prey availability (e.g., kangaroo rats) thereby improving habitat suitability for kit foxes. Grazing is probably the most practical and effective strategy for managing vegetation on the Ranch. A grazing program and infrastructure are already in place on most Ranch lands. Improvements in habitat suitability might be achieved simply by altering the timing and

intensity of grazing to further reduce vegetation density. Furthermore, improving habitat suitability for kit foxes also would benefit other special status species that share similar habitat requirements, such as blunt-nosed leopard lizards (*Gambelia sila*), San Joaquin antelope squirrels, short-nosed kangaroo rats, and Tulare grasshopper mice.

Habitat suitability for kit foxes also might be enhanced through the installation of artificial dens. Kit foxes are critically dependent on dens for avoiding predators, avoiding temperature extremes, conserving moisture, daytime resting, and rearing young. On average, each kit fox annually uses approximately 11 different dens, which are scattered around its home range (Koopman et al. 1998). Den availability may be a limiting factor in areas that are used intermittently by foxes or that are used primarily for movement (e.g., dispersal). The installation of artificial dens can provide additional refugia that could facilitate use of or movement through an area by kit foxes. Artificial den materials are relatively inexpensive (<$100 per den), easy to install, and readily used by kit foxes (B. Cypher, CSUS ESRP, unpublished data).

TEHACHAPI POCKET MOUSE

Five individual Tehachapi pocket mice were captured in the Bi-Centennial and Tri-Centennial areas in just 5 nights of live-trapping. These 5 individuals were captured in 4 locations (Figure 7). All 4 locations were in arid shrub communities on slopes (Fig. 8). On the Bi-Centennial area where 2 individuals were captured, one site was dominated by manzanita (*Arctostaphylos* spp.) and the other site was dominated by Joshua tree, California buckwheat (*Eriogonum fasiculatum*), and cheesebush (*Hymenoclea salsola*). The 2 sites on Tri-Centennial where 3 individuals were captured were dominated by California buckwheat and goldenbush (*Ericameria* spp.) with sparse juniper (*Juniperus* spp.). Tehachapi pocket mice are reported to occur in arid forest, shrub, and grassland communities (Best 1994). They apparently have even been found in rangeland dominated by non-native grasses and anthropogenically altered habitats such as fallow grain fields dominated by tumbleweed (*Salsola* spp.) (Williams 1986). On Tejon Ranch and elsewhere, Tehachapi pocket mice occur in areas subject to moderate grazing indicating that this is probably a compatible land use for this species.

In addition to the 5 individuals captured during this survey, a pocket mouse was captured in Bronco Canyon in the Bi-Centennial area in 2001 (J. Patton, University of California-Berkeley, personal communication), and another was captured just west of the Bi-Centennial area in 2003 (CNDDB 2010). The distribution of capture locations and the frequency of captures indicate that Tehachapi pocket mice probably are widely distributed throughout the Bi-Centennial and Tri-Centennial areas. The total range for the Tehachapi pocket mouse is comparatively restricted. The known range extends from the mountains just each of Tehachapi across the Transverse Ranges to about Mt. Pinos, and along the north slope of the nearby San Gabriel Mountains from about the Interstate 5 corridor eastward to about Lake Elizabeth (Williams et al. 1993). Thus, Tejon Ranch and the Bi-Centennial and Tri-Centennial acquisition areas appear to encompass a large portion of this range, and preserving habitat in these areas clearly would contribute significantly to the conservation of this species.

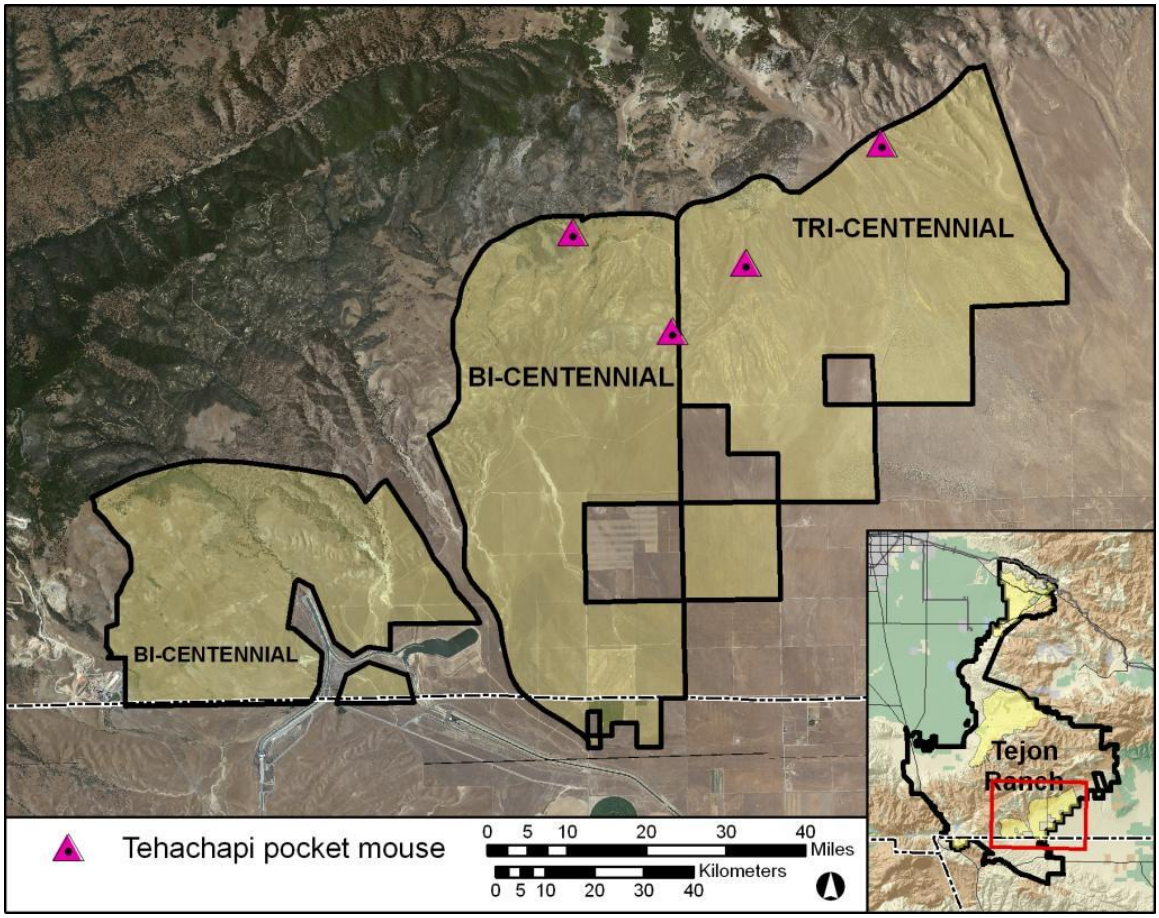

Figure 7. Locations of Tehachapi pocket mouse captures on the Bi-Centennial and Tri-Centennial acquisition areas, Tejon Ranch, California, April 2010.

Figure 8. Example habitats where Tehachapi pocket mice were captured on the Tri-Centennial and Bi-Centennial acquisition areas, Tejon Ranch, California, April 2010.

OTHER SPECIES

Badger was the only other special status species detected during the surveys. Badgers have been observed in many locations on Tejon Ranch and appear to be relatively widespread. This species probably occurs on all of the acquisition areas. Despite being a

California species of special concern, badgers apparently are occasionally legally harvested on the Ranch.

Ringtails were not detected during the surveys. However, ringtails characteristically occur at low densities and are difficult to detect, particularly during short-duration surveys. Also, the relatively open habitats prevalent throughout much of the acquisition areas are less optimal for this species. Ringtails generally favor dense brushy or forested cover in proximity to water (Orloff 1988). Ringtails probably occur on Tejon Ranch and potentially could occur on the acquisition areas, particularly in riparian areas, rocky canyons, and chaparral habitat. Accordingly, the greatest potential for this species may be in the Bi-Centennial and Tri-Centennial areas.

Giant kangaroo rats, short-nosed kangaroo rats, and San Joaquin antelope squirrels generally prefer more arid conditions than are present in the White Wolf and Old Headquarters areas. The highest potential for these species in the acquisition areas may be the northwest portion of the White Wolf area. On Tejon Ranch, the highest potential for these species probably is in the Comanche Point area where a population of blunt-nosed leopard lizards is known to occur. Blunt-nosed leopard lizards typically occur in habitat conditions favored by giant kangaroo rats, short-nosed kangaroo rats, and San Joaquin antelope squirrels (U.S. Fish and Wildlife Service 1998).

The probability of occurrence of Tulare grasshopper mice on the White Wolf and Old Headquarters areas is high. This species typically occurs in very low densities and is difficult to detect. The highest potential for this species is probably in the more sparsely vegetated Tejon Hills of the Old Headquarters area and northwest portion of the White Wolf area.

The methods employed during the surveys were not appropriate for detecting Buena Vista Lake shrew. The distribution and habitat requirements of this species are poorly defined. However, the shrews generally are found in perennial wetland and riparian areas where soil stays moist, even if surface water is not always present. Focused surveys for shrews could be conducted in locations with appropriate habitat conditions in the White Wolf and Old Headquarters areas. However, it should be noted that the taxonomic relationships of ornate shrews in the San Joaquin Valley are unresolved and it is possible that any ornate shrews occurring on Tejon Ranch might not be Buena Vista Lake shrews. Thus, any shrews captured on the Ranch should be genetically sampled and tested to verify identification.

Despite the relatively short duration of the survey effort, 28 species were detected, including a diversity of rodents (14 species) and carnivores (9 species). As expected, many non-special status species were detected. Among these were 2 non-native species, red foxes (Figure 9) and feral pigs. Red foxes have been increasing in the San Joaquin Valley in the past 2 decades (B. Cypher, personal observation). The effects of this species on native wildlife are unknown. Of potential concern are impacts to endangered kit foxes through interference and exploitation competition (Cypher et al. 2001, Clark et al. 2005). However, there is no evidence to suggest that red foxes are displacing kit foxes. In an interesting ecological dynamic, coyotes appear to effectively limit or even exclude red foxes in natural habitats (Cypher et al. 2001). Thus, red foxes in the San Joaquin Valley are mostly relegated to anthropogenic habitats such as agricultural and urban areas. Indeed, the red fox detected in the Old Headquarters area was captured on a

camera located approximately 1.5 km south of the nut orchards and vineyards along Chiminez Road.

Figure 9. Red fox image from an automated digital camera station on the Old Headquarters acquisition area, Tejon Ranch, California, December 2009.

Feral pigs also were commonly observed during the surveys. The pigs have been present on the Ranch for over a decade. The impacts of feral pigs on native fauna and flora are abundantly documented. Feral pigs are heavily harvested on Tejon Ranch through a hunting program, and this may help reduce numbers. However, control of feral pig populations is difficult to achieve.

CONCLUSIONS AND RECOMMENDATIONS

The mammal surveys conducted by ESRP helped further document the immense biodiversity on Tejon Ranch, with particular emphasis on the White Wolf, Old Headquarters, Bi-Centennial, and Tri-Centennial acquisition areas. These surveys also contributed significantly to Recovery Task 3.2.23 in the *Recovery Plan for Upland Species of the San Joaquin Valley*, California (U.S. Fish and Wildlife Service 1998). This task calls for surveys to be conducted for special status animals along the southeastern and southern edge of the San Joaquin Valley. During the surveys, 28 mammal species were detected. The surveys also helped to further document the presence and distribution of 3 special status species: San Joaquin kit fox, Tehachapi pocket mouse, and badger.

RECOMMENDATIONS

Based on the results of this project, the following recommendations are offered:

1. Conduct additional surveys for special status mammal species

The surveys conducted by ESRP were of limited scope and duration. Additional survey efforts may detect additional special status species as well as provide additional distribution and abundance information on previously detected special status species (i.e., San Joaquin kit fox, Tehachapi pocket mouse, badger).

2. Conserve habitat in the White Wolf and Old Headquarters areas for San Joaquin kit foxes

Small populations of San Joaquin kit foxes may be present in the White Wolf and Old Headquarters acquisition areas. Conserving habitat in these areas would facilitate population security and persistence. Particularly important habitat occurs in the northwest portion of the White Wolf area and the Tejon Hills portion of the Old Headquarters area. Conserving habitat in these acquisition areas also would help maintain habitat connectivity and movement corridors through the southeastern edge of the San Joaquin Valley. Conserving existing populations and maintaining connectivity both would contribute significantly to range-wide conservation and recovery of San Joaquin kit foxes.

3. Manage and enhance habitat for kit foxes

Habitat management and enhancement could increase kit fox population security and persistence, and even could facilitate population increase and expansion. In particular, maintaining a relatively low, open vegetation structure would increase predator detection and possibly prey abundance for kit foxes. Vegetation management would probably best be achieved through grazing. A grazing plan that aims to increase and maintain habitat suitability for kit foxes should be developed and implemented, at least in areas considered important for kit foxes as described above. Tejon Ranch may already be considering preparing such a plan (K. Babcock, DUDEK, personal communication). Habitat for kit foxes could be further enhanced through the installation of artificial dens. Artificial dens would increase kit fox capacity for occupying and moving through areas.

4. Gather information on San Joaquin kit foxes

Few data are available on satellite populations of kit foxes (i.e., those populations outside of the Carrizo Plain, western Kern County, and Ciervo-Panoche core areas), and virtually nothing is known about kit fox populations on Tejon Ranch. Gathering data on kit foxes on the Ranch through scientific research and monitoring would provide critical information necessary for conserving fox populations on the Ranch as well as elsewhere. Particularly important data would include distribution, abundance, population trends, demographic patterns (e.g., survival, mortality sources, reproductive rates, dispersal patterns), and ecological parameters (e.g., food habits, space use, den use patterns, interspecific interactions). Also of importance is determining whether Tejon Ranch kit

fox populations are isolated or whether exchange is occurring with neighboring populations. This could be assessed through telemetry methods or genetic analysis.

5. Conserve habitat in the Bi-Centennial and Tri-Centennial areas for Tehachapi pocket mice

Tehachapi pocket mice appear to be relatively widespread and abundant in the Bi-Centennial and Tri-Centennial acquisition areas. These areas and Tejon Ranch in general encompass a substantial portion of the entire range of the Tehachapi pocket mouse. Thus, conserving the habitat in these areas would contribute significantly to the conservation of this species. Current uses and activities in these areas appear to be compatible with this species and thus would not be affected.

6. Gather information on Tehachapi pocket mice

Virtually nothing is known about Tehachapi pocket mice other than its taxonomic relationship to related species. Gathering data on this species through scientific research and monitoring would provide critical information necessary for conserving Tehachapi pocket mouse populations on Tejon Ranch as well as elsewhere. Particularly important data would include distribution, abundance, population trends, demographic patterns (e.g., survival rates, reproductive rates), and ecological parameters (e.g., preferred habitat types and attributes, space use, burrow attributes and use patterns, interspecific interactions).

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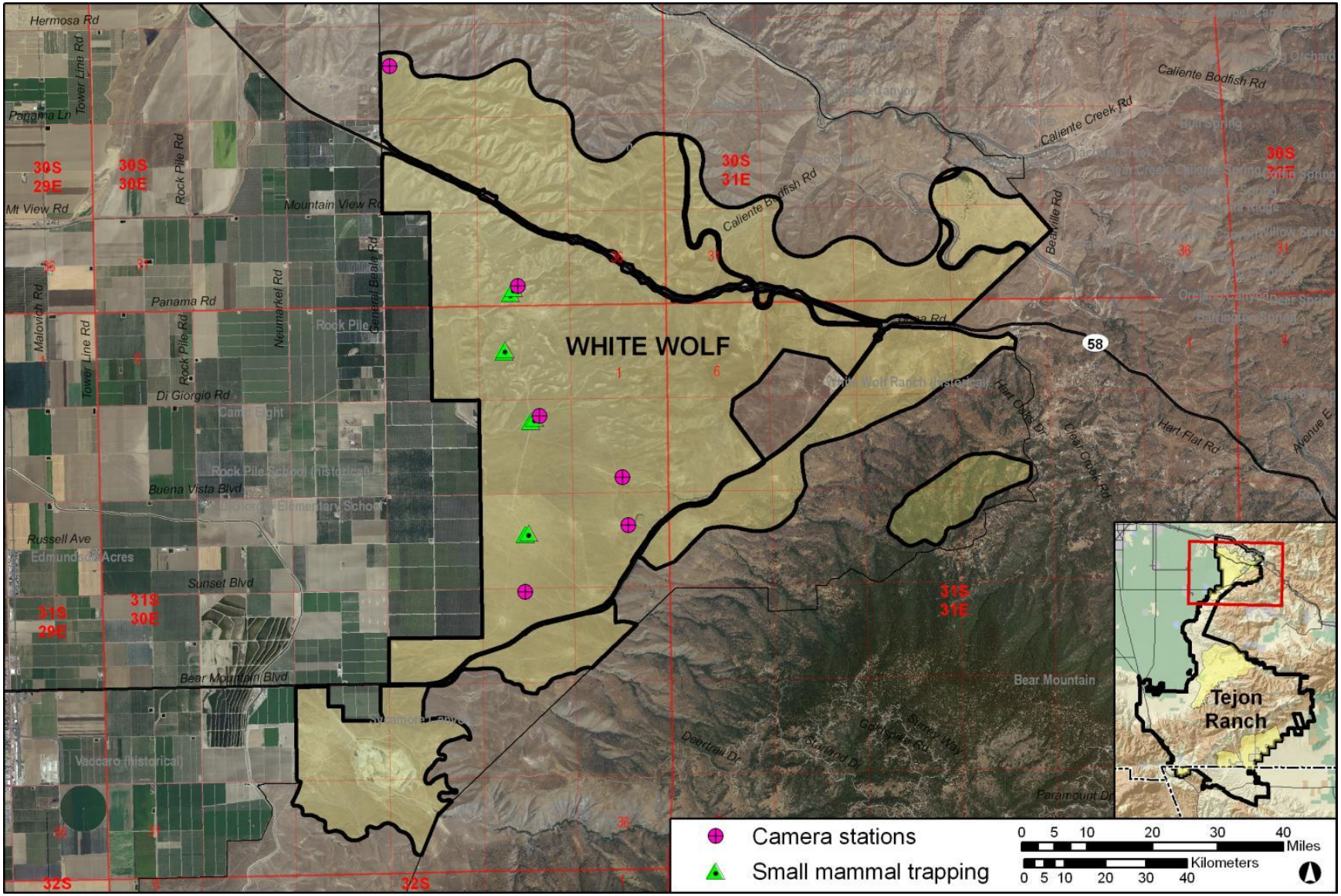
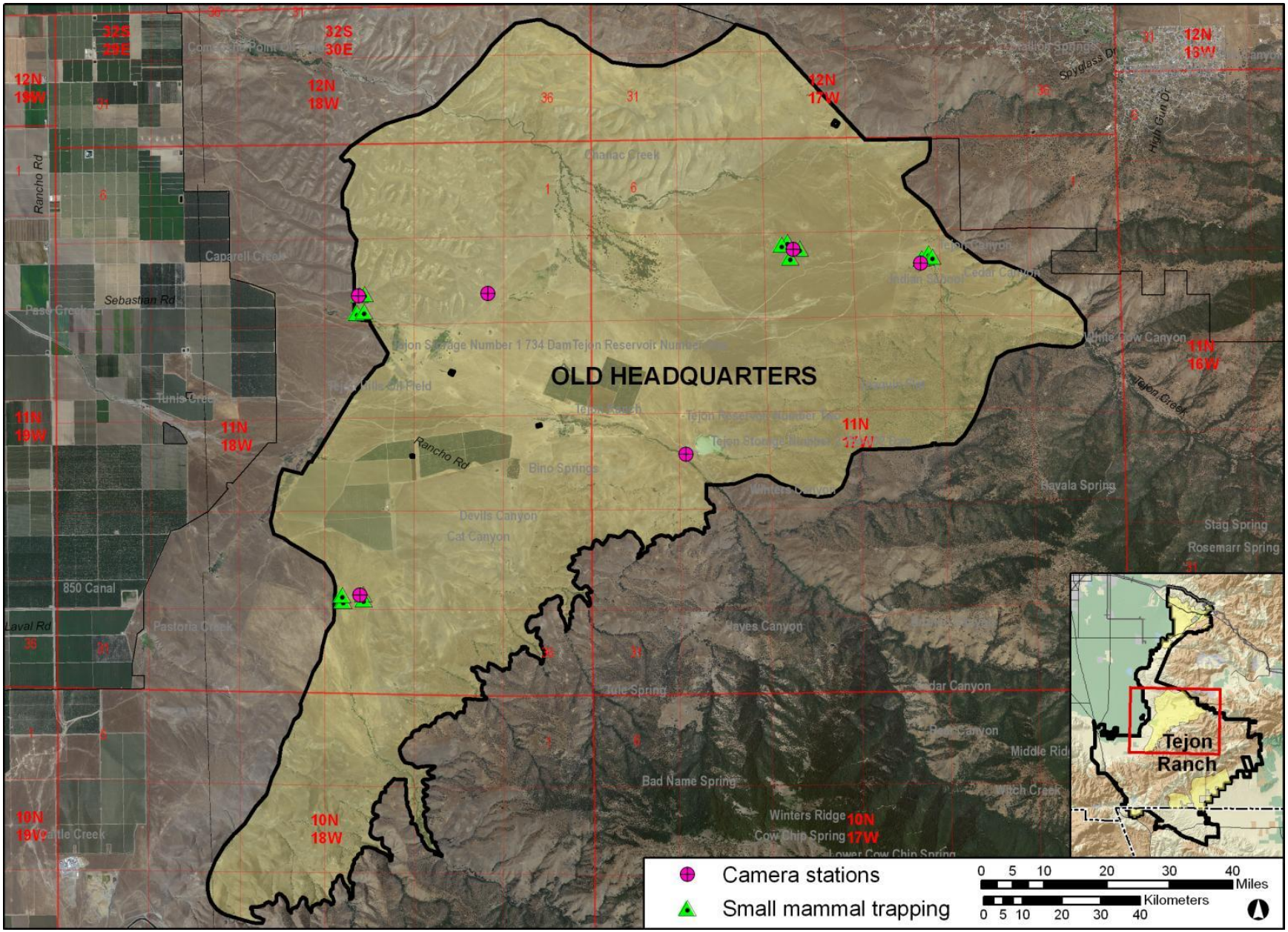
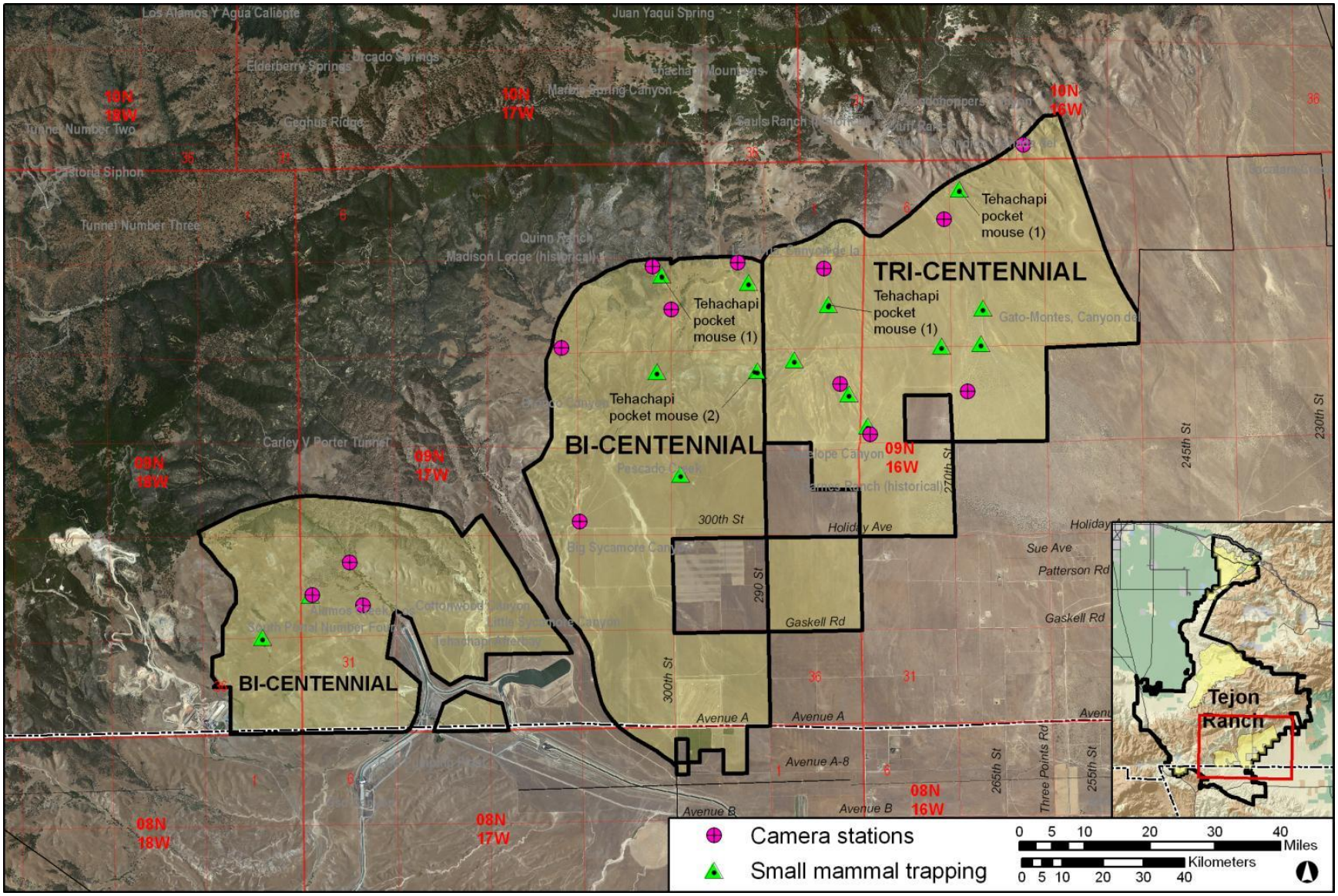
APPENDIX A. LOCATIONS OF CAMERA STATIONS AND SMALL MAMMAL TRAP LINES ON TEJON RANCH ACQUISITION AREAS



Camera stations and small mammal trap lines on the White Wolf acquisition area of Tejon Ranch.



Camera stations and small mammal trap lines on the Old Headquarters acquisition area of Tejon Ranch.



Camera stations and small mammal trap lines on the Bi-Centennial and Tri-Centennial acquisition area of Tejon Ranch.

APPENDIX B. MAMMALIAN SPECIES DETECTED ON TEJON RANCH ACQUISITION AREAS

The table below includes a list of all mammalian species detected on the White Wolf, Old Headquarters, Bi-Centennial, and Tri-Centennial acquisition areas of Tejon Ranch, California, during surveys conducted by the California State University-Stanislaus, Endangered Species Recovery Program during 2009-2010. Detection codes are as follows: C = Camera station image, S = Spotlight observation, L = Live-trapped, O = Opportunistic observation of animal, F = Scat (fecal) observation, T = Track observation, B = Burrow observation.

Species				**Acquisition Area**			
Order	**Family**	**Genus species**	**Common name**	**White Wolf**	**Old Headquarters**	**Bi-Centennial**	**Tri-Centennial**
Lagomorpha	Leporidae	*Lepus californicus*	Black-tailed jackrabbit	C, S	C, S		C, S
		Sylvilagus audubonii	Desert cottontail	O	O		
Rodentia	Sciuridae	*Ammospermophilus leucurus*	White-tailed antelope squirrel				C, L, O
		Spermophilus beechyi	California ground squirrel	O, B	O, B	C, O, B	C, O, B
	Heteromyidae	*Dipodomys heermanni*	Heermann's kangaroo rat	L	L		
		Dipodomys panamintinus	Panamint kangaroo rat			L	C, L
		Chaetodipus californicus	California pocket mouse		L		
		Perognathus alticolus inexpectatus[2]	Tehachapi pocket mouse			L	L
		Perognathus inornatus	San Joaquin pocket mouse	L	L		
		Perognathus longimembris	Little pocket mouse				L
	Geomyidae	*Thomomys bottae*	Bottae's pocket gopher	B	B	B	B
	Cricetidae	*Neotoma bryanti*	Desert woodrat				L, B
		Neotoma macrotis	Dusky-footed woodrat			L, B	
		Onychomys torridus	Southern grasshopper mouse			L	
		Peromysus boylii	Brush mouse				L
		Peromyscus maniculatus	Deer mouse	L	L	L	L
Carnivora	Felidae	*Lynx rufus*	Bobcat	S, O	C		C
	Canidae	*Canis latrans*	Coyote	C, S, F, T	C, S, F, T	C, O, F, T	C, O, F, T
		Urocyon cinereoargenteus	Gray fox		C	C	
		Vulpes macrotis mutica[3]	San Joaquin kit fox	C, S, F, T	F		
		Vulpes vulpes[4]	Red fox		C		
	Mustelidae	*Taxidea taxus*[2]	Badger	B			
	Mephitidae	*Mephitis mephitis*	Striped skunk	C, S	C		
		Spilogale gracilis	Spotted skunk		C		
	Procyonidae	*Procyon lotor*	Raccoon		S		T
Artiodactyla	Suidae	*Sus scrofa*[4]	Feral pig		C, S	O	
	Cervidae	*Odocoileus hemionus*	Black-tailed deer			F	
	Antilocapridae	*Antilocapra americana*	Pronghorn			O	

1 Taxonomy follows Wilson and Reeder 2005 except for Neotoma species, which follow Patton et al. 2007.
2 Federal Species of Concern, California Species of Special Concern
3 Federal Endangered, California Threatened
4 Non-native