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**EFFECTS OF MILITARY-AUTHORIZED
ACTIVITIES ON THE
SAN JOAQUIN KIT FOX
(Vulpes velox macrotis)
AT CAMP ROBERTS
ARMY NATIONAL GUARD
TRAINING SITE, CALIFORNIA**

October 1992

SANTA BARBARA OPERATIONS
130 Robin Hill Road
Goleta, California 93117

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by

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October 1992

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ABSTRACT

The effects of military-authorized activities on San Joaquin kit fox (*Vulpes velox macrotis*) were investigated at Camp Roberts Army National Guard Training Site from 1988 to 1991. Military-authorized activities included military training exercises, facilities maintenance, new construction, controlled burning, livestock grazing, and public-access hunting. Positive effects of the military included habitat preservation, preactivity surveys, and natural resources management practices designed to conserve kit foxes and their habitat. Perceived negative effects such as entrapment in dens, shootings during military exercises, and accidental poisoning were not observed. Foxes were observed in areas being used simultaneously by military units. Authorized activities were known to have caused the deaths of three of 52 radiocollared foxes recovered dead: one became entangled in concertina wire, one was believed shot by a hunter, and one was struck by a vehicle. Entanglement in communication wire may have contributed to the death of another radiocollared fox that was killed by a predator. Approximately 10% of kit fox dens encountered showed evidence of vehicle traffic, but denning sites did not appear to be a limiting factor for kit foxes.

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1. INTRODUCTION

Section 7 of the Endangered Species Act of 1973 imposes several requirements on Federal agencies concerning listed threatened and endangered species and their designated critical habitat. All Federal agencies, in consultation with the Secretary of the Interior, must exercise their authority to carry out programs to conserve these species. The law requires all Federal agencies to insure that any actions authorized, funded, or carried out by the agency are not likely to jeopardize the continued existence of any listed species, or modify or destroy critical habitat.

Camp Roberts is operated by the California Army National Guard (CA ARNG) with funding from the National Guard Bureau (NGB). Camp Roberts' primary mission is to provide a site where military training requirements of the western United States can be met. Military training activities, new construction projects, routine repair and maintenance activities, and authorized non-military activities conducted at Camp Roberts could adversely affect the endangered San Joaquin kit fox (*Vulpes velox macrotis* formerly *Vulpes macrotis mutica*; Dragoo et al. 1990).

In 1988 the National Guard Bureau sponsored a three year study of the effects of military-authorized activities conducted at Camp Roberts on the kit fox. Results of the study were used to prepare a comprehensive Biological Assessment in partial fulfillment of Section 7 requirements. The research focused on determining the abundance and distribution of kit foxes on the installation, as well as reproductive rates, food habits and sources and rates of mortality.

Concurrent with the preparation of the Biological Assessment, CA ARNG developed a conservation program to ensure that all reasonable measures are taken to prevent kit foxes from being harmed or killed by military and non-military activities. The purpose of the program is to conserve the kit fox by protecting individual foxes and fox habitat through the implementation of policies covering installation-wide operations. One of the policies is a requirement that a biological survey be conducted prior to any project that could potentially harm the kit fox. CA ARNG, with the concurrence of the U. S. Fish and Wildlife Service (FWS), developed and implemented this preactivity survey program designed to conserve and protect kit foxes and their habitat without interfering with the military mission of the installation.

This report summarizes pertinent results of the research and conservation program concerning the effects of military-authorized activities on the San Joaquin kit fox.

2. STUDY AREA

Camp Roberts is located approximately 43 km east of the Pacific Ocean midway between San Francisco and Los Angeles along U. S. Highway 101 in San Luis Obispo and Monterey Counties (Figure 1). Camp Roberts encompasses approximately 172 square kilometers consisting mostly of gently rolling hills that form a transition zone between the Salinas River floodplain and the steep foothills of the Santa Lucia Mountains located in the southwest portion of the post.

Elevation ranges between 161 and 521 meters above sea level. Dominant vegetation associations are grassland, oak (*Quercus* spp.) woodland, mixed chaparral, and riparian habitat. Kit foxes occur mainly in grassland and low to medium density oak woodlands. Kit foxes are also found in the developed areas of the installation where they den under buildings (O'Farrell et al. 1987).

Figure 1. Location of Camp Roberts, Monterey and San Luis Obispo Counties, California.

3. DESCRIPTION OF MILITARY ACTIVITIES

Material in this chapter was adapted from the Camp Roberts Master Plan Report (Nakata and Associates 1987).

The installation is organized under the Adjutant General of the California National Guard to provide training, administrative, and logistical site support to reserve components of the United States Sixth Army area and reserve and active components of other armed service branches including active duty units of the Seventh Infantry Division headquartered at Fort Ord.

3.1 TRAINING ACTIVITIES

Camp Roberts is an important training center for the National Guard and Active Reserve component units throughout the western United States. National Guard and Reserve units generally train one weekend per month and for two weeks in the summer or late spring (Annual Training). The installation supports weekend training throughout the year and experiences its highest troop usage during the Annual Training cycle (May - July). Monthly utilization in terms of peak strength (number of individuals on the installation during the month) and man-days for training years (October - September) 1989 - 1991 are presented in Table 1.

Training activities conducted at Camp Roberts fall into two broad classifications: live-fire exercises and field training exercises. Live-fire exercises involve the use of live ammunition or ordnance and fall into three general types: direct fire, indirect fire, and demolition. All three types of live fire exercises can occur simultaneously at Camp Roberts. There are 24 training ranges that support live fire exercises. Camp Roberts supports live-fire of virtually all infantry weapons except tube-launched, optically tracked, wire-guided (TOW) missiles. Weapons fired range in size from .22 caliber rifles to howitzers firing 203 millimeter (8-inch) diameter shells. All live-fire is directed into a dedicated impact area.

Field training exercises encompass a wide variety of activities and individual exercises can involve anywhere from just a few troops to several thousand troops. Common elements of field training exercises include bivouacking, troop and vehicle maneuvers both on and off-road, construction of fortifications and obstacles, and aerial operations.

Bivouacking involves establishing temporary encampments that may be used for a single night or may be used for up to several weeks. Bivouacs vary depending on the type of exercise. Encampments often involve the use of tents that range in size from one man tents to tents the size of small buildings. Bivouacking activities usually involve the digging of latrines with hand shovels. Larger bivouac sites may require the digging of small sumps (3.5 m x 3.5 m x 3.5 m) for wash water associated with kitchen, shower, and laundry facilities.

Table 1. Utilization of Camp Roberts during training years (Oct-Sep) 1989, 1990 and 1991.

Training Year	Month/Year	Strength	Total Man-Days
1989	Oct 1988	9,500	49,550
	Nov 1988	4,151	19,487
	Dec 1988	1,878	12,466
	Jan 1989	3,543	22,855
	Feb 1989	6,998	35,904
	Mar 1989	7,223	36,168
	Apr 1989	8,811	56,108
	May 1989	10,735	91,875
	Jun 1989	13,784	124,305
	Jul 1989	4,461	59,061
	Aug 1989	4,148	23,712
	Sep 1989	4,609	26,453
	Total		557,944
1990	Oct 1989	4,351	21,384
	Nov 1989	3,628	16,674
	Dec 1989	3,457	38,707
	Jan 1990	4,098	26,195
	Feb 1990	3,429	17,429
	Mar 1990	5,682	24,792
	Apr 1990	5,699	22,330
	May 1990	5,596	56,692
	Jun 1990	10,243	143,456
	Jul 1990	2,705	14,414
	Aug 1990	4,044	35,402
	Sep 1990	3,621	20,106
	Total		437,581
1991	Oct 1990	1,869	15,310
	Nov 1990	3,139	32,710
	Dec 1990	1,703	13,467
	Jan 1991	1,214	11,956
	Feb 1991	4,587	22,403
	Mar 1991	7,160	39,697
	Apr 1991	6,743	54,146
	May 1991	5,709	56,817
	Jun 1991	8,906	107,943
	Jul 1991	3,355	29,888
	Aug 1991	6,967	71,184
	Sep 1991	4,058	21,899
	Total		477,420

Troop maneuvers refer to activities conducted by troops on foot. Such activities include marches, patrols, ambushes and other simulated engagements. Battle simulations often involve firing blank rounds from pistols, rifles, and machine guns. Some exercises involve the use of weapons fitted with laser generators. Laser beams from the weapons activate detectors worn by participating troops. These devices increase the realism of the exercises.

Many types of military vehicles are used during training exercises. Wheeled vehicles range in size from motorcycles and small four-person jeeps to cargo trucks and combat vehicles weighing several tons. Tracked vehicles such as personnel carriers, tanks and self-propelled howitzers weigh up to 60 tons. Vehicle maneuvers include simulated combat exercises, transportation of personnel and equipment, and vehicle testing and evaluation. Although vehicle travel mostly takes place on roads and tank trails, cross country travel by wheeled and tracked vehicles does occur during training exercises.

Combat Engineer units training at Camp Roberts construct fortifications, emplacements, and obstacles to protect troops on the battlefield. Fortifications include bunkers, protection berms, and defilades. Bunkers are constructed by digging a hole, lining it with wooden planks, and covering the top with planks and earth. Protection berms protect vehicles and aircraft parked next to them from flying shrapnel and debris. Berms are constructed by bulldozing earth into a mound of appropriate dimensions for the vehicles or aircraft to be protected. Defilades are wide trenches with sloping ends. Vehicles are parked in defilades so the top of the vehicle is close to ground level. Defilades can be covered with tent material and used as a protective shelter for troops.

Emplacements (fighting positions) provide protection to troops during battles. Emplacements vary in size from single person "foxholes" to positions large enough to accommodate a crew serviced weapon such as a machine gun. Construction of emplacements consists of digging a hole or trench of appropriate size. In some cases the hole is further fortified with sandbags or wooden planks. Obstacles are constructed in the path of advancing enemy forces to impede their progress. Obstacles are also used to protect encampments. Commonly constructed obstacles are vehicle exclusion ditch and berm combinations and barriers of concertina wire. Concertina wire is often used to further strengthen the anti-vehicle ditch/berms.

Camp Roberts can accommodate training exercises involving both rotary and fixed-wing aircraft. A dirt runway is available for practice assault landings of aircraft up to the size of C-130 cargo planes. Additional fixed wing aircraft maneuvers include aerial gunning (into the Impact Area), parachute dropping of personnel and equipment, and low altitude drops of equipment. Helicopters transport personnel and equipment, and are used for reconnaissance and combat training. Helicopters also are used in aerial gunning and drop exercises.

3.2 INSTALLATION SUPPORT

There are over 1,000 buildings and almost 200 separate facilities on the installation, most of which are concentrated in the cantonment area of the Main Garrison area. Approximately 50% of the buildings are in poor condition and have been designated inactive.

The interior road network consists of approximately 320 km of streets and roads of which 40% are paved. There are numerous additional unmapped roads and tracked vehicle trails throughout the installation.

Controlled burning is periodically conducted to reduce the standing dead litter that might contribute to the spread of range fires accidentally started by training activities. The burns are generally conducted in the spring or early summer. Records of total area burned each year are not kept, but approximately 4,000 hectares of the Impact Area and the helicopter approach zone are burned annually.

A pest control program is administered by the Directorate of Facilities Engineering. Principles of integrated pest management, consisting of judicious use of both chemical and non-chemical control techniques, are stressed in the pest control plan. Potential negative effects of pest control activities on endangered species have historically been a concern at Camp Roberts. Pest control activities were the subject of formal consultation and an Environmental Impact Statement (U. S. Department of the Interior 1985, U. S. Department of the Army 1977). Camp Roberts has restricted-use permits for strychnine and zinc-phosphide laced grain, and aluminum phosphide cartridges. The Environmental Protection Agency is currently in formal consultation with FWS concerning pesticides that may affect endangered species (U. S. Department of the Interior 1991).

CA ARNG used zinc phosphide and brodifacoum to control ground squirrels and other rodents in the cantonment area and at the sanitary landfill. Diphacinone and aluminum phosphide have also been used at Camp Roberts, but not during the study. Near the end of the study, all ground squirrel control activities were halted, but CA ARNG has proposed to resume ground squirrel control at the landfill using diphacinone-treated grain (0.005%) in bait boxes. The bait boxes will be placed both inside and outside the landfill perimeter fence. The bait boxes will be constructed to exclude kit foxes and other large animals.

Non-military activities authorized to take place at Camp Roberts include livestock grazing, hunting and fishing, and fuel-wood cutting.

4. METHODS

4.1 LIVETRAPPING

Semiannual livetrapping of the entire installation, except the impact area, was conducted in the winter and summer to estimate kit fox population size and distribution (Berry and Standley 1992). Livetrapping was conducted at other times of the year to monitor reproduction (Spencer et al. 1992) and to change or adjust radiocollars (EG&G/EM 1991).

Captured foxes were handled as described by O'Farrell (1987). Newly captured foxes were fitted with uniquely numbered eartags for future identification. Selected animals were radiocollared (Telonics, Inc., Mesa, Arizona). All foxes were released at their capture site.

4.2 MONITORING RADIOCOLLARED FOXES

Radiocollared foxes were monitored approximately five times per week. Attempts were made to determine each fox's exact location three to five times per week. When a fox was located in a den, the den was described and new dens were marked with a wooden stake and a unique identification number (Reese et al. 1992).

Radiocollars were equipped with motion sensors that caused the pulse rate to double during periods of inactivity. The doubling of the pulse rate usually indicated that the fox was dead. When foxes were recovered dead, the carcass was necropsied to determine cause of death (Standley et al. 1992).

4.3 PREACTIVITY SURVEYS

All activities that may affect kit fox or their habitat were preceded by a survey conducted by a wildlife biologist so potential impacts could be identified. If the potential for negative impacts existed, measures to avoid impacts were recommended and evaluated, and mitigation measures were developed if needed. Results of preactivity surveys serve as documentation of NGB compliance with the Endangered Species Act.

Known or potential kit fox dens found during surveys were conspicuously staked and flagged so the dens and an appropriate buffer zone were avoided during project activities. Proponents were instructed to provide means of escape for foxes if steep-sided excavations were planned. If the proposed projects included the construction of temporary features, proponents were instructed to restore disturbed areas to approximate original contours.

If avoidance of individual potential kit fox dens was not possible, the unavoidable dens were excavated after determining that the dens were not being used by foxes. A thin layer of fine dust was spread around the entrances of all dens and was examined on three consecutive mornings to detect kit fox tracks prior to excavation. If no evidence of kit fox use was found, the dens were excavated with hand tools.

5. RESULTS AND DISCUSSION

5.1 POSITIVE EFFECTS

5.1.1 Habitat Preservation

Camp Roberts provides a large, contiguous parcel of relatively unaltered kit fox habitat. Although there is little available information concerning kit foxes off of the installation, it appears that their distribution and relative abundance are reduced outside the installation boundary. Most of the adjacent and surrounding lowland areas have been converted to agricultural uses. Remaining areas that appear to contain suitable habitat generally occupy small isolated pockets within agricultural areas.

NGB and CA ARNG have no plans to develop significant amounts of kit fox habitat or to otherwise make portions of the installation unsuitable for use by kit fox. The military mission of Camp Roberts requires training areas to be maintained in a relatively natural, undeveloped condition. Camp Roberts should therefore continue to provide a large area of kit fox habitat.

5.1.2 Natural Resources Management Practices

Several land use and operation policies function to conserve and benefit the kit fox at Camp Roberts. Public access is highly restricted. Ground squirrel control is only conducted to reduce squirrel numbers in specific problem areas, not to reduce the overall population. This policy helps to maintain a dependable food supply for kit foxes.

Vehicle travel is limited by a maximum speed limit of 56 kilometers per hour (35 mph). Off-road travel by vehicles is prohibited except during mission-essential training exercises. Both of these regulations benefit the kit fox by reducing the likelihood of a fox being struck by a vehicle. Off-road restrictions help to reduce habitat damage and reduce the likelihood of dens being run over.

5.1.3 Preactivity Surveys

Between October 1988 and September 1991 preactivity surveys were conducted for 63 projects that had the potential to impact kit foxes. Four hundred twenty-four hectares of land were surveyed; 18 known kit fox dens, one of which was believed to be occupied, and 1,087 potential kit fox dens were identified. All of the known dens were protected by establishing exclusion zones around the dens. Only 24 (2.2%) of the potential dens could not be protected. They were excavated after determining they were not occupied by kit fox. No evidence was found during the excavations to indicate that the dens had ever been used by kit foxes. One of the potential dens protected by a preactivity survey was subsequently used by a radiocollared kit fox.

A total of 146.5 hectares was developed. Temporary development accounted for 16% (23.5 hectares). The majority (82%) of all development took place on previously developed land. Only 5.7 hectares (4% of all development) of previously undeveloped land was permanently developed by military-authorized activities.

5.2 LACK OF OBSERVED NEGATIVE EFFECTS

5.2.1 Specific Activities

Several military and non-military activities conducted at Camp Roberts were initially perceived as having potential negative effects on San Joaquin kit fox. It was believed that foxes might be killed during live-fire exercises, struck by vehicles, or buried in dens run over by tactical vehicles. Non-military activities such as controlled burning, maintenance projects, and pest control were also believed to have potential negative impacts.

There was no evidence of any foxes being killed by military live-fire exercise. Although some kit fox dens were driven over by vehicles and a few sustained some damage (Section 5.3.2), no foxes were known to have become trapped within dens. Four radiocollared kit foxes died in their dens and the dens had to be excavated to recover the carcasses. None of these foxes were killed by military-authorized activities. During the excavation of each den it was determined that the dens had been intact prior to excavation, and no evidence of suffocation or other den-related cause was found. No foxes were known to become trapped in any steep-sided excavations constructed during field exercises or during maintenance or new construction projects.

No kit foxes were known to have been poisoned by installation pest control activities, controlled burning, or maintenance activities. Two kit foxes were believed to have been poisoned when chlorophacinone-treated grain was applied on private land adjacent to the installation. Two additional foxes were possibly poisoned during the same incident, but laboratory tests were not conclusive.

No negative effect from human harassment were observed. Sixteen radiocollared foxes were known to den beneath buildings in the cantonment area. The cantonment area is subject to substantial human activity including vehicle traffic. Three mated pairs raised pups in the cantonment area (Spencer et al. 1992).

Radiocollared foxes in the training areas were occasionally located denning near troop encampments. On at least 20 occasions radiocollared foxes (one or more) were monitored either denning or moving above ground within 400 meters of military activities including artillery live firing. On one occasion a fox occupied a den within 30 meters of a military encampment. On another occasion a fox used a den within a military encampment and continued to use the den for five days while the troops occupied the area.

Gese et al. (1989) reported coyotes (*Canis latrans*) changing their home range and activity patterns in response to military activities, and indicated the short-term effect on coyote behavior appeared moderate. The military activities described appeared to be more discrete in duration compared to the on-going level of activities at Camp Roberts.

5.2.2 Non-Specific Activities

Although the kit fox population declined during the study (Berry and Standley 1992) and the reproductive success appeared to be relatively low (Spencer et al. 1992), no evidence was found to indicate that military-authorized activities were the cause. Military-authorized activities did not appear to be a significant source of kit fox mortality (section 5.3.1).

A biological assessment was prepared that addressed the effects of military-authorized activities on the kit fox and other federally listed species that may occur on Camp Roberts (NGB and CA ARNG 1991). The biological assessment was submitted to FWS in partial fulfillment of Section 7 of the Endangered Species Act. FWS responded with a biological opinion that NGB-authorized activities could impact individual kit foxes, but FWS believed that such activities would not jeopardize the existence of the San Joaquin kit fox population (U. S. Department of the Interior 1992).

5.3 OBSERVED NEGATIVE EFFECTS

5.3.1 Direct Mortality

Material in this section was adapted from Standley et al. (1992).

From November 1988 to September 1991, only four kit foxes were determined to have been killed as a result of activities conducted at Camp Roberts. One fox died of shock and blood loss after becoming entangled in concertina wire being used in a training exercise. The fox was radiocollared and the antenna of the radiocollar was also entangled in the concertina wire and may have contributed to the fox's death.

One fox was believed to have been shot by a hunter. The radiocollar the fox had been wearing was recovered in the Nacimiento River. The transmitter had indentations caused by shotgun pellets, and the collar had been cut with a knife or similar sharp implement.

Two foxes (one radiocollared, one non-collared) were killed by vehicles. It was unknown what type of vehicles struck the foxes. The vehicles could have been involved in either military or authorized non-military activities.

Military activities may have contributed to the death of a fifth kit fox. This juvenile radiocollared fox was determined to have been killed by a predator, but it was recovered with

a length of plastic-coated electrical wire wrapped around its neck and shoulders. This type of wire is used by the military for field communications. The wire may have impaired the fox's ability to escape the predator.

The four radiocollared foxes that were killed, by authorized activities represent 4.3% of the 94 foxes radiocollared during the study, 7.7% of the 52 radiocollared foxes recovered dead, and 11.4% of the 35 radiocollared foxes with a known cause of death. The most frequently identified cause of death for kit foxes was predation. Predation, excluding the fox entangled in the communication wire, accounted for 23 (65.7%) of the 35 radiocollared foxes with a known cause of death.

The non-collared fox killed by a vehicle was the only fox out of 16 non-radiocollared foxes recovered dead on or within 2 km of the installation that died from authorized activities. Four of the sixteen foxes were also believed to be killed by vehicles but were all recovered along U. S. Highway 101. This highway passes through the installation, but is not controlled by CA ARNG.

5.3.2 Loss of Dens

From December 1988 to September 1991 radiocollared foxes were located in 1001 different typical earthen dens (Reese et al. 1992). Over 90% (903) of the dens showed no external evidence of having been disturbed. Only 98 (9.8%) of the dens showed evidence of having been run over by vehicles. At least 12 of the 98 dens were run over after kit foxes were first known to have used the dens. None of the dens were believed to be occupied by kit foxes when the dens were run over.

Radiocollared kit foxes used an average of 17.8 dens each during the study, and the number of dens used per fox ranged from one to 64, with a median of 13 dens (Reese et al. 1992). These numbers probably underestimate den use because foxes were not relocated every day. Because of the large number of kit fox dens, it appears that den sites are not a limiting factor for kit foxes at Camp Roberts. Even if a few dens are lost, due to military authorize activities or to natural causes, such loss should not effect the viability of the fox population.

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