KIT FOX (*Vulpes macrotis*)
COLORADO DIVISION OF WILDLIFE
2007 SURVEY PROGRESS REPORT
SOUTHWESTERN REGION

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SUMMARY

Kit fox (*Vulpes macrotis*) populations in Colorado are thought to be close to extirpation (Fitzgerald 1996; Beck 1996-2000). Because kit fox surveys had not been completed since 2000, we desired to develop both an evaluation of current population status and a long-term monitoring program. To assess the status of populations, eighty track-plate boxes were used to survey extensive areas in Montrose and Delta counties where a known population had been documented (Fitzgerald 1996). Track-plate boxes were determined to be an effective technique at detecting kit foxes as demonstrated by successful sampling of known populations in Utah. Surveys in Colorado resulted in a probable single kit fox track obtained from 700 survey checks (<1% success). Though this survey year provided little evidence of kit fox occupation in the state, we believe that additional surveys should be conducted in areas of documented occurrence and in potential habitat before conclusions regarding the status of the species in the state are made.

ACKNOWLEDGMENTS

This project would not have been possible without the hard work and dedicated assistance of the Montrose Colorado Division of Wildlife Volunteer Crew. These volunteers spent countless hours buying materials, designing and constructing track-plate boxes, preparing track-plates for field surveys, and checking and re-baiting track-plate stations in the desert heat. During this project the volunteers never lost their good humor and enthusiasm. I am indebted to the following volunteers: Jack Beck, Emory and Julia Arbdt, Leland Howard, Buck and Susi McGee, Bob Hartwig, Duane Gardner, Jack Hughes, Jerry McLellan, Alex Labak, Dick Manhart, Fred Sieber, Gus and Lorraine Tranello, Dave Olsen, Keith Elmer, Terry and Cheryl Ryan, Peggy Carey, Royce Adair, Ubaldo Barberi, Chuck Best, Sue Towsley, Keith Krickbaum, Jim Fisher, and Bob and Pat Knowllenberg.

We would also like to thank Tony Wright from the Utah Division of Wildlife Resources who agreed to test the viability of track-plate boxes as detection devices at a known population of kit fox in Utah. In addition, T. Wright set up several triggered cameras to photograph kit fox at track-plate boxes. All photos contained in this document were those collected by T. Wright during surveys conducted in Utah.

INTRODUCTION

The kit fox is a specialized canid adapted to arid and semi-arid ecosystems throughout southwestern North America (Hall 1981). In Colorado, it occupies the lower Gunnison and Colorado River drainages below about 1,828 m in elevation (Fitzgerald 1996). Its historical range in Colorado was thought to encompass around 1.83 million ha where as today it is estimated to be 120,000 ha (Boyle and Reeder 2005). Though probably never very common in the state as apparent by lack of documented sightings, recent survey work (1992-1996) estimated less than 100 individuals occurring in 4 counties and evidence of self-sustaining populations non-existent (Fitzgerald 1996). Follow-up surveys ending in 2000 (Beck from 1997-2000) suggested that the already small kit fox population had declined substantially and the species was close to extirpation in Colorado. Since 1998, the kit fox has been designated as a state endangered species and trapping seasons have been indefinitely closed.

In the past, kit fox populations were subject to multiple threats including bounty hunting, carcass poisoning, and unregulated hunting. Today, threats include habitat loss, interspecific competition with other predators such as coyotes (*Canis latrans*) and red foxes (*Vulpes vulpes*), disturbance from off-highway vehicle (OHV) use, decline in prey abundance, and urban encroachment (Meaney et al. 2006). Because of the presence of these threats and lack of continued assessment of kit fox after 2000, information was needed on the current status of the species as well as for the potential development of a long-term monitoring program to assess current and future management of the kit fox.

Fitzgerald (1996) used live-trapping and radio-collaring to monitor the status and distribution of the kit fox from 1992-1996. During his study he found that this type of intensive monitoring resulted in foxes abandoning initially occupied areas. To avoid this problem, he recommended using methods such as cameras to minimize disturbance when future surveys were planned. Our 2008 survey was designed to incorporate Fitzgerald's recommendation for minimizing disturbance to kit fox as well as attempting to develop a reliable technique that could be used to inventory presence across extensive areas.

To accomplish our goals, track-plates and covered boxes were used to inventory kit fox distribution. The decision to use this method was based on the technique's proven effectiveness at non-intrusively detecting small to medium size carnivores including marten (*Martes americana*), fisher (*M. pennanti*), gray fox (*Urocyon cinereoargenteus*), red fox, ringtail (*Bassariscus astutus*), weasels (Mustelidae spp.), raccoons (*Procyon lotor*), striped and spotted skunk (*Mephitis mephitis* and *Spilogale gracilis*), in addition to squirrels (Sciuridae spp.) and small rodents (Muridae and Heteromyidae spp.). If proven to have a high probability of detecting kit fox, track-plate boxes could be used to inventory statewide distribution and as a technique to develop an occupancy modeling approach to monitor long-term population trends.

Another positive attribute associated with the use of track-plate boxes is potential detection of non-target species. In Colorado, kit fox were found to primarily forage on murid rodents, scuirids (white-tailed prairie dogs [*Cynomys leucurus*] and rock squirrels

[*Spermophilus variegates]*) and leporids (Eussen 1999, Meaney et al. 2006). Many of these species can be detected by track-plate boxes, providing valuable insight into community dynamics and prey species distribution. In addition, detecting predator species during sampling would provide information on the potential for interspecific competition and could direct conservation strategies to control predators in areas where kit fox are detected.

THE OBJECTIVES OF THIS STUDY ARE TO:

1. Test reliability of track-plates boxes to detect kit fox
2. Inventory kit fox presence in previously occupied study areas (Fitzgerald 1996)
3. Inventory new sites to determine distribution of the kit fox in Western Colorado
4. Establish monitoring protocol to evaluate long-term population trends

STUDY AREA:

Based on historical records, anecdotal reports, known occurrences in Utah, and availability of suitable habitat, kit fox are predicted to occur in 8 counties in Colorado (Boyle and Reeder 2005). However, Fitzgerald (1996) captured them in only 4 counties (Delta Montrose, Garfield, and Mesa); kit fox were not found in Rio Blanco, Montezuma, Moffat, or San Miguel counties. Of the areas that Fitzgerald found kit fox, the Peach Valley area in Montrose and Delta counties and areas east of Montrose (Fig. 1) had the highest capture rate during all 4 years of the study and had documented reproduction for more than 2 years. Thus we concentrated our 2007 survey efforts in these areas (Fig. 1).

METHODS

Surveys were conducted from 9 August - 7 October 2007. Higher detection rates for kit foxes have been documented to occur during late summer and fall which corresponds to the time of greater mobility of young foxes and their parents and during dispersal which normally occurs around October (Egoscue 1956). Uresk (2003) used track-plates to detect swift fox (*Vulpes velox*) and recommended that surveys be completed in late August and September to obtain the highest rate of detection. Thacker (1995) found sampling in late summer to early fall yielded the highest detection rates of kit fox at scent stations.

Track-plates (31 x 81 cm) were constructed from 0.063 gauge aluminum sheeting and sooted with acetylene gas flame from a welding torch. White-contact paper was affixed to the center of the track-plate (sticky surface up) so that a distinguishable track could be made as the animal stepped on the soot and then stepped on the sticky white contact-paper. The contact paper was more effective in obtaining an identifiable track than a sooted plate alone. In addition, contact paper allowed the actual print to be saved and archived for future identification and reference.

The track-plate was placed in a plywood box to protect it from precipitation and other inclement weather. The box was constructed with low-grade plywood and had a dimension of 33 x 31 x 83 cm. One end of the plywood box was left open for the animal to enter and walk across the plate. Canned mackerel was placed at the rear of the box as

bait to entice the animal to enter. Track-plate boxes were checked and re-baited every 2-4 days.

Three sample periods were completed during the 2007 survey effort. A sample period was defined as the time period a track-plate box was left at the same location. All sample periods consisted of a minimum of 12 nights. A survey check was defined as the day that the track-plate box was checked for tracks, track-plate removed and replaced with a freshly sooted plate, and the track-plate box re-baited with mackerel. Therefore, if the track-plate box was left in the same location and checked every 4 days for 12 days, then 3 survey checks were completed for one sample period.

The first sample period (9 August – 25 August) consisted of eighty track-plates systematically positioned along existing public roads. Following recommendations by Uresk et al. (2003), track-plate boxes were placed at 0.5-km intervals on 1.6-km transects (Fig. 2). Track-plate boxes were placed 20–30 m from roads.

The second sample period (25 August – 10 September) consisted of the original eighty track-plate boxes being relocated to cover locations within the original survey area (Fig. 1) that had not been sampled. These new locations were in areas between transects and further along roads than original transects. Again track-plate boxes were placed 20–30 m from roads.

The final sample period (25 September – 7 October) consisted of twenty track-plate boxes being relocated by OHVs to areas inaccessible by truck and near the area where a kit fox track was detected during initial surveys (Fig.2). Track-plate boxes were placed along existing OHV 2-track roads at 0.5 km intervals and placed 20-30 m from the road.

In order to confirm that track-plate boxes are a valid technique to detect kit fox, we coordinated with the Utah Division of Wildlife Resources to place track-plate boxes and cameras in areas of known kit fox occurrence in Utah based on spotlight surveys. Nine track-plate boxes and three cameras were positioned near Cisco, Utah and were surveyed for one sample period.

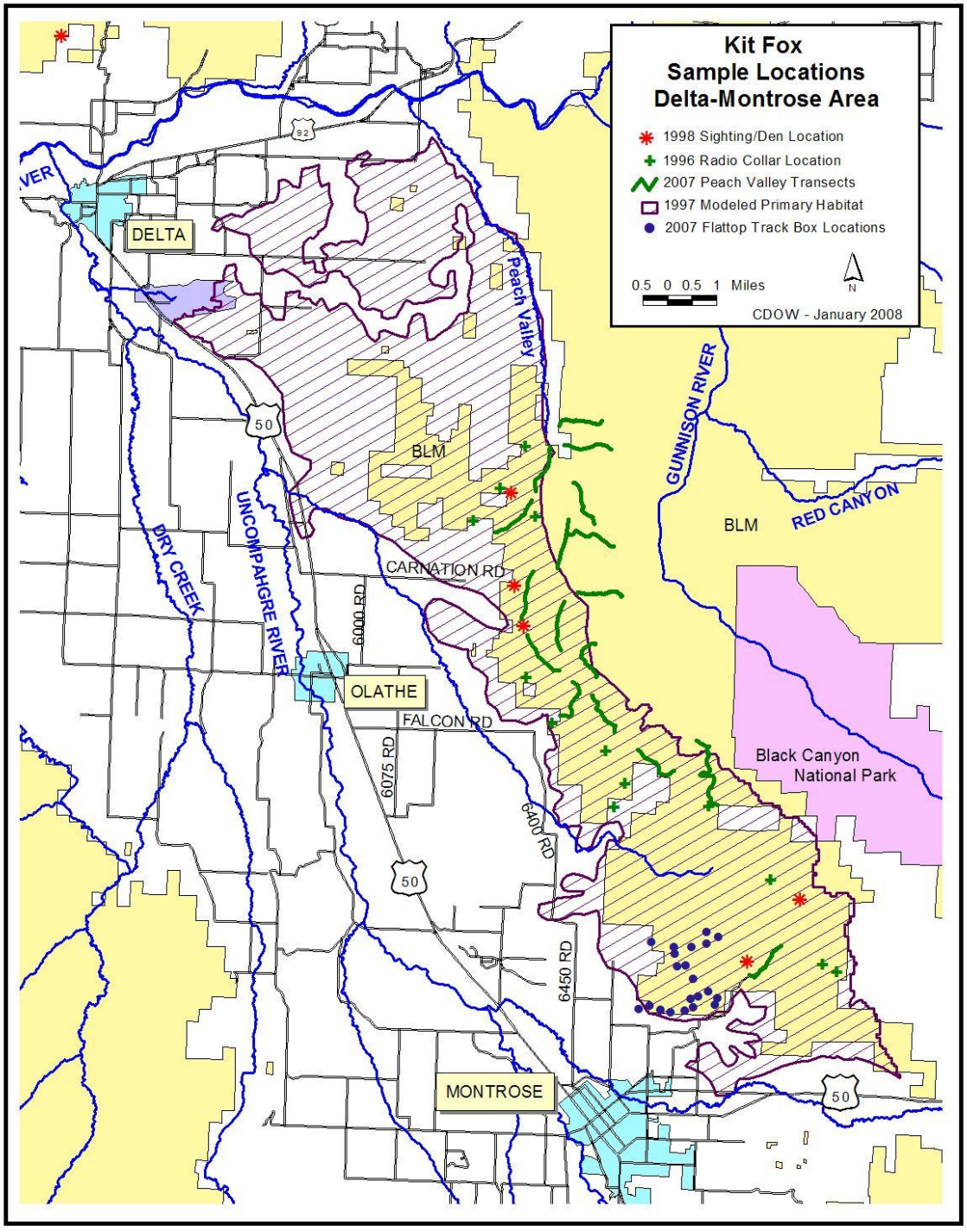


Figure 1. Kit fox study area and location of track-plates boxes and transects in Peach Valley and east of Montrose in 2007.

Results

One probable kit fox track was detected during the 2007 survey effort (Fig. 2 and 3, Table 1) resulting in a <1% success rate (1 detection/700 survey checks). Other species detected during surveys were striped skunk (23 detections/3% success), rock squirrel (27 detections/3.8 % success), murid rodents (unknown species) (29 detections/4.1% success), domestic cat (*Felis domesticus)* (17 detections/2.4% success), domestic dog (*Canis domesticus*) (3 detections/<1% success), raccoon (4 detections/<1% success), gray fox (4 detections/<1% success), and bobcat (*Lynx rufus*) (3 detections/<1% success). This species list corresponds closely to species trapped by Fitzgerald (1996) in the same area from 1992-1996.

In Utah, 4 of the 9 track-plate boxes had kit fox detections during the 24 day sample period (44% trap success) (Fig. 4). The number of (new) detections continued to increase through 24 days, but most (3 of 4) were made during the first 2 weeks. Kit fox were present at 2 sites (as demonstrated by tracks in the snow), but never entered track plate boxes. Red fox were also present at 2 sites, but never entered boxes. One motion sensitive camera that was placed in the field took pictures of kit fox (Fig. 5).

Table 1. Species detected during track-plate surveys in Peach Valley and east of Montrose in 2007.

Date Baited	Date Checked	#Stations	Survey	Striped Skunk	Rock Squirrel	Mice	House Cat	Bobcat	Raccoon	Dog	Gray Fox	Kit Fox
8/9/2007	8/13/2007	80	1	3	5	2	3	1	0	0	0	0
8/13/2007	8/17/2007	80	1	4	4	10	1	1	0	0	0	0
8/17/2007	8/21/2001	80	1	3	1	3	1	1	0	0	0	0
8/21/2007	8/25/2007	80	1	3	2	5	3	0	1	0	0	0
8/25/2007	8/28/2007	80	2	0	5	2	3	0	0	1	0	0
8/29/2007	9/4/2007	80	2	1	7	2	2	0	0	1	1	0
9/4/2007	9/6/2007	80	2	2	0	0	2	0	1	0	0	0
9/6/2007	9/10/2007	80	2	2	3	3	2	0	1	1	0	probable
9/25/2007	9/29/2007	20	3	0	0	1	0	0	0	0	1	0
9/29/2007	10/3/2007	20	3	2	0	1	0	0	0	0	1	0
10/3/2007	10/7/2007	20	3	3	0	0	0	0	1	0	1	0
		700 survey checks		**23**	**27**	**29**	**17**	**3**	**4**	**3**	**4**	**1**

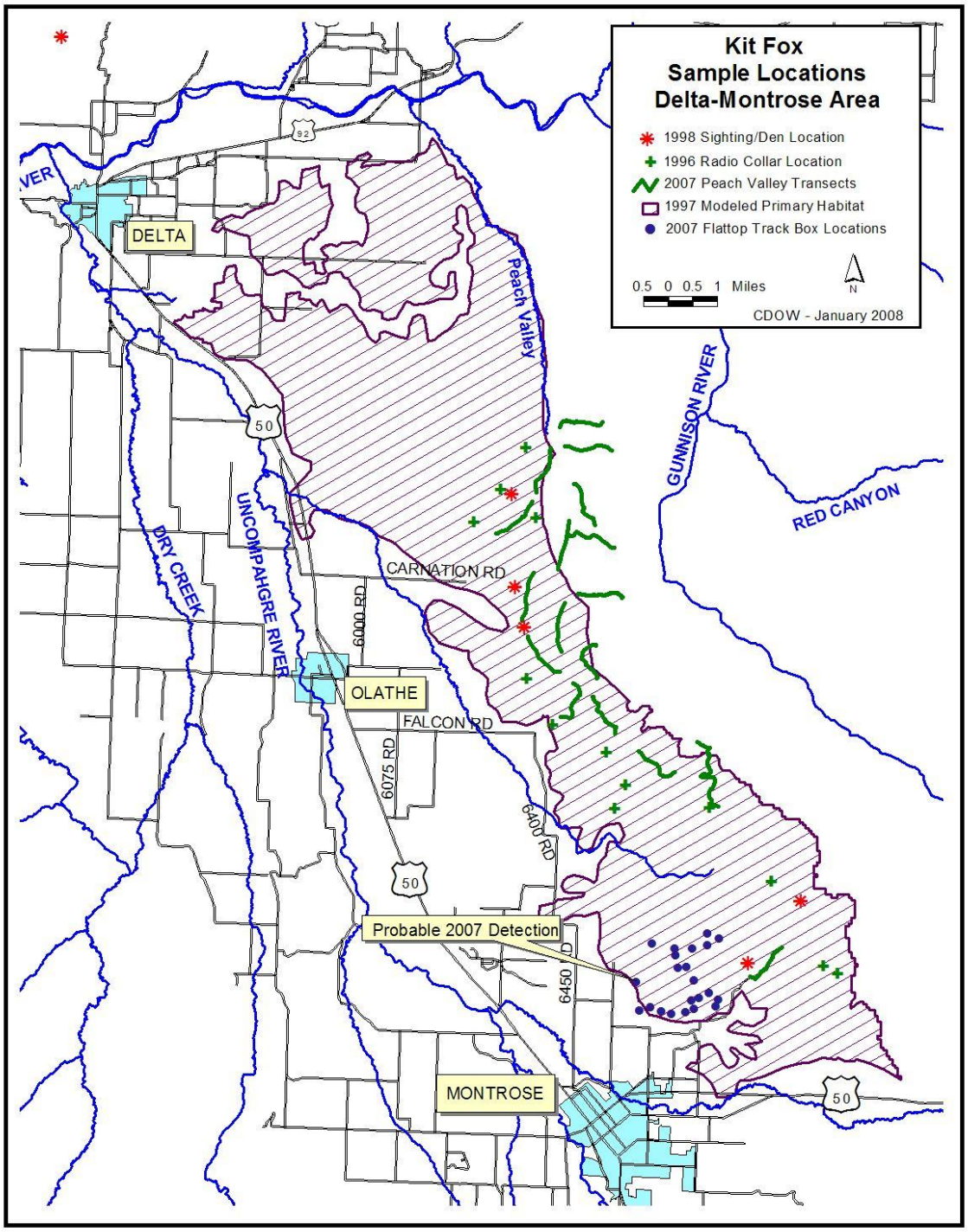


Figure 2. Kit fox survey locations and location of probable kit fox track found during track-plate surveys in Peach Valley and east of Montrose in 2007.

Figure 3. Scan of probable kit fox track detected during 2007 track-plate surveys in Montrose County.

Figure 4. Photo of kit fox track collected in Utah by the Division of Wildlife Resources in 2007.

Figure 5. Photo of kit fox entering track-plate box during surveys conducted in Utah to determine if track-plate surveys were a viable method to detect kit fox.

Discussion

It appears from our experimental surveys in Utah, that track-plates are a viable technique to detect kit fox and may be a potential method to be used in a long-term occupancy modeling approach. Track-plate boxes detected kit fox in Utah during the first 4-day survey check and continued to detect foxes throughout the sample period. Cameras also detected kit fox but were not as reliable because of technological malfunctions. In addition, due to the cost of cameras, it would be unfeasible to sample extensive areas as inexpensively as was done with track-plate boxes. We demonstrated that track-plate boxes are a reliable, non-intrusive method to survey areas for kit fox.

Overall our surveys indicate that kit fox are extremely rare in the survey areas with only one probable kit fox track detected. While other areas of suitable habitat in the state remain unsurveyed, the fact that our efforts were concentrated in the area of the highest known abundance (Fitzgerald 1996) may indicate that kit fox indeed are near extirpation. Low detection rates may be attributed to multiple factors including: 1) interspecific competition with other predators; 2) prey availability; 3) environmental conditions (drought); and 4) increased human disturbance (i.e., OHV).

Predators such as red foxes and coyotes are thought to regulate and or displace kit fox (Meaney et al. 2006). Though neither species was detected at track-plate boxes during surveys, a number of predators including both domestic dogs and cats were. In addition, a gray fox was detected multiple times at the same station where the single kit fox was detected. Presence of these predators in suitable kit fox habitat may indicate that competition is occurring resulting in displacement of individuals. The number of domestic predators that were detected during surveys and their potential adverse impacts on kit fox is a valid concern.

Our surveys in Peach Valley and east of Montrose found these areas almost devoid of prairie dogs though many burrows were seen. In Colorado, white-tailed prairie dogs have been identified as an important component of the kit fox diet (Eussen 1999) as well as providing burrows for kit fox dens and potential escape routes (Meaney 2006). Lack of this prey species may be an indicator of the health of the ecosystem and may help explain the lack of kit fox detections in the sampled area.

Kit fox populations evolved in arid areas that experience periodic droughts, and population fluctuations in response to annual environmental conditions were probably normal. However, human-facilitated changes in the western landscape during the last century have caused alterations in plant species composition, and disruption of ecosystem function and structure (Fleischner 1984). These rangeland condition changes may have resulted in kit fox populations being more susceptible to environmental conditions. Research on the San Joaquin kit has suggested that population numbers and reproductive success may be tied to drought cycles, especially those that impact food availability (Cypher et al. 2000; White and Ralls 1993 *in* Boyle and Reeder 2005). Because drought conditions have impacted the Delta-Montrose area from 2002 until as recently as 2006, kit fox populations may have declined, and along with their low survival and reproductive rates in Colorado (Fitzgerald 1996), are now at extremely low population levels. With the return of a moister weather regime, we may see kit fox re-colonize suitable areas. Thus, long-term survey efforts should continue to determine the status of the species.

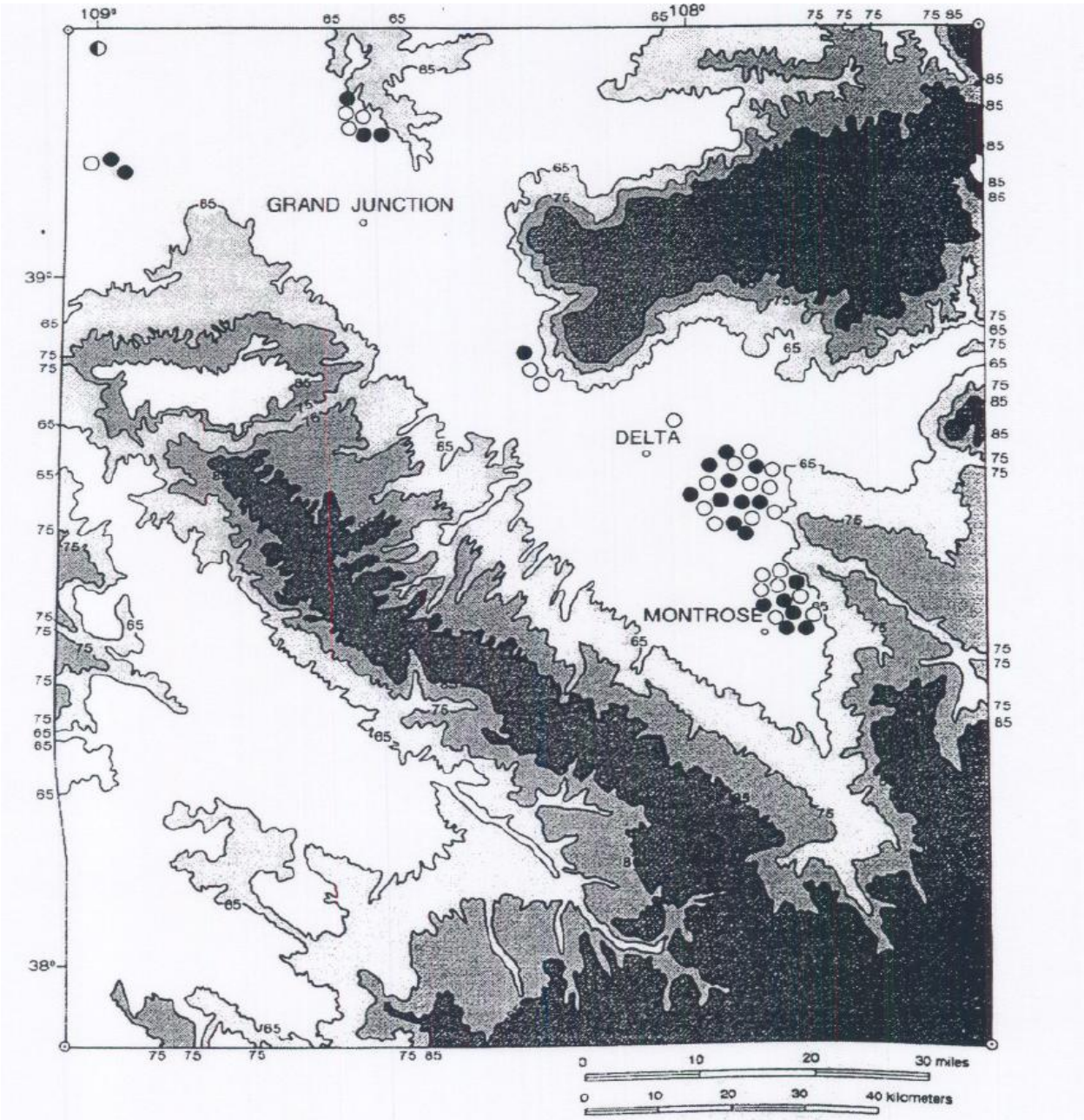
OHV use in Peach Valley is extensive, with roads and motorcycle trails bisecting the entire study area. Kit fox can tolerate some level of human disturbance but Link (1995 *in* Boyle and Reeder 2005) noted that kit foxes in Colorado spent more time in their dens during weekends when peak periods of noise and disturbance occurred. The human population in both Delta and Montrose counties is increasing resulting in more people recreating in the Peach Valley area. This increase in recreational activities may disturb kit foxes and cause additional stress to already small populations making it difficult for maintenance and re-colonization to occur.

Although kit fox have never been abundant in Colorado, populations in the state appear to be declining (Fitzgerald 1996, Beck 2000). Beck (1999, 2000) strongly suggested that the already small kit fox populations in Colorado were close to extirpation (Boyle and Reeder 2005). Our surveys indicate that Beck's assertions may have been correct and this species is in danger of becoming extirpated.

Recommendations:

1. Continue to assess the current population of kit fox in the state. Sampling should occur in other areas where Fitzgerald (1996) successfully trapped kit fox and in areas of potential habitat (Fig.6). Until all suitable areas are surveyed, we can not adequately assess the current status of the kit fox in Colorado.
2. The kit fox has been identified as one of Colorado's most vulnerable species, but is also a species on the periphery of its range in Colorado. If indeed this species is in danger of being extirpated from the state, CDOW must consider its options for conserving and re-establishing populations. These options may become very costly and time intensive (see recommendations in Fitzgerald 1996). The needs of the kit fox should be evaluated along with the needs of other species of concern in the state and decisions made on how much time and effort should be expended on kit fox conservation.
3. Include kit fox conservation and management strategies into current management plans that have been or are being developed for associated species. An example of this is the inclusion of kit fox management in the White-tailed and Gunnison's Prairie Dog Conservation Plan that is currently being developed.
4. Implement the multi-species regional conservation planning approach for wildlife species of concern in sagebrush habitats (Boyle and Reeder 2005).

Figure 6. Map from Fitzgerald (1996) showing locations of trapped foxes. These are the areas the Wildlife Conservation Section is recommending to conduct track-plate surveys in 2008.



igure 3. Locations of male (open circle) and female (black circle) kit fo
nd one fox of unknown sex (half-shaded circle) trapped in western
olorado, 1992-96. Base map is modified from Anderson et al. 1992.

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