

# SWIFT FOX RESTORATION IN WEST CENTRAL SOUTH DAKOTA

Final Progress Report (2003 – 2007)

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## RESTORATION OF SWIFT FOX TO THE BAD RIVER RANCHES AND ENVIRONS IN SOUTH DAKOTA

### Summary

In 1999, the Turner Endangered Species Fund (TESF), in collaboration with private landowners, state, federal and tribal agencies, and other private organizations embarked on an effort to restore a self-sustaining population of swift foxes (*Vulpes velox*) to the environs of western South Dakota (Figure 1). Since then we trapped 274 foxes (126 males, 148 females) in 4,416 trap nights (6.2 captures/100 trap nights) from wild source populations in Colorado and Wyoming. We translocated and released 180 of these foxes (82 males, 98 females) onto private lands in South Dakota, along with an additional 46 pups (28 males, 18 females) born in captive soft-release pens. We documented 90 pups (32 males, 29 females, 29 unknown) born to 25 wild litters (3.6 pups/litter). We documented 160 mortalities (82 females, 77 males) attributed to coyotes (*Canis latrans*; 0.43), vehicles (0.14), human (0.08), bobcats (*Lynx rufus*; 0.04), raptors (0.04), swift fox (0.01), miscellaneous (0.01), and unknown (0.25) causes. We stimulated at least four similar restorative efforts within the state and have documented movement and reproduction between three of the restoration areas. As a result of a trap related injury, we rehabilitated and donated a male to the American Zoological and Aquarium Association's captive breeding program. Finally, we documented the longest known post-release (411 km) and natal dispersal (367 km) movement events known for the species.

This report outlines our activities during the period of January 1, 2003 to December 31, 2007. Annual activities during the reporting period fell into ten categories: (1) post-release monitoring; (2) captive husbandry of soft-release/breeding pairs; (3) predator control; (4) trapping and translocation of wild foxes; (5) fall hard-releases; (6) management relocations of free-ranging foxes; (7) veterinarian services; (8) prey and predator surveys; (9) education and outreach; and (10) administration. Please refer to previous reports (e.g., Kunkel et al. 1999; Kunkel et al. 2001a, b; Kunkel et al. 2003; Kunkel et al. 2004) for all methods.

We conducted this reintroduction with a rigorous experimental design to gain the most knowledge possible without compromising our ultimate objective of restoring a swift fox population that persists in the presence of minimal management. We strove to establish a self-sustaining population of swift fox on and around the Bad River Ranches (BRR), which serves as a source for swift fox recovery and expansion in South Dakota while assisting in the removal of foxes from South Dakota's threatened species list. Private landowners working in conjunction with agency and non-governmental organizations have made a significant contribution toward the conservation of swift foxes, while simultaneously maintaining their agricultural activities. Since over 75% of swift fox habitat is on private property (Swift Fox Conservation Team 1997), innovative plans that actively engage private landowners in the restoration process will be needed to fully recover populations. In South Dakota we enlisted the cooperation of over 100 neighboring and local landowners who allowed us access to their lands for the purposes of monitoring, collection of mortalities, documenting reproduction, and beginning in fall 2004, providing release sites off the BRR. Such continued cooperative efforts will be vital for recovering fox populations in South Dakota and for creating a template for the long-term management of the species throughout its historical range.

### Primary Objectives

Our primary objectives of this study were to:

1. Establish a self-sustaining population of swift foxes (hereafter “foxes”) on the BRR and within TESF’s Swift Fox Restoration Area (SFRA, Figure 1).
2. Establish a population that serves as a source for swift fox recovery and expansion in South Dakota and neighboring states and assists in removing foxes from threatened status in South Dakota.
3. Establish a population that enhances the long-term survival of the species, restores natural biodiversity to the area (as part of the restoration of a full array of native species), and promotes prairie conservation awareness.
4. Collect and disseminate information on reintroduction techniques and the ecological requirements for successful swift fox restoration.
5. Collect and disseminate information on the ecology of foxes.

### Secondary Objectives

Our secondary objectives of this restoration project were to:

1. Estimate fox density annually for 6-10 years following first release.
2. Estimate fox reproductive parameters annually for 6-10 years following first release.
3. Estimate fox cause-specific mortality rates annually for 6-10 years following first release.
4. Determine primary factors limiting fox population.
  - a. Monitor fox population trends.
  - b. Monitor fox prey population trends.
  - c. Monitor fox predator (coyote) population trends.
5. Determine fox diet annually for 6-10 years following first release.
6. Determine fox resource selection annually for 6-10 years following first release.

### **Post-Release Monitoring**

Built around concepts and experience gleaned from other fox research, experts in the field, and other reintroduction efforts, we attempted to refine an aggressive post-release monitoring program aimed at determining the overall, long-term success of our restoration work. This program included, but was not limited to, a 60-day initial post-release monitoring period (October - December), a maintenance monitoring and re-collaring period (January - April), a daily den observation period (May - June), and a 60-day post-release monitoring period for soft-released foxes (July - September).

Monitoring was accomplished primarily through a combination of aerial- and ground-based telemetry augmented by visual observations at den sites in early summer. We found that monitoring for fox home-range, survival, and mortality was best accomplished during the late evening and early morning hours when foxes were most active and above ground, while den locations, pairing, and reproduction were best documented during the day. We also found aerial reconnaissance was most effective during the evening hours, especially when combined with

coordinated ground crews who were then able to pinpoint, via triangulation, dispersing or dead foxes.

All foxes trapped and translocated to South Dakota from Wyoming and Colorado in 2003, 2004, 2005, 2006, and 2007 were fitted with radio collars prior to release (Table 1). We also radio-marked as many wild-born and captive-born pups that were large enough to support either intraperitoneal transmitters or collars. Free-ranging foxes with known locations were re-collared at least once during the year to maintain telemetric contact with them.

### Monitoring Effort

During the 2003-2007 reporting period we logged 428 hours of aerial reconnaissance and 5,891 hours of ground monitoring. By air we documented 1,902 detections (does not include 2003 detection data) and 1,428 relocations and by ground we documented 12,567 detections (does not include 2003 detection data) and 9,582 relocations (Table 2).

### Dispersal

One aspect of our work that may prove most illuminative is the relatively long range dispersal and post-release movements we have observed. These events are important since understanding the processes and components of animal movements has increasingly become a central tenant in determining the long-term viability of threatened and endangered native species, which often occur in small, geographically isolated populations. This is thought to be true for swift foxes whose range is increasingly experiencing habitat fragmentation and which are thought to exhibit limited dispersal abilities (Moerhenschlager and MacDonald 2003). Long-distance dispersal events, such as those we are documenting, have the potential to overcome difficulties posed by this trend, especially relating to reintroduced populations that are expected to expand from established populations within release areas or maintain connection to existing populations in the core of the species range (Trakhtenbrot et al. 2005).

#### *2003*

Of the ten surviving hard-released foxes, one adult male dispersed beyond the project area. Two of the ten surviving soft-released foxes also dispersed beyond the project area: one was a juvenile female that escaped from the pens in March and the other was a juvenile male. Both of these dispersing foxes were located again. The female was found killed by a vehicle near Isabel, South Dakota, north of the Cheyenne River and approximately 160 km north of the release area. The male was found dead 80 km west of the release area, likely the result of coyote predation.

#### *2004*

No dispersal data were available for 2004.

#### *2005*

In March 2005, we conducted several wide-ranging flights that encompassed a large portion of central and western South Dakota. These flights were conducted to search for missing foxes and

to determine if there were mortalities of radio-collared foxes outside our normal monitoring area. While we did not detect any mortalities we detected two missing foxes, including one that had been missing for over one year, and both foxes were on or near the Badlands National Park (BNP). We notified BNP project staff and they verified that two male foxes released on the BRR had paired with females from BNP releases. These were the first documented cases of foxes integrating from the two project areas.

#### *2006*

In March 2006, we received two reports of collared swift foxes that had been trapped in leg-hold traps. The first was a female (424F) hard released on the south unit of the BRR that established residency on non-Turner lands roughly 16 km north of Murdo, SD (Jones County). Nearly one year to the day after her last known location, she was trapped south of Belle Fourche, SD (Butte County), 263 km away.

The second report was of a collared fox trapped south of Prairie City, SD (Perkins County). This fox (456M) was a wild-born juvenile male from the BRR's north unit that had last been located 30 days earlier at his natal den site, 218 km from where he was trapped.

In May 2006, we received a third report of a collared fox that was shot while (supposedly) raiding a chicken coop 24 km west of Winner, SD (Tripp County). Released the previous fall on the north unit of the BRR, 417M had been missing since his last location on 3/21/06, still within a mile of his release site and 120 km from where he was killed.

#### *2007*

We documented two movements that constituted the longest post-release movement and true dispersal events for the species. Both of these foxes were recovered as road kills in the same general area of central North Dakota, hailing from the same area in South Dakota. One fox was a wild-born female juvenile; the other was a translocated yearling male. While last known locations for each were documented within a week of one another, it would be speculation to assume that these foxes traveled together. A more plausible explanation may be that one followed the other using a scent trail, which is a dispersal technique well documented in larger canids (i.e., gray wolves). Regardless of the mechanism, such a scenario could also have a second important ramification: illustrating the potential for long-distance dispersal events to result in breeding pairs that ultimately contribute to the establishment of additional sub-populations, as opposed to lone, spatially isolated animals.

### Reproduction

During the 2003-2007 reporting period we documented 25 wild-born litters with a total of 102 pups and 12 captive-born litters with a total of 48 pups.

#### *2003*

We documented four wild litters of 16 pups (four pups per litter) and placed collars on seven pups. Three pairs (out of four) in our captive, soft-release pens produced litters of three, four, and five pups. All 12 captive-born pups were collared.

*2004*

We documented three wild litters of 11 pups (five males, six females) and placed collars on ten of the 11 pups. A minimum of three pups survived at, or near, their natal den areas. Two of the survivors appeared to have paired with translocated foxes from this year's hard- and soft-releases. One pair (out of four) in our captive, soft-release pens produced a litter of four pups. One pup survived and was paired with a lone, hard-released fox as part of our experimental management relocation program (see Management Relocations section).

*2005*

We documented four wild litters of 18 pups (eight males, six females, four unknown) and placed intraperitoneal transmitter implants (ITI's) in 12 of the 18 at seven weeks of age. Six wild-born pups (three males, three females) were fitted with radio-collars. One pair (out of four) in our captive, soft-release pens produced a litter of five pups. Four of the five captive-born pups were implanted and one was fitted with a radio-collar.

*2006*

We documented four wild litters of 21 pups (eight males, ten females, three unknown) and placed ITI's in 13 of the 21 at seven weeks of age. Nine wild-born pups (three males, six females) were fitted with radio-collars. Three pairs (out of five) in our captive, soft-release pens produced litters of four, four, and five pups, respectively. Parturition dates were known for all three litters to within two days: two litters were born in late May and the third was born on June 5, 2006. Due to the lateness of the litters, only six captive-born pups from two litters were large enough to fit with ITI's before being released from soft-release pens. One captive-born pup was fitted with a radio-collar.

*2007*

We documented ten wild litters of 36 pups (11 males, six females, 19 unknown) and estimated parturition dates to occur between April 14<sup>th</sup> and April 29<sup>th</sup>. Four of the litters produced second generation pups (those born to first generation South Dakota-born foxes). One of these litters was born to a missing captive-born female whose transmitter had been dead for over nine months, but who had remained within 12 km of her natal area. We placed ITI's in nine of the 36 wild-born pups at 7-9 weeks of age. Ten wild-born pups (four females, six males) were fitted with radio-collars. Four pairs (out of five) in our long-term soft-release pens produced a total of 14 pups (10 males, four females), the highest number since the project's inception. Parturition dates were known for all four captive-born litters to within two days: three litters were born in early May and the first was born in late April.

### Survival and Mortality

Survival was calculated annually (365 days post-release) on a release cohort basis (Figure 2). Minimum survival estimates were calculated using a Kaplan-Meier staggered entry estimator (Pollock et al. 1989).

### 2003

Survival of foxes released in 2003 was tracked through the end of the year (December 2003). The survival rate of hard-released foxes was 0.42 (n=20, 95% CI = 0.23 – 0.80) and 0.43 (95% CI = 0.27 – 0.70) for soft-released foxes. By the end of 2003, we had known locations for 16 surviving foxes and an additional six were missing. Missing foxes were defined as not having been located by ground or aerial tracking efforts for >14 days.

We documented 19 mortalities (seven hard-released, 12 soft-released) caused by coyotes (n=14), bobcat (n=2), vehicles (n=1), humans (n=1), and unknown (n=1).

### 2004

Survival of foxes released in 2004 was tracked through the end of the year (December 2004). Survival was significantly higher than in 2003 for all release strategies, including hard-released foxes (0.78), soft-released foxes (0.64), wild-born foxes (0.36), and for the overall population (0.67). By the end of 2004, we had known locations for 26 surviving foxes (16 males, ten females) and an additional 16 were missing (eight males, eight females).

We documented 21 mortalities (eight males, 13 females; 14 juveniles, seven adults) caused by coyotes (n=12), vehicles (n=3), raptors (n=2), and unknown (n=4). Three foxes (two adult males, one female pup) died prior to release and thus were not included in the analysis. The two males were found drowned in the below-ground den boxes after heavy rains and the female pup died of asphyxiation while recovering from implant surgery.

### 2005

Survival was tracked for foxes released in July (soft-release, n=5) and in October (hard-release, n=18) of 2004 until the one-year anniversary of their release date. Overall survival for 2004 releases was 0.23 (95% CI = 0.03 – 0.42) with higher survival in hard-released foxes (0.56, 95% CI = 0.26 – 0.85) than soft-released foxes (0.00).

Survival of foxes released in 2005 was also tracked through the end of the year (December 2005). There was an overall survival rate of 0.60, (95% CI = 0.46 – 0.74), a hard-release survival rate of 0.70 (n=20, 95% CI = 0.53 – 0.87), and a soft-release survival rate of 0.67 (n=18, 95% CI = 0.49 – 0.84). By the end of 2005, we had known locations for 30 surviving foxes (15 males, 15 females) and an additional 11 were missing (six males, five females). Missing foxes were defined as not having been located by ground or aerial tracking efforts for >14 days.

We documented 33 mortalities (19 males, 14 females; 12 juveniles, 21 adults; 12 hard-released, 12 soft-released, nine wild-born) caused by coyotes (18 [0.55]), vehicles (6 [0.18]), unknown (6 [0.18]), raptors (1 [0.03]), snake (1 [0.03]), and swift fox (1 [0.03]). One fox (female adult) drowned in her soft-release pen after heavy rains prior to release and was not included in the analysis.

### 2006

Survival was tracked for foxes released in July (soft-release, n=14) and in October (hard-release, n=20) of 2005 until the one-year anniversary of their release date, ending years three (soft-release) and four (hard-release). Survival for all foxes was 0.57 (95% CI = 0.48 – 0.65). We saw



higher survival in soft-released foxes (0.40, 95% CI = 0.09 – 0.70) than in hard-released foxes (0.38, 95% CI = 0.12 – 0.64) for the first time. Survival for wild-born pups born in 2005 (n=14) was 0.36 (95% CI = -0.04 – 0.75), which was slightly higher than pups born to the captive soft-released pairs (n=3; 0.25, 95% CI = -0.17 – 0.67).

Survival of all foxes released in previous years was also tracked through December 2006. There was an overall survival rate of 0.89, (95% CI = 0.82 – 0.95), a hard-release survival rate of 0.84 (n=25, 95% CI = 0.70 – 0.98), and a soft-release survival rate of 0.43 (n=6, 95% CI = 0.02 – 0.67). Wild-born pup survival for the 2006 cohort (n=21) was 0.53 (95% CI = 0.33 – 0.72), while captive-born pup survival (n=13) was 0.50 (95% CI = 0.22 – 0.78). By the end of 2006, we had known locations for 38 surviving foxes (18 males, 20 females) and an additional 40 were classified as missing (17 males, 23 females).

We documented 32 mortalities (15 males, 17 females; 15 pups, three juveniles, 14 adults) caused by coyotes (13 [0.40]), bobcats (2 [0.06]), raptors (2 [0.06]), unknown (11 [0.34]), injury/starvation (2 [0.06]), and human-caused (1 [0.03]). Two captive-born pups (males) who had not yet been released, succumbed to possible heat exhaustion during extreme summer temperatures in mid-July. Pierre, SD reported a high of 47.2 °C on the same day they were found dead. Tarps secured over the pens provided enough shade to lower temps in the pens by nearly 14° C.

#### *2007*

Survival was tracked for foxes released in July (soft release-long, n=10) and in October (soft release-short, n=25) of 2006 until the one-year anniversary of their release date. Survival for all translocated foxes was  $0.48 \pm 0.02$  SE (n = 35) and  $0.27 \pm 0.01$  SE (n = 22) for wild-born foxes. We saw higher survival in the soft-released/short cohort (n = 25;  $0.72 \pm 0.003$  SE) than soft-released/long foxes (n = 10;  $0.40 \pm 0.01$  SE). Survival for wild-born pups was  $0.50 \pm 0.003$  SE (n = 12), which was slightly higher than pups born to the captive soft-release pairs ( $0.40 \pm 0.01$  SE (n = 10).

Survival of all foxes released in previous years was also tracked through December 2007. There was an overall survival rate of  $0.54 \pm 0.01$  SE (n = 36), a soft/long survival rate of  $0.70 \pm 0.01$  SE (n = 10), and a soft/short survival rate of  $0.69 \pm 0.001$  SE (n = 26). Wild-born pup survival for the 2007 cohort was  $0.77 \pm 0.003$  SE (n = 17) while captive-born pup survival was  $0.31 \pm 0.006$  SE (n = 14). By the end of 2007, we had known locations for 78 surviving foxes and an additional 81 were classified as missing.

We documented 24 mortalities (17 females, seven males; 13 sub-adults, 11 adults; Figure 3) caused by coyotes (7 [0.29]), bobcats (2 [0.08]), raptors (1 [0.04]), vehicle-collisions (8 [0.33]) and unknown causes (6 [0.25]).

## Population Trend

### *2003*

As of December 15, 2003, there were 27 foxes surviving in the restoration area. With 19 mortalities and six missing foxes, there was a net population growth of 26 foxes (17 wild-born pups, 12 captive-born pups) for a lambda of 1.47 (Table 3).

### *2004*

The year 2004 was characterized by significantly higher survival of released foxes and slightly lower reproduction than in previous years (Table 3). This yielded a positive population growth since releases were first conducted in 2002. We began 2004 with a minimum of 24 foxes surviving from the previous two years of releases and reproduction (i.e., 2002 and 2003). As of December 21, 2004 (the end of the 60-day post-release monitoring period), there were an additional 11 wild-born pups, 11 soft-released foxes (eight adults, three pups; one female, two males), and 18 hard-released foxes (seven females, 11 males). With 24 mortalities, this yielded a net population growth of 16 foxes (lambda = 1.67).

### *2005*

The year 2005 was characterized by slightly lower survival of released foxes and slightly higher reproduction than in previous years (Table 3). This yielded a positive population growth since releases were first conducted in 2002. We began the year with a minimum of 26 foxes surviving from the previous two years of releases and reproduction. As of December 31, 2005, there were an additional 18 wild-born pups, 18 soft-released foxes (14 adults, four pups), and 20 hard-released foxes (five males, 15 females). With 33 mortalities, this yielded a net population growth of 23 foxes (lambda = 1.88).

### *2006*

The year 2006 was characterized by slightly higher survival of released foxes and slightly higher reproduction than in previous years (Table 3). This yielded a positive population growth since releases were first conducted in 2002. We began the year with a minimum of 28 foxes surviving from the previous three years of releases and reproduction. As of December 31, 2006, there were an additional 21 wild-born pups, 19 soft-released foxes (six adults, 13 pups), and 29 hard-released foxes (14 males, 15 females). With 32 mortalities and 27 missing foxes, this yielded a net population growth of 12 foxes (lambda = 1.36).

### *2007*

The year 2007 was characterized by slightly higher survival of released foxes, greater numbers of documented breeding pairs, and significantly higher reproduction than in previous years (Table 3). This yielded a positive (and the greatest) population growth since releases were first conducted in 2002. We began the year with a minimum of 38 foxes surviving from the previous four years of releases and reproduction. As of December 31, 2007, there were an additional 36 wild-born pups, 14 captive-born pups, 10 summer-released adults, and 26 fall-released foxes. With 24 mortalities and 22 missing foxes, this yielded a net population growth of 40 foxes (lambda = 2.05). The Badlands National Park Swift Fox Restoration Project also reported a significant population growth for the same period, nearly doubling the numbers of breeding pairs

and more than doubling reproduction from the previous year (Greg Schroeder, personal communication).

### **Captive Husbandry / Soft-Releases**

*2003*

We successfully maintained ten foxes (eight juveniles and two adults) in five soft-release/breeding pens built on the BRR in areas we felt would be suitable habitat for foxes once they were released. Two of these foxes (#166 and #182) escaped from holding pens in March. We visited each pen for feeding on average every five to seven days during September through May and every three to four days during May through October. Foxes were fed approximately 200 – 250 gm/fox/day of road-killed wild game (i.e., deer, antelope, rabbits, and birds) supplemented with high-protein dry kibble (Mazuri brand, exotic canine) ad libitum during the winter months. We provided fresh water (six gallons) at every feeding. During pup-rearing, the diet remained the same but the amount was increased slightly over time to accommodate the energetic needs of the nursing female and growing pups. We recaptured all foxes and their offspring for health checks and replaced radio collars on adults in July and collared pups in September after they weighed  $\geq 1.5$  kg.

On October 6, 2003 we released all soft-release foxes along with their offspring (Figure 4). Adult foxes used the pens for one to three days post-release. Juvenile foxes used the pens for one to 80 days post-release. We continued to provide food at pens that were still being used by foxes.

*2004*

We successfully maintained eight foxes (3 adults, 5 juveniles) in four soft-release/breeding pens on the BRR. During the husbandry period we fed foxes once or twice per week (depending on the time of year) a diet of road-killed deer, rabbits, and birds. We trapped prairie dogs on neighboring lands as part of a “good neighbor” policy and fed these to foxes as whole carcasses. Dry dog kibble, provided ad libitum, supplemented this wild game diet. We provided fresh water (six gallons) at every feeding. During their time in captivity, all foxes gained weight. Also during this period one captive-born litter of four pups (two males, two females) was born to the only adult pair being maintained (the other three non-breeding pairs were composed of one or more sub-adults [ $<$ one year old]). This litter of pups served as a pilot project to determine the efficacy of fitting pups too small for radio collars with abdominal implants, allowing us to monitor survival during the rearing stage prior to dispersal. We surgically fitted these pups with abdominal implants at age 58 days old.

On July 21, 2004 we released all soft-release foxes (Figure 5) and supplemented the pens with food for another four weeks. We documented three out of the four pairs establishing dens in the area immediately around their release site ( $<$  one km). Four individuals remained in the area by the end of the year.

*2005*

We successfully maintained 14 foxes in seven soft-release/breeding pens on the BRR. During the husbandry period one male fox (422M) escaped from his enclosure and was killed by coyotes seven days later 46 km from his release site. A second fox (420F) drowned in her soft-release

pen after heavy rains prior to being released. We fed foxes once or twice per week (depending on the time of year) a diet of road-killed deer, rabbits, and birds. We trapped prairie dogs on neighboring lands as part of a “good neighbor” policy and fed them to foxes as whole carcasses. Dry dog kibble, provided ad libitum, supplemented this wild game diet. We provided fresh water (six gallons) at every feeding. During their time in captivity, all foxes gained weight. Also during this period one captive-born litter of five pups (4 males, 1 female) was born to an adult pair being maintained. We surgically fitted the four male pups with abdominal implants at age 54 days.

On July 13, 2005 we released all soft-release foxes (n=18; Figure 6) and supplemented the pens with food (i.e., road-killed rabbits, prairie dogs) for another four weeks, if foxes were nearby.

### 2006

We successfully maintained 10 foxes in five soft-release/breeding pens on the BRR. Three captive-born litters of four, four, and five pups (6 males, 5 females, 2 unknown) were born. We surgically fitted six pups (3 male, 3 female) with abdominal implants at age 68 days.

On August 7, 2006 we released all soft-release foxes (n=19; Figure 7) and supplemented the pens with food (i.e., road-killed rabbits, and prairie dogs) for another four weeks, if any foxes were nearby. One of the foxes released (515M) had badly injured his shoulder the previous fall after being released. After undergoing surgery performed by Dr. Carpenter, DVM, in Sturgis, SD, 515M was returned to the BRR and placed in a soft-release pen to recover. He was observed on a number of feeding visits above ground and running around in the pen. There did not seem to be any pronounced, even noticeable limp to his gait and in July the decision was made to release him along with his pen mate and pups. Two days after his release he was observed digging at a prairie dog burrow near his release pen. Three of his four pups were with him at the den.

### 2007

For the fifth and final year, we successfully maintained 10 foxes in five soft-release/breeding pens on the BRR. Four captive-born litters of three, three, four, and four pups were born. We surgically fitted four pups (1 male, 3 female) with ITI's at an average age of 66 days. Five of these pups (2 female, 3 male) were fitted with radio collars prior to release.

Due to losing several pups in the extreme summer heat of 2006, we decided to release the soft-release pens approximately a month earlier than in past years. On June 16<sup>th</sup> we locked open the gates to the pens and released four of the five pens (n=18; Figure 8). A female in the fifth pen was found to be injured as a result of a loose collar, and required veterinary care, thus was not released until later in the summer when she had completely healed.

Due to the young age of the pups, we continued to provide both water and food at the pens, hoping this would encourage the adults to remain in the area as caretakers. Two of the males left the area soon after being released; one joined several other wild-born juveniles in the eastern part of the ranch. Two females and one male were killed within weeks of their release and one female was not accounted for, likely the result of a malfunctioning collar. Surviving adults from separate pens have paired and continued to use a soft-release pen and the immediate area surrounding it. It is not known whether there are still pups with these adults.

## Predator Control

We attempted to achieve our primary objective by temporarily reducing the abundance of coyotes in the SFRA. This coyote reduction program had several objectives:

1. Reduce and maintain coyote densities at <50% of pre-control abundance (approximately 0.20 – 0.40 coyotes/km<sup>2</sup>).
2. Maintain coyote-caused mortality rates on foxes at <25%.
3. Reduce coyote predation rates on foxes annually.
4. Stop coyote control if it appears ineffective at reducing coyote predation rates on foxes (see criteria above).
5. Stop coyote control when it appears that fox density has reached a level to maintain a viable fox population capable of withstanding coyote predation (fox density >0.10/km<sup>2</sup>), or if we have not maintained a viable fox population in 10 years.

Kamler (2003) suggests a survival rate >0.60, such as that found only in Wyoming and Colorado, is needed to create a source population of swift foxes. While coyotes appeared to be the single greatest source of mortality for our reintroduced foxes, research has shown that survival, especially of juveniles, can be increased by efforts aimed at reducing coyote populations (Karki 2003). The results of this may have implications for our reintroduced foxes, which like dispersing juvenile foxes in Karki's study area, were unfamiliar with the area and did not have a known network of escape dens available. Thus the behavior of translocated foxes is likely similar to juvenile foxes in established populations (Kunkel et al. 2004). For this reason we designed and implemented a coordinated coyote control program aimed at short-term reductions timed to coincide with early summer and fall releases. Our primary method of control was aerial shooting from a fixed-winged aircraft (Piper Super Cub) combined with targeted use of recreational coyote callers and opportunistic shooting. We made an effort to collect a representative number of downed animals for necropsy to determine coyote population demographics and potentially transferable diseases.

### 2003

We removed 116 coyotes during 41.6 hours (2.79 coyotes/hr) of flying on 12 February, 11 July, 30 September – 2 October, and 26 November, 2003. Twelve of 25 (48%) coyotes collected were adults, of which six were males. Fifteen of the 24 (62.5%) coyotes were females.

We also removed coyotes on the ground, primarily by using local trappers who called and shot them under a TESH biologist's direction and following approved protocols (Kunkel et al 2001b). We targeted resident breeding pairs. Callers removed five coyotes (two males, three females; four adults, one juvenile).

Our fall fecal-line surveys indicated a declining population trend for coyotes (Table 4). Using fecal-line index data through 2002 and our removal data in an Eberhardt (1982) population estimator (index removal method), we obtained an estimate of 190 coyotes (95% CI = 171 – 209; 0.33 coyotes/km<sup>2</sup>) on the BRR prior to our removals. Based on the fecal-line survey index, the proportion of the coyote population on BRR that we removed since removals commenced was 0.70.

#### *2004*

We contracted a pilot prior to our fall hard releases and removed 39 coyotes in 15 hours of hunting (Table 5). Six coyotes (four males, two females) were collected for necropsy. Average age and mass for collected coyotes was 2.25 years and 11.7 kg for males, respectively, and 2.5 years and 10.35 kg for females. Results from disease testing were unavailable at the time of this report. We also employed the use of several recreational coyote callers who continued this removal work in areas of known foxes. This combination of methods appeared to have complemented the other and may have been partially responsible for the high survival of the hard-released foxes. Due to pilot availability we did not conduct any aerial control work prior to our soft releases in 2004, which may have contributed to a high number of mortalities in our wild-born pups and soft-released foxes.

#### *2005*

We contracted a pilot prior to our fall hard releases and removed 27 coyotes in 13 hours of hunting (Table 6). Six coyotes (four males, two females) were collected for necropsy. The average age and mass for collected coyotes was 2.75 years and 13.7 kg for males, respectively, and 0.75 years and 8.9 kg for females. Results from the disease testing were unavailable at the time of this report. We also employed the use of several recreational coyote callers who have continued the removal work in areas of known foxes. These callers are known to have harvested over 100 coyotes from the BRR during 2005. This combination of methods may have been partially responsible for the high survival of the hard-released foxes. Due to pilot availability during good to excellent conditions (i.e., significant snow cover) we did not conduct any aerial control work prior to our soft releases in 2005.

#### *2006*

We conducted control operations twice during the year. The first removal effort was in March and the second was in August shortly before the release of soft-release pens. We removed 47 coyotes in 16.5 hours of aerial hunting. We continued to employ several recreational predator callers who concentrated their efforts in areas of known fox locations. Between the two hunting methods we collected 29 coyote carcasses (15 male, 14 female) for analyses. The average age and mass for collected coyotes was 2.5 years and 12.74 kg for males, respectively, and 2.2 years and 10.56 kg for females. Results from the disease testing are provided in Table 7. In 2006, we had greater hunting success (i.e., the number killed per hours hunting; 2.85 coyotes/hour) than in 2005 (2.36 (coyotes/hour)), which may have indicated an increasing population, as this trend was also evident in our coyote surveys. Analysis of blood samples showed no coyotes with antibodies to plague (Table 7).

#### *2007*

We did not conduct any aerial predator control during 2007. Recreational coyote callers opportunistically removed coyotes in areas of know fox locations, but no blood samples were collected.

## **Trapping and Translocation**

### Wyoming Population Surveys

We assisted the Wyoming of Game and Fish Department (WGFD) with their annual swift fox surveys in order to assess translocation impacts on the Wyoming source population. We conducted a presence /absence survey using track plates coated with chalk and baited with canned mackerel. The survey was conducted prior to trapping activities so as not to affect the detection probabilities. Plates were placed along 16, two-mile long transects selected by WGFD biologists for Region 2 (Laramie and Goshen Counties) and lasted for six weather-free nights or until a fox was detected. Foxes were detected on four of nine transects in Laramie County and on zero of seven transects in Goshen County (Table 8).

#### *2003*

We trapped foxes from a 1,119-km<sup>2</sup> area around Cheyenne, WY. By stipulations of WGFD we did not trap specific sites that were <nine km from where we captured foxes in 2002. We trapped on lands owned by ten different landowners and along 35 km of county roads. We captured 40 foxes during 851 trap nights (4.7 foxes/100 trap nights) from August 21 to September 12. We trapped and processed 23 females (11 adults, 12 juveniles) and 17 males (12 adults, five juveniles; Table 9). Traps were set in the evening, checked again at dawn, and closed during the day. We used a handling bag to remove foxes from traps. Foxes were physically restrained and handled by two technicians. Body condition was assessed, parasites were counted and collected, blood was drawn, and measurements were taken on the neck, canines, shoulder, tail, and body length. We also weighed, ear-tagged and radio-collared each fox. Eighteen foxes (45%; eight adult males, one unknown age male, seven adult females, two juvenile females) tested positive for plague and were released at their capture sites. Four foxes tested positive for tularemia and eight tested positive for distemper; these were transported to BRR. Juvenile female mass averaged 1.8 kg, adult females averaged 1.9 kg, juvenile males averaged 1.9 kg, and adult males averaged 2.3 kg.

We translocated nine adults (five males, four females) and 13 juveniles (four males, nine females) to our South Dakota quarantine facilities (i.e., Van Metre Field Station in Jones County, South Dakota), eight foxes short of our permitted quota. We held foxes in kennels in Wyoming for periods of four to six days before translocating them to quarantine facilities on BRR. We found no apparent deleterious effects from this holding period.

As a result of low trapping success in fall 2003 and the high incidence of plague in captured foxes, we trapped again in December around the Laramie, Wyoming area to capture the final eight foxes we were permitted to translocate. With the help of two biologists from WGFD, we captured 23 foxes during 333 trap nights (6.9 foxes /100 trap nights) from December 18 to December 21. We captured 13 females (four adults, nine juveniles) and ten males (five adults, five juveniles). Twenty-two (96%; four adult females, eight juvenile females, five adult males, five juvenile males) tested positive for plague exposure and 21 were released back to their capture sites. One juvenile female was captured with an amputated rear left foot, probably as a result of trapping injury related to a leg-hold trap, and tested positive for plague. This fox was donated to the Wyoming State Vet Lab (Beth Williams/ Hank Edwards) for serum harvest with

permission from WGFD. Juvenile female mass averaged 2.1 kg, adult females averaged 2.3 kg, juvenile males averaged 2.4 kg, and adult males averaged 2.5 kg. We translocated one fox (a juvenile female) to BRR South Dakota quarantine facilities.

#### 2004

We trapped and processed 45 wild foxes (26 males, 18 females; 24 adults, 20 sub-adults; Table 10) from a 1,310 km<sup>2</sup> area around Lusk, WY (14 Townships; T30 –T33N, R60 – R64W) in 1,190 trap nights (3.78/100 trap nights). We trapped 43 foxes on private land with permission from 14 landowners and two on state land with permission from the leaseholders. We followed the same handling and data collection protocol as described above. Juvenile female mass averaged 2.05 kg, adult females averaged 2.11 kg, juvenile males averaged 2.35 kg, and adult males averaged 2.39 kg.

We translocated 36 (21 males, 15 females; 16 adults, 20 sub-adults) to South Dakota that tested negative for exposure to the sylvatic plague virus (*Yersinia pestis*). We secured all necessary documents prior to shipping, including health certificates and SD Animal Industry Board shipping permits #'s CRS 9-8-04C-SP-A, CRS 9-8-04C-SP-B, and SDH9-14-1W. We released the other eight adult foxes (testing positive) back to the wild at their capture sites. One female fox, 444F, was trapped twice on consecutive nights and released. Foxes free of any overt signs of disease were shipped to SD and quarantined Van Metre Field Station in Jones County, South Dakota for a minimum of 21 days prior to release.

#### 2005

We trapped and processed 60 wild foxes (21 males, 39 females; 35 adults, 25 sub-adults; Table 11) from a 1,119-km<sup>2</sup> area around Cheyenne, WY (12 Townships; T12 –T18N, R63 – R67W) in 810 trap nights (7.41foxes/100 trap nights). We trapped 59 foxes on private land with permission from five landowners and one at a den on a county road right-a-way. We followed the same handling and data collection protocol as described above. Juvenile female mass averaged 1.94 kg, adult females averaged 2.17 kg, juvenile males averaged 2.14 kg, and adult males averaged 2.33 kg.

We translocated 30 foxes (10 male, 20 female; 18 adults, 12 sub-adults) to South Dakota that tested negative or that showed no increasing titer levels for exposure to the sylvatic plague bacterium (*Yersinia pestis*). We vaccinated foxes for rabies, distemper, infectious hepatitis, adenovirus (Type 2), para influenza, and parvovirus. We treated foxes, shipping kennels, and transport vehicles with Sevin dust (carbaryl powder) prior to shipment to South Dakota. We secured all necessary documents prior to shipping, including health certificates and SD Animal Industry Board shipping permits, #'s SP-1223-DO, SP-1226-DO, SP-1229-DO. We released the other 30 foxes to the wild at their exact capture sites. All 30 translocated foxes were free of any overt signs of disease and were quarantined the Van Metre Field Station in Jones County, South Dakota for a minimum of 21 days prior to release.

#### 2006

In an effort to increase the genetic diversity and spread out any potential local impacts, we secured permits to translocate foxes from both Colorado and Wyoming for the 2006 trapping



season. We trapped and processed 37 wild foxes (17 males, 20 females; 20 adults, 17 sub-adults; Table 12) from the area around Karval, CO in 291 trap nights (12.7 foxes/100 trap nights). With assistance from the Colorado Division of Wildlife (CDOW) Regional biologist Bob Davies, staff biologists Casey Cooley and Brian Dreher, Conservation Officer Warren Cummings, and other CDOW personnel, we trapped foxes on private land with permission from at least five landowners. We followed the same handling and data collection protocol as described above. Juvenile female mass averaged 2.02 kg, adult females averaged 2.21 kg, juvenile males averaged 2.24 kg, and adult males averaged 2.42 kg.

We translocated 35 foxes (17 male, 18 female; 19 adults, 16 sub-adults) to South Dakota. All foxes tested negative for exposure to the sylvatic plague bacterium. Again, we vaccinated foxes for rabies, distemper, infectious hepatitis, adenovirus (Type 2), Para influenza, and parvovirus. We treated foxes, shipping kennels, and transport vehicles with Sevin dust (carbaryl powder) prior to shipment to South Dakota. We secured all necessary documents prior to shipping, including health certificates from CDOW veterinarian Dr. Lisa Wolfe and SD Animal Industry Board import permit # 090106. We released the two non-translocated foxes to the wild at or near their capture sites. All 35 translocated foxes were free of any overt signs of disease and were quarantined at the Van Metre Field Station for a minimum of 21 days prior to release.

Trapping under TESH's Chapter 33 Scientific Collection Permit (ID # 325) issued by the WGFD was also conducted by BNP personnel, with the permission of Scott Talbott, Assistant Chief of the Wildlife Division. BNP personnel successfully trapped a total of 65 foxes (26 males, 39 females; 32 pups, 27 sub-adults, 6 adults), and translocated 26 (10 males, 16 females; 20 pups, 6 sub-adults) to South Dakota after testing results were determined to be negative for plague antibodies. Foxes testing positive for antibodies (n=39; 16 males, 23 females; 12 pups, 21 sub-adults, and 6 adults) were returned to their capture locations.

#### 2007

We trapped and processed 27 wild foxes (13 males, 14 females; 19 adults, 8 sub-adults: Table 13) from an area around Lamar, CO in 199 trap nights (13.6 foxes/100 trap nights). We trapped the foxes on private land with permission from two landowners by CDOW biologists. We followed the same handling and data collection protocol as described above.

We translocated 26 (13 males, 13 females; 18 adults, 8 sub-adults) to South Dakota. Again, we vaccinated foxes for rabies, distemper, infectious hepatitis, adenovirus (Type 2), Para influenza, and parvovirus. We treated foxes, shipping kennels, and transport vehicles with Sevin dust (carbaryl powder) prior to shipment to South Dakota. We secured all necessary documents prior to shipping, including health certificates and SD Animal Industry Board shipping permit #SP-2409TC. We released the 27th fox to the wild at her exact capture site.

Based on serologic titers, nine of the 26 translocated foxes initially tested positive for exposure to the sylvatic plague bacterium, and were held in a quarantine facility located at the TESH Van Metre Field Station for a minimum of 21 days before release. Samples from the nine foxes were shipped to the Center for Disease Control (CDC), Fort Collins, CO for follow-up testing to determine baseline titer levels. Blood was re-drawn 14 days after their initial capture and sent to CDC for analysis. Titer levels were compared between the initial and subsequent rounds of

testing and results indicated that no foxes suffered from active infections of the bacterium as evidenced by a significant rise in titer levels.

## **Fall Hard Releases**

### *2003*

We released 19 foxes on October 13, 14, 15, and 21, 2003. Two foxes escaped from holding pens, one on September 3<sup>rd</sup> and one on September 16<sup>th</sup> – the latter without a radio collar. We released ten males (four adults) and 11 females (four adults), 12 from kennels and nine from pens (Table 14, Figure 4). Eight foxes were released in the north unit, ten were released in the south unit, and three were released in the west unit. We released two foxes from den boxes that had been buried at the release site. Foxes did not use these sites after release. We also released an adult pair into a previously occupied swift fox den. The female of the pair used this den and the area around the den for approximately three days.

### *2004*

On October 21, 2004 we conducted the third consecutive year of swift fox releases. We released 18 foxes (11 males, seven females; two adults, 16 juveniles; Table 15). We conducted releases to focus on two areas of the BRR we hoped to establish breeding populations in (Figure 5). We also received authority from the SDGFP to conduct three releases on non-Turner lands, given we secured landowner permission. These releases were conducted to optimize favorable habitat used by previous foxes or to supplement lone, unmated foxes. Fourteen foxes (eight males, six females; one adult, 13 sub-adults) were released onto BRR property and four foxes (three males, one female; one adult, three sub-adults) onto other private lands (an additional female sub-adult wild-born on the BRR, was paired with a WY translocated male and relocated to other private lands). We also received authority from the SDGFP to trap and relocate lone foxes to other sites within the restoration area, allowing greater flexibility in managing such foxes to limit future dispersal as well as increase survival and reproduction.

We made several changes to 2004's fall releases. The first change was to increase reproduction in soft-release pens by holding adults in lieu of sub-adults. Preliminary data has shown survival of hard-released foxes to be equivocal between adult and sub-adults (Honness, unpublished data), however, reproduction data from our captive/soft-release pairs suggested that adult pairs produced litters with greater frequency than did sub-adult pairs. We theorized that retaining adult foxes as captive breeders would enable us to produce more pups for soft-releases. We held six adults and two adult: sub-adult pairs over winter in the soft-release/breeding pens. These pairs, along with any pups born to them, were released in July 2005.

A second change was to clump releases using a 'softer' hard-release technique. Analysis from data collected in 2002-2003 suggested that survival rates were higher for soft-released foxes (0.41) than for hard-released foxes (0.29) and correlated with lower dispersal rates of soft-released foxes (Kunkel et al 2004). We theorized that affecting similar behavior in hard-released foxes may limit initial dispersal distance, increase fox density in focal areas, and increase the likelihood that foxes encounter each other, further limiting dispersal, especially during the

second dispersal pulse of breeding season. Such behaviors could likely improve overall survival rates and increase reproductive success.

### *2005*

On October 9, 2005 we conducted the fourth consecutive year of swift fox releases. We released 20 foxes (five males, 15 females; ten adults, ten sub-adults; Table 16). We conducted releases in two areas of the BRR we hoped to establish breeding populations in (Figure 6). We also received authority from the SDGFP to conduct eight releases on other private lands, given we secured landowner permission. These cooperating landowners were Mr. David Stirling and Mrs. Lois Hall. These releases were conducted to take advantage of favorable habitat used by previous foxes or to supplement lone, unmated foxes. Twelve foxes (two males, ten females; five adults, seven sub-adults) were released onto BRR property and eight foxes (three males, five females; five adults, three sub-adults) were released onto other private lands.

### *2006*

In an effort to maximize the survival potential of foxes during the fifth year of scheduled releases, we secured the permission of landowner Jack Hansen to conduct the bulk of the 2006 releases on lands centered in Haakon County (Figure 7). In previous years several foxes were observed traveling through and a litter of pups was born (in 2003) within five km of this land, we felt this area would be well suited to direct releases. Additionally, Hansen's land (then owned by his father, Bud Hansen) was also one of the two original release sites for the first swift fox reintroduction effort conducted by the South Dakota Game, Fish and Parks (SDGFP) in 1980 (Sharps and Whitcher 1984).

On October 1, 2006 we conducted the fifth consecutive year of swift fox releases. We released 29 foxes (14 males, 15 female; 13 adults, 16 sub-adults; Table 17); 20 of them (ten males, ten females; 11 adults, nine sub-adults) were released on the Hansen ranch. Two male-female pairs that did not breed in soft-release pens were held through the summer and released in the Haakon County cohort. All foxes in Haakon County were released using mush pens. Nine foxes (four males, five females; two adults, seven sub-adults) were released onto BRR property in the Ash Creek area of the northeast unit. These releases were used to supplement breeding opportunities for wild-born pups born in the area and to take advantage of one fox family's experience of living on and around a large prairie dog colony in Colorado. All releases were conducted within the parameters of our permit from the SDGFP and with the permission of cooperating landowners.

### *2007*

In an effort to build on the success of the previous year, we conducted the bulk of our 2007 releases on Jack Hansen's lands in Haakon County (Figure 8). On October 8, 2007 we conducted the sixth and final year of swift fox releases. We released 26 foxes (13 males, 13 females; 15 adults, 11 sub-adults; Table 18); 21 of them (10 males, 11 females; 12 adults, nine sub-adults) were released on the Hansen ranch. All foxes were released using short-term soft-release pens. Four foxes (two males, two females; two adults, two sub-adults) were released onto BRR property in the Ash Creek area of the northeast unit. These releases were used to supplement breeding opportunities for wild-born pups born in the area. One fox self released prior to being moved to his acclimation pen, but after the quarantine period was complete. As in previous

years, all releases were conducted within the parameters of our permit from the SDGFP and with the permission of the cooperating landowners.

## **Management Relocations**

*2003*

We captured and collared six wild born pups during June to September, 2003. Four of these were pups were dug from their den near Highway 14 after both their parents were killed by vehicles and transferred to a holding pen for release later in the fall.

We trapped and relocated one far-ranging female fox that had traveled > 64 km from any other known foxes. This fox, #239F, had located in an area along the White River known to have a high density of coyotes. Consequently, we decided to trap and move her to a neighboring ranch possessing both high quality habitat and a lone male fox, #170M. The female was held in a mush pen constructed of metal t-posts and chicken wire and placed over an existing fox den for five days. This time was necessary to allow the free-ranging male to “discover” her and potentially hold her to the area upon release. She continued to use this area for at least three weeks after being released.

*2004*

We developed a method of releasing paired foxes or introducing unpaired foxes to one another by placing one or two animals in a temporary pen structure (mush pen) erected over an existing den or hole. The goal of this method was to increase survival, fidelity to release sites, and reproduction. This approach has been effective in encouraging fidelity to both a place and a mate. We hoped this method would decrease the likelihood that unpaired foxes would exhibit a second dispersal pulse in advance or during the breeding season. Although we have documented instances where foxes have established pairings on their own, we also know that foxes will travel great distances during the breeding period, presumably in search of a mate. Our data suggested that foxes who travel widely have a relatively high likelihood of being killed. By employing our temporary pen structure to facilitate the pairing of foxes, we hoped to minimize wide-ranging movements and mortality while maximizing the production of pups. To date, we employed this mush pen release method for five paired releases and six management releases (pairing unpaired foxes with established foxes).

*2005*

We did not trap and move any free-ranging South Dakota foxes in 2005.

*2006*

Due to the initial success of this year’s releases we had little need to attempt management relocations, with one exception. Fox 619M, released in the Ash Creek area of the BRR, moved east toward Fort Pierre and established a territory along the Bad River, just outside of town limits. He was caught in a box trap set for raccoons by Tom Maupin, a local youth living along Bad River road (the landowner, Darby Nutter called to inform us of the capture). The decision was made to relocate this fox to the BRR and pair him with an adult female who had lost her mate in August. They were confined to a mush pen for seven days and then released.

2007

No management relocations were necessary during 2007.

## **Veterinarian Services**

We worked primarily with a local veterinarian, Dr. Virginia Trexler-Myren, DVM, to conduct the surgical procedure necessary to place intraperitoneal transmitters (ITI's) in a sample of wild-born and captive-born pups in order to better assess neonate survival. We also relied on her expertise to treat what may have been several life-threatening injuries to foxes incurred either in the wild or while being held in captivity.

## Implants

We developed a protocol (Appendix 1) to use ITI's in swift fox pups to determine survival, causes of mortality, and dispersal habits during the critical pup rearing stage (Kitchen et al. 1999). Pups in this stage (three to 20 weeks) are vulnerable to disease and predators and are typically too small to be fitted with radio collars. While observations carried out at den sites can provide data relating to reproductive success, the recovery of carcasses and determination of cause of mortality is often limited. Survival, reproductive success, and dispersal are considered to be critical components that contribute to the success or failure of reintroduction efforts (Bar David et al. 2005). Having the means to assess these components may assist in developing strategies to mitigate losses and increase juvenile recruitment. We attempted to capture and implant a representative sample from each of our known litters, given annual funding parameters.

2003

No ITI's were placed in swift fox pups during 2003.

2004

Two-thousand and four served as a pilot year in which we experimented with ITI's to track neonatal survival of fox pups too small for radio collars. One captive-born litter of four pups (two males, two females) served as a pilot project to determine the efficacy of fitting pups too small for radio collars with abdominal implants, allowing us to monitor survival during the rearing stage prior to dispersal. We surgically fitted these pups with abdominal implants at age 58 days old.

2005

In July, when pups ranged in age from 54 to 66 days old, we placed ITI's in four captive-born and 12 wild-born fox pups. Pups were captured in the early morning by hand (captive-born) or using baited box traps (wild-born) and transported to the All Creatures Animal Hospital, Pierre, SD in Vari Kennel shipping crates. Dr. Virginia Trexler-Myren, DVM conducted the surgery. Pups were monitored closely post-operation and all pups were returned to their natal sites by late afternoon. No pups died as a result of the surgery, although one wild female pup died shortly after administering the gas anesthesia. This pup appeared anemic and unhealthy. The body was shipped to the WY State Vet Lab in Laramie for necropsy and disease testing. Lab results

indicated that she was severely dehydrated, underweight, and suffering from severe anemia, which was likely caused by a blood-borne parasite. A littermate was also dehydrated and underweight but responded well to IV fluids, thus was implanted and released.

### *2006*

During June and July we placed ITI's in six captive-born and 13 wild-born fox pups. Pups were between 52 to 76 days old and weighed between 0.73-1.34 kg (females) and 0.76 – 1.5 kg (males) at the time of the surgery. As in 2005, pups were captured in the early morning by hand (captive-born) or using baited box traps (wild-born) and transported to the All Creatures Animal Hospital, where Dr. Trexler-Myren, DVM, conducted the surgeries. Pups were monitored closely post-operation and all pups were returned to their natal sites by late afternoon. Pups were observed for several hours to determine their acceptance by the parents and their post-operative condition. Implanted pups were observed eating and running around briskly with their litter mates. No pups appeared to have died as a direct result of the surgery.

Implants have yielded a great amount of data relating to neonate survival and their causes of mortality that would not otherwise have been possible to determine. Of the 19 pups implanted in 2006, we have known fates for 17 with just two classified as missing. Of the 17 known fates, 12 were mortalities (five coyote, two vehicle, one starvation, and four unknown causes) and five survived. Five of the mortalities were documented before pups were large enough for radio-collars which would not have been possible without the ITI's. Before ITI's, these animals would have likely been classified as missing from the population. Ten of the implanted pups were located and collared in late August, a process greatly facilitated by the ability to track a signal to a particular hole, as opposed to blindly setting traps in an area known to be used by pups.

### *2007*

During July we placed ITI's in four captive-born and nine wild-born fox pups. Pups were between 52 to 76 days old and weighed between 0.76-1.37 kg (females) and 0.97 – 1.7 kg (males) at the time of the surgery. All capture, surgery, post-surgery, and release events followed previous year's protocols. No pups appear to have died as a direct result of the surgery. Several pups have been re-trapped post-surgery and no complications (i.e., infections, tears) were documented.

## Injuries

### *2003*

Three injuries were observed while we were trapping foxes in Wyoming during the fall. Likely as a result of being trapped, canines of one fox were broken and the foot of a second fox was cut to bone. One juvenile female had a pre-existing fractured foot, probably from a leg-hold trap. Veterinarians at the East Broadmoor Veterinary Clinic in Cheyenne set the broken foot. We kept this fox in a large kennel for two weeks, administering daily penicillin shots, and then transported her to the BRR. Four weeks after the injury, x-rays indicated that the bones had healed well, and the fox was transferred to a soft-release pen for later release.

### *2004*

No reported injuries to foxes requiring veterinary services were incurred during 2004.

*2005*

Shortly after being trapped and translocated from Wyoming, a male fox (515M) escaped from his quarantine pen and was free-ranging for four days until we located and trapped him. He was suffering from an injury to the head and right shoulder. We transported him to All Creatures Animal Hospital for treatment. The head injury appeared to be an abscess while the shoulder appeared to be a gunshot wound that was affecting the shoulder joint. Dr. Trexler-Myren successfully treated the head injury, but due to the nature of the shoulder recommended another surgeon, Dr. Larry Carpenter, DVM, MS repair the shoulder. This was successfully done on October 3, 2005. Dr. Carpenter's assessment of the injury was that it was probably caused by a blunt trauma (i.e., getting kicked) rather than by a gunshot. Fox 515M was paired with a female in a soft-release pen and released in 2006.

*2006*

A wild-born male fox (456M) released on the BRR was trapped south of Prairie City, SD (Perkins County). He was alive but injured, so an aerial monitoring flight was rerouted to Faith, SD to pick him up and bring him to Pierre for medical attention. Though his paw had been damaged in the trap, Dr. Trexler-Myren was able to save enough of the lower leg to allow him to bear weight. Dan Miller, Director for the Bramble Park Zoo in Watertown, SD assisted by locating a zoo that was interested in taking him into their American Zoological Association sanctioned breeding program. In June, 456M was transferred from Pierre to the Riverside Zoo in Scottsbluff, NE, where he now resides and is passing on his genes through the captive breeding program.

Dr. Trexler-Myren also repaired an injury to a female fox (629F) that was obtained either before being trapped in Colorado or while in the trap. She was treated for an infection and after several weeks of consistent care and daily antibiotics, was placed in a soft-release pen on the BRR and released in 2007.

*2007*

Two injuries to long-term soft-release foxes required medical attention. The first was sustained by a female fox (629F) in the fall of 2006 prior to being translocated from Colorado to South Dakota. This injury required stitches and was held at All Creatures for approximately 16 days. She was placed in a long-term soft-release pen where she was held along with a male (609M) until their release in June 2007, along with their three pups. She showed no adverse effects from the injury or medical confinement.

A second female (604F) was found injured while we conducted the final handling and re-collaring prior to release of the long-term soft-release pens. Her collar had become much too loose, probably while nursing, which allowed her to get her right front leg through the collar strap. Once she began to put body weight on again, the collar began rubbing into her neck and 'arm pit' causing a large laceration, which required stitches. Due to the flexing that occurred in that area of the leg, the healing time was substantial and required the fox to remain at the hospital for 107 days during which time the wound was cleaned every 3<sup>rd</sup> day. This was the longest medical confinement we experienced during the life of this project. She was released on October 8, 2007 along with her mate, 628M, and their three pups.

## Prey and Predator Surveys

### 2003

We assessed both prey and predator trends. Preliminary analysis suggested the relative abundance of breeding birds (Table 19, Table 21) and density of lagomorphs (Table 36) were higher than in 2002. We found an average of 4.8 grassland birds/ha on all sites over the three sessions in 2003 compared with 4.1 grassland birds/ha on all sites over the three sessions in 2002. We counted a mean of 0.06 grasshoppers/m<sup>2</sup> during the September 2003 session (four days) on four transects in three habitats (coulee, prairie dog colony, and upland grass), which was a decline from what we observed in 2002 (i.e., mean = 0.31 grasshoppers/ m<sup>2</sup>; Table 31).

We had higher small mammal capture success in 2003 versus 2002. We captured 80 small mammals during 2,857 trap nights from 16 September to 11 October, 2003 (Table 26). Capture success was 2.8 small mammals/100 trap nights during the session. Drought in 2002 and our change to marking small mammal with paint instead of toe clipping may have accounted for this decline in trapping success.

Relative density of coyote scats along transects declined significantly during fall 2002 – fall 2003. Mean relative scat density for red foxes remained low and stable. Established coyote densities along transects declined from 0.269/km<sup>2</sup> in spring 2002 to 0.207/km<sup>2</sup> in fall 2002 to 0.139/km<sup>2</sup> in fall 2003 (Table 41). Estimated swift fox density declined from 0.041/km<sup>2</sup> in fall 2002 to 0.031/km<sup>2</sup> in fall 2003.

### 2004

We assessed both prey and predator trends. Preliminary analysis suggested the relative abundance of breeding birds (Table 19, Table 22) and small mammals (Table 27), and estimated densities of arthropods (Table 32) and leporids (Table 37) all increased from previous years sampling. Most notable was small mammal abundance (as measured by capture success [captures / 100 trap nights]) was nearly seven times greater than for 2003. Also, spotlighting results for leporids indicated a five-fold increase in cottontail rabbits (*Sylvilagus floridanus*) over 2003 estimates. These increasing trends indicated that prey abundance was likely not a limiting factor in restoring swift foxes.

Conversely, results from predator surveys indicated the coyote population rebounded to pre-control levels (Table 41). This increase may be reflective of our inability to effect a significant amount of control during the year. The targeted removal we conducted immediately prior to our fall hard releases was done after the surveys were completed and thus results may not accurately reflect this once foxes were released.

### 2005

We assessed both prey and predator trends. Preliminary analysis suggested the relative abundance of breeding birds (Table 20, Table 23) and density of lagomorphs (Table 38) were down slightly from 2004's estimates, while estimated densities of arthropods (Table 33) were higher than the previous year. Most notable was the 2005 small mammal abundance (Table 28), which was dramatically lower than in 2004 but roughly equal to the estimate in 2003 (as measured by capture success [captures / 100 trap nights]). Similar trends for both years (i.e., 2004 and 2005) were also observed on the Lower Brule Reservation (S. Grassel, personal



communication). These estimates appeared to indicate large-scale fluctuations in densities and species diversity annually, a phenomena that has been well documented in the scientific literature. Because it is also documented that roughly 80% of the swift fox diet is comprised of small mammals (Hines 1980), these fluctuations may play an important role in both movements and survival of foxes.

Results from predator surveys and our aerial hunting effort indicated the coyote population on the BRR was at an all time low since the project's inception in 1999. During the spring and fall survey periods, we estimated coyote densities at 0.22/ km<sup>2</sup> and 0.10/km<sup>2</sup>, respectively (Table 41). Normally densities would increase over the course of the year as reproduction is added to the population. In 2005, however, we collected what was thought to be the first case of mange in a coyote since we began removing and collecting coyotes in 2001. Anecdotally, recreational coyote hunters and SDGFP staff also observed numerous cases of coyotes with mange in this area during summer and fall of 2005, which could partially explain why coyote densities have declined.

### 2006

Preliminary analysis suggested that relative abundance of breeding birds (Table 20, Table 24) and small mammals (Table 29) were down slightly from 2005's estimates, while estimated densities of arthropods (Table 34) and lagomorphs (Table 39), particularly jack rabbits (*Lepus tonwsendii*) were higher than the previous year's estimates. Most notable were arthropods and jackrabbit densities which showed an increase of 0.89 and 0.59, respectively over 2005 estimates. For jackrabbits, this increase represented an upward trend for each year surveys have been conducted, with the exception of 2005, which decreased slightly. While estimates of both breeding birds and small mammals were lower in 2006, neither were dramatically lower, and breeding bird densities were likely affected by the mowing of the Conservation Reserve Program (CRP) units for upland hay forage as a result of the drought relief assistance offered to west-river ranchers. Though abundance estimates for small mammals was slightly lower (as measured by capture success [captures / 100 trap nights]), species diversity was higher.

Results from predator surveys and aerial hunting effort indicated the coyote population on the BRR increased over 2005's estimates, while fox abundance decreased slightly (Table 41). These trends were consistent between both survey methods – fecal line transects and night spotlighting. Coyote indices were measured using nine, 1.6 km transects located along unimproved roads, moderately used two-tracks, and seldom used two-tracks within the BRR boundaries. Transects were first cleared of scats and then scats deposited during the sampling period were counted and collected if presumed to be from foxes. The index is the deposition rate of fresh scats (scats/km/day; Knowlton 1984). Indices were converted to estimates of coyote density (number/km<sup>2</sup>) using the regression equation:  $density = (index - 2.66) \times 0.054$  (Stoddart et al. 2001). Density estimates in 2006 for coyotes and foxes were 8.5/ km<sup>2</sup> and 0.55/km<sup>2</sup> respectively. Estimated densities derived from 2006 nocturnal spotlighting transects were 0.16/ km<sup>2</sup> and 0.02/km<sup>2</sup> for coyotes and foxes, respectively, compared to 2005 estimates of 0.11/ km<sup>2</sup> and 0.05/ km<sup>2</sup>. While estimates from the two methods differ greatly, the trend between years was consistent between methods and compared favorably to the aerial hunting effort data.

2007

Preliminary analysis suggests that relative abundance small mammals (Table 30) was experienced a two-fold increase from 2006's estimates, while estimated densities of arthropods (Table 35) and lagomorphs (Table 40) showed only slight increases. Estimated densities of breeding birds (Table 20, Table 25) were lower than in 2006; however, estimates did not include data from the spring survey period, which was not conducted due to weather, logistics, and scheduling difficulties. Since the spring period was typically the peak for breeding bird activity, estimates lacking these data will naturally be skewed downward.

Results from predator surveys indicate the coyote population on the BRR decreased slightly from the previous year's estimate, while fox abundance increased by a factor of three (Table 41). Again, these trends were consistent between both survey methods – fecal line transects and night spotlighting. Density estimates in 2007 for coyotes and foxes were 6.51/ km<sup>2</sup> and 3.79/km<sup>2</sup> respectively, compared with 2006 estimates of 8.5/ km<sup>2</sup> and 0.55/km<sup>2</sup>. Estimated densities derived from 2007 nocturnal spotlighting transects were 0.14/ km<sup>2</sup> and 0.06/ km<sup>2</sup> for coyote and fox respectively, compared with 2006 estimates of 0.16/ km<sup>2</sup> and 0.02/ km<sup>2</sup>. Both methods reflected the sizable increase observed in the overall population trend.

## Education and Outreach

According to IUCN guidelines for reintroductions (IUCN/SSC Re-introduction Specialist Group 1998) conservation education and public relations through mass media and in local communities are important elements in any reintroduction program. We created and distributed an annual newsletter, *Swift Fox Restoration News*, to local residents via mail and through a project website ([www.tesf.org/projects/swiftfox](http://www.tesf.org/projects/swiftfox)). We also extended our outreach efforts by speaking to area civic and conservation groups, student groups, and professional societies.

By far, the most important and effective method of promoting our work was from one-on-one contacts with area residents and adjoining landowners while conducting daily field activities. Because many foxes released on the BRR have migrated to other private lands outside the boundaries of the ranch, we have been heavily dependent on the gracious cooperation of these landowners for collecting our data. As mentioned previously, we have received access from nearly 90 individual landowners to conduct monitoring, collect mortalities, determine reproductive success, and provide release sites for hard released foxes outside of the BRR. In several cases, we were permitted to trap and remove unwanted prairie dogs from neighboring lands to use as a high quality food source for captive foxes and their pups. These relations speak to the careful nature by which we conducted our work on lands adjacent to the BRR, but also to the charismatic nature of the swift fox itself and the non-controversial role it can play in promoting the continued conservation of native grasslands.

Because local support is crucial to conservation efforts, we provided numerous forums for public involvement in the project and stressed the program's responsiveness to the needs, desires, and opinions of the local public. We held the initial public fox release on September 30, 2002 for 81 people including personnel from project cooperators: SDGFP, WGFD, U. S. Fish and Wildlife Service, FPNG, LBST, Badlands National Park, the National Fish and Wildlife Foundation, state

and regional environmental organizations and producer groups, along with local neighbors and citizens. Representatives from state and regional media organizations were also present.

### 2003

We conducted a tour of the BRR in May for representatives of the FPNG and the Prairie Partners Program under the Rocky Mountain Bird Observatory, Denver, Colorado. We also conducted a field trip in August for students of the Pierre Indian Learning Center in cooperation with the South Dakota Wildlife Federation, National Wildlife Federation (Regional Office), SDGFP, FPNG, and the BRR.

We conducted four public meetings and two public hearings with local residents to provide information on fox ecology and the reintroduction proposal. We stressed the program's responsiveness to the needs, desires, and opinions of the local public and incorporated these into the program whenever possible. We conducted field tours of the release areas with representative of South Dakotan agricultural groups. We sought and obtained cooperation from nearly 50 private landowners in relation to monitoring, carcass retrieval, trapping/recollaring and denning. We published three editions of our newsletter, Swift Fox Restoration News, on the progress of the project. We cooperated with: Wildlife Experiences, Inc. (WEI), a presenter of live-animal education programs based in Rapid City, South Dakota; the Bramble Park Zoo in Watertown, South Dakota; and the SDGFP to provide an ambassador swift fox program to schools and civic organizations around western South Dakota. We have been working with the South Dakota Trapper Association to reduce likelihood of fox capture in coyote traps or snares.

### 2004

We conducted myriad tours of the BRR and one-on-one discussions with residents of South Dakota. We continued our work with neighboring and willing landowners for securing access to mortalities, and natal dens.

### 2005

In April and May of 2005, TESH and BRR staff conducted a series of classroom education programs for the Jones County School District, grades 4–12. These programs were followed up with a ranch field trip for the 11<sup>th</sup> grade science class where prairie ecology relating to bison management, prairie dog restoration, and swift fox reintroduction were discussed. With a theme of “Be a biologist for a day”, activities were designed to give students an opportunity to participate in actual field research techniques such as burrowing owl (*Athene cunicularia*) nest surveys, black-tailed prairie dog (*Cynomys ludovicianus*) density estimates, and fox tracking using vehicle and hand-held telemetry equipment. The program was well received. We also presented a talk entitled “Ecological Restoration on the Bad River Ranches” to the SD Ornithological Union in Pierre, SD. This talk covered the broader vision of imperiled species restoration and how it relates to commodity (i.e., bison) production.

### 2006

For the second year, TESH and BRR staff conducted a series of classroom education programs for the Jones County School District, grades 4–12. These programs were followed up with a ranch field trip for the 11<sup>th</sup> grade science class where students participated in our “Be a biologist for a day” event.

2007

We did not conduct any formal outreach programs during 2007. We continued our work with neighboring and willing landowners for securing access to mortalities, natal dens, and for providing release areas in higher quality habitat outside the BRR.

## **Administration**

As with any long-term research effort conducted over a broad landscape, much work was necessary to administer the needed support to keep field activities running smoothly. Project coordination between agency, tribal and other non-governmental entities was vital in promoting a broad vision capable of recovering a species as opposed to a single, isolated population. We organized and forged a working group comprised of private, federal, and tribal entities to reintroduce and restore multiple populations of swift foxes throughout western South Dakota.

Beginning in 2003, the National Park Service at Badlands National Park conducted swift fox releases within the Park's administrative boundaries. After a review of their initial efforts, BNP decided to translocate additional foxes in 2006, beyond the three years proposed in the original plan. Because we trapped our full complement of foxes from Colorado, the WGFD allowed BNP to trap foxes under the 2006 permit granted to TESH. As a result, BNP trapped and translocated 26 foxes (10 males, 16 females) in 2006. It was our hope that these additional foxes provided breeding opportunities to foxes dispersing between the TESH and BNP release areas and would contribute to the existing population in South Dakota.

Two tribal governments in South Dakota, the Lower Brule Sioux Tribe (LBST) and the Ogallala Sioux Tribe, received federal funds in 2004 to assess the potential for reintroducing foxes and to conduct surveys for the presence of foxes on their respective tribal lands. In 2006, the LBST released 40 foxes in the first of three years of proposed releases. We actively cooperated with these projects by sharing sampling design and providing hands-on trapping and monitoring opportunities. We also cooperated with the LBST project by monitoring for missing foxes, and locating and collecting mortalities. By enlisting the support of private landowners between these other project areas, we hoped that swift foxes would again occupy much of their historical range within the state.

## Funding proposals

2003

We received \$45,000 from the U. S. Fish and Wildlife Service for the 2003 proposal:

Kunkel, K. E., K. M. Honness, and M. K. Phillips. Restoration of swift fox in the northern Great Plains. U.S. Fish and Wildlife Service Private Lands Stewardship Grant Program.

We received a matching grant of \$35,000 from the National Fish and Wildlife Foundation in 2003 for the proposal:

Kunkel, K. E., K. M. Honness, and M. K. Phillips. Restoration of swift fox in the northern Great Plains - II.

2004

We did not submit proposals for any additional funding during 2004.

2005

In total, we secured \$228,000 in grant monies that were added to TESH funding to administer the fox project in 2005, 2006, and 2007.

We received \$118, 000 from the South Dakota State Wildlife Grants Program for the proposal:

K.M. Honness, and M.K. Phillips. 2005. Restoring Swift Foxes (*Vulpes velox*) to the Bad River Ranches and environs in western South Dakota.

We received \$90,000 from the U. S. Fish and Wildlife Service Private Stewardship Grant Program (PSGP) for the 2005 proposal:

K.M. Honness, and M.K. Phillips. 2005. Restoration of Swift Fox to the Bad River Ranches and Environs in South Dakota. U.S. Fish and Wildlife Service Private Lands Stewardship Grant Program.

We received \$20,000 from the National Fish and Wildlife Foundation (NFWF) for the 2005 proposal:

K. M. Honness, and M.K. Phillips. 2005. Restoration of the Swift Fox in the Northern Great Plains. National Fish and Wildlife Foundation Grant Program.

2006

In total, we secured \$53,000 in grants that were added to TESH funding to administer the fox project in 2007 and 2008.

We received \$53, 000 from the South Dakota State Wildlife Grants Program for the proposal:

K. M. Honness and J.A. Jenks. 2006. Assessing Swift Fox (*Vulpes velox*) habitat use and resource selection in the pup-rearing period in the mixed-grass prairie of west-central South Dakota.

2007

We did not submit proposals for any additional funding during 2007.

### Papers produced

- Kunkel, K. E., K. Honness, M. K. Phillips, and L. N. Carbyn. 2003. Plan for restoring swift foxes to west-central South Dakota. Pages 189-198 in Ecology and Management of Swift Fox in a Changing World. L. Carbyn and M. Sovada, editors. Canadian Plains Research Center, Regina, Saskatchewan, Canada.
- Kunkel, K. E. and K. M. Honness. 2004. Restoring Swift Foxes (*Vulpes velox*) to the Bad River Ranches in western South Dakota, Progress Report: 2002 - 2003. Turner Endangered Species Fund Conservation Report 01-04.
- K. M. Honness, M. Phillips, and K.E. Kunkel. 2005. Swift Fox Restoration in west central South Dakota: 2004 Annual Progress Report. Turner Endangered Species Fund Conservation Report 01-05.
- K. M. Honness, M. Phillips, and K.E. Kunkel. 2005. Swift Fox Restoration in west central South Dakota: 2004 Annual Progress Report. Turner Endangered Species Fund Conservation Report 01-06.

### Professional Presentations

- Sovada, M. and K. E. Kunkel. 2003. Restoration of swift foxes in the northern Great Plains: Bad River Ranches and Badlands National Park. Society for Ecological Restoration Annual Meeting, Austin, Texas.
- Kunkel, K. E. and K. M. Honness. 2003. Restoration of swift foxes in the northern Great Plains: Bad River Ranches. Swift Fox Conservation Team annual meeting, Ft. Collins, Colorado.
- Honness, K. M., and K. E. Kunkel. 2004. Restoring Swift Foxes (*Vulpes velox*) to the Bad River Ranches in western South Dakota, Progress Report: 2002 - 2003. The Wildlife Society South Dakota Chapter Annual Meeting, Chamberlain, South Dakota.
- K. M. Honness. 2005. Ecological Restoration on the Bad River Ranches. South Dakota Ornithological Union, Pierre, South Dakota.
- K. M. Honness. 2005. Swift Fox Restoration in West-central South Dakota: 2002 – 2004. Swift Fox Conservation Team, Kansas City, Kansas.
- F. J. Ferrara, K.M. Honness, T.M. Ecoffey, D. Albertson, G.M. Schroeder, and S.M. Grassel. June, 23, 2006. Preserving a piece of the prairie: Partnerships are key for swift fox restoration in South Dakota. American Society of Mammalogists, National Meeting, Massachusetts.
- Honness, K.M., J.A. Jenks, and S.M. Grassel. March 6, 2007. Dispersals and long-range, post-

release movements of reintroduced swift fox in western South Dakota. The Wildlife Society, South Dakota Chapter meeting, South Dakota.

Honness, K.M., J.A. Jenks, S.M. Grassel, and G.M. Schroeder. April 17, 2007. Dispersals and long-range, post-release movements of reintroduced swift fox in western South Dakota. Swift Fox Conservation Team annual meeting. Rapid City, South Dakota.

Honness, K.M., and J.A. Jenks. December 10, 2007. Movement parameters of reintroduced and native-born swift foxes (*Vulpes velox*) in a mixed-grass prairie. 68<sup>th</sup> Midwest Fish and Wildlife Conference. Madison, Wisconsin.

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South Dakota Game, Fish, and Parks (SDGFP), Colorado Division of Wildlife (CDOW), Wyoming Game and Fish Department (WGFD), Badlands National Park (BNP), U.S. Forest Service – Fort Pierre National Grasslands (FPNG), U.S. Fish and Wildlife Service (USFWS), Lower Brule Sioux Tribe (LBST), Wyoming State Veterinary Lab, South Dakota State Veterinarian and Animal Industry Board, Swift Fox Conservation Team (SFCT), National Fish and Wildlife Foundation (NFWF), Burgduff Aviation, Capital City Air Carrier, East Broadmoor Veterinary Clinic in WY, Eileen Dowd Stukel (SDGFP), Lu Carbyn (Canadian Wildlife Service), Marsha Sovada (U. S. Geological Survey), Shaun Grassel (Lower Brule Sioux Tribe), Brian Kenner, Todd Russell, Greg Schroeder (Badlands National Park), Hank Edwards (WSVL), Kyran Kunkel (Mountain Thinking Institute), and Jon Jenks (South Dakota State University).

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- Kunkel, K.E., K.M. Honness, M.K. Phillips, L.N. Carbyn. 2001b. Plan for restoring Swift fox to west central South Dakota. Turner Endangered Species Fund Conservation Report 01-02.
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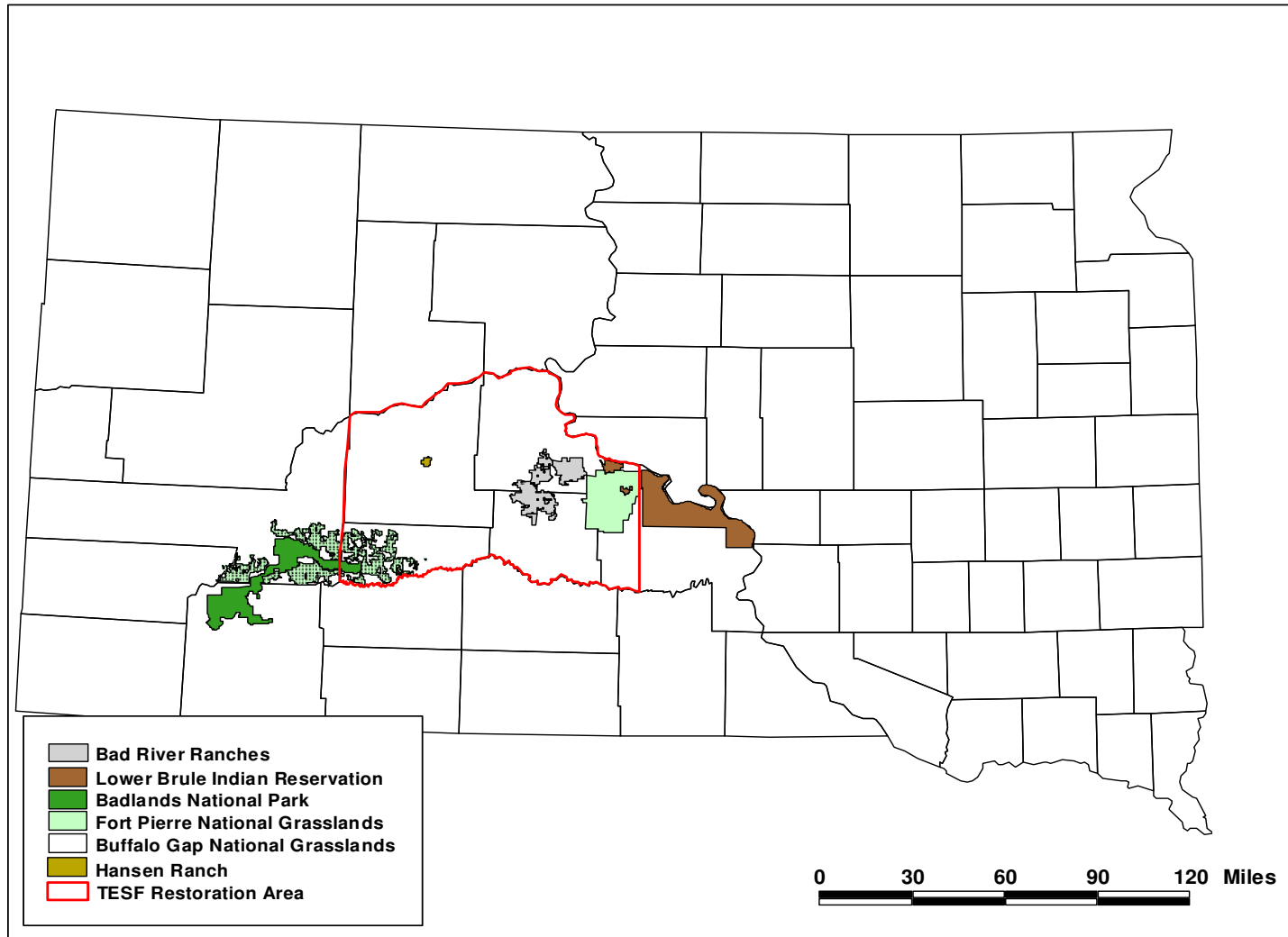


Figure 1. Turner Endangered Species Fund Swift Fox Restoration Area (SFRA).

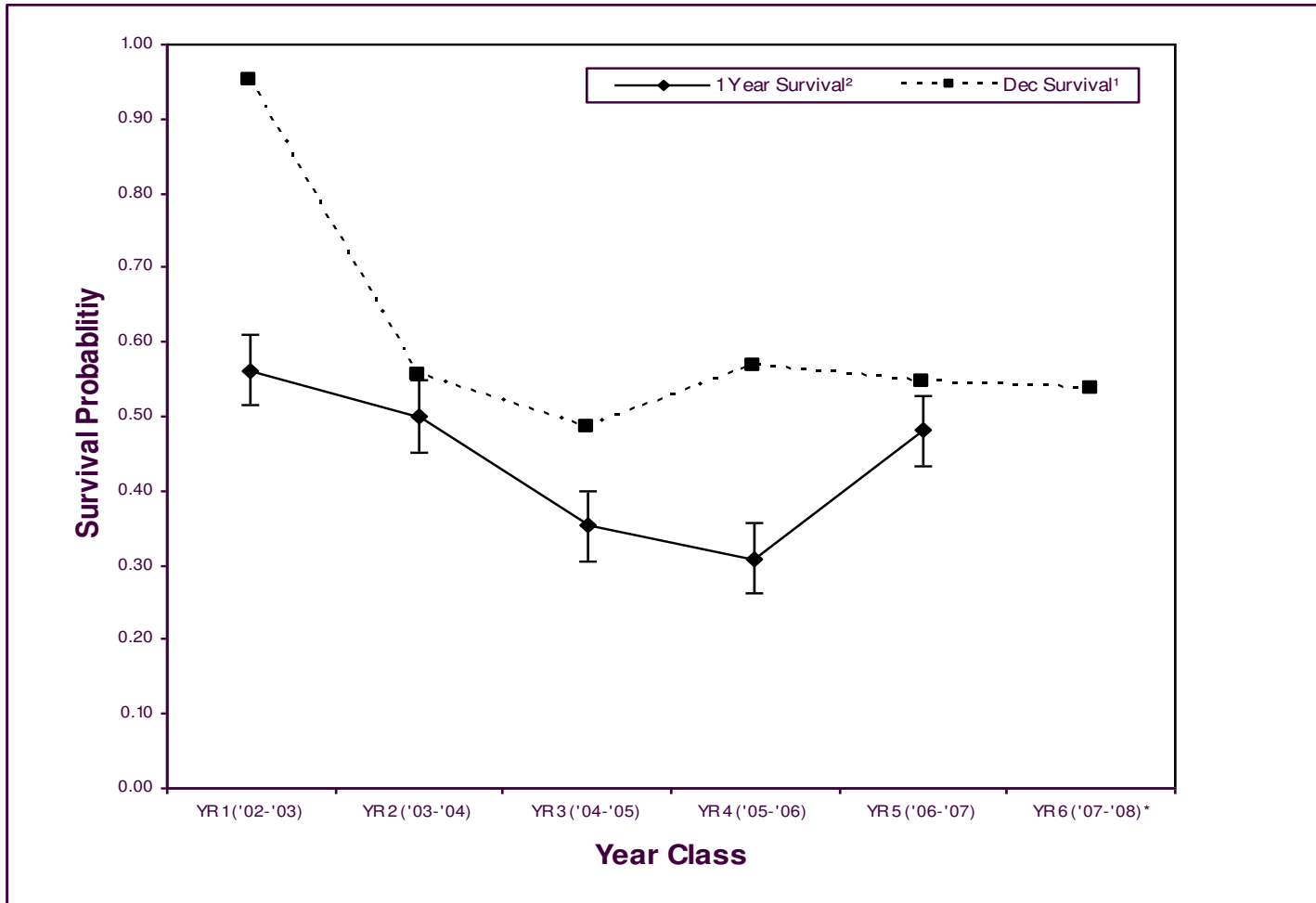


Figure 2. Graph showing overall survival by release year class for foxes translocated to TESH Swift Fox Restoration Area, 2002 – 2007. One-year survival was calculated for the first 365 days post-release for each class. December survival is shown to allow comparison across all years since Year 6 data were incomplete at the time of this report.

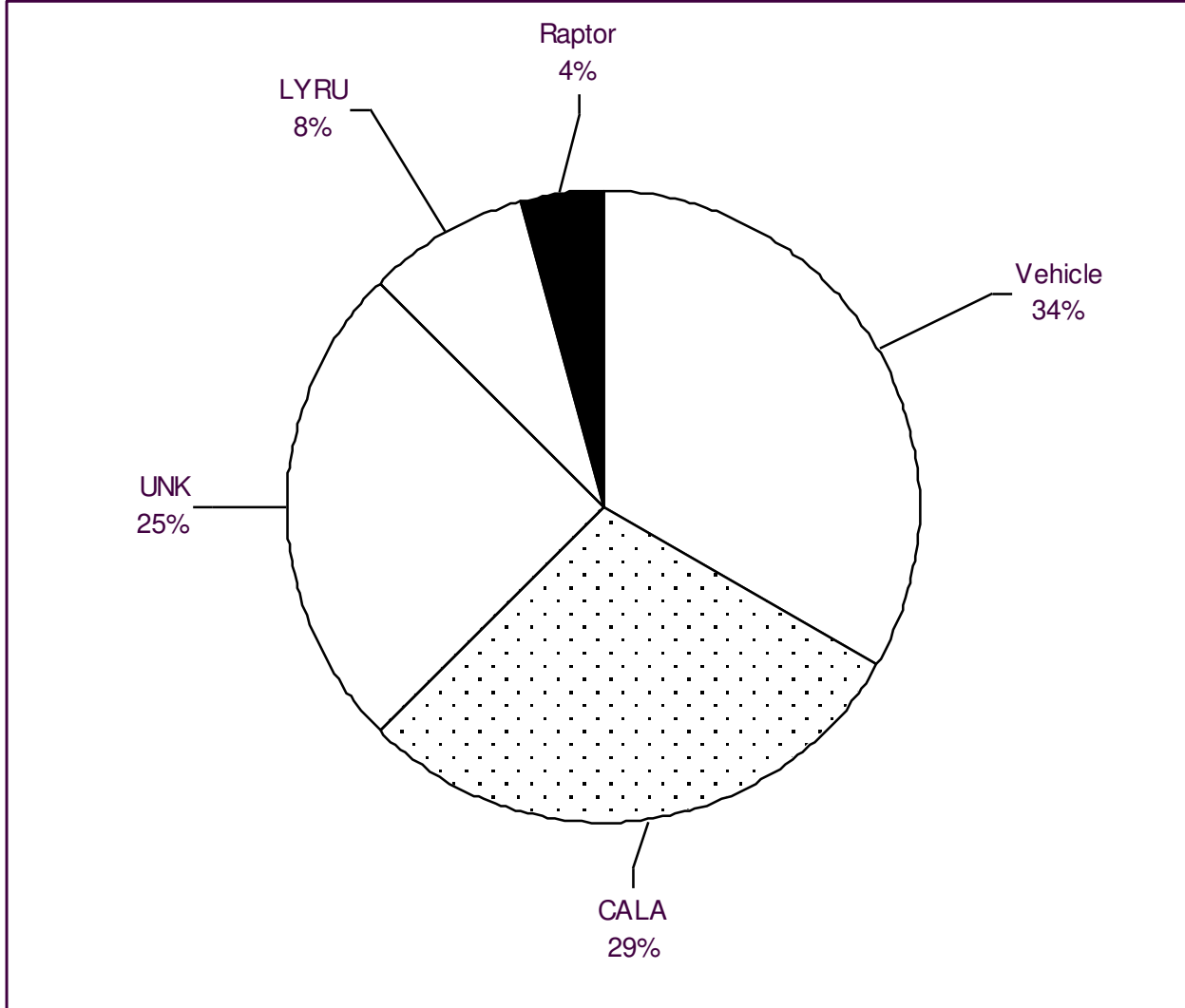


Figure 3. Cause-specific mortalities of foxes collected during 2007 ( $n = 24$ ).

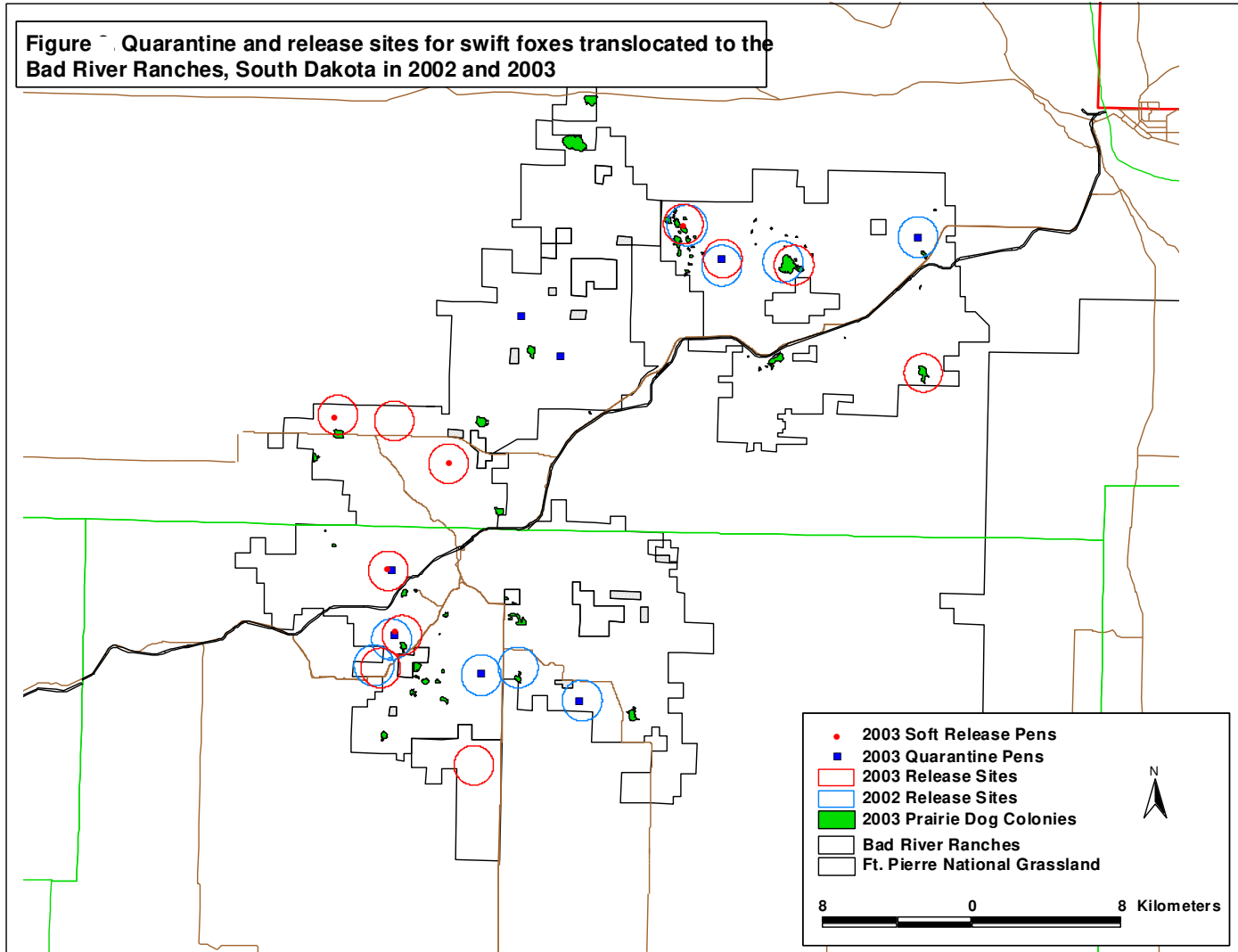


Figure 4. Release sites for foxes released in the TESH Swift Fox Restoration Area (SFRA) during 2002 and 2003.

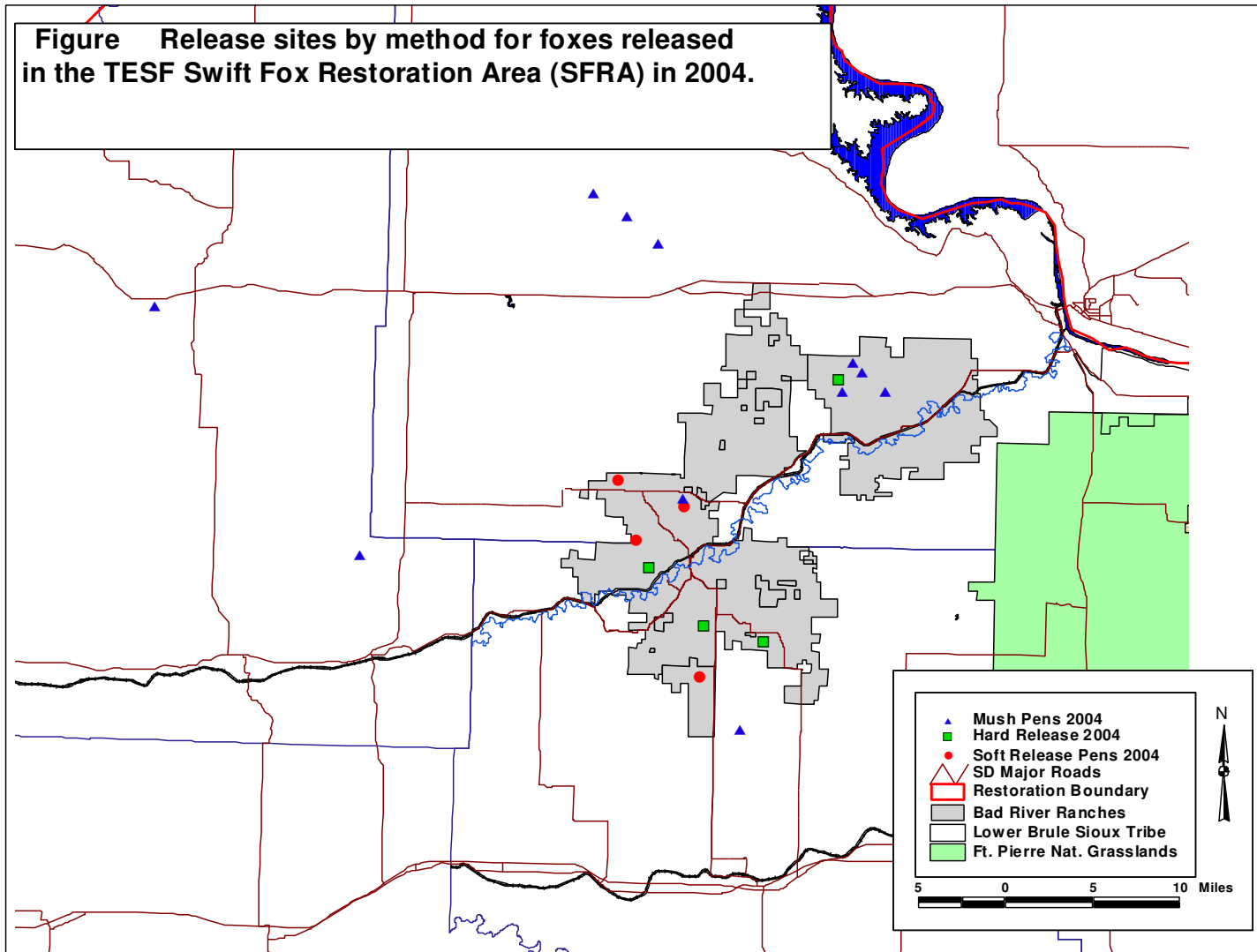


Figure 5. Release sites for foxes released in the TESH Swift Fox Restoration Area (SFRA) during 2004.

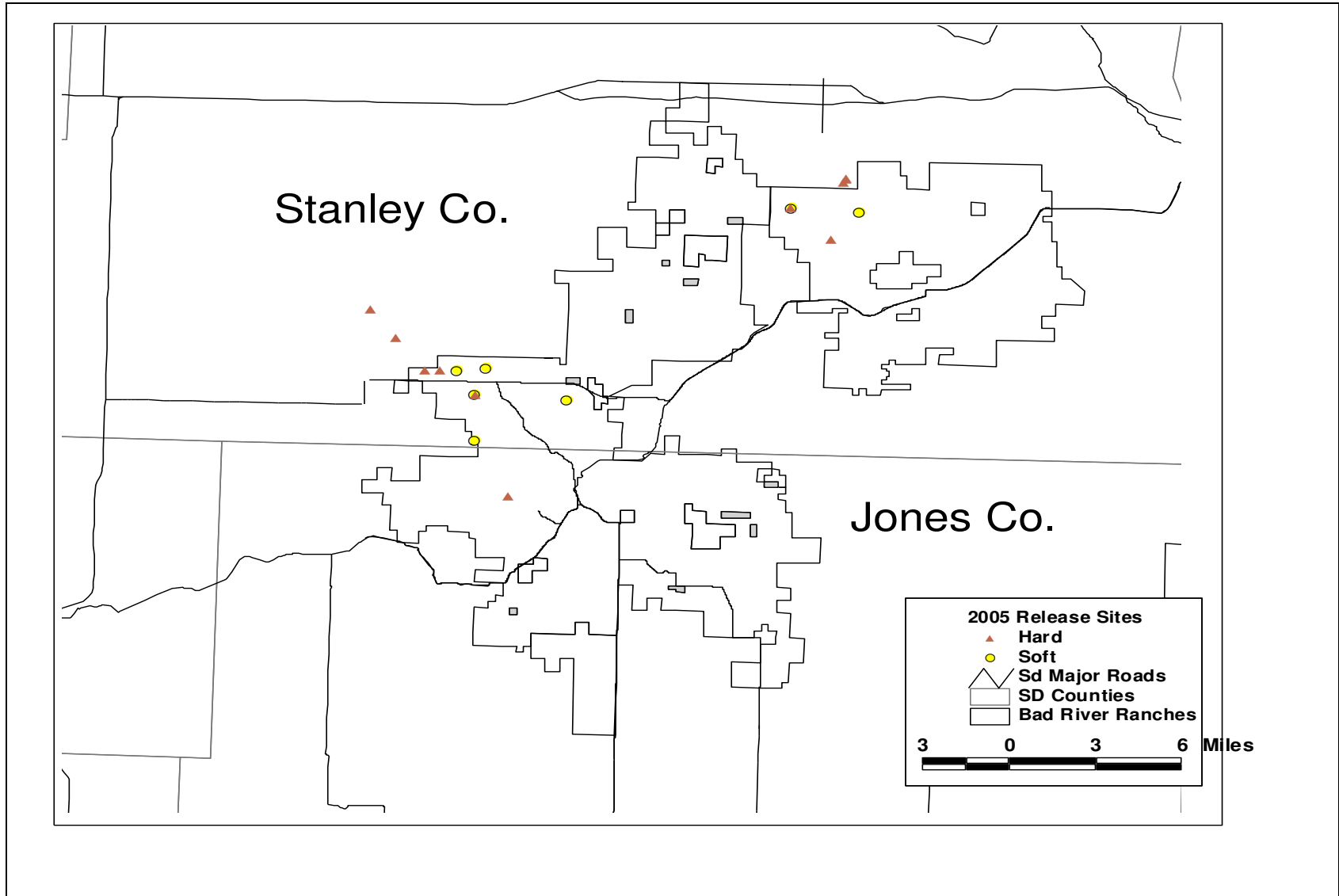


Figure 6. Release sites for foxes released in the TESH Swift Fox Restoration Area (SFRA) during 2005.

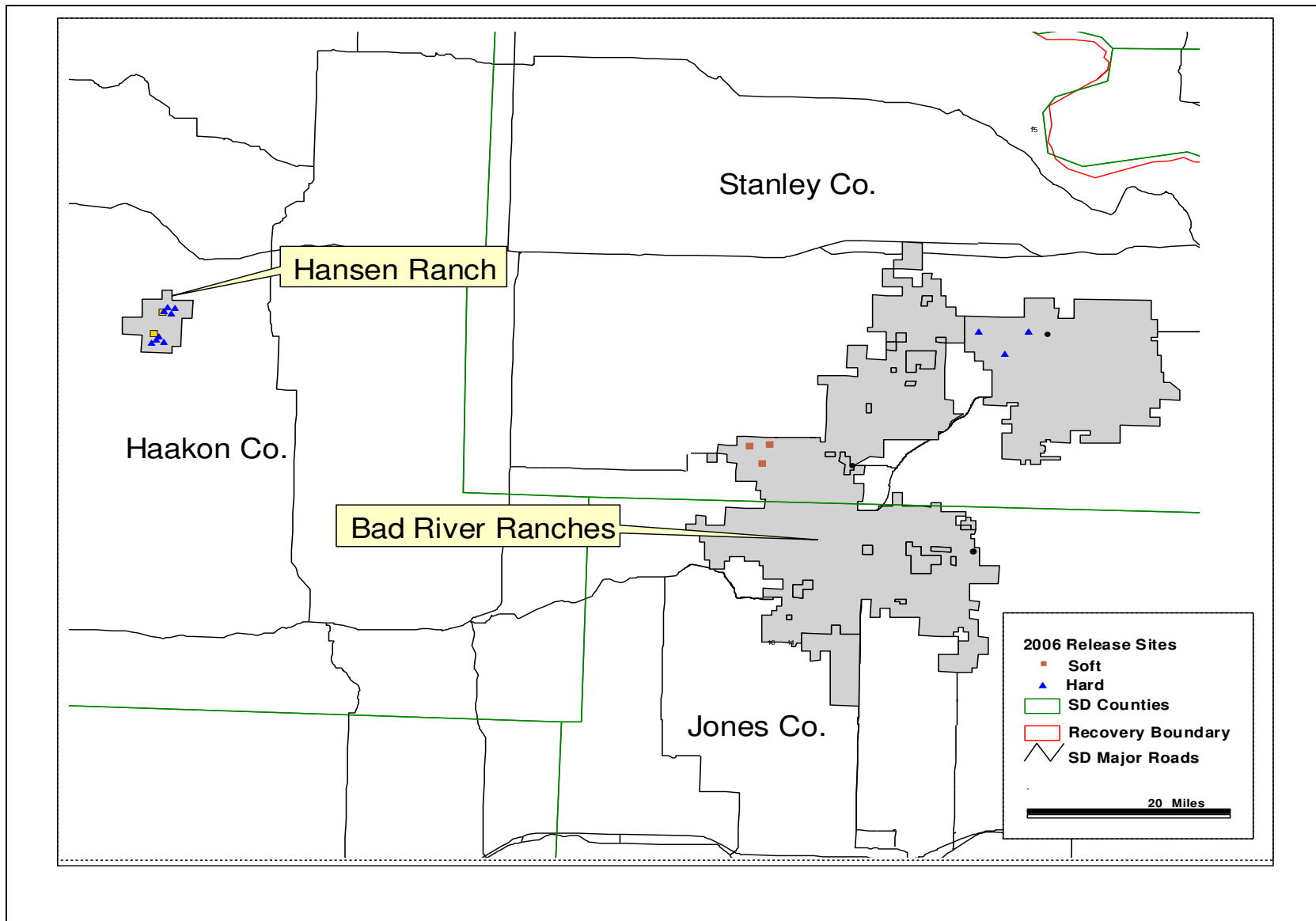


Figure 7. Release sites by release type for foxes released in the TEF Swift Fox Restoration Area (SFRA) during 2006.



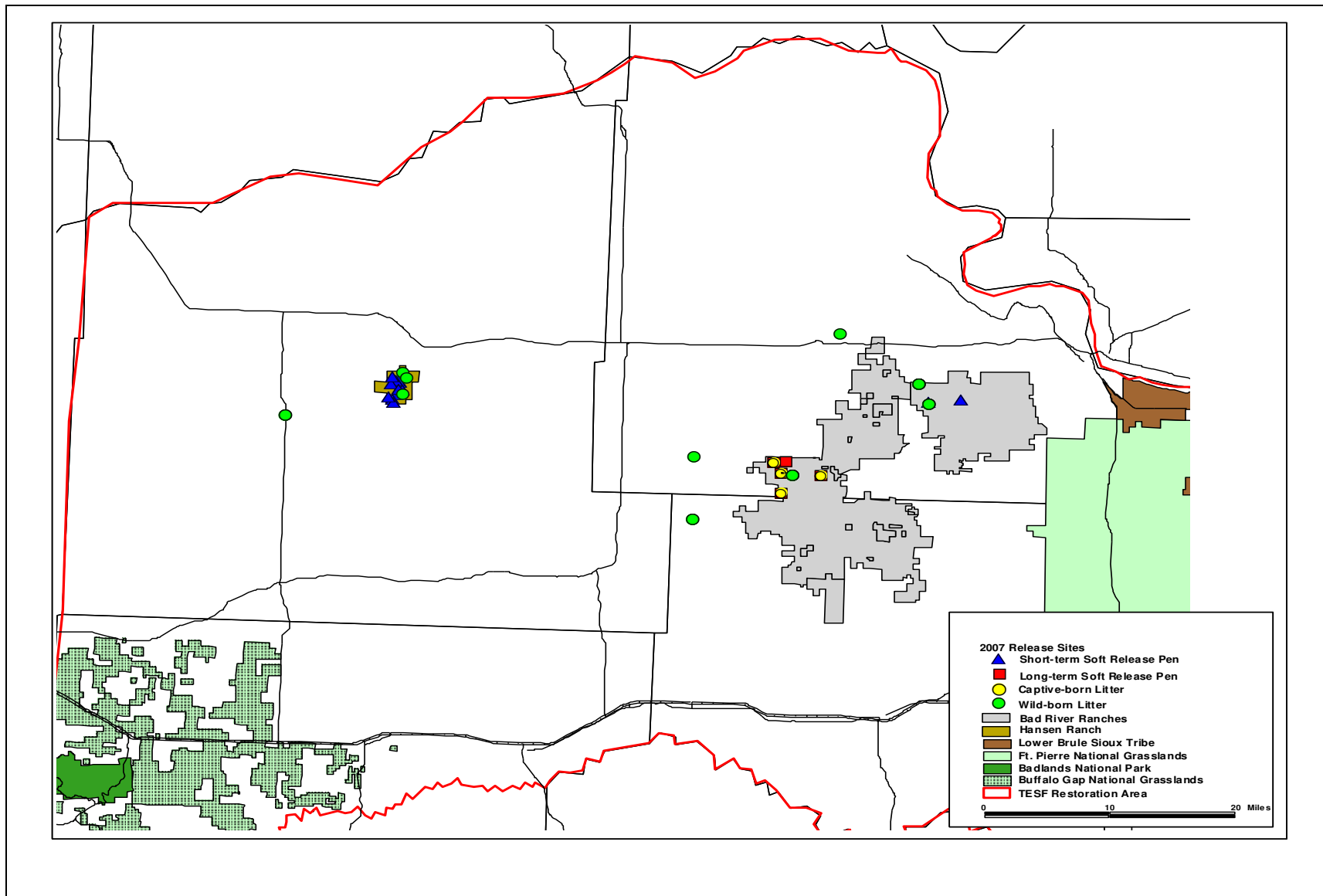


Figure 8. Release sites by release type for foxes released in the TESF Swift Fox Restoration Area (SFRA) during 2007.

Table 1. Summary of swift foxes trapped, translocated, and collared during the reporting period.

Year	Trapping Location	Number of Foxes Trapped, Translocated, and Collared	Number of Wild-Born Pups <sup>7</sup> Marked	Number of Captive-Born Pups Marked	Number of Free-Ranging Foxes Collared
2003	Wyoming	23	7	12	n/a
2004	Wyoming	28	10	4	n/a
2005	Wyoming	30	12	0	9
2006	Colorado	35	13	3	9
2007	Colorado	26	11	5	26

Totals: 142 53 24 minimum: 44

Table 2. Monitoring effort summary by type for monitoring conducted in TESF's Swift Fox Restoration Area in 2003, 2004, 2005, 2006, and 2007.

Year	Monitoring Type	Sessions	Hours	Locations*	Detections^	Locations/Hour	Detections/Hour	Locations/Detections
2003	Aerial	25	98	275	n/a	2.81	n/a	n/a
	Ground	n/a	554	562	n/a	1.01	n/a	n/a
2004	Aerial	n/a	64	246	339	3.84	5.30	73/100
	Ground	n/a	815	1,007	1,476	1.24	1.81	68/100
2005	Aerial	32	131	550	577	4.29	4.50	95/100
	Ground	341	1,157	2,895	3,947	2.50	3.41	73/100
2006	Aerial	19	70	337	482	4.85	6.90	70/100
	Ground	428	2,004	3,855	5,119	1.93	2.56	75/100
2007	Aerial	17	65	20	504	0.38	9.40	4/100
	Ground	318	1,361	1,825	2,475	1.34	1.78	75/100

\* Locations are defined as a fixed spatial point with a corresponding UTM.

^ Detections are defined as hearing a signal without determining a precise spatial point.

Table 3. Population trend of swift foxes released and reproduced in west central South Dakota during 2002 – 2006. Includes missing foxes, censored from the population.

Period	2002 Hard Release	2003 Wild Born	2003 Soft Release	2003 Hard Release	2004 Wild Born	2004 Soft Release	2004 Hard Release	2005 Wild Born	2005 Soft Release	2005 Hard Release	2006 Wild Born	2006 Soft Release	2006 Hard Release	Total
2002 Hard Release	20													
31-Dec-02	16													16
Post Whelp, 31-May-03	11	16												
<b>End Year 1</b> 30-Sept-03	6	4												<b>10</b>
2003 Soft Release			22											
2003 Hard Release				18										
31-Dec-03	2	2	9	7										20
Post Whelp, 31-May-04	0	0	8	3	11									
2004 Soft Release						8								
<b>End Year 2</b> 30-Sept-04			6	3	4	4								<b>17</b>
2004 Hard Release							18							
31-Dec-04			5	3	3	3	14							28
Post Whelp, 31-May-05			1	0	1	1	10	14						
2005 Soft Release									18					
<b>End Year 3</b> 30-Sept-05			1	0	1	0	9	6	10					<b>27</b>
2005 Hard Release										20				
31-Dec-05			0		1		7	5	9	12				34
Post Whelp, 31-May-06					0		2	3	5	4	21			
2006 Soft Release												16		
<b>End Year 4</b> 30-Sept-06							1	2	4	3	16	9		<b>35</b>
2006 Hard Release													25	
31-Dec-06							1	1	4	3	5	3	21	38

Table 4. Predator management data collected from coyotes removed from the Bad River Ranches in 2003.

Date	Species	Age	Sex	Weight(kg)	Easting	Northing	Type	Method	Hunter
2/12/03	CALA	Pup	F	9.5	353694	4888341	Tab	Aerial	Burgduff
2/12/03	CALA	Adult	F	12.25	355316	4887637	-9	Aerial	Burgduff
10/1/03	CALA	Pup	F	8.35	354409	4883920	Tab	Aerial	Burgduff
10/1/03	CALA	Pup	F	8	357421	4887514	Tab	Aerial	Burgduff
10/1/03	CALA	Adult	F	13	357420	4887581	Tab	Aerial	Burgduff
10/1/03	CALA	Pup	F	9.98	360187	4886990	Tab	Aerial	Burgduff
10/1/03	CALA	Adult	M	14.5	358492	4893127	Tab	Aerial	Burgduff
10/1/03	CALA	Yearling	F	11	351714	4891776	Tab	Aerial	Burgduff
10/1/03	CALA	Adult	F	11.5	351662	4891400	Tab	Aerial	Burgduff
10/1/03	CALA	Pup	F	8.1	351662	4891400	Tab	Aerial	Burgduff
10/1/03	CALA	Pup	F	8.9	358089	4891695	Tab	Aerial	Burgduff
10/1/03	CALA	Pup	M	7.1	353138	4897097	Tab	Ground	Honness
10/2/03	CALA	Adult	M	15.2			Tab	Aerial	Burgduff
11/26/03	CALA	Adult	M	12.5			Tab	Aerial	Burgduff
11/26/03	CALA	Adult	F	12.1	356565	4888341	Tab	Aerial	Burgduff
11/26/03	CALA	Adult	M	13.1	357173	4888289	Tab	Aerial	Burgduff
11/26/03	CALA	Pup	F	12.2	352747	4887543	Tab	Aerial	Burgduff
11/26/03	CALA	Adult	F	9.25	354554	4884393	Tab	Aerial	Burgduff
11/26/03	CALA	Pup	F	9.6	349846	4897388	Tab	Aerial	Burgduff
11/26/03	CALA	Adult	F	9.6			-9	Ground	Honness
11/26/03	CALA	Adult	M	11.9			Tab	Aerial	Burgduff
11/26/03	CALA	Adult	M	15.5	352589	4886674	Tab	Aerial	Burgduff
11/26/03	CALA	Pup	M	10.6	352860	4887814	Tab	Aerial	Burgduff
11/26/03	CALA	Yearling	M	12	356620	4888763	Tab	Aerial	Burgduff

Table 5. Predator management data collected from coyotes removed from the Bad River Ranches in 2004.

Animal #	Date	Species	Age	Sex	Weight(kg)	Easting	Northing	Type	Animal #	Method	Hunter
221	10/11/2004	CALA	Yearling	M	9.6	354622	4895499	Tab	221	Aerial	Harmen
222	10/11/2004	CALA	Adult	M	12.1	354064	4894382	Tab	222	Aerial	Harmen
223	10/11/2004	CALA	Adult	F	11	355180	4886661	Tab	223	Aerial	Harmen
224	10/12/2004	CALA	Adult	M	11.5	352576	4896429	Tab	224	Aerial	Harmen
225	10/12/2004	CALA	Adult	F	9.7	373600	4906755	Tab	225	Aerial	Harmen
226	10/12/2004	CALA	Adult	M	13.6	373600	4906755	Tab	226	Aerial	Harmen

Table 6. Predator management data collected from coyotes removed from the Bad River Ranches in 2005.

Animal ID	Date	Species	Age	Sex	Weight (kg)	Easting	Northing	Blood Sample Type	Method	Hunter
228	8/28/05	CALA	U	F	0	3698106.3	4908294.8	tab	ground	Lewis
229	9/6/05	CALA	3-4	M	0	369918.98	4906523.0	tab	ground	Lewis
230	9/6/05	CALA	<1	M	0	381440.08	4906139.2	tab	ground	Lewis
231	9/6/05	CALA	<1	F	0	381441.55	4906171.9	tab	ground	Lewis
232	12/2/05	CALA	2-3	M	12.6			tab	ground	Lewis
233	12/2/05	CALA	<1	F	8.9	353575.78	4889506.7	no	ground	Lewis
234	12/8/05	CALA	5-6	M	14.9	355217.44	4886548.7	no	ground	Lewis

Table 7. Predator management data collected from coyotes removed from the Bad River Ranches in 2006 (n=29).

Carcass#	Date	Sex	Age	Weight	Easting	Northing	Type	Accession #	Plague	Tularemia	Titer	Distemper	Titer	Mange	Kill Method	Hunter
236	1/10/2006	F	2	12	355364	4889823	no		no test	no test		no test		Y	Ground	Lewis
240	2/22/2006	F	2		364830	4899816	no	6003886	Negative	Negative	1:32	no result			Ground	Lewis
241	2/22/2006	F	2		358314	4900066	no	6003886	Negative	Negative	<=1:32	no result			Ground	Lewis
243	3/22/2006	F	2	10.1	358314	4900066	no	6003886	Negative	Negative	<=1:32	no result			Ground	Lewis
246	4/27/2006	F	3	11.1	373306	4905891	TAB	601176	Negative	Negative	<1:4	Negative	<1:4		Ground	Lewis
248	4/27/2006	F	3	11	371157	4906963	TAB	601176	Negative	Negative	<1:4	Negative	<1:8		Ground	Lewis
249	5/2/2006	F	2	11	377923	4906043	TAB	601176	Negative	Negative	<1:4	Negative	<1:16	Y	Ground	Lewis
250	5/1/2006	F	3	11.1	364944	4898687	TAB	601176	Negative	Negative	<1:4	Negative	<1:16		Ground	Lewis
253	5/4/2006	F	2.5				TAB	601176	Negative	Negative	<1:4	Negative	<1:4		Ground	Lewis
256	5/5/2006	F	4		371157	4906963	TAB	601176	Negative	Negative	<1:4	Negative	<1:4		Ground	Lewis
257	5/2/2006	F	1		361724	4901625	TAB		*	*	*	*	*		Ground	Lewis
258	4/29/2006	F	3		354527	4886225	TAB	601176	Negative	Negative	<1:4	Negative			Ground	Lewis
259	8/2/2006	F	.5	8.7	368775	4906085	TAB		*	*	*	*	*		Aerial	Harmon
262	8/1/2006	F	1	9.5	357488	4898122	TAB		*	*	*	*	*		Ground	Rhode
235	1/10/2006	M	1.5	14.2	356523	4889944	no		no test	no test		no test			Ground	Lewis
237	3/16/2006	M	3	12.5			no		no test	no test		no test		Y	Ground	Lewis
238	3/16/2006	M	2	10.85			no		no test	no test		no test			Ground	Lewis
239	2/9/2006	M	3.5		367220	4908351	no	6003886	Negative	Negative	<=1:32	no result			Ground	Lewis
242	2/9/2006	M	1		367220	4908351	no	6003886	Negative	Negative	<=1:32	no result			Ground	Lewis
244	4/14/2004	M	4	16.8	390545	4909887	TUBE		no test	no test		no test			Road kill	
245	4/27/2006	M	3	12.1	371157	4906963	TAB	601176	Negative	Negative	<1:4	Negative	<1:16		Ground	Lewis
247	4/27/2006	M	3	13.2	368633	4908957	TAB	601176	Negative	Negative	<1:4	Negative	<1:16		Ground	Lewis
251	5/1/2006	M	3	12	361724	4901625	TAB	601176	Negative	Negative	<1:4	Negative	<1:16		Ground	Lewis
252	5/4/2006	M	4	13.5			no		no test	no test		no test			Ground	Lewis
254	5/18/2006	M	1	13			TAB	601176	Negative	Negative	<1:4	Negative	<1:128		Ground	Lewis
255	6/12/2006	M	2	13.7	370468	4908251	TUBE		*	*	*	*	*		Ground	Lewis
260	8/2/2006	M	.5	8.8	354170	4892901	TAB		*	*	*	*	*		Aerial	Harmon
263	8/3/2006	M	2	12	367800	4907274	TAB		*	*	*	*	*		Aerial	Harmon
261	8/1/2006		3.5	13	357341	4898015	TAB		*	*	*	*	*		Ground	Rhode

\* Diagnostic results unavailable at time of press.



Table 8. Summary of swift fox track plate surveys conducted for WGFD, Region 2 (Laramie and Goshen Counties), 2001 - 2005.

Study Region	County	Total # Transects Run	Total # Track Plates	Ave # of Plates/ Transect	Total # Nights Run	Total # of Track Plate Nights	Total Miles of Transects	2005 Swift Fox Detections	Previous Swift Fox Locations	2001 Swift Fox Detections	2002 Swift Fox Detections	2003 Swift Fox Detections
2	Goshen	7	35	5	42	210	14	0	8	5	0	2
2	Laramie	9	45	5	35	175	18	4	9	9	5	9
Total		16	80	10	77	385	32	4	17	14	5	11

Table 9. Summary of trapped and translocated foxes from Wyoming to South Dakota in 2003.

Fox#	Date	Sex	Age class	E UTM	N UTM	General Location	Status	Ascension #	Plague	Tulerimia	Titer	Distemper	Titer	Heartworm
210	8/21/2003	F	Pup	505770	4585248	Moyer (Nimmo)	translocated	3009594	Negative	Negative	1:64	Negative	<1:4	No Test
211	8/21/2003	M	Adult	507348	4586954	Moyer (Nimmo)	translocated	3009594	Negative	Negative	<1:4	Negative	<1:4	No Test
212	8/22/2003	F	Pup	506852	4586173	Moyer (Nimmo)	translocated	3009594	Negative	Negative	<1:4	Negative	<1:4	No Test
213	8/23/2003	M	Pup	507348	4586961	Moyer (Nimmo)	translocated	3009594	Negative	Negative	1:8	Negative	<1:4	No Test
214	8/24/2003	F	Adult	511199	4588173	State land Nimmo lease	released	3009594	Positive	Negative	<1:4	Negative	<1:8	No Test
215	8/24/2003	M	Adult	512081	4586600	State land Nimmo lease	released	3009594	Positive	Negative	<1:4	Negative	<1:4	No Test
216	8/25/2003	M	Adult	511202	4588180	State land E. of I-25	translocated	3009594	Negative	Negative	<1:4	Negative	<1:4	No Test
217	8/27/2003	F	Sub	514907	4592797	Dave Nimmo private flats	translocated	3009825	Negative	Negative	1:4	Negative	<1:8	No Test
218	8/26/2003	F	Adult	525050	4543034	203 4 1/4 mi east of 85 jct.	released	3009924	Positive	Negative	1:8	Negative	<1:4	No Test
219	8/30/2003	M	Adult	534899	4545043	203 1 mile west of 138 jct	translocated	3009924	Negative	Positive	1:256	Negative	<1:4	No Test
220	8/31/2003	M	Adult	493525	4569314	D. Barry wheat strips	released	3009924	Positive	Positive	1:128	Negative	<1:4	No Test
221	8/31/2003	F	Adult	494099	4569818	D. Barry wheat strips	released	3009924	Positive	Negative	<1:4	Negative	<1:4	No Test
222	8/31/2003	M	Adult	494764	4570371	D. Barry wheat strips	released	3009924	Positive	Negative	1:8	Negative	<1:4	No Test
223	9/1/2003	F	Adult	553637	4545064	Chaulks Bluff rd.	released	3009924	Positive	Negative	1:8	Negative	<1:4	No Test
224	9/1/2003	F	Sub	531415	4544444	CO. Road 203, 3mi. W of 138	translocated	3009924	Negative	Negative	<1:4	Negative	<1:4	No Test
225	9/1/2003	M	Adult	495119	4568369	D. Barry wheat strips	translocated	3009924	Negative	Negative	<1:4	Negative	<1:4	No Test
226	9/1/2003	F	Adult	496643	4567653	D. Barry wheat strips	released	3009924	Positive	Negative	1:4	Negative	<1:4	No Test
227	9/2/2003	F	Pup	529644	4545272	Epler, west pasture	translocated	3009924	Negative	Negative	1:8	Negative	<1:4	No Test
228	9/2/2003	F	Adult	527288	4545274	Epler, west pasture	translocated	3009924	Negative	Negative	1:16	Negative	<1:4	No Test
229	9/2/2003	M	Adult	527236	4545715	Epler, west pasture	translocated	3009924	Negative	Negative	1:64	Negative	<1:4	No Test
230	9/2/2003	M	Adult	549709	4542972	0.6mi east Jct CR 203/CR 145	released	3009924	Positive	Positive	1:256	Negative	<1:8	No Test
192	9/2/2003	F	Adult	496692	4566600	D. Barry wheat strips	released	3009924	Positive	Negative	1:32	Positive	1:512	No Test
231	9/2/2003	F	Adult	495504	4567377	D. Barry wheat strips	released	3009924	Positive	Positive	1:256	Negative	<1:8	No Test
232	9/2/2003	F	Sub	496679	4570254	D. Barry wheat strips	translocated	3009924	Negative	Negative	1:8	Negative	<1:4	No Test
233	9/6/2003	M	Sub	529585	4543672	Epler NE	translocated	3010227	Negative	Negative	<1:4	Negative	<1:4	No Test
234	9/6/2003	M	Adult	536402	4556071	Hales/Lummis	released	3010227	Positive	Negative	1:32	Negative	<1:4	No Test
235	9/6/2003	M	Adult	535642	4554270	Hales/Lummis	translocated	3010227	Negative	Negative	1:61	Negative	<1:4	No Test
236	9/6/2003	F	Adult	539882	4554467	Hales/Lummis - Tri State towers	released	3010227	Positive	Negative	1:61	Negative	<1:4	No Test
237	9/7/2003	F	Adult	535622	4554010	Hales/Lummis	translocated	3010227	Negative	Negative	1:8	Negative	<1:4	No Test
238	9/7/2003	F	Adult	537892	4554455	Hales/Lummis	released	3010227	Positive	Negative	1:32	Negative	<1:8	No Test
239	9/9/2003	F	Adult	538115	4547694	Foster east	translocated	3010574	Negative	Negative	<1:4	n/a	-9	No Test
240	9/9/2003	F	Adult	536827	4549825	Foster west	translocated	3010574	Negative	Negative	<1:4	Negative	<1:8	No Test
241	9/10/2003	M	Adult	527317	4543929	Foster west	released	3010574	Positive	Negative	<1:4	Negative	<1:4	No Test

Table 9 (continued). Summary of trapped and translocated foxes from Wyoming to South Dakota in 2003.

Fox#	Date	Sex	Age class	E UTM	N UTM	General Location	Status	Ascension #	Plague	Tulerimia	Titer	Distemper	Titer	Heartworm
242	9/11/2003	M	Adult	511373	4543582	Foster west	released	3010574	Positive	Negative	<1:4	Negative	<1:4	No Test
243	9/11/2003	F	Sub	525498	4544217	CR 203	translocated	3010574	Negative	Negative	<1:4	Negative	<1:4	No Test
244	9/11/2003	M	Pup	533177	4545038	CR 203	translocated	3010574	Negative	Negative	<1:4	Negative	<1:4	No Test
245	9/12/2003	M	Adult	526890	4543482	CR 203	translocated	3010476	Negative	Negative	1:16	Negative	<1:4	No Test
246	9/12/2003	F	Pup	511883	4543377	Terry Bison Ranch	translocated	3010476	Negative	Negative	1:8	Negative	<1:4	No Test
247	9/12/2003	M	Adult	514342	4543194	Terry Bison Ranch	released	3010476	Positive	Negative	<1:4	Negative	<1:4	No Test
248	9/12/2003	F	Adult	513210	4541498	Terry Bison Ranch	released	3010476	Positive	Negative	<1:4	Negative	<1:4	No Test
262	12/18/2003	F	Sub	439544	4637647	Wheatland Res. #3	translocated	3013959	Negative	Negative	1:16	Negative	<1:4	No Test
263	12/18/2003	M	Sub	435800	4643881	Wheatland Res. #3, North	released	3013959	Positive	n/a		n/a		No Test
264	12/18/2003	F	Sub	435963	4653543	Wheatland Res. #3, North	released	3013959	Positive	Negative	1:8	Negative	<1:4	No Test
265	12/18/2003	F	Sub	435642	4645497	Wheatland Res. #3, North	released	3013959	Positive	Negative	1:32	Negative	<1:4	No Test
266	12/19/2003	M	Adult	426218	4628988	Wheatland - W	released	3013999	Positive	Negative	1:8	Negative	<1:4	No Test
267	12/19/2003	M	Adult	435900	4633748	Wheatland - W	released	3013999	Positive	Negative	1:16	Negative	<1:8	No Test
269	12/19/2003	F	Sub	436329	4633918	Wheatland - W	released	3013999	Positive	Negative	1:32	Negative	<1:4	No Test
270	12/19/2003	M	Adult	437097	4634541	Wheatland - W	released	3013999	Positive	Negative	1:16	Negative	<1:4	No Test
271	12/19/2003	F	Adult	436752	4634164	Wheatland - W	released	3013999	Positive	Negative	1:8	Negative	<1:4	No Test
272	12/19/2003	F	Pup	434559	4633235	Wheatland - W	released	3013999	Positive	Negative	1:16	Negative	<1:4	No Test
273	12/19/2003	M	Adult	439375	4635186	Wheatland S	released	3013999	Positive	Negative	1:32	Negative	<1:8	No Test
274	12/19/2003	M	Sub	439897	4634776	Wheatland S	released	3013999	Positive	Negative	1:32	Negative	<1:4	No Test
275	12/19/2003	M	Pup	446004	4563285	Hutton NWR	released	3013999	Positive	Negative	1:8	Negative	<1:4	No Test
276	12/19/2003	F	Pup	433640	4632992	Wheatland - W	released	3013999	Positive	Negative	1:16	Negative	<1:4	No Test
277	12/20/2003	M	Sub	444520	4586725	Howell/Bosler Rds.	released	3014010	Positive	Negative	1:8	Negative	<1:4	No Test
278	12/20/2003	F	Adult	442794	4588015	Howell/Bosler Rds.	released	3014010	Positive	Negative	1:32	Negative	1:64	No Test
279	12/20/2003	M	Pup	438483	4596298	Howell/Bosler Rds.	released	3014010	Positive	Negative	1:8	Negative	<1:8	No Test
280	12/20/2003	F	Pup	444928	4586419	Howell/Bosler Rds.	released	3014010	Positive	Negative	1:16	Negative	<1:4	No Test
281	12/20/2003	M	Adult	442436	4588275	Howell/Bosler Rds.	released	3014010	Positive	Positive	1:128	Negative	1:8	No Test
282	12/20/2003	F	Pup	437818	4595148	Howell/Bosler Rds.	released	3014010	Positive	Negative	1:8	Negative	<1:4	No Test
283	12/21/2003	F	Sub	421656	4572446	WY Hwy 130	released	3014010	Positive	Negative	1:8	Negative	<1:4	No Test
284	12/21/2003	F	Adult	441327	4575421	WY Hwy 130	released	3014010	Positive	Negative	1:8	Negative	<1:4	No Test
285	12/21/2003	F	Adult	441846	4575469	WY Hwy 130	released	3014010	Positive	Negative	1:8	Negative	<1:8	No Test

Table 10. Trapping data for swift foxes captured in Lusk, Wyoming, August – September, 2004.

Fox#	Capture Date	Sex	Age	Easting*	Northing*	General Location	Habitat	Status	Accession No.	Plague	Tulerimia	Titer	Distemper	Titer
401	8/29/2004	M	Adult	533626	4738601	Manville State land-Bud Reed	grazed shortgrass prairie	shipped	4008216	Negative	Positive	1:128	Negative	<1:4
402	8/30/2004	F	Adult	not recorded	recorded	Manville State land-McClurry	grazed shortgrass prairie	released	4008216	Positive	Negative	1:64	Negative	<1:4
403	8/30/2004	F	Adult	566986	4721735	Van Tassel Ranch	shortgrass prairie	released	4008216	Positive	Negative	1:16	Negative	<1:4
404	8/30/2004	M	Adult	565427	4720891	Neil Holmes Ranch	grazed shortgrass prairie	shipped	4008216	Negative	Negative	1:8	Negative	<1:4
405	8/31/2004	M	Pup	568910	4718065	Ed Perry (homesite, Goshen County)	shortgrass prairie	shipped	4008257	Negative	Negative	1:16	Negative	<1:4
406	8/31/2004	F	Adult	573973	4718098	Dan Tadewald SE unit along CR19	shortgrass prairie	shipped	4008257	Negative	Negative	1:4	Negative	<1:4
407	8/31/2004	M	Adult	566054	4721276	Neil Holmes Ranch	grazed shortgrass prairie	released	4008257	Positive	Negative	1:8	Negative	<1:4
408	9/1/2004	M	Adult	569247	4718048	Ed Perry (homesite, Goshen County)	shortgrass prairie - roadside	shipped	4008362	Negative	Negative	<1:4	Negative	<1:4
409	9/1/2004	M	Pup	569833	4716480	Ed Perry (homesite, Goshen County)	shortgrass prairie - roadside	shipped	4008362	Negative	Negative	1:4	Negative	<1:4
410	9/2/2004	M	Pup	567452	4715640	Ed Perry (homesite, Goshen County)	shortgrass prairie	shipped	4008362	Negative	Positive	1:128	Negative	<1:4
411	9/2/2004	M	Pup	568548	4718275	Bill Miskimmons Ranch	grazed shortgrass prairie	shipped	4008362	Negative	Negative	1:8	Negative	<1:4
412	9/3/2004	F	Pup	569438	4719516	Bill Miskimmons Ranch	grazed shortgrass prairie	shipped	4008508	Negative	Negative	1:32	Negative	<1:4
413	9/3/2004	M	Adult	560981	4724834	Frye Cattle Co.	grazed shortgrass prairie	released	4008508	Positive	Negative	1:64	Negative	<1:4
414	9/3/2004	F	Pup	562155	4724422	Frye Cattle Co.	grazed shortgrass prairie	shipped	4008508	Negative	Negative	1:16	Negative	<1:4
415	9/4/2004	M	Pup	566886	4731965	Ed Perry (north)	short grass prairie	shipped	4008508	Negative	Positive	1:256	Negative	<1:4
416	9/4/2004	M	Pup	567909	4733379	Ed Perry (north)	short grass prairie	shipped	4008508	Negative	Positive	1:128	Negative	<1:4
417	9/4/2004	M	Pup	567909	4733368	Ed Perry (north)	short grass prairie	shipped	4008508	Negative	Negative	1:32	Negative	<1:4
418	9/5/2004	F	Pup	567909	4733379	Ed Perry (north)	short grass prairie	shipped	4008508	Negative	Negative	1:4	Negative	<1:4
419	9/5/2004	F	Adult	568359	4730958	Ed Perry (north)	short grass prairie	shipped	4008508	Negative	Negative	<1:4	Negative	<1:8
420	9/6/2004	F	Adult	554937	4719787	Kevin Barrs Ranch (west)	grazed shortgrass prairie	shipped	4008508	Negative	Negative	1:32	Negative	<1:4
421	9/6/2004	M	Adult	561567	4716437	Steve Cole (south)	short grass prairie	shipped	4008508	Negative	Negative	1:8	Negative	<1:4
422	9/6/2004	M	Adult	560023	4716349	Steve Cole (south)	short grass prairie	shipped	4008508	Negative	Negative	1:8	Negative	<1:4
423	9/7/2004	F	Pup	552791	4719463	Kevin Barrs Ranch (west)	grazed shortgrass prairie	shipped	4008508	Negative	Negative	1:32	Negative	<1:4
424	9/7/2004	F	Pup	554930	4718695	Kevin Barrs Ranch (west)	grazed shortgrass prairie	shipped	4008508	Negative	Positive	1:512	Negative	<1:4
425	9/7/2004	F	Adult	546004	4726456	Si West Ranch	grazed shortgrass prairie	shipped	4008508	Negative	Positive	1:128	Negative	<1:4
426	9/7/2004	M	Adult	545935	4725683	Si West Ranch	grazed shortgrass prairie	shipped	4008508	Negative	Negative	1:4	Negative	<1:4
427	9/8/2004	F	Pup	556528	4719505	Kevin Barrs Ranch (east)	grazed shortgrass prairie	shipped	4008711	Negative	Negative	1:16	Negative	<1:4
428	9/8/2004	M	Adult	545948	4725677	Si West Ranch	grazed shortgrass prairie	released	4008711	Positive	Positive	1:8	Negative	<1:4
429	9/8/2004	F	Pup	544465	4725392	Si West Ranch	grazed shortgrass prairie	released	4008711	Positive	Positive	1:128	Negative	<1:4
430	9/9/2004	M	Pup	566187	4737919	Ed Perry (upper north)	shortgrass prairie	shipped	4008711	Negative	Negative	1:8	Negative	<1:4
431	9/9/2004	M	Pup	566586	4737464	Ed Perry (upper north)	shortgrass prairie	shipped	4008711	Negative	Negative	1:64	Negative	<1:4
432	9/9/2004	F	Pup	424215.5	1042656.1	Kilmer Arabian Ranch	shortgrass prairie	shipped	4008711	Negative	Negative	1:32	Negative	<1:4

Table 10 (continued). Trapping data for swift foxes captured in Lusk, Wyoming, August – September, 2004.

Fox#	Capture Date	Sex	Age	Easting*	Northing*	General Location	Habitat	Status	Accession No.	Plague	Tulerimia	Titer	Distemper	Titer
434	9/11/2004	M	Adult	-9	-9	Kilmer Arabian Ranch	shortgrass prairie	released	4008844	Negative	Negative	1:4	Negative	<1:4
435	9/11/2004	M	Adult	569472	4729319	Rex Shoults Ranch	shortgrass prairie	shipped	4008844	Positive	Positive	1:128	Negative	<1:4
436	9/11/2004	M	Adult	568498	4729352	Rex Shoults Ranch	shortgrass prairie	shipped	4008844	Negative	Positive	1:128	Negative	<1:4
437	9/11/2004	M	Adult	568505	4730954	Rex Shoults Ranch	shortgrass prairie	shipped	4008844	Negative	Negative	1:16	Negative	<1:4
438	9/11/2004	M	Adult	568502	4731602	Rex Shoults Ranch	shortgrass prairie	shipped	4008844	Negative	Negative	1:8	Negative	<1:4
439	9/12/2004	M	Adult	546630	4717971	Hwy 85, trap line 1	shortgrass prairie - roadside	shipped	4008844	Negative	Negative	1:4	Negative	<1:4
440	9/12/2004	F	Pup	548871	4724137	Hwy 85, trap line 2	shortgrass prairie - roadside	shipped	4008844	Negative	Negative	1:4	Negative	<1:4
441	9/12/2004	M	Pup	423733.7	1041649.7	Steve Cole property	shortgrass prairie	shipped	4008844	Negative	Positive	1:128	Negative	<1:4
442	9/12/2004	F	Adult	570538	4732584	Rex Shoults Ranch	shortgrass prairie	shipped	4008844	Negative	Negative	1:4	Negative	<1:4
443	9/12/2004	F	Adult	568519	4732581	Rex Shoults Ranch	shortgrass prairie	shipped	4008844	Negative	Negative	1:64	Negative	<1:4
444	9/13/2004	M	Adult	546507	4718496	Hwy 85, trap line 2	shortgrass prairie - roadside	released	4008844	Negative	Positive	1:128	Negative	<1:4

Table 11. Trapping data for swift foxes captured in Cheyenne, Wyoming, August – September, 2005.

Fox#	Capture Date	Capture Location	Easting	Northing	Sex	Age class	Status	Fox#	Accession No.	Plague Test #1	Test #1 Titer	Plague Test #2	Test #2 Titer	Tularemia	Titer	Distemper	Titer
500M	8/20/2005	Jerry Harding Ranch	544798	4591067	M	Pup	Released	500M	5011433	Positive	n/a	n/a	n/a	No test	.	No test	.
501F	8/20/2005	Doran Lummis Ranch - S. camp	525057	4548475	F	Pup	Shipped	501F	5011433	Negative	n/a	n/a	n/a	Negative	1:32	Negative	<1:4
502F	8/20/2005	Doran Lummis Ranch - S. camp	526045	4548659	F	Adult	Released	502F	5011433	Positive	n/a	n/a	n/a	No test	.	No test	.
503F	8/20/2005	Doran Lummis Ranch - S. camp	524038	4549262	F	Adult	Shipped	503F	5011433	Negative	n/a	n/a	n/a	Negative	1:32	Negative	<1:4
504F	8/20/2005	Doran Lummis Ranch - S. camp	527232	4549304	F	Pup	Released	504F	5011433	Positive	n/a	n/a	n/a	No test	.	No test	.
505M	8/20/2005	Doran Lummis Ranch - S. camp	526819	4550434	M	Adult	Released	505M	5011433	Positive	n/a	n/a	n/a	No test	.	No test	.
506F	8/20/2005	Doran Lummis Ranch - S. camp	527231	4549709	F	Pup	Released	506F	5011433	Positive	n/a	n/a	n/a	No test	.	No test	.
507F	8/20/2005	Doran Lummis Ranch - S. camp	527232	4548904	F	Adult	Released	507F	5011433	Positive	n/a	n/a	n/a	No test	.	No test	.
508M	8/21/2005	Doran Lummis Ranch - S. camp	525433	4548593	M	Adult	Shipped	508M	5011433	Negative	n/a	n/a	n/a	Negative	1:16	Negative	<1:4
509M	8/21/2005	Doran Lummis Ranch - S. camp	527228	4549303	M	Adult	Released	509M	5011433	Positive	n/a	n/a	n/a	No test	.	No test	.
510M	8/21/2005	Jerry Harding Ranch	544798	4591067	M	Pup	Released	510M	5011433	Positive	n/a	n/a	n/a	No test	.	No test	.
511F	8/21/2005	Jerry Harding Ranch	542706	4591345	F	Adult	Released	511F	5011433	Positive	n/a	n/a	n/a	No test	.	No test	.
512F	8/21/2005	Jerry Harding Ranch	544798	4591067	F	Pup	Released	512F	5011433	Positive	n/a	n/a	n/a	No test	.	No test	.
513M	8/22/2005	Jerry Harding Ranch	544798	4591067	M	Pup	Released	513M	5011433	Positive	n/a	n/a	n/a	No test	.	No test	.
514F	8/22/2005	Jerry Harding Ranch	544807	4592017	F	Adult	Released	514F	5011433	Positive	n/a	n/a	n/a	No test	.	No test	.
515M	8/22/2005	Warren Livestock Co. - Ghetto	518014	4569443	M	Adult	Shipped	515M	5011433	Negative	n/a	n/a	n/a	Negative	1:64	Negative	<1:4
516M	8/23/2005	Doran Lummis Ranch - Savory	528470	4549197	M	Adult	Released	516M	5011433	Positive	n/a	n/a	n/a	No test	.	No test	.
517F	8/23/2005	Doran Lummis Ranch - Savory	527239	4547401	F	Adult	Released	517F	5011433	Positive	n/a	n/a	n/a	No test	.	No test	.
518F	8/23/2005	Doran Lummis Ranch - Savory	528842	4548503	F	Adult	Released	518F	5011433	Positive	n/a	n/a	n/a	No test	.	No test	.
519F	8/24/2005	Jerry Harding Ranch - Goshen Co	545533	4600076	F	Adult	Released	519F	5011433	Positive	n/a	n/a	n/a	No test	.	No test	.
520F	8/25/2005	Jerry Harding Ranch - Clark	543813	4600956	F	Pup	Released	520F	5011633	Positive	n/a	n/a	n/a	No test	.	No test	.
521M	8/25/2005	Jerry Harding Ranch	542271	4600985	M	Adult	Released	521M	5011633	Positive	n/a	n/a	n/a	No test	.	No test	.
522F	8/25/2005	Jerry Harding Ranch	542706	4591345	F	Adult	Released	522F	5011633	Positive	n/a	n/a	n/a	No test	.	No test	.
523M	8/25/2005	Warren Livestock Co. - Jordan	525700	4568826	M	Adult	Shipped	523M	5011633	Negative	n/a	n/a	n/a	Positive	1:128	Positive	6
524M	8/25/2005	Don Berry Ranch	530539	4580630	M	Adult	Shipped	524M	5011633	Negative	n/a	n/a	n/a	Negative	1:8	Negative	<1:4
525F	8/25/2005	Don Berry Ranch	529002	4580348	F	Pup	Shipped	525F	5011633	Negative	n/a	n/a	n/a	Negative	1:16	Negative	<1:4
526F	8/26/2005	Warren Livestock Co.- Drake	512842	4582395	F	Pup	Released	526F	5011633	Positive	n/a	n/a	n/a	No test	.	No test	.
527M	8/26/2005	Warren Livestock Co.- Drake	515734	4582377	M	Pup	Released	527M	5011633	Positive	n/a	n/a	n/a	No test	.	No test	.
528F	8/27/2005	Don Berry Ranch	529541	4580641	F	Adult	Shipped	528F	5011631	Negative	n/a	n/a	n/a	Negative	1:4	Positive	1:64
529F	8/27/2005	Don Berry Ranch	529010	4580639	F	Adult	Shipped	529F	5011631	Negative	n/a	n/a	n/a	Negative	1:4	Positive	8
530F	8/27/2005	Warren Livestock Co.- Drake	513474	4581568	F	Adult	Released	530F	5011631	Positive	n/a	n/a	n/a	No test	.	No test	.
531M	8/27/2005	Warren Livestock Co.- Drake	513079	4581571	M	Adult	Released	531M	5011631	Positive	n/a	n/a	n/a	No test	.	No test	.
532M	8/27/2005	Warren Livestock Co.- Drake	512431	4582401	M	Adult	Released	532M	5011631	Positive	n/a	n/a	n/a	No test	.	No test	.
533M	8/27/2005	CR 203	540900	4545262	M	Adult	Shipped	533M	5011631	Negative	n/a	n/a	n/a	Negative	1:64	Positive	1:32

Table 11 (continued). Trapping data for swift foxes captured in Cheyenne, Wyoming, August – September, 2005.

Fox#	Capture Date	Capture Location	Easting	Northing	Sex	Age class	Status	Fox#	Accession No.	Plague Test #1	Test #1 Titer	Plague Test #2	Test #2 Titer	Tularemia	Titer	Distemper	Titer
534M	8/27/2005	Iron Mtn Bison Ranch- Porter draw	540037	4540670	M	Pup	Released	534M	5011631	Positive	n/a	n/a	n/a	No test	.	No test	.
535F	8/28/2005	Warren Livestock Co. - Whitaker	511197	4580761	F	Pup	Released	535F	5011631	Positive	n/a	n/a	n/a	No test	.	No test	.
536F	8/28/2005	Warren Livestock Co. - Whitaker	511218	4579956	F	Adult	Released	536F	5011631	Positive	n/a	n/a	n/a	No test	.	No test	.
537F	8/28/2005	Warren Livestock Co. - Whitaker	511218	4579554	F	Pup	Released	537F	5011631	Positive	n/a	n/a	n/a	No test	.	No test	.
538F	8/28/2005	Warren Livestock Co. - Whitaker	511469	4580473	F	Adult	Shipped	538F	5011631, 054867	Positive	1:32	Positive	1:32	No test	.	No test	.
539M	8/28/2005	Warren Livestock Co. - Whitaker	511177	4580709	M	Adult	Shipped	539M	5011631, 054868	Positive	1:64	Positive	1:32	No test	.	No test	.
540F	8/28/2005	Don Berry Ranch	530626	4580594	F	Adult	Shipped	540F	5011631	Negative	n/a	n/a	n/a	Negative	1:32	Positive	1:16
541F	8/28/2005	Don Berry Ranch	530993	4580610	F	Pup	Shipped	541F	5011631	Negative	n/a	n/a	n/a	Negative	1:4	Negative	<1:4
542M	8/29/2005	Don Berry Ranch	532897	4580422	M	Pup	Shipped	542M	5011704	Negative	n/a	n/a	n/a	Negative	1:64	Negative	<1:4
543F	8/29/2005	Don Berry Ranch	532533	4579007	F	Pup	Shipped	543F	5011704	Negative	n/a	n/a	n/a	Negative	<1:4	Negative	<1:4
544F	8/31/2005	Don Berry Ranch	530626	4580594	F	Adult	Released	544F	54869	Positive	1:32	No test		No test	.	No test	.
545F	8/31/2005	Don Berry Ranch	530643	4579897	F	Pup	Released	545F	54870	Negative	n/a	No test		No test	.	No test	.
546F	8/31/2005	Iron Mtn Bison Ranch	535438	4584715	F	Pup	Shipped	546F	54871	Negative	n/a	n/a	n/a	No test	.	No test	.
547F	8/31/2005	Iron Mtn Bison Ranch	538241	4585122	F	Adult	Shipped	547F	54872	Negative	n/a	n/a	n/a	No test	.	No test	.
548F	8/31/2005	Iron Mtn Bison Ranch	539105	4584676	F	Pup	Shipped	548F	54873	Negative	n/a	n/a	n/a	No test	.	No test	.
549F	8/31/2005	Iron Mtn Bison Ranch	539180	4584443	F	Pup	Shipped	549F	54874	Positive	1:64	Positive	1:64	No test	.	No test	.
550M	8/31/2005	Iron Mtn Bison Ranch	540957	4586889	M	Adult	Shipped	550M	54875	Negative	n/a	n/a	n/a	No test	.	No test	.
551F	9/1/2005	Warren Livestock Co. - Whitaker	515807	4571725	F	Adult	Shipped	551F	54876	Negative	n/a	n/a	n/a	No test	.	No test	.
552F	9/1/2005	Warren Livestock Co. - Whitaker	517680	4570748	F	Pup	Shipped	552F	54877	Negative	n/a	n/a	n/a	No test	.	No test	.
553F	9/1/2005	Warren Livestock Co. - Whitaker	517681	4570263	F	Adult	Shipped	553F	54878	Negative	n/a	n/a	n/a	No test	.	No test	.
554F	9/1/2005	Warren Livestock Co. - Whitaker	509601	4581345	F	Adult	Shipped	554F	54879	Positive	1:32	Positive	1:32	No test	.	No test	.
555F	9/1/2005	Iron Mtn Bison Ranch	535440	4584498	F	Pup	Shipped	555F	54880	Negative	n/a	n/a	n/a	No test	.	No test	.
556M	9/1/2005	Iron Mtn Bison Ranch	537102	4585398	M	Pup	Shipped	556M	54881	Negative	n/a	n/a	n/a	No test	.	No test	.
557M	9/1/2005	Iron Mtn Bison Ranch	538287	4584172	M	Pup	Shipped	557M	54882	Positive	1:16	Positive	1:32	No test	.	No test	.
558F	9/1/2005	Iron Mtn Bison Ranch	535431	4585052	F	Adult	Shipped	558F	54883	Positive	1:32	Positive	1:64	No test	.	No test	.
559F	9/1/2005	Iron Mtn Bison Ranch	540885	4587336	F	Adult	Shipped	559F	54884	Positive	1:16	Positive	1:32	No test	.	No test	.

Table 12. Trapping data for swift foxes captured near Karval, Colorado, August 2006.

Fox ID	Sex	Age Class	Capture Date	Capture Location	Easting	Northing	Status	Accession #	Plague	Tularemia	Titer	Distemper	Titer
600M	M	Adult	8/29/2006	STOGSDILL NE	0615826	4281997	Translocated	6013225	NEG	NEG	1:4	NEG	<1:4
601M	M	Pup	8/29/2006	STOGSDILL NE	0617918	4281133	Translocated	6013225	NEG	NEG	1:8	NEG	<1:4
602F	F	Adult	8/29/2006	STOGSDILL NE	0617985	4280662	Translocated	6013225	NEG	NEG	1:64	POS	1:512
603F	F	Adult	8/29/2006	STOGSDILL NE	0616905	4281988	Translocated	6013225	NEG	NEG	1:8	NEG	<1:4
604F	F	Adult	8/29/2006	STOGSDILL NE	0616714	4282130	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
605M	M	Adult	8/29/2006	STOGSDILL NE	0618592	4283116	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
606F	F	Pup	8/29/2006	STOGSDILL NE	0617414	4283115	Released	6013225	NEG	NEG	<1:4	NEG	<1:4
607F	F	Pup	8/29/2006	DAVIS SW	0613622	4278268	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
608F	F	Adult	8/29/2006	DAVIS SW	0613010	4277238	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
609M	M	Adult	8/29/2006	DAVIS SW	0613826	4275571	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
610F	F	Adult	8/29/2006	DAVIS SW	0613243	4275964	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
611M	M	Adult	8/29/2006	STOGSDILL HOUSE	0614787	4280569	Translocated	6013225	NEG	NEG	1:8	NEG	<1:4
612F	F	Pup	8/29/2006	STOGSDILL HOUSE	0614793	4279364	Translocated	6013225	NEG	NEG	1:8	POS	1:256
613M	M	Pup	8/29/2006	STOGSDILL HOUSE	0613718	4278953	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
614M	M	Adult	8/29/2006	STOGSDILL HOUSE	0612628	4279472	Translocated	6013225	NEG	NEG	1:32	NEG	1:16
615F	F	Adult	8/29/2006	DAVIS SE	0616097	4274636	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
616M	M	Pup	8/29/2006	DAVIS SE	0615854	4278403	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
617F	F	Pup	8/29/2006	DAVIS SE	0615997	4276103	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
618F	F	Pup	8/29/2006	DAVIS SE	0618722	4274830	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
619M	M	Pup	8/29/2006	DAVIS SE	0617464	4277879	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
620M	M	Adult	8/30/2006	S RD/CR 25	0621049	4285892	Translocated	6013225	NEG	POS	1:128	NEG	<1:4
621F	F	Pup	8/30/2006	CR 25-N	0621371	4291481	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
622M	M	Pup	8/30/2006	CR 25-N	0621702	4292637	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
623M	M	Adult	8/30/2006	CROWN RANCH	0588745	4309363	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
624F	F	Pup	8/30/2006	CROWN RANCH	0591682	4303737	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:8
625M	M	Pup	8/31/2006	STOGSDILL PDOG	0621409	4285892	Translocated	6013225	NEG	NEG	1:32	NEG	<1:4
626F	F	Pup	8/31/2006	STOGSDILL PDOG	0621049	4285892	Translocated	6013225	NEG	NEG	1:16	NEG	<1:4
627F	F	Adult	8/31/2006	STOGSDILL PDOG	0621049	4285892	Translocated	6013225	NEG	NEG	1:16	NEG	<1:4
628M	M	Adult	8/31/2006	SCHACK EAST	0609080	4289829	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
629F	F	Adult	8/31/2006	SCHACK WEST	0606511	4288964	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
630M	M	Pup	8/31/2006	SCHACK WEST	0605682	4289853	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
631F	F	Adult	8/31/2006	SCHACK WEST	0605990	4289832	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
632F	F	Adult	8/31/2006	STOGSDILL NE	0618478	4278834	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
633F	F	Adult	8/31/2006	STOGSDILL NE	0615884	4278779	Released	6013225	NEG	NEG	1:32	NEG	1:64
634M	M	Pup	8/31/2006	STOGSDILL NE	0616635	4279216	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4
635M	M	Adult	8/31/2006	STOGSDILL NE	0615847	4281992	Translocated	6013225	NEG	NEG	1:32	NEG	<1:4
636F	F	Pup	8/31/2006	STOGSDILL NE	0616715	4282138	Translocated	6013225	NEG	NEG	<1:4	NEG	<1:4



Table 13. Trapping data for swift foxes captured near Lamar, Colorado, September 2007.

FOX ID	CAP DATE	SEX	AGE	CAP LOC	EASTING	NORTHING	Q-TINE#	PLAGUE	TITER #1	TITER #2	STATUS	PIT TAG
700F	9/3/2007	F	1-2	Walker- W	710787	4199696	VMC -C	NEG	--	--	Trans	103*785*041
701F	9/3/2007	F	1-2	Walker- W	710568	4200581	H5	POS	1:256	1:256	Trans	103*789*534
702F	9/3/2007	F	1-2	Walker- W	711828	4202666	VMC -E	NEG	--	--	Trans	103*777*352
703F	9/3/2007	F	1-2	Walker- W	711386	4202835	VMC -6	NEG	--	--	Trans	103*773*569
704F	9/3/2007	F	<1	Walker- W	711360	4203499	VMC -G	NEG	--	--	Trans	103*789*028
705M	9/3/2007	M	3-4	Walker- W	711227	4207399	H2	POS	1:64	1:128	Trans	103*794*261
706M	9/3/2007	M	1-2	Walker- W	711218	4207780	VMC -J	NEG	--	--	Trans	103*793*265
707M	9/3/2007	M	<1	Walker- W	711196	4208767	VMC -H	NEG	--	--	Trans	103*777*288
708M	9/3/2007	M	2-3	Walker- W	709536	4209927	VMC -1	NEG	--	--	Trans	103*798*293
709F	9/3/2007	F	2-3	Walker- W	709789	4201314	VMC -2	NEG	--	--	Trans	103*791*060
710F	9/3/2007	F	2-3	Walker- S	713880	4198768	H1	POS	1:16	1:16	Trans	103*795*020
711F	9/3/2007	F	<1	Walker- S	710019	4194688	H11	NEG	--	--	Trans	103*789*592
712F	9/3/2007	F	3-4	Airport	*	*	--	POS	1:256	--	Released	--
713M	9/3/2007	M	2-3	Gentz	709803	4238139	H8	POS	1:2048	1:2048	Trans	103*773*598
714M	9/3/2007	M	<1	Gentz	709987	4238024	H10	POS	NEG	NEG	Trans	103*786*077
715M	9/3/2007	M	1-2	Gentz	712496	4238081	H4	POS	1:64	1:128	Trans	103*786*317
716M	9/4/2007	M	<1	Walker - E	714493	4206028	VMC -5	NEG	--	--	Trans	103*797*888
717F	9/4/2007	F	<1	Walker- W2	710775	4198701	H9	NEG	--	--	Trans	103*773*821
718M	9/4/2007	M	<1	Walker- W2	710172	4199968	H12	POS	1:512	1:512	Trans	103*786*312
719M	9/4/2007	M	2-3	Walker- W2	709963	4200760	H6	POS	1:512	1:512	Trans	103*785*294
720F	9/4/2007	F	<1	Walker- W2	711018	4201429	VMC -3	NEG	--	--	Trans	103*794*011
721M	9/4/2007	M	<1	Walker- W2	711036	4208770	VMC -F	NEG	--	--	Trans	103*787*842
722M	9/4/2007	M	1-2	Walker- W2	711143	4210553	VMC -D	NEG	--	--	Trans	103*785*793
723F	9/4/2007	F	<1	Walker- W2	710816	4211379	VMC -I	NEG	--	--	Trans	103*786*051
724M	9/4/2007	M	<1	Gentz	712496	4238081	VMC -4	NEG	--	--	Trans	103*794*350
725F	9/4/2007	F	1-2	Gentz	712988	4238093	H3	NEG	--	--	Trans	103*787*635
726F	9/4/2007	F	1-2	Airport	*	*	H7	POS	1:128	1:256	Trans	103*786*544

Table 14. Release summary for swift foxes released on Bad River Ranches and environs in 2003.

Release Unit	Date	Fox ID's	Release Type	Release Site Type	Site UTM	Quarantine Pen	# Days held in pen	Fate
North	10/6/03	153M 156F	Soft	Pen	368228/ 4908161	White Dog Pen	402	153M-BRR/WACRA 156F – Coyote
“	10/6/03	195M, 196F, 197F	Soft	Pen	368228/ 4908161	White Dog Pen	134	195M – Coyote 196F – Coyote 197F – War Crk. Rd.
“	10/14/03	219M 223F	Hard	Pen	370448/ 4906160	Guardrail Pen	41	219M – BRR/WACRA 223F – BRR/WACRA
“	10/14/03	235M 237F	Hard	Kennel	374022/ 4906434	N. Bunkhouse	31	235M – BRR/WACRA 237F – Coyote
East	10/21/03	240F, 244M, 245M, 246F	Hard	Kennel	380855/ 4900899	S. BunkHouse	37	240F – Coyote 244M – MIA 245M – Coyote 246F – BRR/SE
South	10/13/03	207M, 208M, 209M	Hard	Pen	352946/ 4886488	Capa	107	207M – UNK 208M – War Crk. Rd 209M – UNK
“	10/13/03	224F 239F	Hard	Pen	352946/ 4886488	Capa	40 30	224F – MIA 239F – Prince
“	10/13/03	210F 211M	Hard	Kennel	351494/ 4884282	VMC-E	47	210F – Coyote 211M – MIA
“	10/13/03	228F 229M	Hard	Kennel	357144/ 4879745	VMC-G	40	228F – Coyote 229M - Gunshot
“	9/3/03	217F	Hard	Pen	352946/ 4886488	Capa -C	0	217F – Coyote
West	10/6/03	172F 174M	Soft	Pen	355766/ 4895918	Bullhead	409	172F – BRR/BR Rd 174M– BRR/BR Rd
“	10/6/03	203M, 204F, 205F, 206M	Soft	Pen	355766/ 4895918	Bullhead	148	203M – BRR/ BR Rd 204F – UNK 205F – BRR/ BH Pen 206M – Coyote
“	10/6/03	170M 176F	Soft	Pen	349632/ 4897821	Hoffman	409	170M – Prince 176F – Coyote
“	10/6/03	198F, 199F, 200F, 201M, 202M	Soft	Pen	349632/ 4897821	Hoffman	137	198F – BRR/HFM Pen 199F – MIA 200F – Coyote 201M – Coyote 202M – BRR/HFM Pen
“	10/6/03	154F 161M	Soft	Pen	352463/ 4889541	Van Metre Complex	402	154F – Bobcat 161M – Bobcat
“	9/16/03	212F	Hard	Pen	352463/ 4889541	VMC-D	20	212F – BRR/ VMC
“	10/15/03	216M 243F	Hard	Kennel	352421/ 4897163	VMC-C, NB-C	49 32	216M – Hall 243F – BRR/Van Metre Rd.

Table 15. Release summary for swift foxes released on Bad River Ranches and environs in 2004.

Release Type	Release Unit	Date	Fox ID's (Sex, Age)	Release Site Type	Site Description	Site UTM	# Days Survival	Fate/Location
Hard	North	10/21/04	440FJ, 411MJ	Pen	BRR / GR	370448 / 4906160	440 – 18 411 - NA	440 – Possible raptor 411 – BRR/ ACRA, Stanley Co.
Hard	“	10/21/04	418FJ, 410MJ	Mush Pen	Prince Bros. Ranch	353316 / 4919810	418 – 33 410 – NA	418 – Coyote 410 – Prince Bros., Stanley, Co.
Hard	“	10/21/04	409MJ	Mush Pen	Prince Bros. Ranch	350407 / 4922336	409 – NA	409 – Iverson Ranch, Stanley Co.
Hard	“	10/21/04	427FJ, 405MJ	Mush Pen	BRR / EAC-N	371237 / 4908724	427 – NA 405 – NA	427 – BRR/ACRA, Stanley Co. 405 - BRR/ACRA, Stanley Co.
Hard	“	10/21/04	416MJ, 417MJ	Mush Pen	BRR / EAC-M	372054 / 4907922	416 – NA 417 – NA	416 – BRR/EAC, Stanley Co. 417 - BRR/EAC, Stanley Co.
Hard	“	10/21/04	412FJ, 415MJ	Mush Pen	BRR / EAC-S	347249 / 4906138	412 – NA 415 – NA	412 - BRR/EAC, Stanley Co. 415 – Hwy 63, Stanley Co.
Hard	“	10/21/04	423FJ	Mush Pen	BRR / EAC-W	370280 / 4906172	423 – NA	423 - BRR/EAC, Stanley Co.
Hard	South	10/21/04	424FJ, 439MA	Pen	BRR / WC	363058 / 4883070	424 – NA 439 - 10	424 – A. Peters Ranch, Jones Co. 439 - Vehicle
Hard	“	10/21/04	432FJ, 431MJ	Pen	BRR / PP	357600 / 4884515	432 – NA 431 - NA	432 – BRR, Jones Co. 431 – BRR, Jones Co.
Hard	West	10/21/04	430MJ	Mush Pen	BRR / Bullhead	355544 / 4896290	430 - 12	430 - Coyote
Hard	“	10/21/04	408MA	Mush Pen	J. Jones Ranch	325759 / 4891088	408 – NA	408 – BRR / Golden
Soft	West	7/21/04	205FA, 219MA	Pen	BRR/ BH	355766 / 4895918	205 – NA 219 – NA	205 – BRR/ BH, Stanley Co. 219 - MIA
Soft	“	7/21/04	262FA, 202MA	Pen	BRR / HFM	349632 / 4897820	262 – 101 202 - 3	262 – Coyote 202 - Coyote
Soft	“	7/21/04	227FA, 213MA	Pen	BRR / TBS	350604 / 4893279	227 – NA 213 – 63	227 – BRR/TBS, Stanley Co. 213 - Coyote
Soft	S	7/21/04	232FA, 233MA 286FP, 287FP, 288FP, 289MP	Pen	BRR / GLDN	357325 / 4879642	232 – 15 233 – NA 286 – 72 287 – 0 288 – 23 289 - NA	232 – Coyote 233 - A. Peters Ranch, Jones Co. 286 – Unknown 287 – Surgery 288 – Coyote 289 - A. Peters Ranch, Jones Co.
Manag	North	12/24/04	246FA	Mush Pen	Prince Bros. Ranch	347328 / 4924436	246 – NA	246 - Prince Bros., Stanley, Co.
Manag	South	12/16/04	424FJ	Mush Pen	A. Peters Ranch	360872 / 4875042	424 – NA	424 - A. Peters Ranch, Jones Co.
Manag	West	12/15/04	174MA	Mush Pen	J. O’Dea Ranch	306935 / 4914043	174 - NA	174 - J. O’Dea Ranch, Haakon Co.
Manag	North	10/21/04	297FJ	Mush Pen	Prince Bros. Ranch	350407 / 4922336	297 – 166	297 – Coyote

Table 16. Release summary for swift foxes released on Bad River Ranches (BRR) and neighboring lands in 2005.

Fox ID	Sex	Age	Release Type	Release Unit	Release Date	Release Site Type	Release Site Description	Landowner	Site UTM Easting	Site UTM Northing	Total Days Acclimation
401	M	Adult	Soft	West	7/13/2005	Pen	Hoffman	Bad River Ranches	349632	4897820	340
404	M	Adult	Soft	West	7/13/2005	Pen	Twin Buttes - South	Bad River Ranches	350604	4893279	330
406	F	Adult	Soft	North	7/13/2005	Pen	Powell Crk	Bad River Ranches	380317	4910158	339
414	F	Adult	Soft	West	7/13/2005	Pen	Dandee Butte	Bad River Ranches	351215	4897951	269
419	F	Adult	Soft	North	7/13/2005	Pen	Twin Buttes - North	Bad River Ranches	350640	4896226	334
421	F	Adult	Soft	West	7/13/2005	Pen	Dandee Butte	Bad River Ranches	351215	4897951	266
422	M	Adult	Soft	West	3/25/2005	Pen	Twin Buttes - North	Bad River Ranches	350640	4896226	225
425	M	Adult	Soft	North	7/13/2005	Pen	White Dog	Bad River Ranches	368228	4908161	324
426	F	Adult	Soft	North	7/13/2005	Pen	Powell Crk	Bad River Ranches	380317	4910158	332
433	M	Adult	Soft	West	7/13/2005	Pen	Twin Buttes - South	Bad River Ranches	350604	4893279	323
435	F	Adult	Soft	North	7/13/2005	Pen	White Dog	Bad River Ranches	368228	4908161	320
437	M	Adult	Soft	South	11/26/2004	Pen	Golden	Bad River Ranches	357325	4879642	92
438	M	Adult	Soft	West	7/13/2005	Pen	Bullhead	Bad River Ranches	355766	4895918	319
442	M	Adult	Soft	West	7/13/2005	Pen	Bullhead	Bad River Ranches	355766	4895918	319
443	F	Adult	Soft	West	7/13/2005	Pen	Hoffman	Bad River Ranches	349632	4897820	318
458	M	Pup	Soft	West	7/13/2005	Pen	White Dog	Bad River Ranches	368228	4908161	60
459	M	Pup	Soft	West	7/13/2005	Pen	White Dog	Bad River Ranches	368228	4908161	60
460	M	Pup	Soft	West	7/13/2005	Pen	White Dog	Bad River Ranches	368228	4908161	60
461	M	Pup	Soft	West	7/13/2005	Pen	White Dog	Bad River Ranches	368228	4908161	60
501	F	Pup	Hard	West	9/8/2005	Pen	BRR / Van Metre	Bad River Ranches	352466	4889663	31
503	F	Adult	Hard	North	10/9/2005	Mush Pen	D. Stirling	David Stirling	371169	4909824	49
508	M	Adult	Hard	North	10/9/2005	Mush Pen	D. Stirling	David Stirling	371169	4909824	48
525	F	Pup	Hard	West	10/9/2005	Pen	BRR / Twin Buttes	Bad River Ranches	350604	4893279	44
528	F	Adult	Hard	West	10/9/2005	Mush Pen	L. Hall / North	Lois Hall	344822	4901693	42
529	F	Adult	Hard	West	10/9/2005	Pen	BRR / Twin Buttes	Bad River Ranches	350604	4893279	42
533	M	Pup	Hard	West	10/9/2005	Mush Pen	L. Hall / North	Lois Hall	344822	4901693	42
542	M	Pup	Hard	North	10/9/2005	Pen	BRR / Guardrail	Bad River Ranches	370443	4906159	40
546	F	Adult	Hard	North	10/9/2005	Pen	BRR / Guardrail	Bad River Ranches	370443	4906159	39
547	F	Pup	Hard	North	10/9/2005	Pen	BRR / White Dog	Bad River Ranches	368228	4908161	39
548	F	Pup	Hard	North	10/9/2005	Pen	BRR / White Dog	Bad River Ranches	368228	4908161	39

Table 16 (continued). Release summary for swift foxes released on Bad River Ranches (BRR) and neighboring lands in 2005.

Fox ID	Sex	Age	Release Type	Release Unit	Release Date	Release Site Type	Site Description		Site UTM Easting	Site UTM Northing	Total Days Acclimation
549	F	Adult	Hard	North	10/9/2005	Pen	BRR / Guardrail	Bad River Ranches	370443	4906159	39
551	F	Pup	Hard	West	10/9/2005	Mush Pen	L. Hall / South	Lois Hall	346224	4899897	38
552	F	Adult	Hard	North	10/9/2005	Mush Pen	D. Stirling	David Stirling	371309	4910105	35
553	F	Adult	Hard	North	10/9/2005	Mush Pen	D. Stirling	David Stirling	371309	4910105	35
554	F	Adult	Hard	West	10/9/2005	Mush Pen	BRR / Bad River Rd	Bad River Ranches	348564	4897744	38
555	F	Pup	Hard	North	10/9/2005	Pen	BRR / Guardrail Pen	Bad River Ranches	370443	4906159	38
556	M	Pup	Hard	West	10/9/2005	Mush Pen	L. Hall / South	Lois Hall	346224	4899897	38
557	M	Pup	Hard	West	10/9/2005	Mush Pen	BRR / Bad River Rd	Bad River Ranches	348564	4897744	38
558	F	Adult	Hard	West	10/9/2005	Mush Pen	BRR / Bad River Rd	Bad River Ranches	348445	4897806	38

Table 17. Release summary for swift foxes released on Bad River Ranches (BRR) and neighboring lands in 2006.

Fox ID	Sex	Age	Release Date	Release Type	Release Method	Site Description	Landowner	County	UTM Easting	UTM Northing	Total Days Acclimation
515M	M	Adult	8/7/2006	Soft	Pen	Hoffman	Turner	Stanley Co.	349632	4897820	334
524M		Adult	8/7/2006	Soft	Pen	Dandee Butte	Turner	Stanley Co.	351215	4897951	334
538F	F	Adult	8/7/2006	Soft	Pen	Twin Buttes / North	Turner	Stanley Co.	350640	4896226	334
539M	M	Adult	8/7/2006	Soft	Pen	Twin Buttes / North	Turner	Stanley Co.	350640	4896226	334
540F	F	Adult	8/7/2006	Soft	Pen	Dandee Butte	Turner	Stanley Co.	351215	4897951	334
541F	F	Adult	8/7/2006	Soft	Pen	Hoffman	Turner	Stanley Co.	349632	4897820	334
573M	M	Pup	8/7/2006	CB	Pen	Hoffman Pen (TB-S)	Turner	Stanley Co.	349632	4906160	72
574M	M	Pup	8/7/2006	CB	Pen	Hoffman Pen (TB-S)	Turner	Stanley Co.	349632	4906160	72
575F	F	Pup	8/7/2006	CB	Pen	Hoffman Pen (TB-S)	Turner	Stanley Co.	349632	4906160	72
581M	M	Pup	8/7/2006	CB	Pen	TB-N	Turner	Stanley Co.	350640	4896226	77
582F	F	Pup	8/7/2006	CB	Pen	TB-N	Turner	Stanley Co.	350640	4896226	77
583F	F	Pup	8/7/2006	CB	Pen	TB-N	Turner	Stanley Co.	350640	4896226	77
584M	M	Pup	8/7/2006	CB	Pen	Dandee Pen	Turner	Stanley Co.	351215	4897951	63
585F	F	Pup	8/7/2006	CB	Pen	Dandee Pen	Turner	Stanley Co.	351215	4897951	63
586M	M	Pup	8/7/2006	CB	Pen	Dandee Pen	Turner	Stanley Co.	351215	4897951	63
587M	M	Pup	8/7/2006	CB	Pen	Dandee Pen	Turner	Stanley Co.	351215	4897951	63
523M	M	Adult	10/1/2006	Hard	Mush Pen	Bullhead/Hansen - N8	Hansen	Haakon Co.	301693	4909873	388
543F	F	Adult	10/1/2006	Hard	Mush Pen	Bullhead/Hansen - N8	Hansen	Haakon Co.	301693	4909873	388
550M	M	Adult	10/1/2006	Hard	Mush Pen	TB-S/Hansen - S3	Hansen	Haakon Co.	300984	4908018	388
559F	F	Adult	10/1/2006	Hard	Mush Pen	TB-S/Hansen - S3	Hansen	Haakon Co.	300984	4908018	388
600M	M	Adult	10/1/2006	Hard	Mush Pen	Hansen - N6	Hansen	Haakon Co.	302116	4910366	28
601M	M	Pup	10/1/2006	Hard	Mush Pen	Hansen - S5	Hansen	Haakon Co.	301247	4907446	28
602F	F	Adult	10/1/2006	Hard	Mush Pen	Hansen - S4	Hansen	Haakon Co.	301875	4907231	28
603F	F	Adult	10/1/2006	Hard	Mush Pen	Hansen - N10	Hansen	Haakon Co.	302787	4910291	28
607F	F	Pup	10/1/2006	Hard	Mush Pen	Hansen - S5	Hansen	Haakon Co.	301247	4907446	28
610F	F	Adult	10/1/2006	Hard	Mush Pen	Hansen - S1	Hansen	Haakon Co.	300822	4907146	28
611M	M	Adult	10/1/2006	Hard	Mush Pen	Hansen - N10	Hansen	Haakon Co.	302787	4910291	28
612F	F	Pup	10/2/2006	Hard	Mush Pen	White Dog	Turner	Stanley Co.	368228	4908161	29
613M	M	Pup	10/1/2006	Hard	Mush Pen	Hansen - S2	Hansen	Haakon Co.	301410	4907732	28
614M	M	Adult	10/1/2006	Hard	Mush Pen	Hansen - S1	Hansen	Haakon Co.	300822	4907146	28

Table 17 (continued). Release summary for swift foxes released on Bad River Ranches (BRR) and neighboring lands in 2006.

Fox ID	Sex	Age	Release Date	Release Type	Release Method	Site Description	Landowner	County	UTM Easting	UTM Northing	Total Days Acclimation
616M	M	Pup	10/1/2006	Hard	Mush Pen	Hansen - S4	Hansen	Haakon Co.	301875	4907231	28
617F	F	Pup	10/2/2006	Hard	Mush Pen	Guardrail	Turner	Stanley Co.	370443	4906159	29
618F	F	Pup	10/1/2006	Hard	Mush Pen	Hansen - N9	Hansen	Haakon Co.	302505	4909757	28
619M	M	Pup	10/2/2006	Hard	Mush Pen	Guardrail	Turner	Stanley Co.	370443	4906159	29
620M	M	Adult	10/2/2006	Hard	Mush Pen	EAC - MP'06	Turner	Stanley Co.	372368	4908183	29
621F	F	Pup	10/2/2006	Hard	Mush Pen	White Dog	Turner	Stanley Co.	368228	4908161	29
622M	M	Pup	10/2/2006	Hard	Mush Pen	White Dog	Turner	Stanley Co.	368228	4908161	29
624F	F	Pup	10/1/2006	Hard	Mush Pen	Hansen - N7	Hansen	Haakon Co.	301895	4909986	28
625F	F	Pup	10/2/2006	Hard	Mush Pen	EAC - MP'06	Turner	Stanley Co.	372368	4908183	29
626M	M	Pup	10/2/2006	Hard	Mush Pen	EAC - MP'06	Turner	Stanley Co.	372368	4908183	29
627F	F	Adult	10/2/2006	Hard	Mush Pen	EAC - MP'06	Turner	Stanley Co.	372368	4908183	29
630M	M	Pup	10/1/2006	Hard	Mush Pen	Hansen - N9	Hansen	Haakon Co.	302505	4909757	28
632F	F	Adult	10/1/2006	Hard	Mush Pen	Hansen - N6	Hansen	Haakon Co.	302116	4910366	28
634M	M	Pup	10/1/2006	Hard	Mush Pen	Hansen - N7	Hansen	Haakon Co.	301895	4909986	28
636F	F	Pup	10/1/2006	Hard	Mush Pen	Hansen - S2	Hansen	Haakon Co.	301410	4907732	28

Table 18. Release summary for swift foxes released on Bad River Ranches (BRR) and neighboring lands in 2007.

Fox ID	Sex	Age	Release Date	Release Type	Release Method	Site Description	Landowner	County	UTM Easting	UTM Northing	Total Days Acclimation
604F	F	Adult	10/8/2007	Soft - long	Pen	Twin Buttes / South	Turner	Stanley Co.	350604	4893279	395
605M	M	Adult	6/17/2007	Soft - long	Pen	Bullhead	Turner	Stanley Co.	355766	4895918	284
608F	F	Adult	4/21/2007	Soft - long	Pen	Dandee Butte	Turner	Stanley Co.	351215	4897951	228
609M	M	Adult	6/17/2007	Soft - long	Pen	Twin Buttes / North	Turner	Stanley Co.	350640	4896226	284
615F	F	Adult	6/17/2007	Soft - long	Pen	Hoffman	Turner	Stanley Co.	370198	4906228	284
623M	M	Adult	6/17/2007	Soft - long	Pen	Hoffman	Turner	Stanley Co.	370198	4906228	284
628M	M	Adult	10/8/2007	Soft - long	Pen	Twin Buttes / South	Turner	Stanley Co.	350604	4893279	395
629F	F	Adult	6/17/2007	Soft - long	Pen	Twin Buttes / North	Turner	Stanley Co.	350640	4896226	284
631F	F	Adult	6/17/2007	Soft - long	Pen	Bullhead	Turner	Stanley Co.	355766	4895918	284
635M	M	Adult	4/28/2007	Soft - long	Pen	Dandee Butte	Turner	Stanley Co.	351215	4897951	235
640F	F	Pup	10/8/2007	CB	Pen	Twin Buttes / South	Turner	Stanley Co.	350604	4893279	151
641M	M	Pup	10/8/2007	CB	Pen	Twin Buttes / South	Turner	Stanley Co.	350604	4893279	151
642F	F	Pup	6/17/2007	CB	Pen	Twin Buttes / North	Turner	Stanley Co.	350640	4896226	33
643M	M	Pup	6/17/2007	CB	Pen	Twin Buttes / North	Turner	Stanley Co.	350640	4896226	33
644F	F	Pup	6/17/2007	CB	Pen	Twin Buttes / North	Turner	Stanley Co.	350640	4896226	33
645M	M	Pup	6/17/2007	CB	Pen	Bullhead	Turner	Stanley Co.	355766	4895918	47
646F	F	Pup	6/17/2007	CB	Pen	Bullhead	Turner	Stanley Co.	355766	4895918	47
647M	M	Pup	6/17/2007	CB	Pen	Bullhead	Turner	Stanley Co.	355766	4895918	47
648M	M	Pup	6/17/2007	CB	Pen	Bullhead	Turner	Stanley Co.	355766	4895918	47
649F	F	Pup	6/17/2007	CB	Pen	Hoffman	Turner	Stanley Co.	370198	4906228	45
650M	M	Pup	6/17/2007	CB	Pen	Hoffman	Turner	Stanley Co.	370198	4906228	45
651M	M	Pup	6/17/2007	CB	Pen	Hoffman	Turner	Stanley Co.	370198	4906228	45
652M	M	Pup	6/17/2007	CB	Pen	Hoffman	Turner	Stanley Co.	370198	4906228	45
653M	M	Pup	10/8/2007	CB	Pen	Twin Buttes / South	Turner	Stanley Co.	350604	4893279	151
700F	F	Adult	10/8/2007	Soft - short	Mush Pen	Hansen 20-4	Hansen	Haakon Co.	301410	4907732	31
701F	F	Adult	10/8/2007	Soft - short	Mush Pen	Hansen 16-3	Hansen	Haakon Co.	301601	4908543	31
702F	F	Adult	10/8/2007	Soft - short	Mush Pen	Hansen 16-1	Hansen	Haakon Co.	301763	4909424	31
703F	F	Adult	10/8/2007	Soft - short	Mush Pen	Hansen 16-2	Hansen	Haakon Co.	302148	4908295	31
704F	F	Pup	10/8/2007	Soft - short	Mush Pen	Hansen 20-2	Hansen	Haakon Co.	300822	4907146	31
705M	M	Adult	10/8/2007	Soft - short	Mush Pen	Hansen 9-1	Hansen	Haakon Co.	301694	4909876	31
706M	M	Adult	10/8/2007	Soft - short	Mush Pen	Hansen 16-1	Hansen	Haakon Co.	301763	4909424	31
707M	M	Pup	10/8/2007	Soft - short	Mush Pen	BRR -WAC	Turner	Stanley Co.	369445	4906691	31



Table 18 (continued). Release summary for swift foxes released on Bad River Ranches (BRR) and neighboring lands in 2007.

Fox ID	Sex	Age	Release Date	Release Type	Release Method	Site Description	Landowner	County	UTM Easting	UTM Northing	Total Days Acclimation
708M	M	Adult	10/8/2007	Soft - short	Mush Pen	BRR - EAC	Turner	Stanley Co.	373589	4906946	31
709F	F	Adult	10/8/2007	Soft - short	Mush Pen	BRR - EAC	Turner	Stanley Co.	373589	4906946	31
710F	F	Adult	10/8/2007	Soft - short	Mush Pen	Hansen 9-1	Hansen	Haakon Co.	301694	4909876	31
711F	F	Pup	10/8/2007	Soft - short	Mush Pen	Hansen 17-1	Hansen	Haakon Co.	300742	4909402	31
713M	M	Adult	10/8/2007	Soft - short	Mush Pen	Hansen 8-2	Hansen	Haakon Co.	300899	4910334	31
714M	M	Pup	10/8/2007	Soft - short	Mush Pen	Hansen 8-1	Hansen	Haakon Co.	301381	4909867	31
715M	M	Adult	10/8/2007	Soft - short	Mush Pen	Hansen 20-1	Hansen	Haakon Co.	300340	4907473	31
716M	M	Pup	10/8/2007	Soft - short	Mush Pen	Hansen 16-2	Hansen	Haakon Co.	302148	4908295	31
717F	F	Pup	10/8/2007	Soft - short	Mush Pen	Hansen 8-1	Hansen	Haakon Co.	301381	4909867	31
718M	M	Pup	10/8/2007	Soft - short	Mush Pen	Hansen 17-1	Hansen	Haakon Co.	300742	4909402	31
719M	M	Adult	10/8/2007	Soft - short	Mush Pen	Hansen 16-3	Hansen	Haakon Co.	301601	4908543	31
720F	F	Pup	10/8/2007	Soft - short	Mush Pen	Hansen 20-3	Hansen	Haakon Co.	301070	4906626	31
721M	M	Pup	10/8/2007	Soft - short	Mush Pen	Hansen 20-2	Hansen	Haakon Co.	300822	4907146	31
722M	M	Adult	10/8/2007	Self release	Acclimation Pen	BRR -VM	Turner	Jones Co.	352463	4889541	31
723F	F	Pup	10/8/2007	Soft - short	Mush Pen	BRR - WAC	Turner	Stanley Co.	369445	4906691	31
724M	M	Pup	10/8/2007	Soft - short	Mush Pen	Hansen 20-3	Hansen	Haakon Co.	301070	4906626	31
725F	F	Adult	10/8/2007	Soft - short	Mush Pen	Hansen 20-1	Hansen	Haakon Co.	300340	4907473	31
726F	F	Adult	10/8/2007	Soft - short	Mush Pen	Hansen 8-2	Hansen	Haakon Co.	300899	4910334	31

Table 19. Estimated densities of breeding birds by habitat type for area search counts (9 ha) conducted on the BRR during June (I), July (II), and August (III) of 2003 and 2004.

2003 Habitat	I	II	III	Average	Est. Density (/ha)
Upland Grassland	75	58	11	48.00	5.33
CRP	83	20	12	38.33	4.26
Prairie Dog Colony	34	43	49	42.00	4.67
Total	192	121	72		
<b>Ave. Est. Density</b>					<b>4.75</b>
2004 Habitat	I	II	III*	Average	Est. Density (/ha)
Upland Grassland	47	18	--	32.50	3.61
CRP	59	15	--	37.00	4.11
Prairie Dog Colony	129	40	--	84.50	9.39
Total	235	73	--		
<b>Ave. Est. Density</b>					<b>5.70</b>

\*Survey not conducted during this period.

Table 20. Estimated densities of breeding birds by habitat type for area search counts (9 ha) conducted on the BRR during June (I), July (II), and August (III) of 2005, 2006, and 2007.

2005 Habitat	I	II	III	Average	Est. Density (/ha)
Upland Grassland	56	70	26	50.67	5.63
CRP	31	38	12	27.00	3.00
Prairie Dog Colony	52	107	46	68.33	7.59
Total	139	215	84		
<b>Ave. Est. Density</b>	<b>5.15</b>	<b>7.96</b>	<b>3.11</b>		<b>5.41</b>
2006 Habitat	I	II	III	Average	Est. Density (/ha)
Upland Grassland	77	21	13	37.00	4.11
CRP	69	3	0	24.00	2.67
Prairie Dog Colony	117	89	39	81.67	9.07
Total	263	113	52		
<b>Ave. Est. Density</b>	<b>9.74</b>	<b>4.19</b>	<b>1.93</b>		<b>5.28</b>
2007 Habitat	I*	II	III	Average	Est. Density (/ha)
Upland Grassland	--	24	2	8.67	0.96
CRP	--	20	2	7.33	0.81
Prairie Dog Colony	--	52	28	26.67	2.96
Total	--	96	32		
<b>Ave. Est. Density</b>	<b>0.00</b>	<b>3.56</b>	<b>1.19</b>		<b>1.58</b>

\*Survey not conducted during this period.

Table 21. Summary of breeding bird counts by species, habitat type, and survey period for counts conducted on the Bad River Ranches in June (I), July (II), and August (III), 2003.

Species	Upland Grass			CRP			Prairie Dog Colony			TOTAL
	I	II	III	I	II	III	I	II	III	
Western Meadowlark	30	28	6	18	1	6	6	5	14	114
Grasshopper Sparrow	33	23	4	43	17	2	-	-	-	122
Horned Lark	-	-	-	-	-	-	20	25	19	64
Mourning Dove	1	1	1	5	-	-	1	9	14	32
Brown Headed Cowbird	10	3	-	14	-	1	4	-	-	32
Upland Plover	-	-	-	2	-	-	1	1	1	5
Dicksissel	-	3	-	1	-	-	-	-	-	4
Killdeer	-	-	-	-	-	-	1	3	-	4
Barn Swallow	-	-	-	-	1	3	-	-	-	4
Starling	1	-	-	-	-	-	-	-	-	1
Burrowing Owl	-	-	-	-	-	-	-	-	1	1
Northern Harrier	-	-	-	-	-	-	1	-	-	1
Greater Prairie Chicken	-	-	-	-	1	-	-	-	-	1
<b>TOTAL</b>	<b>75</b>	<b>58</b>	<b>11</b>	<b>83</b>	<b>20</b>	<b>12</b>	<b>34</b>	<b>43</b>	<b>49</b>	<b>385</b>

Table 22. Summary of breeding bird counts by species, habitat type, and survey period for counts conducted on the Bad River Ranches in June (I), July (II), and August (III), 2004.

Species	Upland Grassland			CRP			Prairie Dog Colony			Total
	I	II	III	I	II	III	I	II	III	
Horned Lark							54		32	86
Western Meadowlark	19	15		23	2		13		2	74
Grasshopper Sparrow	18	2		20	10					50
Mourning Dove							50			50
Brown Headed Cowbird	9			15			3			27
Killdeer							4			4
Burrowing Owl									3	3
Upland Sandpiper							2			2
Unknown Spp.							2			2
Northern Harrier	1	1								2
Short-eared Owl				1	1					2
Chestnut-collared Longspur							1		1	2
Prairie Falcon									1	1
Barn Swallow							1			1
Short-tailed Grouse					2					2
Loggerhead Shrike									1	1
Total	47	18		59	15		130		40	309

Table 23. Summary of breeding bird counts by species, habitat type, and survey period for counts conducted on the BRR in June (I), July (II), and August (III), 2005.

Species	Upland			Grassland			CRP			Prairie	Dog	Colony	Total
	I	II	III	I	II	III	I	II	III				
Western Meadowlark	20	27	5	14	7	2	20	65	3			163	
Grasshopper Sparrow	18	32	11	10	20	4	-	-	-			95	
Horned Lark	-	-	-	-	-	-	12	23	15			50	
Killdeer	-	-	-	-	-	-	3	16	26			45	
Brown Headed Cowbird	17	6	-	6	5	-	2	1	-			37	
Upland Sandpiper	-	5	1	-	-	-	10	-	-			16	
Mourning Dove	1	-	7	-	-	5	1	-	-			14	
Burrowing Owl	-	-	-	-	-	-	2	2	2			6	
Eastern Kingbird	-	-	-	-	4	-	-	-	-			4	
Greater Prairie Chicken	-	-	-	-	-	-	4	-	-			4	
Unknown Sparrow	-	-	1	-	-	1	-	-	-			2	
Dickcissel	-	-	-	-	1	-	-	-	-			1	
Fly Catcher	-	-	1	-	-	-	-	-	-			1	
Total	56	70	26	30	37	12	54	107	46			438	

Table 24. Summary of breeding bird counts by species, habitat type, and survey period for counts conducted on the BRR in June (I), July (II), and August (III), 2006.

Species	Upland Grassland			CRP*			Prairie Dog Colony			Total
	I	II	III	I	II	III	I	II	III	
Horned Lark							57	76	31	164
Western Meadowlark	22	5		12			27	1	6	73
Grasshopper Sparrow	32	3	2	31						68
Mourning Dove	7	9	2	4	2		6		4	34
Brown Headed Cowbird	12	2		11			8			33
Unknown Sparrow							17	1		18
Killdeer							2	11	2	15
Upland Sandpiper	4	1		5	1					11
Greater Prairie Chicken		1	3	6						10
Sharp-tailed Grouse			4							4
Burrowing Owl							1	1		2
Barn Swallow			2							2
Total	77	21	13	69	3	0	118	90	43	434

\* CRP lands were mowed and harvested for upland hay between counts I and II.

Table 25. Summary of breeding bird counts by species, habitat type, and survey period for counts conducted on the BRR in June (I), July (II), and August (III), 2007.

Species	Upland Grassland			CRP			Prairie Dog Colony			Total
	I <sup>1</sup>	II	III	I <sup>1</sup>	II	III	I <sup>1</sup>	II	III	
Western Meadowlark	--	11	1	--	8	2	--	11	2	35
Grasshopper Sparrow	--	11		--	12		--			23
Horned Lark	--			--			--	12	9	21
Killdeer	--			--			--	12	4	16
Mourning Dove	--			--			--	4	10	14
Bobolink	--			--			--	5		5
Burrowing Owl	--			--			--	4	1	5
Upland Sandpiper	--			--			--	3		3
Ferruginous Hawk	--			--			--		2	2
Brown Headed Cowbird	--	2		--			--			2
Northern Harrier	--		1	--			--			1
Unknown Species	--			--			--	1		1
Total	0	24	2	0	20	2	0	52	28	128

<sup>1</sup> Survey not accomplished due to weather and logistics



Table 26. Summary of small mammal captures by period, habitat, and species for surveys conducted on the BRR during 2003.

Period	Species	Habitat				Total (%)
		Pdog	Upland	Road	Coulee	
Fall	<i>Peromyscus maniculatus</i>	20	9	15	32	76 (95)
	<i>Peromyscus leucopus</i>	0	0	0	1	1 (1.25)
	<i>Onychomys leucogaster</i>	1	0	2	0	3 (3.75)
TOTAL		21	9	17	33	80

Success (/100 trap nights) = 2.8

Table 27. Summary of small mammal captures by habitat and species for surveys conducted on the BRR during 2004

Period	Species	Habitat				Total	(%)
		P dog	Upland	Road	Coulee		
Fall	<i>Peromyscus maniculatus</i>	126	59	168	110	463	86.38%
	<i>Peromyscus leucopus</i>	0	0	1	0	1	0.19%
	<i>Onychomys leucogaster</i>	1	0	2	0	3	0.56%
	<i>Napaeozapus insignis</i>	0	0	1	0	1	0.19%
	<i>Perognathus hispidus</i>	0	0	2	0	2	0.37%
	<i>Cyptotis (parva?)</i>	0	0	1	0	1	0.19%
	<i>Blarina brevicauda</i>	0	0	1	0	1	0.19%
	<i>Microtus spp</i> ( <i>pennsylvanicus</i> and <i>ochrogaster</i> )	0	2	61	1	64	11.94%
	TOTAL	127	61	237	111	536	100.00%

Trap nights:	2751
Capture success:	19.48%
Recapture percentage:	32.09%

Table 28. Summary of small mammal captures by habitat and species for surveys conducted on the BRR during 2005.

Period	Species	Habitat Type				Total	(%)
		P dog	Upland	Road	Coulee		
Fall	<i>Peromyscus maniculatus</i>	28	7	2	47	84	96.55
	<i>Onychomys leucogaster</i>	1				1	1.15
	<i>Cryptotis parva</i>			2		2	2.30
TOTAL		29	7	4	47	87	

Trap Nights:	2,865
Capture Success:	5.58%
Recapture percentage:	45.63%

Table 29. Summary of small mammal captures by habitat and species for surveys conducted on BRR during 2006.

Period	Species	Habitat Type				Total	(%)
		P dog	Upland	Road	Coulee		
Fall	<i>Peromyscus maniculatus</i>	16	16	21	63	116	88.5
	<i>Cryptotis parva</i>	3	2	2		7	5.3
	<i>Reithrodontomys megalotis</i>			1	6	7	5.3
	<i>Sorex cinereus</i>				1	1	0.8
	<i>Microtus ochrogaster</i>			1		1	0.8
TOTAL		19	18	24	70	131	

Trap Nights:	2,810
Capture Success:	4.70%
Recapture percentage:	32.58%

Table 30. Summary of small mammal captures by habitat and species for surveys conducted on the BRR during 2007.

Period	Species	Habitat Type				Total	(%)
		P dog	Upland	Road	Coulee		
Fall	<i>Peromyscus maniculatus</i>	40	52	35	110	237	86.8
	<i>Onychomys leucogaster</i>	11	1	0	0	12	4.4
	<i>Reithrodontomys megalotis</i>	1	0	2	0	3	1.1
	<i>Microtis pennsylvanicus</i>	0	3	4	0	7	2.6
	<i>Spermophilus</i> <i>tridecemlineatus</i>	0	1	2	0	3	1.1
	<i>Microtis ochrogaster</i>	0	9	2	0	11	4.0
	TOTAL		52	66	45	110	273

Trap Nights:	2,643
Capture Success:	10.33%
Recapture percentage:	34.80%

Table 31. Estimated densities for Orthoptera (grasshoppers) by habitat type for jump count surveys conducted June (I), July (II), and August (III) on the BRR during 2003.

Habitat	I	II	III	Ave.	Est. Den. (m <sup>2</sup> )
Coulee	134	321	160	205	0.032
Upland Grass	167	272	103	180.67	0.028
Prairie Dog Town	43	97	15	51.67	0.008
Total	344	690	128	387.33	0.061

Table 32. Estimated densities for Orthoptera (grasshoppers) by habitat type for jump-count surveys conducted on the BRR during June (I) 2004.

Habitat	Day 1	Day 2	Day 3	Day 4	Total	Est. Den. (m <sup>2</sup> )
Coulee	7	143	252	185	587	0.091
Upland Grass	5	31	27	15	78	0.012
Prairie Dog Town	5	5	11	5	26	0.004
Total	17	179	290	205	691	0.11

Table 33. Estimated densities for Orthoptera (grasshoppers) by habitat type for jump count surveys conducted July (I), and August (II) on the BRR during 2005.

Habitat	I	II	Ave.	Ave. Est. Den. (m <sup>2</sup> )
Coulee	2,165	9,139	5,652	0.88
Upland Grass	507	2,129	1,318	0.21
Prairie Dog Town	91	465	278	0.04
Total	2,763	11,733	7,248	0.38



Table 34. Estimated densities for Orthoptera (grasshoppers) by habitat type for jump count surveys conducted June (I), July (II), and August (III) on the BRR during 2006.

Habitat	I		II		III		Year Total	Ave. Den
	Total	Ave. Den	Total	Ave. Den	Total	Ave. Den		
Coulee	10,842	3.01	7,187	2.00	4,028	1.12	22,057	2.04
Prairie Dog colony	121	0.03	81	0.02	136	0.04	338	0.03
Upland	485	0.13	406	0.11	395	0.11	1,286	0.12
Roadside	2,686	0.75	2744	0.76	2,038	0.57	7,468	0.69
Total							31,149	0.72

Table 35. Estimated densities for Orthoptera (grasshoppers) by habitat type for jump count surveys conducted June (I), July (II), and August (III) on the BRR during 2007.

Site	I <sup>1</sup>		II		III		Total	Ave. Den
	Total	Ave. Den	Total	Ave. Den	Total	Ave. Den		
Coulee	--	--	9,763	2.71	5,302	1.47	15,065	2.09
Prairie Dog colony	--	--	326	0.09	120	0.03	446	0.06
Upland	--	--	4,183	1.16	2,003	0.56	6,186	0.86
Roadside	--	--	326	0.09	702	0.20	1,028	0.14
Total							22,725	0.79

<sup>1</sup> No survey conducted

Table 36. Estimated densities of lagomorphs, coyotes and swift fox in Swift Fox Recovery Area (SFRA) by period and species for spotlighting surveys conducted in 2002.

Site	Period	Species	Sampling Nights				Total	Density
			1	2	3	4		
SFRA	Fall 2003	<i>Lepus townsendii</i>	17	10	12	20	59	0.916
		<i>Sylvilagus floridanus</i>	2	2	4	1	9	0.139
		<i>Canis latrans</i>	1	3	4	1	9	0.139
		<i>Vulpes velox</i>	1	0	1	0	2	0.031

Table 37. Estimated densities of lagomorphs, coyotes and swift fox in Swift Fox Recovery Area (SFRA) by period and species for spotlighting surveys conducted in December, 2004.

Period	Species	Sampling Nights				Total	Density (km <sup>2</sup> )
		1	2	3	4		
Fall 2004	<i>Lepus townsendii</i>	18	13	13	15	59	0.92
	<i>Sylvilagus floridanus</i>	5	25	6	12	48	0.75
	<i>Canis latrans</i>	6	3	11	2	22	0.34
	<i>Vulpes velox</i>	0	0	0	0	0	0.0

Table 38. Estimated densities of lagomorphs, coyotes and swift fox in Swift Fox Recovery Area (SFRA) by period and species for spotlighting surveys conducted in December, 2005.

Period	Species	Sampling Nights				Total	Density (km <sup>2</sup> )
		1	2	3	4		
Fall 2005	<i>Lepus townsendii</i>	24	12	8	11	55	0.85
	<i>Sylvilagus floridanus</i>	5	11	3	8	27	0.42
	<i>Canis latrans</i>	0	1	3	3	7	0.11
	<i>Vulpes velox</i>	0	0	1	2	3	0.05

Table 39. Estimated densities of lagomorphs and meso-carnivores in Swift Fox Recovery Area (SFRA) by period and species for spotlighting surveys conducted in November, 2006.

Period	Species	Sampling Nights				Total	Density (km <sup>2</sup> )
		1	2	3	4		
Fall 2006	<i>Lepus townsendii</i>	25	20	18	24	87	1.35
	<i>Sylvilagus floridanus</i>	3	10	12	4	29	0.45
	<i>Canis latrans</i>	2	4	3	1	10	0.16
	<i>Vulpes velox</i>	--	1	--	--	1	0.02
	<i>Procyon lotor</i>	1	--	2	--	3	0.05
	<i>Erethizon dorsatum</i>	1	--	2	2	5	0.08
	<i>Mephitis mephitis</i>	--	1	1	2	4	0.06
	<i>Taxidea taxus</i>	--	--	--	2	2	0.03

Table 40. Estimated densities of lagomorphs and meso-carnivores in Swift Fox Recovery Area (SFRA) by period and species for spotlighting surveys conducted in November, 2007.

Period	Species	Sampling Nights				Total	Density (km <sup>2</sup> )
		1	2	3	4		
Fall 2007	<i>Lepus townsendii</i>	18	28	24	30	100	1.55
	<i>Sylvilagus floridanus</i>	19	7	13	5	44	0.68
	<i>Canis latrans</i>	1	4	2	2	9	0.14
	<i>Vulpes velox</i>	1	2	1	--	4	0.06
	<i>Procyon lotor</i>	--	--	--	1	1	0.02
	<i>Erethizon dorsatum</i>	2	--	--	--	2	0.03
	<i>Mephitis mephitis</i>	1	--	1	--	2	0.03
	<i>Taxidea taxus</i>	--	1	--	--	1	0.02

Table 41. Estimated relative densities (RD) of coyote and red foxes corrected by mean sightability (= 0.775) of fecal piles for fecal line surveys conducted on the Bad River Ranches, South Dakota during spring (2003-2005 only) and fall of 2003-2007.

Sample Period	Coyote <sup>1</sup>	Fox <sup>2</sup>
Spring 2003	25.38	--- <sup>3</sup>
Fall 2003	64.94	6.85
Spring 2004	256.02	19.2
Fall 2004	179.34	68.36
Spring 2005	67.2	0.0
Fall 2005	44.8	24.9
Fall 2006	160.0	12.8
Fall 2007	123.2	72.8

<sup>1</sup> Computed by summing all corrected indices and dividing by the total number of transects for that sampling period.

<sup>2</sup> Includes all fox species

<sup>3</sup> Did not sample for foxes



## Appendix I

### *Animal Handling Protocol & Justification for use of Intraperitoneal Transmitters Implants (ITI's)*

While much of our work reintroducing a population of swift foxes involves non-invasive techniques (i.e., post-release telemetric monitoring, den watches, prey and predator surveys), techniques such as trapping, marking/tagging with ear tags, pit tags and/or radio-collars, and drawing blood for disease analysis are considered by some to be invasive of the animal's safety and well-being. Techniques which involve major and minor surgical procedures, such as the use of ITI's are clearly invasive since they expose animals to the serious risk of infection and death. While such procedures may be necessary to collect data needed to discern key aspects of a reintroduction (i.e., pup survival and causes of mortality), they should not be used indiscriminately and should follow the strictest possible protocols to ensure the well being of the animals involved.

We have developed such a protocol to use ITI's in swift fox pups to determine survival, causes of mortality, and dispersal habits during the critical pup rearing stage (Kitchen et al. 1999). Pups in this stage (3 to 20 weeks) are vulnerable to disease and predators and are typically too small to be fitted with radio collars. While observations carried out at den sites can provide data relating to reproductive success, the recovery of carcasses and determination of cause of mortality is often limited. Survival, reproductive success, and dispersal are considered to be critical components that contribute to the success or failure of reintroduction efforts (Bar David et al. 2005) and having the means to assess these components may assist in developing strategies to mitigate losses and increase juvenile recruitment.

Since we are investigating the efficacy of several types of release methods (i.e., soft-, hard-, and modified hard-releases) relating to survival and dispersal of translocated foxes, we have the opportunity to test whether the type of release method effects the reproductive success of adults and survival of their offspring. By maintaining mixed-sex pairs of foxes over winter in a captive environment (i.e., soft-release pens), we may be able to increase the likelihood of breeding success. Access to high quality and abundant food may also have a positive effect on litter's sizes along with gestational and post-whelp development and survival of pups when compared to free-ranging foxes. However, overall survival of soft-released pups may depend on releasing these family groups earlier in the rearing stage than later. Increased experience with natural prey items brought back to the den could play a critical role in the development of a prey search image as pups learn to forage. Therefore, the earlier family groups can be released, the better the tools young captive-born pups will have as they develop their survival skills. By using ITI's, pups, wild- or captive-born and too small for radio-collars, can still be effectively monitored and tracked. ITI's also provide a secondary benefit by assisting in locating and trapping of implanted individuals once they are large enough to carry a radio-collar.

Determining reproductive success (litter sizes) in soft-release pens is accomplished by twice weekly checks of belowground den boxes beginning in mid-April to mid-May. Free-ranging breeding pairs are observed at natal den sites over the course of the pup-rearing period (May-August, Kitchen et al. 1999). During weekly observation for 3- 4 weeks after pups initially

emerge from the den, the maximum number of visible pups is recorded during morning and evening activity periods. These observations give us the minimum number of pups that have survived to emergence and minimum survival post-emergence until pups are large enough (700 – 800 grams) to safely hold a 13-gram transmitter. After implanting, pups can be monitored telemetrically, allowing us to monitor movements, and determine when a mortality occurred through the pre-programmed mortality sensor in the transmitter. All mortalities are located as promptly as possible and the site investigated to determine cause of death.

Preliminary data from the first two years of reintroductions suggest that females had larger home ranges than males and lower overall survival when data was censored (Kunkel et al. 2004). Moerhenschlager and MacDonald (2003) noticed that survival among translocated swift foxes in Canada was higher in males and was negatively correlated to distance traveled away from release site. They speculated that one reason for this may be due to a higher degree of dispersal experience among males prior to translocation. Fitting swift fox pups with ITI's may allow us to compare movement patterns between males and females and test for differences that may explain the lower female survival seen among translocated foxes.

## Methods

Study animals will be captured using box traps (Tomahawk Live Trap Co., Tomahawk, WI) baited with rabbit and mackerel. Bait will be covered and secured at the back of the trap to prevent ingestion. Trap locations will be typically associated with den sites. All the trap sites will be on the Bad River Ranches or on other private property with landowner permission. Traps will be baited and set in early morning (before sunrise) and late afternoon (before sunset) to coincide with peak activity periods. Traps will be checked 2-3 hours later to minimize the time pups are confined within the trap. After the check the traps will be closed and captured foxes processed.

Fox pups will be immobilized using isoflurane induced anesthesia administered via a portable wildlife anesthesia machine (Bruce Heath, MD, Denver, CO) and cone mask. Captured foxes may be immobilized using a Ketamine/medetomidine combination (100 mg Ketamine and 1 mg medetomidine per milliliter) at 3 mg of Ketamine and 0.1 mg medetomidine per pound of body weight OR 1.4 mg of Ketamine and 0.05 mg of medetomidine per kg of body mass. Ophthalmic ointment will be placed into the eyes and the animal's eyes covered. Study animals will be instrumented with intraperitoneal implant transmitters (M1215) manufactured by Advanced Telemetry Solutions, Isanti, MN. Implant transmitters will be gas-autoclaved using ethylene oxide at a sterilization temperature of 94C.

Licensed TESH staff veterinarian, David Hunter will conduct the implant surgery at the capture sites. The surgical site on the fox will be prepped using standard aseptic surgical procedures. Temperature, pulse and respiration will be monitored continually during procedure. A 3-cm incision will be made in the ventral-medial area near the umbilicus along the linea alba. Omentum and small intestine will be reflected to the right quadrant and the implant transmitter inserted into the left lower quadrant of the abdominal cavity. The transmitter signal will be checked and a 4-layer closure used to close the incision. Linea Alba, subcutaneous layers and subcuticular sutures will be closed with absorbable suture. The skin will be closed with surgical

glue (Vet bond). A therapeutic level of a broad-spectrum, sustained release antibiotic will be administered to prevent infection. The procedure is expected to take < 15 minutes to perform.

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