CONSERVATION ASSESSMENT
AND CONSERVATION STRATEGY
FOR
SWIFT FOX IN THE UNITED STATES

September 1997

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EXECUTIVE SUMMARY

The swift fox (*Vulpes velox*) is considered a somewhat specialized species that inhabits the shortgrass and midgrass prairie ecosystem in the Great Plains region of North America. The original continental range of this small, buff-colored fox, may have extended north-south from central Alberta to central Texas and east-west between western Iowa and eastern Colorado. Between the early 1800s and the mid 1900s the swift fox was subject to a dramatic range reduction that was apparently a result of human related activities associated with the settlement and development of the prairie region. During the 1950s, swift fox were thought to be reoccupying many areas of their former range. As a result of natural recolonization and reintroduction efforts the species is now present in nine states and two provinces. An apparently common and contiguous population occupies portions of Wyoming, Colorado, and Kansas, with the species considered locally common in portions of Oklahoma, Texas, and New Mexico. Swift fox appear to have a restricted distribution in Nebraska, South Dakota and Montana while the species is thought to be absent from North Dakota. The provinces of Alberta and Saskatchewan now maintain a wild population with a restricted distribution as the result of a reintroduction program (Carbyn et al. 1994). Although the known distribution of swift fox may represent an estimated 30 percent of the species' reported pre-settlement range, the population status of swift fox in many occupied areas has yet to be fully investigated.

In the United States, the present level of species protection varies among the ten states and several federal agencies involved with swift fox conservation. The species is classified as endangered or threatened in the states of Nebraska and South Dakota; is a furbearer in seven states; and is a nongame wildlife species in Wyoming. The U.S. Fish and Wildlife Service (USFWS) lists the swift fox as a candidate species with a priority rating of eight (61 FR 7596; Feb. 28, 1996); the U.S. Forest Service (USFS) designates the swift fox as a sensitive species; and the Bureau of Land Management (BLM) also recognizes this designation for swift fox. Most state Natural Heritage Programs (NHP) describe the species as rare or extirpated.

In 1992 a petition was submitted to the USFWS to list the swift fox under the Endangered Species Act (ESA) in the states of Montana, North Dakota, South Dakota and Nebraska, if not throughout its entire range. The USFWS published a 90-day finding in 1994 which concluded that a species listing may be warranted range-wide (59 FR 28328; June 1, 1994). The ten state wildlife management agencies affected by this decision and interested cooperators formed the Swift Fox Conservation Team (SFCT) in 1994 to develop a species conservation assessment and conservation strategy document which would provide a framework to direct conservation of the species as an alternative to a federally mandated recovery effort. With the knowledge of this initiative, the USFWS published a 12-month finding in 1995 which resulted in a warranted, but precluded decision, concluding that the magnitude of threats to the species is low to moderate although the immediacy of threats remains imminent (60 FR 31663; June 16, 1995). This candidate listing recommendation is reviewed and reassessed annually by the USFWS.

State wildlife agencies and cooperating federal land management agencies within the current United States range of the swift fox have demonstrated a commitment to ensure the conservation of the swift fox and its habitat by identifying a specific conservation strategy for the species.

Accomplishment of conservation strategy objectives will be coordinated through the SFCT and may be reviewed annually by the USFWS, with specific activities implemented by state wildlife agencies in cooperation with the federal land management agencies, research institutions, tribal governments, private organizations and private landowners as dictated by available funding and resources. This effort reflects the present position of the states involved, which was indicated to the USFWS in a letter signed by the ten state wildlife agency directors in 1994, that conservation of the swift fox can be achieved by this coordinated and cooperative management approach utilizing state and federal funding sources rather than through a species listing under the ESA (Appendix B). The stated goal, objectives, strategies, and activities described in the conservation strategy may be modified by the SFCT if the ESA is utilized at a later date.

A review of the numerous studies on swift fox in the United States indicate that they have collected qualitative ecological data, but have not adequately addressed defining range-wide habitat requirements. However, it is generally accepted that swift fox are associated with the shortgrass and midgrass prairie ecosystem. Habitat within this ecosystem support a diverse prey base, provide relatively level topography which affords long viewing distances to detect predators, and consist of firm friable soils that are suitable for the excavation and maintenance of multiple den sites utilized for year-round use.

The primary considerations identified by the SFCT to develop a successful conservation strategy for swift fox are to:

1) Maintain and protect existing areas of species abundance while expanding the distribution of swift fox where ecologically and politically feasible.
2) Develop methods to monitor population status and species distribution.
3) Identify, manage and protect suitable swift fox habitat.
4) Implement cooperative efforts with private landowners and conservation agreements with federal land management agencies to maintain and manage habitat for swift fox.
5) Elevate state legal status and/or management priority of the species throughout its range.
6) Although not necessarily provide a geographically continuous population, it is essential to maintain a genetically connected continental population.

In order to achieve the stated objectives outlined in the conservation strategy, the SFCT and each state swift fox working group may facilitate the collection and transfer of information to direct the:

1) Development of a survey protocol to monitor trends in the distribution and population status of swift fox throughout the species range.
2) Define what constitutes suitable swift fox habitat within various geophysiographic regions and identify components of swift fox habitat.
3) Implementation of habitat and population management practices on state and federal lands which emphasize the conservation of swift fox.
4) Development of private landowner incentive programs to support swift fox management and research.

5) Development of educational programs to promote positive public support for swift fox conservation efforts.
6) Reestablishment of local populations in unoccupied suitable habitat, with initial emphasis in the northern portion of the species range.
7) Periodic monitoring of genetic diversity and species health.
8) Implementation of unified harvest regulations to facilitate the collection of biological information in states where swift fox population levels support a legal harvest.
9) Investigate the need and availability of captive swift fox in existing zoos and reserves to maintain a source of genetic diversity.

Swift fox conservation criteria used to evaluate the success of this program will include 1) the ability to maintain local self-sustaining populations which are geographically distributed throughout each state or large blocks of contiguous prairie and 2) that the United States population occupies a minimum of 50 percent of the suitable habitat that is available. Attainment of conservation strategy objectives are intended to be accomplished by 2015 if adequate funding and resources are available, with approximately half of the species restoration completed by 2005. It is estimated that the total cost of implementing the conservation strategy over a 20 year period could reach $1,500,000 or more. State, federal and private funding sources will be solicited as needs are identified.

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CONSERVATION ASSESSMENT

INTRODUCTION

The purpose of this conservation assessment is to describe the current known status of the swift fox in the United States and to identify and assess the risks to the species. It is intended to focus efforts toward conserving existing populations and minimizing the continuation of these threats which will allow an expansion of the species' range. Information is provided primarily at the state level, an approach that provides a habitat and species assessment which considers regional variation. Canada has recently completed a national recovery plan for the swift fox (Brechtel et al. 1996). This conservation assessment is intended to address the USFWS species candidate listing in the United States under the ESA of 1973, as amended. This assessment should be considered dynamic with revisions expected periodically as new information becomes available..

TAXONOMY

The three North American members of the genus *Vulpes* are the red fox (*V. vulpes*), swift fox and kit fox (*V. macrotis*). Scientists have long debated the taxonomic status of the two arid land foxes (Samuel and Nelson 1982, Scott-Brown et al. 1987). The swift fox and kit fox represent the smallest canids in North America with morphological similarities that have resulted in several locally common names, such as northern kit fox, swift kit fox, and prairie kit fox, which are often applied interchangeably.

Swift fox differ from the kit fox in appearance by a broader skull and shorter ears, shorter tail length, and slightly larger body size. Swift fox are considered residents of the grassland prairies while kit fox occupy the more desert environments. Swift fox and kit fox are recognized as two separate species (Scott-Brown et al. 1987, FaunaWest 1991, Mercure et al. 1993) although findings by Dragoo et al. (1990) may continue this debate.

DESCRIPTION

The primary physical species-specific characteristics of the swift fox are its small size, large ears, black muzzle patches, buffy tan pelage coloration and black-tipped tail. Adult swift fox are 30-32 cm (12-12.5 inches) in height and about 80 cm (31 inches) in total length (Scott-Brown et al. 1987). The average weight is reported to be 2.44 kg (5.4 lbs) for males and 2.3 kg (5.0 lbs) for females. Pelage color is similar for both sexes, which is a dark buffy gray across the back extending into a yellow-tan coloration across the sides and legs. The throat, chest, and belly area are pale yellow to white. Pelage color may be more rufus during the summer months. Specific field identification marks are considered to be the black patches on either side of the muzzle and the black-tipped tail.

Skull characteristics of swift fox are similar to other canids. The dental formula is: 3/3; 1/1; 4/4; 2/3; for a total of 42 teeth. Egoscue (1979) reports the female has eight evenly spaced mammae.

Swift fox are primarily nocturnal and closely associated to underground den sites (Hillman and Sharps 1978, Eqoscue 1979). The swift fox likely received its descriptive name from its ability to outrun predators and pursue certain prey species, particularly the black-tailed jackrabbit (*Lepus californicus*) and white-tailed jackrabbit (*L. townsendii*). A number of studies (Cutter 1958b, Egoscue 1962, Kilgore 1969, Zumbaugh et al. 1985) support the importance of lagomorphs in the diet of swift fox.

DISTRIBUTION AND STATUS

Distribution

The swift fox is native to the grassland prairies in the Great Plains region of North America. The original range of the species was influenced primarily by the extent of the shortgrass and midgrass prairie ecosytems. Historic swift fox range is reported to have included 1.6 million km² (624,000 mi²) of the grassland prairie in central North America (Scott-Brown et al. 1987), extending north-south from central Alberta to central Texas and east-west between western Iowa and Minnesota to central Colorado (Hall 1981, Hall and Kelson 1959, Samuel and Nelson 1982, Scott-Brown et al. 1987).

Although historic United States range maps include extreme western Minnesota and Iowa (Hall 1981, Scott-Brown et al. 1987, FaunaWest 1991, Samuel and Nelson 1982), specimens were not collected for verification (Swanson et al. 1945, Allen 1870, Bowles 1975 *in* FaunaWest 1991). Historic swift fox range (pre-1850) in the United States has been based on verified and unverified museum records and observational accounts recorded by early naturalists and explorers (FaunaWest 1991), with the latter not quantitatively measuring abundance or indicating if species distribution was continuous or patchy and disjunct. Recent vegetation classification mapping that has been modified to delineate the extent of potential grassland types in the central United States (Lauenroth 1996) may further confound historic range estimates and presents a theory that could suggest historic swift fox range was 20-25 percent less than what has been reported in the literature (Fig. 1). Consequently, the extent of historic distribution and population estimates are difficult to accurately assess today, based on the available historical literature and unverified specimen records.

However, a dramatic range reduction did occur in the United States in the early 1800s and continued until the mid 1900s as a result of human related activities associated with the settlement and development of the prairies (Scott-Brown et al. 1987, FaunaWest 1991, Samuel and Nelson 1982). This range reduction was apparently more dramatic in the eastern and northern portions of swift fox range (Hillman and Sharps 1978). The loss of native prairie habitat, predator control campaigns, unregulated trapping and hunting, and rodent control programs all contributed to a restricted distribution (Samuel and Nelson 1982, FaunaWest 1991). Swift fox were extremely susceptible to strychnine-laced carcasses on the prairie during wolf (*Canis lupus*) extermination campaigns in the late 1800s.(Scott-Brown et al. 1987, Young 1944). Johnson (1969) reported the commercial trade of thousands of swift fox pelts between 1835 and 1838. Robinson (1953) considered foxes to be vulnerable to coyote (*C. latrans)* control methods

used through the mid 1900s. FaunaWest (1991) suggests the loss of native habitat to agriculture, a changing prey base, and increased interspecific competition from coyotes and red foxes maintained this restricted distribution.

Recent species accounts (post-1950), however, now suggest that swift fox populations have been increasing and reoccupying some portions of their historic range in the United States (FaunaWest 1991, Samuel and Nelson 1982). According to Jones et al. (1987), by mid-century the swift fox began a remarkable recovery from remnant populations in much of the western portion of its original range.

The last historical record of swift fox in Montana was reported by Bailey and Bailey (1918) and Hoffman et al. (1969) concluded that the species was extirpated in the state. In 1978, the first of a series of collected swift fox specimens was recovered in Custer County in southeastern Montana (Moore and Martin 1980). No sightings were made of swift fox between 1915 and 1970 in North Dakota (Bailey 1926, Pfeifer and Hibbard 1970), between 1914 and 1966 in South Dakota (Visher 1914, Hillman and Sharps 1978), or during the period 1901 to 1953 in Nebraska (Jones 1964).

Long (1965) stated that swift fox were not reported for many years in Wyoming prior to 1958. In Colorado, Lechleitner (1969) indicated that swift fox range had contracted by 1900 which led to local extinctions in many areas of the state. Recent status information indicates the species is well distributed in eastern Colorado (Fitzgerald et al. 1994). Allen (1874) felt that swift fox were still somewhat abundant in western Kansas, although Knox (1875), Baker (1889), and Lantz (1905) suggested that the species was becoming rare. By the 1930s Black (1937) and Cockrum (1952) believed the species had been extirpated. During the 1950s the swift fox began to recover and specimens were collected (Martin and Sternberg 1955, Hibbard and Taylor 1960, Anderson and Fleharty 1964, Janes and Gier 1966, and Walker 1978). Boggess and Johnson (1981) considered the swift fox population in Kansas to be stable or expanding throughout much of its historic range.

Blair (1939) did not list the swift fox as part of Oklahoma's mammalian fauna, however after 1956 swift fox were observed in several western counties (Glass 1956, Cutter 1959, Kilgore 1969). Only several swift fox specimens were reported in New Mexico between 1850 and 1950 while numerous records from a seven county area collected between 1952 and 1982 confirmed their presence in the state (Schmitt 1996). Bailey (1905) noted that Texas ranchers commented that the "swifts" were scarce compared to their numbers in previous years. As late as 1954, the species was reported as rather scarce in certain localities of Texas. Although Jones et al. (1987) indicated that swift fox distribution had been reduced in Texas, they estimated 20,000 swift fox remained in the panhandle area of the state.

Current swift fox distribution in the United States could be considered relatively widespread, although it remains limited to only a portion of the species original range. Swift fox occupy portions of Montana, South Dakota, Wyoming, Nebraska, Colorado, Kansas, Oklahoma, New Mexico, and Texas (Allen et al. 1996) (Fig. 2). However, distributions and associated densities

appear highly variable among the nine occupied states. The present known range is constricted and somewhat disjunct, with an identified population core present in the states of Wyoming, Colorado, and Kansas, an undetermined species distribution in the adjacent states of Nebraska, Oklahoma, Texas, and New Mexico, and a restricted species distribution in South Dakota and Montana. Swift fox are apparently absent in North Dakota, despite several recently collected specimens. Current known swift fox distribution is apparently about 25 percent of the reported historic range from the literature or approximately 40 percent of the suggested historic range based on vegetation classification mapping of the shortgrass and midgrass prairie grassland types in the central United States (Fig. 3).

Population Status

According to Giddings and Knowles (1996) a recent increase in the frequency and intensity of swift fox occurrence reports and collected specimens between 1992-1995 in Montana suggest that a resident population occupies at least three counties in the northcentral part of the state and possibly three counties in southeastern Montana. Dispersal from several reintroduction sites in Canada (Brechtel et al. 1993) and the Wyoming population are considered to be the source of Montana animals. A preliminary statewide habitat assessment in 1994 identified nearly 8 million acres of prairie grasslands as suitable swift fox habitat in Montana (Appendix C, Fig. 1).

Although several individual specimens have been collected in North Dakota over the past fifteen years, the presence of swift fox has not been detected during recent furbearer track occurrence surveys in the western part of the state (Allen 1996). Differential reporting rates for red fox and coyote harvests and several confirmed swift fox observations indicate swift fox may exist at extremely low densities if at all in the suitable grassland/agricultural habitat available in the southwestern counties of North Dakota (Appendix C, Fig. 2).

The reported current distribution of swift fox in South Dakota includes the two most extreme southwestern counties of the state (Dowd Stukel, pers. comm.), although species presence has been recorded in as many as 13 counties between 1963-1995 (Kruse et al. 1996). Suitable shortgrass prairie habitat is present in southwestern South Dakota (Appendix C, Fig. 3).

Swift fox presence was documented during 1995 in 8 of 12 counties through field surveys in eastern Wyoming. According to Woolley et al. (1996) these occurrences, combined with Wyoming Game and Fish Department observation records and trapper surveys, suggest swift fox are currently distributed throughout most of their historical range in Wyoming, although survey results in three northern counties remain inconclusive. Suitable habitat includes shortgrass, mixedgrass, sagebrush-grassland, and sagebrush-greasewood habitat types with topography ranging from flat to badland-like terrain (Appendix C, Fig. 4).

Swift fox are known to occur in very limited numbers in the panhandle and southwestern Nebraska (Andelt 1996). Attempts to determine present distribution and status of the swift fox population in recent years have had limited success (Appendix C, Fig. 5). Swift fox numbers appear to be very low making it difficult to assess population size or determine trends during the

past several years.

Kahn and Fitzgerald (1996) reported the occurrence of swift fox in 13 counties in eastern Colorado which comprise shortgrass prairie and associated agricultural lands. This species inventory resulted in fox captures on 64% of the sample plots. For plots in which swift fox occurred, the mean number of fox captured was 5.7 fox per 20 mi^2. Current species distribution is apparently similar to reported historic range (Appendix C, Fig. 6). In addition, recent data suggests an increase in swift fox numbers on a research study area with in the state.

Swift fox are currently present throughout most of their historic range in Kansas and have maintained a stable population for the past 20 years (Fox and Roy 1996). Current swift fox distribution includes at least 21 counties in western Kansas which are comprised of grassland and cropland habitats (Appendix C, Fig. 7). Several methods are currently used to monitor population status and trend. Current research projects are examining differential survival rates between swift fox that occupy rangeland and cropland habitats, mortality causes, home range size, and den site characteristics.

Recent status information indicates swift fox currently occupy a four to six county area in the panhandle and the northwestern portion of Oklahoma. Whitaker Hoagland (1996) suggests that swift fox occur at low densities and recent studies by Lomolino and Shaughnessy (1995) also indicate that population levels are low, except for the extreme northwestern corner of the panhandle. Successful presence/absence surveys have focused on the panhandle which is comprised of rangeland, mesa, cropland, riparian habitats, and prairie dog towns (Appendix C, Fig. 8).

According to Schmitt (1996) a literature review, compilation of records, examination of museum specimens of swift fox, and correspondence with individuals familiar with swift foxes in New Mexico have provided only little additional information on which to substantiate the current distribution and status of this species in New Mexico. However, Schmitt (1996) indicated that the swift fox has been verified from ten counties in New Mexico and may likely occur in three additional counties, all of which include large areas of the plains-mesa grassland type (Appendix C, Fig. 9).

Swift fox may occupy twenty-five or more counties in the panhandle and westcentral regions of Texas (Horner 1996). Species presence is currently being verified through surveys of identified suitable habitat. Horner (1996) indicates the shortgrass prairie habitat of the panhandle will support the majority of swift fox in Texas (Appendix C, Fig. 10).

Management Status

Swift fox are managed under state authority. The level of legal protection and species management varies among the ten states presently involved in swift fox conservation (Table 1). The species is classified as endangered in Nebraska and threatened in South Dakota, a furbearer in Montana, North Dakota, Colorado, Kansas, Oklahoma, New Mexico and Texas, and as a

nongame wildlife species in Wyoming. Of the states that list swift fox as a furbearer, legal harvest seasons have occurred in recent years in Colorado (closed in 1995), Kansas, New Mexico and Texas, with variable annual harvest estimates (Table 2). The furbearer season has remained closed for swift fox in Montana, North Dakota and Oklahoma while a limited harvest is allowed as an incidental take in Wyoming. Prior to 1995, numerous swift fox research studies have been conducted in eight of the ten states (excluding Montana and North Dakota) presently involved with swift fox conservation efforts under their present furbearer or nongame management programs (Scott-Brown et al. 1987).

The USFWS lists the swift fox as a candidate species for possible addition to the List of Endangered and Threatened Wildlife and Plants under the ESA, with an assigned listing priority of eight (61 FR 7596; Feb. 28, 1996). This low to moderate listing priority is assigned on the basis of immediacy and magnitude of threats as well as taxonomic status. Both the USFS and the BLM list the swift fox as a sensitive species which requires these agencies to evaluate impacts in their land management decisions.

LIFE HISTORY AND HABITAT RELATIONSHIP

Life History

Swift fox are monestrous, apparently monogamous, and will form pair bonds in early winter that may last several years. Both males and females are capable of breeding during their first season. Family units of two females and one male have been reported (Covell 1992). They breed from December to February depending on latitude (Kilgore 1969, Hines 1980, Covell 1992). Gestation is approximately 51 days. Litter size based on pup counts at natal den sites averages four to five young, with a range of one to eight (Scott-Brown et al. 1987). At four or five months, the young foxes are almost fully grown and difficult to distinguish from adults. Dispersal begins during September and October. The young foxes will occupy separate dens around August but remain close to their parents until they disperse (Kilgore 1969, Hines 1980, Covell 1992, Roy and Sovada, unpubl. data). Swift fox are considered good dispersers although little is known concerning dispersal movement activities.

Swift foxes use dens year-round to protect themselves against predators and extreme weather conditions, and to raise their young. Swift foxes usually excavate their own dens but will also modify or enlarge dens of other species such as badger (*Taxidea taxus*) and ground squirrels (*Spermophilus spp.*) (Hillman and Sharps 1978, Fitzgerald et al. 1983, Uresk and Sharps 1986). Their dens range from a simple one-way tunnel to a complex system of channels and chambers as deep as four feet below the surface with as many six entrances (Cutter 1958a, Kilgore 1969, Hillman and Sharps 1978, Fitzgerald et al. 1983, Roy unpubl. data). They typically kick and pull soil away from the entrance creating one or two long soil tailings (Hillman and Sharps 1978, Scott-Brown et al. 1987, Covell 1992). Swift foxes will den in a variety of shortgrass prairie habitats including modified habitats such as pastures, rolling hills, roadside ditches, fence rows, fallow fields, and cultivated fields (Cutter 1958a, Scott-Brown et al. 1987, Covell 1992, Fox and Roy, unpubl. data). In Nebraska, soils from den sites ranged from a clay-loam to sandy-loam

and were preferably soils that contained some loam mixture that evidently provided easy excavation and maintenance of the structural properties of the den site (Hines 1980, Hines and Case 1991). Swift fox may change natal den sites several times during the pup rearing period.

As an opportunistic predator, swift fox feed yearlong or seasonally on a variety of small mammals, insects, reptiles, carrion, and ground nesting birds (Cutter 1958b, Kilgore 1969, Zumbaugh et al. 1985, Uresk and Sharps 1986, Hines and Case 1991). Small mammals are especially important food items (Scott-Brown et al. 1987), particularily in winter months. Winter food habit studies in Kansas found that 65% of swift fox stomach contents contained mammal remains, nearly half of which were cottontail rabbit (*Sylvilagus spp.*) and jackrabbit (Zumbaugh et al. 1985).

Coyotes are apparently the primary predator of swift fox throughout the species range and have the potential to become the major cause of swift fox mortality (Scott-Brown et al. 1987, Sovada and Roy, unpubl. data). Other known predators include golden eagles (*Aquila chrysaetos*), badgers, bobcats (*Lynx rufus*), and domestic dogs (*C. familiaris*). Present activities by humans may also directly impact swift fox survival. Mortality can be attributed to vehicle-caused roadkills along highways and secondary roads and legal or illegal poisoning, trapping, and predator shooting. Habitat loss from agricultural conversion is considered to have an indirect effect on swift fox survival.

There is no evidence from studies in the literature that swift fox exhibit signs of territoriality. Information indicates that the home ranges of several individuals often overlap. Measured home range sizes of swift fox appear quite variable and have been estimated at 212 to 519 acres (86 to 210 ha) in areas of Colorado (Rongstad et al. 1989) and at 7,980 acres (3,230 ha) in Nebraska (Hines and Case 1991).

Habitat Relationships

Swift fox habitat descriptions apparently vary with geo-physiographic area although the species occupies these habitats within the shortgrass and midgrass prairie ecosystem which is primarily characterized by level to gently rolling topography (Kilgore 1969, Hillman and Sharps 1978, Egoscue 1979, Samuel and Nelson 1982). Vegetation compostion in native prairie habitat includes grass species such as blue grama (*Bouteloua gracilis*), buffalo grass (*Buchloe dactyloides*), western wheatgrass (*Agropyron smithii*) and needle and thread (*Stipa comata*) and shrub species such as sagebrush (*Artemisia spp.*), snakeweed (*Gutierrezia spp.*) and saltbrush (*Atriplex canescens*). These habitats consist of firm friable soils that range from clay-loam to sandy or gravelly loam and generally provide intermittent and permanent water sources during most years. In the western portion of its range, swift fox are apparently found in a broader range of habitat types (Wooley et al. 1996).

As more investigations are underway to better understand swift fox ecology, several studies have documented the use of non-native habitats within the shortgrass/midgrass prairie ecosystem. In Kansas, swift fox are considered abundant in cultivated fields, excavating and utilizing dens in

summer fallow, wheat stubble, growing wheat, sunflower, or corn fields (Cutter 1958a, Fox and Roy, unpubl. data, Sovada, unpubl. data). Kilgore (1969), Hines (1980) and Fitzgerald et al. (1983) also indicated that swift foxes inhabit areas with a mixture of agricultural cropland and prairie grassland. These modified habitats may consist of crested wheatgrass (*Agropyron cristatum*), Russian thistle (*Salsola pestifer*), common sunflower (*Helianthus annuus*), lamb's quarters (*Chenopodium album*), bindweed (*Convolvulus spp.*), grassbur (*Cenchrus spp.*), western ragweed (*Ambrosia psilostachya*), and prickly pear cactus (*Opuntia polyacantha*) (Scott-Brown et al. 1987).

The extent to which swift fox can adapt to various native and non-native habitats within the grassland prairie ecosystem is not well documented. However, observations in highly modified or other non-native habitats suggest the need to further investigate the adaptative strategies of swift fox and survival rates within areas that are considered to be outside of the classic native grassland prairie.

RISK ASSESSMENT

Historically, swift fox inhabited the shortgrass and midgrass prairies within the Great Plains region of the central United States. However, it is not known how swift fox utilized the various prairie habitats. It is unclear if historic species distribution was continuous, occurred regionally or existed in a relatively patchy distribution within this range. Historical literature suggests that some authors considered swift fox densities to be locally high (Grinnell 1914, Wright 1913) while others traversed vast areas of prairie habitat without reporting any observations of swift fox (Emory 1848).

Conversion of native grassland prairies to agricultural cropland has been implicated as one of the most important factors that led to a constricting swift fox distribution and more recently for the species failure to recover (Cutter 1958a, Kilgore 1969, Hillman and Sharps 1978, Hines 1980, Fitzgerald et al. 1983). Although dramatic prairie habitat loss has occurred, current ecological investigations may indicate that it is not solely the conversion of prairie to cropland that hinders current swift fox restoration efforts, but also juxtaposition of the remaining prairies, management of rangelands, cropping patterns of farmlands and changes in canid communities that occur in response to the conversion of prairie habitat to cropland. Ownership patterns involve federal lands that comprise a large percentage of the northern and western portions of swift fox range but diminish southward and eastward, where nearly all lands are privately-owned.

The key component to species restoration is to provide suitable habitats where swift fox can obtain prey while avoiding predation. Swift fox historically inhabited relatively level to moderately rolling native grassland terrain (Hillman and Sharps 1978, Hines 1980, and Fitzgerald et al. 1983) which provided a small mammal prey base and afforded long viewing distances to detect predators. Throughout large portions of the Great Plains the areas of relatively level topograhy, with deeper and more friable soils and adequate natural moisture, were acquired into private ownership and have been converted to cropland. Habitat loss and degradation, such as conversion to cropland, intensive grazing, habitat fragmentation and

urban/rural development, are all thought to have contributed significantly to swift fox distribution and population declines early in the century. However, the direct and indirect impacts of these factors on swift fox survival and population viability have not been scientifically investigated to any great extent. Recent ecological studies and anecdotal information are beginning to contribute knowledge towards addressing species adaptability and survival strategies of swift fox. This current information suggests that swift fox are capable of inhabiting, surviving and reproducing in other vegetation types, including sagebrush-grassland, sagebrush-greasewood and plains-mesa grassland and also certain cropland species including winter wheat, sunflower, and irrigated corn and soybeans (Dieni et al. 1997, Sovada and Roy, unpubl. data)

The Conservation Reserve Program (CRP), established under the 1985 Farm Bill and renewed under that Bill's 1990 extension, has revegetated millions of cropland acres into grass cover. However, in many areas of the shortgrass prairie ecosystem, CRP fields were planted to tallgrass prairie species or non-native grasses. When these fields are left ungrazed, unmowed, and unburned, these grasses developed into dense rank stands. Current management guidelines for CRP enrolled lands do not appear to provide adequate habitat for swift fox, although it is utilized as cover by coyotes and red fox. New CRP guidelines may provide incentives for program participants to plant native grass species, particularily in areas that support an existing swift fox population.

An increasing public (including the agricultural community) awareness of poor range conditions in recent years, particularly on federal lands, is slowly leading to a growing emphasis to improve land stewardship. Improvements in rangeland vegetation quality is expected as a result of this public issue directed at federal land management agencies. In the ten states that encompass swift fox range the BLM controls over 36,000,000 acres (14,500,000 ha) of which a large portion is managed as prairie rangeland. Range quality enhancement, directed at water quality and increasing vegetative productivity, could benefit swift fox. These may include an improved vegetative compostion that would provide more productive small mammal and lagomorph populations and greater stability in soil conditions for den sites. However there may be conditions, particularly along the eastern edge (mixedgrass prairie ecosystem) of swift fox range, where high rainfall and fertile soils may produce excessive vegetation that would not be considered optimal swift fox habitat. Coyote and red fox may exclude swift fox under these circumstances. Perhaps swift fox pioneered eastward to some extent when mixedgrass prairies were grazed by native ungulates or in the absence of predators, although if these areas are allowed to recover they may become marginal swift fox habitat. In this case, future land management decisions may involve a choice between reinstating intensive grazing or accepting the loss of some peripheral habitats.

The importance of human harvest in limiting or regulating swift fox populations is unknown. There is insufficient information to weigh the impact of harvest on species distribution or population densities. For example, swift fox populations in Colorado have remained widespread despite 55 years of harvest. No noticeable reduction in distribution has occurred in Kansas since the opening of a season on swift fox in 1982. In comparison, swift fox have been protected from

harvest in South Dakota, Nebraska, and Oklahoma, with no apparent increase in distribution or population densities during the same period.

Prices for swift fox pelts have varied from $3-$10 during the last ten years. Low pelt prices provide some interest but little incentive to actively harvest swift fox. In some states, swift fox are apparently taken incidentally to coyote trapping activities and are not considered a target species. States that allow a regulated harvest collect data on harvest estimates, harvest densities, distibution information or biological data through the cooperation of furharvesters. Figures indicate that the total estimated harvest of swift fox has steadily declined since 1982 (Table 2).

Predation is presently the most common mortality factor for swift fox (Covell 1992, Carbyn et al. 1993, Sovada and Roy, unpubl. data). The literature on swift fox and also kit fox indicate that coyotes are the primary cause of natural mortality (Ralls and White 1995). In discussing this situation with the San Joaquin kit fox, Berry et al. (1987:21) stated, "Over 50% of all fox deaths, and nearly 80% of the fox deaths for which cause of death could be determined, were attributed to coyotes." Covell (1992:26) stated, "Predation and non-traumatic deaths account for 87% and 13 % of all determined deaths, respectively. Coyotes were responsible for 85% of all predation, whereas raptors accounted for only 15%."

The canid community of the Great Plains and its hierarchy is a dynamic and complex issue. A comprehensive description of this issue is provided by Johnson and Sargeant (1977). Historically, the core of swift fox range was occupied primarily by wolves and to a lesser extent coyotes and foxes. Gray wolves were mostly eliminated by the late 1800s and this event appears to coincide with a buildup of coyotes (Sargeant 1982). Red fox and gray fox (*Urocyon cinereoargenteus*) numbers were low or absent in the core of swift fox range prior to human settlement. Wolves directly influence coyote numbers and it is thought that swift fox prospered, at least in the northern portion of the species range, by scavenging on prey left by wolves. Wolf extermination probably allowed coyote populations to expand and become more extensive predators of swift fox.

The interactions between canid communities and various prairie habitats are complex and have baffled naturalists and wildlife managers for decades. Leopold (1933) pondered the lack of a population response of red fox to habitat changes after the turn of the century. In several areas, increases in favorable habitat did not result in corresponding increased red fox densities.

Swift fox appear to prosper in certain areas where intensive control measures were applied to coyotes. Studies conducted by Kilgore (1969) in Oklahoma and Hines (1980) in Nebraska mention the scarcity of coyotes due to control practices on the areas they selected for swift fox studies. Covell (1992) also noted the occurrence of helpers at natal swift fox dens in an area where coyote control had occurred and an absence of helpers at natal dens on an adjacent area with no coyote control. An exception to the generalization that coyote control may influence arid land fox survival is provided by Cypher and Scrivner (1992) who were unable to document an increase in San Joaquin kit fox on areas where coyote control was applied. However, few coyotes were actually removed and the area that was impacted was considered small. Obviously,

the relationship between arid land foxes and coyotes is not simple and further research is needed. Competition between canid species may shape canid communities as much or to an even greater extent than predation. Competition between members of the canid community are expected to be the most intense between species of similar size. Although once numerous on Isle Royale in Michigan, coyotes disappeared soon after colonizing wolves established territories on the island (Mech 1970). The competitive relationship of coyotes excluding red foxes has been well documented (Sargeant 1982, Voigt and Earle 1983, Major and Sherburne 1987, Sargeant et al. 1987, Harrison et al. 1989, Sargeant et al. 1993, Sovada et al. 1995). Similarly, this relationship between red foxes and arctic foxes (*Alopex lagopus*) has been demonstrated (Schmidt 1985, Bailey 1993).

Non-canid predation on swift fox has been documented, however, the frequency of observations appears to be relatively small compared to canid predation. Predation from badgers, golden eagles, great-horned owls (*Bubo virginianus*) and ferruginous hawks (*Buteo regalis*) have been documented, but are not considered significant (Rongstad et al. 1989, Brechtel et al. 1993).

Other factors which may affect swift fox include the impact of parasites and diseases. Swift fox are occasionally found to be heavily infested with external and internal parasites (Kilgore 1969, Scott-Brown et al. 1987). However, no evidence exists that suggests parasites influence survival. There is a general absence of information on the incidence of diseases in wild swift fox populations. Of the 185 swift fox mortalities from 369 monitored animals in various studies, none have been attributed to disease. Available data on kit fox appears to have similar results, however, serologic tests on San Joaquin kit fox have indicated a high prevalence of antibodies to canine parvo virus, although simultaneous monitoring of animals showed no clinical indications of disease, and diseases were not recognized as a major source of mortality in these foxes (Berry et al. 1987). Closer monitoring of swift fox in the future will be required to understand if diseases and parasites are important in shaping the distribution and abundance of swift fox populations.

Swift fox are legally protected under state law in all ten states that encompass the species range and are currently protected from harvest through law or regulation in seven of these states (Table 1). The swift fox is classified as endangered or threatened in the states of Nebraska and South Dakota; is a furbearer in seven states; and is a nongame wildlife species in Wyoming. States that provide harvest opportunities regulate take by season length and monitor harvests numbers annually. Several recent changes have occurred in the harvest regulations for swift fox. Swift fox were reclassified in 1995 from a predator to being listed in the non-game regulation in Wyoming. Colorado had previously designated changes in trap devices in a portion of the state occupied by kit fox and in 1995 the state was mandated to close its trapping season on furbearers, including swift fox. Kansas maintains a regulated harvest season and recently instituted a mandatory pelt tagging program to provide detailed harvest records and information for statewide distribution. New Mexico and Texas provide a regulated harvest season and estimate annual harvest figures.

Trapper education programs are becoming more available to furharvesters in a increasing

number of mid-western states. Furharvester education courses are currently required in several states. A general aspect of these programs is to inform trappers on various methods that can be used to avoid incidental capture of certain species. The educational process has demonstrated that changes in capture methods can be modified on a voluntary basis without additional regulation.

Swift fox inhabit vast areas of privately-owned and privately-controlled lands where the landowner regulates access and harvest opportunities. Since these individuals control access to their lands they dictate allowable management practices. For example, while obtaining permission from private landowners in western Kansas to conduct scientific studies of swift fox, the research team learned that several landowners practiced selective management to protect swift fox on their lands (Fox, pers. comm.).

It is generally accepted that the past widespread use of strychnine intended to kill wolves and coyotes resulted in dramatic declines in swift fox populations (Scott-Brown et al. 1987, Young 1944). However, control practices which specifically target coyotes that result in few non-target mortalities are generally considered beneficial to swift fox (Robinson 1953, and Egoscue 1956). Federal predator control program changes made in the 1950s to eliminate non-selective strychnine and replace it with the more selective toxicant Compound 1080, which significantly reduced swift fox mortalities (USDA 1994). Following the 1080 ban inposed in 1972, most swift fox removed during federal control activities are taken by M44 devices (USDA 1994). The U.S. Department of Agriculture (USDA) maintains records of the number of swift fox killed during federal predator control activities, and they comprise a very small percentage of total mortalities. Most swift fox are taken in New Mexico and it is unclear as to the number of these animals that are actually kit fox (USDA 1994). Private predator shooting activities result in swift fox mortalities although it is unknown if this activity is a major source of mortality that directly impacts local population levels.

Swift fox are occasionally killed due to collisions with vehicles (Sovada and Roy, unpubl. data). A population trend index based on the numbers of live and roadkilled swift fox observed each year has been conducted in Kansas since 1986 (Roy, pers comm.). Swift fox are frequently observed along roadways, which may increase the rate of animals being killed specifically by vehicles. Factors such as road density, miles traveled and driver speed may increase the rate of swift fox mortalities. Measuring vehicle-caused swift fox mortalities per unit time may, however provide a population monitoring method.

Although quantitative data is unavailable, anedoctal information indicates that swift fox social groups can survive successfully close to towns, roads and occupied farms. Field data on coyote and red fox in North Dakota indicates that red fox family groups occupy sites close to towns, roads and occupied farms within general areas predominately inhabited by coyotes (Allen and Sargeant, unpubl. data, Sargeant et al. 1987). This suggests urban and rural communities may provide refuges for red fox in landscapes dominated by coyotes. However, urban sources of red fox may periodically expand and have a detrimental impact on local swift fox distribution and abundance.

Trends in farming practices during the twentieth century have resulted in an increasing emphasis on large farm implements and related advances in technology (USDA 1994). The result has been increases in the size of farms and a demographic shift away from rural areas and into urban centers. Therefore, the opportunity for a swift fox to encounter a human is considered less today than it was at the turn of the century, when the human population was much denser in the rural areas, generally with a family homestead on every 160 acres (65 ha).

The larger geographic areas within current swift fox range where the land use pattern has not been altered significantly for decades (rangeland and farmland) are not likely to change in the foreseeable future. An increasing emphasis on soil and water conservation practices may result in a gradual improvement of range quality, or in the case of cropland, there may be periodic conversions to different crops, or replanting to native grasses as the availability of affordable water for irrigation diminishes. Large blocks of federal lands that remain in a prairie grassland state will likely continue to be managed primarily as grazed rangeland, although subject to periodic, short-term development for oil/gas leasing and coal mining. However, the long-term effects of these development activities on swift fox survival has yet to be fully investigated.

Private land uses and landowner cooperation with government agencies or private organizations are crucial to successful swift fox conservation activities. Management practices by private landowners during the previous 40 years have been sufficient to allow swift fox to survive in many areas and in some cases expand distribution and numbers. However, swift fox have prospered indirectly and not intentionally from man's agricultural activities. New developments in federal agricultural programs provide more incentives to private landowners for promoting wildlife and habitat management. These include the recent 1996 Farm Bill with changes in CRP and other program enrollment criteria. For example, under the present CRP enrollment criteria, NRCS will assign points to landowners with ESA candidate species, including swift fox, which may favor native habitat reinstallment.

CONSERVATION STRATEGY

INTRODUCTION

This conservation strategy describes the goal, objectives, strategies and activities that will be implemented to restore the United States swift fox population and to conserve swift fox habitat. This strategy reflects a metapopulation concept to assure species persistence and an ecosystem management approach for habitat conservation. This is a coordinated planning effort among the ten states that represent the species range in cooperation with other government agencies and private entities. State commitments to this conservation strategy were indicated to the USFWS in a letter signed by the ten state wildlife agency directors in 1994 that stated conservation of the swift fox can be achieved by a coordinated and cooperative management approach utilizing state and federal resources rather than through a species listing under the ESA (Appendix B). The organizational structure of this effort consists of an interstate/interagency swift fox conservation team (Appendix A) of which members may be assigned to internal technical committees as specific information needs arise. Each state team member is responsible for the formation and lead of a state working group to coordinate conservation strategy activities within their respective states.

This conservation strategy is designed to be implemented through the state wildlife resource agencies and federal land management agencies in cooperation with other state, federal, and municipal government agencies, and involve collaborative efforts and partnerships with tribal governments, private conservation organizations, individuals, and private landowners. Species restoration and habitat conservation efforts are linked to key federal and private land ownership patterns. This conservation strategy identifies both short- and long-term objectives and sets general time frames to complete specific species and habitat activities. If this conservation strategy is successful, it is expected that 50 percent of the activities will be accomplished by the year 2005.

The conservation strategy section is organized by goal, objectives (1., 2., 3., etc.), strategies (2.1, 5.1, 5.2, etc.) and activities (3.1.1, 3.1.2, 4.1.1, etc.). Strategies have been assigned to general priority rankings, as follows, to address the completion of basic information needs, to approach specific species and habitat conservation actions, and to accomplish additional tasks related to the implementation of a successful conservation strategy.

Top: 1.1, 2.1
High: 3.1, 5.1, 5.2, 8.1
Medium: 6.1, 6.2, 7.2, 9.1
Low: 4.1, 7.1, 8.2, 9.2, 10.1, 11.1, 11.2

Activities associated with top priority strategies have either been completed or were initated by 1996. Activities listed below high, medium or low priority strategies in this section are intended to be accomplished in three (1999), six (2002) and nine (2005) year timeframes, respectively.

GOAL

The goal of this conservation strategy is to maintain or restore swift fox populations within each state to provide the spatial, genetic and demographic structure of the United States swift fox population, throughout at least 50 percent of the suitable habitat available, to ensure long-term species viability and to provide species management flexibility.

OBJECTIVES, STRATEGIES AND ACTIVITIES

1. Establish a Swift Fox Conservation Team (SFCT).

    1.1 The SFCT is to be comprised of a single representative from each of the ten state wildlife resource agencies (state), BLM (regional), USFS (regional), U.S. Geological Service (USGS)(regional), Animal and Plant Health Inspection Service (APHIS) (regional), USFWS (regional) and Canadian recovery team (national). Interested cooperators are encouraged to participate with the team (other state and federal agencies, state universities, tribal governments, conservation organizations, research insitutions) or to become members of the state working groups. The SFCT is to coordinate and assist in directing management and research activities outlined in the conservation strategy. The SFCT will annually monitor the attainment of objectives and evaluate the completion of specific activities within each state.

        1.1.1 Responsibilities of the SFCT are to: 1) determine priorities and set timetables for conservation strategy objectives and activities, 2) establish interteam technical committees that will address specific management or research needs to accomplish stated objectives, 3) draft habitat and species management guidelines when appropriate, 4) provide a forum for technical information exchange, and 5) promote state and federal funding support for specific activities. The SFCT will be formed as a functional team by 1996.

        1.1.2 The SFCT will generate an annual report to present state and regional progress toward attainment of conservation strategy objectives. An annual SFCT meeting is to be scheduled by the appointed chair to synthesize information and prepare the annual report, which will be produced each March.

        1.1.3 Each state wildlife agency representative on the SFCT is to form a state swift fox working group. The group will consist of interested cooperators from other state and federal agencies i.e. Natural Resources and Conservation Service (NRCS), tribal governments, universities and research institutions, private conservation organizations i.e. The Nature Conservancy, and private landowners or agricultural organizations that are interested in achieving conservation strategy objectives. State working

groups should be active by 1996 and function to provide recommendations in directing state activities.

2. Determine current swift fox distribution in the United States.

2.1 Document the present distribution of swift fox within each state utilizing various detection methods and/or species harvest data. Systematic presence/absence and population surveys or compiling site-specific harvest information should provide each state with adequate information to delineate statewide species distributions.

2.1.1 State wildlife agencies will collect and compile existing species distribution data internally and from cooperators. State agencies and cooperators may need to collect additional information utilizing various sources such as: 1) species population surveys; 2) state and federal agency occurrence reports; 3) soliciting public participation; 4) scientific field investigations; or 5) trapper and hunter harvest data. The SFCT will assign members to a technical committee to review techniques and standardize protocols for selected survey methods by 1996.

2.1.2 State wildlife agencies will generate initial statewide species distribution maps based on current information. Initial draft distribution maps will be provided a SFCT annual report by 1996. Updated maps based on field investigations will be completed by 1999. These maps will provide baseline information from which to monitor long-term changes in distribution and evaluate progress toward conservation strategy objectives. Maps will be periodically updated or modified as species distribution changes or as new data becomes available.

3. Monitor the status of swift fox populations.

3.1 Develop and implement statewide monitoring programs that provide population trend information and that detect changes in local distribution. Determining long-term population trends for existing and reestablished swift fox populations is a primary strategy to ensure species maintenance and persistence. This effort will require standardized data collection methods and survey protocols (Sovada 1996).

3.1.1 The SFCT will assign members to a technical committee for the purpose of reviewing techniques, scientific literature and findings from current swift fox research studies to develop recommendations for standardized population monitoring techniques. Monitoring may include the use of: 1) annual harvest data; 2) marking programs; 3) bait stations; 4) track plates; 5) scent-posts surveys; and 6) spotlighting. This technical committee will recommend a monitoring plan that will encourage coordination among state, federal, and private activities. Results of this activity should be

available by 1999.

3.1.2 Each state wildlife agency will coordinate and implement a monitoring program for existing swift fox populations or newly established populations, in cooperation and with assistance of federal agencies (BLM, USFS, USGS, APHIS) and other interested parties such as tribal governments, state universities, research institutions, and private landowners. Statewide monitoring programs will be implemented by 1999, dependent on the development of standardized techniques.

3.1.3 The state wildlife agencies of Kansas, New Mexico and Texas which allow a legal harvest and Wyoming for incidental take of swift fox, will evaluate the feasibility of implementing a registration/pelt tagging program in addition to conducting mandatory carcass collections.

4. Determine minimum viable population size estimates and genetic integrity.

4.1 The SFCT is to identify, and then encourage research studies, that will address minimum viable population size estimates, monitor genetic diversity among populations and resolve species taxonomic issues.

4.1.1 Investigate minimum population viability through population monitoring, biological research and natal den studies. Studies are to be identified by the SFCT and state working groups or cooperators.

4.1.2 The SFCT will assign members to a technical committee to resolve any taxonomic issue and investigate the genetic integrity of the United States swift fox population by 2005.

4.1.3 Conduct periodic testing and analysis of genetic variation among state populations. This effort will validate the basis of the metapopulation concept to ensure species persistence. Utilize state, federal, or institutional wildlife and veterinary laboratories that can support appropriate analysis.

5. Identify the existing native shortgrass/midgrass prairie ecosystem and other suitable swift fox habitats.

5.1 Develop swift fox habitat criteria. These criteria are essential to define suitable habitat and to identify current habitat availability. Species-specific habitat requirements should be considered in addition to recognizing that habitat use may vary between geo-physiographic areas and that swift fox adaptive strategies evidently allow the species to occupy non-native habitats, such as road corridors, certain agricultural croplands, sagebrush-grasslands, high desert basins and plains

mesa.

5.1.1 The SFCT will review scientific literature and incorporate findings from current swift fox research projects, particularly the Canadian swift fox reintroduction program, to develop rangewide habitat criteria. An initial site habitat assessment evaluation was developed by Mamo (1987) which has been used as a model in Alberta, Saskatchewan and Montana. Criteria should include representative descriptions of occupied habitat and prey availability within species range. Habitat criteria should be developed by 1999.

5.2 Identify and delineate existing suitable swift fox habitat within each state. This effort will form the basis for evaluating species restoration activities, and identify constraints and opportunities within each state.

5.2.1 Each state wildlife agency will coordinate with state and federal land management agencies and private landowners to conduct habitat inventories. Landscape analysis of suitable prairie habitat is to be completed utilizing Gap Analysis and from prepared maps (soils, vegetation) and by aerial or ground surveys. Field verification will be required to evaluate habitat data. Survey and inventory activities will be initiated by 1999.

5.2.2 Each state wildlife agency will delineate available swift fox habitat on state cover maps utilizing the Geographic Information System (GIS) and Gap Analysis, report habitat acreage sizes, and describe land ownership patterns in an annual report. Cooperation from the BLM, USFS, state NHPs, Natural Resources and Conservation Service (NRCS), state universities, and other entities with GIS/Gap Analysis mapping capabilities. Suitable habitat mapping will be initiated by 1999.

6. Promote habitat conservation and habitat management in occupied and suitable swift fox habitat.

6.1 Identify and delineate public lands under federal or state management control in occupied/suitable swift fox habitat. The ability to maintain or restore state swift fox populations will depend on conserving the existing prairie habitat. This is to be addressed initially on public lands. For example, the BLM controls over 36 million acres in the ten cooperator states (BLM 1992), of which a large portion is shortgrass/midgrass prairie habitat.

6.1.1 Each state wildlife agency will coordinate with the federal and state land management agencies to evaluate current levels of legal protection of native grasslands located within federal and state ownership. These areas are to be delineated as an additional cover layer with suitable habitat and

current swift fox distribution. Examples of potential key areas which are distributed along the prairie ecosystem are USFS National Grasslands and Research Natural Areas (Ryan et al. 1994). Protected sites are to be mapped and acreages determined within the ten states. Spatial relationships, such as defining habitat corridors or habitat blocks, will be examined. Prairie habitat is to be classified as currently protected, in need of protection, or for special management needs based on maintaining or enhancing habitat quality for swift fox. This process should be completed by 2002.

6.1.2 State and federal wildlife agencies will initiate habitat protection agreements with federal and state land management agencies, as habitat conservation needs are identified, by 2002. Habitat protection activities should be stratified to levels based on spatial relationships and swift fox distribution. Establish memorandums of understanding (MOU) and habitat conservation agreements (HCA) for habitat protection and management with these land management agencies to conserve or enhance suitable prairie habitats under public ownership.

6.1.3 Identify habitat corridors and surrounding areas between habitat blocks, based on the spatial location of suitable habitat that is available to be managed for swift fox. This activity will identify where habitat conservation and management efforts should occur to protect, enhance or improve suitable habitat. This may provide an opportunity for the Gap Analysis process to be used. Each state is to identify and delineate these areas through mapping which will direct conservation measures, agreements, or habitat enhancement efforts.

6.2 Identify and delineate private land ownership patterns under individual or corporate control in occupied and suitable swift fox habitat. The ability to maintain or restore state swift fox populations will depend on conserving existing prairie habitat. In some states, private lands comprise 98 percent of the land ownership.

6.2.1 State and federal wildlife agencies are to initiate land conservation or protection measures under current lands programs as limited by priorities and within funding ability, or are to consider creating a lands program with new or redirected funding sources. Agencies will investigate the feasibility of partnerships with the private sector. On identified critical private lands state agencies should utilize conservation easements or agreements, leases, donations, exchanges, or acquisitions. Federal wildlife agencies should consider habitat conservation plans (HCPs) and federal land management agencies should consider land exchanges and acquisitions. An evaluation and prioritization process of private lands in

areas identified to implement land conservation efforts will be initiated by 2002.

6.2.2 Implement methods and techniques to gain and maintain cooperation with private landowners that will influence range management practices, primarily through state extension agents, federal grazing leases, and NRCS range specialists. Efforts will be directed primarily at occupied habitat and secondarily at suitable habitat.

7. Expand distribution of the United States swift fox population to occupy 50 percent of the suitable habitat that is available.

7.1 Expand distribution of existing state populations and restore swift fox to unoccupied suitable habitat. Promote natural dispersal through species protection measures while developing methodology and priority areas for augmentation through wild-captured swift fox introductions (Carbyn et al. 1993). This strategy is a priority in states which do not have a swift fox population present or the population has a severely limited distribution. The SFCT and state working groups should investigate the potential of utilizing existing captive breeding programs for reintroductions.

7.1.1 State working groups will develop criteria and establish priority areas within their respective state. Working groups will consider state, federal and private cooperation as well as funding sources and the extent of suitable habitat available within that state. Groups will evaluate natural dispersal vs. augmentation or reintroduction.

7.1.2 State working groups will provide recommendations to state wildlife agencies, federal land management agencies and cooperators on priorities and timetables to implement population restoration efforts, if needed, by 2005.

7.1.3 The SFCT will assign members to a technical committee to investigate and review the availability of wild/captive foxes and evaluate their potential success for releases. The SFCT will provide technical information and release protocol to state working groups and agencies considering releases. Recommendations and information should be available by 2005.

7.2 Monitor and identify new, continuing or diminished threats to swift fox population expansion.

7.2.1 The SFCT will assign members to a technical committee to review available scientific literature on interspecific competition and applicable control methods by 2002. The committee will provide information and

recommendations to state wildlife and federal land management agencies as guidelines.

7.2.2 The SFCT and state working groups will review and incorporate information from scientific investigations that address the adaptibility of swift fox to colonize non-native habitats and which evaluate the species ability to maintain itself in these habitats.

7.2.3 The SFCT and state working groups will identify and report new, continuing or dimishing threats to swift fox population expansion.

8. Integrate swift fox conservation strategy objectives with management and habitat objectives of other prairie ecosystem species such as bison (*Bison bison*), black-footed ferret (*Mustela nigripes*), burrowing owl (*Speotyto cunicularia*), mountain plover (*Charadrius montanus*), prairie chicken (*Tympanuchus spp.*), and prairie dog (*Cynomys spp.*).

8.1 Provide swift fox distribution and suitable habitat information to other prairie ecosystem mapping efforts through state NHPs and GIS or Gap Analysis activities.

8.1.1 The SFCT and state working groups will coordinate information exchanges with similar prairie species working groups, cooperating agencies, universities and conservation organizations beginning in 1999.

8.2 The Conservation Assessment and Conservation Strategy for Swift Fox in the United States (CACSSF) may be subject to periodic revision to incorporate related objectives, strategies or activities which may be outlined in other prairie species conservation plans.

8.2.1 The SFCT will review the need to update or revise the CACSSF and incorporate new or changing information accordingly.

9. Promote scientific swift fox management and a public education program.

9.1 Provide a scientific basis for swift fox management and an avenue for technical information exchange.

9.1.1 The SFCT and state working groups will collect and compile current technical literature and management information for distribution through information requests from state and federal managers and other interested individuals.

9.1.2 The SFCT and state working groups are to provide recommendations on

standard management guidelines, beneficial range management practices for swift fox, methods for data collection/database management, and current information on swift fox ecology, management, and research to wildlife and land managers, government entities, land planners, state and federal policy makers by 2002.

9.1.3 The SFCT will consider cooperating on a joint publication that promotes the scientific basis for conserving prairie species, including swift fox, for distribution to wildlife and land managers. If it is determined that this document is needed and jointly supported, funding will be solicited from cooperators and partners.

9.2. Promote public support for swift fox conservation activities.

9.2.1 The SFCT will develop informational and educational materials. It is considered essential that swift fox conservation efforts are supported by an informed public throughout the species range. Public support will enhance funding opportunities and ease implementation of conservation strategy activities. The various publics to be targeted are trappers, hunters, wildlife viewers, livestock and farm groups, private landowners, conservation groups, public schools, and city/county governments. Funding will be solicited from participating states and cooperators.

9.2.2 Each state working group will develop the structure for an information and education program in their state. The SFCT or a state working group will publish the informational and education materials. Materials will be available for distribution from state working groups by 2005.

9.2.3 The SFCT and state working groups will jointly develop an informational package and educational initiative for private landowners, specifically addressing swift fox habitat and management needs by 2005.

10. Implement research on swift fox biology and ecology.

10.1 Investigate biological and ecological parameters of swift fox. The amount of research required will depend on an assessment of the scope of previous research efforts.

10.1.1 The SFCT is to assign members to a technical committee to review the current state of knowledge on the species and habitat requirements. This technical committee will review ongoing threats to the U.S. swift fox population in an effort to guide research priorities and also to consider funding opportunities. Research needs and potential studies should be outlined by 2005.

10.1.2 Each state wildlife agency and cooperators will address species/habitat needs in site-specific areas identified as having special concerns for population maintenance. An example would be a reintroduction area that does not maintain animals.

10.1.3 Investigate the susceptibility of swift fox to common diseases and parasites in various parts of the species range. This research may be conducted in combination with the collection of individuals and blood samples for genetic tracking or other objectives.

11. Removal of the swift fox from the ESA candidate species listing.

11.1 The SFCT will initiate a cooperative effort with the USFWS to develop criteria for removal of the swift fox from candidate listing.

11.1.1 The SFCT and USFWS will evaluate current species and habitat information with developed criteria for the removal of the swift fox from the candidate species list beginning in 2005.

11.2 States will develop a long-term management plan for swift fox.

11.2.1 Each state wildlife agency, with assistance of cooperators, will develop a comprehensive set of management guidelines which detail species and habitat conservation measures to assure species persistence. These may involve a review of state legal classification and protection; long-term programs to monitor species distribution, population size and habitat maintenance; and may include harvest strategies above target population levels. Draft state management plans should be initiated by 2005.

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APPENDIX A. Swift fox conservation team membership, 1996-1997.

APPENDIX B. State agency director's letter to USFWS regional director.

APPENDIX C. State maps indicating historic swift fox range, current known species Distribution and potenially suitable habitat by county.