

Alberta Swift Fox Recovery Plan 2006-2011



Alberta Species at Risk Recovery Plan No. 14

Alberta

Alberta Swift Fox Recovery Plan 2006-2011

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The logo for the province of Alberta, featuring the word "Alberta" in a stylized, bold, sans-serif font. The letter 'A' is unique, with a diagonal line through it. The logo is positioned below a thin horizontal line.

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PREFACE

Albertans are fortunate to share their province with a diverse variety of wild species. Populations of most species of plants and animals are healthy and secure. However, a small number of species are either naturally rare or are now imperiled because of human activities. Recovery plans establish a basis for cooperation among government, industry, conservation groups, landowners and other stakeholders to ensure these species and populations are restored or maintained for future generations.

Alberta's commitment to the *Accord for the Protection of Species at Risk* and to the *National Framework for the Conservation of Species at Risk*, combined with requirements established under Alberta's *Wildlife Act* and the federal *Species at Risk Act*, has resulted in the development of a provincial recovery program. The overall goal of the recovery program is to restore species identified as *Threatened* or *Endangered* to viable, naturally self-sustaining populations within Alberta.

Alberta species at risk recovery plans are prepared under the supervision of the Fish and Wildlife Division, Alberta Sustainable Resource Development. These recovery plans are prepared by recovery teams composed of a variety of stakeholders including conservation organizations, industry, landowners, resource users, universities, government agencies and others. Membership is by invitation from the Director of Wildlife Management, and includes representation from the diversity of interests unique to each species and circumstance. Conservation and management of these species continues during preparation of the recovery plan.

These plans are provided by the recovery team as advice to the Minister responsible for fish and wildlife management (the Minister) and to all Albertans. Alberta's Endangered Species Conservation Committee reviews draft recovery plans, and provides recommendations to the Minister. In addition, an opportunity for review by the public is provided. Plans accepted and approved for implementation by the Minister are published as a government recovery plan. Approved plans are a summary of the Department's commitment to work with involved stakeholders to coordinate and implement conservation actions necessary to restore or maintain these species.

Recovery plans include three main sections: background information that highlights the species' biology, population trends, and threats; a recovery section that outlines goals, objectives, and strategies to address the threats; and an action plan that profiles priority actions required to maintain or restore the *Threatened* or *Endangered* species. These plans are "living" documents and are revised as conditions change or circumstances warrant. Each approved recovery plan undergoes an annual review, and progress of implementation is evaluated. Implementation of each recovery plan is subject to the availability of resources, from within and from outside government.

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The Species at Risk Program of Alberta Sustainable Resource Development funded the preparation of the recovery plan.

Members of the Sage-grouse/Swift Fox Recovery Team should be commended for their continued commitment to the recovery planning process. The Team was initially convened to write the recovery plan for sage-grouse and extended their effort to the swift fox, recognizing that continuity between the planning processes for both of these species would be beneficial. The extra volunteer time contributed to species at risk recovery in Alberta is appreciated.

EXECUTIVE SUMMARY

Swift foxes (*Vulpes velox*) are canids identified by their small size (2 - 3 kg), long black-tipped bushy tails, and by black facial spots on each side of their muzzle. Their pelage tends to be soft grey tinged with orange or tan. Historically, large populations of swift foxes ranged across the Canadian Prairies. Rapid declines in abundance began in the late 1800's as foxes were trapped or eliminated during predator control programs. The last sighting of a swift fox in Alberta was in 1938 near Manyberries (Herrero et al. 1991). In 1978, the Committee on the Status of Endangered Species in Canada (COSEWIC) officially listed this species as *Extirpated* in Canada. Beginning in 1983, captive-raised and wild-born swift foxes from the United States were reintroduced into southern Alberta and Saskatchewan. Following this successful reintroduction, COSEWIC designated the swift fox as *Endangered* in Canada (COSEWIC 1999, 2002).

The Swift Fox Recovery Team was initiated by the Minister of Sustainable Resource Development, and receives operational guidance and approval from the Director of Wildlife Management. The team's primary responsibility is to facilitate and coordinate the conservation and recovery of this species in Alberta.

The Swift Fox Recovery Team believes the swift fox can recover based on the following:

- The population is showing a positive trend in terms of numbers and range expansion
- There is remaining unoccupied habitat to support swift foxes at increased population levels
- There is significant technical information available to contribute to management actions to aid in species recovery (e.g. reintroductions techniques, information on population ecology from research, population monitoring information, habitat analyses)
- There is interest in the local community to participate in recovery of the swift fox

The Swift Fox Recovery Team's long-term goal for the species in Alberta is as follows:

Within 20 years, establish a well distributed, healthy, and self-sustaining viable population within its remaining historic range in Alberta.

Threats to the species include habitat alteration and fragmentation, predator and competitor abundance, inappropriate predator and pest control, disease, and human-caused mortality. In support of the long-term goal, and to address immediate threats to the species, the Swift Fox Recovery Team recommended four short-term goals to work toward recovery. These short-term goals are as follows:

1. Enhance and maintain habitat for swift foxes to satisfy life cycle requirements.
2. Reduce swift fox mortality from disease and human-related causes.

3. Work cooperatively with the national Swift Fox Recovery Team to monitor the population (number, distribution, ongoing threats etc.) and determine the location, amount, type and quality of habitat required/available for recovery in order to assess both the necessity and potential for further reintroductions.
4. Communicate information about swift fox management to land managers, industry, trappers, recreational users, regulators and other relevant parties in the area for the purpose of fostering stewardship of the species and its habitat.

The recovery plan will serve a period of five years (2006-2011), but will be reviewed annually, or as needed, with relevant information from modeling exercises and research activities currently being conducted. A series of actions for each goal with measurable objectives, timelines and responsible parties are detailed. The emphasis is on actions that will promote good stewardship and best management practices for maintaining habitat.

The cost of implementing the recovery plan is estimated at \$564,000 over five years, including cash and in-kind support. A variety of agencies will be invited to participate in the funding and implementation of recovery actions.

1.0 INTRODUCTION

1.1 Ministerial Conservation Action Statement

In April 1987 swift foxes (*Vulpes velox*) were listed as *Endangered* in Alberta. This status was reaffirmed in March 2000 when the Minister approved the listing of swift fox on the recommendation of the Alberta Endangered Species Conservation Committee (ESCC). Once considered to be extirpated from the province, this changed after a successful reintroduction established a small population (<1000). The Initial Conservation Action Statement from the ESCC specified that a recovery plan should be developed in order to set goals, objectives, strategies and management actions necessary to guide the recovery of this species during the next five years. This plan was to involve all those that would affect or be affected by the recovery process. The Action Statement recommended that management should focus on conservation of existing populations by preventing habitat decline and by implementing policy and management necessary to protect dens and key habitats.

Nationally, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated the swift fox as *Extirpated* in April 1978. The status was re-examined and downlisted to *Endangered* in April 1998 after the successful reintroductions. The status was re-examined and confirmed as *Endangered* in May 2000. With the passing of the *Species at Risk Act* (SARA) in June of 2003, the swift fox is also listed as *Endangered* in Schedule 1 of the Act, which is the official list of wildlife species at risk in Canada.

1.2 Recovery Team

The Swift Fox Recovery Team was initiated by the Minister of Sustainable Resource Development, and receives operational guidance and approval from the Director of Wildlife Management. The team's primary responsibility is to facilitate and coordinate the conservation and recovery of this species in Alberta. It provides expert advice to the Minister (or his delegate) on all matters relating to the management of swift foxes in Alberta. The team is also responsible for writing, updating, and guiding the implementation of the provincial recovery plan. The recovery team is not usually directly involved in implementation of recovery actions, although team members and the organizations they represent may participate in the planned recovery actions. The team will encourage and facilitate the involvement of all interested parties in the recovery of swift foxes in Alberta whenever possible, and will periodically report on the progress of the recovery program.

Membership of the recovery team attempts to strive for the best representation of parties likely to affect or to be affected by recovery actions and currently consists of the following members: Alberta Sustainable Resource Development (Alberta Fish and Wildlife Division and Alberta Public Lands Division), Alberta Energy, Canadian Association of Petroleum Producers, Alberta Fish and Game Association, Society of Grasslands Naturalists, and members of the ranching community.

1.3 Technical Advisory Group

The technical advisory group reporting to the swift fox recovery team is responsible for providing scientific information and advice to the team to aid in the decision making process. Experts on swift fox biology and population ecology, habitat specialists, computer modeling and geographic information system specialists will be consulted on an as need basis to provide suitable information to the recovery team.

2.0 SWIFT FOX BIOLOGY

Swift foxes are canids identified by their small size (2 - 3 kg), long black-tipped bushy tails, and black facial spots on each side of their snout. Their pelage tends to be soft grey tinged with orange or tan. The throat, chest and belly are white to tan. They have large ears and dark eyes. The sexes appear similar, but males tend to be slightly heavier than females (Cotterill 1997b).

Swift foxes are active only at night. During the day, they remain underground in burrows or dens. Swift foxes are opportunistic predators and will consume a variety of food items including small and medium-sized mammals, carrion, invertebrates, birds, vegetation, and occasionally fish, amphibians, and reptiles (Cutter 1958, Kilgore 1969, Carbyn et al. 1994, Hines and Case 1991, Sharps 1984, Uresk and Sharps 1986). Scat analysis in Alberta indicated that the swift fox diet was mainly small rodents and carrion from ungulates, with a small portion from lagomorphs and ground squirrels (Reynolds et al. 1991).

Swift foxes are noted for their speed (up to 50 km/h), which facilitates escape from predators. Coyotes (*Canis latrans*) appear to be their main predator, although coyotes rarely consume swift fox once killed. Other common predators are badger (*Taxidea taxus*), golden eagle (*Aquila chrysaetos*) and bobcat (*Lynx rufus*) (Cotterill 1997a).

In Alberta, breeding begins in mid February. Gestation lasts about 50 days and two to five pups are born in dens from late April to mid-May. Pups are born blind and are completely dependent on their parents for food and protection. Both parents provide food for the young, although initially the male is the main food provider. Pups open their eyes 10 to 15 days old. They remain inside the dens for approximately one month before venturing out above ground. Pups are weaned at six to seven weeks but remain with the adults for four to five months before dispersing. Swift foxes can breed during their first year of life and generally live between 3 to 6 years in the wild (Cotterill 1997a).

2.1 Habitat

Swift foxes generally prefer short- to mixed-grass prairie with flat to gently rolling terrain and sparse vegetation that allows for good mobility and visibility (Russell and Scotter 1984, Cotterill 1997a). Coulees, brushy areas, and cultivated land are usually avoided (Moehrensclager and MacDonald 2003).

Swift foxes are considered the most den-dependent of all canine species. They use multiple dens year-round for shelter, cover from predators, and for rearing young. These dens may be newly constructed, but are often modified from existing burrows dug by other fossorial mammals (Cutter 1958, Kilgore 1969, Carbyn et al. 1994). Consequently, the presence of these mammals, such as badgers and ground squirrels (*Spermophilus richardsonii*), may increase suitability of habitat for swift foxes. Dens have been found on both flat terrain and hilltops in well-drained sites. The presence of permanent water bodies and the absence of high densities of predators may also increase suitability of habitat for swift foxes (Brechtel et al. 1996, Mamo 1994). Protection under the Alberta *Wildlife Act* prevents damage or destruction of swift fox dens in Alberta.

2.2 Population, Distribution and Trends

Historically, large populations of swift foxes ranged across the Canadian Prairies. Rapid declines in abundance of this species began in the late 1800's as foxes were trapped for furs or eliminated during predator control programs. By the early 1900's, the swift fox had been eliminated from its Canadian range; in Alberta, the last sighting of a swift fox was in 1938 near Manyberries (Herrero et al. 1991). In 1978, the Committee on the Status of Endangered Species in Canada (COSEWIC) officially listed this species as *Extirpated* in Canada. Beginning in 1983, captive-raised foxes from Canada and translocated wild-born swift foxes from the United States were reintroduced into southern Alberta and Saskatchewan. These introductions provided a foundation for establishing populations of swift foxes in these provinces. Following this reintroduction, COSEWIC designated swift foxes as *Endangered* in Canada (COSEWIC 1999, 2002).

Historically, swift foxes occurred throughout southern Alberta, ranging north to the 53rd parallel and east from the foothills to the Saskatchewan border (Soper 1964). When the reintroductions started, swift foxes were introduced annually at two sites in southeastern Alberta: one near the Alberta-Saskatchewan border (hereafter the "border population") and another in the Milk River Ridge area. Introductions were also conducted in Grasslands National Park and the Wood Mountain area of Saskatchewan. In total, 942 foxes were released into these areas between 1983 and 1997. Introductions at in the Milk River were discontinued in 1989 following problems with rabies.

A number of provincial and national surveys of swift foxes have occurred since their reintroduction. Data collected by Brechtel et al. (1993) from 1989-1991 indicated that foxes in the border population numbered approximately 150 to 250. A subsequent 1994 survey of this area indicated a decline in the border population to 100 to 135 foxes (Mamo 1994). A national census for swift foxes conducted in the winter of 1996 and 1997 indicated that the Canadian population was in excess of 289 individuals (95% confidence interval (CI): 179-412 foxes) (Cotterill 1997b); further, the Alberta/Saskatchewan border population was estimated to be 192 foxes (95% CI: 93-346 animals). Eighty percent of the foxes captured during this survey were wild-born individuals. Another border population survey in 1999 indicated that they increased in size by as much as 1.38 times since the 1996-97 survey of that population (Moehrensclager and Moehrensclager 1999). An international census was also conducted during the winter of 2000 and 2001 (Moehrensclager and Moehrensclager 2001). This study surveyed the same 108 Canadian townships from the 1996-97 survey and an additional 80 townships from Montana. The study revealed that the swift fox population had tripled since the 1996-97 survey. The total

population was estimated to be 877 foxes, with 560 in the border population, 96 in Grasslands National Park in Saskatchewan and 221 in Montana. A significant extension in distribution was also noted during the study. In particular, swift foxes in the Alberta-Saskatchewan border area were found in 38 townships, compared to only 18 in the 1996-97 survey.

Following a five-year schedule, a census was conducted in the winter of 2005-06. In total, 196 foxes were caught and released. For the first time, 100% of captured foxes were wild-born. The proportion of townships with fox captures increased from 39.7% in 2000/2001 to 52.1% during the 05/06 census. This increase was primarily driven by an expansion of foxes in Montana. Population connectivity also improved as all townships with fox captures were separated by no more than one township, whereas 2000/2001 captures were separated by up to three townships. (Moehrenschrager and Moehrenschrager 2006).

Canadian fox numbers and densities were similar to the high levels documented in 2001 with a 2006 population abundance estimate of 647.3 foxes. This population level indicates stability for Canadian swift foxes. Populations in Montana increased significantly to an estimated 515.2 individuals, for a combined 2006 population estimate of 1162.5 foxes (Moehrenschrager and Moehrenschrager 2006).

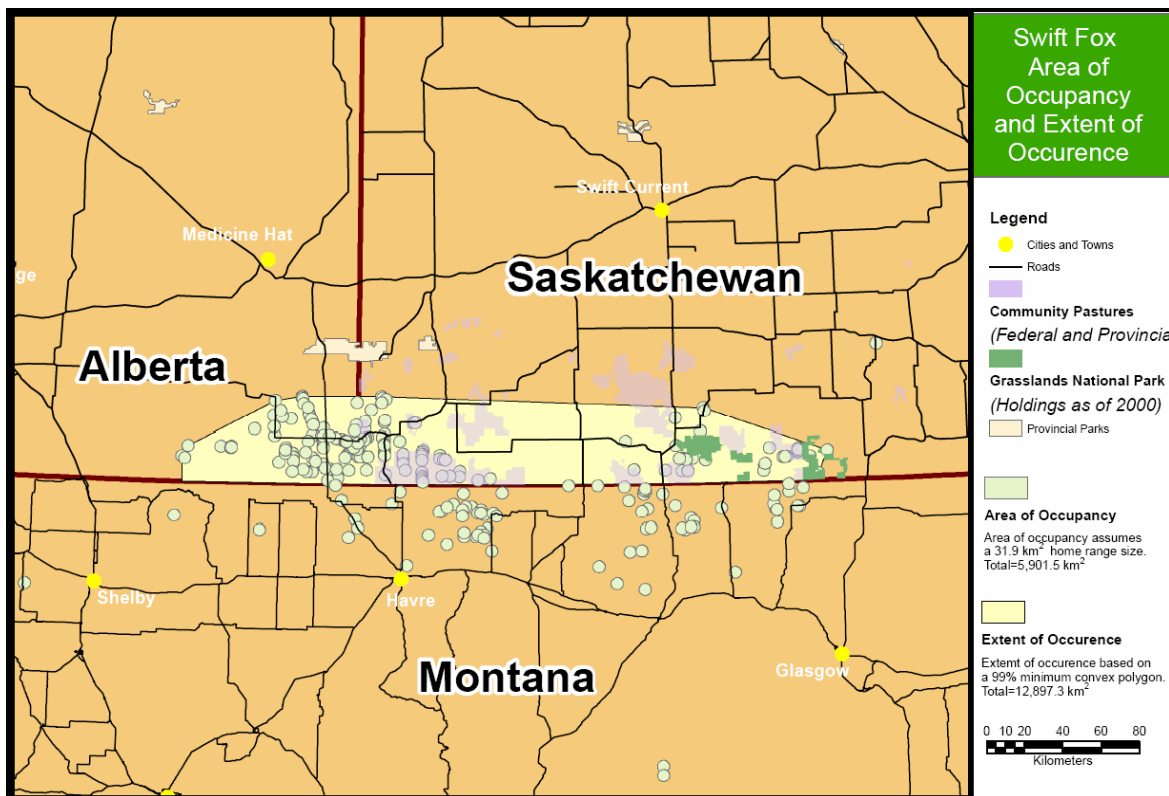


Figure 1. Current extent of occurrence and area of occupancy using confirmed records from 1996-2003. Circular areas of occupancy assume a 31.9 km² home range size (data from Moehrenschrager 2000)

3.0 POPULATION THREATS AND LIMITING FACTORS

3.1 Habitat Alteration and Fragmentation

Conversion of native prairie to agricultural land was a major factor in the decline of swift foxes in Canada (Carbyn et al. 1994). Further conversion of grassland to cropland in southern Alberta could threaten the persistence of swift foxes in Alberta. Other anthropogenic (i.e., human-caused) disturbances such as oil and gas development and construction of roadways may lead to additional loss and fragmentation of native habitat. These disturbances may also negatively impact the Alberta swift fox population by increasing mortality on roads.

3.2 Predator and Competitor Abundance

Coyotes are the primary predator and competitor of swift foxes and are an important limiting factor to the swift fox population in Alberta. Since the extirpation of the wolf (*Canis lupus*) on the Canadian prairies, coyote densities are high despite the harvest for their fur and persecution by landowners. A more recent threat to the persistence of swift foxes may be the increase in number and distribution of red foxes that may act as competitors for resources (food, dens) (Cotterill 1997a).

3.3 Predator Control Programs

Intensive predator control programs directed at coyotes, skunks (*Mephitis mephitis*) and other mammals might affect swift foxes (Carbyn et al. 1994). Trapping and poisoning programs for these species may indirectly target swift foxes and may reduce prey populations (e.g., rodents). However, if control measures are applied selectively for coyote and red fox these programs could enhance survival of swift foxes by reducing the density of their main predator and competitor.

3.4 Incompatible Range Management

It is generally noted that swift foxes prefer grazed areas, probably because these areas allow for increased monitoring of predators. However, the particular effects of grazing regimes on swift foxes are not well understood. Natal dens have not been observed in cultivated fields or fields planted to crested wheat grass. Overgrazing may reduce habitat quality and prey abundance. O'Farrell (1983) documented reduced prey abundance and concomitant population declines of closely-related kit foxes (*Vulpes macrotis*) resulting from overgrazing. Well-managed rangeland with grazing regimes that increase rodent abundance should provide suitable year-round habitat for swift foxes.

3.5 Disease

Antibodies to diseases such as canine distemper and canine parvovirus have been documented in swift foxes in Alberta, confirming exposure to these diseases. Outbreaks have the potential to dramatically affect small populations of canids. In the winter of 2003, a canine distemper outbreak occurred in domestic dogs in the Medicine Hat area. Mortality associated with diseases is currently not understood in the Alberta swift fox population. The role of transmission by

coyotes, red foxes, and domestic dogs is also not well understood, however it is very likely swift foxes come into contact with all of these species.

3.6 Other Human-Caused Mortality

Mortality of swift foxes has also been documented from road kill, trapping activities, poisoning, shootings, and encounters with domestic dogs. The extent of other mortality factors is not currently known, but may play a role in recovery of swift fox populations.

4.0 CRITICAL HABITAT AND RESIDENCE

Critical habitat is a legal designation under the SARA. Recovery Teams define critical habitat in the recovery strategy, with the emphasis on habitat that is “necessary for survival or recovery of a listed wildlife species” (Species at Risk Act 2002 s 2). In defining critical habitat, recovery teams must also specify activities that may result in destruction of such areas. These parameters afford protections for critical habitat, as its destruction is illegal on lands where the SARA applies.

Critical habitat for swift foxes has not been fully defined to date. However, the national Recovery Team has developed a residence description, which is a separate definition under SARA describing the habitat requirements for various parts of the life cycle of the animal. The residence description can help to define what features within legally designated critical habitat areas are especially important to preserve.

In an effort to maintain continuity with the national Recovery Team, the Alberta Swift Fox Recovery Team has elected to adopt the residence description and contribute to further studies to define critical habitat for the national population. The National Swift Fox Recovery Team’s (unpubl.) position on residence is paraphrased below.

4.1 Description of Residence

Swift foxes are prairie specialists and occur in short and mixed grass prairie in southern Alberta and Saskatchewan (Allardyce and Sovada 2003). Dens are an important habitat feature for this species; swift foxes are among the most den-dependent of all canids and use dens throughout the year. Repeated use of dens by canids has been described for many North American species including the closely related kit fox (Egoscue 1962), although each den is not necessarily used every year (Egoscue 1962; Kilgore 1969; Hillman and Sharps 1978). This repeated use of den sites has also been observed for wild swift foxes in Canada (Moehrenschrager 2000; Pruss 1994; Tannerfeldt et al. 2003).

Swift foxes often modify prairie burrows such as badger holes and use them as maternal den sites (Herrero et al 1986; Pruss 1999). Den complexes with one or more central chambers connected to the surface by tunnels (Cutter 1958; Kilgore 1969) are used to rear young in the spring and

summer (approximately April – August). Adult swift foxes are thought to choose dens based on their location and physical characteristics, particularly for the selection of maternal den sites, which usually have more entrances compared to temporary escape or shelter dens (Pruss 1999; Moehrenschrager 2000; Olson 2000). Occupied maternal den sites are typically located on hilltops with gradual slopes, with relatively higher grass, further from water, and closer to roads and/or trails (Pruss 1999).

Dens also serve as shelter from weather extremes and refuge from predators. While entrance holes for shelter dens may be smaller (≥ 11 cm diameter with a clear tunnel) than entrance holes for maternal dens, opportunistic use of appropriate sized holes may occur during predator avoidance.

4.2 Determination of Unprotected Portions

Dens of swift foxes are currently protected at all times of year under the *Alberta Wildlife Act*. At this time, no further specific habitat protection provisions occur in the *Alberta Wildlife Act*. Certain areas of the province that contain swift fox habitat may have additional protection afforded (e.g. Natural Areas, Heritage Rangelands, and areas under protective notation (PNT) on Crown Land).

4.3 Guidelines for Minimum Disturbance

Any activity that destroys the function of shelter dens would constitute damage or destruction of the residence. This would include, but is not limited to, habitat change near the den, particularly plowing or disturbing native short or mixed grassland communities. Repeated human and/or domestic dog activity at a den site could result in the abandonment of the den, which may cause altered reproduction and increased mortality.

Provincial guidelines reflect that timing of activity is critical (Alberta Fish and Wildlife Division 2001). Dens used by parents and young from April 1 to August 31 are maternal dens and should be considered potentially active for five years since the last known occupancy. Burrows > 11 cm with a clear tunnel within 800 m of occupied maternal rearing dens should be protected from April 1 to August 31 (see Moehrenschrager 2000 for further discussion of disturbance).

4.4 Schedule of Comprehensive Studies to Identify Critical Habitat

The Alberta Recovery Team will be contributing to the National Swift Fox Recovery Team's efforts to define critical habitat. This will ensure that efforts are not duplicated between federal and provincial processes and that critical habitat is defined over the entire range of swift foxes in Canada. Over the life of the Alberta Recovery Plan, we will participate in the following cooperative efforts as identified by the national team:

1. Conduct analyses to determine genetics for use in population viability analysis (PVA) modeling by fall 2006.
2. Model species habitat to estimate habitat suitability/use based on presence/absence of live trapping data by fall 2006.

3. Model species demographics to estimate population dynamics and risk of extinction concurrent with the recovery goal. Combine population and suitable habitat model results in a spatially explicit Population and Habitat Viability Analysis (PVHA) to estimate the amount and location of habitat required to achieve short- and long-term recovery goals for existing populations. This analysis will help to make decisions about the necessity of further reintroductions and should be complete by 2007.
4. Estimate ecological process and function attributes of swift foxes' critical habitat in order to evaluate the acceptability/permisibility of activities and identify appropriate protection mechanisms by early 2007 (National Swift Fox Recovery Team, unpubl.).

5.0 INFORMATION GAPS AND RESEARCH PRIORITIES

Research is required to answer questions about whether the reintroduced population is thriving in its current habitat, whether further releases of translocated and/or captive bred foxes are necessary to augment the population, and what the threats from predators and disease are for the population. The answers to these questions will help the Recovery Team to make decisions about future management of the population. Research priorities, listed below, along with other opportunities for research, should be coordinated with the national Recovery Team wherever possible.

- On a section level, study relative habitat preferences of swift foxes, coyotes, and red foxes, in order to determine how land-use changes might influence canid interaction dynamics.
- Determine relative densities of coyote and red fox that would reduce mortality of swift fox and reduce the likelihood of range exclusion due to coyotes.
- Create a population viability model using demographic, genetic, habitat, and disease parameters using existing data from the swift fox census and other sources.
- Assess the prevalence of canid diseases, their vectors and potential effects for swift fox survival and reproductive success. Emphasis should be on diseases that affect sympatric canids.

6.0 RECENT RECOVERY AND CONSERVATION EFFORTS

Recent conservation and recovery efforts for swift foxes include the 2005-06 census, headed by the Calgary Zoo with cooperation and funding from numerous government and other agencies throughout Alberta, Montana and Saskatchewan. During the winter, swift foxes were live trapped over their known range in order to derive a population estimate. While further conservation actions are clearly still needed, the results of the 2005/2006 swift fox census showed population stability in Canada and continuing population increase in Montana. These results indicate that this is the most successful reintroduction of a nationally extirpated carnivore to date (Moehrenschrager and Moehrenschrager 2006).

There are ongoing efforts to limit disturbance at den sites by implementing guidelines for industrial activity. The guidelines are for timing and distance of activity from den sites.

Recently, the Blood (Kanai) Tribe near Lethbridge has expressed a desire to see swift foxes reintroduced on tribal lands in southwestern Alberta. This process was initiated independently of the provincial recovery team. The Blood Tribe is now represented on the National Swift Fox Recovery Team and investigations into the viability of further introductions on tribal land are being discussed at this level.

7.0 BIOLOGICAL AND TECHNICAL FEASIBILITY OF RECOVERY

The swift fox was once extirpated from Alberta, but today it is one of the few examples of a successful reintroduction program. Despite numerous threats, the small population continues to expand over a larger territory. The status of the population remains *Endangered*, however between the first census in 1996-97 and 2000-01, significant population growth was documented (Moehrensclager and Moehrensclager 2001). The biological viability of the population is not currently well understood, however the recommended population viability analysis should prove useful in determining long-term viability. Numerous factors have likely changed since the time in which swift foxes were extirpated from the Canadian Prairies. Several of the listed threats can be managed to improve/increase the habitat available to swift foxes, and thereby improve the species' chances of survival and recovery. As an example, grazing regimes that enhance and maintain habitat for swift foxes can play a key role in the maintenance and recovery of the population.

The Swift Fox Recovery Team believes the swift fox can recover based on the following:

- The population is showing a positive trend in terms of numbers and range expansion;
- There is remaining unoccupied habitat to support swift foxes at increased population levels;
- There is significant technical information available to contribute to management actions aimed at species recovery (e.g. reintroductions techniques, information on population ecology from research, population monitoring information, habitat analyses); and
- There is interest in the local community to participate in recovery of the swift fox...

8.0 RECOVERY

8.1 Long and Short-Term Goals and Objectives

The National Swift Fox Recovery Team has developed a long-term population goal for recovery of the species. In order to be consistent with the national team, Alberta will work in support of their long-term goal, which is as follows:

Within 20 years, establish a well distributed, healthy, and self-sustaining viable population within its remaining historic range in Alberta.

In support of the long-term goal, the Alberta Swift Fox Recovery Team has four short-term goals for recovery, focusing on habitat protection and reclamation; reduction of swift fox mortality; habitat assessment for recovery; and outreach. These short-term goals are listed below with the associated objectives.

Goal 1: Enhance and maintain habitat for swift foxes to satisfy life cycle requirements.

- 1.1 Place protections on all known current swift fox dens by 2008 and eliminate disturbance of known den sites by 2009.
- 1.2 Reduce/mitigate the footprint of industry within swift fox habitat, and foster good stewardship in energy planning and development in promotion of high quality habitat by 2010.
- 1.3 Increase habitat area protected by stewardship, providing for a sustainable ranching industry and high quality habitat by 2011.

Goal 2: Reduce swift fox mortality from disease and human-related causes.

- 2.1 Eliminate swift fox mortality resulting from incompatible predator control practices by 2009.
- 2.2 Reduce/maintain vehicle mortality levels so there is minimal impact on swift fox populations by 2010.
- 2.3 Determine the prevalence of canid diseases in swift fox and their vectors, identify potential impacts on swift fox survival/reproductive success, and take measures to reduce mortality from canid disease by 2009.

Goal 3: Work cooperatively with the National Swift Fox Recovery Team to monitor the population (number, distribution, ongoing threats etc.) and determine the location, amount, type and quality of habitat required/available for recovery in order to assess both the necessity and potential for further reintroductions.

- 3.1 Participate in the development of population viability model to determine necessity of additional reintroductions by 2007.
- 3.2 Participate in inter-jurisdictional population censuses every five years that are quantifiably comparable to 96/97, 00/01, and 05/06 censuses.
- 3.3 Provide necessary information to develop a GIS habitat model to determine which habitats swift foxes select, by 2007.
- 3.4 If additional reintroductions are necessary, use GIS habitat model for swift foxes to determine optimal reintroduction areas in Alberta (pending completion of objective 3.3).

Goal 4: Communicate information about swift fox management to land managers, industry, trappers, recreational users, regulators and other relevant parties in the area for the purpose of fostering stewardship of the species and its habitat.

- 4.1 Develop and disseminate an information package for outreach and education aimed at land managers, industry, trappers, and recreational users by 2008.
- 4.2 Contact all relevant stakeholders to identify conservation and stewardship opportunities for swift foxes by 2009.
- 4.3 Integrate swift fox biology and conservation information, along with other species at risk and prairie conservation information, into local and provincial school curricula by 2008.
- 4.4 Disseminate information regarding the Alberta Species at Risk Program, illustrating potential benefits of stewardship activities for landowners, by 2007.

8.2 Strategies for Achieving Recovery

In order to achieve the goals of enhanced habitat and reduced mortality of swift fox populations, the Swift Fox Recovery Team has recommended focusing on a number of strategies over the next five years. Contiguous habitat is key to survival and expansion of the species; therefore, efforts should be directed toward habitat management, conservation and protection. The population will be closely monitored to determine whether mortality from human causes remains a factor in recovery, and also to provide data to models of the national population. Finally, it is also important to ensure that best practices for swift fox management are communicated to those who make management decisions in the area. The strategies for reaching the goals are listed below.

8.2.1 Habitat Management, Conservation and Protection

Habitat conservation and protection for swift foxes will focus on protection and further identification of den sites. In addition, stewardship measures will be encouraged on rangelands and for industrial operators within swift fox habitat. Anthropogenic activity leading to mortality should also be reduced, such as fur trapping methods that affect swift foxes and road mortality. Modeling will help to determine the current amount and quality of habitat for swift foxes.

8.2.2 Population Management and Enhancement

The population will be monitored for trends in size and distribution. Modeling exercises will help to determine whether further reintroductions or translocations are necessary, possible sites for reintroductions or translocations, and guide the development of a reintroduction program if necessary. This work will be done in conjunction with the National Swift Fox Recovery Team.

8.2.3 Outreach and Education

Information about swift fox management will be communicated to land managers, industry, recreational users and other relevant parties in the area for the purpose of fostering stewardship of the species. The emphasis is on promoting the benefits of endangered species conservation and encouraging industrial and recreational users to follow best practices for conservation.

8.2.4 Research

Research will focus on specific threats to swift fox recovery including the impacts of red fox competition and canid disease.

8.2.5 Plan Management and Administration

A key element of this strategy is to maintain regular contact with the National Swift Fox Recovery Team in order to ensure that provincial and national recovery actions are compatible and complementary to each other and contribute to the overall recovery of the species. Considering the international range of the swift fox population, coordination with neighboring jurisdictions for population management and recovery should also be pursued (i.e., Saskatchewan and Montana).

9.0 ACTION PLAN

Objectives	Action Items	Responsible Party ¹
<i>1.0 Enhance and maintain habitat for swift foxes to satisfy life cycle requirements</i>		
1.1 Place protections on all known current swift fox dens by 2008 and eliminate disturbance of known den sites by 2009	<ul style="list-style-type: none"> • Maintain reporting mechanism for den sites • Maintain database of known den sites • Specify acceptable access within a set radius of den sites and timing of access within BMPs • Provide maps to landowners and lessees with den sites on properties • Place PNTs on all current den sites 	FWD PLD
1.2 Reduce/mitigate the footprint of industry within swift fox habitat, and foster good stewardship in energy planning and development in promotion of high quality habitat by 2010	<ul style="list-style-type: none"> • Identify potential areas for reclamation to enhance swift fox habitat • Develop BMPs for industry active in swift fox habitat and ensure their implementation • Investigate/develop recognition program for companies following BMPs for swift foxes and other species at risk 	FWD CAPP AE Petroleum Companies
1.3 Increase habitat area protected by stewardship, providing for a sustainable ranching industry and high quality habitat by 2011	<ul style="list-style-type: none"> • Provide incentives for appropriate management through the stewardship programs and increase awareness of programs like MultiSAR • Investigate incentives at county level for good stewardship for swift foxes • Develop BMP for grazing management in relation to swift fox habitat 	FWD PLD
<i>2.0 Reduce swift fox mortality from disease and human-related causes</i>		
2.1 Eliminate swift fox mortality resulting from impacts of incompatible predator control practices by 2009	<ul style="list-style-type: none"> • Determine extent of incompatible predator control • Develop and implement trapping BMP for swift foxes • Investigate alternative predator control methods for landowners/lessees and trappers 	FWD ATA AFGA
2.2 Reduce/maintain vehicle mortality levels so there is minimal impact on swift fox populations by 2010	<ul style="list-style-type: none"> • Record vehicle counts and mortality (e.g., along highway 41) • Reduce road access in areas with high strikes • Post signage along high mortality areas • Manage industrial traffic on public lands through Area Operating Agreements (e.g. recommend consolidating transportation for employees and specifying road access times) • For private lands, encourage methods for vehicle mortality reduction through MultiSAR and other stewardship agreements 	FWD PFLD CAPP Municipal governments

Objectives	Action Items	Responsible Party ¹
2.3 Determine the prevalence of canid diseases in swift foxes and their vectors, identify potential impacts on swift fox survival/reproductive success, and take measures to reduce mortality from canid disease by 2009	<ul style="list-style-type: none"> • Record mortality/incidence of canid disease • Promote compliance of dog vaccination within swift fox habitat; contact local vet clinics to set up discount vaccination program and distribute brochures about the program to landowners/lessees within swift fox habitat • Monitor any known outbreaks/measure mortality 	FWD
<i>3.0 Work cooperatively with the National Swift Fox Recovery Team to monitor the population (number, distribution, ongoing threats etc.) and determine the location, amount, type and quality of habitat required/available for recovery in order to assess both the necessity and potential for further reintroductions.</i>		
3.1 Participate in the development of population viability model to determine necessity of additional reintroductions by 2007	<ul style="list-style-type: none"> • Determine information needs and collect data in tandem with other jurisdictions at agreed upon intervals 	FWD NSFRT
3.2 Participate in inter-jurisdictional population censuses every five years, that are quantifiably comparable to 96/97, 00/01 and 05/06 censuses	<ul style="list-style-type: none"> • Determine information needs and collect data in tandem with other jurisdictions at agreed upon intervals • Report on findings within specified time frame with National Recovery Team 	FWD NSFRT
3.3 Provide necessary information to develop a GIS habitat model to determine which habitats are selected by swift foxes by 2007	<ul style="list-style-type: none"> • Work with National Recovery Team to determine information needs for GIS database • Create database to record information to provide to GIS model 	FWD NSFRT
3.4 If additional reintroductions are necessary, use GIS habitat model for swift foxes to determine optimal reintroduction areas in Alberta (pending completion of objective 3.3)	<ul style="list-style-type: none"> • Analyze population trends for swift foxes from census data • Determine if genetic diversity is sufficient for sustainable population • If necessary, prioritize areas for reintroduction • If necessary, develop reintroduction program 	FWD NSFRT

Objectives	Action Items	Responsible Party ¹
<i>4.0 Communicate information about swift foxes to land managers, industry, trappers, recreational uses and other relevant parties in the area for the purpose of fostering stewardship of the species and its habitat</i>		
4.1 Develop and disseminate an information package for outreach and education aimed at land managers, industry, trappers, and recreational users by 2008	<ul style="list-style-type: none"> • Develop brochures with information on trapping BMPs to include with trapping permits • Develop brochure with grazing and industry BMPs for land managers and industry • Participate in events such as Manyberries community fair promoting BMPs and stewardship information • Provide BMP information to CAPP to distribute on their website • Record communications and evaluate whether outreach is effective (i.e. are more people aware of conservation efforts?) 	FWD PLD CAPP AFGA ATA
4.2 Contact all relevant stakeholders to identify conservation and stewardship opportunities for swift foxes by 2009	<ul style="list-style-type: none"> • Contact landowners/lessees with swift foxes for information/maps once habitat selection model is completed • Work with interested landowners/lessees to develop stewardship agreements 	FWD PFLD
4.3 Integrate swift fox biology and conservation information, along with other species at risk and prairie conservation information, into local and provincial school curricula by 2008	<ul style="list-style-type: none"> • Provide swift fox information at regional elementary schools including possible field opportunities (e.g., Manyberries school kids could participate in field counts etc.) • Contact Alberta Education about including species at risk in provincial curriculum/ revising information 	FWD
4.4 Disseminate information regarding Alberta Species at Risk program illustrating potential benefits of stewardship activities for landowners by 2007	<ul style="list-style-type: none"> • Incorporate information about potential benefits of the Alberta Species at Risk Program and other programs such as MultiSAR in an informational brochure about swift fox conservation 	FWD

¹ AE - Alberta Energy
AFGA - Alberta Fish and Game Association
ATA - Alberta Trapping Association
CAPP - Canadian Association of Petroleum Producers
FWD - Alberta Fish and Wildlife
NSWRT - National Swift Fox Recovery Team

PLD - Alberta Public Lands Division

10.0 TIMETABLE FOR IMPLEMENTATION AND SCHEDULE OF COSTS

The following table provides a timeline for implementation of activities identified by the Swift Fox Recovery Team as being important to the conservation of swift foxes, and provides an estimate of the costs associated with their implementation. It is anticipated that a variety of agencies will participate in the funding and implementation of these activities. Costs are not provided for activities that are part of the daily operations of the identified organizations. Costs associated with team members' expenses to attend recovery team meetings are not included, but represent valued and necessary contributions associated with implementation of the recovery plan.

Objective	Activity	Lead Agency	Cost (thousands/year)					Total
			2006-07	2007-08	2008-09	2009-10	2010-11	
Goal 1								
1.1	Reporting mechanism		0	0	0	0	0	0
	Database		0	5	0	0	0	5
	Access guidelines		0	10	0	0	0	10
	Maps		0	2	2	2	2	8
	PNTs on den sites	FWD/PLD	5	0	0	0	0	5
1.2	ID reclamation areas	FWD	10	10	5	0	0	25
	Industry BMPs	FWD/CAPP/AE	0	3	0	0	0	3
	Recognition programs		2	2	2	2	2	10
1.3	Stewardship program	FWD/PLD	0	5	10	10	10	35
	County incentives	FWD/PLD	0	0	10	10	10	30
	Grazing BMP	FWD/PLD	0	5	0	0	0	5
			17	42	29	24	24	136
Goal 2								
2.1	Incidental control	FWD/AFGA	5	0	0	0	0	5
	Trapping BMPs	FWD/ATA	0	3	0	0	0	3
	Predator control		0	5	0	0	0	5
2.2	Record vehicle counts	FWD	2	2	2	0	0	6
	Record SF mortality	FWD	2	2	2	0	0	6
	Reduce road access	FWD/PLD	0	5	5	5	0	15
	Post signage on highway	Municipal Governments	0	0	5	5	0	10
	Develop AOA	PLD/CAPP	0	0	0	0	0	0
	Road reduction on private lands		0	0	0	0	0	0
2.3	Measure canid disease	FWD	10	10	0	0	0	20
	Vaccination compliance	FWD	5	1	1	1	1	9
	Monitor outbreaks	FWD	10	10	0	0	0	20
			34	38	15	11	1	99
Goal 3								
3.1	Determine/collect data	FWD/ NSWFRT	10	0	0	0	0	10
3.2	Determine census needs	FWD/ NSWFRT	0	0	0	0	0	0
	Report on findings	FWD/ NSWFRT	20	0	0	0	30	50
3.3	Determine GIS data	FWD/ NSWFRT	0	0	0	0	0	0
	Collect data GIS model	FWD/ NSWFRT	20	0	0	0	0	20
3.4	Population trends	FWD/ NSWFRT	5	5	5	5	5	25
	Genetic diversity	FWD/NSWFRT	20	20	20	20	20	100
	Prioritize reintroduction	FWD/NSWFRT	0	0	0	20	0	20
	Initialize reintroduction	FWD/NSWFRT	0	0	0	0	50	50
			70	25	25	45	105	275

Goal 4								
4.1	Trapper brochures	FWD/ATA	0	3	3	0	0	6
	Land manager	FWD/PLD/ CAPP	0	3	3	0	0	6
	Community events	FWD	2	2	2	2	2	10
	Information to CAPP	FWD/CAPP	0	3	3	0	0	6
	Evaluate communication efforts	FWD	1	1	1	1	1	5
4.2	Contact landowners	FWD/PLD	1	1	1	1	1	5
	Stewardship agreements	FWD/PLD	0	0	0	0	0	0
4.3	Local school programs	FWD	2	2	2	2	2	10
	Alberta Education	FWD	0	0	0	0	0	0
4.4	Include Species at Risk information	FWD	0	3	3	0	0	6
			6	18	18	6	6	54
	TOTAL		127	123	87	86	136	564

11.0 ECONOMIC IMPLICATIONS OF RECOVERY ACTIONS

The recovery plan recognizes the value of the landscape for activities such as grazing and industrial development. It is hoped that stakeholder involvement during the recovery process has helped in considering ways to minimize or mitigate costs associated with implementation of the plan. Implementation of best management practices for grazing and industrial activity may have associated economic costs. Costs could also result from restrictions on resource extraction or increased costs for extraction or development due to mitigation measures.

There are several social and economic benefits that may be realized from implementation of the recovery plan. There is the potential for leaseholders and landowners to realize increased productivity and sustainability of their rangelands through range/habitat management plans. Activities that lead to the maintenance of an intact prairie landscape, may also lead to increased recreational opportunities, such as nature viewing, hunting, and ecotourism.

The swift fox is a unique prairie species and there is inherent value in maintaining it on the landscape. Implementation of action items that conserve or improve the quality of native rangeland should lead to rangelands with high native biodiversity and should help conserve other species at risk on the prairies. Conservation of native prairie is also beneficial for continuing Alberta's heritage of ranching and ultimately contributes to maintaining clean air and water for society.

12.0 PLAN REVIEW AND AMENDMENT

The life of this plan is five years. The Alberta Swift Fox Recovery Team will conduct an annual review of the plan to monitor the implementation of the plan and to assess the effectiveness of recovery actions. The Chair of the recovery team will provide an annual report to the Director of Wildlife Management that details progress on implementation of the plan and any recommended changes to the plan. Recovery action plans are considered “living” documents and can be amended during these reviews. At the end of five years, the recovery team will meet again to determine whether any other amendments are required, prior to the plan being renewed for another five years. The team may determine that the existing recovery plan is suitable or is in need of revision.

13.0 REFERENCES

- Alberta Fish and Wildlife Division. 2001. Recommended Land Use Guidelines For Protection Of Selected Wildlife Species And Habitat Within Grassland And Parkland Natural Regions Of Alberta. Edmonton, AB. 5pp. Available at: <http://www3.gov.ab.ca/srd/fw/landuse/pdf/GrasslandParkland.pdf>. Accessed February 23, 2006.
- Allardyce, D., and M. A. Sovada. 2003. A review: ecology, historical distribution and status of swift fox in North America. In M. Sovada and L. Carbyn, eds. Swift fox conservation in a changing world. Canadian Plains Research Center, University of Regina
- Brechtel, S., L. Carbyn, G. Erickson, D. Hjertaas, C. Mamo, and P. McDougall. 1996. National recovery plan for the Swift Fox. Report No. 15. Recovery of Nationally Endangered Wildlife Committee, Ottawa, ON. 29 pp.
- Brechtel, S. H., L.N. Carbyn, D. Hjertaas, and C. Mamo. 1993. Canadian Swift Fox reintroduction feasibility study: 1989-1992; report and recommendations of the national Recovery Team. Unpublished report, Alberta Fish and Wildlife Services, Edmonton, AB. 95 pp + appendices.
- Carbyn, L.N., H.J. Armbruster, and C. Mamo. 1994. The swift fox reintroduction program in Canada from 1983 to 1992. Pp. 247-271 in Restoration of Endangered Species: Conceptual Issues, Planning and Implementation. Editors M.L. Bowles and C.J. Whelan, Cambridge University Press, Cambridge.
- COSEWIC. 2002. Canadian Species at Risk, May 2002. Committee on the Status of Endangered Wildlife in Canada.
- COSEWIC. 1999. Canadian Species at Risk, May 1999. Committee on the Status of Endangered Wildlife in Canada.
- Cotterill, S.E. 1997a. Status of the Swift Fox (*Vulpes velox*) in Alberta. Alberta Environmental Protection, Wildlife Management Division, Wildlife Status Report No. 7. Edmonton, AB. 17 pp.
- Cotterill, S.E. 1997b. Population census of Swift Fox (*Vulpes velox*) in Canada: winter 1996-1997. Prepared for the Swift Fox National Recovery Team. Alberta Environmental Protection, Natural Resources Service, Wildlife Management Division. 50 pp.
- Cutter, W.L. 1958. Denning of the swift fox in northern Texas. *Journal of Mammalogy* 39(1): 70-74.

- Egoscue, H.J. 1962. Ecology and life history of the kit fox in Toole County, Utah. *Ecology* 43(3): 481-497.
- Government of Canada. 2003. Species at Risk Act (Bill C-5). Ottawa, ON.
- Herrero S, Schroeder C, Scott-Brown M. 1986. Are Canadian foxes swift enough? *Biological Conservation* 36:159-167.
- Hillman, C.N., and J.C. Sharps. 1978. Return of swift fox to northern Great Plains. *Proceedings of the South Dakota Academy of Science* 57: 154-162.
- Hines, T.D. and R.M. Case. 1991. Diet, home range, movements, and activity periods of Swift Fox in Nebraska. *Prairie Naturalist* 23: 131-138.
- Kilgore, D.L. Jr. 1969. An ecological study of the swift fox (*Vulpes velox*) in the Oklahoma panhandle. *The American Midland Naturalist* 81(2): 512-533.
- Mamo, C. 1994. Swift Fox (*Vulpes velox*) population assessment (1994). Unpublished report for Alberta Fish and Wildlife and The Swift Fox Conservation Society, Edmonton, AB. 28 pp.
- Moehrensclager, A and D.W.Macdonald. 2003. Movement and survival parameters of translocated and resident swift foxes (*Vulpes velox*). *Animal Conservation* Vol. 6, no. 3, pp. 199-206.
- Moehrensclager, A. and C. Moehrensclager. 2006. Population census of reintroduced swift foxes (*Vulpes velox*) in Canada and northern Montana 2005/2006. Centre for Conservation Research Report No. 1, Calgary Zoo. Calgary, Alberta, Canada.
- Moehrensclager, A. and C. Moehrensclager. 2001. Census of the Swift Fox (*Vulpes velox*) in Canada and Northern Montana: 2000-2001. Alberta Sustainable Resource Development, Fish and Wildlife Division, Alberta Species at Risk Report No. 24. Edmonton, AB. 21 pp.
- Moehrensclager, A. 2000. Effects of ecological and human factors on the behaviour and population dynamics of reintroduced Canadian swift fox (*Vulpes velox*). Dissertation, University of Oxford, Oxford, United Kingdom.
- Moehrensclager, C.A.J., and A. Moehrensclager. 1999. Canadian Swift Fox (*Vulpes velox*) Population Assessment: Winter 1999. Alberta Environment, Fisheries and Wildlife Management Division, Edmonton, AB. 25 pp.
- National Swift Fox Recovery Team. Unpublished. Recovery Strategy for the Swift Fox (*Vulpes velox*) in Canada (proposed).

- O'Farrell, T.P. 1983. The San Joaquin Kit Fox recovery plan. United States Fish and Wildlife Service, Portland, OR. 84 pp.
- Olson, T. L. 2000. Population characteristics, habitat selection patterns, and diet of swift fox in southeast Wyoming. M. Sc. Thesis. University of Wyoming, Laramie. 139pp.
- Pruss S.D. 1999. Selection of natal dens by the swift fox (*Vulpes velox*) on the Canadian prairies. *Canadian Journal of Zoology* 77:646-652.
- Pruss S.D. 1994. An observational natal den study of wild swift fox (*Vulpes velox*) on the Canadian Prairie. M.E.Des. Alberta, Canada. University of Calgary.
- Reynolds, J., L. Carbyn, M. Nietfield, H. Arbruster, S. Herrero and C. Mamo. 1991. Food habits of Swift Foxes (*Vulpes velox*) in release programs in Alberta and Saskatchewan. Unpubl. manuscript. 26 pp.
- Russell, R.H. and G.W. Scotter. 1984. Return of the native. *Nat. Canada* 13: 7-13.
- Sharps, J.C. 1984. Game Report. Northern Swift Fox investigations 1977-1981. Completion Report No. 85-11. Unpublished report for Department of Game, Fish, and Parks, Pierre, SD. 26 pp.
- Soper, J.D. 1964. The Mammals of Alberta. Hamley Press Ltd., Edmonton, AB. 402 pp.
- Tannerfeldt, M., Moehrensclager, A., and A. Angerbjörn. 2003. Den ecology of swift, kit and arctic foxes: a review. In M. Sovada and L. Carbyn, eds. Swift fox conservation in a changing world. Canadian Plains Research Center, University of Regina.
- Uresk, D.W. and J.C. Sharps. 1986. Denning habitat and diet of the Swift Fox in western South Dakota. *Great Basin Naturalist* 46: 249-243.

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- No. 2 Alberta Piping Plover Recovery Plan 2002-2004. (2002)
- No. 3 Alberta Peregrine Falcon Recovery Plan 2004-2010. (2005)
- No. 4 Alberta Woodland Caribou Recovery Plan 2004/05-2013/14. (2005)
- No. 5. Recovery Plan for Ord's Kangaroo Rat in Alberta. (2005)
- No. 6 Recovery Plan for Burrowing Owl in Alberta. (2005)
- No. 7 Alberta Northern Leopard Frog Recovery Plan 2005-2010. (2005)
- No. 8 Alberta Greater Sage-Grouse Recovery Plan. (2005)
- No. 9 Maintenance and Recovery Plan for Western Spiderwort in Alberta 2005-2010. (2005)
- No. 10. Alberta Piping Plover Recovery Plan 2005-2010. (2006)
- No. 11. Alberta Trumpeter Swan Recovery Plan 2005-2010. (2006).
- No. 12. Recovery Plan for Soapweed and Yucca Moth in Alberta 2006-2010. (2006).
- No. 13. Alberta Shortjaw Cisco Recovery Plan 2006-2011. (2007)