*Species at Risk Act*
Recovery Strategy Series

# Recovery Strategy for the Swift Fox (*Vulpes velox*) in Canada

## Swift Fox

January 2008

Parks Canada Parcs Canada

Canada

## About the Species at Risk Act Recovery Strategy Series

**What is the *Species at Risk Act* (SARA)?**
SARA is the Act developed by the federal government as a key contribution to the common national effort to protect and conserve species at risk in Canada. SARA came into force in 2003 and one of its purposes is *"to provide for the recovery of wildlife species that are extirpated, endangered or threatened as a result of human activity."*

**What is recovery?**
In the context of species at risk conservation, **recovery** is the process by which the decline of an endangered, threatened or extirpated species is arrested or reversed, and threats are removed or reduced to improve the likelihood of the species' persistence in the wild. A species will be considered **recovered** when its long-term persistence in the wild has been secured.

**What is a recovery strategy?**
A recovery strategy is a planning document that identifies what needs to be done to arrest or reverse the decline of a species. It sets goals and objectives and identifies the main areas of activities to be undertaken. Detailed planning is done at the action plan stage.

Recovery strategy development is a commitment of all provinces and territories and of three federal agencies — Environment Canada, Parks Canada Agency and Fisheries and Oceans Canada — under the Accord for the Protection of Species at Risk. Sections 37–46 of SARA (http://www.sararegistry.gc.ca/the_act/default_e.cfm) spell out both the required content and the process for developing recovery strategies published in this series.

Depending on the status of the species and when it was assessed, a recovery strategy has to be developed within one to two years after the species is added to the List of Wildlife Species at Risk. Three to four years is allowed for those species that were automatically listed when SARA came into force.

**What's next?**
In most cases, one or more action plans will be developed to define and guide implementation of the recovery strategy. Nevertheless, directions set in the recovery strategy are sufficient to begin involving communities, land users, and conservationists in recovery implementation. Cost-effective measures to prevent the reduction or loss of the species should not be postponed for lack of full scientific certainty.

**The series**
This series presents the recovery strategies prepared or adopted by the federal government under SARA. New documents will be added regularly as species get listed and as strategies are updated.

**To learn more**

To learn more about the Species at Risk Act and recovery initiatives, please consult the SARA Public Registry (http://www.sararegistry.gc.ca/) and the web site of the Recovery Secretariat (http://www.speciesatrisk.gc.ca/recovery/default_e.cfm).

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**Additional copies:**

You can download additional copies from the SARA Public Registry (http://www.sararegistry.gc.ca/)

**Cover illustration**: Photo of a swift fox by C. Moehrenschlager used with permission.

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# DECLARATION

Under the *Accord for the Protection of Species at Risk* (1996), the federal, provincial, and territorial governments agreed to work together on legislation, programs, and policies to protect wildlife species at risk throughout Canada. The *Species at Risk Act* (S.C. 2002, c.29) (SARA) requires that federal competent ministers prepare recovery strategies for listed Extirpated, Endangered and Threatened species.

The Minister of the Environment presents this document as the recovery strategy for the swift fox as required under SARA. It has been prepared in cooperation with the jurisdictions responsible for the species, as described in the Preface. The Minister invites other jurisdictions and organizations that may be involved in recovering the swift fox to use this recovery strategy as advice to guide their actions. The Minister of the Environment will take steps to ensure that, to the extent possible, Canadians interested in or directly affected by these measures will be consulted.

The goals, objectives and recovery approaches identified in the strategy are based on the best existing knowledge and are subject to modifications resulting from new findings and revised objectives.

This recovery strategy will be the basis for one or more action plans that will provide further details regarding measures to be taken to support protection and recovery of the swift fox. Success in the recovery of the swift fox depends on the commitment and cooperation of many different constituencies that will be involved in implementing the actions identified in this strategy. In the spirit of the *Accord for the Protection of Species at Risk*, all Canadians are invited to join in supporting and implementing this strategy for the benefit of the species and of Canadian society as a whole. The Minister of the Environment will report on progress within five years.

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# STRATEGIC ENVIRONMENTAL ASSESSMENT STATEMENT

In accordance with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*, a strategic environmental assessment (SEA) is conducted on all *Species at Risk Act* (SARA) recovery strategies. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision making. Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that strategies may also inadvertently lead to environmental effects beyond the intended benefits. The results of the SEA (Forrestall 2006) are summarized below.

This recovery strategy will clearly benefit the environment by promoting the recovery of the swift fox (*Vulpes velox*). In addition, the large number of vulnerable species and the ever shrinking mixed-grass prairie ecosystems they inhabit will benefit from the additional conservation efforts afforded through this recovery strategy. This recovery strategy will also have a positive effect on aboriginal culture by promoting the recovery of the swift fox, thereby returning it to a living part of aboriginal culture. However, there is the potential for negative effects in two situations.

Two potential impacts were identified. First, it was determined that increases in swift fox populations have the potential to adversely affect populations of Sage-Grouse and black-tailed prairie dogs through potentially increased predation. These species are listed under SARA and therefore require recovery planning that will address monitoring, research and any actions that may be necessary to limit the impacts of increases in swift fox populations. In addition, there is a strategy to pursue integrating swift fox recovery into a prairie based conservation plan incorporating all existing prairie species.

Second, it is also possible that plans to alter coyote/red fox density would be proposed as a result of research into optimal coyote/red fox densities for swift fox survival. This could result in a potential negative effect on coyote and red fox populations if a reduction in populations is required. Both the coyote and red fox have abundant and secure populations so alterations to their population densities in specific locations are not likely to put them at risk. However, changes to predator prey relations for other species as a result of such a population alteration should also be taken into consideration. Any potential plans to alter the coyote/red fox density for the benefit of the swift fox should consider all alternatives (could include lethal methods, trapping and relocation, birth control, habitat modification and more). The option that has the least impact on the swift fox, the mixed-grass prairie ecosystem and other species should be chosen.

The SEA concluded that this recovery strategy will have many positive effects and not cause any important negative effects as long as the mitigation measures recommended are implemented, including any further assessments of actions identified as a result of research conducted in this recovery strategy such as any potential culling or species removal from a national park. Further information is presented in the *Strategic Environmental Assessment of the Recovery Strategy for the Swift Fox (Vulpes velox) in Canada*.

# RESIDENCE

SARA defines residence as: *a dwelling-place, such as a den, nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating* **[Subsection 2(1)]**.

Residence descriptions, or the rationale for why the residence concept does not apply to a given species, are posted on the SARA public registry: http://www.sararegistry.gc.ca/plans/residence_e.cfm.

Swift fox residences are protected from damage or destruction under the SARA. The Swift Fox Recovery Team considers dens to be residences**.**

# PREFACE

This Recovery Strategy addresses the recovery of the swift fox. In Canada, this species can be found in southeastern Alberta and southwestern Saskatchewan.

The recovery strategy for the swift fox was developed by the authors for the Parks Canada Agency on behalf of the competent minister (the Minister of the Environment). It was developed in collaboration with a recovery team whose members include representatives from provincial government wildlife and land management agencies, land managers, conservation organizations, industry, academia, Blood Tribe First Nation, Parks Canada, Environment Canada, and Agriculture and Agri-Food Canada.

# EXECUTIVE SUMMARY

- Swift foxes are found predominately in short- and mixed-grass prairie areas of North America.

- Swift foxes were previously extirpated from Canada. As of the 2006 census a small population of approximately 647 animals (1,162 animals including Montana) has been established in Alberta and Saskatchewan through reintroductions. Animals are successfully breeding in the wild, although the species is potentially at risk from predation and habitat loss.

- Major threats to swift foxes include: habitat loss, degradation and fragmentation; predation and competitive exclusion by coyotes (*Canis latrans*) and red fox (*Vulpes vulpes*); mortality from vehicles; disease; poisoning and trapping. Climate change and associated habitat changes and range shifts also contribute to an uncertain future for swift foxes.

- The long-term recovery goal: By 2026, restore a self-sustaining swift fox population of 1,000 or more mature, reproducing foxes that does not experience greater than a 30% population reduction in any 10-year period.

- To assess progress, an additional short-term recovery goal has also been described as follows: Ensure a mature, reproducing population of at least 250 foxes by 2012.

- Eight objectives have been developed to achieve the short-term goal:
    1) Determine the amount and spatial configuration of habitat required to achieve the short- and long-term population goals.
    2) Quantitatively assess the long-term population viability and then re-assess the long-term recovery goal. Determine if additional swift fox reintroductions are necessary to achieve the long-term recovery goal.
    3) Identify and initiate the securement of swift fox habitat necessary to achieve recovery goals.
    4) Develop research or modelling programs to assess the threats of intraguild competition and climate change.
    5) Ensure that accidental poisoning, trapping, and vehicular collisions do not threaten swift fox recovery.
    6) Raise awareness and support from key stakeholders for swift fox conservation and recovery.
    7) Monitor trends in swift fox abundance and spatial distribution, genetic diversity, and prevalence and distribution of high-risk diseases.
    8) Integrate swift fox recovery efforts into larger, unified conservation planning programs for co-existing prairie species.

- A comprehensive identification of critical habitat for the swift fox cannot be completed at this time. Although some elements of swift fox habitat have been determined, not enough is known to be able to calculate the exact type, amount, and location of habitat required to recover the species throughout its Canadian range. Nevertheless, results of very recent research will facilitate a partial identification of critical habitat, which will be included in an addendum to the recovery strategy. The recovery strategy addendum will be posted in June 2008. The recovery strategy includes a schedule of studies that outlines the steps necessary to complete a comprehensive identification of critical habitat for inclusion in a draft action plan, which will be ready for review and consultation by Nov 2010.

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# 1 BACKGROUND

## 1.1 Species Assessment Information from COSEWIC

**Common Name: Swift Fox**

**Scientific Name:** ***Vulpes velox***

**Assessment Summary**
**COSEWIC Status:** Endangered

**Reason for designation:** The species was previously extirpated from Canada. A small population is now established in Alberta and Saskatchewan through reintroductions. Animals are successfully breeding in the wild, although the species is potentially at risk from coyote predation and habitat loss.

**Canadian Occurrence:** Alberta and Saskatchewan

**COSEWIC Status History:** Last seen in Saskatchewan in 1928. Designated Extirpated in April 1978. Status re-examined and designated Endangered in April 1998 after successful reintroductions. Status re-examined and confirmed in May 2000. Last assessment based on an existing status report.

## 1.2 Description

Swift foxes are cat-sized canids with pale yellowish-red and grey on the upperparts peppered with white and black-tipped hairs; they average 30 cm high at the shoulders and weigh 2.2-2.4 kg (James 1823, Bailey 1926, Soper 1964). Swift foxes have a characteristic black tipped tail and black patches on either side of the muzzle (Seton 1909, Rand 1948).

Long before the Europeans named the swift fox *Vulpes velox* (or initially *Canis velox*), the native people of North America had given it a variety of common names in a diversity of languages. In fact, many First Nation cultures had fox societies, such as the Kainai (Blood Tribe) Kit Fox Society. These kit, swift, or prairie fox societies had unique apparel, haircuts, ceremonies, dances, customs, and accompaniments (Laubin 1977). The status of these societies was related directly to the Tribe's image of the fox's worth and character. For example, the "kit-fox" was the name of an extinct Piegan society that was regarded as being very powerful. It was considered dangerous even to speak of it and "of all the societies of the I-kun-uh-Kah-tsi, the Sin-o-pah, or Kit-Fox Bands, had the strongest medicine" (Wissler 1995). Kainai spirituality is influenced directly or indirectly by the sacred Kit Fox Society (Francis First Charger, pers. comm., Elder, Blood Tribe). The Blood Tribe Elders in Southern Alberta recognize the Sinopaa (swift fox) as a very important part of Kainai spirituality, and considerable interest exists in continuing to reintroduce swift foxes to their lands (Francis First Charger, pers. comm., Elder, Blood Tribe).

## 1.3 Populations and Distribution

Historically, swift foxes were widely distributed throughout the North American Great Plains but population density steadily declined throughout the late 1800's and early 1900's (Merriam 1902, Seton 1909). In Canada, the last recorded specimen, before extirpation, was collected in 1928 (Carbyn 1998). Although the last confirmed sighting of a swift fox in Canada occurred in Alberta in 1938 (Pied Piper 1950), they were not officially designated as extirpated until 1978.

The combined historical range in North America has been estimated at 1.6 million km$^2$ (Scott-Brown *et al.* 1987) but has probably always been patchy in some areas and continuous in others (Carbyn 1996).

### Canadian population and distribution

Prior to the turn of the century the distribution of swift foxes in Canada approximated the mixed prairie regions in the southern portions of Alberta, Saskatchewan, and Manitoba (Merriam 1902, Seton 1909, Rand 1948, Soper 1964, see COSEWIC 2000). Following swift fox extirpation from Canada by 1938 (Pied Piper 1950), swift foxes were reintroduced annually into southern Alberta and Saskatchewan beginning in 1983 until 1997. Additionally, in 2004, 15 swift foxes were reintroduced to Blood Tribe lands of southwestern Alberta. Numbers and distribution of foxes have been increasing since the last releases in 1997 (Moehrenschlager and Moehrenschlager 2006). Although the current population is concentrated in southeastern Alberta and southwestern Saskatchewan, occasional sightings have been documented in Suffield, AB., north of Swift Current SK., and a single sighting in Manitoba. Currently, the best estimate of extent of occurrence is 12,897 km$^2$, based on live trapping records (Cotterill 1997, Moehrenschlager and Moehrenschlager 2001) and sightings from 1996 to 2003 that were reviewed and confirmed by the Recovery Team (Figure 1).
The Saskatchewan - Alberta border area and Grasslands National Park region, which are loosely connected through the contiguous habitat in northern Montana, have an estimated 513 and 134 individuals respectively (Moehrenschlager and Moehrenschlager 2006) but it is unknown how many of these foxes are mature, reproducing individuals. (Please see IUCN Red List Criteria http://www.redlist.org/info/categories_criteria2001.html#definitions for a discussion on defining "mature"). Additionally, consecutive surveys are needed to confirm population increases and or stability. The Montana area is thought to support 515 foxes for a total of 1,162 foxes in the Canadian/Montana area (Moehrenschlager and Moehrenschlager 2006).

### Percent of Global Distribution in Canada

The estimated current U.S. distribution of swift foxes is between 505,149 km$^2$ and 607,767 km$^2$, based on an approximation of 39-42% of the historical range remaining (Sovada and Scheick 1999). Two percent of the current global distribution is found in Canada, calculated from the Canadian occurrence estimate of 12,897 km$^2$ and the midpoint of the U.S. distribution estimates.

## United States distribution

Estimates of swift fox abundance in the United States and the ability of management agencies to accurately assess these numbers are difficult to determine (Carbyn 1996). Based on vegetation mapping, Kahn et al. (1997) estimated the current geographical distribution of swift foxes in the United States as being about 40% (approximately 600,000 km$^2$) of its original range which is consistent with estimates by Sovada and Scheick (1999) (see COSEWIC 2000).

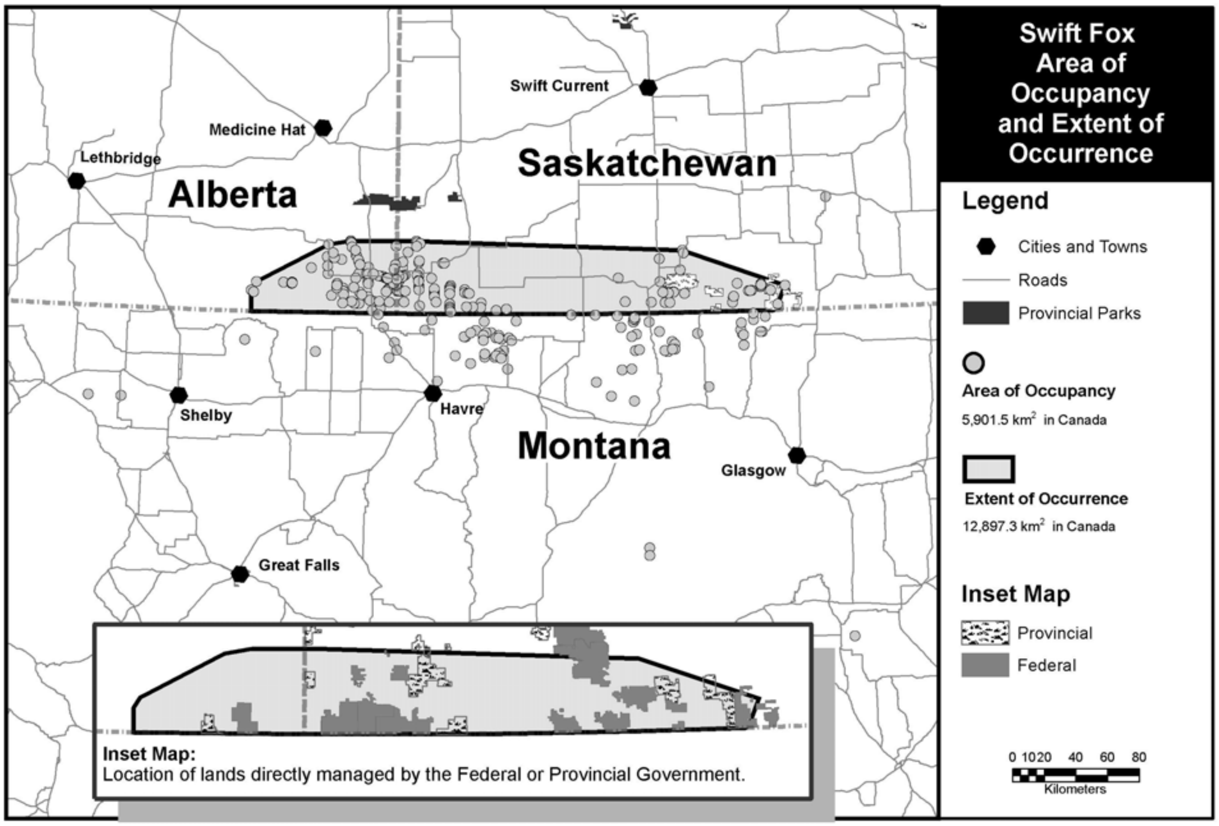


**Figure 1**. **Area of Occupancy and Extent of Occurrence in Canada**. Current area of occupancy and extent of occurrence (IUCN 2001)) are based on live trapping records (Cotterill 1997, Moehrenschlager and Moehrenschlager 2001) and sightings from 1996 to 2003 that were reviewed and confirmed by the Recovery Team. Circular areas of occupancy assume a 31.9 km$^2$ home range size and were calculated from a re-analysis of telemetry data from Moehrenschalger (2000). Exent of occurrence was calculated using a 99% minimum convex polygon.

## 1.4 Needs of the Swift Fox

### 1.4.1 Biological needs

Swift foxes are among the most den dependent of the canids and use burrows throughout the year. Availability of suitable den sites is thought to be an important factor affecting the maintenance of viable swift fox populations (Egoscue 1979, Russell 1983, Pruss 1999, Harrison and Whittaker-Hoagland 2003). Swift foxes often modify burrows such as badger (*Taxidea taxus*) holes and use them as natal and rearing den sites and as escape refugia from predators throughout the year (Herrero *et al.* 1986, Pruss 1999). Swift foxes opportunistically use a variety of foods (Pruss 1994) and a list of identified items from scats collected in Oklahoma included 13 species of mammals, four species of birds, one species each of amphibians and reptiles and 30 species of invertebrates (Kilgore 1969). On a seasonal basis, ground squirrels (*Spermophilus* spp.) and grasshoppers (*Melanoplus* spp.) are important food resources while white-tailed jack rabbits (*Lepus townsendii*) are probably the largest prey species for swift foxes in Canada (COSEWIC 2000).

### 1.4.2 Habitat needs

In Canada, the availability of mixed-grass prairie in Alberta and Saskatchewan is important for swift fox reintroduction and survival (Carbyn 1998, COSEWIC 2000, Smeeton *et al.* 2003). Swift foxes are especially well adapted to the prairies as evidenced by their opportunistic foraging strategy and use of dens for shelter and protection from predators (Pruss 1999, see reviews Allardyce and Sovada 2003, Harrison and Whitaker-Hoagland 2003, Tannerfeldt *et al.* 2003). Swift foxes do not appear to rely on open water sources (Golightly and Ohmart 1984, Pruss 1999). Swift foxes have demonstrated that they can coexist amicably with humans within a native landscape where the primary land use is extensive livestock production on native prairie.

## 1.5 Threats

### 1.5.1 Threat classification

**Table 1. Identification and Ranking of Threats**

Identification and ranking of the current (2006) threats to the survival and habitat of the swift fox (*Vulpes velox*) on the Canadian prairie (1= severe/widespread, 2= moderate/potentially widespread, 3= limited threat in scope and severity, 4= unknown).

| # | Threat | Rank |
|---|---|---|
| 1 | Habitat loss or degradation due to unsuitable agricultural practices or industrial development | 1 |
| 2 | Habitat fragmentation due to unsuitable agricultural practices and oil & gas development | 2 |
| 3 | Predation and competitive exclusion by coyotes and red fox | 2 |
| 4 | Direct mortality due to collisions with vehicles | 3 |
| 5 | Indirect mortality due to disease, poisoning or trapping | 3 |
| 6 | Climate Change | 4 |

### 1.5.2 Description of threats

#### Habitat loss, degradation, and fragmentation due to unsuitable agricultural practices or industrial development

Fragmentation and destruction of habitat are the sources of many conservation problems and are some of the primary reasons many canid populations are rare or endangered (Debinski and Holt 2000, Crooks 2002, Swihart *et al.* 2003). With habitat destruction and degradation, demographic and environmental stochasticities make small populations more vulnerable to extinction (Hill *et al.* 2002). Of the endemic Great Plains species, over 74% are listed by government agencies as species of concern (Erickson *et al.* 2004). Since swift foxes are primarily prairie specialists, grassland conversion to cropland has been one of the most important factors for the loss of swift fox habitat (Soper 1964, Hillman and Sharps 1978, Carbyn 1998). In Canada, estimates suggest that 80% or more of the native prairie landscape has been converted into agricultural use (Gauthier and Patino 1993), while about 70% of the North American Great Plains has been lost. Fragmentation continues to occur with roads, service trails, towns, and the expansion of oil and gas industry into previously isolated prairie areas (Carbyn 1998, Moehrenschlager 2000, Forrest *et al.* 2003, Samson *et al.* 2004). In the transboundary area of Saskatchewan, Alberta and Montana, the grasslands at risk of cultivation (i.e., potentially arable, that are publicly or privately owned and do not have restrictions on cultivation) total 8,247 $km^2$, which is 45% of the native grassland remaining in this area (Erickson *et al.* 2004).

### Predation and competitive interference/exclusion by coyotes and red foxes

For swift foxes, competition with and predation by coyotes (*Canis latrans*), as well as expansion of red fox (*Vulpes vulpes*) populations may be two of the most important limiting factors to swift fox movement into suitable habitat (Scott-Brown *et al.* 1986, Carbyn *et al.* 1994, Brechtel *et al.* 1996, Carbyn 1998). In the case of coyotes, expansion has been facilitated by the extirpation of the wolf from the prairie (Riley *et al.* 2004). Changes in faunal and floral species composition, ungulate grazing patterns, fire suppression, and use of pesticides and insecticides all alter the ecosystem in ways that probably influence local and seasonal prey availability (Voigt and Berg 1987, Linnell and Strand 2000). This may increase risk of interference intraguild interactions between swift foxes and other predators such as the coyote and red fox (Voigt and Berg 1987, Carbyn 1998, Linnell and Strand 2000). Killing of swift foxes by coyotes has consistently been identified as the principal cause of swift fox mortality in many studies (Covell 1992, Carbyn *et al.* 1994, Sovada *et al.* 1998, Kitchen *et al.* 1999, Moehrenschlager 2000, Smeeton and Weagle 2000, Schauster *et al.* 2002, Andersen *et al.* 2003). Additionally, avian predators are also a cause of swift fox mortality (COSEWIC 2000).

The dietary overlap between Canadian sympatric (i.e., occurring in the same area) swift and red foxes is greater than that of sympatric coyotes and swift foxes (Moehrenschlager and Sovada 2004). Consequently, the potential for exploitative competition is highest between the former. Moreover, in sympatric populations there is greater chance of a red fox – swift fox encounters than coyote - swift fox encounters because, when compared to coyotes, red foxes tend to be found in higher densities, with smaller home ranges, and they move as individuals rather than as pairs or groups (Henry 1996). Work by M. A. Sovada (unpublished data) suggests that red foxes may actually limit the expansion of swift fox populations into suitable uninhabited areas. In Canada, red fox dens were significantly closer to human habitation than coyote dens, while swift fox dens were spaced randomly (Moehrenschlager 2000). Anthropogenic change such as greater urbanization and fragmentation (e.g., oil and gas development) of native prairie may facilitate the expansion of red foxes with potentially devastating effects on swift foxes, particularly in the core areas of the population (Carbyn 1998).

In rural areas, coyotes typically avoid areas of high human activity (Roy and Dorrance 1985, Pruss 1994, Pruss 2002). This trend, coupled with coyote control, could lead to interference and exploitative competitive exclusion (i.e., situations where competition can influence species distribution) of established swift foxes by red foxes in prairie areas (Carbyn 1998, Linnell and Strand 2000, Allardyce and Sovada 2003). This effect could potentially be more damaging to swift fox recovery efforts than the direct, density dependent killing of swift foxes by coyotes. This competitive exclusion has been documented for kit foxes (*Vulpes macrotis*) (White *et al.* 1994) with their apparent displacement by red foxes (Allardyce and Sovada 2003). The fact that coyotes may be necessary to exclude red foxes suggests that scenarios exist where too many or too few coyotes could lead to the exclusion of swift foxes; determining where these equilibria fall and how they are affected by changing environmental conditions or human disturbance needs to be examined (Moehrenschalger *et al.* 2004). Currently, the extent and severity of this problem remains unknown and research into this problem should be initiated within the next five years.

### Direct and indirect human induced mortality

**Vehicle collisions**: Swift foxes are often observed near roadways and swift fox dens are often located relatively close to roads (Hillman and Sharps 1978, Hines 1980, Hines and Case 1991, Pruss 1999, Moehrenschlager 2000, Kintigh and Anderson 2005). Collisions with vehicles can be a major source of mortality particularly for juvenile foxes (Pruss 1994, Sovada *et al.* 1998, Herrero 2003). Oil and gas development includes the creation of new roads, as well as increased traffic along existing roads, which contributes to an increased risk of collisions.

**Poisoning and trapping**: Several factors are thought to have contributed to the reduction in population size and distribution of swift foxes. Bailey (1926) states that swift foxes were very easily trapped, poisoned, or caught by dogs and that they became increasingly rare after the country was settled. Widespread poison campaigns for wolves, prairie dogs, and coyotes are thought to have contributed significantly to the decline in swift fox numbers around the turn of the last century (Scott-Brown *et al.* 1987).

In both Alberta and Saskatchewan, poison bait, including strychnine, is available to producers for controlling Richardson's ground squirrels (*Spermophilus richardsonii*). Swift foxes may inadvertently consume the poison bait, directly or indirectly (i.e., secondary poisoning by eating poisoned ground squirrels). In Alberta, trained municipal staff investigates complaints of predation and can provide landowners with poison and/or snares to control predators (Joel Nicholson pers. comm. Species at Risk Biologist, Alberta Sustainable Resource Development). In both cases, although swift foxes are not the target species, accidental mortality can occur as a result of these practices. Saskatchewan has a swift fox exclusion zone (Twp 1 to 7 W of $3^{rd}$) where no predator poisoning is allowed. Power snares and free hanging snares can be used in the exclusion zone but the bottom of the snare must be at least 30 cm high and a special snaring permit is required (Sue McAdam pers. comm. Ecological Specialist, Saskatchewan Environment).

In the United States, the 1972 presidential ban on predator toxicant use (e.g., strychnine, compound 1080) on Federal lands may have contributed to recovery of swift foxes. Compound 1080 is currently being legalized in prairie areas of Saskatchewan, which will likely limit reintroduced swift fox populations. Moreover, some landowners who are attempting to protect their livestock from predation illegally use poison baits and swift foxes readily consume such baits (Moehrenschlager 2000). Current rodent and predator control activities, legal and illegal, and their effects on swift fox population viability are unknown. Best management practices and/or policy should also be developed for addressing potential increased insecticide use during grasshopper outbreaks. The Alternative Strategies and Regulatory Affairs Division of the Pest Management Regulatory Agency has reevaluated regulations regarding the use of sodium cyanide in an effort to protect swift foxes from poisoning and has proposed changes to the label to indicate: 1) a website for a swift fox range map; and 2) users must consult with the Alberta Fish and Wildlife Office in Medicine Hat or Lethbridge for approval to use this poison (Pest Management Regulatory Agency 2006).

**Disease:** Small populations are particularly vulnerable to disease outbreaks that could threaten or defeat recovery efforts (Thorne and Williams 1988). Exposure of swift foxes to canid diseases and the prevalence in different age classes and regions has not been determined in

Canada (Moehrenschager and Sovada 2004). The effects and likelihood of disease transfer between swift foxes and sympatric coyotes, red fox, and domestic dogs should be evaluated (Pybus and Williams 2003). This is critical as disease can have devastating effects on endangered canid populations (Woodroffe *et al.* 1999, Laurenson *et al.* 1998).

The long period of extirpation from the Canadian prairies is a testament to the presence of dispersal barriers and the inability of swift fox populations in Wyoming, South Dakota, and Nebraska to disperse northward and “rescue” the Canadian population. The rate and extent of disease flow is unknown but there is potential for transmission from and reservoirs in other canid species.

### Climate change

Currently, conservation strategies typically do not take into account the future effects of climate change and the challenges associated with changes in species distribution and abundance as well as geographic variation in the scale of responses to climate change (Huntley and Webb 1989, Hannah *et al.* 2002a). Although it is difficult to predict with certainty, general circulation model (GCM) simulations indicate that the trend throughout the northern Great Plains will be decreased precipitation and increased mean annual temperatures (Karl and Heim 1991, Lemmen *et al.* 1997). Globally, predictions suggest species distributional shifts to both higher elevations and latitudes (Hughes 2000). Climate vegetation modeling by Rizzo and Wiken (1992) proposes that southern Alberta and Saskatchewan may become a semi-desert. Some obvious conservation planning implications are shifts in species ranges in terms of protected area boundaries as well as maintaining populations of rare and endangered species in cases where climatic conditions for them may be deteriorating (Peters and Darling 1985, Hannah *et al.* 2002a, 2000b). These climatic changes could result in current swift fox habitats becoming unsuitable; whether any new habitat would be appropriate is unknown. Modelling of these potential effects of climate change can provide important insight into strategies for future conservation and recovery planning.

## 1.6 Knowledge Gaps and Recommended Studies

1) A quantitative evaluation of recovery habitat has not been completed at this time. The utilisation of different habitats by swift foxes is not well understood, particularly those habitat types that are considered atypical. Research is needed to assess the limited dispersal of swift foxes to seemingly suitable habitats, and to identify the barriers (physical and ecological) for more effective management and conservation (Moehrenschlager and Sovada 2004). What levels of habitat loss, degradation, and fragmentation limit the viability of swift foxes? While individual foxes occasionally utilize human-modified habitats, there is a need to understand appropriate ratios of modified to native habitat, degrees of connectivity, and the changes in habitat quality that would still allow swift fox populations to recover. In Canada, the oil and gas industry is rapidly expanding and undeveloped prairie areas are now targeted for exploration and development. The effects of disturbance and associated road and infrastructure development needs to be investigated. These activities have the potential to decrease habitat carrying capacity, alter canid interspecific interactions, and increase vehicular swift fox mortalities. Guidelines for mitigating these impacts need to be developed.

2) Currently, conservation strategies typically do not take into account the future effects of climate change and the challenges associated with changes in species distribution and abundance as well as geographic variation in the scale of responses (including habitat alteration in quality, type, and distribution) to climate change. Further modeling will be required to address the potential effects of climate change on swift foxes.

3) Swift fox exposure to canid diseases and the prevalence in different age classes and regions has not been assessed in Canada. The effects and likelihood of disease transfer between swift foxes and sympatric coyotes, red foxes, and domestic dogs should be evaluated (Pybus and Williams 2003). Antibodies to numerous disease agents have been found and canine distemper and rabies antibodies have been noted among swift foxes (Miller *et al*. 2000, Olson 2000), but it remains unclear under what conditions diseases will be expressed and what the effects might be.

4) Interspecific competition with and predation by coyotes as well as expansion of red fox populations may be two of the most important limiting factors to the movement of swift foxes into suitable habitat (Scott-Brown *et al.* 1986, Carbyn *et al.* 1994, Brechtel *et al.* 1996, Carbyn 1998). One of the strongest examples of intraguild pressure among carnivores is the killing of swift foxes by coyotes. The fact that coyotes may be necessary to exclude red foxes suggests that scenarios exist where too many or too few coyotes could lead to swift fox exclusion. Determining where these equilibria fall and how they are affected by changing environmental conditions or human disturbance should be an area for future investigation (Moehrenschlager *et al.* 2004).

5) Data on swift fox demography, disease prevalence, genetics, habitat use, and population trends should be incorporated into Population Viability Models to guide conservation planning on a provincial and/or federal basis.

6) Genetic analyses should be conducted to examine bottlenecks, genetic variability, connectivity, and dispersal distances in Canada and within isolated population fragments of the United States. It is necessary to understand the genetic viability of small populations and the genetic barriers that habitat fragmentation might pose over time. It would be important to estimate effective population size of introduced swift fox populations to determine the rates of effective to census population size (Ne/N).

7) This recovery strategy identifies many studies that, once completed, can be used to identify whether further reintroductions will be required to achieve the population goal. Currently it is unknown if further reintroductions are required.

8) Work on small mammal biomass in winter by Klausz (1997) suggests that there are differential concentrations of prey availability within various habitats of the swift fox release areas. Because little is known about the effects of land management practices and large scale grazing management on prey availability, experiments are underway in Grasslands National Park (Henderson 2005).

9) Some behavioural research has been done on swift foxes in Canada (Pruss 1994, 1999), however further research into swift fox behavioural ecology would be valuable.

10) There is a need for collaborative research approaches that address similar problems of prairie species. Unified conservation planning for these species might be the most effective way to achieve financial, political, and ecological means that will sustain grassland communities into the future.

# 2 RECOVERY

## 2.1 Recovery Feasibility

Recovery of swift foxes in Canada is determined to be feasible because the species meets all the four necessary conditions (Environment Canada 2005), as described below.

**1) Are individuals capable of reproduction currently available to improve the population growth rate or population abundance? Yes**

Following swift fox extirpation from Canada by 1938 (Pied Piper 1950), the Canadian population of swift foxes was reintroduced in 1983. By 1997, 942 foxes had been released (Carbyn 1998). These releases have established a small swift fox population in Alberta, Saskatchewan, and Montana. Results of a survey conducted in 2005-2006 indicated a three-fold increase in replicated areas of the Canadian swift fox population since the 1996-97 survey with 100% of the Canadian/Montana population being born in the wild. In the eight-year period between these two population estimates, the Alberta/Saskatchewan border subpopulation increased from 192 to 513 individuals, the Grasslands National Park region increased from 87 to 134 individuals while the Montana area is thought to support 515 foxes for a total of 1,162 foxes in the Canadian/Montana area (Moehrenschlager and Moehrenschlager 2006). Additionally, in 2004, 15 swift foxes were reintroduced to Blood tribe lands of southwestern Alberta.

**2) Is sufficient suitable habitat available to support the species or could it be made available through habitat management or restoration? Yes**

The observed growth of the reintroduced swift fox population demonstrates that there is currently sufficient habitat to support swift foxes. Further research must be done to determine how much habitat is needed to achieve the recovery goal and efforts must be maintained to protect and restore this habitat. Strategies are being developed to mitigate the threats of habitat loss and fragmentation that include securement, stewardship, and restoration.

**3) Can significant threats to the species or its habitat be avoided or mitigated through recovery actions? Yes**

Significant threats to the species include loss and degradation of habitat, habitat fragmentation, interaction and competitive exclusion with coyotes and red foxes, direct and indirect mortality, and climate change. These threats can be effectively avoided or mitigated through: (1) the use of management and stewardship actions to protect and improve habitat; (2) education, research and monitoring to support conservation and management decisions, (3) policy changes to minimize/eliminate the use of poisons, and (4) habitat and climate modelling to assess swift fox areas that are at the greatest risk from climate change and adaptive and proactive management to predict and respond to those changes.

**4) Do the necessary recovery techniques exist and are they demonstrated to be effective? Yes**

Techniques needed to ensure recovery of the species are available and include, but are not limited to: captive breeding and release techniques, wild translocations, census methodology (eg. live trapping), and telemetry. Development of a non-invasive census technique, using DNA from scats and hair, is currently underway.

## 2.2 Recovery Goals and Population Objectives

**Long-term recovery goal**:

- By 2027, restore a self-sustaining swift fox population of 1,000 or more mature, reproducing foxes that does not experience greater than a 30% population reduction in any 10-year period.

**Short-term recovery goal (5 years):**

- Ensure a mature[1], reproducing swift fox population size of at least 250 foxes by 2012.

## 2.3 Recovery Objectives (5-year):

1. Determine the amount and spatial configuration of habitat required to achieve the short- and long-term population goals.
2. Quantitatively assess the long-term population viability and then re-assess the long-term recovery goal. Determine if additional swift fox reintroductions are necessary to achieve the long-term recovery goal.
3. Identify and initiate the securement of swift fox habitat necessary to achieve recovery goals.
4. Develop research or modelling programs to assess the threats of intraguild competition and potential effects of climate change.
5. Ensure that accidental poisoning, trapping, and vehicular collisions do not threaten swift fox recovery.

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- [1] The number of mature individuals is the number of individuals known, estimated or inferred to be capable of reproduction. When estimating this quantity, the following points should be borne in mind:
- Mature individuals that will never produce new recruits should not be counted (e.g. densities are too low for fertilization).
- In the case of populations with biased adult or breeding sex ratios, it is appropriate to use lower estimates for the number of mature individuals, which take this into account.
- Where the population size fluctuates, use a lower estimate. In most cases this will be much less than the mean.
- Reproducing units within a clone should be counted as individuals, except where such units are unable to survive alone (e.g. corals).
- In the case of taxa that naturally lose all or a subset of mature individuals at some point in their life cycle, the estimate should be made at the appropriate time, when mature individuals are available for breeding.
- Re-introduced individuals must have produced viable offspring before they are counted as mature individuals.

IUCN definitions: http://www.iucnredlist.org/info/categories_criteria2001#definitions

6. Raise awareness of and support from key stakeholders for swift fox conservation and recovery.
7. Monitor the following: trends in swift fox abundance and spatial distribution, genetic diversity, and prevalence and distribution of high-risk diseases.
8. Integrate swift fox recovery efforts into larger, unified conservation planning programs for co-existing prairie species.

## 2.4 Rationale for Goals and Objectives

Population viability analysis for swift foxes has not been completed, and therefore the current long-term recovery goal (Section 2.2) is based on the COSEWIC (2004) quantitative status assessment criteria for a designation of Threatened status. Meeting this goal may lead to a downlisting by COSEWIC from Endangered to Threatened, however, future research may lead to a refinement of short- and long-term recovery goals (IUCN Red List Categories and Criteria 2001).

The swift fox population has shown a 3-fold population increase since 1996 and may be on its way to recovery. Therefore, the majority of the objectives focus on research and analyses that are needed to determine what, if anything should be done to ensure this species' recovery in Canada. The research and analyses may reveal that minimal interventions, beyond habitat restoration and securement, are needed. If it is determined that further reintroductions are required to reach recovery goals, then a reintroduction action plan will be developed.

The swift fox Recovery Team recognises and is supportive of First Nation interests such as the Blood Tribe (Kainai), which have valid cultural and spiritual reasons for swift fox (Sinopaa) reintroductions. Timelines for moving ahead with reintroductions will depend on the Blood Tribe planning process. Some of this planning can be initiated though a Blood Tribe swift fox workshop that considers both long-term and short-term goals as well as methodologies. The Recovery Team would be pleased to assist with this workshop.

## 2.5 Approaches Recommended to Meet Recovery Objectives

**Table 2. Steps to Address Threats and Meet Recovery Objectives**

| Priority | Objective # | Performance Measures | Threats addressed | Broad Approach/ Strategy | General Steps |
|---|---|---|---|---|---|
| Urgent | 1. Determine the amount and spatial configuration of habitat required to achieve the short- and long-term population goals. | • Completed GIS model with associated monitoring on the ground<br>• ID of Critical Habitat | Habitat loss | Research/ GIS Modelling | • see Section 2.6.1: Schedule of studies to identify critical habitat<br>• develop a GIS model to determine which habitats are selected by swift foxes on both the broader landscape scale and at the finer home range scale<br>• monitor range expansion/contraction in non-census years<br>• identify best locations for reintroductions if they are determined to be necessary<br>• determine effects of industrial activities on swift fox habitat |
| Urgent | 2. Quantitatively assess the long-term population viability and then re-assess the long-term recovery goal. | • PHVA model completed<br>• Parameters/ activites detrimental to swift foxes identified | Habitat loss | Research/ GIS and PHVA Modelling | • develop a population viability model using demographic, genetic, habitat, and disease parameters to determine the probability of meeting the long-term and short-term recovery goals and used to re-assess goals<br>• determine critical parameters affecting population viability<br>• determine effects of industrial activities on swift fox population<br>• assess whether further reintroductions are required |
| Urgent | 3. Identify and initiate the securement of swift fox habitat necessary to achieve recovery goals. | Recovery and/or survival habitat identified | Habitat loss | Research/ Consultation | • see Section 2.6: Schedule of Studies to identify Critical Habitat |

| Priority | Objective # | Performance Measures | Threats addressed | Broad Approach/ Strategy | General Steps |
|---|---|---|---|---|---|
| Necessary | 4. Develop research or modelling programs to assess:<br>a) the threats of intraguild competition and<br>b) climate change. | • Models and/or research program to assess habitat preferences and optimal densities of the 3 canids<br>• Models to assess potential habitat changes resulting from climate change | Intraguild interference<br><br>Habitat loss | Research/ GIS and Habitat Modelling/ Climate Modelling | • identify differences in habitat and den site selection between red foxes, coyotes, and swift foxes<br>• determine relative coyote and red fox densities that are optimal for the survival and reproduction of swift foxes<br>• identify possible impacts of climate change on current and potential swift fox habitat over the next 25, 50, and 100 years and determine the potential severity and scope of climate threats<br>• initiate strategies to cope with climate change (based on above analyses) |
| Urgent | 5. Ensure that accidental poisoning, trapping, and vehicular collisions do not threaten swift fox recovery. | BMP developed and communicated | Direct mortality | Policy/ Guidelines | • develop and effectively communicate best practices<br>• contribute to developing policy when possible<br>• develop best management practices and/or policy for addressing potential increased insecticide use during grasshopper outbreaks |

| Priority | Objective # | Performance Measures | Threats addressed | Broad Approach/ Strategy | General Steps |
|---|---|---|---|---|---|
| Necessary | 6. Raise awareness and support from key stakeholders for swift fox conservation and recovery. | Success of public outreach, awareness and education programs initiated by the recovery team and/or other agents | All threats | Education and Outreach | • inform audiences in regions with swift foxes or potential swift fox habitat about swift fox conservation<br>• communicate to landowners about stewardship programs<br>• complete effective consultation on critical habitat<br>• provide timely feedback to landowners on swift fox related research<br>• when appropriate, hire from local landowners and communities to assist in research or education activities<br>• incorporate swift fox recovery elements in school programming and increase awareness of school children regarding prairie conservation issues<br>• work with AAFC-PFRA species at risk extension program when possible |
| Necessary | 7. Monitor trends in swift fox abundance and spatial distribution, genetic diversity, and prevalence and distribution of high-risk diseases. | • Replace live-trapping with less invasive techniques for each 5-yr survey<br>• Determine disease risks and potential spread<br>• Identify genetic composition of swift foxes in the northern prairies (AB,SK, MT) | Habitat loss, direct and indirect mortality | Monitoring and Research | • improve live-trapping efficacy and develop less-invasive censusing techniques that can eventually augment or replace live-captures as a surveying technique<br>• continue the coordinated 5-year International swift fox population survey<br>• monitor range expansion/contraction<br>• assess the prevalence of canid diseases in swift foxes, their vectors, and potential effects on swift fox survival / reproductive success<br>• determine the potential rate and extent of disease spread through the population (given dispersal and gene flow parameters)<br>• determine gene flow between Canadian 'subpopulations' and contiguous areas in Montana and identify effective (versus census) population size |

| Priority | Objective # | Performance Measures | Threats addressed | Broad Approach/ Strategy | General Steps |
|---|---|---|---|---|---|
| Necessary | 8. Integrate swift fox recovery efforts into larger, unified conservation planning programs for co-existing prairie species and broader prairie conservation issues. | • Increased level of public support for recovery work on the prairies measured partly by increased stewardship and collaborative forums attended by prairie residents | all | Planning | • improve stakeholder recognition of the important biodiversity values in the region and develop collaborative forums in which local knowledge can be accessed and local interests incorporated into conservation program delivery<br>• provide direction to the Federal Species at Risk Habitat Stewardship Program on swift fox habitat securement and stewardship priorities<br>• participate in prairie conservation/endangered species related planning initiatives |

## 2.6 Critical Habitat

A comprehensive identification of critical habitat for the swift fox cannot be completed at this time. Although some elements of swift fox habitat have been determined, not enough is known to be able to calculate the exact type, amount, and location of habitat required to recovery the species throughout its Canadian range. Nevertheless, results of very recent research will facilitate a partial identification of critical habitat, which will be included in an addendum to the recovery strategy. The recovery strategy addendum will be posted in June 2008. The recovery strategy includes a schedule of studies that outlines the steps necessary to complete a comprehensive identification of critical habitat for inclusion in a draft action plan, which will be ready for review and consultation by Nov 2010.

### 2.6.1 Schedule of studies to identify critical habitat

**Table 3. Schedule of Studies**

| Action | Completion Date |
|---|---|
| 1. Based on current knowledge, determine the functional attributes of swift fox habitat that need to be maintained as part of a cumulative effects assessment of human disturbance that includes the identification of knowledge gaps and future research and monitoring priorities. This would contribute to the development of best management practices and environmental assessment mitigations. | July 2007 |
| 2. Model species' habitat to estimate habitat suitability/use based on presence/absence live trapping data. | July 2007 |
| 3. Model species' demographics to estimate population dynamics and risk of extinction concurrent with recovery goal. Combine population and suitable habitat model results in a spatially explicit PHVA (Population Habitat Viability Analysis) (or other means) to estimate the amount and location of habitat required to achieve short- and long-term recovery goals for existing Canadian populations. This analysis will be used to determine if further reintroductions are necessary. | May 2008 |
| 4. Post an addendum to the recovery strategy that identifies partial critical habitat for swift foxes. | June 2008 |
| 5. Synthesize current knowledge into a discussion paper (incorporating 1 through 3 above). Discussion Paper will include a biological description of critical habitat including maps of potential critical habitat and will explain how these maps were developed. The discussion paper will also list activities that constitute destruction of critical habitat, communicate what the Federal Policy is on effective protection, and discuss the options available for securing swift fox critical habitat in the different jurisdictions. | January 2009 |
| 6. Conduct a workshop series with stakeholder representatives in communities proximal to Canadian swift fox habitat or in regions with large amounts of potential swift fox habitat as part of comprehensive critical habitat consultations. A primary purpose of | February 2009 – July 2009 |

| Action | Completion Date |
|---|---|
| the consultation workshops is to communicate/discuss/clarify the Discussion Paper on Critical Habitat for swift foxes. Information on the potential socio-economic impacts of various critical habitat designation options would be gathered and strategies for mitigating the socio-economic impacts developed. Where possible, conduct consultation workshops collaboratively, with the Greater-Sage Grouse recovery team, in order to improve efficiency and effectiveness. | |
| 7. A draft action plan for swift foxes (including the identification of critical habitat) will be ready for the review/consultation process. Evaluate the potential ecological, social, and economic impacts of critical habitat identification, protection, and management. Develop collaboratively, with the Greater-Sage Grouse recovery team, where possible, to achieve efficiencies. Begin review/consultation process | November 2010 |

## 2.7 Effects On Other Species

Please refer to Strategic Environmental Assessment (Forrestall 2006) summary at the beginning of this document.

## 2.8 Statement on Action Plans

An action plan (that includes a delineation of critical habitat) will be (see Table 3) ready for the review and consultation process by November 2010. An addendum to the Recovery Strategy (including partial critical habitat identification) will be posted in June 2008. If it is determined that additional reintroductions are required to reach recovery goals, then a reintroduction action plan will be developed either separately, or, as part of the action plan that comprehensively delineates critical habitat. The Province of Alberta is also preparing its own swift fox Recovery Action Plan.

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