PROPOSED

Species at Risk Act
Recovery Strategy Series

Recovery Strategy for the Black-footed Ferret (*Mustela nigripes*) in Canada

Black-footed Ferret

March 2009

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/approach/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 are listed and strategies 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).

Recovery Strategy for the Black-footed Ferret (*Mustela nigripes*) in Canada [PROPOSED]

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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 black-footed ferret 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 species to use this recovery strategy as advice to guide their actions.

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 species. Success in the recovery of this species 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.

AUTHORS

This strategy was written by Joanne Tuckwell, Parks Canada Agency, Winnipeg, Manitoba and Tian Everest, Calgary Zoological Society, Calgary, Alberta, and in collaboration with the Canadian Black-footed Ferret / Black-tailed Prairie Dog Recovery Team.

ACKNOWLEDGMENTS

This document required the dedication and commitment of many organizations and individuals across North America. The editors are especially indebted to the members of the Canadian Black-footed Ferret / Black-tailed Prairie Dog Recovery Team for their extensive contributions to this strategy.

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Special thanks are extended to the participants, organizers and financial supporters of four key workshops:

- Towards a Management Strategy for Black-tailed Prairie Dogs and Black-footed Ferrets in Southwestern Saskatchewan (June 8 – 9, 2004, Val Marie, Saskatchewan)
- International Black-footed Ferret Recovery Workshop (April 1 – 4, 2005, Calgary Alberta)
- Black-footed Ferret Recovery Strategy Workshop (September 8 – 10, 2005, Val Marie Saskatchewan)
- Black-footed Ferret/Black-tailed Prairie Dog Recovery Team meeting (Sept 5 – 7, 2007 in Toronto, Ontario).

Knowledge contributions provided by the participants of these workshops are the basis for extensive sections of this document. Steve Forrest, Travis Livieri (Prairie Wildlife Research), Rurik List (Universidad Nacional Autonoma de Mexico), J. Michael Lockhart, Paul Marinari (U.S. Fish & Wildlife Service) and Randy Matchett (U.S. Fish & Wildlife Service) contributed valuable insights into black-footed ferret ecology and ferret recovery experiences in the U.S. and Mexico.

Pat Fargey and Shelley Pruss (Parks Canada Agency) provided important information and guidance on recovery strategy planning and the requirements of this document. Axel Moehrenschlager (Calgary Zoological Society) provided support throughout the writing process as well as valuable editorial contributions. Judy Toews (Parks Canada Agency) also assisted with the editing of this document. The time and valuable insights contributed by the participants of the community focus groups are also greatly appreciated.

STRATEGIC ENVIRONMENTAL ASSESSMENT STATEMENT

A strategic environmental assessment (SEA) is conducted on all *Species at Risk Act* recovery strategies, in accordance with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals* (2004). 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 their intended benefits. Environmental effects, including impacts to non-target species and the environment, were considered during recovery planning. The SEA is not a separate document, but is incorporated directly into the recovery strategy in sections 1.4.2, 1.7 and 2.7 and is summarized below.

This recovery strategy will benefit the environment by reintroducing and promoting the recovery of the black-footed ferret in an area it had historically occupied. The recovery strategy will also have indirect positive effects. Potential black-tailed prairie dog (Special Concern) colony expansion will increase habitat for species such as the Burrowing Owl (Endangered) and swift fox (Endangered) and increase prey abundance for species such as the Golden Eagle and Ferruginous Hawk (Special Concern). Potential negative effects as a result of the recovery strategy include increased disease potential, decreases in habitat such as sagebrush communities, and destruction of invertebrate communities. The importance of these effects is unknown and each has been addressed in greater detail in section 1.7. There will be significant mortality of black-tailed prairie dogs (Special Concern) due to direct predation by black-footed ferrets and there is also potential for ferret predation on Burrowing Owls (Endangered) and Greater Sage-Grouse (Endangered). However, it is believed that ferrets do not have population level effects on these species in areas of the U.S. (Rodger et al. 2004).

Mitigation of the potential negative effects on species at risk will be addressed by working cooperatively with the affected species recovery teams on a regular basis, and monitoring of ferret activities, diet and habitat use, as well as population monitoring of other species at risk in the reintroduction area. Effects on other species at risk will be closely evaluated and management strategies for the ferrets will be modified if any detrimental effects are detected. Mitigation measures for other associated species are discussed in section 2.7. Strategies to address potential negative effects will be developed prior to implementing recovery actions and will be included in the ferret action plan.

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/sar/recovery/residence_e.cfm

PREFACE

This recovery strategy addresses the recovery of black-footed ferrets in Canada. Historically black-footed ferrets were found principally in southern Saskatchewan, although they also ranged into southern Alberta.

The Parks Canada Agency led the preparation of this recovery strategy with the members of the Canadian Black-footed Ferret / Black-tailed Prairie Dog Recovery Team. This strategy was developed in cooperation with the provincial and federal agencies responsible for this species and associated habitat (Saskatchewan Environment, Saskatchewan Agriculture and Food, Prairie Farm Rehabilitation Administration, Canadian Wildlife Service) as well as the Toronto Zoo, the Calgary Zoological Society, the Royal Alberta Museum, the United States Fish and Wildlife Service, the World Wildlife Fund and Prairie Wildlife Research.

EXECUTIVE SUMMARY

The black-footed ferret (*Mustela nigripes*) is a mid-sized member of the weasel family that inhabits grassland ecosystems where prairie dogs are present (*Cynomys* spp.). Once thought to be globally extinct, black-footed ferrets have been reintroduced in the United States, but remain extirpated in Canada. Historical data suggests the ferret's range once included southern Saskatchewan and southern Alberta. Recovering and reintroducing black-footed ferrets in Canada will contribute to North American ferret conservation efforts by re-establishing a wild-functioning ferret population at the northern edge of the species' distribution.

A successful conservation breeding program has been providing black-footed ferrets for reintroduction in the U.S. and Mexico since 1991. Sufficient animals are being produced from this program to facilitate reintroductions in Canada as well. The U.S. Black-footed Ferret Recovery Implementation Team (BFFRIT), coordinated by the U.S. Fish & Wildlife Service, will apply their knowledge and experience in managing black-footed ferrets to assist in a reintroduction in Canada. Extensive analyses and planning have already been completed in an effort to prepare for this reintroduction and will be detailed in an action plan that will follow this recovery strategy. This experimental reintroduction will be adaptively managed, involving frequent monitoring to mitigate threats and bolster the population with additional individuals when necessary. The lessons learned from the Canadian reintroduction will help inform other efforts to reintroduce black-footed ferrets across the international range of the species.

The primary threats to ferret recovery are sylvatic plague, natural disease (canine distemper virus and rabies) and predation. Additional threats include poisoning of Richardson's ground squirrels and black-tailed prairie dogs (*Cynomys ludovicianus*), climate change (increased drought frequency) and reduced genetic diversity.

With only approximately 1000 hectares of prairie dog colonies in Canada, habitat limitations may present a significant challenge to ferret recovery. Black-footed ferrets are highly dependant on prairie dogs for prey and on their burrows for shelter, escaping predators, and rearing their young. Significant efforts may be required to ensure sufficient habitat exists to support the ferret recovery goal.

Black-footed ferret recovery is considered feasible in Canada. The recovery goal is to establish a wild population of black-footed ferrets in Canada with at least 80 percent probability of persisting for 20 years (i.e., less than 20 percent probability of extinction in 20 years). The determination of specific goals for population size are not feasible at this time because the number of ferrets the Canadian range will be able to support is not known. Many factors will be evaluated after the initial reintroductions to enable estimates of population goals for the future.

Recovery objectives, knowledge gaps, actions to date, specific steps to achieve the recovery objectives and measures of success are all described in this recovery strategy.

Critical habitat for black-footed ferrets is identified in this document and is defined by the limits of the prairie dog colonies in Canada based on their boundaries mapped in 2007. A list of

activities likely to result in its destruction and a schedule of studies to further refine the critical habitat are also included. An action plan outlining the proposed reintroduction methodology is currently in draft form and will be completed by September 2009. Initial releases of black-footed ferrets are proposed for the fall of 2009.

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1. BACKGROUND

1.1 Species Assessment Information from COSEWIC

Date of Assessment: May 2000

Common Name: black-footed ferret

Scientific Name: *Mustela nigripes*

Status: Extirpated

Reason for Designation: This ferret no longer occurs in the wild in Canada. Prairie dogs, the ferret's necessary and preferred prey species, are now limited to a small area of Saskatchewan.

Occurrence: Alberta, Saskatchewan, Manitoba

Status History: Extirpated by 1974. Designated Extirpated in April 1978. Status re-examined and confirmed in May 2000. Last assessment based on an existing status report.

1.2 Description

The black-footed ferret is a nocturnal, intermediate-sized member of the weasel family (Mustelidae). Both sexes have yellowish-buff fur with lighter under parts, a nearly white face and throat, black legs, a black-tipped tail and a black mask across the eyes. Adult ferrets weigh 0.75 to 1.2 kg and have a total length of approximately 0.5 meters (Anderson 1986). Females are usually about 10% smaller than males (Fitzgerald 1994).

1.3 Populations and Distribution

Black-footed ferrets are the only ferret species native to North America. Their distribution is tightly linked to that of their primary prey, black-tailed prairie dogs (*C. ludovicianus*), white-tailed prairie dogs (*Cynomys leucurus*) and Gunnison's prairie dogs (*C. gunnisoni*) (Biggins 2003). As prairie dog control measures and sylvatic plague devastated prairie dog populations, black-footed ferret populations crashed. Black-footed ferrets were thought to be globally extinct until 1981 when a small population was discovered near Meeteetse, Wyoming. All current populations of black-footed ferrets descend from this last remaining population.

Canadian distribution

Currently extirpated from Canada, the historical range of black-footed ferrets included southwestern Saskatchewan and southeastern Alberta (Figure 1; COSEWIC 2000). The last confirmed record of black-footed ferrets in Canada occurred in 1937 near Climax, Saskatchewan, in the vicinity of the Frenchman River valley. Despite the close ecological relationship between prairie dogs and black-footed ferrets, the black-footed ferret's range in Canada also appears to

have extended beyond that of prairie dogs (Laing & Holroyd 1989). This implies that historically, black-footed ferrets exploited alternative prey sources and habitats in Canada, possibly preying on Richardson's ground squirrels (*Spermophilus richardsonii).* Although there are relatively few historical records of ferrets in areas near prairie dog colonies in the Frenchman River valley, this is likely due to the fact that the colonies were in a remote area of Saskatchewan where incidental observations were unlikely and systematic surveys had not occurred.

Global distribution

Black-footed ferrets are classified as extinct by the IUCN Red List and are listed on Appendix 1 of CITES (IUCN 2006a). However, the IUCN listing has not been updated since 1994 when only preliminary reintroduction of ferrets had occurred. In the U.S., the *Endangered Species Act* lists black-footed ferrets as 'Endangered' throughout their range. However, most extant wild populations are classified as 'Experimental/Nonessential' pursuant to the Act. Reintroduction efforts have resulted in black-footed ferrets currently occurring in Montana, South Dakota, Wyoming, Arizona, Colorado and Utah.

Black-footed ferrets are not officially listed by the Mexican government. Reintroduction efforts have occurred in the Chihuahua region.

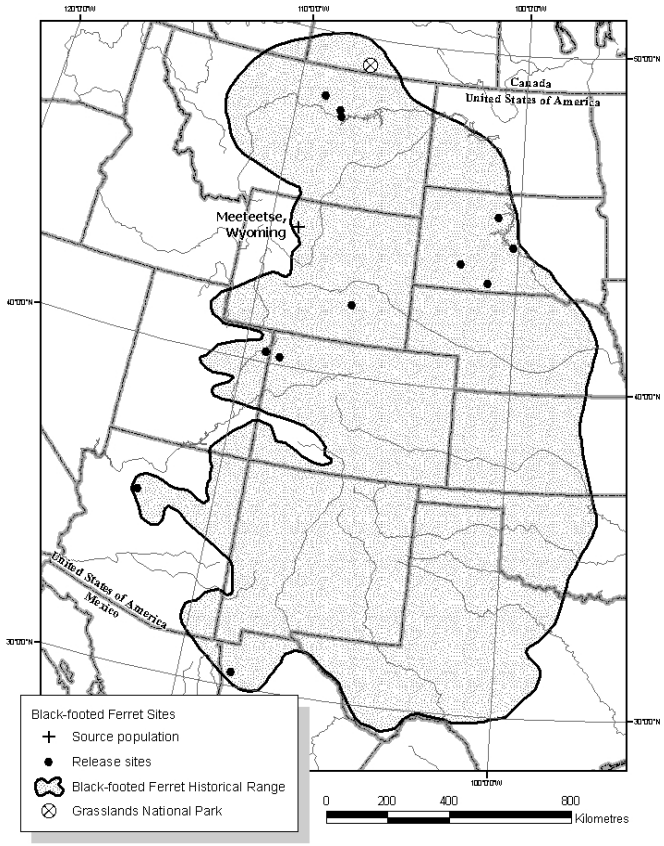

Figure 1. Black-footed ferret's historical range and reintroduction locations (Livieri, pers. comm.)

Conservation breeding program
Between 1985 and 1987, 18 wild black-footed ferrets were brought into captivity from the Meeteetse, Wyoming population in an attempt to develop a conservation breeding program. Successful breeding and husbandry techniques have been developed, and currently seven breeding facilities exist in North America. This program has produced approximately 5800 ferrets since 1987 (Marinari pers. comm.), all descended from seven founder animals. Genetic diversity and kit production are maximized within the breeding program through the Association of Zoos and Aquariums (AZA) Black-footed Ferret Species Survival Plan (SSP). This successful conservation breeding program has provided ferrets for 11 separate reintroduction sites across six U.S. states and in Mexico (Lockhart pers. comm.). Captive-bred ferrets are allocated for release by the U.S. Fish & Wildlife Service (USFWS).

The Toronto Zoo, a member of the AZA Black-footed Ferret SSP and a partner of the U.S. Black-footed Ferret Recovery Implementation Team (BFFRIT), is the only Canadian organization actively breeding black-footed ferrets for reintroduction. Since 1992, the Toronto Zoo has raised 269 kits (young), the majority of which have been reintroduced into the wild in the U.S. and Mexico. The Toronto Zoo's participation in this conservation breeding program has added a Canadian component to international ferret recovery efforts over the past 15 years.

1.4 Needs of the Black-footed Ferret

1.4.1 Habitat and biological needs

The black-footed ferret is a prairie species that inhabits semi-desert shrubland, short-grass and mixed-grass ecosystems where prairie dogs are present. Black-footed ferrets require active prairie dog colonies for their year-round habitat throughout all stages of their lifecycle. Prairie dogs comprise approximately 90% of the black-footed ferret's diet (Campbell et al. 1987; Sheets et al. 1972). Black-footed ferrets also rely on prairie dog burrows for shelter, escaping predators, and rearing their young (Miller & Forrest 1996).

Black-tailed prairie dogs, the only species of prairie dog occurring in Canada, are limited to southwestern Saskatchewan. In 2006, prairie dog colonies occurred on two privately managed ranches, as well as the Masefield Prairie Farm Rehabilitation Administration Community Pasture, the Dixon Provincial Community Pasture and Grasslands National Park of Canada. Of the 1000 hectares (ha) of prairie dog colonies occurring in Canada, approximately two-thirds are located within Grasslands National Park. Overall, surveyed colonies have been stable or increasing in size since 1994 (R. Sissons, unpublished data). Prairie dogs co-exist with cattle grazing.

Vegetation and topography have indirect effects on black-footed ferrets as they influence prairie dog colony establishment and size (Sheets et al. 1971). Both the size of the prairie dog colony and the density of prairie dogs are critical components of black-footed ferret habitat (Biggins et al. 1998); however, the relationship between these two habitat components is not well understood. The relationship between black-footed ferrets and vegetation or topography has not been studied directly. Throughout the black-footed ferret's historical range, prairie dog colonies occurred in a diversity of grass and shrub/grass communities with differing topographical relief.

This suggests that size and density of prairie dog colonies may be more important elements of black-footed ferret habitat than vegetation or topography (Forrest et al. 1985; Knowles 2005).

Prairie dog density

Biggins et al. (1993) estimated that a minimum density of 3.63 prairie dogs/ha is needed to meet the breeding requirements of black-footed ferrets. They noted that prairie dog colonies below this threshold may still support non-breeding ferrets and play a role in the persistence of ferrets. Lower density colonies could provide a buffer of replacement ferrets and may be instrumental in maintaining breeding populations over the long term.

Social behaviour may dictate a maximum black-footed ferret density regardless of prey abundance. Although more than one family group of ferrets may occasionally occupy the same area simultaneously (Paunovich & Forrest 1987; Richardson et al 1987), the solitary, territorial nature of black-footed ferrets limits their density even when prey numbers are high. Reintroduced ferret populations in South Dakota showed a minimum female territory size of approximately 30 ha even when prey density was high enough to energetically support one female per 20 ha or less (Biggins et al. 2006b). A complex of several prairie dog colonies, each with high enough density to support a female and her litter, may support more ferrets overall then would large blocks of uniform habitat by reducing the limiting effect of female territoriality (Biggins et al. 2006b).

1.4.2 Ecological role

The black-footed ferret is a highly specialized predator of prairie dogs. The tight relationship between ferrets and prairie dogs suggests a long-term association between these two species (Hillman & Clark 1980). Ferrets themselves are also prey for a range of larger mammalian and avian predators.

1.4.3 Limiting factors

The black-footed ferret is a highly specialized carnivore. The ferrets' specialization in both prey and habitat requirements makes them especially vulnerable to declines in prairie dog distribution and density. With only approximately 1000 ha of prairie dog colonies currently occurring in Canada, the availability of suitable habitat could be a significant factor limiting ferret recovery. The potential for black-footed ferrets to utilize Richardson's ground squirrels for both habitat (burrows) and prey is unknown in Canada, but the historical range of ferrets beyond prairie dog colonies suggests this is a possibility (Laing & Holroyd 1989). The significance of this limiting factor in Canada will be determined through ongoing evaluation of behaviour, survival, and population viability of both ferrets and prairie dogs.

1.5 Threats

1.5.1 Threat classification

Table 1. Threats Classification Table

'Local' refers to the Canadian population distribution; 'range-wide' refers to the North American population distribution.

1	**Sylvatic Plague**	**Threat Information**		
Threat Category	Exotic species	**Extent**	Widespread	
			Local	**Range-wide**
General Threat	Sylvatic plague	**Occurrence**	Anticipated	Current
		Frequency	Recurrent	Recurrent
Specific Threat	Increased incidence or prevalence rate of disease, reduced prey availability	**Causal Certainty**	High	High
		Severity	High	High
Stress	Increased mortality, reduced population size	**Level of Concern**	High	

2	**Natural Diseases**	**Threat Information**		
Threat Category	Natural processes or activities	**Extent**	Widespread	
			Local	**Range-wide**
General Threat	Canine distemper virus, rabies	**Occurrence**	Anticipated	Current
		Frequency	Recurrent	Recurrent
Specific Threat	Increased incidence or prevalence rate of disease, reduced prey availability	**Causal Certainty**	High	High
		Severity	Moderate	Moderate
Stress	Increased mortality, reduced population size	**Level of Concern**	Moderate	

3	**Predation**	**Threat Information**		
Threat Category	Natural processes or activities	**Extent**	Widespread	
			Local	**Range-wide**
General Threat	Carnivores that prey upon ferrets	**Occurrence**	Anticipated	Historic
		Frequency	Continuous	Continuous
Specific Threat	Predation by carnivores such as individual owls that learn to specialize on ferrets during the time shortly after release	**Causal Certainty**	High	High
		Severity	High	Low
Stress	Increased mortality	**Level of Concern**	Moderate	

4 Richardson's ground squirrel poisoning		**Threat Information**		
Threat Category	Changes in ecological dynamics or natural processes	**Extent**	Widespread	
			Local	**Range-wide**
General Threat	Richardson's ground squirrel suppression	**Occurrence**	Current	Current
		Frequency	Unknown	Continuous
Specific Threat	Reduced prey availability, consumption of poisoned prey	**Causal Certainty**	Low	Low
		Severity	Unknown	Unknown
Stress	Reduced population size, increased mortality	**Level of Concern**	Unknown	
5 Black-tailed prairie dog poisoning		**Threat Information**		
Threat Category	Changes in ecological dynamics or natural processes	**Extent**	Widespread	
			Local	**Range-wide**
General Threat	Prairie dog suppression	**Occurrence**	Historic	Current
		Frequency	Unknown	Recurrent
Specific Threat	Reduced prey availability, consumption of poisoned prey	**Causal Certainty**	High	High
		Severity	High	High
Stress	Reduced population size, increased mortality	**Level of Concern**	Low	
6 Climate change		**Threat Information**		
Threat Category	Climate and natural disasters	**Extent**	Widespread	
			Local	**Range-wide**
General Threat	Changes in weather patterns	**Occurrence**	Anticipated	Anticipated
		Frequency	Unknown	Unknown
Specific Threat	Increased frequency and/or duration of droughts	**Causal Certainty**	Low	Low
		Severity	Unknown	Unknown
Stress	Reduced prey availability, reduced reproduction rate	**Level of Concern**	Low	
7 Reduced genetic diversity		**Threat Information**		
Threat Category	Natural processes or activities	**Extent**	Widespread	
			Local	**Range-wide**
General Threat	Inbreeding depression	**Occurrence**	Unknown	Unknown
		Frequency	Continuous	Continuous
Specific Threat	Reduced genetic diversity	**Causal Certainty**	Low	Low
		Severity	Moderate	Moderate
Stress	Reduced reproduction and survival	**Level of Concern**	Low	

1.5.2 Description of threats

Threat 1 – Sylvatic plague
Sylvatic plague, caused by the bacterium *Yersinia pestis*, is one of the primary factors limiting black-footed ferret recovery in the U.S. Effective prevention or control strategies for plague are not currently available. Black-footed ferrets are highly susceptible to plague and may suffer high mortality rates on infection (Williams et al. 1994). Plague also dramatically impacts the black-footed ferret's main prey, prairie dogs. Prairie dogs have exhibited 90 to 100 percent mortality upon infection (Antolin et al. 2002; Cully & Williams 2001; Lorange et al. 2005; Stapp et al. 2004). Although it was thought that prairie dogs cannot survive in the presence of even low levels of plague, recent evidence suggests that the disease can exist in prairie dog colonies without causing widespread mortality (Hanson et al. 2007).

The main plague transmission route for prairie dogs is via the bites of infected fleas and, for ferrets, through both flea bites and direct consumption of infected prey or carrion (Butler et al. 1982; Castle et al. 2001; Rocke et al. 2004; Thomas et al. 1989). Plague-resistant mammals, such as coyotes and other rodents, may serve as reservoir hosts. Disease modeling suggests that fleas are important in the initial introduction and establishment of plague in prairie dog towns, but that transmission from a different short-term reservoir, such as a plague-resistant rodent species, may also serve a role in the dynamics of plague outbreaks (Webb et al. 2006).

At the landscape level it appears that roads, streams and lakes may serve as barriers to plague in black-tailed prairie dog colonies by affecting the movement of, or habitat quality for, either plague hosts or fleas that serve as the vector (Collinge et al. 2005). While sylvatic plague has not been documented in prairie dogs in Canada, antibodies for plague have been found in 4.2 % of rural domestic dogs and cats in southern Saskatchewan including areas near Grasslands National Park (Leighton et al. 2001).

Ultimately, control of plague in black-footed ferrets would require the control of this disease in prairie dogs. The effectiveness of several insecticides to control flea populations on prairie dogs and in prairie dog burrow systems has been investigated (Hoogland et al. 2004; Karhu & Anderson 2000; Seery et al. 2003). These studies show that insecticidal dusting during the early stages of an outbreak can stop the spread of plague, while application during later stages does not. Work is also underway to develop a vaccine against plague for use in black-footed ferrets. A small-scale clinical study found that a vaccine that has been developed offers black-footed ferrets some protection from *Y. pestis* (Rocke et al. 2006), but the duration of the protection as well as the effectiveness of the vaccine against different routes of exposure and different levels of *Y. pestis* remain unknown. The effectiveness of this vaccine over time in protecting wild black-footed ferrets against infection is currently being assessed in the U.S. While the likelihood of a sylvatic plague outbreak in the proposed ferret reintroduction area is unknown, the impacts on the ferret population could be dramatic if it occurred.

Threat 2 – Natural diseases
Canine distemper virus (CDV) is a globally distributed *Morbillivirus* virus species affecting many terrestrial carnivores and aquatic carnivores. Members of the weasel family are among the most susceptible to CDV disease (Deem et al. 2000). Blood testing shows CDV is present in wild

dog populations on the Canadian prairie, including southern Saskatchewan. Eleven of 21 swift foxes that were tested contained antibodies indicative of CDV infection (A. Moehrenschlager, unpublished data). Black-footed ferrets are extremely susceptible to CDV exhibiting nearly 100 percent morbidity and mortality when exposed experimentally and naturally (Liu & Coffin 1957; Williams et al. 1988).

Rabies, a viral disease affecting the central nervous system, has been documented in Saskatchewan (CFIA 2006). The implementation of an effective ferret vaccination protocol for rabies, such as has been done in the U.S., effectively addresses this threat.

A range of other diseases may pose a low risk level to wild black-footed ferrets in Canada, but are not a deterrent to the reintroduction of ferrets. These diseases include:

- Tularemia (*Francisella tularensis*)
- Parvovirus
- Toxoplasmosis (*Toxoplasma gondhii*) – seen in captive black-footed ferret populations
- Coccidiosis – higher morbidity and mortality in captive black-footed ferret populations
- Cryptosporidiosis (*Cryptosporidium parvum*) – seen in captive black-footed ferret populations
- Influenza
- Blastomycosis (*Blastomyces dermatidis*).

Threat 3 – Predation

Numerous mammalian and avian predators, such as coyotes and Great Horned Owls, occur in southwestern Saskatchewan and may prey on black-footed ferrets. Predation has been a problem at reintroduction sites, causing up to 95% of the documented mortality of ferrets (Breck et al. 2006). Review of data from South Dakota and Montana indicates that removal of individual Great Horned Owls causing significant ferret mortality can be beneficial but that lethal control of coyotes and the use of electric fencing does not enhance short- or long-term survival of reintroduced ferrets (Breck et al. 2006). This review also indicates that the data are confounded by a variety of factors and that further studies are needed to properly address the effectiveness of predator management for enhancing ferret survival.

In the Grasslands National Park area the Great Horned Owl (*Bubo virginianus*) population is currently artificially high. Great Horned Owls typically occur in woodlands that contain some open habitat (Houston et al 1998) not in prairie grassland ecosystems. However, abandoned buildings and shelter belts have altered the mixed-grass prairie of southwestern Saskatchewan to the extent that Great Horned Owls are now one of the most common raptors nesting in Grasslands National Park (Sissons pers. comm.). This could lead to significant mortality of ferrets by Great-Horned Owls and the need for removal of individual owls.

Threat 4 - Richardson's ground squirrel poisoning

Poisoning of Richardson's ground squirrels is widespread outside Grasslands National Park. Though ferrets prey almost exclusively on prairie dogs throughout their range in the U.S., the historic range of ferrets suggests that they may have utilized alternate prey sources in Canada (Clark et al. 1985; Laing & Holroyd 1989). As a result, the consumption of poisoned Richardson's ground squirrels may result in ferret mortality outside Grasslands National Park.

Threat 5 – Black-tailed prairie dog poisoning
Prairie dogs are protected against unlicensed killing on provincial and private lands and are fully protected on lands managed by Parks Canada (Government of Canada 2000; Government of Saskatchewan 1998; Government of Saskatchewan 1981). No permits have been issued for prairie dog poisoning; however, it is possible that illegal poisoning of prairie dogs could occur outside Grasslands National Park. Indirect poisoning via the consumption of contaminated prey could cause ferret mortalities outside Grasslands National Park.

Threat 6 – Climate change
Conservation strategies must consider the effects of climate change, the challenges associated with changes in species distribution and abundance, and geographical variation in the scale of responses to climate change (Hannah et al. 2002; Huntley & Webb 1989). Many studies suggest that the northern plains will experience decreased precipitation and increased mean annual temperature (Karl & Heim 1991; Lemmen et al. 1997; Rizzo & Wiken 1992). Such climatic changes will undoubtedly affect primary productivity in the prairie ecosystem impacting prairie dogs and, in turn, black-footed ferrets. While the extent of this impact is unclear, prairie dog densities have been observed to decline by 80 percent in response to drought (Sissons pers. comm.). Drought is believed to impact ferret reproduction more than adult survivorship with fewer kits produced in association with drought (Miller et al. 2005). The predicted climate change could exacerbate multi-year droughts which may result in the inability of ferret populations to recruit breeding females, as their life expectancy is less than three years.

Threat 7 - Reduced genetic diversity
Loss of genetic variation can reduce individual fitness (fecundity and survival) including the ability to resist disease and the potential for populations to adapt to environmental change (Altizer et al. 2003; Lacy 1997). The loss of the Great Plains populations of black-footed ferrets and the population bottleneck associated with the establishment of the conservation breeding program greatly diminished the species' genetic diversity (Wisely et al. 2002). Due to habitat limitations, the Canadian black-footed ferret population will likely always be small. Preliminary modeling suggests that inbreeding depression has the potential to reduce population viability and that these effects will be greater and experienced sooner in smaller populations (Miller et al. 2005).

1.6 Actions Already Completed or Underway

A successful conservation breeding program has been providing black-footed ferrets for reintroduction in the U.S. and Mexico since 1991. Sufficient animals are being produced from this program to facilitate reintroductions in Canada as well. BFFRIT will apply their in-depth knowledge and experience in the reintroduction and management of black-footed ferrets to assist with ferret recovery in Canada. Extensive analyses and planning have already been completed in an effort to prepare for this reintroduction and will be detailed in an action plan that will follow this recovery strategy.

A number of initiatives have been completed or are underway to consolidate knowledge gained through black-footed ferret recovery efforts in the U.S. and Mexico and to develop a ferret recovery strategy and action plan for Canada. These include:

Workshops and meetings

- Potential of Black-footed Ferret Recovery in Canada (May 24-25, 2003, Val Marie, Saskatchewan)
  Representatives from government agencies and potential partners investigated the feasibility of initiating black-footed ferret recovery efforts in Canada, leading to the formation of formal workshops.
- Towards a Management Strategy for Black-tailed Prairie Dogs and Black-footed Ferrets in Southwestern Saskatchewan (June 8-9, 2004, Val Marie, Saskatchewan)
  This workshop brought together 27 scientists and managers from the U.S. and Canada specializing in biological, ecological and management aspects of black-footed ferrets, black-tailed prairie dogs and associated species. The main goal was to share information and advice in order to inform decisions regarding black-footed ferret recovery and black-tailed prairie dog conservation in Canada. This workshop led to the formation of Canada's Black-footed Ferret / Black-tailed Prairie Dog Recovery Team.
- International Black-footed Ferret Recovery Workshop (April 1-4, 2005, Calgary Alberta)
  Facilitated by the IUCN Conservation Breeding Specialist Group, this population viability analysis workshop brought together 29 black-footed ferret and black-tailed prairie dog scientists and managers from Canada, the U.S. and Mexico to form ferret population goals and recovery strategies for Canada and Mexico. Management and research recommendations were also developed.
- Black-footed Ferret Recovery Strategy Workshop (September 8-10, 2005, Val Marie, Saskatchewan)
  Utilizing the expertise of those involved in black-footed ferret recovery in the U.S. and input from affected local stakeholders, key elements of the Black-footed Ferret Recovery Strategy, USFWS Ferret Allocation Request and Black-tailed Prairie Dog Management Plan were outlined by the recovery team.
- Community Focus Groups (November 14-17, 2006, Val Marie, Saskatchewan)
  Seven focus group sessions, moderated by a social science specialist from Parks Canada's Western and Northern Service Centre, were conducted with various stakeholders from the Val Marie area to assess the current knowledge about black-footed ferrets, the level of support for ferret reintroduction and to identify potential concerns around ferret recovery.
- Black-footed Ferret and Black-tailed Prairie Dog Recovery Team meeting (December 5-6 2006, Val Marie Saskatchewan)
  Team members and invited Parks Canada Agency staff gathered for two days to discuss components of the draft black-footed ferret recovery strategy and to provide input and edits for the final draft.
- Black-footed Ferret and Black-tailed Prairie Dog Recovery Team meeting (September 5-7 2007, Toronto Zoo, Toronto, Ontario)
  Team members and key U.S. ferret recovery specialists gathered for three days to discuss components of the draft black-footed ferret recovery strategy and action plan and prairie-dog management plan.

Knowledge consolidation

- Black-footed Ferret and Black-tailed Prairie Dog Communication Plan – Draft 1.0 (G. Holroyd & M. Franke 2005)
- An ecological review of the black-footed ferret with special reference to prairie dog habitat in southwestern Saskatchewan (C.J. Knowles 2005)
- A plague response plan – currently under development by Parks Canada and Claire Jardine (University of Guelph) in conjuction with Saskatchewan Environment, Saskatchewan Health and Health Canada

Research and monitoring

- Black-tailed prairie dog colony mapping and density counts in Grasslands National Park (Parks Canada – ongoing)
- Assessment of disease risk for black-footed ferret reintroductions in Grasslands National Park (C. Jardine, G. Crawshaw and T. Shury)
- Evaluation of the viability of the black-tailed prairie dog metapopulation in Canada (T. Stephens, D. Gummer, and D. Bender – ongoing)
- Baseline monitoring of Burrowing Owl populations, productivity and distribution in Grasslands National Park and adjacent black-tailed prairie dog colonies (G. Holroyd and H. Trefry – ongoing)

1.7 Knowledge Gaps

Many knowledge gaps exist because no scientific studies have been conducted on black-footed ferrets in Canada. With the last confirmed record of a black-footed ferret in Canada occurring in 1937, existing knowledge is based on research in the U.S. and Mexico. This leaves many unknowns around the behaviour of ferrets at the northern edge of their range, their biological and ecological characteristics, and the way they interact with co-existing species. Monitoring the ferrets and the effects of the ferret reintroduction on other species will allow adaptive management of the reintroduced ferret population, reveal any unique considerations regarding ferret recovery in the Canadian Great Plains, and allow threats to be evaluated and mitigated when necessary. Working closely with black-footed ferret recovery committees in the U.S. and Mexico and coordinating recovery efforts on a continental level will benefit recovery of black-footed ferrets across North America. Unifying conservation planning for related prairie species may also create the political, financial and ecological means needed to sustain grassland communities into the future.

1. The extent to which ferrets in Canada will use alternative prey sources (e.g., Richardson's ground squirrels) is unknown.

2. Sylvatic plague is severely restricting the recovery of black-footed ferrets in the U.S. and Mexico. Plague has been detected in rural domestic dogs and cats in southwestern Saskatchewan (Leighton et al. 2001), but plague levels are unknown in wild dog and rodent populations. The species that act as reservoirs and/or vectors for this disease are also unknown in Canada.

3. Insecticidal dusting of prairie dog burrows has been used in many areas in the U.S. to reduce the risk of epizootic sylvatic plague outbreaks. Dusting burrows with deltamethrin and/or vaccinating ferrets against plague has increased ferret survival two-fold (Rocke et al. 2006). The long-term impact of dusting on invertebrate populations and other species inhabiting prairie dog colonies, such as Burrowing Owls (*Athene cunicularia hypugaea*) is unknown.

4. The extent of predation on reintroduced ferrets is not well known and makes it difficult to predict for the Canadian reintroduction. The effectiveness of predator management for enhancing ferret survival is also unknown.

5. The carrying capacity of Grasslands National Park and surrounding areas to support black-footed ferrets is unknown. As black-footed ferrets prey primarily on prairie dogs throughout their range, a better understanding of black-tailed prairie dog population dynamics is needed to refine the carrying capacity for ferrets. Evaluating the viability of black-tailed prairie dogs based on demography, spatial distribution, disease risk, habitat characteristics/requirements, predation, weather and climate is necessary to facilitate recovery actions for ferrets. Canadian prairie dog populations may also behave differently from those in the U.S. or Mexico due to their location at the extreme northern edge of the species' distribution. For example, prairie dogs in Grasslands National Park hibernate for approximately four months per year in dense family groups, appear larger in mass and do not experience the same level of human disturbance and population control measures as those in the U.S. (Miller et al. 2005; Rodger et al. 2004). Factors such as these may impact the habitat requirements of ferrets. Once our understanding of carrying capacity is improved, short-term and long-term goals for population size can be formulated.

6. Climate change may alter species population levels and distribution. Evidence suggests that drought decreases prairie dog populations in Grasslands National Park (Miller et al. 2005), underlining the importance of understanding the impacts of climate on black-footed ferret prey species and predator/prey interactions. Understanding the impacts of climate change may become increasingly important to the recovery of black-footed ferrets.

7. Little is known about either black-footed ferret behaviour or the demographic characteristics of ferret populations at the northern edge of the species' range. This includes, but is not limited to, ferret sociality, survivorship, productivity, movement and dispersal patterns, prey selection and how these are affected by a ferret's age, sex, reproductive state and history (captive or wild born).

8. The effects of black-footed ferret recovery on other species at risk in Canada are unknown. Black-tailed prairie dogs, the ferrets' primary prey, are themselves listed as Special Concern (COSEWIC 2006). Ferret releases in the U.S. do not appear to have resulted in declines of prairie dog populations (Rodger et al. 2004). In Canada, however, black-tailed prairie dogs are already susceptible to declines because they occur in a small area with a relatively small population size, are threatened by plague, and are geographically isolated at the edge of the species range (COSEWIC 2000b). Unlike

southern prairie dog species, Canadian black-tailed prairie dogs use extensive hibernation to facilitate over-winter survival (Gummer 2005). White-tailed prairie dogs in the U.S. hibernate and sustain predation by ferrets, but they are much more dispersed and solitary during the winter whereas Canadian black-tailed prairie dogs hibernate in large family groups (Gummer 2005). This behaviour may predispose black-tailed prairie dogs in Canada to particularly intensive predation by ferrets.

Burrowing Owls (Endangered) live on prairie dog colonies (COSEWIC 2006). While the impact of ferret predation on Burrowing Owl populations is unknown, expert opinion suggests it is likely to be minimal (Rodger et al. 2004). Burrowing Owls occur on almost every current ferret reintroduction site in the U.S. and there appears to be no impact of ferret predation at the population level (Livieri pers. comm.). The direct impact of ferrets on Greater Sage-Grouse is also unknown, but thought to be minimal (Rodger et al. 2004).

Black-footed ferret recovery may impact other species through ferret habitat expansion. While increasing ferret habitat may be beneficial for some species such as the Burrowing Owl, it could be detrimental to others, such as the Greater Sage-Grouse.

2 RECOVERY

2.1 Recovery Feasibility

The recovery of black-footed ferrets in Canada is considered feasible because the species meets the four necessary conditions (Environment Canada 2005) described below:

1. **Are individuals capable of reproduction currently available to improve the population growth rate or population abundance? Answer: Yes**
   A very successful black-footed ferret conservation breeding program currently exists based on founder stock collected in the mid 1980s from the last remaining population of wild black-footed ferrets in Meeteetse, Wyoming. This conservation breeding program balances the goal of maximizing genetic diversity with the goal of maximizing kit production (CBSG 2004). The breeding program is spread across seven facilities in the U.S. and Canada to prevent genetic loss due to a catastrophic event. Since 1987, approximately 5800 black-footed ferrets have been born in captivity (Marinari pers. comm.). This includes a Canadian black-footed ferret breeding program at the Toronto Zoo which extends back to 1992 and produces ferrets for the AZA Black-footed Ferret SSP and reintroduction efforts in the U.S. and Mexico.

   Although the allocation of ferrets must be balanced across recovery efforts throughout North America, BFFRIT strongly supports the recovery of ferrets in Canada and will strive to ensure sufficient ferrets are available (Lockhart pers. comm.).

   The black-footed ferret conservation breeding program is based on only seven founder animals, raising some concerns about the genetic viability of the population. However, the expression of inbreeding depression is highly species and population specific. The

North American regional black-footed ferret studbook database is currently being modified to allow a systematic evaluation of the relationship between inbreeding coefficients and population viability rates (Miller et al. 2005). Despite a moderate level of inbreeding (the average inbreeding coefficient approaches F=0.12), there is no anecdotal evidence suggesting the occurrence of inbreeding depression in the captive population (Miller et al. 2005).

Ferret recovery efforts in the U.S. show that captive bred ferrets do successfully reproduce in the wild (CBSG 2004). Nearly every captive bred female breeds in the first breeding season after release and their litter sizes are similar to those of more experienced wild ferrets (Livieri pers. comm.). Despite the loss of genetic diversity associated with the small founder population and more than a decade of subsequent captive breeding, neither female fecundity nor juvenile survival appears affected (Wisely et al. 2002). Several U.S. ferret reintroductions that utilized captive bred ferrets are now self-sustaining including Conata Basin and Cheyenne River Sioux Tribe, South Dakota; Shirley Basin, Wyoming and Aubrey Valley, Arizona (Livieri pers. comm.).

2. **Is sufficient suitable habitat available to support the species, or could it be made available through habitat management or restoration? Answer: Yes**
The primary limiting factor to black-footed ferret recovery in the U.S. is lack of sufficient habitat of adequate size and configuration. Influences that negatively affect the size of prairie dog colonies and the density of prairie dogs within colonies reduce the suitability of black-footed ferret habitat (Rodger et al. 2004). Habitat fragmentation can render remaining prairie dog colonies unsuitable for black-footed ferrets if the distance between the colonies becomes too great to create sufficient ferret habitat across the greater prairie dog complex or if ferret movement between colonies is impeded. Successful ferret movement between colonies is less likely and the total ferret population that can be supported is reduced as prairie dog colonies become smaller or more widely separated (Bevers et al. 1997). That being said, relatively limited amounts of black-footed ferret habitat do not always hinder recovery efforts. Experiences in the U.S. show that reintroduction efforts on smaller prairie dog colonies can be successful. For example, 36 ferrets were released at Heck Table, a subcomplex within Conata Basin, South Dakota measuring less than 1000 ha. No additional supplementation of ferrets occurred after the initial release in 1999. Yearly monitoring shows this population has been self-sustaining for seven years (Livieri pers. comm.).

Population viability analysis (PVA) modeling of black-footed ferrets in the Conata Basin, South Dakota shows that approximately 4,047 ha of prairie dog colonies connected by a maximum distance of 1.5 km are required to sustain a ferret population with greater than 90 percent probability of persistence over 100 years (CBSG 2004). Though PVA modeling provides a useful tool, many unknowns around ferret behaviour and demographics in Canada make it difficult to accurately predict the number of ferrets the habitat will support before ferrets are released. For example, the ‘island’ arrangement of Canadian prairie dog colonies may be beneficial in supporting higher numbers of ferrets than the larger blocks of more uniform habitat. Biggins et al. (2006b) suggest that ‘island’ arrangements of prairie dog colonies with high enough density to support just one female

and her litter reduce the limiting effect of female territoriality and, thereby, support more ferrets overall than large blocks of uniform habitat. Five of nine ferret litters in Mellette County, South Dakota were raised on colonies less than 16 ha in size (Hillman et al. 1979). Ferrets may also utilize alternative prey sources more extensively as the historical range map in Canada suggests. Post-release monitoring of ferrets will provide the best assessment of habitat requirements. Should strategic increases in prairie dog colony numbers or size be required to meet the recovery goal, effective techniques exist to expand the prairie dog colonies in a directed manner (Bly-Honness et al. 2004; Hof et al. 2002; Johnson & Collinge 2004; Merriman et al. 2004; Milne-Laux & Sweitzer 2006).

Currently, approximately 1000 ha of black-tailed prairie dogs exist in Grasslands National Park and the surrounding area. Though it is difficult to predict, preliminary estimates suggest that current prairie dog colonies within Grasslands National Park may support approximately 30 ferrets, a population size that would be highly vulnerable to extinction and would likely require on-going supplementation (Miller et al. 2005). Based on knowledge gained through black-footed ferret recovery efforts in the U.S. and Mexico, the long-term target of a carrying capacity of 50 ferrets is suggested for Canada (Miller et al. 2005).

The limited habitat available in Canada should not preclude reintroductions of ferrets in Canada. However, intensive monitoring of ferrets, prairie dogs, and other species at risk will be necessary to ensure that subsequent recovery actions can proceed adaptively with detailed information regarding successes, challenges and effects on other species.

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

Significant threats to black-footed ferrets have been identified as: sylvatic plague, natural diseases, Great-Horned Owl predation, poisoning of Richardson's ground squirrels and black-tailed prairie dogs, climate change and reduced genetic diversity. All threats, except sylvatic plague, can be effectively addressed with the actions outlined below.

Mitigations for Threat 1 – Sylvatic plague

There are currently no effective prevention or control strategies for sylvatic plague, although insecticide dusting of prairie dog burrow systems can aid in halting the spread of plague in the early stages of an outbreak (Hoogland et al. 2004; Karhu & Anderson 2000; Seery et al. 2003). Managing prairie dog colonies in such a way that some colonies remain isolated from the larger complexes may offer some protection in the event of a plague outbreak.

Although sylvatic plague is prevalent in the ecosystem and has the ability to dramatically reduce both prairie dog numbers and black-footed ferret viability if a disease outbreak occurs, the potential impacts of this disease should not deter the reintroduction of ferrets to Canada. A sylvatic plague outbreak has not been documented in Canadian prairie dogs and may not occur despite its presence in the environment. For example, coyotes consistently test positive for plague in some ferret reintroduction sites in the U.S., such as Aubrey Valley, Arizona, but a plague outbreak has not occurred (Livieri pers. comm.). In

addition, the previously accepted belief that the ferret's main prey, prairie dogs, could not survive in the presence of even low levels of plague may not hold true. Recent evidence suggests that plague can exist in prairie dog colonies without causing widespread prairie dog mortality (Hanson et al. 2007).

American ferret recovery efforts also yield differing outcomes for plague outbreaks post-ferret release. In many cases, a plague outbreak results in the demise of the ferret population and the discontinuation of the site for further reintroductions. However, in the case of Shirley Basin, Wyoming, the effects of a plague outbreak appear to have been overcome. Two hundred thirty-eight ferrets were released at Shirley Basin between 1991 and 1993. A plague outbreak subsequently occurred and it was assumed that no ferrets survived. The site was not managed or monitored until 1997 when five ferrets were found; this number increased to 12 in 2000 and to 196 in 2006 (Livieri pers. comm.). Although plague is a serious threat and the risk to the population is unknown, recovery efforts should not be stalled due to lack of knowledge. Even a failed reintroduction attempt will increase knowledge and contribute to North American ferret conservation.

Mitigation for Threat 2 – Natural diseases

Natural disease threats can be effectively addressed through proper quarantine and vaccination protocols. Black-footed ferret reintroductions in the U.S. have shown that canine distemper virus can be addressed by vaccinating all released and wild-born ferrets with Purevax Ferret® (Merial, Athens, Georgia, 30601, U.S.A). A vaccine booster should be administered. A single vaccination with Imrab 3® (Merial, Athens, Georgia, 30601, U.S.A.) provides ferrets with sufficient protection against rabies infection. Working with local residents to ensure that all domestic dogs maintain a current rabies and canine distemper virus vaccination status will also reduce this threat. All other natural diseases present only low level threats.

Mitigation for Threat 3 – Predation

Pre-release conditioning of captive-born black-footed ferrets significantly reduces mortality (Biggins et al. 1999). Therefore, releasing only pre-conditioned captive-born or wild translocated ferrets will minimize the predation threat. Should an individual predator, such as a Great-Horned Owl, begin to specialize on preying upon ferrets to the extent that an entire ferret release group is threatened, that particular individual will be removed from the ferret reintroduction area.

Mitigation for Threats 4 through 7

In Canada, existing legislation that prohibits the unlicensed killing of black-tailed prairie dogs provides a legal tool to protect ferret habitat. Black-footed ferrets are listed as 'Extirpated' under the *Species at Risk Act* and *The Wildlife Act* of Saskatchewan, making killing, harming, harassing or capturing black-footed ferrets, as well as destroying their residence or critical habitat illegal (Government of Canada 2002; Government of Saskatchewan 1998, 1981). The remaining threats can be effectively avoided or mitigated through:

- supplementation of the ferret population at key points to reduce extinction risks from genetic loss,

- education, research and monitoring to support conservation and management decisions,
- implementation and enforcement of existing legislation (*Species at Risk Act*, *Canada National Parks Act*, *The Wildlife Act* of Saskatchewan and Saskatchewan Wildlife Regulations), and
- landowner agreements and inter-agency cooperation.

4. **Do the necessary recovery techniques exist and are they demonstrated to be effective? Answer: Yes**
   The first releases of black-footed ferrets occurred in the U.S. in 1991. Since then, the techniques required to recover black-footed ferrets have been developed and demonstrated to be effective. These include, but are not limited to: captive breeding, pre-release conditioning, release and wild translocation techniques, monitoring and census methodology, and disease management protocols. Canada will benefit greatly from the BFFRIT's many years of experience in reintroducing ferrets.

2.2 Recovery Goal

The recovery goal is to establish a wild population of black-footed ferrets in Canada that has at least an 80 percent probability of persisting for 20 years (i.e. less than 20 percent probability of extinction in 20 years). This level of viability is a significant milestone because it is commonly used as a quantitative indicator of endangerment (COSEWIC 2004; IUCN 2006b).

2.3 Recovery Objectives

These objectives are for the 5-year time period following the final posting of this document on the SARA Registry:

1. Develop and maintain broad sector support for black-footed ferret recovery and conservation, with emphasis on key stakeholders.
2. Reintroduce black-footed ferrets in Canada.
3. Ensure that other species at risk populations are not adversely affected by black-footed ferret recovery.
4. Determine the factors affecting carrying capacity of ferret habitat in Canada in order to establish short-term and long-term population goals.
5. Integrate black-footed ferret recovery efforts into larger conservation planning and actions for co-existing prairie species.

An accurate understanding of the maximum number of ferrets for which there is theoretically enough habitat (i.e. carrying capacity) is a prerequisite for estimating the viability of the black-footed ferret population. Unfortunately, current estimates of carrying capacity for ferrets in Canada are imprecise, although expert opinion suggests that additional habitat will be required. Studies of released ferrets and the characteristics and dynamics of the prairie dog population will be necessary to improve estimates of carrying capacity and consequently, the amount of habitat required to achieve the recovery goal.

Once the current carrying capacity for ferrets has been estimated, a strategic long-term plan for developing sufficient habitat to achieve the recovery goal can be developed. This may encompass lands outside Grasslands National Park and potentially beyond the current distribution of prairie dog colonies. Preliminary population models based on expert opinion indicate that achieving the recovery goal may necessitate an increase of 500 to1100 ha of prairie dog colonies in order to achieve a carrying capacity of at least 40 ferrets, assuming female ferrets each require 55 to 80 ha of habitat (Miller et al. 2005; Rodger et al. 2004). This model will be refined using the results of future research projects. The engagement of stakeholders and conservation partners is necessary to assist in the development and implementation of a program to increase the number and size of prairie dog colonies through voluntary habitat stewardship and land securement programs. If additional habitat is required, this will be addressed in conjunction with the development of revised recovery strategy/action planning documents that includes cooperation and consultation with the relevant parties.

Black-footed ferret populations will require monitoring as the population may need periodic supplementation to prevent extirpation. Infrequent supplementation may be required even after achieving the recovery goal. The recovery of a Canadian population of black-footed ferrets will contribute to the North American conservation of ferrets by re-establishing a wild-functioning ferret population at the northern edge of the species' distribution. This population would be primarily affected by natural factors, thus providing opportunities for natural selection to occur.

Stakeholder Considerations

Focus group surveys of regional stakeholders showed that there is broad support for black-footed ferret reintroduction and recovery (Bowman 2006). However, landowners and the Rural Municipality of Val Marie have expressed significant concerns about the implications of a ferret reintroduction on the management of black-tailed prairie dog populations and Richardson's ground squirrels. Most of the concern is due to the uncertainty of how these issues will be handled. Before a black-footed ferret reintroduction is attempted these concerns need to be satisfactorily addressed in the black-footed ferret action plan and black-tailed prairie dog management plan.

2.4 Approaches Recommended to Meet Recovery Objectives

Table 2. Summary of recovery objectives and strategies for recovery (Critical = without which the population will decline; Necessary = needed to evaluate and guide recovery; Beneficial = beneficial to recovery).

Objective	Priority	Broad Strategy	Threat addressed	Specific Steps
1. Develop and maintain broad sector support for black-footed ferret recovery and conservation, with emphasis on key stakeholders	Necessary	Consultation, education, visitor experience and community outreach	All threats	• Assess the initial attitude of potentially affected stakeholders, key agencies and the local community towards black-footed ferret recovery and measure the attitude changes over time. • Finalize and implement a communication plan to effectively inform/involve local, regional and national audiences about black-footed ferret recovery and conservation as well as prairie dog management. As part of this communication strategy develop visitor experience opportunities for park visitors, volunteers, and regional stakeholders to assist research and monitoring activities and receive educational opportunities from ferret and prairie dog management specialists. • Develop a stewardship program to reduce risk of accidental ferret mortality due to poisoning and to encourage landowner acceptance of prairie dogs and their habitat. • Work with local residents to ensure that domestic dogs obtain a current rabies and canine distemper virus vaccination status to reduce the threat of disease to the ferrets. • When appropriate, hire persons from local communities to assist in research, monitoring or education activities. • Provide timely feedback to landowners and potentially affected stakeholders on black-footed ferret related research.
2. Release black-footed ferrets in Canada	Critical	Research; Planning	All threats	• Complete an action plan and submit a ferret allocation request to the U.S. Black-footed Ferret Implementation Team to obtain ferrets for release. • Release black-footed ferrets on well-connected prairie dog colonies along the Frenchman River, Saskatchewan. The number of ferrets allocated for release in Canada will determine the number and location (possibility of release outside of the park) of reintroduction sites. The first ferret releases are proposed for the fall of 2009. • Monitor black-footed ferret population size, demographics and genetics. • Support the US Fish & Wildlife Service and the AZA Black-footed Ferret Species Recovery Plan

Objective	Priority	Broad Strategy	Threat addressed	Specific Steps
3. Ensure that other species of at risk populations are not adversely affected by black-footed ferret recovery	Necessary	Research; Monitoring		• Conduct pre and post-ferret reintroduction surveys of species at risk populations occurring in the ferret release area. • Mitigate adverse affects of ferret recovery on other species at risk in conjunction with relevant recovery teams.
4. Determine the factors affecting carrying capacity of ferret habitat in Canada in order to establish short-term and long-term population goals	Necessary	Research	Sylvatic plague; Natural diseases; Climate change.	• Map prairie dog colonies at least every 2 years. • Monitor density of prairie dogs on a sub-sample of colonies each year. • Estimate the number of ferrets that the current habitat can support. • Quantify demographic rates for prairie dogs and how these are affected by seasonal weather patterns (such as drought) and predation. • Improve population viability analysis as new information becomes available. • Evaluate the extent of predation on the ferrets and methods to manage such predation if necessary. • Evaluate ferret prey selection and habitat selection in Canada.
5. Integrate black-footed ferret recovery efforts into larger conservation planning and actions for co-existing prairie species	Necessary	Communication and collaboration	All threats	• Integrate black-footed ferret recovery into more comprehensive prairie conservation/species planning initiatives and collaborate with other Canadian recovery teams to explore landscape scale conservation initiatives that may benefit all species concerned. • Integrate ferret recovery into prairie conservation education programming. • Hold a meeting of prairie SAR recovery teams annually to coordinate recovery approaches and action planning. • Work in partnership with black-footed ferret recovery committees in the U.S. and Mexico to coordinate black-footed ferret recovery on a continental basis.

2.5 Performance Measures

An adaptive management approach should be used whereby new information feeds back into the recovery process on a regular basis in order to take advantage of new tools, knowledge, challenges and opportunities. A five-year evaluation of our progress in achieving the recovery objectives will be based on the performance measures listed below, using 2008 as the benchmark year.

- The Management Plan for Black-tailed Prairie Dogs in Canada has been written, and broad sector support, especially in key stakeholders, for black-footed ferret recovery has been developed and maintained.
- An approved black-footed ferret action plan that successfully addresses stakeholder concerns has been completed.
- Black-footed ferrets have been reintroduced to Canada.
- The number of ferrets that can currently be supported by existing habitat has been estimated.
- The short and long-term recovery goals have been developed and refined.
- Populations of prairie dogs and Burrowing Owls on prairie dog colonies have been monitored within the ferret release region and any necessary mitigations implemented.

2.6 Critical habitat

2.6.1 Identification of the black-footed ferrets' critical habitat

An initial step in achieving the recovery goal will be to establish a population of black-footed ferrets in the prairie dog colonies along the Frenchman River in Saskatchewan. The critical habitat needed to support this phase of ferret recovery in Canada is defined by the limits of the boundaries of the prairie dog colonies in Canada as of 2007 (Figure 2), but excludes all existing roads and their ditches within these boundaries. This includes prairie dog colonies within the current boundary of Grasslands National Park, the Masefield Community Pasture (Prairie Farm Rehabilitation Administration, Agriculture Canada), the Dixon Community Pasture (Province of Saskatchewan), on provincially leased land and privately deeded land. The colonies that occur on lands managed by two landowners, which are on a combination of private and provincially leased lands, are within the boundary of the proposed Grasslands National Park. As part of the 1988 Parks Canada – Province of Saskatchewan Grasslands National Park establishment agreement, section 12.1 specifies that "Saskatchewan agrees to manage the proposed national park in a manner that recognizes the need to maintain the lands in their existing natural state for park purposes prior to the transfer of administration and control of such lands to Canada." This implies that those lands and prairie dog colonies within the proposed park boundary are afforded some protection. The management of the black-tailed prairie dog colonies will be specified in a Species at Risk Act compliant black-tailed prairie dog management plan.

Ferret populations will be monitored for five years post-release and the number of ferrets that the existing habitat can support will be estimated, as well as their usage of additional habitats. This information will be used to determine whether existing critical habitat can support the recovery

goal. If additional habitat is required, this will be addressed in conjunction with the development of revised recovery strategy/action planning documents that includes cooperation and consultation with the relevant parties.

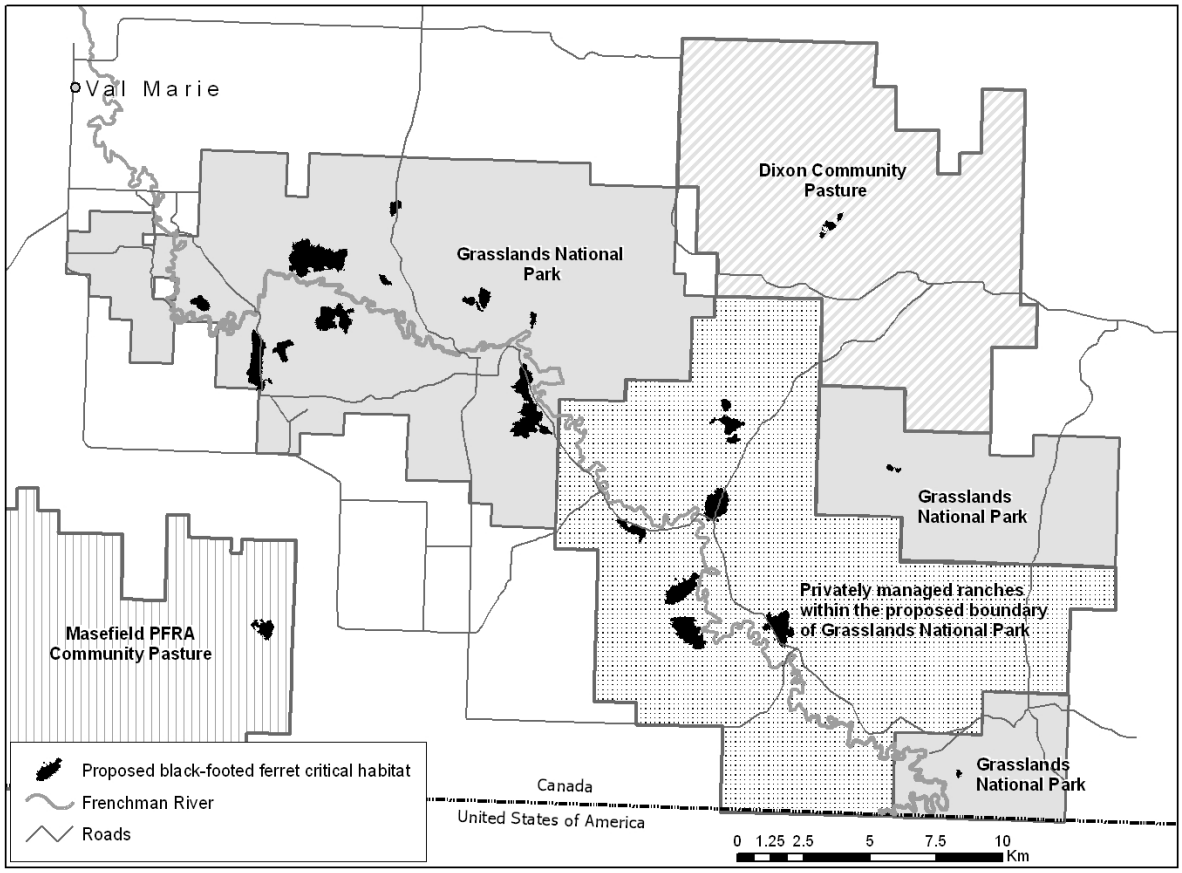

Figure 2. Proposed critical habitat for the black-footed ferret in Canada.

Because the identification of additional habitat may be needed to achieve the long-term ferret recovery goal, several of the recovery actions outlined in Table 3 are prerequisite activities to determine the location of potential habitat. Parks Canada may also conduct research on the techniques to expand existing prairie dog colonies or establish new prairie dog colonies.

2.6.2 Examples of activities likely to result in destruction of critical habitat

Critical habitat for black-footed ferrets is destroyed when ferrets can no longer use any portion of a prairie dog colony for feeding, obtaining shelter and raising young. This happens when burrows collapse, fill in with soil or water or are excavated or otherwise blocked. Critical habitat is also destroyed if the vegetation community is changed dramatically and becomes too tall or obstructive, causing difficulty for ferrets in movement between burrow holes to obtain shelter, or increasing potential cover and perching opportunities for predators. The prairie dogs maintain this vegetation at levels suitable for the ferrets. Destruction of the critical habitat could happen

due to physical alteration of the land or if the prairie dogs on a colony are destroyed and the colony is therefore no longer maintained. The fact that some pastures contribute to ferret habitat is evidence of the importance of large-scale grazing ecosystems. Proper grazing management and associated activities are compatible with critical habitat. Creation of new shallow pipelines may be compatible with critical habitat. Management practices that do not constitute destruction of critical habitat include the use and maintenance of:

- existing fence lines;
- existing shallow water pipelines and dugouts;
- salting locations;
- existing prairie tracks for vehicles including two-track trails; and
- existing and emergency fire guards.

Some examples of activities that may result in destruction of critical habitat, include, but are not limited to:

- cultivation;
- gravel extraction;
- industrial exploration, development and infrastructure;
- construction of new permanent fire guards;
- deliberate flooding or filling;
- anthropogenic development (including roads or buildings); and
- destruction of enough prairie dogs (ie. shooting, poisoning or other killing activity) to destroy the function of the prairie dog town for a ferret (ie. ability to obtain food and maintain habitat)

In contrast, pre-existing agricultural activities, like sustainable livestock grazing, are compatible with critical habitat for ferrets. Existing roads are not included in the description of critical habitat and therefore road maintenance activities are not likely to result in destruction of critical habitat.

Only some of these activities alone, such as cultivation and flooding, are likely to destroy critical habitat. However, there are probably thresholds or threshold zones of habitat loss, habitat fragmentation, and changes to habitat conditions beyond which their cumulative effects would jeopardize the ability to achieve the recovery population and distribution objectives (Huggett 2005, Lindenmayer & Luck 2005, Jager et al. 2006, Bets et al. 2007, Rhodes et al. 2008). The cumulative effects of some combination of these activities could alter the habitat attributes and functions beyond a threshold necessary to achieve the population and distribution objectives for the species' recovery. Unfortunately these threshold values are unknown for ferret critical habitat at the time of writing of this document.

2.6.3 Schedule of studies for identification of critical habitat

Table 3. Studies linked to identification of critical habitat of black-footed ferrets in Canada

Action	Completion date
Complete the Action Plan for the Black-footed Ferret in Canada and reintroduce ferrets.	September 2009
Monitor ferrets post-release and estimate carrying capacity of current prairie dog colonies.	August 2011
Monitor success of reintroduction and determine necessity of increasing prairie dog colonies inside and outside Grasslands National Park.	March 2011
Incorporate black-footed ferrets into a multi-species action plan and identify ferret critical habitat in conjunction with other species that share the same habitat.	June 2011

2.7 Effects on Other Species

The impact of black-footed ferret recovery activities on co-existing species in Canada is largely unknown (see Knowledge Gaps section 1.7). A brief summary of the potential effects of ferret recovery on non-target species, natural communities and ecological processes is provided in Table 4.

Working cooperatively with the affected species' recovery teams can mitigate many of the identified negative effects of black-footed ferret recovery on co-existing species. The effects on other species will be closely monitored and a meeting of all prairie recovery teams will be proposed each year to discuss issues that impact multiple species. Conducting proper pre-release quarantine procedures on all black-footed ferrets, and maintaining current CDV and rabies vaccination status for all released and wild-born ferrets can reduce the potential for negative disease effects. Minimizing the effects of increasing prairie dog colonies as much as possible can mitigate negative impacts on the habitat of other species. This can be accomplished by avoiding the expansion of prairie dog colonies in areas where rare plants or sagebrush communities occur. Insecticidal dusting of prairie dog burrows may be conducted as part of a plague response plan if the onset of sylvatic plague is detected in a prairie dog colony. This can have a positive effect on the prairie dogs and ferrets but a negative effect on the invertebrate fauna.

Ferrets, prairie dogs and other potentially affected species will be monitored closely post-release and any significant effects on other species at risk will be mitigated in conjunction with the relevant species at risk recovery teams. These mitigation measures will be outlined in the ferret action plan. Although not anticipated, if a species at risk becomes clearly imperilled due to the effects of ferrets, the ferrets may have to be removed from the area. If this is found to be the case, the decision to remove ferrets will be made on recommendation by the jurisdictions on the Saskatchewan Species at Risk Coordinating Committee with advice from the relevant recovery teams.

Table 4. Potential effects of black-footed ferret recovery actions on co-existing non-target species and natural communities

Species or community	Anticipated effect	Impact of effect	Likelihood of occurrence	Importance of effect
Black-tailed prairie dogs (Special Concern)	Direct predation by black-footed ferrets	Unknown, may be negative	Certain	Unknown (May be negligible, but could affect population levels if combined with stressful conditions such as drought and hibernation.)
	Increase in habitat	Positive	Probable	Moderate
	Increased disease risk	Negative	Possible	Unknown (See section 1.7.)
Burrowing Owls (Endangered)	Direct predation on adults, young and eggs by ferrets	Negative	Possible	Unknown [See section 1.7. Burrowing owls occur on almost every current ferret reintroduction site in the U.S. with no apparent impact of ferret predation on the owls at the population level (Livieri pers. comm.).]
	Increased nesting habitat with expansion of prairie dog colonies	Positive	Probable	Unknown
	Increased disease potential with expansion of prairie dog colonies	Negative	Possible	Unknown (See section 1.7)
Swift foxes (Endangered)	Increased habitat through prairie dog colony expansion	Positive	Possible	Low [Other habitat elements and predation may be greater limiting factors (Moehrenschlager et al. 2004).]
Greater Sage-Grouse (Endangered)	Predation of eggs and young by ferrets	Negative	Possible	Unknown (Not thought to be important in the U.S. ferret recovery program. See Section 1.7.)
	Habitat loss through prairie dog colony expansion	Negative	Possible	Negligible. (The prairie dog expansion being considered in this strategy is limited in scope and will occur away from sage grouse nesting habitat.)
Mountain Plovers (Endangered)	Predation on adults, young and eggs by ferrets	Negative	Unlikely	Negligible (No recent nests found in the Grassland National Park region.)
	Increase habitat availability through prairie dog colony expansion	Positive	Possible	Low (No recent nests found in the Grassland National Park region despite the existence of prairie dog colonies.)
Plains bison	Decreased grazing capacity with prairie dog colony expansion	Negative	Possible	Negligible (Very low grazing levels planned for Grasslands National Park.)
Prairie rattlesnakes	Increased prey availability through predation on ferrets	Positive	Probable	Unknown
	Increased habitat availability through increases in prairie dog colonies	Positive	Probable	Unknown

Species or community	Anticipated effect	Impact of effect	Likelihood of occurrence	Importance of effect
Golden Eagles and Ferruginous Hawks (Special Concern)	Increased prey availability with increased prairie dog populations	Positive	Probable	Low
Richardson's ground squirrels	Direct predation by ferrets	Negative	Probable	Unknown (Although black-footed ferrets prey almost exclusively on prairie dogs in the U.S., historical data suggests ferrets may have exploited alternative prey sources more extensively in Canada. See sections 1.3 and 1.4.1.)
Invertebrates	Increased mortality through insecticidal dusting for sylvatic plague control	Negative	Possible	Unknown (Dusting also affects non-target endemic and beneficial invertebrates that provide prey for insectivorous species. See section 1.7.)
Herptiles	Direct predation by ferrets	Negative	Unlikely	Negligible (Black-footed ferrets feed almost exclusively on prairie dogs. See section 1.4.1.)
	Increase habitat availability through prairie dog colony expansion	Positive	Possible	Low (Herptiles in Grasslands National Park do not appear to rely extensively on prairie dog colonies for habitat.)
Rare plants	Habitat loss through prairie dog colony expansion	Negative	Possible	Low (Prairie dog colony expansion can be conducted in a manner that avoids areas with rare plants.)
	Increase habitat availability	Positive	Possible	Low (Rare plants in Grasslands National Park do not appear to rely extensively on prairie dog colonies.)
Late successional native prairie	Decreased biodiversity of endemic or unknown species through prairie dog colony expansion	Negative	Possible	Low (Prairie dog colony expansion can be conducted in a manner that avoids areas with rare plants.)
Sagebrush communities	Reduction of sagebrush habitat	Negative	Probable	Moderate (Prairie dog colony expansion can be conducted in a manner that avoids areas with rare plants.)
Other native predators	Increased mortality or displacement for common ferret predators	Negative	Possible	Low (Predation mortality will be primarily reduced by preconditioning release ferrets. See section 2.1.)

Species or community	Anticipated effect	Impact of effect	Likelihood of occurrence	Importance of effect
	Increased risk of disease (sylvatic plague, CDV and/or rabies)	Negative	Possible	Low (The presence of sylvatic plague, CDV and rabies has already been documented in southern Saskatchewan. All released ferrets will undergo appropriate quarantine procedures and be vaccinated for CDV and rabies. See section 2.1.)
	Increase prey availability through prairie dog colony expansion and ferret themselves	Positive	Probable	Low

2.8 Statement on Action Plans

The Action Plan for Black-footed Ferrets in Canada will be completed by September 2009.

3 GLOSSARY

Carrying capacity: the maximum theoretical population that an area will support without deterioration.

Fecundity: the potential reproductive capacity of an organism or population, measured by the number of gametes (eggs), seed set or asexual propagules.

Kit: the young of a ferret.

Morbidity: the rate of incidence or prevalence of a disease.

Vector: an organism, such as a mosquito or tick that carries disease-causing microorganisms from one host to another.

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Personal Communications

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