Species at Risk Act
Recovery Strategy Series

Recovery Strategy and Action Plan for the Black-tailed Prairie Dog (*Cynomys ludovicianus*) in Canada

Black-tailed Prairie Dog

2021

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For copies of the recovery strategy, or for additional information on species at risk, including the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Status Reports, residence descriptions, action plans, and other related recovery documents, please visit the Species at Risk (SAR) Public Registry[1].

Cover illustration: *Cynomys ludovicianus*. Photo: Stefano Liccioli/Parks Canada, 2019.

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[1] http://sararegistry.gc.ca/default.asp?lang=En&n=24F7211B-1

Preface

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996)[2] agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of recovery strategies and action plans (for species for which recovery has been deemed feasible) for listed Extirpated, Endangered, and Threatened species. They are also required to report on progress within five years after the publication of the final document on the Species at Risk Public Registry.

This document has been prepared to meet the requirements under SARA of both a recovery strategy and an action plan. As such, it provides both the strategic direction for the recovery of the species, including the population and distribution objectives for the species, as well as the more detailed recovery measures to support this strategic direction, outlining what is required to achieve objectives. SARA requires that an action plan also include an evaluation of the socio-economic costs of the action plan and the benefits to be derived from its implementation. It is important to note that the setting of population and distribution objectives and the identification of critical habitat are science-based exercises and socio-economic factors were not considered in their development. The socio-economic evaluation only applies to the more detailed recovery measures. The recovery strategy and action plan are considered part of a series of documents that are linked and should be taken into consideration together, along with the COSEWIC status report.
The Minister of Environment and Climate Change and Minister responsible for the Parks Canada Agency (PCA) is the competent minister under SARA for the Black-tailed Prairie Dog and has prepared this combined recovery strategy and action plan, as per sections 37 and 47 of SARA. To the extent possible, it has been prepared in cooperation with Saskatchewan Ministry of Environment, Saskatchewan Ministry of Agriculture, Environment and Climate Change Canada, and in consultation with former community pasture boards and local landowners, as per sections 39(1) and 48(1) of SARA.

Success in the recovery of this species depends on the commitment and cooperation of different constituencies that will be involved in implementing the directions set out in this strategy and will not be achieved by Environment and Climate Change Canada, the Parks Canada Agency or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this strategy for the benefit of the Black-Tailed Prairie Dog and Canadian society as a whole. Implementation of this recovery strategy and action plan is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

[2] http://registrelep-sararegistry.gc.ca/default.asp?lang=en&n=6B319869-1#2

The recovery strategy sets the strategic direction to arrest or reverse the decline of the species, including identification of critical habitat to the extent possible. It provides all Canadians with information to help take action on species conservation. When critical habitat is identified, either in a recovery strategy or an action plan, SARA requires that critical habitat then be protected.

In the case of critical habitat identified for terrestrial species including migratory birds SARA requires that critical habitat identified in a federally protected area[3] be described in the *Canada Gazette* within 90 days after the recovery strategy or action plan that identified the critical habitat is included in the public registry. A prohibition against destruction of critical habitat under ss. 58(1) will apply 90 days after the description of the critical habitat is published in the *Canada Gazette*.

For critical habitat located on other federal lands, the competent minister must either make a statement on existing legal protection or make an order so that the prohibition against destruction of critical habitat applies.

For any part of critical habitat located on non-federal lands, if the competent minister forms the opinion that any portion of critical habitat is not protected by provisions in or measures under SARA or other Acts of Parliament, or the laws of the province or territory, SARA requires that the Minister recommend that the Governor in Council make an order to prohibit destruction of critical habitat. The discretion to protect critical habitat on non-federal lands that is not otherwise protected rests with the Governor in Council.

Acknowledgments

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Parks Canada reviewers: Joanne Tuckwell, Darien Ure

[3] These federally protected areas are: a national park of Canada named and described in Schedule 1 to the *Canada National Parks Act*, The Rouge National Park established by the *Rouge National Urban Park Act*, a marine protected area under the *Oceans Act*, a migratory bird sanctuary under the *Migratory Birds Convention Act, 1994* or a national wildlife area under the *Canada Wildlife Act* see ss. 58(2) of SARA.

Executive Summary

The Black-tailed Prairie Dog (*Cynomys ludovicianus*) is a diurnal, semi-fossorial, herbivorous, colonial ground squirrel (family Sciuridae). It is distributed from Saskatchewan, Canada through the United States to the states of Chihuahua and Sonora in northern Mexico. In Canada, the species is restricted to the lower Frenchman River Valley and adjacent areas in southwestern Saskatchewan. The species was last assessed as Threatened by COSEWIC in 2011 and listed under the *Species at Risk Act* in 2018.

There are unknowns regarding the feasibility of recovery of the Black-tailed Prairie Dog as presented in the recovery feasibility summary section. In keeping with the precautionary principle, this recovery strategy has been prepared as per section 41(1) of SARA, as would be done when recovery is determined to be technically and biologically feasible.

Primary threats to the Black-tailed Prairie Dog in Canada include drought and sylvatic plague, both of which are documented to cause significant population declines, and are expected to occur with increasing frequency with current climatic trends. Considering its small size and isolation, the Canadian Black-tailed Prairie Dog population may have limited ability to recover after significant and/or consecutive crashes associated with these threats. The social and economic conflict between the species and ranching operations also severely limits the availability of habitat for restoring the species at the landscape scale. In this sense, it should be noted that while this document has been developed in consultation with former community pasture boards and local landowners, this process did not lead to consensus between all parties on all points. Most municipal governments and ranchers still dispute the accuracy of historic populations, population trends, the necessity of expanding the active range of Black-tailed Prairie Dogs, and the potential for economic impacts, and are therefore not supportive of this recovery document.

This document has been prepared to meet the requirements under SARA of both a recovery strategy and an action plan. As such, it provides both the strategic direction for the recovery of the species as well as the more detailed recovery measures to support this strategic direction, outlining what is required to achieve the objectives. The population and distribution objective is to ensure, by 2040, at least 80% probability of persistence of the Canadian Black-tailed Prairie Dog population over 50 years (i.e., 2040-2090) within its known range in Canada, and maintain i) a minimum area of occupancy of 1,400 ha, measured as a moving average over a 6-year period, distributed across a minimum of 20 prairie dog colonies currently existing; and ii) a minimum average population density of 7.5 individuals/ha, measured as a moving average over a 6-year period across visual count plots. In order to meet this objective, one or more of the following broad recovery actions may be required: (i) minimize the risk of plague outbreak by implementing different strategies for plague management (e.g., preventive and emergency dusting, sylvatic plague vaccine and Fipronil); (ii) restore and/or establish up to 600 ha of additional Black-tailed Prairie Dog colonies on

currently unoccupied habitat in Grasslands National Park to reduce the risk of population extirpation under current climate change projections; and (iii) conduct population management (e.g., captive breeding, conservation translocation, supplemental feeding), should research determine that these measures are necessary and effective for species survival and recovery. Given the uncertainty associated with key threats to the species (i.e., climate change, sylvatic plague), the precise combination and relative contribution of these individual activities toward reaching the population and distribution objective will be assessed through the Population Viability Analysis, expert opinion and upon evaluation of their feasibility. Furthermore, new ecological data and refined modelling tools may lead in the future to revised projections and consequently, revised management targets. Notwithstanding this uncertainty, the targets and objectives identified within this document are intended to maintain >80% probability of persistence of the Black-tailed Prairie Dog in Canada over 50 years. Acknowledging and understanding the long history of conflict with ranching operations, and managing the species in ways that facilitate coexistence with stakeholders are deemed critical for long-term conservation of the Black-tailed Prairie Dog.

Preliminary results obtained through a Population Viability Analysis suggest that approximately 2,000 ha of occupied Black-tailed Prairie Dog colonies may help increase the probability of persistence of the population, if no other active management actions are implemented. Standardized monitoring of Black-tailed Prairie Dog colony extents in Canada provided an accurate estimate of the critical habitat that could be identified at this time. This corresponds to the maximum extent of Black-tailed Prairie Dog colonies during 2002-2019, which total 1,400 hectares. A schedule of studies has been developed to provide the information necessary to identify areas suitable for natural or assisted establishment of new prairie dog colonies and/or expansion of existing colonies, in order to increase population resilience and meet the population and distribution objective. The identification of additional critical habitat may be included in a revised recovery strategy or action plan when the information becomes available.

Measures proposed in this recovery strategy and action plan are expected to have limited socio-economic impact and place minimal to no additional restrictions on land use outside of Grasslands National Park. Should additional restrictions apply (e.g., excavation), Saskatchewan Ministry of Agriculture will work with lessees on agricultural Crown land to accommodate land use requests in a way that balances the need to support sustainable grazing while protecting critical habitat. The majority of the costs of implementing this plan will be covered by Parks Canada and additional costs to society will be minimal. Benefits will include positive impacts on recovery of associated species at risk, greater awareness and appreciation of the value of biodiversity to Canadians, and opportunities for engagement of stakeholders, partners and visitors.

Recovery Feasibility Summary

Based on the following four criteria that the Government of Canada uses to establish recovery feasibility, there are unknowns regarding the feasibility of recovery of the Black-tailed Prairie Dog. In keeping with the precautionary principle, this recovery strategy and action plan has been prepared as per section 41(1) of SARA, as would be done when recovery is determined to be technically and biologically feasible. This plan addresses the unknowns surrounding the feasibility of recovery.

1. Individuals of the wildlife species that are capable of reproduction are available now or in the foreseeable future to sustain the population or improve its abundance. Yes, a breeding population exists and it is distributed over a minimum of 20 colonies, as of 2019. Population size range between 3,008 and 20,851 individuals >1-year-old, based on data on population density (i.e., number of individuals within visual count plots) and colony extent collected in 2013-2019. Since these estimates include females that have not yet reached sexual maturity, the number of individuals actually capable of reproduction is possibly lower.

2. Sufficient suitable habitat is available to support the species or could be made available through habitat management or restoration. Yes. Eighteen of 20 colonies are located within the West Block of Grasslands National Park. A maximum of 14,062 hectares of habitat (with 5,600 ha and 8,462 ha located in lowlands and uplands, respectively) are estimated to be available for natural or assisted establishment of new prairie dog colonies and/or expansion of existing colonies. Outside Grasslands National Park, two colonies currently exist but availability of additional habitat for prairie dog restoration is limited by the extent of farmland and challenged by the social and economic conflict between the species and ranching operations.

3. The primary threats to the species or its habitat (including threats outside Canada) can be avoided or mitigated.
Unknown. Although several knowledge gaps still exist, the primary threats to the Black-tailed Prairie Dog are identified to be sylvatic plague and drought (COSEWIC 2011, Stephens et al. 2018). For both threats, the frequency of occurrence is expected to increase due to climate change. It is unknown whether increases in these threats due to climate change can be avoided or mitigated.

4. Recovery techniques exist to achieve the population and distribution objectives or can be expected to be developed within a reasonable timeframe.
Yes. It is biologically and technically feasible to mitigate sylvatic plague at the current frequency and intensity of occurrence, restore native prairie, translocate individuals and restore or establish prairie dog colonies. However, the Canadian Black-tailed Prairie Dog population is small, fragmented, and isolated from the nearest colonies and colony complex in the US. It is therefore recognized that the recovered condition of this species may continue to be associated with an assessed status of Threatened (D criterion – Restricted population).

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1. COSEWIC* Species Assessment Information

* COSEWIC (Committee on the Status of Endangered Wildlife in Canada)

Date of Assessment: November 2011

Common Name (population):
Black-tailed Prairie Dog

Scientific Name:
Cynomys ludovicianus

COSEWIC Status:
Threatened

Reason for Designation:
This small mammal is restricted to a relatively small population in southern Saskatchewan. The change in status from Special Concern to Threatened is based mainly on the threat of increased drought and sylvatic plague, both of which would be expected to cause significant population declines if they occur frequently. Drought events are predicted to increase in frequency due to a changing climate. Sylvatic plague was first recorded in 2010. Although the majority of the Canadian population is in a protected area, it exists within a small area and is isolated from other populations, all of which are located in the United States.

Canadian Occurrence:
Saskatchewan

COSEWIC Status History:
Designated Special Concern in April 1978. Status re-examined and confirmed in April 1988, April 1999 and November 2000. Status re-examined and designated Threatened in November 2011.

2. Species Status Information

The Black-tailed Prairie Dog is ranked globally as Least Concern on the IUCN Red List and is ranked G4-Apparently Secure under the NatureServe Global Conservation Status Rank System. The species' range extends from southern Canada through the United States into northern Mexico, with the Canadian population occupying less than 1% of the species' global range. In Canada, the NatureServe National and Provincial conservation status ranks for the Black-tailed Prairie Dog are N2-Imperiled and S2-Imperiled, respectively, due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors. The species was first assessed and designated Special Concern by COSEWIC in April 1978. The status was reassessed and confirmed as Special Concern in April 1988, April 1999 and November 2000 due to the population's relatively small size and isolation from the United States and a risk of sylvatic plague. In November 2011 the status was re-examined and designated Threatened, COSEWIC Status Criteria D2 due to the threat of increased drought and sylvatic plague. As of 2018, the Black-tailed Prairie Dog is listed as Threatened on Schedule 1 of the federal *Species at Risk Act* (SARA).

3. Species Information

3.1 Species Description

The Black-tailed Prairie Dog is a diurnal, semi-fossorial, herbivorous, colonial ground squirrel endemic to North America (Animalia, Chordata, Mammalia, Rodentia, Sciuridae, *Cynomys ludovicianus*). Black-tailed Prairie Dogs have short legs, long phalanges and claws for digging, yellowish-brown to reddish-brown fur and relatively long tails with black tips (Banfield 1974, Hoogland 1995, 1996). They are one of the most social ground squirrel species and live in territorial family groups, known as coteries, within defined colonies (Hoogland 1995, COSEWIC 2011). One of the primary advantages of coloniality in Black-tailed Prairie Dogs is reduced predation as a result of increased predator detection through vigilance and alarm behaviours and through clipping vegetation to improve sight lines (Hoogland 1981). Within coteries, Black-tailed Prairie Dogs exhibit amicable behaviours, such as allogrooming and communal nursing. Between coteries they exhibit more hostile behaviours, such as fighting and territorial defense (Hoogland 1995).

Previously, Canadian Black-tailed Prairie Dogs were reported to conserve energy during winter months - when temperatures are lowest and food resources are limited - by entering hibernation for 4 months, a behaviour distinct from more southern populations (COSEWIC 2011). However, field observations and research since 2014 suggest that similar to United States populations (Lehmer and Biggins 2005), Canadian Black-tailed Prairie Dogs may be able to adapt body temperature patterns in response to changes in environmental conditions and include both torpor and hibernation bouts (Lane, unpublished data).

3.2 Species Population and Distribution

Global Range

The Black-tailed Prairie Dog is the most widely distributed of the five prairie dog species. Its historical range spans from the grasslands of southern Saskatchewan, Canada through the United States to the states of Chihuahua and Sonora in northern Mexico and from the foothills of the Rocky Mountains east to the central lowlands of the Great Plains (Koford 1958, Hall 1981, Hoogland 1995) (Figure 1). Historical records suggest that Black-tailed Prairie Dogs occupied more than 40 million nearly contiguous hectares of native prairie (Merriam 1902 cited in Van Putten and Miller 1999). However, by the end of the 20th century the species was estimated to occupy less than 2% of its historic range (Van Putten and Miller 1999). This contraction is primarily the result of land conversion associated with settlement of the Great Plains, widespread eradication programs (Anderson et al. 1986, Miller et al. 1994) and the accidental introduction of sylvatic plague (Miller et al. 1990, Proctor et al. 2006, Eads and Biggins 2015).

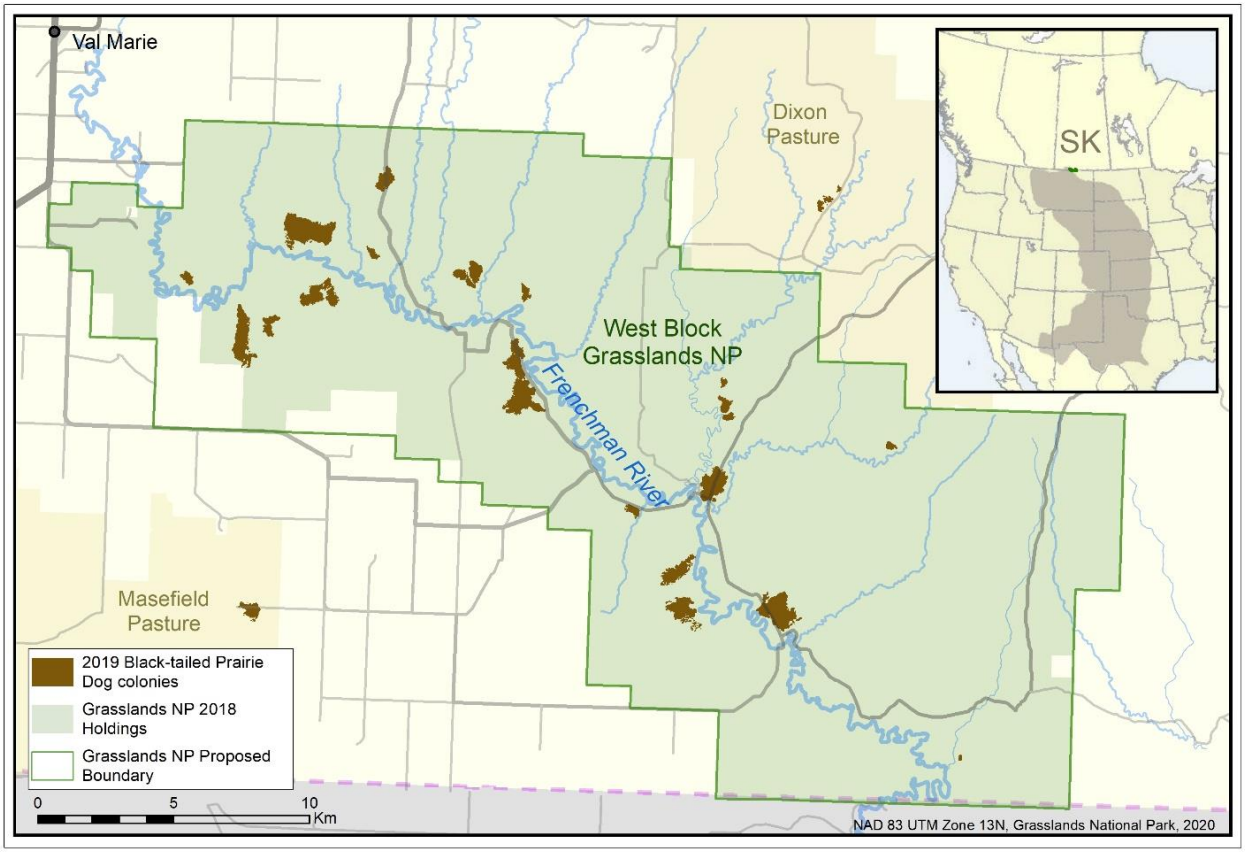

Figure 1. Distribution and extent of Black-tailed Prairie Dog colonies in SK Canada, as of 2019, with respect to the approximate historical range of the species (inset; Tuckwell and Everest 2009, based on Hall 1981 and Patterson et al. 2005). A total of 18 colonies are located inside Grasslands National Park holdings (light green), while the remaining 2 colonies are located in the Dixon and Masefield pastures. Data from Parks Canada Agency.

Canadian Range

The Black-Tailed Prairie Dog was historically documented and is currently found in the Frenchman River Valley and surrounding uplands of southern Saskatchewan in Treaty 4 and the traditional territory of various Northern Plains Indigenous groups. Unlike in the United States, the historic distribution of the species is not well documented in Canada. Historical records suggest that Black-tailed Prairie Dogs in Canada ranged across three Townships (1,2,3) and six Ranges (2,10,11,12,13,26) which equates to an extent of occurrence of approximately 1236.3 km^2 (Soper 1938, Soper 1944, Paynter 1962). Given the location of the Canadian population at the northern edge of the species' range, and these early records, Black-tailed Prairie Dogs presumably were not as widely nor densely distributed in the Canadian prairies as in the United States. Nevertheless, the record of over 20 Black-footed ferret specimens found in and around the Frenchman river valley in South Saskatchewan during 1924-1937 supports the hypothesis that the Black-tailed Prairie Dog's range in Canada was historically large enough to sustain a Black-footed Ferret population (Anderson et al. 1986). The size and number of individual colonies has fluctuated widely since early surveys (Kerwin and Scheelhaase 1971). However, the estimated Canadian

distribution (extent of occurrence) has remained relatively stable at approximately 474 km^2 along the Frenchman River Valley and the surrounding uplands and has not changed since the early 1960s.
Currently, Canadian Black-tailed Prairie Dogs are separated from the nearest colony in Montana by approximately 20 kilometers, and the nearest colony complex by approximately 60 kilometers, both of which exceed the species' recorded maximum dispersal distance (Garrett and Franklin 1988, Milne 2004).

Population Size and Trend

Population size is difficult to estimate for Black-tailed Prairie Dogs as densities do not vary predictably within or between colonies (Hoogland 1995) and are not correlated with total burrow densities (King 1959, Campbell III and Clark 1981, Hoogland 1981, 1995). Colony extent mapping and visual count density estimates have been commonly used to describe relative population size and trends for the species. However, they are not always reliable in quantifying their changes over time.

Colony Extents

Between 1970 and 2019, sixteen surveys mapped the relative extents and area occupied by Black-tailed Prairie Dog colonies in Canada (Kerwin and Scheelhaase 1971, Millson 1976, Laing 1986, Gauthier and Boon 1994, Parks Canada and Saskatchewan Ministry of Environment, unpublished data). However, these surveys used different techniques, and in some cases, did not describe how colony boundaries were defined. Since 1993, Parks Canada Agency and the Saskatchewan Ministry of Environment have mapped colony extents on average every second year based on the methods of Gauthier and Boon (1994).

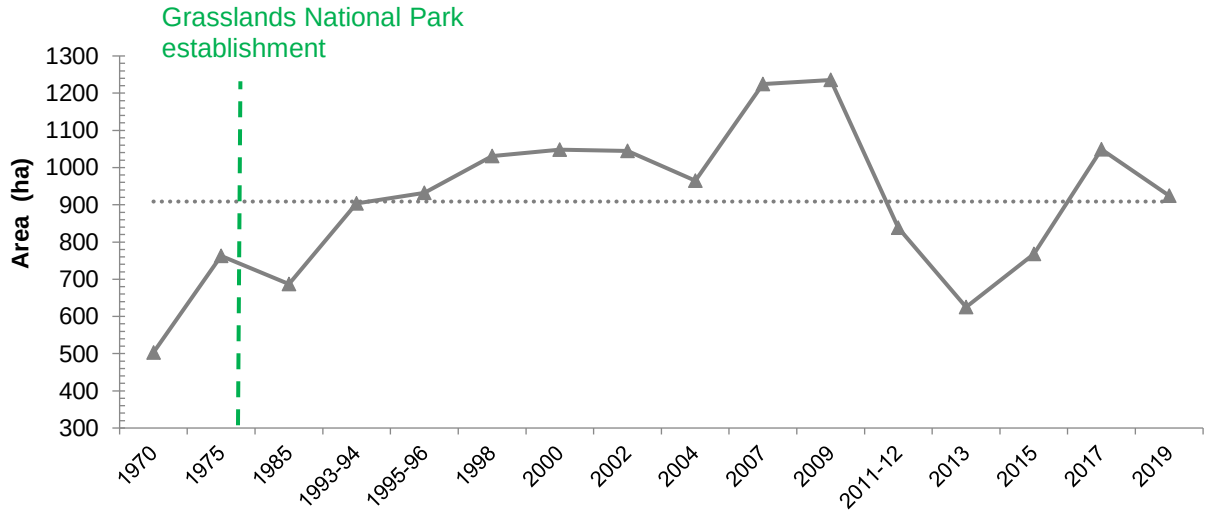

Figure 2. Estimated total area occupied by Black-tailed Prairie Dog colonies in Canada in 1970-2019 (Parks Canada Agency and Saskatchewan Ministry of Environment, unpublished data). Dotted line indicates the average area of occupancy during the reference period. Grasslands National Park's establishment is provided as a reference with respect to the population trend.

Population Density

Since 1996, estimates of relative density of Black-tailed Prairie Dogs in Canada have been conducted using visual censuses of individuals (Menkens and Anderson 1993, COSEWIC 2011). Like colony extents, mean densities (95% Confidence Interval) widely fluctuated from a high of 29.8 (24.1-34.9) in 2007 to a low of 3.8 animals/ha (2.9-4.9) in 2013 (Figure 3). Although visual counts did not follow standardized methodologies throughout the study period, the data suggest that Canadian Black-tailed Prairie Dogs experience dramatic crashes from extremely high densities, periods of relative stability, and periods of consecutive growth from extremely low densities (Parks Canada Agency and Calgary Zoo, unpublished data). Such dramatic fluctuations make the population particularly vulnerable to unpredictable, catastrophic environmental events such as extreme drought or sylvatic plague outbreaks, which could lead to the extirpation of the population.

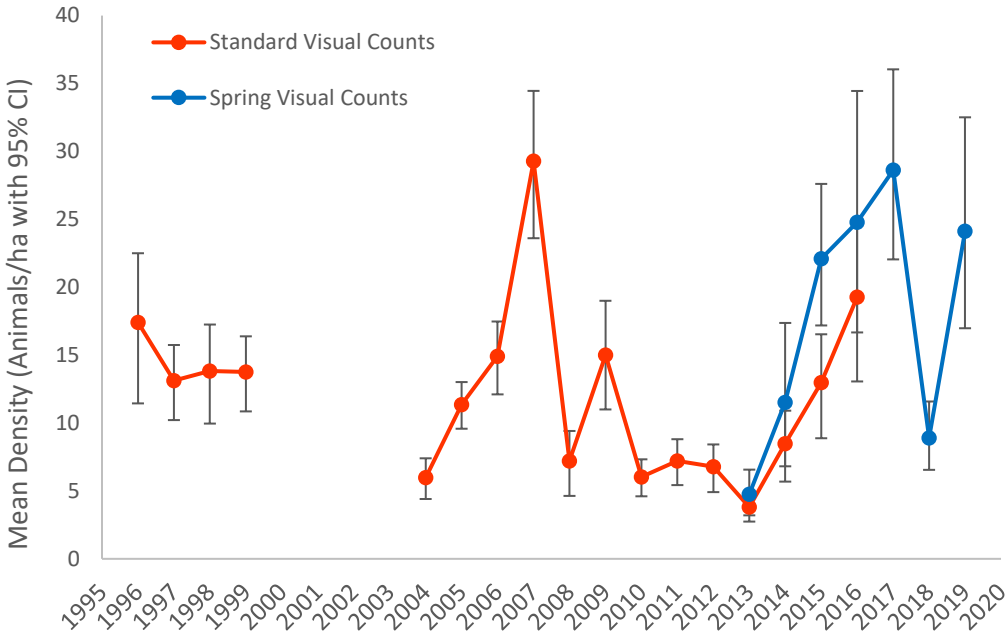

Figure 3. Mean Black-tailed Prairie Dog densities (with 95% confidence intervals) estimated through visual counts in Grasslands National Park (Parks Canada Agency and Calgary Zoo, unpublished data). Standard counts (red lines) were conducted June 1-September 30 and were used to compare density estimates obtained through different methods (i.e., visual counts, mark-recapture and burrow counts). Spring counts (blue lines) were conducted June 1-30 (i.e., after pup emergence), and were used to estimate population densities and the proportion of pups to adults in the population.

3.3 Needs of the Black-tailed Prairie Dog

Across their range, Black-tailed Prairie Dogs generally occupy areas characterized by short vegetation (Koford 1958, Proctor 1998, Roe and Roe 2003), relatively high percent cover of grasses and forbs (Clippinger 1989, Avila-Flores et al. 2010), low slope (Proctor 1998, Stephens 2012), and well-drained, deep soils that have few rocks and are composed of clay and/or loam (Reading and Matchett 1997, Avila-Flores et al. 2010, Stephens 2012). These

characteristics reflect the burrowing, foraging and predator detection needs of the species (Clippinger 1989, Reading and Matchett 1997, Avila-Flores et al. 2010).

Black-tailed Prairie Dogs excavate extensive burrow systems to provide shelter from inclement weather, escape predation attempts, sleep, mate and rear pups (Hoogland 1995). While soil depth, composition, and drainage are thought to influence burrow construction and stability (Reading and Matchett 1997), vegetation attributes were identified as having the strongest influence on the distribution of colonies (Avila-Flores et al. 2010).

Black-tailed prairie dogs are primarily herbivorous and forage on a wide range of grasses, sedges, and forbs native to short-grass and mixed-grass prairie (Summers and Linder 1978, Fagerstone and Williams 1982, Uresk 1984, Hoogland 1995). The diversity and abundance of plant food items may impact Black-tailed Prairie Dog body condition and consequently, their survival and reproduction. The structure of plant communities (particularly vegetation height) may have an indirect impact on survival by affecting predator detection. The range of plant species in their diet can vary widely within a colony, between colonies, and between sites across their range (Fagerstone et al. 1977, Summers and Linder 1978, Fagerstone et al. 1981). Throughout the year, the Black-tailed Prairie Dog diet also shifts seasonally with the availability and nutritional value of plants (Summers and Linder 1978, Fagerstone et al. 1981, Fagerstone and Williams 1982, Uresk 1984). Seasonal changes in the moisture content of plants is also important as Black-tailed Prairie Dogs derive the water required for metabolic functions from the plants they eat. To date, the diet of Canadian Black-tailed Prairie Dogs has not been studied.

Survival and recovery of Black-tailed Prairie Dogs in Canada is ultimately determined by population resilience (i.e., ability to recover after climate and plague-driven crashes, mainly related to population size and genetic diversity), redundancy (i.e., number of sub-populations and geographic distribution) and connectivity (i.e., movement corridors between colonies). At the landscape scale, Black-tailed Prairie Dog population dynamics are the result of extirpation and re-colonization patterns (Roach et al. 2001). As colonies become extirpated due to plague (Stapp et al. 2004, Johnson et al. 2011) or other environmental factors, including drought (Avila-Flores et al. 2012), connectivity between colonies facilitates recolonization (Antolin et al. 2002, Augustine et al. 2008) and overall persistence of the metapopulation. Although less connectivity may result in a loss of genetic diversity, increased connectivity may result in more plague-extirpations; considering this, intermediate connectivity may be ideal for prairie dog survival and recovery (Sackett et al. 2012). Based on their spatial configuration, which results in a relatively high number of small colony sub-complexes (i.e., spatial clusters defined using a minimum inter-colony distance of 1.5 km; Biggins et al 2006), Black-tailed Prairie Dog colonies in Canada appear overall fragmented and at the low end of the connectivity range. Additionally, preliminary data available (for details, see section 6.1) indicate that the Canadian population is genetically depauperate and isolated from other populations across the species range.

4. Threats

4.1 Threat Assessment

The Black-tailed Prairie Dog threat assessment is based on the IUCN-CMP (International Union for Conservation of Nature – Conservation Measures Partnership) unified threats classification system. The threat assessment conducted for the species' status report (COSEWIC 2011) was used as the basis for this document and updated to reflect current and potential threats. Threats are defined as the proximate activities or processes that have caused, are causing, or may cause in the future the destruction, degradation, and/or impairment of the entity being assessed (population, species, community, or ecosystem) in the area of interest (global, national, or subnational). Limiting factors are not considered during this assessment process. For purposes of threat assessment, only present and future threats are considered. Historical threats, indirect or cumulative effects of the threats, or any other relevant information that would help understand the nature of the threats, including justification for changes to threat priority from the species' status report, are presented in the Description of Threats section.

Table 1. Threat Assessment Summary Table

Threat #	Threat description	Impact[a]	Scope[b]	Severity[c]	Timing[d]
1	Residential & commercial development				
1.3	Tourism & recreation areas	Unknown	Unknown	Unknown	Moderate (Possibly in the short term, < 10 yrs)
2	Agriculture & aquaculture				
2.1	Annual & perennial non-timber crops	Low	Small (1-10%)	Moderate (11-30%)	Moderate (Possibly in the short term, < 10 yrs)
2.3	Livestock farming & ranching	Low	Large (31-70%)	Slight (1-10%)	High (Continuing)
3	Energy production & mining				
3.1	Oil & gas drilling	Not calculated *	Small (1-10%)	Slight (1-10%)	Low (Possibly in the long term, >10 yrs)
3.3	Renewable energy	Low	Small (1-10%)	Slight (1-10%)	Moderate (Possibly in the short term, < 10 yrs)
4	Transportation & service corridors				
4.1	Roads & railroads	Low	Restricted - Small (1-30%)	Slight (1-10%)	High - Low
4.2	Utility & service lines	Low	Small (1-10%)	Slight (1-10%)	Moderate (Possibly in the short term, < 10 yrs)
5	Biological resource use				
5.1	Hunting & collecting terrestrial animals	Negligible	Negligible (<1%)	Extreme (71-100%)	Unknown
6	Human intrusions & disturbance				
6.1	Recreational activities	Low	Large (31-70%)	Slight (1-10%)	High (Continuing)
7	Natural system modifications				
7.1	Fire & fire suppression	Low	Restricted (11-30%)	Slight	Moderate
7.2	Dams & water management/use	Unknown	Unknown	Unknown	Moderate (Possibly in the short term, < 10 yrs)
8	Invasive & other problematic species & genes				
8.1	Invasive non-native/alien species a) Sylvatic plague b) Yellow sweet clover and Crested Wheatgrass	a) Very high b) Unknown	a) Pervasive (71-100%) b) Unknown	a) Extreme (71-100%) b) Slight (1-10%)	a) Moderate (Possibly in the short term, < 10 yrs) b) High (Continuing)

Threat #	Threat description	Impact[a]	Scope[b]	Severity[c]	Timing[d]
8.2	Problematic native species a) Tularemia b) Shrub encroachment	a) Low b) Unknown	a) Restricted (11-30%) b) Unknown	a) Slight (1-10%) b) Slight (1-10%)	a) Moderate (Possibly in the short term, < 10 yrs) b) High (Continuing)
11	Climate change & severe weather				
11.1	Habitat shifting & alteration	Unknown	Pervasive (71-100%)	Unknown	Unknown
11.2	Droughts	High	Pervasive (71-100%)	Serious (31-70%)	High-Low
11.3	Temperature extremes	Unknown	Pervasive (71-100%)	Unknown	High (Continuing)

[a] **Impact** – The degree to which a species is observed, inferred, or suspected to be directly or indirectly threatened in the area of interest. The impact of each threat is based on Severity and Scope rating and considers only present and future threats. Threat impact reflects a reduction of a species population or decline/degradation of the area of an ecosystem. The median rate of population reduction or area decline for each combination of scope and severity corresponds to the following classes of threat impact: Very High (75% declines), High (40%), Medium (15%), and Low (3%). Unknown: used when impact cannot be determined (e.g., if values for either scope or severity are unknown); Not Calculated: impact not calculated as threat is outside the assessment timeframe (e.g., timing is insignificant/negligible or low as threat is only considered to be in the past); Negligible: when scope or severity is negligible; Not a Threat: when severity is scored as neutral or potential benefit.

[b] **Scope** – Proportion of the species that can reasonably be expected to be affected by the threat within 10 years. Usually measured as a proportion of the species' population in the area of interest. (Pervasive = 71–100%; Large = 31–70%; Restricted = 11–30%; Small = 1–10%; Negligible < 1%).

[c] **Severity** – Within the scope, the level of damage to the species from the threat that can reasonably be expected to be affected by the threat within a 10-year or three-generation timeframe. Usually measured as the degree of reduction of the species' population. (Extreme = 71–100%; Serious = 31–70%; Moderate = 11–30%; Slight = 1–10%; Negligible < 1%; Neutral or Potential Benefit ≥ 0%).

[d] **Timing** – High = continuing; Moderate = only in the future (could happen in the short term [< 10 years or 3 generations]) or now suspended (could come back in the short term); Low = only in the future (could happen in the long term) or now suspended (could come back in the long term); Insignificant/Negligible = only in the past and unlikely to return, or no direct effect but limiting.

* outside assessment timeframe

4.2 Description of Threats

The Black-tailed Prairie Dog was assessed by COSEWIC in 2011 as Threatened based on the increasing threats posed by drought and sylvatic plague, both of which are documented to cause significant population declines, and are expected to occur with increasing frequency with current climatic trends. All other threat impacts are low, negligible or unknown. Low impact threats include annual and perennial non-timber crops, livestock farming & ranching, oil and gas drilling, renewable energy, roads and railroads, utility and service lines, recreational activities, fire and fire suppression, tularemia, storms and flooding. Hunting and collecting terrestrial animals have a negligible impact. Threats with an unknown level of impact include tourism and recreation areas, dams and water management/use, invasive non-native plant species, problematic native plant species, habitat shifting and alteration, and temperature extremes. For threats that are strongly connected to each other, their description has been grouped. Black-footed ferrets were excluded from the list of threats, since the species is no longer known to be present within Canada (Parks Canada, unpublished data).
Threats are listed according to their numeric order according to the IUCN-CMP classification system, irrespectively of their impact on species survival.

2.1 Annual & perennial non-timber crops

Annual and perennial non-timber crop production occurs at different extents in and around Grasslands National Park. Within Grasslands National Park's West Block, hayfields along the Frenchman River have been historically (i.e., prior to park establishment) used for production of winter forage for livestock, and continue being used today to support beneficial cattle grazing and bison management operations. Since these sites represent <3% of the total area of the West Block, and were identified to have low potential for Black-tailed Prairie Dog habitat restoration (Thorpe and Stephens 2017), their impact is considered negligible. While Black-tailed Prairie Dog colonies are currently protected from agricultural development on federal land, native prairie around Grasslands National Park is being converted to cropland, and this trend may continue. Although cropland is not a barrier to movement (Sackett et al. 2012), conversion of grasslands to cropland is a threat to Black-tailed Prairie Dog natural colony establishment and expansion. Agricultural crops alter soil and plant communities and create visual obstruction, reducing habitat available to Black-tailed Prairie Dog.

2.3 Livestock farming and ranching / 5.1 Hunting & collecting terrestrial animals
Ranching

Since Black-tailed Prairie Dogs consume and clip many of the same species of grasses and forbs that are consumed by livestock (Detling 2006), the species has been historically regarded as a competitor with ranching operations and a threat to the livelihood of ranchers. In addition to financial concerns, Black-tailed Prairie Dogs are generally perceived as a symbol of poor land stewardship, aggravated by the fear that the government may impose restrictions or take control of private and public land to manage the species (Detling 2006, Lamb et al. 2006).

While this conflict may locally result in shooting or poisoning of Black-tailed Prairie Dogs, direct removal of individuals is likely a negligible threat, especially considering that the majority of the Canadian population is protected within Grasslands National Park under the *Canada National Parks Act* and the *Species At Risk Act*. Similarly, the impact of livestock on Black-tailed Prairie Dogs through competition for forage is likely minimal. Several studies have shown that interactions can vary depending on forage availability and population density, with competitive interactions reported in years of low productivity, and facilitative or neutral interactions reported in years of average or higher productivity (Uresk and Bjugstad 1983, Cheng and Ritchie 2006, Avila-Flores et al. 2012, Augustine and Springer 2013, Breland et al. 2014, Connell et al. 2019).
Instead, the greatest threat is posed by the social and economic conflict between the species and ranching operations, which severely limits opportunities for restoring the species at the landscape scale, both inside and outside Grasslands National Park.
It is equally recognized that traditional ranching has been and continues to be a critical factor in preserving native prairie, without which intact grasslands and associated imperiled species would likely not exist today. Livestock farming and ranching can still provide opportunities for Black-tailed Prairie Dog restoration, provided appropriate policies, incentives, communications and management strategies are developed and implemented to ensure their coexistence with species recovery.
The scope was changed from COSEWIC (2011) from Small to Large, since low acceptance of Black-tailed Prairie Dogs affects species restoration at the landscape scale.

3.1 Oil and gas drilling; 3.3 Renewable energy

Oil and gas drilling, renewable energy development and associated roads and infrastructure would result in habitat loss and threats to natural colony expansion. Some potential impacts to Black-tailed Prairie Dogs would include increases in invasive and undesirable plant species due to disturbance from construction activities (see yellow sweet clover and crested wheatgrass section), soil alteration (Nasen et al. 2011), increases in noise and vibration (Lovich and Ennen 2013) and increases in human disturbance during construction (see recreational activities section). Based on local knowledge and observations, oil and gas drilling in the surroundings of Grasslands National Park have declined in the last decade, and no active wells are currently present in the nearest Rural Municipality.
These threats were included in the species' status report only with respect to expansion, with no assessment of impact, scope, severity or timing. Since the timing of this threat is ranked as low (i.e., possibly in the long term, > 10 years), the impact of this threat is not calculated (i.e., outside the assessment timeframe).

4.1 Roads & railroads

Roads often cross colonies (Knowles 1986) and high densities of Black-tailed Prairie Dogs have been found by roads (Koford 1958). The effect of roads on Black-tailed Prairie Dogs has been shown to be both positive and negative, depending on circumstances. One study showed that increased road density was associated with increased abundance and burrow density (Johnson and Collinge 2004). Through other research, noise from road traffic was found to lower aboveground activity, increase vigilance behaviour and reduce foraging

behaviour (Shannon et al. 2014). Road noise was also found to lead to earlier detection of predators (Shannon et al. 2016). Although potentially positive, such an outcome could be actually driven by increased vigilance and flight behaviour, which could be associated with decreases in foraging time (Shannon et al. 2016) and therefore, reduction in overall survival and reproduction (Ramirez and Keller 2010).
In Canada, gravel roads or two-track trails cross or are found within 50 metres from seven Black-tailed Prairie Dog colonies. Since 2016, Grasslands National Park has been implementing a traffic management strategy and using speed reduction signs (30 km/hour) from April to October to mitigate the risk of species at risk mortality at identified wildlife-vehicle collision hotspots. At these sites, Black-tailed Prairie Dog road mortalities in 2018 have shown a 58.8% reduction in comparison to baseline level (i.e., 2016, prior to use of speed reduction signs). Given the limited impact and the existence of mitigation measures, roads are not considered a significant threat to Black-tailed Prairie Dogs.

4.2 Utility & Service lines

The construction of the Keystone XL pipeline through the former Masefield Community Pasture is currently on hold, pending litigation (Syd Smailes, *pers. comm.*). The new pipeline will follow the existing pipeline, which is located within close proximity to one Black-tailed Prairie Dog colony (i.e., closest distance to the right-of-way is approximately 114 m, less than 500 m recommended setback; Stantec Consulting Ltd. 2019). Pipeline construction has been shown to reduce soil quality (Naeth et al. 1987), affect water runoff and erosion (Lovich and Bainbridge 1999), introduce invasive species (Espeland and Perkins 2017), reduce biological soil crust cover and alter plant communities (Pyle et al. 2016). These potential adverse effects of pipelines may affect Black-tailed Prairie Dog habitat and forage quality, thus reducing vital rates (Lehmer and Horne 2001). Such habitat changes may also prevent the natural expansion of the colony. Importantly, local knowledge gathered during the consultation phase for this recovery document has indicated the presence of Black-tailed Prairie Dog burrows and activity in recent years (after 2002) extending east of the current colony and crossing over the existing pipeline. Pipeline construction could therefore fragment and prevent recolonization of suitable habitat that has not been identified during colony perimeter mapping.
Black-tailed Prairie Dogs typically respond to human disturbance by interrupting foraging or social interactions and then making alarm vocalizations, returning to their burrow entrances, and concealing themselves underground (Hoogland 1995). Noise and human disturbance associated with pipeline construction may thus negatively affect Black-tailed prairie dog survival and colony persistence if foraging behaviour is frequently interrupted (Ramirez and Keller 2010).
This threat was not included in the species' status report. Within this document, the threat was fully assessed given its expected occurrence adjacent to proposed critical habitat.

6.1 Recreational activities; 1.3 Tourism & Recreation Areas

Human disturbance can lead Black-tailed Prairie Dogs to increase vigilance and decrease time spent foraging, mating or providing parental care (Frid and Dill 2002), which could lead to an overall reduction in survival and reproduction (Ramirez and Keller 2010). Black-tailed

Prairie Dogs have been shown to increase responsiveness to human disturbance (Shannon et al. 2016), increase concealment behaviour and decrease alarm calls (Magle et al. 2005). Human disturbance by visitors (e.g., individual hikers, interpretative tours, school groups) is more frequent on roadside colonies and colonies with easier access, in particular those along marked trails (Parks Canada Agency, unpublished data). Increased visitation to Grasslands National Park, should this follow recent trends (i.e., from approx. 5,800 visitors in 2013 to approx. 15,000-18,000 in 2017-2018), could increase road traffic and visitation to colonies on foot.

While road mortality is currently mitigated through a traffic management strategy (see threat 4.1), disturbance to Black-tailed Prairie Dog by visitors is minimized by managing type and length of activities on colonies, and prohibiting access to colonies to visitors with pets (which may transfer vectors for plague among colonies and facilitate zoonotic transmission). Researchers and park staff conducting population monitoring and management activities on all colonies throughout the year (but primarily between March and October) follow protocols to minimize time spent on the colony.

Existing Parks Canada Agency's impact assessment and planning processes ensures that infrastructure development within park boundaries will consider species at risk needs and not jeopardize species survival and recovery. The overall impact of these threats is therefore considered to be low.

7.1 Fire & fire suppression

Southeastern Saskatchewan, including the West Block of Grasslands National Park and the surrounding areas, is historically (1981-2010) at a high or extreme fire risk from May to September (https://cwfis.cfs.nrcan.gc.ca/ha/fwnormals?type=fwi&month=8). While wildfires have occurred in the area, fires in the greater park ecosystem are more often unintentionally ignited by agricultural operations taking place outside the park. This includes the largest fire documented in the park to date (2013 Frenchman river fire; 4,750 ha).

Potential immediate effects of fire on Black-tailed Prairie Dogs are direct mortality, smoke inhalation, and reduced vegetation availability. Due to low fuel loads, Black-tailed Prairie Dog colonies are considered to be natural fire breaks for prescribed fire planning within Grasslands National Park (Parks Canada 2016a), and animals taking refuge in cavities or burrows may be exposed to lower smoke (Guelta and Balbach 2005), temperatures and carbon monoxide levels (Engstrom 2010).

Although fire may have immediate negative effects on Black-tailed Prairie Dogs (i.e., loss of forage), it has been shown to favor colony expansion through reduction in vegetation cover and height (Augustine et al. 2007, Breland et al. 2014). For this reason, prescribed fire has been identified and used as a habitat management tool to maintain favorable conditions for natural Black-tailed Prairie Dog habitat expansion in Grasslands National Park (Parks Canada 2016b). While uncontrolled fires (i.e., both wild and human-induced) within Grasslands National Park are fully suppressed to prevent destruction of large areas of species at risk critical habitat, prescribed fire programs have been and will continue to be in place for targeted habitat management and enhancement for multiple species at risk including Black-tailed Prairie Dogs (Parks Canada 2016b). Outside Grasslands National Park, fire suppression is not accompanied by prescribed fire programs. However, since the park manages more than 90% of the species' critical habitat, the impact of fire suppression

is considered largely compensated by the benefits of prescribed fire, and the overall impact of the threat is considered low. This threat was not listed in the species' status report, but was included in this document given its relevance in the Canadian range.

7.2 Dams & water management/use

Changes to dam and water management that might affect the West Block of Grasslands National Park are possible within the next 10 years. Potential impacts for Black-tailed Prairie Dogs might include changes in forage quality and quantity due to changes in water availability (Breland et al. 2014, Connell et al. 2019), unsuitability of soil for burrowing due to changes in soil moisture (Roe and Roe 2003) and direct mortality due to flooding. The impact of this threat is unknown at this time.

8.1 Invasive non-native/alien species

Sylvatic Plague

Sylvatic plague has been a threat to Black-tailed Prairie Dogs across their range since the mid-20th century (Cully and Williams 2001, Antolin et al. 2002). The pathogen responsible for the disease, the bacterium *Yersinia pestis*, was introduced from Asia to North America in the early 1900s, and today is found from Texas to southern Canada (Richgels et al. 2016). It typically circulates among rodent hosts and their fleas, but can infect more than 200 different mammalian species including rabbits and hares, carnivores, and humans (Biggins and Kosoy 2001, Gage and Kosoy 2005). Sylvatic plague was first recorded in Saskatchewan in 1946 (Humphreys and Campbell 1947), was confirmed circulating in domestic carnivore hosts in Grasslands National Park in 1995 (Leighton et al. 2001) and reported in the Canadian Black-tailed Prairie Dog population in 2010 (Antonation et al. 2014). Sylvatic plague is transmitted primarily through flea bites (Cully and Williams 2001, Antolin et al. 2002, Eisen et al. 2006, Hinnebusch et al. 2017). Other mechanisms of transmission include direct contact with respiratory droplets of an infected animal, consumption of plague-positive carcasses, contact with contaminated soil, and movement of infected fleas by alternate hosts on and around Black-tailed Prairie Dog colonies (Webb et al. 2006, Richgels et al. 2016).

The sociality of Black-tailed Prairie Dogs is considered to increase the spread of plague (Hoogland 1979, Biggins and Kosoy 2001), although social grooming, causing direct mortality of fleas (Hoogland 1995), may help reduce transmission (Eads et al. 2017). In Black-tailed Prairie Dog populations in the United States, plague has shown both epizootic (unexpected high number of cases and widespread mortality during a short time interval) and enzootic patterns (the disease occurs at regular, expected rates). Mortality rates of 90-100% and local extinction of colonies have been documented during epizootic outbreaks (Cully and Williams 2001, Antolin et al. 2002, Stapp et al. 2004, Lorange et al. 2005). The area closest to Canada where plague epizootic outbreaks have been observed is Phillips County, Montana, where it affected a colony complex located approximately 70 km from Grasslands National Park (Collinge et al. 2005). Here, epizootic outbreaks were recorded as recently as 2018-2019, and caused a 50-70% contraction of total colony area compared to pre-outbreak levels (R. Matchett, *unpublished data*).

Black-tailed Prairie Dogs have been found to be able to survive through enzootic levels of plague (Hanson et al. 2007) and in some rare cases, have developed resistance to plague after epizootic events (Cully et al. 1997, Pauli et al. 2006, Rocke et al. 2012, Russell et al. 2019). Colonies can recover after plague outbreaks following reproduction of the survivors (Cully and Williams 2001, Pauli et al. 2006) and immigration (Cully and Williams 2001, Antolin et al. 2002). In the United States, recovery from plague epizootics has been observed after 4-15 years (Augustine et al. 2008, Cully et al. 2010, Johnson et al. 2011). However, these examples of plague recovery occur over larger areas (>4,000 ha colony extents) and across a larger number of colonies (i.e., up to 100) than what currently exists within the Canadian population (Cully and Williams 2001, Augustine et al. 2008, Johnson et al. 2011). Recovery likely depends on the frequency of plague epizootics and the rate of immigration (COSEWIC 2011). Considering its small size and isolation from Montana colony complexes, recovery following a plague outbreak may be difficult for the Canadian population.

Recent research suggests that sylvatic plague in Canada may be maintained at an enzootic level, whereby the disease results in a low number of occurrences, affects only a small proportion of the host population, but contributes to chronic mortality rates (Biggins et al. 2010). This is likely due to limited flea activity other than in the spring months, low prevalence of *Y. pestis* in fleas (<1% of flea samples collected in 2013-2018), and relatively low Black-tailed Prairie Dog densities compared to other areas of the species range (Liccioli et al. 2020). However, epizootic plague has been previously suspected in two instances. In 2010, when plague was first confirmed in the Canadian Black-tailed Prairie Dog population (Antonation et al. 2014), a very small and isolated colony (i.e., different than the one where plague was confirmed) became extirpated. No fleas were collected from the second colony and no dead Black-tailed Prairie Dogs or Richardson's ground squirrels were found and tested for plague. In absence of supporting evidence for plague activity, it is possible that the population crash was in response to the drought recorded in the previous year. The colony was naturally recolonized in 2017. In 2013, a colony collapsed and plague-positive fleas were confirmed, but no plague-positive Black-tailed Prairie Dog or Richardson's ground squirrel carcasses were found. While no colony collapse or widespread mortalities have been conclusively tied to sylvatic plague in Canada, the enzootic maintenance of the disease may reduce population growth and hence limit Black-tailed Prairie Dog resilience to other stressors (Eads and Biggins 2015). In interaction with a small population size and climate change, sylvatic plague therefore poses a sufficiently substantial long-term threat that warrants vigilance and mitigation. This is especially important in consideration of a warming climate, which has the potential to shift or extend vector life cycles, alter flea community composition and host-parasite interactions (Eads and Hoogland 2017) and cause an overall shift in the geographic range of plague in accordance with climatic patterns (Nakazawa et al. 2007).

<u>Yellow Sweet Clover and Crested Wheatgrass</u>

Yellow sweet clover (*Melilotus officinalis*) is an invasive herbaceous legume, which was introduced in North America to enhance nitrogen in soil (Wolf et al. 2004), stabilize hillsides (Wolf et al. 2003) and as a forage crop (Turkington et al. 1978). Yellow sweet clover forms dense monotypic stands that can be up to 90-300 cm in height in grassland sites and has

been shown to alter native species composition and soil characteristics (Wolf et al. 2003, Wolf et al. 2004). It invades areas with altered soil, such as human disturbance, but can also invade non-disturbed areas (Wolf et al. 2003, Chen et al. 2013). Yellow sweet clover is present in and around Grasslands National Park and has been confirmed on and around some Black-tailed Prairie Dog colonies.

Crested wheatgrass (*Agropyron cristatum*) was originally introduced into North America as a livestock forage crop. Crested wheatgrass is a bunchgrass that forms monotypic stands (McWilliams and Van Cleave 1960) from 30-90 cm in height (USDA 2000) and is a strong competitor with native species, dominant both in vegetation and the seed bank (Henderson and Naeth 2005). Crested wheatgrass has been shown to reduce chemical quality of soil (Dormaar et al. 1995), increase soil erosion risk (McWilliams and Van Cleave 1960), facilitate other invasive species and restrict native species growth (Jordan et al. 2008), and reduce plant (Henderson and Naeth 2005) and vertebrate species diversity (Reynolds and Trost 1980). Crested wheatgrass is present in and around Grasslands National Park and has been confirmed on and around some Black-tailed Prairie Dog colonies.

Yellow sweet clover and crested wheatgrass may affect Black-tailed Prairie Dogs through increased vegetation height, which can reduce predator detection and expansion of existing colonies. Habitat assessment and anecdotal evidence collected at the Monument prairie dog colonies within Grasslands National Park seem to support this hypothesis. Invasion of these plant species may also alter vegetation communities and soil, which can negatively affect Black-tailed Prairie Dog body condition through diet (Rayor 1985, Lehmer and Horne 2001, Hayes et al. 2016). Finally, both yellow sweet clover and crested wheatgrass are often found as near-monocultures (McWilliams and Van Cleave 1960, Wolf et al. 2003) which are generally avoided by Black-tailed Prairie Dogs (Roemer 2019) and may therefore result in reduction of suitable habitat. However, local knowledge has indicated that prairie dog colonies or individual dispersers often establish in disturbed communities characterized by crested wheatgrass and yellow sweet clover. It is therefore possible that while these species may prevent natural expansion of existing colonies, they could facilitate establishment of new ones. This factor deserves further investigation as it could help achieve Black-tailed Prairie Dog conservation objectives that are compatible with those of other species at risk. This threat was not listed in the species' status report, but was included in this assessment given its documented occurrence in the Canadian range.

8.2 Problematic native species

Tularemia

Tularemia is caused by the bacterium *Francisella tularensis* and is considered an endemic disease in many species of wild rodents in North America, including Black-tailed Prairie Dogs (Zeidner et al. 2004). The most common vectors are ticks, although it can be transmitted through other blood-feeding arthropods, animal bites and scratches, contaminated water (Bäckman et al. 2015), consumption of infected tissue, and inhalation of aerosolized bacteria (McLean 1994). In Texas, an outbreak caused 7% mortality on a Black-tailed Prairie Dog colony. Tularemia has not been detected in the Canadian Black-tailed Prairie Dog population, although antibodies were detected in domestic cats and dogs

around Grasslands National Park (Leighton et al. 2001). Overall, this is not considered a high-level threat due to its limited presence and population level effects.

Shrub Encroachment

Black-tailed Prairie Dogs preferentially consume grasses (65-87%) and forbs (12-34%), with <1% of diet comprised of shrubs (Hansen and Gold 1977, Summers and Linder 1978, Uresk 1984). Black-tailed Prairie Dogs avoid areas with high vegetation (Collins and Lichvar 1986, Guenther and Detling 2003, Avila-Flores et al. 2010, Breland et al. 2014) and high shrub density (Yeaton and Flores-Flores 2006, Avila-Flores et al. 2010). Shrub encroachment on Black-tailed Prairie Dog colonies may thus reduce palatable forage and increase vegetation height, and it has been suggested as a cause of decline in Black-tailed Prairie Dogs in Mexico (Avila-Flores et al. 2012).

Restoration of native silver sagebrush (*Artemisia cana*) is conducted in the West Block of Grasslands National Park to improve habitat for Greater Sage-grouse. However, areas targeted by this program have a low potential for Black-tailed Prairie Dogs (Parks Canada 2016b, Thorpe and Stephens 2017). While the extent of shrub encroachment within Grasslands National Park is unknown, natural and assisted changes in shrub cover are currently not considered a significant threat to the population.

11.1 Habitat shifting & alteration/11.3 Temperature extremes

Climate change predictions for the northern Great Plains show increased mean annual temperatures, warmer and wetter winters (Rizzo and Wiken 1992, Lemmen et al. 1997, Sushama et al. 2010, Hufkens et al. 2016). Climate change may result in habitat alterations such as changes to fire regime (Rizzo and Wiken 1992), soil and hydrology (Lemmen et al. 1997), leading to reduced suitability of soils and plant species for Black-tailed Prairie Dogs. Combined, these changes would further decrease the amount of habitat suitable for the species. However, the overall effect of climate change on Black-tailed Prairie Dogs is unknown, particularly because of the large uncertainty with respect to timing, amount and frequency of precipitations[4], which largely affect reproduction and survival (Stephens et al, 2018; see threat 11.2). Conversely, the effect of increasing winter temperatures may benefit Black-tailed Prairie Dogs by reducing winter severity, which negatively affects reproduction (Grassel et al. 2016) and overwinter survival (Hoogland 2006), in particular following a drought (Calgary Zoo and Parks Canada unpublished. data). However, for species that undergo torpor or hibernation like Black-tailed Prairie Dogs, warmer winters may cause arousal from torpor during time when resources are scarce, and have a negative impact on individual survival. Due to all these uncertainties, the severity of this threat was changed from the COSEWIC assessment of Moderate-Slight to Unknown.

11.2 Droughts

The northern Great Plains are expected to experience increased intensity and/or frequency of droughts due to climate change (Lemmen et al. 1997, Sushama et al. 2010). Drought reduces vegetation productivity (Hoover et al. 2014) negatively affecting Black-tailed Prairie Dog body condition and body mass (Hoogland 1995, Stephens et al. 2018), which leads to

[4] https://climateatlas.ca/map/canada/plus30_2060_85#

reduced survival (Facka et al. 2010, Davidson et al. 2014) and female reproductive success (Knowles 1987, Davidson et al. 2014, Grassel et al. 2016, Stephens et al. 2018). Black-tailed Prairie Dog reproduction has been shown to be sensitive to drought and growing season conditions across the species' range (Knowles 1987, Avila-Flores 2009, Facka et al. 2010, Davidson et al. 2014, Grassel et al. 2016), and was shown to have population level effects for the Canadian Black-tailed Prairie Dog. In Canada, population crashes following drought years have ranged between 54% and 70%, for low and high pre-drought densities, respectively (Stephens et al. 2018). The ability of the Canadian Black-tailed Prairie Dog population to recover after consecutive droughts may be limited, due to its small size and fragmented distribution.

11.4 Storms & flooding

Spring precipitation has been shown to have positive effects on reproduction on Black-tailed and Gunnison's prairie dogs in the United States (Facka et al. 2010, Davidson et al. 2014) but was found to have a negative effect on reproduction in Canadian Black-tailed Prairie Dogs (Stephens et al. 2018). This may be due to spring precipitation being associated with snow storms or heavy rain, which could negatively affect reproduction (Neuhaus et al. 1999). More data are required to understand the impact of spring storms and precipitation on Black-tailed Prairie Dog population dynamics. Negative localized impact of flooding on Black-tailed Prairie Dog survival in Grasslands National Park was observed in the spring of 2011 and 2016 (Tara Stephens, *pers. comm*.). While more data are required to fully assess its impact, this is not anticipated to be a significant threat to Black-tailed Prairie Dogs in Canada.

5. Population and Distribution Objectives

The population and distribution objective is:
To ensure, by 2040, at least 80% probability of persistence of the Canadian Black-tailed Prairie Dog population over 50 years (i.e., 2040-2090) within its known range in Canada, and maintain:

i) a minimum area of occupancy of 1,400 ha, measured as a moving average over a 6-year period, distributed across a minimum of 20 prairie dog colonies currently existing;
ii) a minimum average population density of 7.5 individuals/ha, measured as a moving average over a 6-year period across visual count plots.

To meet this objective, one or more of the following broad recovery actions will be implemented:

1. Minimize the risk of a plague outbreak by implementing different strategies for plague management (e.g., preventive and emergency dusting, sylvatic plague vaccine and Fipronil);

2. Restore and/or establish up to 600 ha of additional Black-tailed Prairie Dog colonies on currently unoccupied habitat in Grasslands National Park to reduce the risk of population extirpation under current climate change projections[5];

3. Conduct population management (e.g., captive breeding, conservation translocation, supplemental feeding), should monitoring and research determine that these measures are necessary and effective for species survival and recovery.

Given the uncertainty associated with key threats to the species (i.e., climate change, sylvatic plague), the precise combination and relative contribution of these individual activities toward reaching the Population and Distribution objective will be assessed through the Population Viability Analysis framework, expert opinion and upon evaluation of their feasibility. Some of these activities, including plague management, are expected to be implemented at some level on an annual basis (see Table 2) due to their significance to species survival. Additionally, it is acknowledged that as a modelling tool, the Population Viability Analysis cannot predict the absolute probability of persistence. Instead, it will help provide an estimate of relative risk when comparing different management options while accounting for various possible future climate and plague scenarios. Furthermore, new ecological data and refined modelling tools may lead in the future to revised projections and consequently, revised management targets. Notwithstanding this uncertainty, the targets and objectives identified within this document are intended to ensure adequate population resilience and maintain >80% probability of persistence of the Black-tailed Prairie Dog in Canada over 50 years.

In the medium term (i.e., approx. 10 years), the feasibility of achieving the Population and Distribution objective set for Black-tailed Prairie Dogs in this document will be evaluated and if applicable, re-assessed in the context of Black-footed ferret recovery. Based on the best available knowledge, approximately 4,000 ha of contiguous (i.e., colony distance < 1.5 km) Black-tailed Prairie Dog habitat are required to support a small population (i.e., ≥30 individuals), of Black-footed Ferrets (Jachowski et al. 2011).

[5] Assessment of habitat suitability for BTPD expansion and establishment is currently in progress.

6. Broad Strategies and General Approaches to Meet Objectives

6.1 Actions Already Completed or Currently Underway

The following research activities have contributed to the current understanding of Black-tailed Prairie Dog ecology and population dynamics, generated data included in a Population Viability Analysis, and helped inform priority recovery actions captured in Table 2. All research programs were driven by the Grasslands National Park Multi-species Action Plan (Parks Canada 2016b):

- Since 2007, population-level research has been conducted by the Calgary Zoo in Grasslands National Park, in partnership and collaboration with Parks Canada. Capture-mark-recapture data collected across eight colonies in relation to growing degree days, precipitation, drought status and winter temperature helped understand the relationship between climate, survival and reproduction in Canadian Black-tailed Prairie Dogs, and illustrated how key vital rates for population dynamics (i.e., survival and female reproduction) are negatively affected by drought conditions during the preceding summer (Stephens et al. 2018).
- Individual-level research has been conducted by the University of Saskatchewan (Dr. Jeff Lane) in 2014-2018 to collect data on demographic rates and life history patterns, as well as describe the winter torpor phenology (i.e., emergence and entrance dates) and expression (i.e., body temperatures) within one colony (Walker).
- Preliminary results of a population genetics study using hair samples collected from eight colonies indicated that that the Canadian Black-tailed Prairie Dog population is amongst the most genetically depauperate across the species range. Furthermore, data on population genetic structure and inbreeding levels (over 1.5 times those observed in Montana and South Dakota) are suggestive of high genetic isolation from populations in the United States. A peer-review manuscript is currently being drafted (*Cullingham et al., in prep.*).
- Ongoing research conducted by the Calgary Zoo is developing a Habitat Suitablity Index, integrating abiotic (e.g., soil, slope, etc.) and biotic factors (e.g., plant species composition). Once developed, this tool will help identify priority sites for promoting expansion of currently occupied colonies, or restoration of Black-tailed Prairie Dog colonies in areas currently unoccupied by the species within the West Block of Grasslands National Park.

The following recovery actions have been implemented as part of the Black-tailed Prairie Dog management plan (Tuckwell and Everest 2009a) and the Grasslands National Park Multi-species Action Plan (Parks Canada 2016b). Actions included in Table 2 continue or build on these efforts:

- Since 2010, Grasslands National Park has been implementing a surveillance and mitigation program for sylvatic plague, following the plague mitigation strategy (Parks Canada 2011) as well as a revised plague management plan. Actions included preventive burrow dusting (i.e., application of Deltamethrin) in sections of prairie dog colonies (average n. of treated colonies/year = 6.6; average area treated=342.8

ha/year), emergency dusting in response to detection of sylvatic plague, distribution of sylvatic plague vaccine baits (average number of treated colonies =4.2/year; average area treated=167.5 ha/year), collection of fleas through burrow swabbing and combing of animals handled for the purposes of capture-mark-recapture research.

- Saskatchewan Research Council and Calgary Zoo analyzed habitat suitability for Black-tailed Prairie Dogs within the West Block of Grassland National Park. The resulting model (i.e., Habitat Mapping and Decision Support Tool) ranked habitats based on broad vegetation communities and soil characteristics and helped identify areas to prioritize finer scale habitat suitability assessments (Thorpe and Stephens 2017).
- Habitat management strategies (spraying, mowing and reseeding) have been implemented in 2016-2018 to remove non-native (e.g., agronomic) and invasive alien plant species, reduce vegetation height and increase density of native plant species over 85 hectares within a former cultivated field identified as priority areas for colony expansion by the Habitat Mapping and Decision Support Tool.
- A traffic management strategy was implemented in Grasslands National Park since 2016 to reduce road mortality of multiple species at risk. Considering years with comparable visitation rates, preliminary results indicate a 58.8% reduction in Black-tailed Prairie Dog mortality across wildlife-vehicle collision hotspots that were identified and mitigated through speed reduction signs.
- Parks Canada, in consultation with ranchers, species experts and governmental organizations, led a recovery planning exercise to identify, to the extent possible, shared management objectives and recovery actions for the species. Specific objectives included: i) share local and scientific information on Black-tailed Prairie Dog ecology and plague management, as well as Parks Canada roles and responsibilities with respect to species at risk recovery; ii) better understand stakeholder perspective and concerns with respect to Black-tailed Prairie Dog management; iii) identify conflict areas between Black-tailed Prairie Dog management/recovery and stakeholder interests; iv) combine scientific and local ecological knowledge to inform Black-tailed Prairie Dog recovery planning; v) identify feasible options for Black-tailed Prairie Dog management inside and outside Grasslands National Park. It should be noted that this exercise, while informative, did not lead to consensus between all parties on all points. Municipal governments and ranchers have disputed the accuracy of historic populations, population trends, the necessity of expanding the active range of Black-tailed Prairie Dogs, and the potential for economic impacts.

6.2 Strategic Direction for Recovery

This document provides the strategic direction for recovery of the Black-tailed Prairie Dog across the entire range in Canada. The recovery measures outlined below are arranged by both the broad strategies required to recover the species and the general descriptions of research and management approaches that will be taken. The classification of broad strategies is based on the conservation actions classification developed by the International Union for the Conservation of Nature–Conservation Measures Partnership (2.0). For each recovery measure, desired outcomes and anticipated timelines for implementation and delivery are indicated. Identified threats that will be addressed by each recovery measure relate to those described in Section 4.

Table 2. Recovery planning table and Implementation Schedule

Approach	#	Recovery Measure	Desired Outcome	Priority[a]	Threats or concerns addressed	Timeline
Broad Strategy: 8. Research & Monitoring – 8.1 Basic Research & Status Monitoring						
Population and/or individual level research to inform recovery planning and active management	1	Support research partnerships to better understand factors affecting population dynamics and the long-term viability of the population.	By 2025, the Population Viability Analysis is updated with newly acquired data on survival and reproduction in response to climatic variation, sylvatic plague and other stressors.	Medium	Knowledge Gaps	2020-2025
	2	Assess genetic viability of the Canadian population and its structure in relation to others within the geographic region to inform conservation translocations and/or genetic management (e.g., genetic rescue), should these be necessary.	By 2025, the genetic diversity, inbreeding coefficient and the degree of genetic isolation from nearest populations are estimated.	Medium		2020-2025
	3	Test, on a small experimental scale, the effectiveness of supplemental feeding in dampening population crashes and minimize risk of population extirpation during multi-year drought, when the population is below minimum target density (e.g., 7.5 individuals/ha).	By 2030, assess whether (and at which ecological thresholds) supplemental feeding is effective in mitigating population crashes following drought.	Medium		2020-2030

Conduct research to inform sylvatic plague management	4	Support research to test alternative and complementary tools for plague management (e.g., Fipronil) and increase its effectiveness.	By 2025, the effectiveness and safety of Fipronil grain bait for control of fleas on Black-tailed Prairie Dog colonies are tested in Canada, provided that applicable permits are obtained.	High	Knowledge Gaps (cont.)	2020-2025
Habitat mapping and assessment to help identify/refine critical habitat and further prioritize sites for Black-tailed Prairie Dog colony expansion and creation within Grasslands National Park	5	• Update vegetation/soil mapping and habitat assessment within Grasslands National Park to help identify/refine critical habitat. • Develop and apply a Habitat Suitability Index to identify priority sites for promoting expansion of currently occupied colonies, or establishing Black-tailed Prairie Dog colonies in suitable areas currently unoccupied by the species within Grasslands National Park • Identify sites for establishment of new colonies in consultation with partners and stakeholders.	• By 2025, vegetation and soil mapping within the West Block of Grasslands N.P is updated. • By 2025, sites that are suitable for expansion and/or establishment of Black-tailed Prairie Dog colonies within Grasslands National Park are identified, based on mapping data and habitat suitability index assessments.	High		2020-2025
Conduct research to identify best techniques and tools for expanding prairie dog occupancy within Grasslands National Park. and increase resilience of the population	6	Test different methods for establishing new colonies (e.g., fire, grazing, restoration and/or translocation), using Habitat Suitability Index and habitat mapping data to prioritize areas for restoration while protecting and managing habitat for the recovery of multiple species at risk.	By 2030, management tools that are effective for establishing new Black-tailed Prairie Dog colonies are identified, depending on the availability of suitable sites.	Medium		2025-2030
Advance understanding of population abundance and distribution within Saskatchewan	7	Utilize local knowledge and satellite imagery to improve understanding of historical and current distribution of Black-tailed Prairie Dogs inside and outside Grasslands National Park	By 2030, the historical range and current distribution of Black-tailed Prairie Dogs in Canada are updated with newly acquired data.	High		2020-2030

Broad Strategy: 2. Species Management – 2.1 Species Stewardship						
Plague mitigation and management	8	Implement the Grasslands National Park sylvatic plague surveillance and management plan. Update and revise the plan based on the best available data/knowledge, available resources, and research results (see recovery action 4).	• A surveillance and mitigation program for sylvatic plague is implemented annually. • By 2030, the plague management plan is updated to reflect best available knowledge, scientific evidence and locally collected data.	High	8.1 - Invasive non-native species (Sylvatic plague)	annually
Traffic management strategy	9	Implement the traffic management strategy to minimize Black-tailed Prairie Dog mortality on road-side colonies. Update and revise the strategy based on the best available data/knowledge and available resources	Road mortality of Black-tailed Prairie Dogs on road-sides colonies is minimized through the annual implementation of a traffic management strategy.	Low	4.1 Roads & railroads	annually
Develop and implement a containment and conflict mitigation plan (outside Grasslands National Park/critical habitat)	10	Prevent and mitigate colonization of Black-tailed Prairie Dogs on private or Crown land outside Grasslands National Park and beyond critical habitat targeted by population and/or habitat management programs, to mitigate conflict and increase neighbor acceptance/trust toward agencies involved in Black-tailed Prairie Dog recovery and management. Control policies and tools to be in place before establishment or restoration of colonies is attempted within Grasslands National Park (see action #5). To be assessed on a case by case basis, and implemented using a combination of non-lethal control options and lethal control options if non-lethal control proves ineffective or non-feasible	By 2023, policies and operational protocols are in place to address, mitigate and manage conflict between ranching/agricultural operations and Black-tailed Prairie Dogs natural colonization on private or Crown land outside Grasslands National Park and beyond critical habitat. Stakeholder feedback and input is sought and included in the development of policies and protocols.	High	2.3 Livestock farming & ranching; 5.1 Hunting & collecting terrestrial animals	2023-2030

Broad Strategy: 1. Land/Water Management – 1.2 Ecosystem & Natural Process (Re)Creation						
Habitat management and enhancement	11	Manage and apply prescribed fire and grazing (i.e., livestock, bison) in areas adjacent to existing Black-tailed Prairie Dog colonies within Grasslands National Park to maintain favourable habitat conditions for occupation and natural expansion. Use existing habitat mapping and decision tool and multi-species at risk approach to prioritize areas for habitat management.	• By 2030, prescribed fires are applied on an average of 25 hectares/year with the goal of maintaining favourable habitat conditions for Black-tailed Prairie Dog occupation and natural expansion while managing for multiple species at risk. • By 2030, grazing strategies are in place to improve habitat for Black-tailed Prairie Dogs and other species at risk.	Medium	2.1 Annual & perennial non-timber crops; 7.1 Fire & fire suppression	2020-2030
Broad Strategy: 5. Livelihood, Economic and Moral Incentives – 5.4 Direct Economic Incentives						
Incentivize innovative grazing practices that are compatible with Black-tailed Prairie Dog management and recovery inside Grasslands National Park	12	Evaluate, develop and implement strategic grazing management or prescriptions, including reduced lease fees (e.g., compensating for loss of forage by prairie dogs or other tools) or providing alternative land for grazing, should additional land be allocated for Black-tailed Prairie Dog management.	By 2030, grazing agreements within Grasslands National Park are in place to manage habitat for Black-tailed Prairie Dogs while accounting for forage loss or providing applicable ranchers with alternative land for grazing.	Medium	2.1 Annual & perennial non-timber crops; 2.3 Livestock farming & ranching	2020-2030
Incentivize innovative grazing practices that are compatible with Black-tailed Prairie Dog management and recovery outside Grasslands National Park	13	Evaluate, and if deemed feasible, implement the use of grass banking and/or tax breaks to compensate for range loss due to Black-tailed Prairie Dogs outside Grasslands National Park on currently occupied habitat; ensure applicable multi-jurisdiction agreements are developed in consultation and coordination with landowner/stakeholders.	• By 2025, policies and agreements to support grazing strategies compatible with Black-tailed Prairie Dogs on occupied habitat outside Grasslands National Park are evaluated or identified. • By 2030, such policies and strategies are implemented, where applicable.	Low	2.1 Annual & perennial non-timber crops; 2.3 Livestock farming & ranching; 5.1 Hunting & collecting terrestrial animals	2020-2030

Broad Strategy: 6. Conservation Designation and Planning – 6.4 Conservation Planning						
Develop a high-level spatial prairie conservation plan/strategy	14	Contribute to an inter-agency, landscape planning process to promote multi-species at risk habitat conservation in the greater Grasslands National Park ecosystem and South of the Divide, capture the ecological value of native prairie in the market (e.g., wildlife-friendly beef) and prevent further habitat loss (e.g., conservation easements on deeded land).	By 2030, responsible jurisdictions, agencies and stakeholders in the South of the Divide have evaluated and identified conservation strategies, economic tools and incentives to capture the ecological value of native prairie and help prevent further habitat loss.	Medium	2.1 Annual & perennial non-timber crops; 2.3 Livestock farming & ranching; 5.1 Hunting & collecting terrestrial animals	2020-2030
Broad Strategy: 3. Awareness raising – 3.1 Outreach and Communications						
Develop and implement a communication plan for Black-tailed Prairie Dog	15	Develop and implement a communication plan (e.g., town hall or one-on-one meetings, newsletter, etc.) to provide details, share information and receive feedback with respect to Black-tailed Prairie Dog management, and to the extent possible, incorporate local knowledge into future plans	• By 2022, Grasslands National Park has developed a communication plan to exchange information with local stakeholders on Black-tailed Prairie Dog recovery and management programs. • By 2025, this plan is implemented annually and amended as required by involved parties.	High	2.3 Livestock farming & ranching; 5.1 Hunting & collecting terrestrial animals	2020-2025
Public engagement and outreach	16	Engage the public in research and active management programs to support conservation science and increase awareness of species at risk recovery, in collaboration with existing or developing outreach programming to urban audiences.	• Volunteer programs in Grasslands National Park are in place and implemented annually to engage the public in Black-tailed Prairie Dog conservation science. • By 2030, Grasslands National Park interpretation programs are built to reflect and share knowledge obtained through Black-tailed Prairie Dog monitoring and recovery programs. • Conservation stories on Black-tailed Prairie Dogs are shared annually using Grasslands National Park social media or other communication tools.	Low	2.1 Annual & perennial non-timber crops; 2.3 Livestock farming & ranching; 6.1 Recreational activities/1.3 Tourism & Recreation Areas;	2020-2030

[1] "Priority" reflects the degree to which the broad strategy contributes directly to the recovery of the species or is an essential precursor to an approach that contributes to the recovery of the species. High priority measures are considered those most likely to have an immediate and/or direct influence on attaining the population and distribution objectives for the species. Medium priority measures may have a less immediate or less direct influence on reaching the population and distribution objectives, but are still important for the recovery of the population. Low priority recovery measures will likely have an indirect or gradual influence on reaching the population and distribution objectives, but are considered important contributions to the knowledge base and/or public involvement and acceptance of the species.

[2] Classification of broad strategies and approaches is adopted from IUCN Conservation Measures Partnership Conservation Actions Classification v. 2.0.

6.3 Narrative to Support the Recovery Planning Table

Sylvatic plague, drought, small population size and isolation are the major threats to the persistence and recovery of Black-tailed Prairie Dogs in Canada. While sylvatic plague can have a significant impact through increase of mortality rates and colony die-off, small population size and isolation limit the resilience of the population to increases in climate-change driven stressors such as drought, which severely affects individual survival and reproduction.

Active plague surveillance through burrow swabbing, host combing and rapid visual surveillance will maximize the chances of early detection of plague and inform active management to minimize the risk of disease outbreak and population die-off. Continuing population-level research will help ensure recovery objectives and actions reflect a proper understanding of environmental stressors associated with climate change. Projected climate trends are not only expected to impact survival and reproduction rates by increasing frequency of drought events (Stephens et al. 2018), but also shift or extend vector life cycles, alter flea community composition and host-parasite interactions (Eads and Hoogland 2017), and cause an overall shift in the geographic range of sylvatic plague (Nakazawa et al. 2007). While burrow dusting is effective in reducing abundance of plague vectors (i.e., fleas), its effects extend to multiple non-target taxa within the invertebrate community, with potential consequences for other imperilled, dependent species such as the Mountain Plover (Dinsmore et al. 2005) and Burrowing Owl (Dechant et al. 2002). However, this must be weighed against the risk of local extirpation of Black-tailed prairie dogs and cascade effects on many associated species at risk. Fleas can develop genetic resistance to deltamethrin following regular exposure (Bossard et al. 1998, Wilder et al. 2008), which limits its long-term use and emphasizes the value of rotational plans for insecticide application. Sylvatic plague vaccines (SPV) are demonstrated to increase apparent survival in both adult and juvenile Black-tailed Prairie Dogs, and can facilitate development of population-level protection over time (Rocke et al. 2017). However, preliminary results from field trials in Montana, Wyoming and Colorado, suggest that average post-plague outbreak survival of Black-tailed Prairie Dog populations treated with SPV is approximately 18% (2019 BFFRIT Disease and CS Subcommittee); therefore, the high costs of this mitigation tool currently outweigh its benefits. The use of orally-administered insecticides (i.e., Fipronil) has returned encouraging results in controlling flea populations on Black-tailed Prairie Dog and other rodent hosts (Borchert et al. 2009, Poché et al. 2017, Eads et al. 2019), and could reduce impacts on non-target invertebrates, as well as lower costs of plague management (Borchert et al. 2009). However, further research and collaboration with partnering United States agencies is required to test for the safety and effectiveness of using orally-administered insecticides in Canada.

The relatively small size of the Canadian Black-tailed Prairie Dog population (estimated ranging between 3,008 and 20,851 individuals >1-year-old in 2013-2019) limits its potential to rebound from periodic disturbance and avoid demographic or genetic collapse (i.e., low resilience). At the same time, the population is present in only one geographical location in Canada (i.e., no redundancy), which makes it more susceptible

to catastrophic loss or extirpation. Population and distribution objectives for Black-tailed Prairie Dogs promote an increase of the area occupied, which could potentially be achieved through a combination of colony expansion (i.e., increase in the extent of existing colonies) and colony creation (i.e., establishment of new colonies). Both activities rely on habitat mapping and suitability assessments to inform habitat management for multiple species at risk. Building on habitat mapping and a decision support tool completed for Grasslands National Park (Thorpe and Stephens, 2017), the development and implementation of a Habitat Suitability Index is required to identify sites for Black-tailed Prairie Dog colony expansion and creation within Grasslands National Park. More research is necessary to fully assess the genetic makeup of the Canadian Black-tailed Prairie Dog population and inform management actions to ensure its genetic viability and persistence (e.g., conservation translocations). Experimental studies are also required to test feasibility and effectiveness of small-scale supplemental feeding in minimizing the risk of population extirpation during multi-year drought.

Black-tailed Prairie Dogs are an iconic species, which can be used to help engage visitors in conservation science and increase awareness on species at risk recovery, in conjunction with existing outreach and educational programming to broader audiences. However, acceptance and tolerance toward Black-tailed Prairie Dogs by local rural communities is challenged by a long history of conflict with agriculture and ranching activities. Grasslands National Park will continue to engage partners (i.e., Calgary Zoo, US Fish & Wildlife, WWF Northern Great Plains program, Nature Conservancy of Canada), neighbors and stakeholders (e.g., local ranchers, SK Ministry of Environment/Agriculture, Community Pastures, Environment & Climate Change Canada, Indigenous Peoples) to implement recovery actions for Black-tailed Prairie Dog inside Grasslands National Park. At the same time, Parks Canada will continue working to identify and develop tools to mitigate conflict with agricultural operations and stakeholder interests, facilitate coexistence with the species and promote support toward Black-tailed Prairie Dog conservation in the greater prairie ecosystem. Effective cooperation and communication with neighboring jurisdictions and agencies (i.e., Environment and Climate Change Canada, SK Ministry of Environment, SK Agriculture) will be also achieved through Species At Risk Coordinating Committee and other existing tools. A communication plan will be developed and implemented to share information and receive feedback from Grasslands National Park stakeholders/neighbors, thus acknowledging stakeholders' concerns and ensuring transparency with respect to Parks Canada’s management objectives and programs for Black-tailed Prairie Dogs. Building consensus with stakeholders will remain challenging due to the long history of conflict between ranching operations and Black-tailed Prairie Dogs.

6.4 Monitoring

As part of the Grasslands National Park’s ecological integrity monitoring program, Parks Canada will continue to monitor relative abundance (i.e., average density in visual count plots) and area of occupancy (i.e., perimeter mapping) of Black-tailed Prairie Dogs.

Visual count data are collected annually on 14 selected Black-tailed Prairie Dog colonies and perimeter mapping is conducted every two years for all the existing colonies. Monitoring of these two metrics have followed standardized methods and protocols since 1998, and will be conducted in collaboration with partners involved in Black-tailed Prairie Dog conservation research (e.g., Calgary Zoo). Data on Black-tailed Prairie Dog area of occupancy within Grasslands National Park is made publicly available through the Open Government portal[6].

7. Critical Habitat

The federal *Species at Risk Act* (SARA) defines critical habitat as "the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species…". Section 41(1)(c) of SARA requires that a recovery strategy includes identification of the species' critical habitat, to the extent possible, as well as examples of activities that are likely to result in its destruction.

As a burrowing species, Black-tailed Prairie Dogs require soils that support extensive burrow systems and that allows them to establish colonies in broad, flat river valleys and upland grasslands (Hoogland 1995). In Saskatchewan, Black-tailed Prairie Dog colonies are predominantly associated with the well-drained soils, moderate slopes and open grasslands in the valley-bottoms of the Frenchman River (Thorpe and Stephens 2017). Very limited knowledge is available in Canada with respect to the fine-scaled habitat requirements for Black-tailed Prairie Dogs such as detailed soil characteristics, plant community structure, and elements that may pose a barrier to movement of individuals (Tuckwell and Everest 2009a). The biophysical attributes of Black-tailed Prairie Dog critical habitat are as follows:

- occurrence of Black-tailed Prairie Dog colonies, including both active and inactive sections, excluding all existing roads
- well-drained soils
- supporting extensive burrow systems
- open grasslands with flat terrain or moderate slopes
- limited invasion by exotic grasses

Preliminary results obtained through the Population Viability Analysis suggest that approximately 2,000 ha of occupied Black-tailed Prairie Dog colonies may help improve the probability of persistence of the species in Canada. Critical habitat for the Black-tailed Prairie Dog is based on habitat occupancy and is identified in this document to the extent possible, based on the best available information. Additional critical habitat may be added in the future if new information supports the inclusion of areas beyond what is currently identified (e.g., additional areas required for expansion of existing colonies or establishment of new colonies).
A schedule of studies (Table 3) has been developed to provide the information necessary to complete the identification of critical habitat that will be sufficient to meet

[6] https://open.canada.ca/data/en/dataset/82f02c1a-6f9d-4441-b2df-7bb59f9e84a2

the population and distribution objectives. The identification of critical habitat will be updated when the information becomes available, either in a revised recovery strategy or action plan(s).

7.1 Identification of the Species' Critical Habitat

The identification of critical habitat in federal recovery documents is reviewed by partners, stakeholders and jurisdictions and is also open to a public consultation process.

Standardized monitoring of the extent of Black-tailed Prairie Dog colonies in Canada has been conducted since 2002 and is used as the basis for the identification of critical habitat. This corresponds to the maximum extent (i.e., dissolved polygons) of active colonies documented in 2002-2019 (Figure 5), which total 1399.8 hectares (ha). All colonies in which critical habitat is identified are currently active and occupied. However, not all portions of critical habitat have been continuously occupied since 2002. Referring to the maximum extent of Black-tailed Prairie Dog colonies across multiple years allows for population responses to fluctuations in forage availability associated with climatic variability (i.e., alternation of years with low and high precipitation).

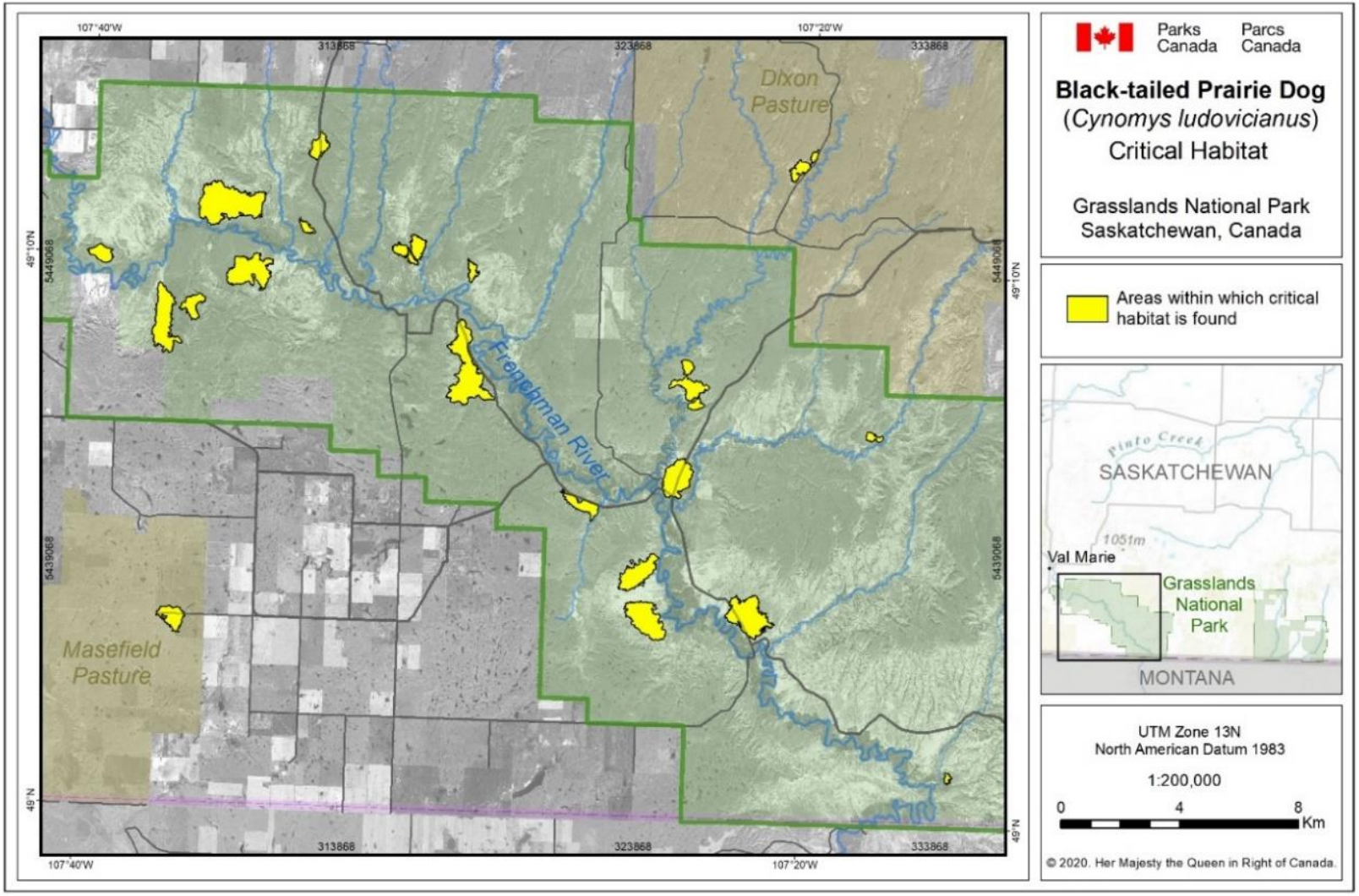

Figure 4. Critical habitat for Black-tailed Prairie Dog in Canada is represented by the maximum extent (i.e., dissolved polygons) of colony perimeters mapped in 2002-2019 within Grasslands National Park (green polygon) and on non-federal land (brown polygons).

Within the West Bock of Grasslands National Park, critical habitat may be amended in the future to include priority sites identified for Black-tailed Prairie Dog habitat expansion (i.e., expansion of currently occupied colonies), restoration (i.e., re-establishment of historic colonies) and/or establishment (i.e., creation of colonies in areas previously not occupied). In Grasslands National Park's West Block, a maximum of 14,062 hectares of habitat (with 5,600 ha and 8,462 ha located in lowlands and uplands, respectively) are currently estimated as potentially suitable for the Black-tailed Prairie Dog, based on abiotic factors relevant to Black-tailed Prairie Dog ecology (i.e., slope, soil; Thorpe and Stephens 2017). Finer scale habitat suitability assessments based on vegetation characteristics (i.e., Habitat Suitability Index) will allow identification of areas suitable for natural or assisted establishment of new prairie dog colonies and/or expansion of existing colonies, in order to increase population resilience and meet population and distribution objectives (see Schedule of Studies, section 7.2).

Critical habitat outside Grasslands National Park will also be refined once new information is generated through specific data collection, habitat assessment and research. Outside Grasslands National Park, however, the extent of farmland and the low social acceptance of the species significantly limit the opportunities for Black-tailed Prairie Dog habitat restoration and colony establishment.

7.2 Schedule of Studies to Identify Critical Habitat

Table 3. Schedule of Studies to Identify Critical Habitat for Black-tailed Prairie Dog

Activity #	Description of activity	Rationale	Timeline
1	Develop and implement a Habitat Suitability Index to rank general areas identified as suitable for Black-tailed Prairie Dogs based on abiotic factors, according to the Habitat Mapping and Decision Support Tool (Thorpe and Stephens 2017).	There is a need to identify priority sites for promoting expansion of currently occupied colonies, or potential establishment of Black-tailed Prairie Dog colonies in areas currently unoccupied by the species, in order to increase population resilience and meet population & distribution objectives	2020-2025
2	Update vegetation/soil mapping and habitat suitability model within Grasslands N.P.	There is a need to update the soil and vegetation inventory and mapping within Grasslands N.P. (currently limited to lowlands and valley grasslands). These data will help identify additional suitable areas for Black-tailed Prairie Dog and thus, following application of Habitat Suitability Index protocols (see activity 1), potentially refine critical habitat within Grasslands N.P.	2025

3	Complete vegetation/soil mapping and habitat suitability assessment outside Grasslands N.P.	There is a need to conduct a soil and vegetation inventory and mapping in land adjacent to Grasslands N.P. These data will help identify additional suitable areas for Black-tailed Prairie Dog and thus, following application of Habitat Suitability Index protocols (see activity 1), potentially refine critical habitat for Black-tailed Prairie Dogs in the larger Grasslands N.P ecosystem.	2025-2030

7.3 Activities Likely to Result in the Destruction of Critical Habitat

Understanding what constitutes destruction of critical habitat is necessary for the protection and management of critical habitat. Destruction of critical habitat is determined on a case-by-case basis, and could result from a single or multiple activities including from the cumulative effects from one or more activities over time. Destruction of critical habitat could result if part of the critical habitat were degraded, either permanently, or temporarily, such that it would not serve its function when needed by the species. Activities described in Table 4 include those likely to cause destruction to critical habitat for Black-tailed Prairie Dogs; however destructive activities are not limited to those listed.

Table 4. List of activities likely to result in the destruction of critical habitat for Black-tailed Prairie Dogs

Description of activity	Description of effect	Details of effect
Destruction of native vegetation through cultivation (e.g., crops and agronomic species).	Plant cover or species become altered so an area is no longer suitable for colony expansion or establishment	Related to IUCN-CMP Threats: 1.3 Tourism and recreation areas; 2.1 Annual and perennial non-timber crops; 2.3 Livestock farming and ranching. This activity may result in destruction of critical habitat if it occurs within the identified polygons. This activity may result in destruction at all times of the year.
Excavation or alteration of substrate that results in a permanent change in condition (e.g., infrastructure and building development, industrial exploration, gravel extraction, road paving)	Physically replaces suitable habitat so that an area is no longer suitable for colony expansion or establishment	Related to IUCN-CMP Threats: 1.3 Tourism and recreation areas; 3.1 Oil and gas drilling; 3.3 Renewable energy; 4.1 Roads & railroads; 4.2 Utility & service lines. This activity may result in destruction of critical habitat if it occurs within the identified polygons. This activity may result in destruction at all times of the year.

Deliberate flooding or filling	Physically replaces suitable habitat so that an area is no longer suitable for colony expansion or establishment	Related to IUCN-CMP Threats: 7.2 Dams and water management/use. This activity may result in destruction of critical habitat if it occurs within the identified polygons. This activity may result in destruction at all times of the year.

Outside Grasslands National Park, conversion of tame (i.e., non-native) grass to annual crops may not result in destruction of critical habitat, if done for the purposes of rejuvenating the forage. This activity may be permitted if conducted for a maximum of three years, followed by reseeding to perennial forage or native vegetation on the fourth year, and the evaluation done through a provincial authorization process. Maintenance of existing roads, through activities such as mowing and grading, will not destroy critical habitat. Should additional restrictions apply on land use outside of Grasslands National Park (e.g., excavation), Saskatchewan Ministry of Agriculture will work with lessees on agricultural Crown land to accommodate land use requests in in a way that balances the need to support sustainable grazing while protecting critical habitat.

7.4 Proposed Measures to Protect Critical Habitat

The information below outlines the measures proposed to be taken to protect critical habitat for the Black-tailed Prairie Dog. Approximately 94% of the critical habitat for Black-tailed Prairie Dogs occurs within the proposed boundary of Grasslands National Park, a federal protected area, while the rest is located within the former community pastures of Dixon (2.3%) and Masefield (3.3%) and on private land adjacent to Grasslands National Park's boundary (1.1%). As of 2019, both Masefield and Dixon pastures are provincial crown land and are under long-term (i.e., 15-years) grazing leases with SK Ministry of Agriculture.

7.4.1 Measures Proposed to Protect Critical Habitat on Federal Lands

As required under SARA (s.58(2)), critical habitat identified on lands in Grasslands National Park named and described in Schedule 1 to the *Canada National Parks Act* will be described in the *Canada Gazette* within 90 days after this plan identifying the critical habitat is included in the public registry. A prohibition against destruction of critical habitat under s. 58(1) will apply 90 days after the description of the critical habitat is published in the *Canada Gazette*. For critical habitat located on other federal lands, including other federal lands associated with Grasslands National Park, the competent minister(s) may make an order, pursuant to SARA ss.58(4) and (5), so that the prohibition against destruction of critical habitat applies to the Black-tailed Prairie Dog within 180 days after this plan identifying the critical habitat is included in the public registry.

A large portion of the Black-tailed Prairie Dog critical habitat here defined (1208.2 ha; 86.3%) is also protected as critical habitat for Black-footed Ferrets (Tuckwell and Everest 2009b), Burrowing Owls (Environment Canada 2012), and Mountain Plovers (Environment Canada 2006).

7.4.2 Measures Proposed to Protect Critical Habitat on non-Federal Lands

The province of Saskatchewan will provide protection for Black-tailed Prairie Dog critical habitat identified on non-federal lands using provincial Lands Act legislation and policies as well as other tools as appropriate.

8. Evaluation of Socio-economic Costs and Benefits

The *Species At Risk Act* requires that an action plan include an evaluation of the socio-economic costs of the action plan and the benefits to be derived from its implementation (SARA 49(1)(e), 2002). This evaluation addresses only the incremental socio-economic costs of implementing this action plan from a national perspective as well as the social and environmental benefits that would occur if the action plan were implemented in its entirety, recognizing that not all aspects of its implementation are under the jurisdiction of the federal government. It does not address cumulative costs of species recovery in general nor does it attempt a cost-benefit analysis. Its intent is to inform the public and to guide decision making on implementation of the action plan by partners.
The protection and recovery of species at risk can result in both benefits and costs. The Act recognizes that "*wildlife, in all its forms, has value in and of itself and is valued by Canadians for aesthetic, cultural, spiritual, recreational, educational, historical, economic, medical, ecological and scientific reasons*" (SARA 2002). Self-sustaining and healthy ecosystems with their various elements in place, including species at risk, contribute positively to the livelihoods and the quality of life of all Canadians. A review of the literature confirms that Canadians value the preservation and conservation of species in and of themselves. Actions taken to preserve a species, such as habitat protection and restoration, are also valued. In addition, the more an action contributes to the recovery of a species, the higher the value the public places on such actions (Loomis and White 1996; DFO 2008). Furthermore, the conservation of species at risk is an important component of the Government of Canada's commitment to conserving biological diversity under *the International Convention on Biological Diversity*. The Government of Canada has also made a commitment to protect and recover species at risk through the Accord for the Protection of Species at Risk. The specific costs and benefits associated with this action plan are described below.

8.1 Policy baseline

The province of Saskatchewan has access to legislative, regulatory, and management tools for the conservation and stewardship of the Black-tailed Prairie Dog.
The *Wildlife Act* of Saskatchewan prevents the unlicensed killing of prairie dogs on national park lands as well as on deeded and on provincial and federal crown lands within Saskatchewan. The *Wildlife Habitat Protection Act* prevents the sale of land with

high ecological value. The *Provincial Lands Act* and the regulations that fall under it provide protection for native vegetation and support good grazing management through lease agreements. The baseline also includes any recovery measures already undertaken, such as those carried out by recovery practitioners funded by federal or provincial species at risk programs, in-kind contributions by recovery biologists and/or universities. The critical habitat located on federal lands associated with Grasslands National Park will be legally protected under s.58 of the Species at Risk Act.

8.2 Socio-economic costs of implementing this action plan

The first category includes the direct costs of recovery and conservation actions, such as monitoring and research, habitat assessment and restoration, conservation and protection, sylvatic plague management, communication and engagement. These costs in the short-medium term (i.e., 10 years) are estimated to total less than $10 million. These costs to the government are expected to be covered by Parks Canada through current funds available for species at risk recovery and management, and not result in additional costs to society. This includes any incremental salary costs, materials, equipment, and contracting of professional services for measures outlined in Table 2. Many of the proposed measures will be integrated into the operations of Grasslands National Park (i.e., ecological integrity monitoring, species at risk recovery). No major socio-economic costs to park visitors, stakeholders or Indigenous groups are expected as a result of this action plan. When applicable, costs of research on population and habitat will be shared with partners and institutions involved in Black-tailed Prairie Dog conservation science.

While it is possible that some critical habitat outside Grasslands National Park may be later identified and require financial incentives for protection, the vast majority of critical habitat is already adequately protected through an existing National Park or other mechanisms (e.g., former provincial pastures). Mechanisms and incentives such as those that develop, recognize and promote the value of sustainable rangeland management could help adequately protect other habitat, but those costs are unknown at this time.

The second category includes opportunity costs (i.e., foregone benefits) that may be associated with the conservation actions implemented. These are the costs of foregone economic activity, should a reduction in such activity be deemed necessary to recover the species. These include, for example, the reduction in profits resulting from the need to alter grazing management practices in some specific situations, foregone financial benefits from converting native grassland to cropland, or foregone profits, taxes and royalties that would result from increasing petroleum development in the region. However, the vast majority (i.e., approx. 96.7%) of the proposed critical habitat is protected through the *Canada National Park Act*, the *Species at Risk Act* (i.e., critical habitat for other species at risk), restrictions under provincial grazing leases, or a combination of these, and therefore not available for conversion to cropland or resource extraction. It is thus reasonable to infer that opportunity costs will be minimal. Importantly, Black-tailed Prairie Dogs consume and clip many of the same species of grasses and forbs that are consumed by livestock (Detling 2006). Because of such a high dietary overlap, Black-tailed Prairie Dogs have been historically regarded as a

competitor with domestic livestock. While the competition between Black-tailed Prairie Dog and livestock at the broad geographic scale is today relatively negligible (Detling 2006) – due to the fact that the species currently inhabits only 2% of its former range across North America (Miller et al. 1990, Miller et al. 2007) – at the local scale (e.g., single paddock or ranch), where prairie dogs can occupy a significant portion of the area, competition can be economically significant.
Costs should thus include forage loss by ranchers due to the presence of Black-tailed Prairie Dogs on the land where their livestock graze, or in the worst-case scenario (i.e., 100% forage loss), the entire number of Animal Units that could be grazed on a given amount of land that is inhabited or managed for Black-tailed Prairie Dogs.
Based on recommended stocking rates for southern Saskatchewan (Thorpe 2007) and data available to Parks Canada, the stocking rates that could be applied on average to pastures with healthy range conditions within the West Block of Grasslands National Park is estimated as 0.41 Animal Unit Months per hectare (AUM/ha). This would correspond to a maximum loss of approximately 27 cow-calf pairs (assuming 6 months of grazing) for 1,400 ha of occupied Black-tailed prairie dog habitat (i.e., 500 ha in addition to what is already occupied by the species as of 2019), which is identified as minimum population and distribution objective within this recovery strategy. Achieving a total of 2,000 ha (i.e., adding an additional 1,100 ha to what is occupied as of 2019), would correspond to a maximum loss of 60 cow-calf pairs (assuming 6 months of grazing). It has to be noticed, though, that 100% forage loss is an extreme scenario; instead, scientific evidence suggests that nutritional content of forage available to herbivores on Black-tailed Prairie Dog colonies is higher than forage outside colonies (Holland and Detling 1990, Fahnestock and Detling 2002). Coupling this element with incentives (e.g., reduced grazing fees) that may be provided to support use of livestock grazing as a management tool to improve habitat for Black-tailed Prairie Dogs within Grasslands National Park and promote natural colony expansion, economic costs may be significantly lower.

The conflict, however, cannot be diminished to an estimate of the economic cost associated to forage loss. Black-tailed Prairie Dogs have been and are still regarded as a threat to the livelihood of ranchers, which is ultimately at the base of eradication campaigns (i.e., shooting, poisoning) that have resulted in the species' decline across its range in North America (Miller et al. 1990, Miller et al. 2007). The species is also perceived as a symbol of poor land stewardship (Lamb et al. 2006). There is therefore a social and emotional cost to the conservation of the species; while this cost cannot be quantified, its implications need to be taken into account when developing and implementing this recovery plan.

8.3 Benefits of implementing this action plan

Black-tailed Prairie Dogs are typically referred to as ecosystem engineers (Bangert and Slobodchikoff 2006) and keystone species (Kotliar et al. 2006). They create and alter habitat through burrowing, grazing and clipping vegetation, influence plant community and composition (Weltzin et al. 1997), maintaining and affecting the rate of ecosystem

processes including disturbance and nutrient cycling (Whicker and Detling 1988, Ceballos et al. 2010, Ponce-Guevara et al. 2016).
Black-tailed Prairie Dog provides a source of food and habitat for many vertebrate and arthropod species (Kotliar et al. 2006, Tuckwell and Everest 2009a). In Canada, this includes several other species at risk (e.g., Ferruginous Hawk, American Badger, Burrowing Owl, Mountain Plover, Tiger Salamander, Prairie Rattlesnake, Swift Fox). Furthermore, conservation of Black-tailed Prairie Dogs is critical for the recovery of the Black-footed Ferret (*Mustela nigripes)* in Canada.
For all these reasons, Black-tailed Prairie Dogs are highly relevant for the ecological integrity of the mixed-grass prairie ecosystem. Recovery actions implemented for Black-tailed Prairie Dogs are expected to result in conservation gains for associated species, and are therefore identified as a conservation priority for the Canadian mixed-grass prairie (Parks Canada 2016b).
Given their conspicuity and unique social behavior, Black-tailed Prairie Dogs are also an iconic species, which can play a unique role in engaging the public in research and active management programs to support conservation science and increase awareness on prairie conservation and species at risk recovery.

8.4 Distributional impacts

Implementation of this action plan will require collaboration among many organizations and groups: not only Parks Canada, but also other jurisdictions, organizations, and individuals. This includes contributions from various levels of federal and provincial government, non-governmental organizations, ranchers, non-profit conservation organizations and universities. It is also possible that new groups would become involved in future recovery efforts.

9. Measuring Progress

The performance indicators presented below provide a way to define and measure progress toward achieving the population and distribution objectives.

- *By 2050, the 6-year moving average of the Black-tailed Prairie Dog population density is maintained to ≥ 7.5 individuals/ha;*
- *By 2050, the 6-year moving average minimum extent of Black-tailed Prairie Dog area of occupancy is ≥ 1,400 ha distributed over ≥ 20 colonies;*
- *Sylvatic plague-induced annual mortality is mitigated and contained to < 5% of the population or area of occupancy;*

The competent minister must monitor and report on the implementation of the recovery strategy (s. 46 of SARA) and action plan (s. 55 of SARA) and the progress towards meeting its objectives within five years.

Reporting on implementation of the action plan (under s. 55 of SARA) will be done by assessing progress towards implementing the broad strategies. Reporting on the ecological and socio-economic impacts of the action plan (under s. 55 of SARA) will be

done by assessing the results of monitoring the recovery of the species and its long term viability, and by assessing the implementation of the action plan.

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Appendix A: Effects on the Environment and Other Species

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*[7]. 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 and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or any of the Federal Sustainable Development Strategy's[8] (FSDS) goals and targets.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that strategies and recovery measures may also inadvertently lead to environmental effects beyond the intended benefits. The planning process, which is based on national guidelines, directly incorporates consideration of all environmental effects, with a particular focus on possible impacts on non-target species or habitats. The results of the SEA are incorporated directly into the recovery strategy and action plan itself, and are summarized below.

Overall, it is anticipated that implementation of this recovery strategy and action plan will have a beneficial impact on non-target species, ecological processes, and the environment in Grasslands National Park and will not result in any significant adverse ecological, social or cultural effects. In particular, measures outlined in this plan may contribute to enhanced understanding and protection of other species and ecosystem processes that co-exist with the Black-tailed Prairie Dog, including the Burrowing Owl (SARA listed as Endangered), Mountain Plover (Endangered), Ferruginous Hawk (Threatened), Swift Fox (Threatened), American Badger (Special Concern), Tiger Salamander (Special Concern) and Prairie Rattlesnake (Special Concern), as well as other rare plants and invertebrates. Furthermore, conservation of Black-tailed Prairie Dogs is critical for the National recovery of the Black-footed Ferret (Extirpated). Recovery measures for the Black-tailed Prairie Dog will be implemented with consideration of all co-occurring species at risk, such that there are no negative impacts to these species or their habitats. This plan aims to address key management priorities aimed at maintaining or improving the broader ecological integrity of Grasslands National Park Reserve (Parks Canada 2016b). Additionally, this plan outlines stewardship measures, educational programs, and awareness initiatives involving park visitors, partners and the general public. This could contribute to greater appreciation, understanding, and action towards the conservation and recovery of species at risk in general.

[7] www.ceaa.gc.ca/default.asp?lang=En&n=B3186435-1
[8] www.ec.gc.ca/dd-sd/default.asp?lang=En&n=CD30F295-1