

Amended Recovery Strategy for the Greater Sage-Grouse (*Centrocercus urophasianus urophasianus*) in Canada

Greater Sage-Grouse



2013

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Amended Recovery Strategy for the Greater Sage-Grouse
(*Centrocercus urophasianus urophasianus*) in Canada
[Proposed]
2013

The Recovery Strategy for the Greater Sage-Grouse (*Centrocercus urophasianus urophasianus*) in Canada (Lungle and Pruss 2008) was posted on the Species at Risk Public Registry in January 2008. Section 2.6 (Critical Habitat section) of the 2008 Recovery Strategy was replaced in October, 2009 (Parks Canada Agency 2009).

Under Section 45 of the *Species at Risk Act* (SARA), the competent Minister may amend a recovery strategy at any time. This 2013 Amended Recovery Strategy for the Greater Sage-Grouse (*Centrocercus urophasianus urophasianus*) in Canada (hereafter, ‘Amended Recovery Strategy’) is for the purposes of:

- Amending all sections of the Recovery Strategy for the Greater Sage-Grouse (*Centrocercus urophasianus urophasianus*) in Canada (Lungle and Pruss 2008), based on the most current information
- Amending the Replacement of Section 2.6 of the Recovery Strategy for the Greater Sage-Grouse (*Centrocercus urophasianus urophasianus*) in Canada (Parks Canada Agency 2009), based on updated information
- Identifying critical habitat throughout the species’ recent range in Alberta and Saskatchewan

Since 2008, when the Recovery Strategy for the Greater Sage-Grouse in Canada (Lungle and Pruss 2008) was written, the Guidelines for Completing Federal Recovery Strategy Templates (part of a series of *Species At Risk Act* Implementation Guidance documents) have been updated considerably. Hence, this Amended Recovery Strategy has been updated in accordance with the most recent Tri-departmental Recovery Strategy Template and the associated guidelines.

This Amended Recovery Strategy is being posted on the Species at Risk Public Registry for a 60-day comment period. At the time of final posting, the Amended Recovery Strategy will replace the 2008 Recovery Strategy for the Greater Sage-Grouse (*Centrocercus urophasianus urophasianus*) in Canada (Lungle and Pruss 2008), including the Replacement of Section 2.6 of the Recovery Strategy for the Greater Sage-Grouse in Canada (Parks Canada Agency 2009).

PREFACE

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996) 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 for listed Extirpated, Endangered, and Threatened species and are required to report on progress within five years.

The Minister of the Environment, as the Minister responsible for the Department of the Environment as well as the Parks Canada Agency, is the competent minister under SARA responsible for the recovery of the Greater Sage-Grouse. She has prepared this amended recovery strategy in accordance with section 45 of SARA and in accordance with the cooperation and consultation requirements set out in s. 39.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy and will not be achieved by Environment Canada and 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 Greater Sage-Grouse and Canadian society as a whole.

This Amended Recovery Strategy will be followed by one or more action plans that will provide information on recovery measures to be taken by Environment Canada and the Parks Canada Agency and other jurisdictions and/or organizations involved in the conservation of the species. Implementation of this strategy is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

ACKNOWLEDGMENTS

This recovery strategy is an amendment to the previous Recovery Strategy for the Greater Sage-Grouse in Canada (Lungle and Pruss 2008). Additional documents and drafts contributing to this Amended Recovery Strategy were provided by Parks Canada Agency (S. Pruss, D. Gummer, P. Knaga, M. Sutor, P. Fargey). Habitat suitability modeling and model validation was performed by D. Gummer and P. Knaga (Parks Canada Agency), with updates by K. Zimmer. Comments and background information received from the Governments of Alberta (D. Eslinger, J. Nicholson, S. Cotterill), Saskatchewan (B. Prieto, Y. T. Hwang, S. McAdam, J. Keith), Agriculture and Agri-Food Canada (R. Ashton), and Parks Canada Agency (P. Fargey, R. Pither) are appreciated. This amended recovery strategy was prepared by T. I. Wellicome and J. (Manalo) Stevens, whose efforts are greatly appreciated; P. Fargey, S. Pruss, J. Tuckwell, D. Gummer, R. Bloom are acknowledged for contributing scientific expertise; and P. Johanson and M. Wayland are acknowledged for their valuable review and comments. The efforts of ranchers, farmers, and other land managers who have helped conserve Sage-Grouse and sagebrush habitat on their lands in southern Alberta and Saskatchewan are appreciated.

EXECUTIVE SUMMARY

This Amended Recovery Strategy for the Greater Sage-Grouse (*Centrocercus urophasianus urophasianus*) in Canada updates and replaces the Recovery Strategy for the Greater Sage-Grouse (*Centrocercus urophasianus urophasianus*) in Canada (Lungle and Pruss 2008), including the Replacement of Section 2.6 of the Recovery Strategy for the Greater Sage-Grouse in Canada (Parks Canada Agency 2009).

The Greater Sage-Grouse (*Centrocercus urophasianus*; herein, Sage-Grouse) is an indigenous North American grouse species that occurs in Canada and eleven western U.S. states. Canada's population is the sub-species *C. u. urophasianus*, which occupies the silver sagebrush grassland communities of southeastern Alberta and southwestern Saskatchewan, at the northern edge of the North American Sage-Grouse range. The Sage-Grouse is listed as endangered under the *Species at Risk Act* in Canada because the very small population has declined substantially.

In 2012, 13 males were counted at leks in Alberta suggesting a population of 39–58 adults, and 18 males were counted at leks in Saskatchewan suggesting a population of 54–80 adults. Thus, the total adult population estimated for Sage-Grouse in 2012 in Canada was 93–138. Both provincial populations have declined by 98% since their highest recorded population estimates in Alberta (1968) and in Saskatchewan (1988).

The main current and future threats to Sage-Grouse in Canada include drought and extreme weather conditions, West Nile virus, sensory disturbance from vertical structures and chronic noise, increased predator pressure, habitat loss and degradation, alteration of natural hydrology, and threats inherent to small populations.

Recovery of Sage-Grouse in Canada is both technically and biologically feasible.

The population and distribution objectives are as follows:

1. Immediately, stop the decline of the adult Sage-Grouse population in Canada.
2. In the short-term, reverse the population decline, and increase the number of active leks, in both Alberta and Saskatchewan.
3. In the long-term, achieve a stable or increasing Sage-Grouse population in Canada of
 - at least 1095 adult Sage-Grouse, among 16 or more active leks in Alberta, and
 - at least 1500 adult Sage-Grouse, among 20 or more active leks in Saskatchewan.

Recovery will be carried out through the following broad strategies: i) habitat assessment, management, conservation, and protection; ii) population management and species protection; iii) population monitoring and assessment; iv) research; v) communication, collaboration, and engagement; and vi) coordination with broader conservation planning programs.

In this Amended Recovery Strategy, year-round critical habitat (for nesting, brood-rearing, and wintering) is fully identified, broadly surrounding 29 previously-identified plus 12 additional critical habitat sites for mating (i.e., leks), across the species' Canadian range. The critical habitat identified in this amended strategy replaces the previous critical habitat identified in the Replacement of Section 2.6 of the Recovery Strategy for the Greater Sage-Grouse in Canada. The amount of critical habitat identified in this amended recovery strategy totals 2812 km² of year-round habitat, plus 12.5 km² of lek critical habitat, in Canada.

One multi-species action plan, involving Sage-Grouse over the majority of the species' Saskatchewan range, will be completed within 1 year of final posting of this Amended Recovery Strategy. Action plans covering the remainder of the species' range in Canada will be completed within 4 years of final posting of this Amended Recovery Strategy.

RECOVERY FEASIBILITY SUMMARY

Under the *Species at Risk Act* (Section 40) the competent minister is required to determine whether the recovery of the listed species is technically and biologically feasible. Based on the following criteria established by Government of Canada (2009) for recovering species at risk, recovery of the Sage-Grouse is considered to be technically and biologically feasible:

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. Sage-Grouse populations on the Canadian prairies have declined dramatically, especially since 2000, but an estimated 93–138 adult birds attended mating sites (leks) in Canada in 2012 (Appendices B & C). Therefore, individuals capable of reproduction are available, but improvements in reproductive success and annual recruitment, and perhaps in adult survival, will likely be needed for population abundance to increase. There are also a large number of wild adult Sage-Grouse in the northern United States, 41 of which have been recently translocated and released into Canada in 2011 and 2012.

2. Sufficient suitable habitat is available to support the species or could be made available through habitat management or restoration.

Yes. There is sufficient habitat available to support Sage-Grouse populations, particularly if land management initiatives favourable to Sage-Grouse are implemented. Sage-Grouse use high-quality ‘source’ habitat (where annual productivity exceeds the level required for population growth) but they also use ‘sink’ habitat (where reproduction is insufficient to offset local mortality) that is sub-optimal for population growth. However, this ‘sink’ habitat may have the potential to support positive population growth if initiatives are implemented to improve land management and restore habitat conditions optimal for Sage-Grouse.

3. The primary threats to the species or its habitat (including threats outside Canada) can be avoided or mitigated.

Yes. The primary threats to Sage-Grouse recovery are as follows: drought and extreme weather conditions; West Nile virus; chronic visual or noise disturbances; habitat conversion, loss, and degradation; increased predator pressure; alteration of natural hydrology; and threats particular to small population size. These threats can be reduced or mitigated by habitat assessment and management; protection of Sage-Grouse critical habitat; population management and species protection; monitoring and assessment; additional research; communication, collaboration and engagement; and linking into broader prairie conservation planning programs.

4. Recovery techniques exist to achieve the population and distribution objectives or can be expected to be developed within a reasonable timeframe.

Yes. Techniques to enhance habitat for increased annual recruitment and Sage-Grouse survival have been developed. Studies recommended in this Amended Sage-Grouse Recovery Strategy, the Alberta Recovery Plan (Alberta Environment and Sustainable Resource Development 2013), and the Saskatchewan Conservation Plan (Weiss and Prieto 2012) will soon provide additional or improved best management practices for Sage-Grouse and their habitat. Translocation of Sage-Grouse from other jurisdictions has been pursued to augment existing populations; however, the long-term effectiveness of translocating Sage-Grouse to augment critically low populations has yet to be determined. Finally, captive-breeding/rearing options are currently being investigated and suitable protocols are expected to be developed within a few years.

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1. COSEWIC* SPECIES ASSESSMENT INFORMATION

Date of Assessment: April 2008

Common Name (population): Greater Sage-Grouse, *urophasianus* subspecies

Scientific Name: *Centrocercus urophasianus urophasianus*

COSEWIC Status: Endangered

Reason for Designation: This large grouse is restricted to sagebrush grasslands in southern Alberta and Saskatchewan and has suffered significant population declines (42% over the last 10 years, 88% since 1988). The number of leks (male display sites) has decreased by 50% in the last 10 years and there are now less than a thousand breeding birds in the population. Causes for the decline are largely due to the loss, fragmentation and degradation of its native grassland habitats through oil and gas exploration and extraction, overgrazing and conversion to crops.

Canadian Occurrence: Alberta, Saskatchewan

COSEWIC Status History: Given conditional designation of Threatened in April 1997. Status re-examined and designated Endangered in April 1998 based on a revised status report. Status re-examined and confirmed in May 2000 and April 2008.

* COSEWIC = Committee on the Status of Endangered Wildlife in Canada

2. SPECIES STATUS INFORMATION

The Greater Sage-Grouse (*Centrocercus urophasianus urophasianus*) is listed as Endangered under Schedule 1 of the federal *Species at Risk Act*. It is also designated as Endangered under Alberta's *Wildlife Act* and under Saskatchewan's *Wildlife Act*. The Sage-Grouse is found in western North America, with just over 1% of its current range and 8% of its historical range occurring in Canada (Figure 1). The global, national, and sub-national rankings for the Greater Sage-Grouse species and the Greater Sage-Grouse subspecies *urophasianus* are provided in Table 1. In the United States, the species is a candidate for listing under the federal *Endangered Species Act*¹. Gunnison Sage-Grouse (*Centrocercus minimus*) is a closely related species that occurs mainly in Colorado, with a few populations also near the Utah-Colorado border. The Gunnison Sage-Grouse is a species of special concern that is currently on the candidate species list under the U.S. *Endangered Species Act* (Aldridge et al. 2012).

¹ The determination of endangered species status for Greater Sage-Grouse (*Centrocercus urophasianus*) in the United States is scheduled to occur in 2015.

Table 1. List and description of conservation status ranks for the Greater Sage-Grouse (NatureServe 2012). The Greater Sage-Grouse is recognized globally as *Centrocercus urophasianus* (no subspecies). The species and subspecies are both presented.

	Global (G) Rank	National (N) Rank	Sub-national (S) Rank
Greater Sage-Grouse, no subspecies (<i>Centrocercus urophasianus</i>)	G3G4 (range rank: vulnerable to apparently secure) IUCN Red List category = NT (near threatened)	N3N4 (range rank: vulnerable to apparently secure in the United States)	California (S3: vulnerable) Colorado (S4: apparently secure) Idaho (S2: imperiled) Montana (S2: imperiled) Nebraska (S1: critically imperiled)* Nevada (S3S4: vulnerable-apparently secure) North Dakota (SU: under review) Oregon (S3: vulnerable) South Dakota (S2: imperiled) Utah (S2?: imperiled?) Washington (S1: critically imperiled) Wyoming (S4: apparently secure) Arizona (SX: presumed extirpated) Kansas (SX) New Mexico (SX) Oklahoma (SX)
Greater Sage-Grouse, subspecies <i>urophasianus</i> (<i>Centrocercus urophasianus urophasianus</i>)	G3G4TU (range rank: vulnerable to apparently secure; subspecies unrankable)	N2 (imperiled in Canada)	Alberta (S2: imperiled) Saskatchewan (S1B, S1N: critically imperiled, breeding and non-breeding)

* Note that the Sage-Grouse population in Nebraska is considered to be extirpated (Aldridge & Brigham 2003; Schroeder et al. 2004)

3. SPECIES INFORMATION

3.1 Species Description

Sage-Grouse are large, round-winged, ground-dwelling grouse that are sagebrush obligates. They are year-round residents in the sagebrush-grasslands of the semi-arid mixed-grass prairie of southeastern Alberta and southwestern Saskatchewan, where they reach the northern extremes of the Sage-Grouse range in North America (Aldridge 1998a, Braun 1998, Connelly et al. 2000, Connelly et al. 2004).

Sage-Grouse are polygynous, as individual males typically mate with several females. Males perform ritualistic displays, called strutting, on communal leks² to attract females, who select from the group a male with which to mate (Bergerud 1988a, Connelly et al. 2004). Males begin displaying at leks as soon as sites are clear of snow (mid-March in Alberta), and continue

² Leks are open areas where male and female Sage-Grouse aggregate, males engage in competitive displays, and mating occurs (Connelly et al. 2000, Walsh et al. 2010).

displaying daily until late-May (Aldridge 2000). Strutting commences before sunrise each morning and continues until about a half-hour after sunrise (Jenni and Hartzler 1978, Aldridge 2000). In Alberta, mating normally occurs over a two-week period with peak female attendance in early April. (See Lungle and Pruss 2008 for a detailed description of Reproduction and Productivity.)

3.2 Population and Distribution

By 2000, the range of Sage-Grouse in North America had been reduced to half its historical range (668 412 km², down from 1 200 483 km²; Schroeder et al. 2004), now occurring in eleven states and two provinces – Alberta and Saskatchewan (Aldridge and Brigham 2003). The recent Sage-Grouse range in Canada (~7370 km²; Figure 1) occupies about 7% of the historical Canadian range (~100 000 km²), which is split between Alberta and Saskatchewan (Aldridge 2000, Aldridge and Brigham 2003; Figure 1).

Counts of males strutting on leks, during spring courtship displays, are used as an index for local population status and trends both in Canada and in the United States (Autenrieth et al. 1982, Beck and Braun 1980, Connelly et al. 2000, Connelly et al. 2003). The trend for North American Sage-Grouse populations was a 2% decline per year between 1965 and 2003 (Connelly et al. 2004); however, Canadian populations have decreased at a faster rate (Appendices B and C). Alberta's numbers dropped from a high of 613 males in 1968, to the current low of 13 males in 2011 and 2012. Similarly, the number of active leks in Alberta has dropped from a high of 21 in 1968, to a low of 5 in 2012 (Appendix B). The number of males/active lek increased from 29.2 in 1968, to a high of 32.8 in 1981, and decreased to 2.6 males/lek in 2012. From 1968 to 2012, Alberta's population data show a decrease of 98% in total number of males at leks, a decrease of 76% in number of active leks, and a decrease of 91% in number of males per active lek.

Recently updated data for Saskatchewan (see '1988^b' in Appendix C) illustrate comparable declines, with a high of 873 males in 1988 and a low of 18 males in 2012 (Appendix C). The number of active leks decreased from a high of 42 in 1988 to lows of 2–3 leks during the 2010–2012 period (Appendix C). The number of males/active lek dropped from a high of 28.4 in 1971 (Kerwin 1971) to a low of 6.0 in 2012. In Saskatchewan, between 1988 and 2012, the number of males at leks decreased by 98%, the number of active leks decreased by 93%, and the total number of males/active lek decreased by 71%.

Alberta's Sage-Grouse population was estimated to be highest in 1968 (1839–2724 birds) and lowest in 2012, with 39–58 birds (Appendix B). Saskatchewan's population estimates ranged from 2619–3880 birds in 1988, dropping to a low of 54–80 birds in 2012 (Appendix C). Since annual surveys began in 1994, the total Canadian population (AB and SK) was highest in 1996 with approximately 777–1151 birds, and has declined to approximately 93–138 birds in 2012, a decrease of 82–92% in less than two decades.

3.3 Needs of the Greater Sage-Grouse

Within the sagebrush-grassland complex, Sage-Grouse have specific habitat requirements for mating (lek sites), nesting, brood-rearing, and wintering (see Habitat reviews in Aldridge 2000,

Connelly et al. 2004, Connelly et al. 2011). Sagebrush is important for cover and for food (Patterson 1952, Braun et al. 1977, Connelly et al. 2000, Connelly et al. 2004), with leaves comprising <60% of Sage-Grouse summer diet but virtually 100% of their winter diet (Patterson 1952, Wallestad et al. 1975, Hanf et al. 1994, Connelly et al. 2004). Forbs and insects are dietary requirements during all seasons except winter (Wallestad et al. 1975, Drut et al. 1994a and 1994b). Forbs are a rich source of protein and provide habitat that enhances the availability of insects (Huer 2004), which in turn can influence nest initiation, clutch size, and reproductive success (Barnett and Crawford 1994, Coggins 1998, Connelly et al. 2004), including growth and survival of the chicks (see summary in Lungle and Pruss 2008).

Availability of suitable habitat for nesting, and the lack of adequate forb- and insect-rich mesic habitat for brood survival, are both important at the population level (Aldridge 2000, Aldridge 2005, Aldridge and Brigham 2003). Research on Sage-Grouse habitat involves Big Sagebrush, *Artemisia tridentata*, in the U.S., which is taller and more robust, providing greater cover than the Silver Sagebrush (*A. cana*) found in prairie Canada (Aldridge 2001, Aldridge and Brigham 2002, Thorpe 2002, McAdam 2003, Connelly et al. 2011). The descriptions below use information from Silver Sagebrush areas wherever possible, but otherwise outline Big Sagebrush habitat.

Mating Habitat. Leks are located in areas with an open view (relatively flat topography with few vertical obstructions) and very little vegetation (e.g., less herbaceous and shrub cover), are typically located slightly lower than surrounding areas, often near standing water (Aldridge 2000), in or adjacent to sagebrush-dominated flats (Connelly et al. 2011). Lek sites are generally located in areas that are relatively free from anthropogenic noise/activity. Leks range in size from 0.04–16 ha (Scott 1942, Patterson 1952, Dalke et al. 1963, Parks Canada 2009) and are typically surrounded by taller (15–30 cm) sagebrush flats (Petersen 1980) that are used for feeding, roosting, and nesting (Peterson 1970, Clark and Dube 1984, Thorpe et al. 2005).

Nesting Habitat. Sage-Grouse nesting habitat is typically a broad area of sagebrush and grassland surrounding leks (Aldridge 2000). Nests are usually under sagebrush; however, herbaceous understory is also important (Connelly et al. 2011), helping to conceal nests from mammalian and avian predators (DeLong et al. 1995). Hens in Alberta select large sagebrush patches (>1 km²), containing a heterogeneous distribution of taller and denser sagebrush (Aldridge 2000, Aldridge and Brigham 2002, Aldridge 2005), with taller (>18 cm) but less dense grass cover, than is randomly available (Aldridge 2000, Aldridge and Brigham 2002, Aldridge 2005). In Alberta, hens nest an average of 4.7 km from leks (range of distances = 0.42 – 15.4 km; Aldridge 2000). In Saskatchewan, and in the adjacent nesting areas in northern Montana, hens nest an average of 5.3 km from leks (0.6 km – 15.7 km; Tack 2009).

Brood-Rearing Habitat. During the first 2–3 weeks post-hatch, Sage-Grouse use brood-rearing areas near (<3 km from) nest sites. These areas consist of sagebrush habitat (Berry and Eng 1985, Connelly et al. 2000, Connelly et al. 2011). Compared to nesting habitats, brood-rearing areas have less sagebrush cover (14% canopy), with a greater canopy (15%) of grasses and forbs (Martin 1970, Kerwin 1971, Wallestad 1971, Autenrieth 1981, Sveum et al. 1998) and a diversity of insects (Dunn and Braun 1986, Drut et al. 1994a), which are an important component of brood habitat (Klebenow 1969, Sveum et al. 1998, Huer 2004). As sagebrush habitat dries

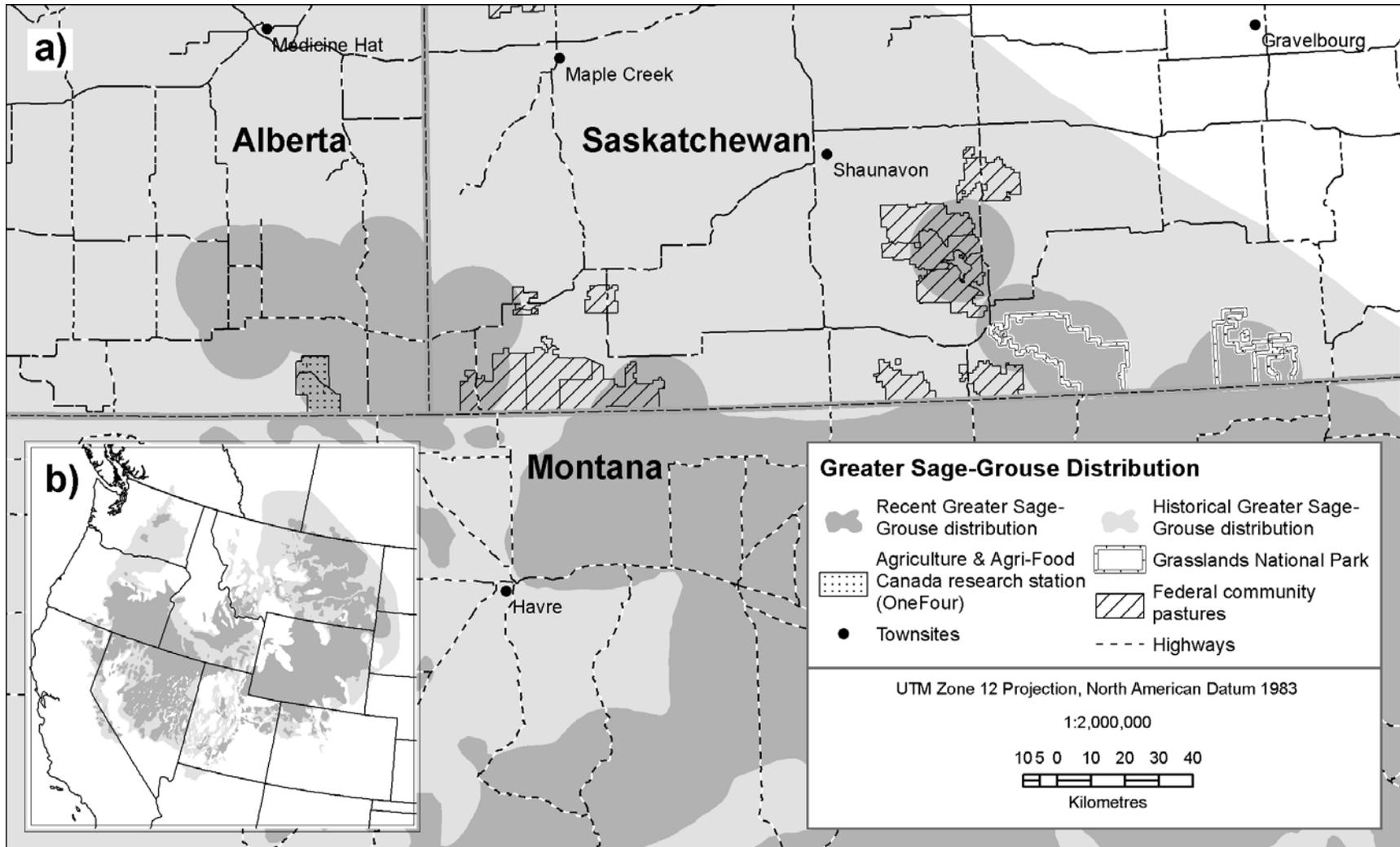


Figure 1. Recent and historical distribution of Sage-Grouse in (a) Canada and (b) North America. Historical distribution (maximum distribution from early-1800's to late-1990's) and recent U.S. distribution (late 1990's) from Schroeder et al. 2004 (data retrieved from <http://sagemap.wr.usgs.gov/ConservationAssessment.aspx>). Recent Canadian distribution updated using data from 2000-2012.

during June and July, hens with broods seek out more mesic wet-meadow sites that are richer in forbs and insects, (Patterson 1952, Klebenow 1969) and select nearby areas with larger sagebrush for roosting and loafing (Dunn and Braun 1986). Males tend to move away from lek sites to summer habitat areas (up to 9 km) that provide a higher density of sagebrush cover (Hagen 1999). Hens and broods move into dense sagebrush in late-summer and fall before moving to wintering grounds (Patterson 1952, Wallestad 1971, Drut et al. 1994a).

Winter Habitat. In the U.S., Sage-Grouse usually congregate in sexually-segregated flocks in the fall (Beck 1977, Eng and Schladweiler 1972, Connelly et al. 1988). In Alberta, however, many mixed-sex winter flocks have been observed, with average flock sizes of 13.5 ± 0.72 birds (\pm SE; range 1–100; Carpenter et al. 2010). Winter survival of Sage-Grouse is typically high (Connelly et al. 2004; Aldridge et al 2004), but severe weather conditions, such as heavy snow and extreme cold (Moynahan et al. 2006), during this period present a significant risk for small populations. For food and shelter during winter, Sage-Grouse rely almost exclusively on sagebrush exposed above snow (Tack 2009, Connelly et al. 2011), so unfavourable snow conditions or unusually high amounts of snow are likely to have negative effects on the remaining Canadian population. On a local scale, Sage-Grouse usually select wintering habitat with low elevation, on south- or southwest-facing aspects with gentle slopes and tall, dense sagebrush (see detailed review in Connelly et al. 2011). On a landscape scale, Sage-Grouse in Alberta selected winter areas that had dense sagebrush cover, in less rugged areas, at lower elevations, and avoided all anthropogenic edges, energy development, and 2-track truck trails (Carpenter et al. 2010).

4. THREATS

4.1 Threat Assessment

Table 2. Threat Assessment Table for the Greater Sage-Grouse.

Threat	Level of Concern ¹	Extent	Occurrence	Frequency	Severity ²	Causal Certainty ³
Climate and Natural Disasters						
Drought	High	Widespread	Anticipated (Historical)	Seasonal	High	Medium
Severe or inclement weather conditions	High	Widespread	Current/ Anticipated	Seasonal	High	High
Exotic, Invasive or Introduced Species						
Disease (West Nile virus)	High	Widespread	Current/ Anticipated	Seasonal	High	High
Disturbances (chronic)						
Facilities associated with noise	High	Localized	Current/ Anticipated	Continuous	Moderate	High
Vehicle noise	High	Localized	Current/ Anticipated	Recurrent	Moderate	High
Vertical structures	Medium	Localized	Current/ Anticipated	Continuous	Moderate	Medium

Threat	Level of Concern ¹	Extent	Occurrence	Frequency	Severity ²	Causal Certainty ³
Natural Processes or Activities						
Small population size	High	Widespread	Current	Continuous	High	Low
Reduced genetic diversity	Low	Unknown	Anticipated	Unknown	Low	Unknown
Habitat Loss or Degradation						
Habitat conversion to crop and forage production	Medium	Localized (Widespread)	Anticipated (Historical)	Recurrent	High	High
Habitat conversion to energy development infrastructure	Medium	Localized	Current/ Anticipated	Recurrent	High	High
Habitat loss or degradation from conversion to roads	Medium	Localized	Current/ Anticipated (Historical)	Recurrent	High	High
Degradation of vegetative cover from grazing levels inappropriate for Sage-Grouse	Medium	Localized (Widespread)	Current (Historical)	Recurrent	High	High
Removal of sagebrush and other shrubs	Low	(Localized)	(Historical)	One-time	High	Medium
Changes in Ecological Dynamics or Natural Processes						
Increased predator pressure	Medium	Widespread	Current (Historical)	Continuous	Moderate	Low
Alteration of natural hydrology	Medium	Localized (Widespread)	Current (Historical)	Recurrent	Moderate	Medium
Alteration to natural fire and grazing regimes	Low	(Widespread)	(Historical)	Recurrent	Unknown	Low
Accidental Mortality						
Collisions with traffic	Low	Localized	Current (Historical)	Continuous	Moderate	Medium
Collisions with infrastructure	Low	Localized	Current (Historical)	Continuous	Moderate	Medium

¹ *Level of Concern: signifies that managing the threat is of (high, medium or low) concern for the recovery of the species, consistent with the population and distribution objectives. This criterion considers the assessment of all the information in the table.*

² *Severity: reflects the population-level effect (High: very large population-level effect, Moderate, Low, Unknown)*

³ *Causal certainty: reflects the degree of evidence that is known for the threat (High: available evidence strongly links the threat to stresses on population viability; Medium: there is a correlation between the threat and population viability e.g. expert opinion; Low: the threat is assumed or plausible).*

4.2 Description of Threats

Threats are described here generally in order of decreasing level of concern for the Canadian Sage-Grouse population (see section 4.1). Threats with a low level of concern are described collectively at the end of this section. Lungle and Pruss (2008) provided a detailed account of threats to the Sage-Grouse population; provided below is a concise summary of those, along with additional updates in light of the most recent decrease in the population, and new ecological information and references. It is important to note that many threats typically co-occur in certain locations or within certain time periods, thus creating a very high overall level of concern for small, concentrated populations, like the current Canadian population of Sage-Grouse (see ‘Small population size’).

Drought

Drought is related to patterns of Sage-Grouse persistence within North America; Sage-Grouse are more likely to be extirpated from areas of their range where three or more droughts occur per decade (Aldridge et al. 2008). In drought conditions, herbaceous cover at nests and the availability of forbs and insects in wet meadows during the breeding season are reduced (Aldridge 1998b, Fischer et al. 1996, Hanf et al. 1994). This reduced availability of mesic habitats may be a limiting factor in both Alberta and Saskatchewan (Aldridge 2000, Aldridge 2001, Aldridge and Brigham 2002), with the risk of chick death increasing as the drought index increases (Aldridge 2005). Drought can exacerbate the degradation of habitat from grazing livestock if stocking rates are not reduced dramatically during these periods (Braun 1998). Livestock grazing in wet meadow areas also intensifies during droughts, as these areas usually have better vegetation production than upland areas (Canadian Sage-Grouse Recovery Team 2001), and interspecific competition between wildlife species (e.g., pronghorn and Sage-Grouse) for food resources (sagebrush and/or forbs) may occur during drought events. Reduction in the quality of habitat and vegetative cover not only results in lower reproductive effort, but the lack of adequate shelter/cover may also increase predation rates and brood mortality (Braun 1998; see also ‘Increased predator pressure’). In addition, McNeil and Sawyer (2003) suggest that the lack of significant precipitation events from 1978 to 1995 in southeastern Alberta compounded the effect of increased impediments to natural water flows and may have adversely impacted sagebrush habitat.

Severe or inclement weather conditions

Heavy rainfall during egg laying, or unseasonably cold temperatures with precipitation during the hatch period, may result in nest failure or poor hatch rates (Wallestad 1975). McNeil et al. (2007) suggested that the greater frequency of cold and wet spring conditions in Saskatchewan between 1999 and 2004 may have led to the population decrease in Saskatchewan during that period. Extreme winter weather (e.g., long periods with temperatures below -15°C and accumulation of snow) had a negative effect on female survival rates in Oregon (Anthony and Willis 2009), and heavy snow and extreme cold in Montana excluded individuals from forage and thermal cover and contributed to elevated mortality and low annual survival of female Sage-Grouse (Moynahan et al. 2006). A greater frequency of unpredictable severe weather events, which is predicted to accompany climate change on the Canadian Prairies, may increase the risk

of extirpation, as the recovery time between severe weather events is reduced (Weiss and Prieto 2012).

Disease (West Nile virus)

The arrival of West Nile virus (WNV) to North America has brought a new and unpredictable threat to Sage-Grouse populations (Naugle et al. 2004, Carpenter 2007, Walker and Naugle 2011). In 2003, mortality from WNV was discovered in four populations of Sage-Grouse (Alberta, Montana, Montana-Wyoming border, and Wyoming), with survival decreasing by 25% (Naugle et al. 2004, Walker et al. 2004, Moynahan et al. 2006). Late summer survival of adult female Sage-Grouse in the WNV-infected site of Montana and Wyoming was 20% compared to 76% at the non-WNV sites and male and female lek attendance was substantially lower the following spring in the WNV-infected site (Walker et al. 2004). Currently, there are few reported cases of Sage-Grouse surviving exposure to WNV; however, resistance to WNV-related disease is expected to increase slowly over time (Walker et al. 2011). On the other hand, it has recently been suggested that Sage-Grouse with elevated glucocorticoid levels, which accompany elevated stress related to chronic noise disturbance, show reduced immune response. This could therefore have a significant impact on survival when these grouse are exposed to WNV (Blickley et al. 2012b).

Facilities associated with noise

Anthropogenic areas are believed to contribute to cumulative landscape effects that suppress populations (Braun et al. 2002, Naugle et al. 2011). It is unclear whether year-round avoidance of anthropogenic sites is primarily due to noise or to other influences, such as associated habitat conversion or elevated vehicle traffic at such sites (see summaries under 'Habitat loss from conversion to energy development infrastructure' and 'Vehicle noise'). Noise from pump jacks disrupts breeding activity at nearby leks (Dube 1993, Braun et al. 2002, Aldridge 2005, Holloran 2005) and can lead to lek abandonment (Aldridge 2000, Holloran 2005). In Alberta, disturbance by oil and gas construction and extraction near leks may have caused the abandonment of at least four leks (Dube 1993, Aldridge 1998a, Braun et al. 2002). A recent experimental study in Wyoming showed that peak male attendance at Sage-Grouse leks decreased when they were subjected to noise levels typical of drilling for natural gas (broadcasts of sound recordings; Blickley et al. 2012a). There was no evidence for habituation to noise in that study, and there was little evidence for a cumulative effect of noise over time indicating that the threat can be mitigated by seasonal noise restrictions on or near leks. In addition, the increasing use of wind power as a source of electricity generation will likely have negative consequences for Sage-Grouse, whenever wind turbine towers are erected in or near Sage-Grouse habitat (Manville 2004; D. Eslinger, pers. comm., Alberta Environment and Sustainable Resource Development).

Vehicle noise

Although vehicle noise can be off-road, it is most often produced on or adjacent to roads. Noise and motion from vehicles disrupts local breeding activities and Sage-Grouse tend to avoid these areas (Braun 1998). Increased vehicle traffic can disrupt breeding activities and may result in lek abandonment (Aldridge 1998b, Braun 1998, Connelly et al. 2000, Herkert et al. 2003). Also,

even low levels of vehicular traffic (≤ 12 vehicles/day) at leks reduce nest initiation rates by hens and increase distances that hens move from leks during nest selection (Lyon and Anderson 2003). Blickley et al. (2012a) showed that the intermittent noise from vehicles on roads caused a large decrease in peak male attendance at leks. The avoidance of habitat near roads reduces habitat availability, and can also contribute to decreased survival (Braun et al. 2002, Holloran 2005).

Small population size

Current Sage-Grouse populations in Canada are precariously low, with clumped local distributions. Furthermore, at the start of each mating season, the small numbers of remaining individuals occupy especially small, sensitive sites, as almost all the birds congregate on or near leks. Small groups, concentrated in small areas, make Sage-Grouse particularly vulnerable to local anthropogenic or natural disturbances, or to catastrophic events. For example, West-Nile virus can cause high mortality in Sage-Grouse, which is devastating for probability of persistence in small, fragmented populations (Naugle et al. 2004; see above discussion). Likewise, small populations are at great risk of extirpation from the cascading and inter-dependent effects of drought, overstocking/overgrazing, and alterations to water regimes causing habitat alterations (e.g., reduction in shelter/cover) and increased predation.

Vertical structures

Utility lines across sagebrush habitat create perch sites for avian predators (Aldridge 1998b, Braun 1998). Sage-Grouse appear to be sensitive to vertical structures (e.g., power distribution and transmission lines, buildings, oil and gas structures, wind turbines) resulting in avoidance of otherwise suitable habitat (Holloran 2005), presumably due to a perceived increased risk of predation. For example, Sage-Grouse will avoid habitat within 600 m of power lines (Braun 1998), and Ellis (1987) showed that the construction of a transmission line within 200 m of an active Sage-Grouse lek in Utah led to decreased male lek attendance and an alteration of dispersal patterns to day-use areas. Also, Sage-Grouse nested at sites where vegetation concealed their nests from visual predators rather than from olfactory predators (Conover et al. 2010).

Habitat conversion to crop and forage production

Cultivation of sagebrush grasslands has been the primary cause of habitat loss and fragmentation across the Sage-Grouse range (Patterson 1952, Dalke et al. 1963, Wallestad and Pyrah 1974, Harris 1998, McAdam 2003). More than 70% of sagebrush dominated rangeland has been converted to agricultural crops (Braun 1998), with losses of 80% in Saskatchewan since the early 1900s (Harris 1998). Aldridge et al. (2008) found that probability of extirpation was most likely in areas with '≥ 25% cultivated cropland'. This pattern might result from habitat fragmentation that impedes normal dispersal movements by Sage-Grouse (Bush et al. 2011) and hence a reduction in 'rescue effect' of local populations by immigration of individuals from neighbouring populations (Connelly et al. 2011). Loss of sagebrush habitat near leks has resulted in abandonment of leks in both Saskatchewan and Alberta (Dube 1993, Aldridge 1998b, McAdam 2003). For example, cultivation rates within 3.2 km of currently active leks were 5.4 ha/year

from 1955 to 1971, and 24.3 ha/year from 1971 to 1996, while those rates at abandoned leks were 25.5 ha/year and 63.7 ha/year over the same periods (McAdam 2003).

Although cultivation may have contributed to loss of habitat and lek abandonment historically, loss of habitat since 1981 has been insignificant (Thorpe et al. 2005). Accordingly, cultivation since 1988 appears unlikely to be a causative factor in more recent population declines and lek abandonment (McAdam 2003, Thorpe et al. 2005). Moreover, at Sage-Grouse consultation meetings held in 2013, some ranchers asserted that agricultural practices and other land uses have changed very little, if at all, over the past several decades in the recent Canadian range of the Sage-Grouse.

Habitat conversion to energy development infrastructure

Although the Sage-Grouse population decline cannot be attributed to any single factor (Braun 1998), increases in petroleum industry activities in southern Alberta from the late-1970s to the early-1980s, and again in the 1990s coincided with Sage-Grouse population declines (Braun et al. 2002). In the winter, Sage-Grouse avoid areas with energy development in Alberta (Carpenter et al. 2010). Furthermore, hens with broods show strong avoidance of human-dominated landscapes, and the risk of brood failure increased 1.5 times with each well site visible within 1 km of brood-rearing areas (Aldridge and Boyce 2007). However, population effects from energy development are likely not solely the result of habitat conversion through removal of vegetative cover because exploration and extraction also involves construction and/or operation of drilling rigs, pump jacks, pump shacks, compressor stations, as well as construction of roadways, pipelines, and power lines to service these facilities (see also ‘Habitat loss from conversion to roads’, ‘Facilities associated with noise’, ‘Vehicle noise’, and ‘Vertical structures’).

Habitat loss or degradation from conversion to roads

Road construction impacts Sage-Grouse by physically removing and fragmenting potential habitat, and by creating travel corridors for mammalian predators (Aldridge 1998b, Braun 1998). The resulting human access, to previously undisturbed areas, can also degrade habitat by destroying important vegetation (e.g., off-road use of all-terrain vehicles) and creating noise disturbance (see ‘Vehicle noise’ above). Sage-Grouse have been reported to avoid anthropogenic edges, whether created by roads, trails, or agricultural cropland (Aldridge and Boyce 2007; Carpenter et al. 2010). New roads also facilitate the spread of alien invasive species (e.g., Downy Brome, *Bromus tectorum*) that eventually degrade Sage-Grouse habitats (Knick et al. 2011). Large numbers of roads are built for petroleum extraction facilities.

Degradation of vegetative cover from grazing levels inappropriate for Sage-Grouse

Livestock grazing is one of the major agricultural activities that occurs throughout Canada’s remaining grasslands. Depending on intensity, grazing can result in changes to habitat structure and species composition in both upland and riparian areas, and to degradation of riparian habitat (Rasmussen and Griner 1938, Patterson 1952, Autenrieth et al. 1982, Call and Maser 1985). Removal of too much vegetation affects habitat suitability if exposure of Sage-Grouse to

predators (see also ‘Increased predator pressure’) and weather extremes (Aldridge 1998b) is increased. Excessive amounts of livestock grazing may result in trampling of sagebrush seedlings and a subsequent decline in sagebrush health in areas where cattle congregate (Owens and Norton 1992, Connelly et al. 2000, Adams et al. 2004), as well as a reduction in the herbaceous understory that is required for security at nesting sites (Dobkin 1995). Heavy grazing can decrease both annual and perennial forbs in grasslands (Hayes and Holl 2003). To avoid such effects, grazing intensities that result in removal of more than 40% annual growth of herbaceous vegetation are not recommended (Braun 2006; Michalsky and Peat Hamm 2009).

There is some indication that a conservative level of grazing may be beneficial to Sage-Grouse, as light grazing, compared to no grazing, maintains greater plant diversity (Stohlgren et al. 1999) and may increase the abundance of forbs that are necessary for chick survival (Thorpe and Godwin 2003, Adams et al. 2004). Heavy grazing leads to natural selection for low-growing, prostrate forms of vegetation (Milchunas and Lauenroth 1993), thus lowering the quality of concealment and nesting cover for Sage-Grouse. Moderate grazing, compared to no grazing, results in higher dominance of shorter grasses, allowing forbs to flourish, but also results in less vertical structure as cover for Sage-Grouse (Thorpe and Godwin 2003).

Increased predator pressure

Changes in predator and prey guild composition and abundance, resulting from anthropogenic changes to Sagebrush ecosystems, can have an important effect on Sage-Grouse productivity (Aldridge and Brigham 2003; Bui et al 2010). The numbers of some predators (e.g., coyotes, Great Horned Owls) have increased on the southern prairies (Vriend and Gudmundson 1996, Houston et al. 1998, Hyslop 1998). Several ranchers and farmers who attended Sage-Grouse consultation meetings in 2013 stated that populations of predators, especially species such as coyotes, raccoons, and swift fox, have increased substantially and that these increases are the main reason for the decline in Sage-Grouse numbers.

High predation rates are usually a secondary symptom of habitat deficiencies in an altered and fragmented habitat that does not provide prey with protection from predators and may increase predator foraging efficiency through amplified amounts of edge, linear travel corridors (e.g., roads, fencelines), or elevated perches for raptors (Sargeant et al. 1993, Greenwood et al. 1995, Braun 1998, Aldridge 1998b, Connelly et al. 2000, Stephens 2003; see also ‘Degradation of vegetative cover’ section). For example, risk from avian predators is increased within 1 km of power lines (Braun 1998; see also ‘Vertical structures’). Risk of predation may increase as grouse are required to travel significant distances, expending a great amount of energy to find food and cover under degraded habitat conditions (Gregg et al. 1993, Fischer et al. 1996, Pyle and Crawford 1996). Increased predation pressure results in low nest success, low chick survival, and ultimately low recruitment into the breeding population despite high reproductive effort (Aldridge 2000, Connelly et al. 2004, Aldridge 2005).

Alteration of natural hydrology

Silver sagebrush is generally associated with mesic (moderately moist) habitat, with moderate to high densities of sagebrush found on alluvial landforms and within areas that have high water

tables and subject to occasional flooding (McNeil and Sawyer 2001, 2003; also see review in Thorpe 2002). The natural flow of water in an area can be altered by man-made ditches, dams, or impoundments, such as those created for livestock watering or cropland irrigation, which may reduce the frequency and magnitude of flood events and instream flow volume during drought (McNeil and Sawyer 2003, White 2007). Also, low availability of moist forb habitat may cause hens and broods to spend more time using habitats with higher mortality risk in order to meet daily nutritional requirements (Aldridge 2005). In southeastern Alberta, the number of water impoundments has increased four-fold between 1951 and 2001 (McNeil and Sawyer 2003). The number of dams within 3.2 km of leks in southern Saskatchewan has increased 20% from 1950–2004, and the number of reservoirs, which result from these dams, has more than doubled (Watters et al. 2004). Use by livestock is often intensified near impoundments causing degradation of surrounding sagebrush habitat (Canadian Sage-Grouse Recovery Team 2001). Water impoundments >50 ha can result in loss of brood habitat, lek sites, and winter habitat (Braun 1998). Other impediments to natural drainage patterns that are not necessarily associated with instream flow (such as elevated road beds, ditches, etc.) can intercept and redirect overland runoff, and may also cause changes to sagebrush productivity upslope of sagebrush ecosites.

Threats with low levels of concern

Historically, very large populations of bison (*Bison bison*), pronghorn (*Antilocapra americana*), and elk (*Cervus elaphus*) inhabited southern prairie Canada (Hood and Gould 1992, Rangeland Conservation Service Ltd. 2004). Varying levels of grazing by these animals, in combination with fire, resulted in a landscape typified by patchiness (England and DeVos 1969, Hood and Gould 1992, Bradley and Wallis 1996). Several studies have focused on the effects of fire and fire suppression in regions with big sagebrush habitat (e.g., Kaufman 1990, Nelle et al. 2000, Rhodes et al. 2010); however, there is a need for greater knowledge of the relationship between fire and silver sagebrush habitats in Canada (see summary in Adams et al. 2004).

Historically, treatments such as chemicals and burning were used to reduce shrub cover, particularly sagebrush, in order to maximize forage production for livestock (see summary in Connelly et al. 2004). However, this practice is not a significant current threat, and it is unclear if it is likely to be a future threat in Canada.

As of 2006, there appeared to be acceptable gene flow among Sage-Grouse in Alberta, northern Montana, and Saskatchewan (Bush et al. 2011), but it is possible that loss or avoidance of habitat by Sage-Grouse, resulting from anthropogenic impacts, could result in fragmentation of populations and loss of genetic diversity in the future.

Hens and broods that forage within cropland (e.g., alfalfa fields) are subject to injury and mortality from farm equipment (Patterson 1952, Aldridge 2000). Likewise, increased traffic volumes on roads and trails (for example, with increased energy exploration and extraction activities) can increase collisions with vehicles (Aldridge 2005). Sage-Grouse can also die by flying into fences, power lines (Patterson 1952, Aldridge 2000, Stevens et al. 2012), and other structures, such as hydro-line, cell phone, or communication towers (Call and Maser 1985, Beck et al. 2006). In addition, wind turbine towers that are erected in or near Sage-Grouse habitat could result in mortality for Sage-Grouse (D. Eslinger, pers. comm. Alberta Sustainable Resource Development; Manville 2004).

5. POPULATION AND DISTRIBUTION OBJECTIVES

Population and distribution objectives for Sage-Grouse are set for three different time horizons: (1) immediate, (2) short-term, and (3) long-term.

1. The immediate objective is to stop the decline of the adult Sage-Grouse population in Canada.
2. The short-term objective is to reverse the population decline, and increase the number of active leks, in both Alberta and Saskatchewan.
3. The long-term objective is to achieve a stable (or increasing) Sage-Grouse population with
 - at least 1095 adult Sage-Grouse among 16 or more active leks in Alberta, and
 - at least 1500 adult Sage-Grouse among 20 or more active leks in Saskatchewan.

It is important to note that, because the current population of Sage-Grouse is small and concentrated in relatively small geographic areas, chance events – such as an outbreak of West Nile virus, a severe winter storm, or cold/wet weather during breeding – can have extreme detrimental effects to the entire remaining population in Canada within any given year. Therefore, the immediate objective is to halt the population decline, and then achieve an increasing population of adult Sage-Grouse at an increasing number of active leks, as soon as possible (i.e., in the short-term; see *Section 8* for details).

At present, it is not possible to quantify with certainty the number of adult Sage-Grouse required for a self-sustaining Canadian population. The long-term population objectives in this Amended Recovery Strategy correspond to population objectives in the 2001 and 2008 Sage-Grouse Recovery Strategies³, which were based on annual population estimates in 1987 and 1989 in Alberta (see Appendix B) and in 1987 and 1988 in Saskatchewan (see ‘1987’ and ‘1988^a’ data in Appendix C).

³ Canadian Sage-Grouse Recovery Team 2001; Lungle and Pruss 2008.

6. BROAD STRATEGIES AND GENERAL APPROACHES TO MEET OBJECTIVES

6.1 Actions Already Completed or Currently Underway

Population Management and Species Protection

- Historical and current genetic diversity and assessment of genetic isolation in Sage-Grouse populations in Alberta, Saskatchewan, and Montana (Bush 2009, Bush et al. 2011).
- Fence-marking project to reduce potential Sage-Grouse mortality from fence collisions (Alberta Conservation Association 2011) and in Grasslands National Park (P. Fargey pers. comm. 2012).
- A combined total of 41 adult Sage-Grouse (38 females and 3 males) were translocated from Montana and released in Alberta in 2011 and in 2012 (Alberta Environment and Sustainable Resource Development 2013).

Monitoring & Assessment

- Ongoing annual spring ground-surveys of strutting males, at active and inactive leks in Alberta, Grasslands National Park and other areas of Saskatchewan (J. Nicholson, pers. comm. 2012; P. Fargey, pers. comm. 2012; Weiss and Prieto 2012).
- Spring aerial surveys (2004 and 2012) to search for any newly-active Sage-Grouse leks in southern Saskatchewan (B. Prieto, pers. comm. 2012).
- Pilot project to identify an appropriate and effective long-term monitoring approach for Sage-Grouse in Saskatchewan using non-intrusive and passive surveillance methods.

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- Vegetative differences between grazed and ungrazed sagebrush lands in Grasslands National Park (Thorpe and Godwin 2003).
- Effects of water dams and diversions and precipitation on sagebrush habitat in southeastern Alberta (McNeil and Sawyer 2003).
- Habitat vegetative characteristics and land use patterns around active and inactive leks in southern Saskatchewan (McAdam 2003, Thorpe et al. 2005).
- The ecology of silver sagebrush and beneficial grazing management practices for Sage-Grouse in southeastern Alberta (Adams et al. 2004).
- Assessment of sagebrush range health and water dams and diversions around Sage-Grouse leks in southern Saskatchewan with site plans for areas surrounding leks in the Frenchman Valley watershed, Saskatchewan (Watters et al. 2004).
- A Landscape Cumulative Effects Simulator (ALCES) model was developed to assess the potential ecological impacts of future landscape scenarios on Sage-Grouse in the southeastern corner of Alberta (Chernoff et al. 2008).
- Government of Alberta developed a system of Land Use Intensity (LUI) Conservation and Development Zones for areas with Sage-Grouse habitat.
- Alberta updated their Industrial Land Use Guidelines under the Enhanced Approval Process for Upstream Oil and Gas development (2011) with year-round restricted activity and setback distances for leks (3200m) and other suitable mapped habitat (1000m).

- Saskatchewan Activity Restriction Guidelines updated (2012) with year-round restricted activity and setback distances for leks (3200m) and mapped habitat (1000m), and recommended to be binding conditions for oil and gas permits within critical habitat for Sage-Grouse.
- Grasslands National Park is applying beneficial grazing practices in occupied nesting and brood-rearing habitat, and planting silver sage (seeds and planted plugs) when re-vegetating formerly cultivated fields.
- Alberta Environment and Sustainable Resource Development (AESRD) is currently consulting with petroleum companies with existing developments within the Sage-Grouse range of Alberta to develop protocols and plans for restoration and reclamation (including the removal of infrastructure).

Research

- Interpretation of aerial photographs to map silver sagebrush communities in Alberta and Saskatchewan (Penniket and Associates Ltd. 2003, 2004; Jones et al. 2005).
- Relationships between silver sagebrush soils and landscapes associated with silver sagebrush and Sage-Grouse in Alberta with predictive mapping tools to assist in habitat management (McNeil and Sawyer 2001).
- Relationships between soil nutrients, grazing patterns and the presence or absence of active and inactive leks in southern Saskatchewan (King et al. 2005).
- West Nile virus and parasites in Sage-Grouse populations (Carpenter 2007).
- Seasonal selection/avoidance of habitats and anthropogenic features (Aldridge and Brigham 2002, Carpenter et al. 2010), and associated reproductive parameters for Sage-Grouse in southeastern Alberta (Aldridge and Boyce 2007).
- Habitat use, demography, and movement of a trans-boundary population of Sage-Grouse in the Milk River basin (Tack 2009).
- Greater Sage-Grouse *Centrocercus urophasianus* migration links the USA and Canada: a biological basis for international prairie conservation (Tack et al. 2011).
- Conserving Montana's sagebrush highway: long distance migration in Sage-Grouse (Smith 2013).
- Recent information from translocated birds has indicated that nest depredation is a serious concern for the remaining small population of Sage-Grouse in Alberta; therefore, AESRD is currently discussing the option of predator management in key habitat areas to support successful nesting and brood-rearing.

Communication, Collaboration, and Engagement

- Saskatchewan Watershed Authority conducted a habitat stewardship project that developed a watering system to reduce livestock impacts on, and improved the condition of, riparian areas in Sage-Grouse habitat.
- The MULTISAR (multiple Species at Risk) project in Alberta has created a process integrating range management and industrial land management with fish and wildlife management principles to conserve multiple species at risk at the landscape level, while maintaining a sustainable rural economy.
- Alberta, Saskatchewan and Montana renewed (2012–2017) the international Memorandum of Understanding for the Northern Sagebrush Steppe Initiative (NSSI), officially agreeing to

cooperate among the three jurisdictions to conserve and manage their combined native grassland and sagebrush habitats and its suite of dependent wildlife species.

- Stakeholders and landowners engaged in the development of a Multi-species Action Plan for Southwest Saskatchewan (South of the Divide).
- Alberta and Saskatchewan promoted an Inter-provincial Greater Sage-Grouse Technical Committee to improve communication and collaboration.
- Prairie Species at Risk fact sheet for Best Management Practices scheduled for completion and distribution in 2013.

Conservation Planning

- Completion of conservation plans, by a multi-jurisdictional northern mixed-grass trans-boundary initiative, for several ecosystem landscapes in southern Alberta, southern Saskatchewan, and northern Montana, with Sage-Grouse as one of the target species of special significance (Smith Fargey 2004).
- Completion of an updated provincial Sage-Grouse recovery plan for Alberta outlining objectives and strategies to be pursued to achieve population recovery (Alberta Environment and Sustainable Resource Development 2013).
- Saskatchewan Prairie Conservation Action Plan: Framework 2009–2013 (Saskatchewan Prairie Conservation Action Plan Partnership 2009).
- Species at Risk Conservation Guidebook for Prairie land Managers (Government of Canada, 2010, Species at Risk Decision Support Tools, Agriculture and Agri-Food Canada - Regina).
- Alberta Prairie Conservation Action Plan: 2011–15 (Prairie Conservation Forum 2011).
- Completion of 'A Conservation Plan for Greater Sage-Grouse in Saskatchewan' (Weiss and Prieto 2012).
- Multi-species Action Plan for Southwest Saskatchewan (South of the Divide Project) scheduled for completion in 2013.

6.2 Strategic Direction for Recovery

Table 3. Recovery Planning Table.

Threat or Limitation	General Description of Research and Management Approaches	Priority
Broad Strategy: Population Management and Species Protection		
Threats related to Small Population Size	<ul style="list-style-type: none"> Evaluate the potential effectiveness of different methods for population augmentation (translocations, captive-breeding or captive-rearing); develop guidelines for Sage-Grouse population augmentation Continue to augment the current Sage-Grouse population, and adjust methods if appropriate based on above evaluation and guidelines 	High
Accidental Mortality	<ul style="list-style-type: none"> Evaluate, improve, and implement approaches to reduce accidental mortality due to fence and vehicle collisions and losses of nests and nesting females to farm equipment Where necessary, develop and implement additional measures designed to reduce accidental mortalities 	High
Increased Predator Pressure	<ul style="list-style-type: none"> Evaluate the potential effectiveness of different methods for managing local populations of common avian or mammalian predators of Sage-Grouse or Sage-Grouse nests, and implement the most effective management actions where feasible. 	Medium
Broad Strategy: Monitoring & Assessment		
All threats	<ul style="list-style-type: none"> Develop and implement a long-term standardized population monitoring program throughout the species' range in Canada – ideally incorporating spring lek surveys, winter population surveys, and associated productivity/recruitment indices – to evaluate progress towards population recovery 	High
Broad Strategy: Habitat Assessment, Management, Conservation & Protection		
Habitat Loss or Degradation threats	<ul style="list-style-type: none"> Further develop and implement habitat-protection, site-protection, stewardship, and management plans emphasizing voluntary, collaborative approaches that focus on results to be achieved, rather than prescriptive tools to be implemented Conduct habitat enhancements where habitat suitability or habitat quality is low (e.g., 'sink' habitats) 	High
Threats related to Disturbances (chronic)	<ul style="list-style-type: none"> Implement, evaluate, and refine disturbance-protection measures that mitigate or eliminate chronic disturbances that may be causing habitat avoidance, during each annual Sage-Grouse life-stage Consider removing or moving vertical structures that are too close to lek habitats 	High
Disturbance and Habitat Loss or Degradation threats	<ul style="list-style-type: none"> Develop and implement protocols for reclamation of areas with existing developments in habitats that could otherwise meet requirements for use by Sage-Grouse 	Medium
Broad Strategy: Research		
Disturbance, Habitat Loss or Degradation,	<ul style="list-style-type: none"> Improved understanding of causal relationships between Sage-Grouse population size and human activities (e.g., industry, agriculture, water 	High

Threat or Limitation	General Description of Research and Management Approaches	Priority
Accidental Mortality	management structures, and field research), including activity thresholds	
Habitat Degradation, Climate, Changes to Ecological Dynamics	<ul style="list-style-type: none"> Conduct additional research regarding Sage-Grouse ecology and the effects of climate, predation pressure, and changes to other natural processes 	High
Disease and Small Population Size threats	<ul style="list-style-type: none"> Continually monitor presence of diseases (e.g., WNV), and parasites when necessary, on Sage-Grouse populations, and develop mitigation measures where possible 	High
All threats	<ul style="list-style-type: none"> Develop population models to estimate Sage-Grouse population persistence (e.g., population viability analysis) 	Medium
Habitat Loss or Degradation threats	<ul style="list-style-type: none"> Identify feasibility of, and potential sites for, the restoration and enhancement of silver sagebrush-grassland complexes within or near Sage-Grouse critical habitat 	Medium
Reduced Genetic Diversity and Small Population Size	<ul style="list-style-type: none"> Periodically monitor and assess genetic diversity and gene flow between Canadian and U.S. populations of Sage-Grouse 	Low
Broad Strategy: Communication, Collaboration & Engagement		
All threats	<ul style="list-style-type: none"> Develop and maintain broad support (agricultural and industrial stakeholders; general public and media) for Sage-Grouse recovery and conservation efforts Collaborate with multiple jurisdictions (in Canada and the U.S.) to ensure/encourage habitat management, conservation and protection measures that support the annual movements of Canada's Sage-Grouse 	High
All threats	<ul style="list-style-type: none"> Communicate information about Sage-Grouse management to land managers, industry, recreational users and other interested parties to foster stewardship of the species Engage ranchers to maintain or enhance a high standard of rangeland stewardship in sagebrush-grassland complexes 	High
Broad Strategy: Conservation Planning		
All threats	<ul style="list-style-type: none"> Integrate Sage-Grouse recovery efforts into broader conservation planning programs for prairie grassland species and prairie conservation initiatives 	High

6.3 Narrative to Support the Recovery Planning Table

Population Management and Species Protection

Because of their extremely small population in Canada, Sage-Grouse are at a high risk of extirpation due to catastrophic events such as drought or a West Nile virus outbreak, or to accidental mortality events. Mitigation measures, such as lower speed limits, should be in place and enforced within critical habitat for Sage-Grouse to prevent accidental mortality whenever possible. The small population size also prompted direct action for population management via adult translocations in Alberta beginning in 2011. This management action is currently being

monitored and critically assessed as part of a collaborative research effort between the Alberta government and the University of Calgary. The potential and feasibility of other methods, including captive-rearing and captive-breeding, will also be investigated to develop and adapt guidelines for Sage-Grouse population augmentation in Canada, as will options for local predator management at sites where remnant small populations of Sage-Grouse occur and where translocations or reintroductions may occur in the future.

Monitoring and Assessment

To determine whether progress towards the population and distribution objectives (Section 5) is being made, a long-term standardized survey and population monitoring protocol should be implemented across the species' Canadian range. Annual spring lek surveys must continue to be conducted to maintain an index of population status and trends. All active and, to the extent possible, abandoned leks should be monitored in accordance with accepted standards for lek monitoring (Connelly et al. 2004). Winter census techniques should be developed to provide baseline data on distribution and for an index of population recruitment and status. Efforts should be directed at using spring lek surveys in conjunction with winter population surveys to obtain non-intrusive indices to annual productivity and recruitment within Sage-Grouse populations.

Habitat Assessment, Management, Conservation & Protection

The focus for habitat management and protection should be to collaborate with land owners/managers on habitat stewardship plans to allow both a sustainable livelihood and ensure protection of habitat for Sage-Grouse (see also Communication, Collaboration, and Engagement).

Both Alberta and Saskatchewan have recently updated their land-use/activity restriction guidelines for Sage-Grouse habitat, and land-use activities should be monitored to ensure compliance with guidelines. Periodic evaluation of all disturbance-protection measures should be performed to keep up-to-date with ongoing research and new information (for example, see Section 7.3). If possible, protocols for habitat reclamation in areas with existing developments that are otherwise suitable for Sage-Grouse can be explored; however, the focus for habitat management should be on areas that are currently occupied by Sage-Grouse, keeping them free from disturbance.

Ungulate grazing is a necessary natural process in maintaining healthy and diverse grassland ecosystems (SK PCAP 2008). Grazing management that prevents the landscape from becoming unhealthy or improves the ecological health status benefits many species on the landscape (Adams et al. 2005). In order to effectively manage livestock grazing, it is necessary to operate and maintain infrastructure such as fencing, water sources, and salting locations to achieve the goal of rangeland health. Livestock do not graze in a uniform manner, resulting in areas of low, high and moderate utilization that provide a patchy biodiverse rangeland which meets habitat requirements of wildlife and species at risk. As such, light to moderate grazing and the maintenance of the infrastructure supporting it, is a beneficial management practice within the critical habitat of Sage-Grouse.

Research

Research to improve knowledge about the relationship between Sage-Grouse and human activities is essential to refining protection and mitigation measures for Sage-Grouse and their habitat. For example, many direct and indirect water-control structures exist on the prairie landscape, altering the natural hydrology. The impacts of these actions on Sage-Grouse productivity, especially maintenance of sagebrush and mesic meadows, should be further investigated. All existing programs, policies, and incentives related to agriculture and the petroleum industry should be examined to determine if there are adverse impacts on Sage-Grouse population recovery efforts. The effects of modified natural processes (such as climate and predation) on Sage-Grouse should also be investigated thoroughly to understand the cumulative effects of all environmental and anthropogenic stressors that affect Sage-Grouse population sustainability.

Research indicates that Sage-Grouse use both source (net population gain) and sink (net population loss) habitats (Aldridge and Boyce 2007). As of 2004, only 11% of the southern Alberta landscape was considered source habitat for nesting and only 5% was quality source habitat for brood rearing (Aldridge 2005). The majority of habitat used by Sage-Grouse in that area was therefore sink habitat. Source habitats should be protected and managed to maintain or improve annual productivity. Sink habitats should be evaluated to determine factors that inhibit productivity and the potential for cooperative efforts with land users to restore or enhance silver sagebrush–grassland complexes should be investigated.

There is a need to monitor and assess the impact of potentially fatal/adverse health threats, especially West Nile virus, on Sage-Grouse populations, and mitigation measures for disease outbreaks should be developed if at all possible. As well, periodic monitoring of genetic diversity and gene flow within populations is important for maintaining genetic viability of small populations (K. Bush pers. comm., in Lungle and Pruss 2008).

Communication, Collaboration and Engagement

Recovery efforts will be more successful with broad-sector support for conservation initiatives. Information and educational material should be further developed to encourage awareness and support for Sage-Grouse conservation and recovery across all sectors of the general public. Information and extension efforts should be directed towards all land users to encourage protection and enhancement of Sage-Grouse habitat and to take steps to minimizing disturbance impacts. Whenever possible, direct involvement of land users in conservation initiatives should be encouraged. For example, beneficial range management practices should be developed for, and with, the ranching community to maintain a sustainable industry while providing optimal mating, nesting, brood-rearing and winter habitat for Sage-Grouse. Community-based initiatives result in shared ownership, shared goals, and shared successes.

Conservation Planning

Land use issues relevant to management of habitat for Sage-Grouse also may be relevant for other prairie wildlife species. Efforts to enhance populations of Sage-Grouse should be coordinated with other initiatives or programs relevant to sustainable management of the prairie ecosystem. Canadian membership in, and coordination with, the Western Association of Fish and Wildlife Agencies (WAFWA) Greater Sage-Grouse Comprehensive Conservation Strategy (Stiver et al. 2006) is an important priority for successful cooperative Sage-Grouse and sagebrush conservation in both Canada and the United States. Additional collaborative recovery initiatives include the Northern Sage-brush Steppe Initiative between Alberta, Saskatchewan, and Montana (a Memorandum of Understanding was renewed in 2012 to align management and research between the three agencies), the South of the Divide Action Plan in Saskatchewan (in preparation), and the ongoing MULTISAR (Multiple Species at Risk) Project in Alberta.

7. CRITICAL HABITAT

Critical habitat is defined in the *Species at Risk Act* (2002) section 2(1) 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*”.

Sage-Grouse are at very high risk of extirpation from Canada, with the current total population considerably lower than the population and distribution objectives for this species. Suitable habitats in which Sage-Grouse are most likely to have recently (2000–2012) occurred during any life stage (e.g., lekking, nesting, brood-rearing, or wintering), as well as additional leks last active in the 1980’s or 1990’s that have intact, suitable habitat currently surrounding them, represent critical habitat for survival and recovery of the species in Canada.

7.1 Identification of the Species’ Critical Habitat

Critical habitat for the Sage-Grouse is fully identified in this Amended Recovery Strategy for nesting, brood-rearing, and wintering habitat (i.e., year-round habitats) that broadly surrounds all leks active in any year between 2000 and 2012 plus additional nearby leks last active in the 1980’s or 1990’s. The critical habitat attributes and locations are identified using the best available information, including documented field observations of Sage-Grouse from Alberta and Saskatchewan, the output from habitat modeling, and other scientific information on seasonal habitat requirements for the species. The following approaches were used to identify 1) lek critical habitat, and 2) year-round (nesting, brood-rearing, and winter) critical habitat for the Sage-Grouse, in Alberta and Saskatchewan.

Lek critical habitat

Lek critical habitat (Figure 2, Appendix D) was previously identified in the ‘*Replacement of Section 2.6 of the Recovery Strategy for the Greater Sage-Grouse in Canada*’ (Parks Canada Agency 2009). All recently-active leks (where at least one displaying male Sage-Grouse was observed between 2000 and 2012) were identified as lek critical habitat, totaling 18 lek locations

in Alberta and 11 lek locations in Saskatchewan. In this Amended Recovery Strategy, 12 additional leks last active in the 1980's or 1990's are also identified as critical habitat, 3 of which are in Alberta and 9 of which are in Saskatchewan (see Parks Canada Agency 2009 for details on how lek locations and extents were determined in the field within each province).

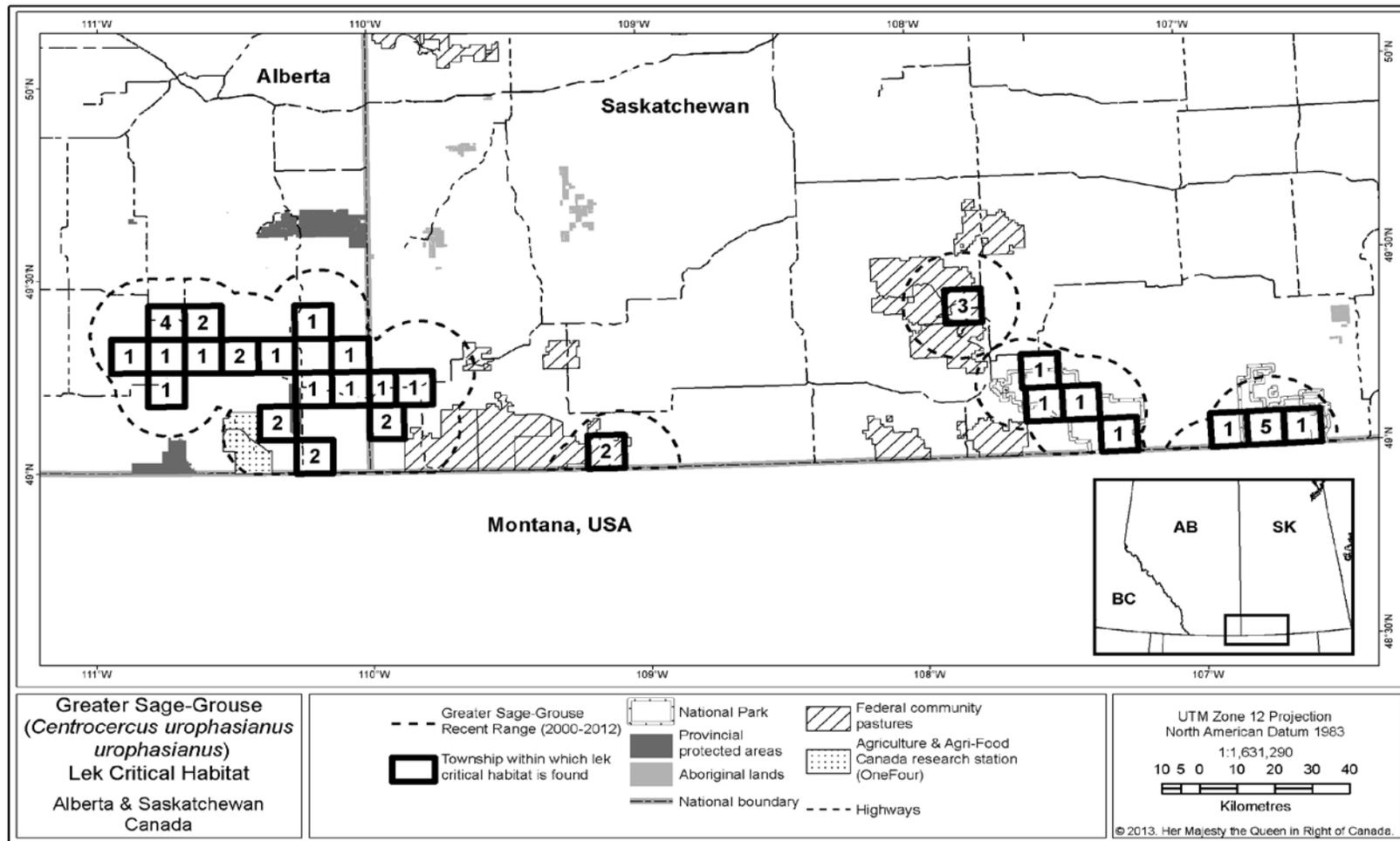


Figure 2. Lek critical habitat for Greater Sage-Grouse (total = 12.5 km²) occurs within each displayed township (~10km x 10km; bold outline) in Alberta and Saskatchewan. To prevent possible disturbance of grouse during their breeding season, the precise locations of leks are not presented here. Instead, the number of leks is indicated within each identified township, for a total of 41 leks across the Sage-Grouse range in Canada (see Appendix D for distribution of leks within a standardized national 10km x 10km grid). Information on dispersal patterns of females from leks to nests (Aldridge and Brigham 2001, Tack 2009) and on estimated numbers of hens per lek was used to predict maximum nesting distances around each recently-active lek. Maximum nesting distances were delineated around each lek with circular buffers, which were merged to form the recent (2000–2012) Canadian nesting range. If more detailed locations are required to support recovery, affected parties can contact Environment Canada (Prairie and Northern Region) for more information.

Thus, a combined total of 41 suitable lek sites (21 in Alberta and 20 in Saskatchewan) are identified as mating critical habitat for Sage-Grouse survival and recovery, with a total area of 12.5 km². The total number of lek sites identified as critical habitat (41 potential leks) is greater than the number required to be active on a per-year basis (36 leks) under the long-term population and distribution objectives; this acknowledges the inherent uncertainty around predicting exactly which abandoned leks will become reoccupied in future years and also allows for some variation in which leks are active each year.

All habitat within the boundaries of these 41 identified leks, which have a history of use by displaying Sage-Grouse, is identified as critical habitat. Although the most important feature of these leks is the recurrent occupancy that occurred in the past, to aid in locating these areas on the ground, the general biophysical attributes of leks are listed below:

- Typically lower elevation than surrounding areas
- Treeless and flat, with sparse vegetation (e.g., dried mud flats or valley bottoms)
- Adjacent to shrub-dominated habitats that are primarily silver sagebrush

The presence of certain human activities or structures on or near leks decreases the probability that Sage-Grouse will continue to occupy otherwise suitable leks, most likely because of behavioural avoidance of such areas by Sage-Grouse. As a result, the presence of Sage-Grouse is associated with lower amounts of these human factors, meaning that the following conditions (or ‘attributes’) are considered functionally important to lek critical habitat:

- Limited noise disturbance
- Limited human presence
- Limited presence of artificial perches, or artificial nest structures for avian predators of Sage-Grouse

Year-round (nesting, brood-rearing, and winter) critical habitat

In this Amended Recovery Strategy, a predictive occurrence-based model was used to identify critical habitat in Canada for Sage-Grouse nesting, brood-rearing, and winter life stages (i.e., year-round critical habitat). One benefit of such predictive models is that they identify suitable habitat not only in areas where Sage-Grouse occurrence data are available, but also where occurrence data are currently unavailable.

The updated model used in this Amended Recovery Strategy followed previous approaches of identifying suitable Sage-Grouse habitat in Alberta (Aldridge 2005, Aldridge and Boyce 2007, Parks Canada Agency 2009; see also Carpenter et al. 2010) but incorporated modifications and improvements that allowed it to be applied across a much larger geographic extent (Aldridge & Gummer 2010; Gummer & Aldridge 2010; Parks Canada Agency and Environment Canada unpubl. data). The model analysis (Parks Canada Agency unpubl. data) related Sage-Grouse nest locations (113 nests; 2001–2004) to habitat variables, and determined that nesting Sage-Grouse hens select relatively large patches of moderate and heterogeneously-distributed shrub cover (predominantly silver sagebrush), favour relatively moist areas, and avoid lush green vegetation cover. This updated nesting-habitat model was tested against a set of other known Sage-Grouse occurrences (116 nests; 1998–2010) that had not been used for model development, and strongly

predicted the locations of these other known nests. In addition, the habitat model was tested against Sage-Grouse occurrences from other life stages (i.e., brood-rearing and winter), and showed that the modeled nesting habitat also contained a large proportion of the known brood-rearing (80–99%, 791 locations) and wintering (88–95%, 208 locations) Sage-Grouse occurrences. This confirms that the modeled habitat provides a good representation of suitable ‘year-round’ habitat for Sage-Grouse.

Year-round (nesting, brood-rearing, and winter) critical habitat for Sage-Grouse was identified by the habitat suitability model through the calculation of optimal combinations of two or more of the following biophysical attributes:

- Moderate shrub cover, typically silver sagebrush with a patchy distribution
- Limited amounts of bare ground
- Moderately moist habitats (under average weather conditions)
- Limited amounts of lush green vegetative cover
- Adequate availability of prey (insects) and forage (forbs)

These areas were mapped using a geographic information system. Within these mapped boundaries, some habitats that are known to be unsuitable (human settlements, annual cropland, non-native hayland, water bodies, roads or roadsides) were identified using independent satellite imagery and then removed from the suitable habitat map. The remaining areas of suitable habitat were mapped within the western portion (Figure 3) and the eastern portion (Figure 4) of the species 2000–2012 range to indicate the year-round critical habitat for Sage-Grouse in Canada. These identified areas encompass 2812 km² of land (1410 km² in Alberta + 1402 km² in Saskatchewan), covering portions of 8360 quarter-sections (4026 in Alberta; 4334 in Saskatchewan). Within these mapped areas (Figures 3 and 4), any remaining human settlements, annual cropland, non-native hayland, water bodies, roads or roadsides [i.e., land within 15m of roads], which were not identified using satellite imagery and omitted from the mapped areas (see previous paragraph), are not to be considered critical habitat.

The presence of other human activities or structures can decrease the probability that Sage-Grouse will occupy otherwise suitable habitat, most likely because of behavioural avoidance of such areas by Sage-Grouse. As a result, the presence of Sage-Grouse in suitable habitat is related to low amounts of these human factors, so the following conditions (or ‘attributes’) are considered functionally important to nesting, brood-rearing, and winter critical habitat:

- Limited human-modified areas
- Limited chronic noise disturbances
- Limited presence of artificial structures that serve as perches for large birds of prey

The critical habitat identified in this Amended Recovery Strategy is considered sufficient for meeting the long-term population and distribution objectives. The critical habitat includes recently occupied habitat and also a substantial amount of historically-occupied habitat. This is important to note because historically-occupied habitat is most likely to provide critical habitat for recovery of the Sage-Grouse population via re-colonization if it is adjacent to sites that are currently or recently occupied.

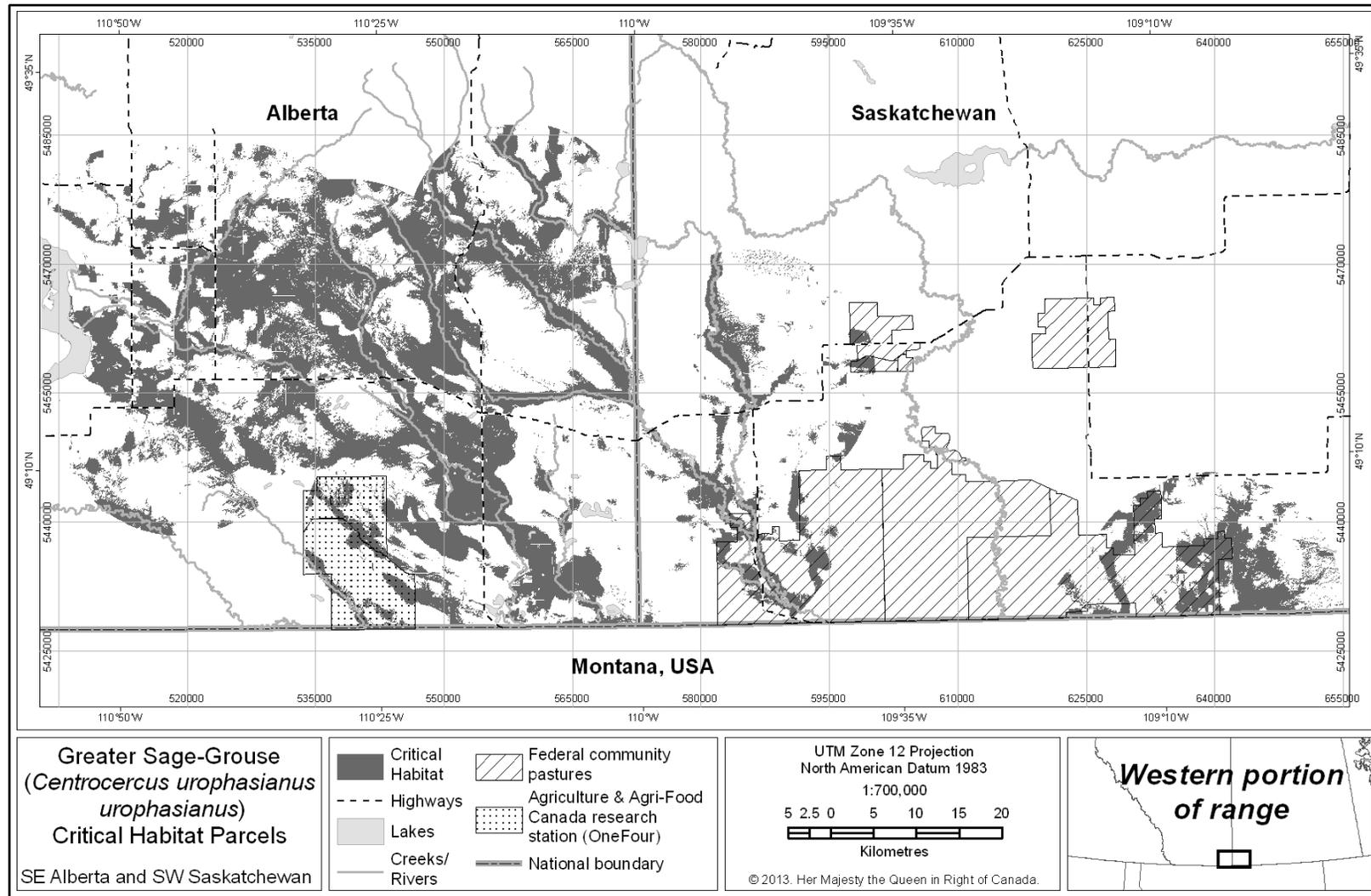


Figure 3. Model-based distribution of year-round critical habitat (for nesting, brood-rearing, and wintering life stages), within the western portion of the recent range of Sage-Grouse, in southeastern Alberta and southwestern Saskatchewan (Parks Canada Agency and Environment Canada unpubl. data). Critical habitat for this species occurs within this distribution. However, human settlements, annual cropland, cultivated hayland, water bodies, roads or roadsides that are included within the area modeled as critical habitat are not to be considered critical habitat. A fine-scale version of this figure is available from Environment Canada upon request.

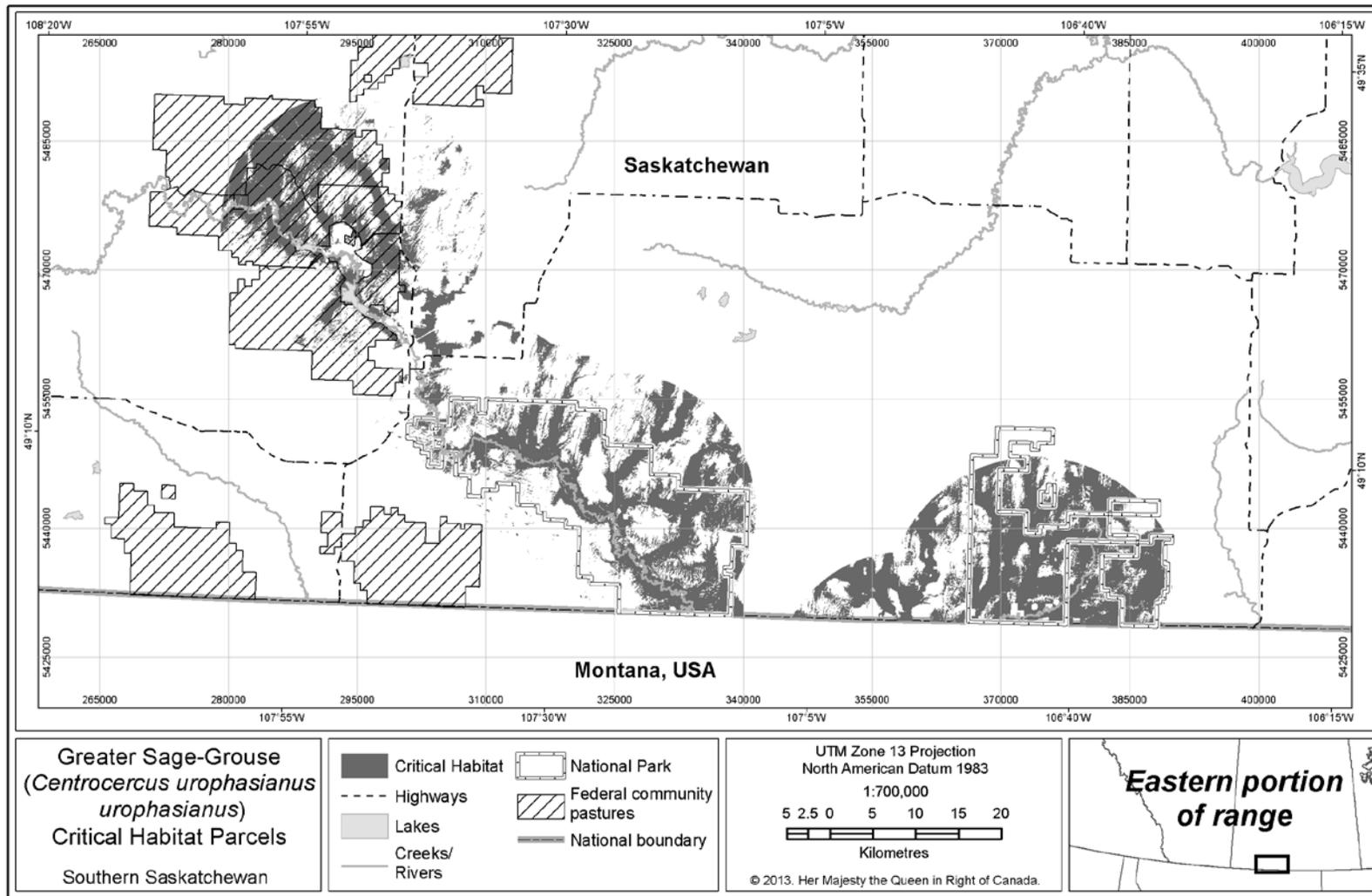


Figure 4. Model-based distribution of year-round critical habitat (for nesting, brood-rearing, and wintering life stages), within the eastern portion of the recent (2000–2012) range of Sage-Grouse in Saskatchewan (Parks Canada Agency and Environment Canada unpubl. data). Critical habitat for this species occurs within this distribution. However, any human settlements, annual cropland, cultivated hayland, water bodies, roads or roadsides that are included within the area modeled as critical habitat are not to be considered as critical habitat. A fine-scale version of this figure is available from Environment Canada upon request.

7.2 Activities Likely to Result in the Destruction of Critical Habitat

Destruction of critical habitat is determined on a case-by-case basis. Destruction would 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. Destruction may result from single or multiple activities at one point in time or from the cumulative effects of one or more activities over time (Government of Canada 2009).

It is recognized that existing facilities and land uses in and adjacent to critical habitat already affect critical habitat, to various degrees, resulting in some variation in quality among specific sites within critical habitat. However, because sage-grouse populations will require this critical habitat to remain in at least as high a quality as it is currently, any additional, increased, or new types of activities that degrade any of the biophysical attributes are considered to be destruction of critical habitat.

Depending on time of year, Sage-Grouse lek or year-round (nesting, brood-rearing, and winter) critical habitat may be destroyed by a variety of activities. These activities may occur within the critical habitat, or outside of the critical habitat if there is resulting destruction inside critical habitat.

An *Emergency Order for the Protection of the Greater Sage-Grouse* (Emergency Order) was made to address the imminent threats of the Sage-Grouse within the habitat that is necessary for their survival or recovery. It contains prohibitions that apply on a number of legal subdivisions⁴ found on provincial and federal crown lands and the road allowances found between those legal subdivisions, which include and surround all leks (mating sites) that were active with male Sage-Grouse in at least one of the years between 2007 and 2012. These legal subdivisions are listed in Part 1 or 2 of Schedule 1 of the Emergency Order and overlap with some of the critical habitat identified in this recovery strategy. Once the Emergency Order comes into force, the restrictions set out in the Emergency Order prevail over those set out in this recovery strategy, to the extent that they address the same activity, as non-compliance with the emergency order would be considered destruction of critical habitat.

In addition to the activities prohibited in the emergency order, the activities in the following non-exhaustive list are likely to result in destruction of critical habitat:

1. Removal, reduction, or degradation of sagebrush-grassland habitat

Sage-Grouse require access to sagebrush-grassland habitat year-round for food and cover. Removal of sagebrush grasslands at any time of year results in direct habitat loss, reduced food availability and nesting cover, and increased exposure of Sage-Grouse to predation and inclement weather. Activities that increase the proportion of bare ground, decrease the proportion of forbs, or remove portions of sagebrush plants so that small amounts of sage leaves remain on those plants, cause habitat degradation to the point where that habitat is no longer functional for Sage-Grouse. These forms of habitat destruction can have severe

⁴ A unit of land described in the Dominion Land Survey System that is $\frac{1}{4}$ of a quarter-section and has an area of approximately 16 ha or 400 m by 400 m.

negative effects on Sage-Grouse populations, particularly when population levels are critically low.

Within lek or year-round critical habitat, at any time of year, examples include:

- Cultivating or converting the vegetation of a sagebrush–grassland complex to an alternative vegetation type
- Constructing a gas or oil well
- Constructing a new road or widening an existing road
- Killing sagebrush by cutting, applying herbicide, or burning
- Prolonged over-grazing to a point where the vegetation structure and plant community is no longer compatible with the requirements of Sage-Grouse⁵

2. Altering natural hydrology

Activities that alter the natural hydrology of the habitat can negatively alter site conditions for silver sagebrush growth and regeneration and for forb production, thereby reducing food availability and foraging ability for Sage-Grouse.

Within lek critical habitat or year-round critical habitat, at any time of year, examples include:

- Constructing a dike, canal, ditch or dam within, or upstream or downstream from critical habitat, such that the natural hydrology within critical habitat is altered to the extent that silver sage and natural forb habitat conditions are measurably degraded (the distance at which a water control structure may impact critical habitat is dependent on the nature of the project)
- Digging a depression in the ground to create a large dugout or man-made wetland inside any critical habitat such that silver sagebrush and forb habitat conditions are directly or indirectly degraded
- Creating a linear impediment to drainage (e.g., an earthen berm or elevated road bed) that alters overland runoff or flow within critical habitat such that silver sagebrush and forb habitat conditions are directly or indirectly degraded

3. Acoustically degrading habitat

Constructing or installing new infrastructure, or a new infrastructure component, that creates long-term continuous or intermittent (i.e., chronic) noise inside any lek or year-round critical habitat will likely result in avoidance of that location by Sage-Grouse and, thus, in functional destruction of critical habitat.

Therefore, within lek critical habitat or year-round critical habitat, at any time of year, examples include:

- Constructing a new road, or widening an existing road

⁵ Typically a pasture that contains nesting and brood-rearing critical habitat should be grazed at a level of forage utilization between 25 to 45% of the herbaceous vegetation (as measured at the range site or eco-site scale). Grazing systems that result in light spring grazing or that defer grazing to later in the summer or fall, and have an average range health score of good to excellent (Adams et al 2004), are most likely to provide high quality habitat for Sage-Grouse and avoid destruction of critical habitat.

- Placing or installing a generator that produces continuous, regular, or intermittent sounds greater than 45 decibels (A-weighted)
- Installing an oil pump-jack or natural gas compressor station that produces in continuous, regular, or intermittent sounds greater than 45 decibels (A-weighted)
- Erecting a wind turbine that produces continuous, regular, or intermittent sounds greater than 45 decibels (A-weighted)

Operating infrastructure or performing activities that result in noises greater than 45 decibels (A-weighted) within any part of lek critical habitat during the mating/display period can lead to long-term lek abandonment, and thus to functional destruction of lek critical habitat.

Therefore, when Sage-Grouse are typically at leks, which is during evening and morning display periods and the intervening night-time hours (i.e., from 1.5 hours prior to sunset until 1.5 hours after sunrise, between April 1st and May 30th), examples of destruction of lek critical habitat may include:

- Drilling for natural gas or oil
- Conducting 2-D or 3-D seismic exploration
- Operating an oil pump-jack or natural gas compressor station
- Operating loud vehicles on a road
- Operating loud off-road or all-terrain vehicles

4. *Constructing, erecting, or installing vertical structures*

The introduction of new elevated anthropogenic structures results in both direct habitat loss and a more substantive functional loss of habitat surrounding such vertical structures, as Sage-Grouse avoid habitat near structures upon which birds of prey seem likely to perch.

Inside any lek critical habitat or year-round critical habitat, or anywhere else within 1.0 km of lek critical habitat, at any time of year, examples may include:

- Constructing or installing a gas or oil well with any component reaching a height that exceeds 1.2 m
- Constructing a new building, or adding to an existing building, such that the final height is greater than 1.2 m
- Constructing, installing or erecting a post, pole, tower, or wind turbine that has a final height greater than 1.2 m (e.g., utility pole, hawk nesting platform)

Outside of the areas listed in the preceding paragraph, anywhere beyond 1.0 km and within 3.2 km of lek critical habitat, examples of tall anthropogenic structures likely to result in destruction, at any time of year, may include:

- Constructing, installing or erecting a wind turbine or tower (e.g., cell phone tower, radio tower, transmission tower) taller than 10 m

Fences installed on or near leks have the potential to improve the efficiency of avian or mammalian predators and represent an increased risk of predation for Sage-Grouse on leks. Hence, such structures are likely to result in lek habitat avoidance or a significant reduction in habitat quality, which equates to functional destruction of lek critical habitat.

Inside any lek critical habitat, or anywhere within 1.0 km of lek critical habitat, at any time of year, examples may include:

- Constructing or installing a fence

8. MEASURING PROGRESS

The performance indicators presented below provide a way to define and measure progress toward achieving the population and distribution objectives. Progress toward meeting the population and distribution objectives must be reported within five years after this Amended Recovery Strategy is finalized.

Immediately:

- The total sum of the number of male Sage-Grouse counted strutting on all active leks in Canada will not decrease between 2013 and 2014.

Over the short-term:

- Within Alberta and within Saskatchewan, the population of adult Sage-Grouse and the number of active leks will increase. This will be measured as the straight-line trend, over 5 consecutive years, for the annual numbers of a) total male Sage-Grouse counted strutting at leks and b) leks containing one or more strutting male Sage-Grouse each year.

Over the long-term:

- The objective of 1095 adult Sage-Grouse in Alberta and 1500 adult Sage-Grouse in Saskatchewan will be considered to have been met when standard surveys at leks, within each survey year, count 365 or more males among 16 or more active leks in Alberta and at least 500 males among 20 or more active leks in Saskatchewan, over at least a 10-year period. Total counts can be conducted every second year during the 10-year period. In each count year, the total adult population will be estimated using a conservative estimation method, which assumes a sex ratio of 2 females for every 1 male observed attending a lek (see 'Low Estimate' in Appendices B&C).

9. STATEMENT ON ACTION PLANS

Action planning will occur in stages: first in Saskatchewan, where action planning initiatives are currently underway, and then in Alberta. In the Saskatchewan portion of the range, a multispecies action plan that includes Sage-Grouse (i.e., the South of the Divide Action Plan for southwestern Saskatchewan) will be completed within one year of final posting of this Amended Recovery Strategy. A multispecies action plan for Grasslands National Park is also currently underway. An Action Plan specific to Alberta will be a cooperative effort by all jurisdictions involved. Action plans covering the species' entire Canadian Range will be completed within four years of posting the final Amended Recovery Strategy.

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11. PERSONAL COMMUNICATIONS

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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*. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making.

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

Sagebrush habitat and the associated grassland landscape support a wide range of plants and animals, many of which are at risk of extinction in Canada. As such, it is anticipated that the activities identified in this Amended Recovery Strategy will benefit several species and the environment. For example, the Bird Conservation Plan for the Prairie Pothole Region identified 28 priority bird species associated with shrub and early successional habitat. This includes many at-risk bird species that will benefit from the protection of sagebrush-grassland complexes, including endangered species such as Sage Thrasher (*Oreoscoptes montanus*) and Burrowing Owl (*Athene cunicularia*); threatened species such as Loggerhead Shrike (*Lanius ludovicianus excubitorides*), Common Nighthawk (*Chordeiles minor*), Sprague's Pipit (*Anthus spagueii*), and Ferruginous Hawk (*Buteo regalis*); and species of special concern such as Long-billed Curlew (*Numenius americanus*) and Short-eared owl (*Asio flammeus*).

Several at risk plants occur in the sagebrush ecosystem, including the endangered Small-flowered Sand-verbena (*Tripterocalyx micranthus*) and Tiny Cryptantha (*Cryptantha minima*), as well as the threatened Soapweed (*Yucca glauca*) and Smooth Goosefoot (*Chenopodium subglabrum*). Other at-risk species that are found in association with sagebrush and surrounding grassland habitat include the endangered Yucca Moth (*Tegeticula yuccasella*), Non-pollinating Yucca Moth (*Tegeticula corruptrix*), Five-spotted Bogus Yucca Moth (*Prodoxus quinquepunctellus*), and Greater Short-horned Lizard (*Phrynosoma hernandesi*); and the threatened Mormon metalmark butterfly (*Apodemia mormo*) and Swift Fox (*Vulpes velox*).

However, one situation was identified where there is the potential for negative effects. Strategies relating to the protection or increase of silver sagebrush habitat would have a positive effect on all species that share the same habitat as the Sage-Grouse, as discussed above. However, too large of an increase in densities of sagebrush habitat for the Sage-Grouse could potentially have a negative impact on the Mountain Plover (*Charadrius montanus*) and perhaps the Burrowing Owl in the immediate vicinity of their respective nests, as both species select areas with very short vegetation, low amounts of tall shrubs (such as silver sage), and relatively high amounts of bare ground. Placement of Ferruginous Hawk nesting substrates (natural or artificial) must also

consider the locations of nearby Sage-Grouse habitats to allow for the concurrent management of Ferruginous Hawk and Sage-Grouse populations over the landscape.

In summary, management and conservation measures aimed at Sage-Grouse recovery will benefit many rare and sensitive species and, overall, will contribute to the conservation of sagebrush habitats in Canada.

APPENDIX B: SAGE-GROUSE LEK COUNT DATA AND ANNUAL POPULATION ESTIMATES FOR ALBERTA

Year	# Leks Checked	# Active Leks	Total # Males	Range-wide Survey?	# Males /Active Lek	Spring Popn. Low Est. ^a	Spring Popn. High Est. ^b
1968	21	21	613	No	29.2		
1969	21	19	554	No	29.2		
...							
1975	20	19	212	No	11.2		
1976	19	19	347	No	18.3		
1977	13	13	286	No	22.0		
1978	14	13	235	No	18.1		
1979	11	11	198	No	18.0		
1980	17	16	482	No	30.1		
1981	16	16	524	No	32.8		
1983	18	18	358	Yes	19.9	1074	1591
1985	15	14	208	Yes	14.9	624	924
1987 ^c	13	13	400	Yes	30.8	1200	1778
1989 ^c	12	12	344	Yes	28.7	1032	1529
1991	12	11	241	Yes	21.9	723	1071
...							
1994	22	8	70	Yes	8.8	210	311
1995	27	12	110	Yes	9.2	330	489
1996	12	11	136	Yes	12.4	408	604
1997	31	8	122	Yes	15.3	366	542
1998	31	8	124	Yes	15.5	372	551
1999	31	9	117	Yes	13.0	351	520
2000	31	8	126	Yes	15.8	378	560
2001	32	9	114	Yes	12.7	342	507
2002	32	10	91	Yes	9.1	273	404
2003	32	9	96	Yes	10.7	288	427
2004	32	9	94	Yes	10.4	282	418
2005	32	9	95	Yes	10.6	285	422
2006	30	9	90	Yes	10.0	270	400
2007	30	10	90	Yes	9.0	270	400
2008	32	9	78	Yes	8.7	234	347
2009	33	10	66	Yes	6.6	198	293
2010	32	9	31	Yes	3.4	93	138
2011	11	8	13	Yes	1.6	39	58
2012	9	5	13	Yes	2.6	39	58

All data provided by Alberta Environment and Sustainable Resource Development.

^a Data on number of males attending leks were extrapolated to provide a crude estimate of total spring breeding populations (Aldridge 1998a, Aldridge and Brigham 2003, Connelly et al. 2004). The low population estimate assumes a female-to-male ratio of 2:1. Population estimates are presented only for years with range-wide surveys (i.e., covered all areas where active leks were likely).

^b The high population estimate assumes the same 2:1 sex ratio, and also that only 90% of leks are known and only 75% of males attend leks.

^c Population objectives in the first Canadian Sage-Grouse Recovery Strategy (Canadian Sage-Grouse Recovery Team 2001) were based on the 1987 and 1989 male lek counts. Subsequent Recovery Strategies use these same long-term population objectives (see Lungle and Pruss 2008, and section 5 in this current Amended Recovery Strategy).

APPENDIX C: SAGE-GROUSE LEK COUNT DATA AND ANNUAL POPULATION ESTIMATES FOR SASKATCHEWAN

Year	# Leks Checked	# Active Leks	Total # Males	Range-wide survey?	# Males /Active Lek	Spring Popn. Low Est.	Spring Popn. High Est.
1970	5	5	133	No	26.6		
1971	8	7	199	No	28.4		
...							
1983	13	12	144	No	12.0		
...							
1987 ^a	45	29	497	No	17.1	(1491)	(2209)
1988 ^a	39	31	593	No	19.1	(1779)	(2636)
1988 ^b	129	42	873	Yes	20.8	2619	3880
1989	15	7	94	No	13.4		
...							
1994	71	15	93	Yes	6.2	279	413
1995	56	16	105	Yes	6.6	315	467
1996	47	19	123	Yes	6.5	369	547
1997	26	10	61	Yes	6.1	183	271
1998	18	11	122	Yes	11.1	366	542
1999	27	8	101	Yes	12.6	303	449
2000	37	10	126	Yes	12.6	378	560
2001	19	10	106	Yes	10.6	318	471
2002	21	10	84	Yes	8.4	252	373
2003	17	10	81	Yes	8.1	243	360
2004	18	8	60	Yes	7.5	180	267
2005	11	8	62	Yes	7.8	186	276
2006	12	6	60	Yes	10.0	180	267
2007	13	6	56	Yes	9.3	168	249
2008	12	5	51	Yes	10.2	153	227
2009	12	5	45	Yes	9.0	135	200
2010 ^c	5	2	42	No	21.0		
2011 ^c	4	3	35	No	11.7		
2012	35	3	18	Yes	6.0	54	80

Data provided by Saskatchewan Ministry of Environment, Saskatchewan Conservation Data Centre, and Parks Canada Agency. See footnotes under Appendix B for descriptions of population estimate calculations.

^a Population objectives in the first Canadian Sage-Grouse Recovery Strategy (Canadian Sage-Grouse Recovery Team 2001) were based on the 1987 and 1988 male lek counts in Saskatchewan, as shown here in this table and in the 2001 Strategy. Surveys in 1987 and 1988 were subsequently shown to be incomplete, so population estimates for those two years are presented in parentheses. The same long-term population objectives from the 2001 Strategy have been maintained in both subsequent Recovery Strategies (see Lungle and Pruss 2008, and section 5 in this current Amended Recovery Strategy).

^b Subsequent to the finalization of the 2001 Recovery Strategy, count data from additional leks surveyed in 1988 were added to the annual total. In 2013, the 1988 count data were checked against the most complete and up-to-date dataset (i.e., the Saskatchewan Conservation Data Centre database), and the values for 1988 are corrected here accordingly.

^c Surveys in 2010 and 2011 were incomplete because wet weather conditions during lekking in both years made some leks inaccessible.

APPENDIX D: 10KM X 10KM GRIDS (DEFINED BY UTM GRID REFERENCE SYSTEM) WITHIN WHICH LEK CRITICAL HABITAT FOR GREATER SAGE-GROUSE IS IDENTIFIED (SEE SECTION 7.1)

10km x 10km Grid ID ^a	Province/Territory	Easting ^b	Northing ^b	Land Tenure ^c	Number of Leks
12XV32	Saskatchewan	630000	5420000	Federal and Non-federal	2
12WV83	Saskatchewan	580000	5430000	Federal and Non-federal	1
12WV84	Saskatchewan	580000	5440000	Federal and Non-federal	1
12WV85	Saskatchewan	580000	5450000		1
13CQ72	Saskatchewan	370000	5420000	Federal and Non-federal	1
13CQ33	Saskatchewan	330000	5430000	Federal and Non-federal	1
13CQ63	Saskatchewan	360000	5430000	Federal and Non-federal	1
13CQ73	Saskatchewan	370000	5430000	Federal and Non-federal	5
13CQ14	Saskatchewan	310000	5440000	Federal and Non-federal	1
13CQ24	Saskatchewan	320000	5440000	Federal and Non-federal	1
13CQ05	Saskatchewan	300000	5450000	Federal and Non-federal	1
13BQ97	Saskatchewan	290000	5470000	Federal and Non-federal	3
12WV75	Alberta & Saskatchewan	570000	5450000	Non-federal	2
12WV62	Alberta	560000	5420000	Non-federal	1
12WV43	Alberta	540000	5430000	Federal and Non-federal	1
12WV63	Alberta	560000	5430000	Federal and Non-federal	1
12WV54	Alberta	550000	5440000	Non-federal	1
12WV15	Alberta	510000	5450000	Non-federal	2
12WV45	Alberta	540000	5450000	Non-federal	2
12WV65	Alberta	560000	5450000	Non-federal	1
12WV16	Alberta	510000	5460000	Non-federal	3
12WV26	Alberta	520000	5460000	Non-federal	3
12WV36	Alberta	530000	5460000	Non-federal	2
12WV66	Alberta	560000	5460000	Non-federal	1
12WV27	Alberta	520000	5470000	Non-federal	1
12WV57	Alberta	550000	5470000	Non-federal	1

^a Based on the standard UTM Military Grid Reference System (see <http://www.nrcan.gc.ca/earth-sciences/geography-boundary/mapping/topographic-mapping/10098>), where the first 2 digits represent the UTM Zone, the following 2 letters indicate the 100 x 100 km standardized UTM grid, followed by 2 digits to represent the 10 x 10 km standardized UTM grid. This unique alphanumeric code is based on the methodology produced from the Breeding Bird Atlases of Canada (See <http://www.bsc-eoc.org/> for more information on breeding bird atlases).

^b The listed coordinates are a cartographic representation of where critical habitat can be found, presented as the southwest corner of the 10 x 10 km standardized UTM grid containing lek critical habitat parcel. The coordinates may not fall within critical habitat and are provided as a general location only.

^c Land tenure is provided as an approximation of the types of land ownership that exist at the parcels containing critical habitat and should be used for guidance purposes only. Accurate land tenure will require cross referencing critical habitat boundaries with surveyed land parcel information.