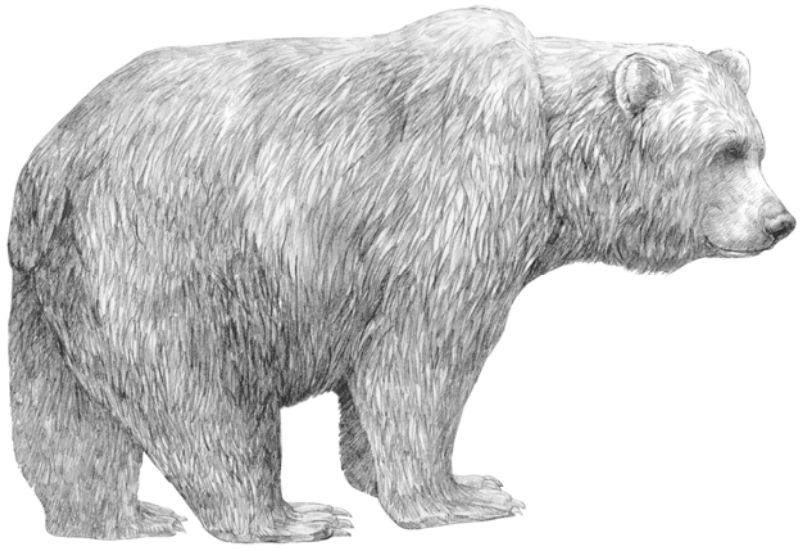
***Species at Risk Act***
Recovery Strategy Series

# Recovery Strategy for the Grizzly Bear (*Ursus arctos*), Prairie Population, in Canada

## Grizzly Bear, Prairie population



**2009**

Environment Canada Environnement Canada

Canada

## About the *Species at Risk Act* Recovery Strategy Series

### What is the *Species at Risk Act* (SARA)?

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

### What is recovery?

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

### What is a recovery strategy?

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

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

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

### What's next?

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

### The series

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

### To learn more

To learn more about the *Species at Risk Act* and recovery initiatives, please consult the Species at Risk (SAR) Public Registry (www.sararegistry.gc.ca/).

# Recovery Strategy for the Grizzly Bear (*Ursus arctos*), Prairie Population, in Canada

**2009**

**Recovery of this species is considered not technically or biologically feasible at this time.**

**Recommended citation:**

Environment Canada. 2009. Recovery Strategy for the Grizzly Bear (*Ursus arctos*), Prairie Population, in Canada. *Species at Risk Act* Recovery Strategy Series. Environment Canada, Ottawa. v + 28 pp.

**Additional copies:**

Additional copies can be downloaded from the SAR Public Registry (www.sararegistry.gc.ca).

**Cover illustration**: © Judie Shore

Également disponible en français sous le titre
« Programme de rétablissement de l'ours grizzli (*Ursos arctos*), population des Prairies, au Canada »


ISBN 978-0-662-46833-2
Catalogue no. En3-4/28-2007E-PDF

# DECLARATION

This recovery strategy has been prepared in cooperation with the jurisdictions responsible for the grizzly bear, Prairie population. Environment Canada has reviewed and accepts this document as its recovery strategy for the grizzly bear, Prairie population, as required under the *Species at Risk Act* (SARA). This recovery strategy also constitutes advice to other jurisdictions and organizations that may be involved in recovering the species.

It was determined that the recovery of the grizzly bear, Prairie population, is not technically or biologically feasible at this time. Individual grizzlies still may benefit from general conservation programs on the Prairies, and the species is protected through SARA, and certain federal and provincial or territorial legislation, policies, and programs.

This feasibility determination will be re-evaluated as warranted in response to changing conditions and/or knowledge.

# RESPONSIBLE JURISDICTIONS

Environment Canada
Government of Alberta
Government of Manitoba
Government of Saskatchewan

# AUTHORS

Diana Ghikas, Renee Franken, and Dave Duncan; Canadian Wildlife Service, Prairie and Northern Region

# ACKNOWLEDGEMENTS

The authors wish to thank a number of people who contributed valuable information and/or assistance: Alberta Sustainable Resource Development – Kim Morton and Richard Quinlan; Clayton Apps; British Columbia Ministry of Environment – Tony Hamilton; Environment Canada – Susan Blackman, Robert Décarie, and Marie-José Ribeyron; many thanks to Environment Canada's GIS Section – Gregg Babish, Mark Gilchrist, Gillian Turney, and especially Gary Weiss; Foothills Model Forest – Gord Stenhouse; Bruce McLellan; Mike Proctor; Saskatchewan Environment – Al Arsenault, Doug Campbell, Sue McAdam, and John Pogorzelec; Parks Canada Agency – Mike Gibeau and Joanne Tuckwell, and the U.S. Geological Survey – Charles Schwartz. Special thanks to Judie Shore for the cover illustration.

# STRATEGIC ENVIRONMENTAL ASSESSMENT STATEMENT

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.

This recovery strategy concludes that recovery of the grizzly bear, Prairie population, is not technically and biologically feasible at this time. However, it may be possible to maintain the occasional presence of individual bears from the Northwestern population in a small region of the Prairies, through conservation measures. Alberta Sustainable Resource Development – Fish and Wildlife Division developed a Prairie Grizzly Operation Strategy (Morton and Lester 2004) to address the management of grizzly bears which foray onto the Prairies. No adverse effects on other species will result from this conservation approach.

# RESIDENCE

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

Residence descriptions, or the rationale for why the residence concept does not apply to a given species, are posted on the SAR Public Registry: www.sararegistry.gc.ca/sar/recovery/residence_e.cfm.

# PREFACE

The grizzly bear, Prairie population, was designated as extirpated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 1991 and was officially listed under the *Species at Risk Act* (SARA) in June 2003. Section 37 of SARA requires the competent minister to prepare a recovery strategy for all listed extirpated, endangered, or threatened species. The Canadian Wildlife Service – Prairie and Northern Region, Environment Canada led the development of this recovery strategy. It was determined that recovery of the Prairie population of grizzly bears is not feasible at this time owing to a lack of suitable habitat and threats that likely cannot be mitigated. The strategy was developed in cooperation or consultation with the governments of Alberta, Saskatchewan, and Manitoba. All responsible jurisdictions reviewed a version of the strategy. This strategy meets SARA requirements in terms of content and process (Sections 39–41).

# EXECUTIVE SUMMARY


- The decline of grizzly bear populations during the 19th century was mainly attributed to European exploration and settlement, and the associated introduction of firearms. The population decline on the Prairies was especially severe, aggravated by the eradication of wild bison and the advent of agriculture. Grizzly bears were rarely seen on the Canadian Prairies after 1900.

- In 1991, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated the Prairie population (delineated by the Prairie Ecozone) as Extirpated (Banci 1991). COSEWIC confirmed the extirpated status of the Prairie population in 2002 (COSEWIC 2002), and it was officially listed under the *Species at Risk Act* in June 2003.

- Primary threats to the recovery of the grizzly bear (Prairie population) are human-caused mortality, habitat loss, and habitat degradation. To understand the extent of the habitat loss, we assessed the amount and distribution of grizzly bear habitat remaining in the Prairie Ecozone based on an *a priori* set of criteria derived from peer-reviewed publications, expert opinion, and historical records. Geographical information system techniques were used to identify habitat considered suitable for adult female grizzly bears.

- There is insufficient suitable habitat presently available to support a Prairie population of grizzly bears. It is unlikely that sufficient habitat could be managed or restored at a scale required to support a viable Prairie population of grizzly bears given past, current, and foreseen human population growth and activities, and the extent of agricultural land use in the Prairie Ecozone.

- Expansive herds of wild bison were an important food resource for the Prairie grizzly (Nielsen 1975), but no longer exist in the Prairie Ecozone. It is uncertain whether natural food resources presently available are adequate to support a Prairie population of grizzly bears.

- **Recovery of this species is considered not technically or biologically feasible at this time.** In accordance with the Government of Canada's *Draft Policy on the Feasibility of Recovery* (2005), determination of recovery feasibility will be re-evaluated in response to changing conditions and/or knowledge.

# TABLE OF CONTENTS

# LIST OF FIGURES



# LIST OF TABLES

# 1. BACKGROUND

## 1.1 Assessment Information from COSEWIC

**Date of Assessment:** May 2002

**Common Name:** Grizzly Bear (Prairie population)

**Scientific Name:** *Ursus arctos*

**COSEWIC Status:** Extirpated

**Reason for Designation:** Extirpated in the prairie region of Canada.

**Canadian Occurrence:** AB, SK, MB

**COSEWIC Status History:** The species was considered a single unit and designated Not at Risk in April 1979. Split into two populations in April 1991 (Prairie population and Northwestern population). The Prairie population was designated Extirpated in April 1991. Status re-examined and confirmed in May 2000 and in May 2002. Last assessment based on an update status report.

## 1.2 Species Description

The grizzly bear (*Ursus arctos*) is larger than the black bear (*Ursus americanus*). It has a distinctive hump between its shoulder blades that is not present in the black bear. The grizzly bear has a nose that turns up at the end, unlike that of the black bear whose nose arches down. Grizzlies are typically browner than black bears, although they can range from nearly white through blond to black. The guard hairs on the shoulders and back of grizzlies are often tipped with white, which gives the fur a grizzled appearance. Another distinctive characteristic of grizzly bears is their fossorial fore-claws used for digging out winter dens, roots, and rodents (Schwartz et al. 2003).

Grizzlies are sexually dimorphic: males are 1.8 times larger than females on average (Hilderbrand et al. 1999). Typical body mass of an adult female ranges from approximately 100-125 kg for interior populations to 225 kg for coastal bears in North America (Schwartz et al. 2003). Apart from a few anecdotal reports, there is little information on the physical characteristics of grizzly bears from the Prairie population, but their size was probably similar to bears living in the interior.

## 1.3 Populations and Distribution

*Ursos arctos* is commonly known world-wide as either a grizzly or brown bear. Historically, its distribution included Asia, the Middle East, North Africa, Europe, Great Britain, and North America (Servheen 1990 *in* Kansas 2002). The global distribution and abundance of grizzlies decreased from the mid-1800s to present by an estimated 50% (Servheen 1990 *in* Ross 2002). Grizzly bear populations are known, or believed, to occur now within the holarctic regions of 42

Eurasian countries, the U.S.A., and Canada, but many of these populations are insular, small, and endangered (Servheen et al. 1999 *in* Ross 2002, Ross 2002, Proctor et al. 2005).

Grizzlies lived across North America prior to European settlement (Nielsen 1975, Banci 1991). A glacial fossil record of a grizzly bear, 11,700 ± 250 years old, was found in southern Ontario (Peterson 1965 *in* Ross 2002). Historically, grizzlies occurred in northern and western North America (Figure 1), although some patches were vacant (Mattson and Merrill 2002), and some small outlier populations (e.g., Labrador) apparently existed (Loring and Spiess 2007).

The decline of grizzly bear populations during the 19th century was mainly attributed to European exploration and settlement, and the associated introduction of firearms (Banci 1991, Mattson and Merrill 2002, Ross 2002). The population decline on the Prairies was especially severe, aggravated by the eradication of wild bison (*Bison bison*) and the advent of agriculture (Nielsen 1975, Mattson and Merrill 2002, Alberta Grizzly Bear Recovery Team 2005). Grizzly bears were rarely seen on the Canadian Prairies after 1900 (Nielsen 1975, Kansas 2002).

COSEWIC identified two separate populations of grizzly bears: i) the Northwestern population (NWP), designated as Special Concern, and ii) the Prairie population, designated as Extirpated. The NWP is within Canada's current grizzly bear range (Figure 1), exclusive of the Prairie Ecozone (Figure 2). The Prairie population represents grizzly bears that occupied the Prairie Ecozone up to the 1880s. When conducting an assessment, COSEWIC occasionally distinguishes among groups or populations, if a single-status designation for a species will not accurately assess its extinction probability.

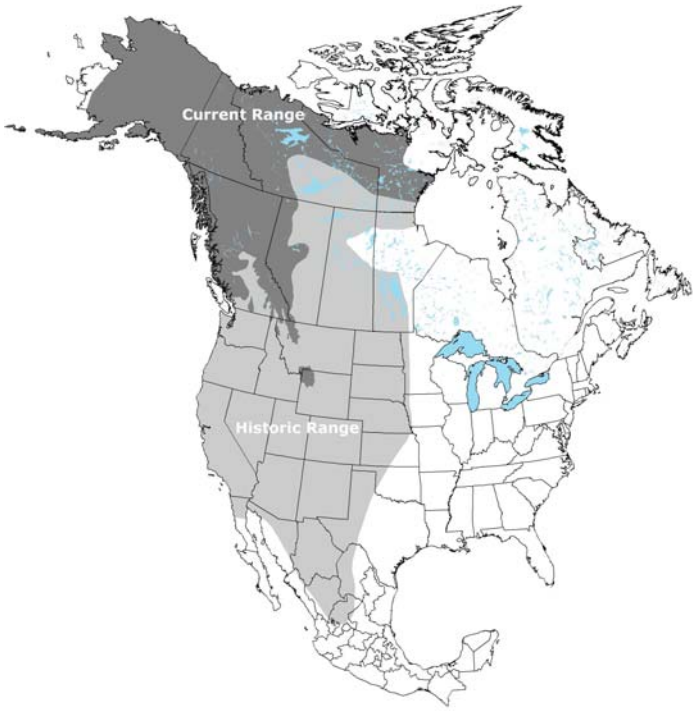



Figure 1. Grizzly bear range in North America (adapted from Mattson et al. 1995, McLellan 1998, Kansas 2002, Ross 2002, and Hamilton et al. 2004; prepared by Environment Canada 2008).

In 2002, approximately 27 000 - 29 000 grizzly bears comprised the NWP: greater than 14,000 bears lived in British Columbia; 6000-7000 bears in the Yukon, 5100 in the Northwest Territories, 1000 in Alberta, and 800 – 2000 in Nunavut. Even though the Prairie population is extirpated, individual grizzly bears from the NWP still occasionally foray to the Alberta prairie (Kansas 2002, Ross 2002, Morton and Lester 2004).

### 1.3.1 Prairie population

One of the earliest written accounts of an encounter with a grizzly bear on the Prairies was by Henry Kelsey in 1691 (Kelsey 1929). Written records from early explorers, fur-traders, naturalists, settlers, hunters, and the Geological Survey of Canada, are the primary sources used to describe historical wildlife populations. Our limited knowledge of the extirpated Prairie population of grizzly bears is based largely on these *incidental* observations, which may not accurately describe the population. For example, most historical observations occurred near a major river (Figure 3). This may be because humans often travelled and settled by water, and/or because bear densities were higher there.

#### *Alberta Prairie*

During 1754, Henday reported grizzlies east of the Red Deer River, and around the Battle River Valley, near Wainwright (MacGregor 1954 *in* Nielsen 1975). During 1787, Thompson recorded numerous grizzlies in the Bow River Valley, as far east as Calgary. Bears were also present near Fort Saskatchewan (Nielsen 1975). Dr. J. Richardson, a naturalist, stated that grizzly bears were most numerous in the woody country along the eastern base of the Rockies, particularly in areas interspersed with open prairies and grassy hills (Richardson 1829 *in* Nielsen 1975).


Figure 2. Prairie Ecozone (461,508 km$^2$; adapted from the Ecological Stratification Working Group 1995; prepared by Environment Canada 2008).

The Palliser Expedition, 1857-1859, frequently encountered grizzlies along the South Saskatchewan, Bow, and Red Deer Rivers. Over two days, members saw seven grizzly bears in the river valley near Medicine Hat. Grizzly bears were also seen on the Prairies north of the Red Deer River (Nielsen 1975). Fur-trading records provide some indication of bear abundance. In 1871, Cowie, a Hudson's Bay fur-trader, received 750 grizzly skins while trading at the Cypress Hills; he estimated that independent traders obtained many more (Nielsen 1975).

By the late 1800s, grizzly bears were rarely seen east of the foothills. For example, Cowie first visited the Cypress Hills in 1871. When he returned twelve years later, he reported that the hills were empty of grizzly bear, elk, and bison (Stegner 1962 *in* Nielsen 1975).

The grizzly bear population in southern Alberta declined during the 19th century because of extensive hunting and mortality associated with human settlement, ranching, and farming, which increased after the *Dominion Lands Act* (1872) and the Canadian Pacific Railroad (1883) were established (Nielsen 1975).

### *Saskatchewan prairie*

Grizzly bears seemed common in Saskatchewan, especially near major rivers (e.g., Battle, North Saskatchewan). During the 1850s, it was well known that grizzlies occurred far down the South Saskatchewan River (Hind 1860 *in* Nielsen 1975). Grizzly bears were frequently seen near Devil's Lake and Fort Pitt near Lloydminster (Graham 1847 *in* Nielsen 1975). A "considerable number" of grizzly bear skins were brought to Fort Pelly in 1857; more were traded when the carts from Fort Qu'Appelle, Fort Ellis, and the Touchwood Hills arrived (Klaus 1961 *in* White 1965). Grizzlies were also observed outside of the Prairie Ecozone, east and north of Prince Albert: Birch Hills in 1772, Nipawin in 1808, Prince Albert in 1820, Pasquia Hills and Cumberland House in 1784, and Wapaweeka Hills near La Ronge (White 1965, Nielsen 1975). During the 1920s, a few grizzlies were reportedly present in the Pasquia Hills, which span the Manitoba-Saskatchewan border (Sutton 1967).

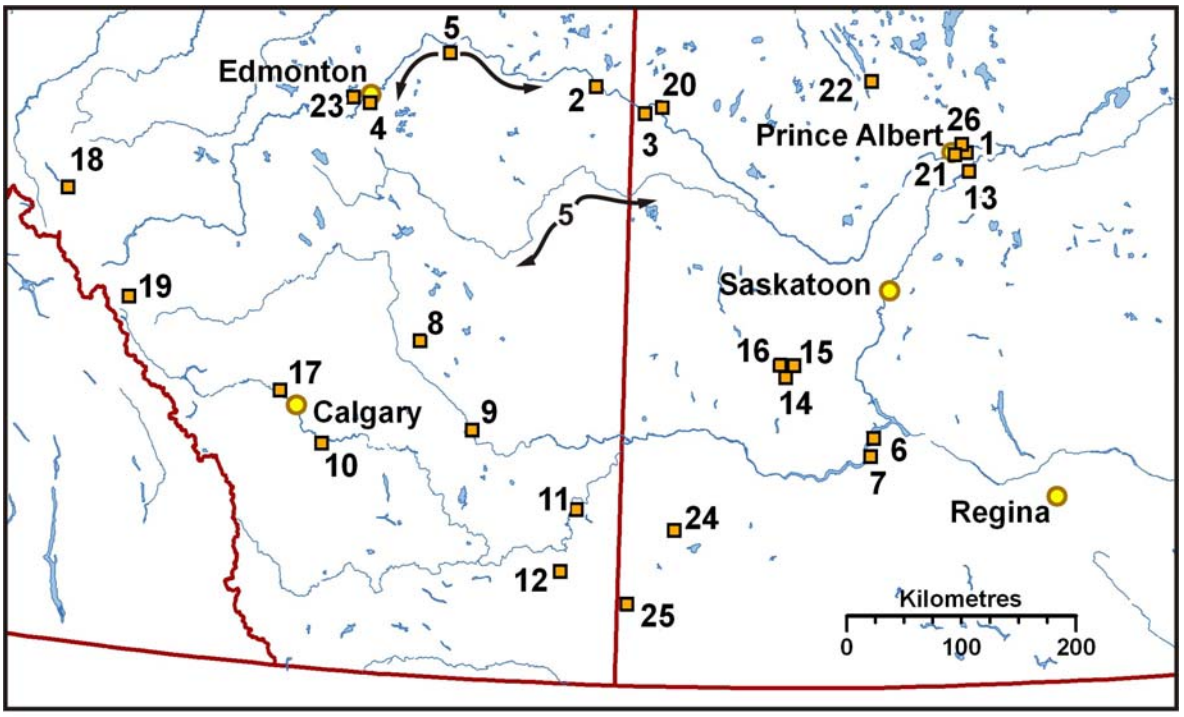
### *Manitoba prairie*

In southern Manitoba, grizzlies were not numerous in the Red River Valley, but were abundant in the Pembina Mountains. In his journals (1799-1814), Henry the Younger reported grizzly skins being obtained from the Pembina River Valley, Pembina Mountains, Portage La Prairie, and Salt River. In North Dakota, near the Manitoba border, grizzly bears were "very common" at Devil's Lake [Lac du Diable], and "seen in droves" on the banks of the Cheyenne [Schian] River, the "nursery of buffalo and deer" (Henry 1897 *in* Seton 1953).

### *Recent sightings*

Even though the Prairie population is extirpated, individual grizzlies from the Northwestern population sometimes travel from the Rocky Mountain foothills to the Prairies in Alberta. Since 1998, sightings of grizzly bears on the Prairies have increased, primarily in the St. Mary and Milk River drainages. These visits to the Prairies are usually short; however, occasionally, grizzly bears establish a semi-permanent residence (Morton and Lester 2004).

A draft Prairie Grizzly Operation Strategy was developed by the Alberta Government (Morton and Lester 2004). Their approach is to monitor the movements and behaviour of the few grizzly bears that frequent the Prairies and to respond to each unique bear accordingly. When possible, a grizzly bear is captured, tagged with a radio or satellite transmitter, and monitored. Information on habitat use by the bear and potential conflict areas is obtained, and can aid in alleviating fears and misconceptions the public may have. Management actions range from monitoring to direct intervention, such as removing attractants or relocating bears (Morton and Lester 2004).




**Grizzly Bear Observations on the Western Prairies Recorded from 1820 to 1869**

| No. | Name | Date | Location | Details |
|---|---|---|---|---|
| 1 | John Richardson | May, 1826 | Fort Carlton | Observed grizzly bear hunt |
| 2 | David Douglas | May, 1827 | Fort Vermilion | Observed 1 grizzly bear |
| 3 | Paul Kane | Sep 24, 1846 | Half way between Fort Edmonton and Fort Carlton | Shot a grizzly bear |
| 4 | Paul Kane | Dec, 1847 | 5 or 6 miles from Fort Edmonton | Observed 1 grizzly bear |
| 5 | Fredric Ulric Graham | Aug & Sep, 1847 | Along the North Sask. and Battle Rivers | Made many observations of grizzlies |
| 6 | Palliser Expedition | Sep 26, 1857 | South Sask. River | Observed a grizzly on the riverbank |
| 7 | Palliser Expedition | Sep 27, 1857 | South Sask. River | Observed 2 grizzly bears and shot 1 |
| 8 | Palliser Expedition | Jun, 1859 | Sand Hills | Killed 3 grizzly bears |
| 9 | Palliser Expedition | Jul 17, 1859 | Plains north of Red Deer River | Observed 5 grizzly bears |
| 10 | Palliser Expedition | Jul 21, 1859 | Bow River near Drowning Ford | Observed 3 grizzly bears |
| 11 | Palliser Expedition | Jul 23, 1859 | South Sask. River | Observed 7 grizzly bears in two days |
| 12 | Palliser Expedition | Jul 28, 1859 | Little Plume Coulee | Observed 1 grizzly bear |
| 13 | Henry Youle Hind | Aug, 1858 | Upper South Sask. River | Referred to presence of grizzly bears in area |
| 14 | Earl of Southesk | Jul, 1859 | Bad Hill | Indian killed by grizzly bear |
| 15 | Earl of Southesk | Jul 20, 1859 | Bad Hill | Observed sow and cub and shot boar |
| 16 | Earl of Southesk | Jul 21, 1859 | Cherry Bush | Observed 1 grizzly bear |
| 17 | Earl of Southesk | Sep, 1859 | Bow Fort | Observed 1 grizzly bear |
| 18 | Earl of Southesk | Sep 5, 1859 | Medicine Tent River | Observed 2 grizzly bears and much sign |
| 19 | Earl of Southesk | Sep 17, 1859 | Kootenay Plains | Observed much grizzly bear sign |
| 20 | Earl of Southesk | Nov 7, 1859 | Vicinity of Fort Pitt | Grizzlies common in area |
| 21 | Milton and Cheadle | Sep, 1862 | Vicinity of Fort Carlton | Observed 2 grizzly bears |
| 22 | Milton and Cheadle | Feb, 1863 | La Belle Prairie | Indian killed by grizzly bear |
| 23 | Milton and Cheadle | May 14, 1863 | Lac St. Albans | 5 grizzlies attacked herd of horses |
| 24 | Issac Cowie | 1868 | Big Sandy Hills | Indians killed by grizzly bear |
| 25 | Issac Cowie | Winter, 1868 | Cyprus Hills | Grizzlies abundant |
| 26 | Charles Messiter | 1860s | Vicinity of Fort Carlton | Killed 2 grizzly bears on river bank |

Figure 3. Recorded observations of grizzly bears in Alberta and Saskatchewan during 1820-1869 (copied from Nielsen 1975; prepared by Environment Canada 2008).

## 1.4 Needs of the Grizzly Bear (Prairie population)

Because there is scant information about the ecology of bears on the Canadian Prairies, much of what is presented in this recovery strategy is based on recent studies of interior populations of grizzlies in North America (*see* Ross 2002).

### 1.4.1 Biology

The biological needs of a grizzly bear vary distinctly by season. During winter, a grizzly resides in its den for 4.5-7 months, does not eat, catabolizes fat and proteins for sustenance (Ross 2002), and loses 16-37% of its body mass (Hellgren 1998 *in* Ross 2002). Litters are born and nursed while mothers are dormant. Spring to fall, foraging is the primary activity, so the bear can replenish its depleted energy reserves and store fat for the next winter hibernation.

Grizzly bears have low reproductive rates because of late maturation, small litters, and long intervals between successive litters (Kansas 2002). On average, a mother has her first successful litter at 5-8 years of age. Litter size, based on surviving cubs, is usually 2, and rarely 4 or more. Litters are produced about every 3 years (Ross 2002, Garshelis et al. 2005, Schwartz et al. 2006). Female reproductive senescence occurs about age 28 (Schwartz et al. 2003).

An offspring accompanies its mother for 2-5 years (Garshelis et al. 2005, Schwartz et al. 2003). At independence, a young bear establishes its own home range. Sons usually disperse away, but daughters often establish home ranges next to or overlapping their mother's home range. Natal dispersal lasts 1-4 years (McLellan and Hovey 2001b *in* Ross 2002). In southeastern B.C., males dispersed 29.9 km and females 9.8 km, on average (McLellan and Hovey 2001b *in* Ross 2002). In Yellowstone National Park, the mean dispersal distance of 4 subadult males was 70 km (Blanchard and White 1991 *in* Ross 2002). Grizzly bears will occasionally disperse much further (e.g., 340 km; P.I. Ross unpubl. data *in* Ross 2002).

Grizzly bear longevity is highly variable and depends on several factors such as individual traits, population characteristics, habitat quality, and the level of protection from humans. During a long-term study in Alberta, the average age of grizzly bears handled was 15-18 years (G. Stenhouse pers. com.). The predicted average longevity was 13.6 years for females experiencing good conditions for survival, whereas it was 2.6 years for males exposed to less favourable conditions (Johnson et al. 2004). Grizzly bears can live >30 years (Schwartz et al. 2006).

### 1.4.2 Diet

Grizzly bears are opportunistic omnivores (Schwartz et al. 2003). The relative content of meat versus plant material in their diet depends on food availability, which varies by season and region (Ross 2002). Female body size and productivity (litter size) varies positively with the proportion of meat (e.g., Pacific salmon, *Oncorhynchus* spp.) in the diet (Hilderbrand et al. 1999). High berry consumption and meat are important for weight gain prior to hibernation (Ross 2002).

Diets of North American grizzly bears have been studied extensively (*see* Ross (2002) for an overview of studies in Canada). Roots (e.g., members of the sweetvetch genus, *Hedysarum* spp.), forbs, graminoids, horsetails (*Equisetum* spp.), sedges (*Carex* spp.), and berries (e.g., buffaloberry, *Sheperdia canadensis*; cranberry, *Vaccinium* spp.) are the main plant foods consumed. Ungulates, burrowed mammals, and carrion are the usual sources of meat in the diets of non-coastal bears (Ross 2002). Grizzlies will scavenge from other carnivores, such as cougars (*Puma concolor*) (Murphy et al. 1998).

There are few details about the diet of the Prairie population, but it was probably similar to the diet described above. Historical accounts tell of prairie grizzlies consuming wild bison (Nielsen 1975, Mattson and Merrill 2002), buffaloberries (Spry 1968), and chokecherries, *Prunus* spp. (Coues 1897 *in* Nielsen 1975). Today, prairie sources of wild meat for grizzly bear consumption would be much reduced; the extensive herds of wild bison are gone and other sources of carrion would be much less because large carnivores rarely occur on the Prairies now.

### 1.4.3 Habitat

Grizzly bears require "food, seasonal foraging habitat, denning habitat, and security in an area of sufficient size for survival" (U.S. Fish and Wildlife Service 2007).

#### *Foraging*

Little is known of the specific habitat requirements of the Prairie population, other than from incidental historical observations (Figure 3; Spry 1968, Nielsen 1975). River valleys probably provided suitable forage for bears (M. Gibeau, pers. com.) because of the abundance of berries, roots, ungulates (Nielsen 1975), and carcasses of drowned bison (Nelson 1973 *in* Nielsen 1975). Relative to the exposed prairie flats, valleys as well as ravines, coulees, and other depressions would have been more productive ecosites supporting more abundant plant growth and higher ungulate densities. In 1859, at Bad Hill, Saskatchewan (Figure 3), favourite habitat of the grizzly bear was described as the "many deep ravines, for the most part overgrown with poplars and thick brushwood"; two people gathering berries were attacked there by a grizzly bear concealed by bushes (Southesk 1969 *in* Nielson 1975).

Similarly, during the 1800s, in the western contiguous United States (U.S.), especially in the drier ecoregions, grizzlies seemed to concentrate along rivers and streams where food (including bison carcasses) and cover were more abundant (Mattson and Merrill 2002).

In the barren grounds of Canada's central Arctic, which has no tree cover like the Prairies, grizzly bears preferred eskers and tall shrub riparian zones (McLoughlin et al. 2002).

#### *Denning*

Steeper terrain in river valleys should provide better denning habitat, with more abundant snow insulation, relative to the open prairie. In Alberta's Rocky Mountains, grizzlies prefer to den in habitats that support deep snow conditions. Typical site characteristics include: steep slopes (i.e.,

30-80%), with north and east aspects (Kansas 2002). Among North American populations, grizzly bears consistently selected steep den sites (Linnell et al. 2000 *in* Schwartz et al. 2003).

Security at den sites appears to be an important factor. Grizzlies may respond to human disturbance around den sites by abandoning their dens, and/or increased activity and heart rates. Bears are especially sensitive around the time of den entry, and possibly during spring, when females with cubs are confined to the den area (Linnell et al. 2000 *in* Schwartz et al. 2003).

#### *Secure habitat*

The goal of secure habitat is to minimize the mortality risk (*see* Section 1.5.1) and disruption to grizzly bears caused by human activities; the proximity or density of motorized access usually determines whether the habitat is considered secure (e.g., Gibeau et al. 2001, U.S Fish and Wildlife Service 2007) or suitable (e.g., Ross 2002, AGBRT 2005) for grizzly bears. Secure habitat, primarily national parks, wilderness areas, and large blocks of public lands, was considered essential to the recovery of the Yellowstone grizzly bear population (U.S Fish and Wildlife Service 1993; 2007).

#### *Home range*

The extent of a grizzly bear's home range can overlap with other grizzlies, and changes in response to social factors [e.g., sex, reproductive status, and density], and environmental factors [e.g., habitat quality and seasonal weather] (U.S. Fish and Wildlife Service 2007). Local climate influences the home-range area by affecting primary productivity and food availability (McLoughlin and Ferguson 2000 *in* Ross 2002). For example, home ranges are usually small in temperate coastal areas, where growing seasons are long and productive, and large in the dry and cold interior and northern regions. In Canada, the average size of an adult female home range was 52 $km^2$ in the Khutzeymateen Valley, B.C., compared to 2434 $km^2$ in the Central Arctic (Ross 2002). Also, within a region, the home-range size varies between 113 - 668 $km^2$ in Canada's boreal plains (Ross 2002) and 35 - 884 $km^2$ in the Central Canadian Rockies (Gibeau et al. 2001), for adult female grizzlies. Bears with access to dependable, high-quality food resources, typically have smaller home ranges than bears with unreliable and scattered foods (Schwartz et al. 2003).

The average home-range size of Prairie grizzlies is unknown, but was likely related to the abundance, distribution, and predictability of food resources. Productivity on the Prairies can vary substantially by year (e.g., drought conditions) and location, so it seems probable that prairie grizzlies had relatively large home ranges, with core activity areas centred on productive ecosites, such as river valleys and coulees.

### 1.4.4 Limiting factors

#### *Population growth: survival and reproduction*

Adult female survivorship often accounts for most variation in the population growth (λ) of long-lived iteroparous species (Crooks et al. 1998, Crone 2001). This appears true for grizzly bears

(Harris et al. 2006). Even though extremely low reproductive rates were evident in Alberta's central Rockies, positive population growth ($\lambda>1$) was still possible because of high adult female survival (Garshelis et al. 2005).

Although female survival is most important, reproductive success also influences population growth. A female grizzly's reproductive performance is associated with her diet. A female's age of first reproduction varied primarily with vegetation productivity among interior North American populations of grizzly bears (Ferguson and McLoughlin 2000 *in* Garshelis et al. 2005). Litter size and female body mass correlated positively with the proportion of meat in the diet (Hilderbrand et al. 1999). Low productivity of adult females in Alberta was attributed to diet, possibly due to restricted habitat use because of human disturbance (Gibeau et al. 2001, Garshelis et al. 2005). The effects of habitat quality and diet on adult female survival and reproductive performance are important considerations when assessing the potential for the recovery of a grizzly bear population.

### *Population recolonization: dispersal*

Grizzlies disperse short distances relative to other large carnivores (Ross 2002; *see* Section 1.4.1). Female offspring tend to reside near their maternal home range; this trait reduces the rate at which grizzlies can recolonize areas where breeding populations have been depleted (Weaver et al. 1996 *in* Kansas 2002). Grizzly bear dispersal is a slow process lasting 1-4 years (McLellan and Hovey 2001b *in* Ross 2002). During dispersal, offspring need habitat suitable for foraging and denning (Ross 2002), and a landscape not dominated by humans, so the potential for human-caused mortality is low (Proctor et al. 2005). The dispersal behaviour (i.e., short distance and long duration) and habitat requirements of grizzly bears, do not favour successful recolonization (i.e., re-establishing a viable population after extirpation) through natural processes, especially in human-dominated landscapes.

### *Population persistence*

Grizzly bear populations in southwestern Canada are prone to being small and isolated, because the landscape is extensively modified, fragmented, and inhabited by humans. Genetic analyses revealed demographically-isolated, vulnerably small ($\leq$ 100 animals) populations of grizzly bears in southern B.C.: inter-population movement was limited for females, and reduced for males, by a highway and associated settlements (Proctor et al. 2005). The authors attributed limited inter-population movement across the transportation and settlement corridor to bears avoiding human-activity centres, and increased bear mortality in these areas, due to bear attractants (e.g., garbage) and concerns about human safety (Proctor et al. 2005). A fragmented system will impede the persistence or recovery of a grizzly bear population, because small isolated populations are more likely to become extinct or extirpated (Lande 1988).

## 1.5 Threats

Human-caused mortality is the foremost threat to the persistence of grizzly bear populations in North America (Mattson and Merrill 2002, Ross 2002, AGBRT 2005, Schwartz et al. 2006, U.S.

Fish and Wildlife Service 2007). Lesser yet pervasive threats are habitat loss and degradation, which adversely affect the vital rates and dynamics of grizzly bear populations (*see* Table 1).

**Table 1. Threat classification table for the grizzly bear, Prairie population**

| Threat category | General Threat | Specific Threat* | Stress |
|---|---|---|---|
| Human-caused mortality | - Human population growth: urban and rural settlement<br>- Extensive agricultural land use: farming and ranching | - Actual/perceived threat to human life or property, management actions, poaching; vehicle/train collisions<br>*Assumes no sport hunting permitted | - High mortality rate<br>- Social disruption<br>- Low dispersal rate<br>- Population decline<br>- Small isolated population |
| Habitat loss | - Human population growth: urban and rural settlement<br>- Extensive agricultural land use: prairie converted to cropland and hayland<br>- Dams on sections of major prairie rivers: loss of important and rare habitat | - Lack of secure habitat (see Section 1.4.3) for foraging and denning<br>- Natural sources of food (e.g., wild bison) for grizzly bears less available than historically | - High mortality rate<br>- Low dispersal rate<br>- Large home ranges<br>- Less body mass<br>- Less reproductive output<br>- Population decline<br>- Small isolated population |
| Habitat degradation | - Human population growth: urban and rural settlement<br>- Motorized access | - Greater potential for human-bear interactions and conflicts<br>- Foraging, denning, and dispersal opportunities are reduced because bears avoid areas used by humans<br>- Habitat fragmentation | - High mortality rate<br>- Low dispersal rate<br>- Less reproductive output<br>- Demographic processes are impaired<br>- Small isolated population |

### 1.5.1 Human-caused mortality

Grizzly bear mortality is highest where bears and humans interact (Johnson et al. 2004). During 1850 – 1970, grizzly bear populations in the contiguous U.S. were more likely to persist where human densities were low (Mattson and Merrill 2002). During 1983 – 2001, humans were the greatest cause of grizzly bear deaths in the Greater Yellowstone Ecosystem (GYE) (Schwartz et al. 2006). Human causes of bear mortality are sport hunting, preservation of life or property, management actions, illegal kills, vehicle/train collisions, incidental trapping, and problems during relocation or research captures (e.g., Ross 2002, Schwartz et al. 2003, AGBRT 2005, Garshelis et al. 2005, Gibeau 2005, Haroldson et al. 2006).

Motorized access increases opportunities for humans to observe and encounter grizzly bears. Roadways typically have high human use (e.g., >1 vehicle / day, Johnson et al. 2004) and are associated with high grizzly bear mortality (McLellan and Shackleton 1988, Stenhouse et al. 2003a *in* AGBRT 2005, Johnson et al. 2004). For example, outside of national parks in Alberta, 89% of 172 human-caused grizzly bear deaths occurred within 500 m of a road (Benn 1998 *in* AGBRT 2005). Secure habitat (i.e., > 500 m from a motorized access route) is considered essential for the recovery of grizzly bears in the GYE (U.S. Fish and Wildlife Service 2007).

Grizzly bears living near humans may become habituated to humans, and are more susceptible to management actions because of concerns about public safety and/or economic loss (e.g., livestock depredation). Habituated and "conflict" bears are more likely to die (Mattson et al. 1992, McLellan et al. 1999, Gunther et al. 2004, Haroldson et al. 2006).

The growth of a grizzly bear population is sensitive to the survival of its adult females (*see* Section 1.4.4), and so, even small changes in this mortality rate may lead to a population decline. Grizzly bear populations can sustain only very low mortality rates (Schwartz et al. 2003).

### 1.5.2 Habitat loss

The Prairie landscape has undergone a dramatic transformation during the past century. Much of the land in the Prairie Ecozone has been converted from native prairie to cropland and hayland. Of the historical range, an estimated 1-39% of the mixed-grass prairie and 14% of the short-grass prairie remains (Samson and Knopf 1994). Human occupation of the Prairies is now extensive (Figure 5); approximately 80% of the land is privately owned (Riley et al. 2007). The dominant land use is agriculture (Figure 4); however, resource, rural, and urban developments are also common. A grizzly bear's mortality risk is high on agricultural lands (Johnson et al. 2004) and private lands (Schwartz et al. 2006), because of permanent human presence (U.S. Fish and Wildlife Service 1993). The six U.S. recovery zones for grizzly bears are comprised of only 2-20% private land; the remainder is public land (U. S. Fish and Wildlife Service 2008). Of the publicly-owned land in the Prairie Ecozone, much of it occurs as relatively small parcels, likely insufficient for the recovery of a grizzly bear population. For the recovery of the Yellowstone population of grizzly bears, the Primary Conservation Area measured 9210 $mi^2$ (23, 854 $km^2$, 2,385, 400 ha; U.S. Fish and Wildlife Service 2007).

River valleys, considered important habitats for prairie grizzlies (*see* Section 1.4.3), are not common in the Prairie Ecozone. During the past century, major prairie rivers were dammed (e.g., South Saskatchewan, Qu'Appelle, Old Man), resulting in the permanent loss of habitats located on the floor and lower slopes of these river valleys, further reducing an already limited resource necessary for any recovery efforts.

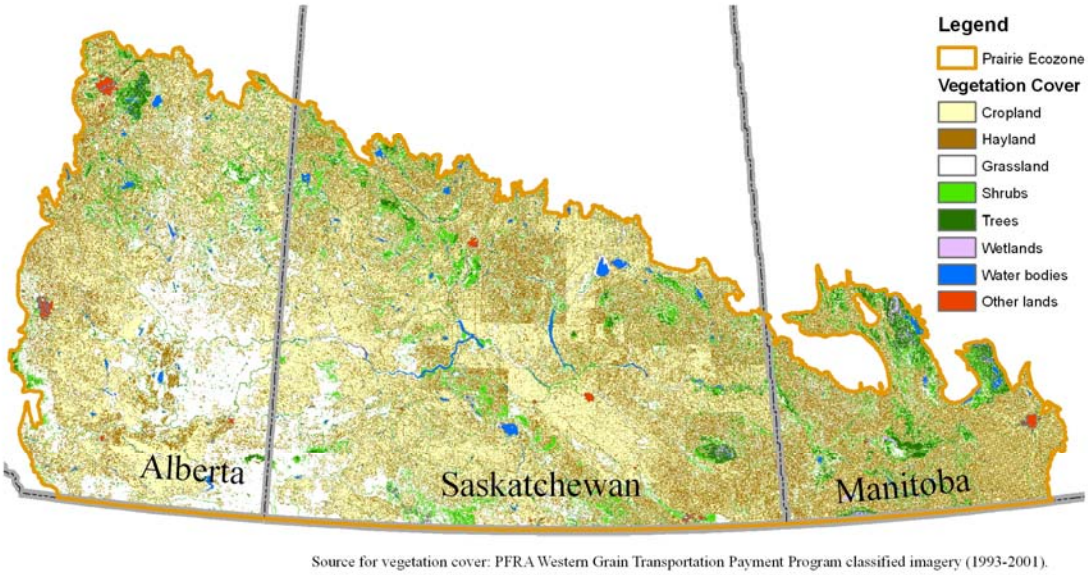



**Figure 4: Vegetation cover in the Prairie Ecozone** (prepared by Environment Canada 2008).

### 1.5.3 Habitat degradation

Human infrastructure (e.g., towns, roadways, industrial facilities, utility right-of-ways) degrades habitat for grizzlies (Ross 2002, AGBRT 2005). Genetic analyses reveal that grizzly bear populations in southwestern Canada are demographically fragmented: a highway and associated settlements limit female and reduce male movements among populations (Proctor et al. 2005). Near human developments and activities, female grizzlies underutilized productive habitat (Mattson et al. 1987, McLellan and Shackleton 1988, Mace et al. 1996, Gibeau and Stevens 2005). In contrast, in areas with little human disturbance, grizzly bears use high quality habitats efficiently (Gibeau and Stevens 2005). Adverse effects on bear foraging behaviour can translate into reduced body mass and reproductive output, and increased mortality.

Also, in developed areas, improperly stored human garbage and food may attract a bear, which will usually result in a management action. Bears with a history of management actions or conflicts with humans are less likely to survive (Johnson et al. 2004, Haroldson et al. 2006). Motorized transport (e.g., vehicles, trains) can disturb bears, and increase the likelihood of a bear being injured or killed (e.g., Mattson et al. 1987, Nagy et al. 1989, Gibeau et al. 1996). A characteristic of the Prairie landscape is the grid road system which provides extensive motorized access (i.e., north-south roads at one-mile intervals and east-west roads at two-mile intervals), which would not favour grizzly bear survival.

Lastly, climate change may affect vegetation productivity on the Prairies, in a region that already experiences extreme conditions, such as droughts. A bear's growth and reproduction would likely decrease, and its home range increase, if food was less nutritious and abundant.

## 1.6 Suitable Habitat

### 1.6.1 Prairie Ecozone

Suitable habitat is determined by the grizzly bear's ecological requirements, at the individual and population level (*see* Section 1.4), in combination with reducing threats to the species (*see* Section 1.5). Habitat selection by grizzly bears is variable, and depends on factors such as individual characteristics (e.g., age, sex, reproductive status), seasonal and yearly weather, abundance and distribution of food, competition, and other biotic and abiotic factors (McLoughlin et al. 2002). To account for detailed habitat requirements of grizzlies on the Prairies would require specific data on habitat use and food resources which is not available for the extirpated Prairie population. No populations of grizzly bears currently exist in prairie habitat exclusively, so extrapolations of a general nature were made from interior North American populations, mainly located in mountains and foothills. Food resources are not accounted for and are recognized as an important gap in the habitat assessment.

### 1.6.2 Habitat assessment

To predict whether there is sufficient suitable habitat presently available to recover the Prairie population of grizzly bears, we developed a spatially-explicit habitat model based on coarse-scale geographical data, and a set of simple but important criteria obtained from peer-reviewed journals, expert opinion, and historical observations. An essential feature of this predictive model is that each adult female would have a small area of secure habitat (*sensu stricto* Gibeau et al. 2001) within her life range. The secure habitat would provide some denning and foraging opportunities, and reduce the potential for human disturbance and human persecution. Food abundance, however, was not modeled.

Geographical information system techniques, described in the appendix, were used to predict potentially suitable habitat in the Prairie Ecozone for adult female grizzly bears, consisting of a 900 $km^2$ life range centered on $\geq$ 9 $km^2$ of secure habitat for each adult female.

#### *Secure habitat: model criteria*

Habitat was identified as secure if the following criteria all applied:

- $\geq$ 9 $km^2$ area
- > 500 m from a roadway or railway
- < 0.5 humans / $km^2$ (Figure 5)
- area covered by natural vegetation (cultivated land considered not secure; Figure 4)
- area consists of drainage landforms: u-shaped valley, canyon, deeply incised stream, midslope drainage, shallow valley, upland drainage; headwaters
- area intersects with a lake or watercourse

In the central Canadian Rockies, suitable grizzly bear habitat was considered secure (less potential for bear-human interactions), if it was $\geq$ 9 $km^2$ (based on the average 1.7 km daily

foraging radius of an adult female), and if it occurred > 500 m from a feature with high human use (> 100 human visits / month), (Gibeau et al. 2001).

When restoring grizzly bear populations, Mattson and Merrill (2002) recommended including core areas with < 0.5 humans / $km^2$, because grizzly bear mortality is positively correlated with human presence (see Section 1.5; Figure 5).

Grizzlies on the Prairies would require some natural (non-cultivated) vegetative cover for foraging (M. Gibeau pers. com.), resting and cooling (AGBRT 2005), and as security from humans. In vegetated areas, grizzlies are less visible, so less likely to be killed by humans (AGBRT 2005). The frequency of bear-human interactions is likely related to the complexity of local topography, as well as, the extent of vegetation cover (Mattson and Merrill 2002).

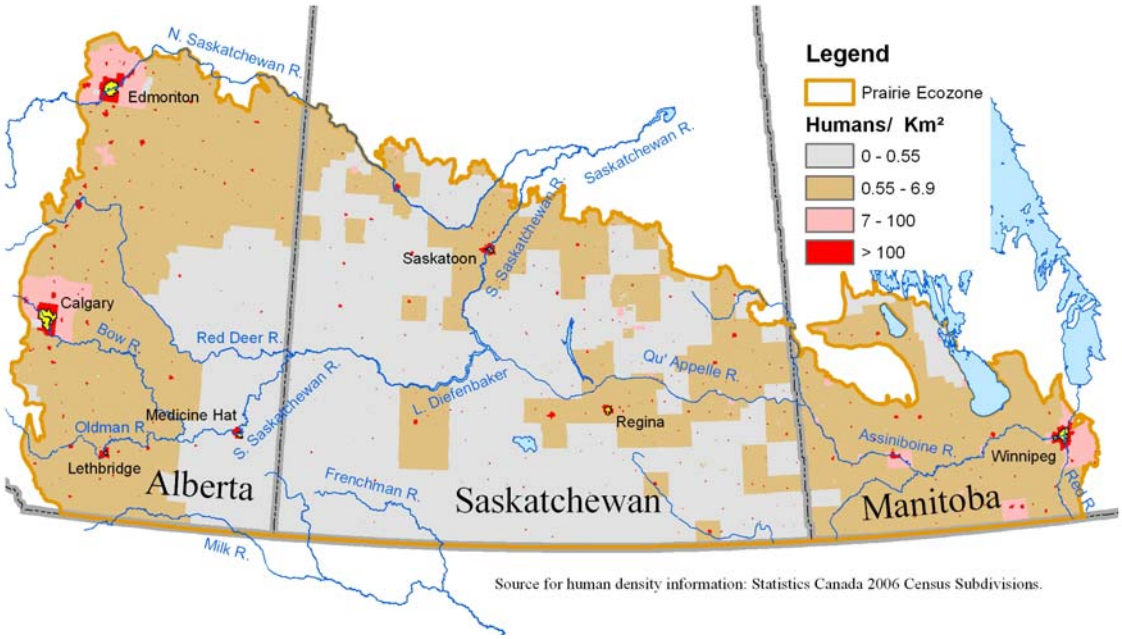



Figure 5. Human density, 2006, by census subdivision, for the Prairie Ecozone (Statistics Canada 2006; prepared by Environment Canada 2008).

Because a grizzly's active season is only 5-7 months, during which a bear must gain sufficient body mass to supply the energetic requirements of its next denning cycle, bears generally tend to concentrate seasonal activity in the most productive habitats available (Schwartz et al. 2003). On the Prairies, grizzlies should concentrate in river valleys where foraging opportunities are likely the most abundant (M. Gibeau pers. com.). Steeper terrain, present in river valleys and coulees, would also be suitable for bear dens and as secure cover. Historical records of prairie grizzlies are often associated with river valleys (*see* Section 1.3.1). Assuming relatively high habitat use in river valleys was key to assessing secure grizzly bear habitat in the Prairie Ecozone, and is accounted for by including drainage and hydrological landforms in the predictive model.

### *Life-range habitat: model criteria*

Suitable life-range habitat was identified if the following criteria all applied:

- secure habitat is present (as identified above)
- ≥ 900 $km^2$ area
- road density ≤ 0.6 km / $km^2$
- < 0.5 humans / $km^2$ (Figure 5)
- < 10 % cultivated land (cropland and hayland)

When examining the persistence of grizzly bear populations over multiple generations, researchers sometimes prefer a lifetime measure of habitat use, called a "life range", rather than an annual measure of home range. In their analysis of grizzly bear extirpation in the contiguous U.S., Mattson and Merrill (2002) chose a 900 $km^2$ life range for adult female grizzly bears based on their knowledge of historical ecological conditions in the western states. Following Mattson and Merrill (2002), a life range of 900 $km^2$ was chosen to predict the habitat requirements of an adult female grizzly bear on the Prairies, which is reasonable given the home range sizes observed for Canadian populations of grizzly bears (*see* Section 1.4.3; Table 5 Ross 2002).

High quality grizzly bear habitat should have open-road densities ≤ 0.6 km / $km^2$, such that human-caused mortality of grizzly bears does not exceed a sustainable rate (AGBRT 2005).

When restoring grizzly bear populations, Mattson and Merrill (2002) recommended including extensive core areas with < 0.5 humans / $km^2$. Low human densities would be especially important in a prairie landscape where secure cover for grizzly bears is minimal.

Because agriculture in the Prairie Ecozone (Figure 4) is ubiquitous, most potential grizzly bear habitat would include some agricultural land, with an elevated mortality risk (Johnson et al. 2004). Grizzly bears in hayland and cropland (annually-seeded crops or summer fallow) would be highly visible to humans, especially after harvest. A potential life range with ≥ 10 % hayland and cropland was considered unsuitable habitat for a grizzly bear because of high mortality risk (K. Morton pers. com.). Grizzly bears should concentrate in the most productive habitats (i.e., river valleys), however, when productivity is low (e.g., few berries), bears would likely explore other food sources within their home range. Cattle grazing occurs on the remaining grasslands in the Prairie Ecozone, and varies in intensity by location and year. In the western U.S., grizzly bear range declined from 1920 to 1970 as cattle density increased (Mattson and Merrill 2002). Although not accounted for in this model, the mortality risk to prairie grizzlies would likely increase with the intensity of cattle grazing.

### *Results*

Twenty-five (25) overlapping life ranges were identified as potentially suitable habitat for adult female grizzly bears in the Prairie Ecozone, located primarily in the areas of Cypress Hills, Milk River drainage, and Grasslands National Park (Figure 6). Accounting for roadways and railways reduced potentially secure habitat the most (Table 2). In contrast, cropland and hayland had the greatest negative effect on potentially suitable life-range habitat (Table 3). To support a

population of grizzly bears, it is necessary to have large areas of continuous habitat suitable for their survival (*see* Sections 1.4.4 and 1.5). Our model predicts that the Cypress Hills and the Milk River drainage would have the largest area of continuous suitable habitat, sufficient for only 17 adult female grizzlies. The remaining eight (8) life ranges represent small, isolated habitat polygons, separated from the Cypress Hills-Milk River habitat polygon, by long (> 75 km) stretches of unsuitable habitat (Figure 6). It is important to note that this analysis did not take into account food resources and that the threat of human-caused mortality risk still exists; these are recognized as important gaps.

**Table 2. Results of identifying secure habitat**

| Model Features (see Section 1.6.1) | # Polygons ≥ 9 $km^2$ | Total Polygon Area ($km^2$) | % Prairie Ecozone |
|---|---|---|---|
| Drainage landforms only | 270 | 14389 | 3.12 |
| Drainage landforms and human density | 238 | 9029 | 1.96 |
| Drainage landforms and road/rail buffers | 222 | 4065 | 0.89 |
| Drainage landforms and vegetation cover | 291 | 8731 | 1.89 |
| Drainage landforms and hydrology | 260 | 14274 | 3.09 |
| **Secure Habitat:** meets all criteria | 93 | 1453 | 0.31 |

**Table 3. Results of identifying suitable life-range habitat**

| Model Features (see Section 1.6.1) | # Secure Habitats ≥ 9 $km^2$ | Total Secure Area ($km^2$) | Total Life-range Area ($km^2$) | % Prairie Ecozone (secure/life range) |
|---|---|---|---|---|
| Life ranges with secure habitat that meet human and road/rail density criteria, but not agricultural criteria | 67 | 1068 | 31,324 | 0.23/6.8 |
| **Suitable Life Ranges**: meets all criteria | 25 | 534 | 11,710 | 0.12/2.5 |

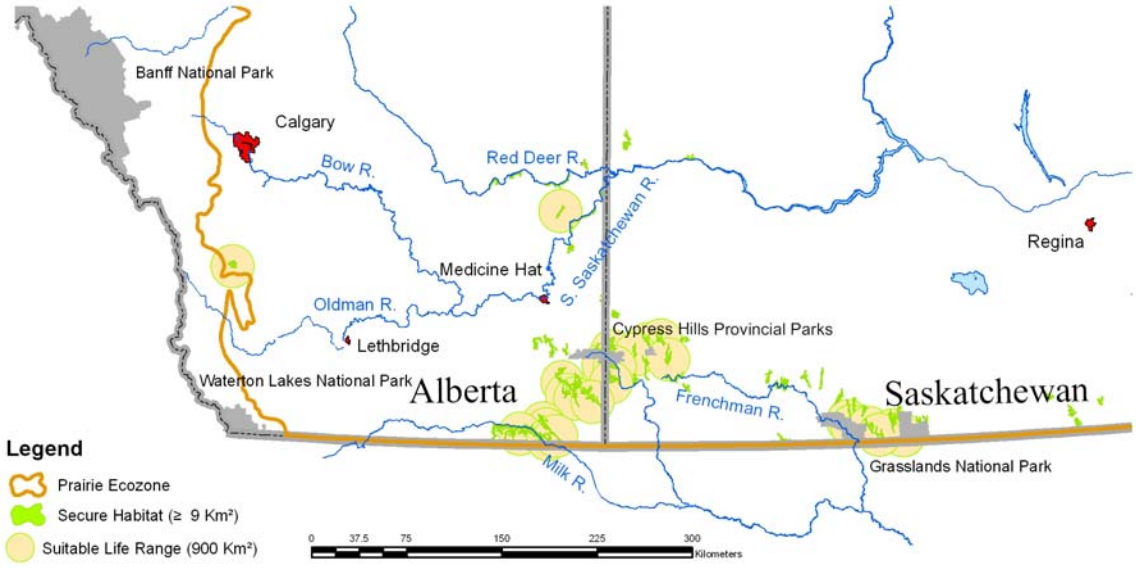



Figure 6. Map of secure habitat and suitable life ranges in the Prairie Ecozone. Twenty five overlapping life ranges were identified as potentially suitable habitat for adult female grizzly bears in the Prairie Ecozone. Food resources were not accounted for and the threat of human-caused mortality of grizzly bears still exists in suitable habitats, especially on private lands, due to possible conflicts with humans and livestock (prepared by Environment Canada 2008).

# 2. RECOVERY

## 2.1 Recovery Feasibility

The federal *Draft Policy on the Feasibility of Recovery* (Government of Canada 2005) states that recovery is *not feasible* if the answer is *no* to any one of the following four questions:

**Are individuals capable of reproduction currently available to improve the population growth rate or population abundance? - *Unlikely*.**

This question is addressed in three parts: i) Are there individuals capable of reproduction? ii) Are they currently available? iii) Will they likely improve the population growth rate or size?

The Prairie population was assessed separately because of its unique state and geographic range in Canada, not because of genetic differences. Sexually-mature bears from interior North American populations (INAP) exist and could be a source for a reintroduction program on the Prairies. However, it is uncertain whether grizzly bears would be available from any of the INAP, given the likely reluctance or concern by another jurisdiction to provide grizzly bears from their populations at risk, especially if the probability of reintroduced bears dying is not acceptable (i.e.,too high). A Prairie population of grizzly bears would be unlikely to achieve population growth because of high mortality risk on agricultural (Figure 4) and private (approximately 80%; Riley et al. 2007) lands, and inadequate habitat (*see* Section 1.5). For example, grizzly bear source-sink dynamics were observed in the Greater Yellowstone

Ecosystem; positive population growth occurred within the grizzly bear recovery zone, consisting of 98% public lands, and, negative population growth ($\lambda = 0.878$) occurred outside of the recovery zone, comprised mainly of private lands (Schwartz et al. 2006). Sink habitat for grizzly bears likely occurs in the foothills of Alberta's Rocky Mountains (Nielsen et al. 2006, M. Proctor pers. com.). For these reasons, it seems unlikely that an active reintroduction program would be feasible and successful.

The occasional grizzly bear will probably successfully disperse to the Prairies, from Canada's Northwest population or the U.S. Northern Continental Divide population, during non-drought years. However, the dispersal rate from these two source populations would likely be extremely low and insufficient to re-establish a viable population on the Prairies. Grizzly bear dispersal is usually of short distance and of long duration (*see* Section 1.4.4), and not successful in human-dominated landscapes (Proctor et al. 2005). Also, grizzly bear habitat on the Prairies is limited. Most grizzly bears dispersing from these two source populations would probably not travel to the habitat areas identified by the predictive model (i.e., southeastern Alberta, Cypress Hills, Grasslands National Park; Figure 6), because it would be too far and involve travel through large areas of unsuitable habitat. Two reproductive female grizzlies have been observed within the Prairie Ecozone of southwestern Alberta since 2001 (K. Morton pers. com.).

**Is sufficient suitable habitat available to support a population, or could it be made available through habitat management or restoration? - *No*.**

Populations of grizzly bears persist in areas where large expanses of relatively secure habitat are retained and where human-induced mortality is low (U.S. Fish and Wildlife Service 2007).

According to the predictive model, potentially suitable habitat is present for up to a maximum of 25 adult female grizzly bears in the Prairie Ecozone, and the largest area of continuous suitable habitat is sufficient for only 17 adult females. Small isolated populations are vulnerable to chance events (e.g., demographic stochasticity, large-scale environmental changes), and have a high probability of being extirpated or becoming extinct because of demographic processes (Lande 1988 *in* Proctor et al. 2005). This concern is evident in the recovery plan for the Yellowstone population of grizzly bears, where the demographic recovery criteria required that a minimum of 48 females with cubs of the year be maintained, and not drop below 48 for any two consecutive years (U.S. Fish and Wildlife Service 1993). Similarly, Proctor et al. (2005) concluded that two grizzly bear populations in southern B.C., each with a total of <100 animals and limited inter-population movements, were vulnerable. A viable and therefore recovered population is one that has high long-term prospects for survival within acceptable levels of risk (U.S. Fish and Wildlife Service 2007). An isolated population of up to 17 reproductive females is not expected to be viable. It is important to note that the threat of human-caused mortality of grizzly bears still exists in the suitable habitats modeled herein.

In addition, the habitat analysis did not account for food resources. The amount of natural food sources available would probably be inadequate for a Prairie population of grizzly bears. Without large herds of wild bison, the primary food source of prairie grizzlies (Nielson 1975, Mattson and Merrill 2002), it would not be possible to recover grizzly bears on the Prairies to densities observed prior to 1880.

There is insufficient suitable habitat available to support a Prairie population of grizzly bears. It is unlikely that sufficient habitat could be managed or restored at a scale required to support a stable Prairie population, given the current and foreseen human population growth in southwestern Canada, and the extent of agricultural land use and privately-owned land in the Prairie Ecozone.

**Can significant threats to the population or its habitat be avoided or mitigated through recovery actions? - *No*.**

The high potential for human-caused mortality and lack of suitable habitat are the primary threats to recovering the Prairie population. A population of prairie grizzlies would be highly visible to humans due to extensive access features (e.g., roads), extensive agricultural activities, and lack of secure cover for bears (e.g., tall vegetation, topographical relief). The prevalence of private lands on the Prairies would certainly aggravate an already high potential for human-caused mortality. Numerous authors discuss how these landscape features and uses increase human-caused mortality of grizzly bears (Nielson 1975, Gibeau et al. 2001, Mattson and Merrill 2002, Ross 2002, Johnson et al. 2004, Proctor et al. 2005, Schwartz et al. 2006). Even in those areas identified as potentially suitable habitat in the Prairie Ecozone, grizzly bears could still be subjected to considerable mortality risk.

Large-scale habitat loss and degradation has occurred on the Prairies since the 1880s. Major river systems have been dammed resulting in much less riparian habitat important to the prairie grizzly. Most native prairie habitats have been lost to cultivation, and rural, urban, and industrial development; loss of native prairie continues (Watmough pers. com.). Habitat degradation due to roadways and railways is ubiquitous.

It is believed that much of the Prairie Ecozone would be sink habitat for a resident population of grizzly bears. Where the occasional grizzly bear occurs, measures can be taken to ensure its survival. For example, monitoring the movements of individual grizzlies, where feasible, is a component of the Prairie Grizzly Operation Strategy developed by Alberta Fish and Wildlife (Morton and Lester 2004). The Draft Alberta Grizzly Bear Recovery Plan 2005-2010 (AGBRT 2005) states there may be opportunities for grizzly bears to expand their range to southeastern Alberta. However, this would likely be limited to only a few individuals, and occupancy on the Prairies may be temporary, restricted to non-drought years.

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

Some populations of grizzly bears have expanded naturally to reoccupy former range (Pyare et al. 2004), because of an adequate source population and sufficient suitable habitat nearby. For example, an estimated 136 bears comprised the Yellowstone source population in 1975, and as already mentioned, nearby secure habitat was extensive: the Primary Conservation Area consisted of 98% public lands, measuring 9210 $mi^2$ (23, 854 $km^2$). By 2006, the Yellowstone population recovered to >500 bears (U.S. Fish and Wildlife Service 2007). However, for reasons

explained above, under the first question in Section 2.1, the recovery of a viable Prairie population, through natural dispersal processes, is unlikely.

A program to actively remove grizzly bears from source populations and reintroduce them to suitable habitat on the Prairies would be an alternative approach, however, it is problematic. It is uncertain whether grizzly bears would be available from any source populations, given the likely reluctance or concern by another jurisdiction to provide grizzly bears from their populations that might be at risk. Techniques for relocating grizzly bears exist and are proven effective, but have associated risks: approximately 30% are more likely to die (Blanchard and Knight 1995 *in* AGBRT 2005). A grizzly bear used to living in mountainous or barren-ground habitats, and relocated to the Prairies, would have to immediately change its foraging behaviour and adapt to its new environment to survive. This would increase the mortality risk to the grizzly bear substantially, especially given the reduced foraging opportunities in the drier and colder Prairie Ecozone. Also, as explained above, insufficient suitable habitat exists to support a viable population of resident grizzlies on the Prairies. A Prairie reintroduction program would likely be ineffective.

## 2.2 Critical Habitat

Critical habitat is defined in Canada's *Species at Risk Act* (SARA) 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." If recovery is not feasible, paragraph 41(2) of SARA requires a recovery strategy to include an identification of the species' critical habitat *to the extent possible*.

Grizzly bears were extirpated from the Prairie Ecozone approximately 125 years ago. There is a lack of suitable habitat to support a sustainable population of the species and there is uncertainty as to whether natural food resources are presently available to support a population. Therefore, the habitat necessary for the survival or recovery of a Prairie population of grizzly bears does not exist and critical habitat cannot be identified.

## 2.3 Conservation Approach

Although the recovery of a Prairie population is not feasible, grizzly bears from the Northwest and Northern Continental Divide populations may occasionally frequent the Prairies, at least temporarily. For example, in the Milk River and St. Mary's River drainages, a few grizzly bears have been observed recently. During 2001, a sow (adult female) grizzly with cubs was seen intermittently. During 2003-2004, two independent male grizzlies were captured, but returned to the mountains immediately after being released. During the 2008 summer, a sow grizzly and cub foraged regularly in a grassland area of southern Alberta (K. Morton pers. com., Morton and Lester 2004). Whether any grizzly bears reside year-round on the Prairies is not known; grizzlies may occupy prairie habitats only temporarily, such as during dispersal, or during seasons or years when vegetation productivity is high. Monitoring the movements of individual prairie grizzlies, where feasible, is a key component of the Prairie Grizzly Operation Strategy, developed by Alberta Fish and Wildlife (Morton and Lester 2004). Engaging in other initiatives,

such as Alberta's "Bear Smart" program, could also minimize the potential for any human-grizzly bear conflicts on the Prairies, which would be beneficial. As well, the Grassland Natural Ecoregion of southern Alberta and the mixed grasslands of southwestern Saskatchewan are recognized provincially as high priority conservation areas for species at risk (R. Quinlan, pers. com., and D. Campbell, pers. com., respectively), with stewardship initiatives and conservation planning underway which will improve habitat conditions for wildlife, such as grizzly bears.

Grizzly bears require productive habitats with few people, minimal motorized access, secure cover (e.g., forest), and adequate food resources, which occur, to some degree, within the historical range of the grizzly bear (Figure 1), but mostly outside of the Prairie Ecozone. To increase the likelihood of persistent grizzly bear populations in Canada, management and conservation activities need to target the habitats best suited to grizzly bear survival.

# 3. APPENDIX 1

## Spatial analysis

Arcview 9.2 (ESRI 2006) was used to find suitable grizzly bear habitat through spatial analysis. This involved two processes: i) identifying secure habitats and ii) identifying the life ranges for each secure habitat.

i) Secure habitats were identified by overlaying the layers below that met the suitability criteria and resulted in polygons ≥ 9 km².

| *Layer theme* | *Suitability criteria* |
|---|---|
| **Human density** | Density ≤ 0.5 humans/ km² |
| **Proximity to transportation corridors** | Distance > than 500 m from roads or railways |
| **Land cover** | Grassland, shrubs, trees, and wetlands. |
| **Landform type** | Canyons, deeply-incised streams, mid-slope drainages, shallow valleys, upland drainages, headwaters, and u-shaped valleys. |
| **Proximity to lakes and streams** | Intersects with a water course or type 2 water body (permanent water polygon feature, other than a slough, irrigation canal, or flooded area). |

ii) Life ranges were identified for each secure habitat using the following steps:

| *Layer theme* | *Suitability criteria* |
|---|---|
| **1. Circular buffer (900 km²) of secure habitat centroids** | Radius = 16.925 km. |
| **2. Life ranges** | Circular buffers with mean human density ≤ 0.5 humans/km², mean road/rail density ≤ 0.6 km/km², and land cover in cropland and hayland is < 10%. |

## Spatial data sources

| *Layer theme* | *Data Source* |
|---|---|
| **Human density** | • Census Subdivision 2006 Cartographic Boundary File, Statistics Canada.<br>• 2006 Census Population, Land Area and Population Density – Manitoba, Saskatchewan and Alberta CSDs, Statistics Canada. |
| **Proximity to transportation corridors** | • The National Road Network, Canada, Level 1, Natural Resources Canada.<br>• National Topographic System 1:250,000 scale railways, Natural Resources Canada. |
| **Land cover** | • Prairie Farm Rehabilitation Administration Western Grain Transition Payment Program Land Cover (Oct, 1993 – Jun, 1995), Agriculture Canada. |
| **Landform type** | • The tool used to create this layer is called the "Topographic Position Index Procedure", developed by Jeff Jenness, Jenness Enterprises ( http://www.jennessent.com ).<br>• GeoBase Canadian Digital Elevation Data, Level 1 (1:250,000 series) digital elevation models, Natural Resources Canada. |
| **Proximity to lakes and streams** | • National Topographic System 1:250,000 scale water bodies and water courses, Natural Resources Canada. |

# 4. REFERENCES

AGBRT (Alberta Grizzly Bear Recovery Team). 2005. Draft Alberta grizzly bear recovery plan. Alberta Sustainable Resources Development, Fish and Wildlife Division, Alberta Species at Risk Recovery Plan Draft. Edmonton, Alberta. 57 pp.

Banci, V. 1991. Update COSEWIC status report on the Grizzly Bear *Ursus arctos* (Prairie, Alberta, British Columbia, Northwest Territories and Yukon Territory populations) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 188 pp.

Campbell, D. 2008. Personal communication. Regina, Saskatchewan.

COSEWIC 2002. COSEWIC assessment and update status report on the Grizzly Bear *Ursus arctos* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 91 pp.

Crone, E. E. 2001. Is survivorship a better fitness surrogate than fecundity? Evolution 55 (12): 2611-2614.

Crooks, K. R., M. A. Sanjayan, and D. F. Doak. 1998. New insights on cheetah conservation through demographic modeling. Conservation Biology 12 (4): 889-895.

Ecological Stratification Working Group. 1995. A National Ecological Framework for Canada. Agriculture and Agri-Food Canada, Research Branch, Centre for Land and Biological Resources Research and Environment Canada, State of the Environment Directorate, Ecozone Analysis Branch, Ottawa/Hull. Report and national map at 1:7,500,000 scale.

ESRI (Environmental Systems Research Institute, Inc.). 2006. ArcGIS 9.2. Redlands, California.

Garshelis, D.L., M.L. Gibeau, and S. Herrero. 2005. Grizzly bear demographics in and around Banff National Park and Kananaskis Country, Alberta. Journal of Wildlife Management 69: 277-297.

Gibeau, M.L. 2005. Mortality of grizzly bears in the Bow River Watershed. Pages 61, *in* S. Herrero, editor. Biology, demography, ecology and management of grizzly bears in and around Banff National Park and Kananaskis Country: The Final Report of the Eastern Slopes Grizzly Bear Project. Faculty of Environmental Design, University of Calgary, Alberta, Canada.

Gibeau, M.L. 2008. Personal communication. Canmore, Alberta.

Gibeau. M.L., S. Herrero, J.L. Kansas, and B. Benn. 1996. Grizzly bear population and habitat status in Banff National Park: Report to the Banff–Bow Valley Task Force. Banff, Alberta. 62 pp.

Gibeau, M.L., S. Herrero, B.N. McLellan, and J.G. Woods. 2001. Managing for grizzly bear security areas in Banff National Park and the Central Canadian Rocky Mountains. Ursus 12: 121-130.

Gibeau, M. and S. Stevens. 2005. Grizzly bear response to human use. Pages 182–192 *in* S. Herrero, editor. Biology, demography, ecology and management of grizzly bears in and around Banff National Park and Kananaskis Country: The Final Report of the Eastern Slopes Grizzly Bear Project. Faculty of Environmental Design, University of Calgary, Alberta.

Government of Canada. 2005. Draft Policy on the Feasibility of Recovery. Ottawa, Ontario. 3 pp.

Gunther, K.A., M.A. Haroldson, K. Frey, S.L. Cain, J. Copeland, and C.C. Schwartz. 2004. Grizzly bear-human conflicts in the Greater Yellowstone ecosystem, 1992-2000. Ursus 15:10-22.

Hamilton, A.N, D.C. Heard, and M.A. Austin. 2004. British Columbia Grizzly Bear (*Ursus arctos*) Population Estimate 2004. British Columbia Ministry of Water, Land and Air Protection. Victoria, British Columbia. 7 pp.

Haroldson, M. A., C.C. Schwartz, and G.C. White. 2006. Survival of independent grizzly bears in the Greater Yellowstone Ecosystem, 1983-2001. Wildlife Monographs 161: 33-43.

Harris, R.B., C.C. Schwartz, M.A. Haroldson, and G.C. White. 2006. Trajectory of the Yellowstone grizzly bear population under alternative survival rates. Wildlife Monographs 161: 44-56.

Hilderbrand, G.V., C.C. Schwartz, C.T. Robbins, M.E. Jacoby, T.A. Hanley, S.M. Arthur, and C. Servheen. 1999. The importance of meat, particularly salmon, to body size, population productivity, and conservation of North American brown bears. Canadian Journal of Zoology 77: 132-138.

Johnson, C. J., M. S. Boyce, C. C. Schwartz, and M. A. Haroldson. 2004. Modeling survival: application of the Andersen – Gill model to Yellowstone grizzly bears. Journal of Wildlife Management 68 (4): 966 – 978.

Kansas. J. L. 2002. Status of the Grizzly Bear (*Ursus arctos*) in Alberta. Alberta Sustainable Resource Development, Fish and Wildlife Division, Alberta Conservation Association. Alberta Wildlife Status Report No. 37. Edmonton, Alberta. 43 pp.

Kelsey, H. 1929. The Kelsey Papers. Introduction by A. G. Doughty and C. Martin. The Public Archives of Canada, Ottawa.

Lande, R. 1988. Genetics and demography in biological conservation. Science 241:1455-1460.

Loring, S., and A. Spiess. 2007. Further documentation supporting the former existence of grizzly bears (*Ursus arctos*) in northern Quebec-Labrador. Arctic 60: 7-16.

Mace, R.D., J.S. Waller, T.L. Manley, L.J. Lyon, and H. Zuuring. 1996. Relationships among grizzly bears, roads and habitat in the Swan Mountains, Montana, USA. Journal of Applied Ecology 33: 1395–1404.

Mattson, D.J., B.M. Blanchard, and R.R. Knight. 1992. Yellowstone grizzly bear mortality, human-habituation, and whitebark pine seed crops. Journal of Wildlife Management 56: 432–442

Mattson, D.J., R.R. Knight, and B.M. Blanchard. 1987. The effects of developments and primary roads on grizzly bear habitat use in Yellowstone National Park, Wyoming. International Conference of Bear Research and Management 7: 259–273.

Mattson, D.J. and T. Merrill. 2002. Extirpations of grizzly bears in the contiguous United States, 1850-2000. *Conservation Biology* 16: 1123-1136.

Mattson, D.J., R.G. Wright, K.C. Kendall, C.J. Martinka. 1995. Grizzly Bears. Pages 103–105 *in* Our Living Resources: a report to the nation on the distribution, abundance, and health of U.S. plants, animals, and ecosystems. E.T. LaRoe, G.S. Farris, C.E. Puckett, P.D. Doran, and M.J. Mac (eds.). U.S. Department of the Interior, National Biological Service, Washington, DC. Available at: http://biology.usgs.gov/s+t/pdf/OLR.pdf

McLellan B.N. 1998. Maintaining viability of brown bears along the southern fringe of their distribution. Ursus 10: 607–611.

McLellan, B.N., F. Hovey, R. Mace, J. Woods, D. Carney, M. Gibeau, W. Wakkinen, and W. Kasworm. 1999. Rates and causes of grizzly bear mortality in the interior mountains of British Columbia, Alberta, Montana, Washington, and Idaho. Journal of Wildlife Management 63: 911-920.

McLellan, B.N., and D.M. Shackleton. 1988. Grizzly bears and resource-extraction industries: effects of roads on behavior, habitat use and demography. Journal of Applied Ecology 25: 451–460.

McLoughlin, P.D., R.L. Case, R.J. Gau, H.D. Cluff, R. Mulders, and F. Messier. 2002. Hierarchical habitat selection patterns of grizzly bears in the central Canadian Arctic. *Oecologia* 132: 102-108.

Morton, K. 2008. Personal communication. Lethbridge, Alberta.

Morton, K. and L. Lester. 2004. Prairie Grizzly Operation Strategy, 2004. Draft July 15, 2004. Draft report prepared for the Lethbridge Wildlife Management Area, Alberta Sustainable Research Development. Lethbridge, Alberta. 9 pp.

Murphy, K. M. 1998. The ecology of the cougar (*Puma concolor*) in the northern Yellowstone ecosystem: interactions with prey, bears and humans. Ph.D. diss., University of Idaho, Moscow.

Nagy, J.A., A.W.L. Hawley, and M.W. Barrett. 1989. Population characteristics of grizzly and black bears in west-central Alberta. AEC Report V88-R1. Alberta Environmental Center. Vegreville, Alberta.

Nielsen, P.L. 1975. The past and present status of the plains and boreal forest grizzly bear in Alberta. Canadian Wildlife Service, unpublished report 75-40. Edmonton, Alberta. 65 pp.

Nielsen, S.E., G.B. Stenhouse, and M.S. Boyce. 2006. A habitat-based framework for grizzly bear conservation in Alberta. Biological Conservation 130: 217-229.

Proctor, M.F. 2008. Personal communication. Kaslo, British Columbia.

Proctor, M.F., B.N. McLellan, C. Strobeck, and R.M.R. Barclay. 2005. Genetic analysis reveals demographic fragmentation of grizzly bears yielding vulnerably small populations. Proceedings of the Royal Society: Biological Sciences 272: 2409-2416.

Pyare, S., S. Cain, D. Moody, C. Schwartz, and J. Berger. 2004. Carnivore re-colonization: reality, possibility and a non-equilibrium century for grizzly bears in the Southern Yellowstone ecosystem. Animal Conservation 7: 71–77.

Quinlan, R. 2007. Personal communication. Lethbridge, Alberta.

Riley, J.L., S.E. Green, and K.E. Brodribb. 2007. A Conservation Blueprint for Canada's Prairies and Parklands. Nature Conservancy of Canada. Toronto, Ontario.

Ross, P.I. 2002. Update COSEWIC status report on the grizzly bear *Ursus arctos* in Canada, in COSEWIC assessment and update status report on the Grizzly bear *Ursus arctos* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 91 pp.

Samson, F. and F. Knopf. 1994. Prairie Conservation in North America. Bioscience 44: 418-421.

Schwartz, C.C., S.D. Miller, and M.A. Haroldson. 2003. Grizzly bear. Pages 556-586 in G.A. Feldhamer, B.C. Thompson, and J.A. Chapman, editors. Wild Mammals of North America: Biology, Management, and Conservation. Second edition. Johns Hopkins University Press. Baltimore, Maryland.

Schwartz, C.C., M.A. Haroldson, G.C. White, R.B. Harris, S. Cherry, K.A. Keating, D. Moody, and C. Servheen. 2006. Temporal, spatial, and environmental influences on the demographics of grizzly bears in the Greater Yellowstone Ecosystem. Wildlife Monographs 161: 1-68.

Seton, E. T. 1953. Lives of Game Animals. Volume II–Part I. The Grizzly bear. Charles T. Brandford Company, Boston.

Spry, I.M. 1968. The Papers of the Palliser Expedition 1857–1860. The Champlain Society, Toronto, Ontario.

Statistics Canada. 2006. 2006 Census subdivision data for human density in Alberta, Manitoba, and Saskatchewan. Government of Canada, Regina, Saskatchewan.

Stenhouse, G. 2007. Personal communication. Hinton, Alberta.

Sutton, R.W. 1967. Possible recent occurrence of grizzly in Manitoba. Blue Jay 25: 190–191.

U. S. Fish and Wildlife Service. 1993. Grizzly bear recovery plan. Prepared by C. Servheen. Missoula, MT.

U. S. Fish and Wildlife Service. 2007. Final conservation strategy for the grizzly bear in the Greater Yellowstone Area. Developed by the Interagency Conservation Strategy Team, Missoula, MT.

U. S. Fish and Wildlife Service. 2008. http://www.fws.gov/mountainprairie.

Watmough, M., D. 2008. Personal communication. Edmonton, Alberta.

White, T. 1965. The possibility of Grizzly bears still existing in Saskatchewan. Blue Jay 23:136-140.