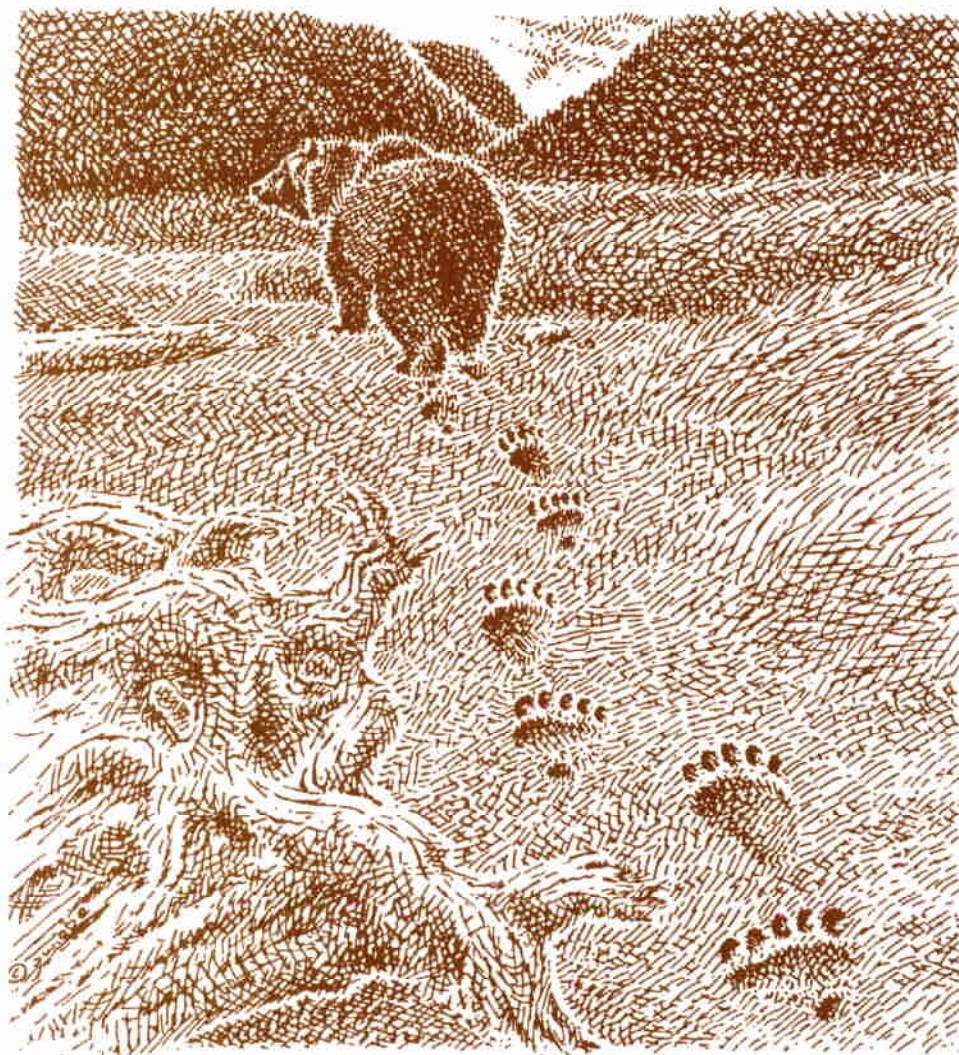


CONSERVATION OF GRIZZLY BEARS IN BRITISH COLUMBIA

BACKGROUND REPORT



May 1995



Province of British Columbia
Ministry of Environment,
Lands and Parks

CONSERVATION OF
GRIZZLY BEARS IN
BRITISH COLUMBIA
BACKGROUND REPORT



The Ministry of Environment, Lands and Parks has also published the Grizzly Bear Conservation Strategy as a companion document to this Background Report. Both documents are available from:

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EXECUTIVE SUMMARY

Grizzly bears once had the widest distribution of any bears in the world. Due to a combination of factors, however, including increasing human populations, habitat loss, and a pervasive intolerance toward grizzlies by people, they have disappeared from most of their original habitats in Europe and Asia.

The number of grizzly bears in North America has halved in the past century. Before European settlement and exploration, grizzly bears occurred throughout Canada from the Pacific coast to the Arctic reaches and as far east as the west coast of Hudson Bay in Manitoba. Today, approximately 25,000 grizzlies are found in western Canada, confined by fields, factories, and towns to less than half of their original range. Grizzlies still inhabit areas in the Yukon and Northwest Territories, the western edge of Alberta, and much of British Columbia. However, a 1990 COSEWIC (Committee on the Status of Wildlife in Canada) status review of grizzly bear populations and habitats was sobering: of the remaining grizzly bear habitat in Canada, over 60 percent was designated as either vulnerable or threatened, and all was considered to be at risk.



British Columbia has an estimated half, or between 10,000 and 13,000, of Canada's grizzlies. Through current land use planning and resource management initiatives such as the Protected Areas Strategy, Commission on Resources and Environment, and the Forest Practices Code, in conjunction with a provincial grizzly bear conservation program, we may be able to halt the loss of important grizzly bear ecosystems.

Conserving grizzly bears and the ecosystems upon which they depend will require tremendous commitment from all of us. We need more information and understanding about grizzly bears and their habitat requirements; inventories, habitat assessments, and research need to be conducted. We need widespread educational programs; through learning more about grizzlies, and biodiversity in general, we can eliminate the ignorance and intolerance so detrimental to these animals. We need more and stronger enforcement capability. Although primarily

focussed on black bears, as the number of grizzlies declines, poaching and illegal trade in bear parts increases and becomes even more clandestine. And we need to establish cooperative programs with adjacent jurisdictions in recognition of the fact that grizzlies know no political boundaries and require avenues of dispersal in order to maintain their genetic diversity.

Three major issues confront us in developing a conservation initiative for grizzly bears:

1. dealing with the loss and alienation of grizzly bear habitat by protecting grizzly bear conservation areas and integrating planning with existing land and resource use initiatives;
2. interactions with humans, including hunting, bear-viewing, and waste management;
3. public education, consultation, and international considerations.

Risks to all grizzly bear ecosystems in British Columbia are high. In the Southern Interior Ecoprovince, grizzlies are considered to be on the edge of disappearance. In parts of the the Boreal Plains and Taiga Plains ecoprovinces in the northeastern corner of our province, grizzlies have been extirpated. And, grizzly bears are locally extinct in areas of the Peace Lowland ecosection and in the Georgia Depression ecosection.

We have the opportunity and responsibility to ensure that the future scenario for British Columbia's grizzly bears is more optimistic than what was suggested by the 1990 assessment. We owe it to ourselves, to future generations, and to the grizzly bear to implement a strategy for the survival of this majestic creature.

We must also increase our tolerance for grizzlies. The rapidly burgeoning human population and associated increase in habitat alienation can only spell increased people/bear conflicts and serious loss of biodiversity unless — through education, research, enforcement, and ecologically sound management practices — we learn to live in harmony with our natural heritage.

This background report discusses the historic and current status of grizzly bears in British Columbia. It explains how we currently manage grizzly bears and grizzly bear ecosystems and identifies the information and activities needed to improve grizzly bear management. It focuses on the impacts of hunting, land-use decisions, inadequate management of garbage, and intolerance of bears by humans.

In recognition of the need, the Wildlife Program of BC Environment seeks to expand its knowledge, research activities, cooperative efforts, and education and enforcement capabilities to ensure the continued survival of grizzly bears and large carnivore ecosystems for the benefit of today's society and future generations.



Saving the grizzly requires a series of large areas from which roads and livestock are excluded... Permanent grizzly ranges and permanent wilderness areas are, of course, two names for one problem. Enthusiasm about either requires a long view of conservation, and a historical perspective. Only those able to see the pageant of evolution can be expected to value its theater, the wilderness, or its outstanding achievement, the grizzly...

Aldo Leopold

INTRODUCTION

A 1990 review of the status of grizzly bears in Canada (Banci 1991) revealed that grizzly bears were extinct in 24 percent of their former range; that of the remaining grizzly bear habitat, 63 percent is designated as vulnerable or threatened; and that half of all the grizzly bears in Canada occur in British Columbia. The review further stated that due to the intensity of land uses, the future risks to grizzly bear ecosystems in Canada remain high. These findings confirm the need for British Columbia to act swiftly and decisively to conserve grizzly bears and their ecosystems in our province.

In order to make decisions that will ensure the future of grizzly bears in British Columbia, we need to look at how we manage grizzly bears today. This background report is a first step in that process. The report presents the historic and current status of grizzly bears in British Columbia, describes what we know about grizzly bears, and discusses what we think grizzlies and their ecosystems must have for their continued survival.

This report also outlines the kind of information we need in order to improve our management of grizzly bears, and recommends a series of changes. Some of these changes should be implemented immediately, others could be phased in over time. Many will require extensive discussion among government agencies, communities, and the public, including First Nations and conservation organizations.

In order to reverse the trend of diminishing grizzly bear populations and habitats, we need to understand more about the impacts of our actions and decisions. This report looks at the potential impacts to grizzly bears from a variety of human activities, including land-use decisions, hunting, how we manage our garbage, and our intolerance of grizzly bears.

The primary issues confronting us in the conservation of grizzly bears and their ecosystems are:

1. the need to address alienation and loss of grizzly bear habitat by protecting grizzly bear conservation areas;
2. our interactions with grizzly bears, including hunting, bear viewing, and garbage management
3. public education and information, consultation, and international considerations

Major points of discussion include (but are not limited to) the following:

- ☐ the need for a province-wide inventory and assessment of grizzly bears and grizzly bear habitats
- ☐ the need for increased research on grizzly bear ecosystems
- ☐ the use of protected areas identified through the CORE and PAS processes to maintain grizzly bear habitats
- ☐ establishing no-hunting zones in key core grizzly bear habitats
- ☐ the development of guidelines for management of grizzly bear habitats that occur outside of protected areas
- ☐ examining cultural uses of bears, hunting, and bear-viewing
- ☐ reviewing hunting regulations and license fees for residents and non-residents
- ☐ increasing enforcement and penalties to deal with poaching and illegal trade in bear parts
- ☐ regulating garbage and waste disposal in ways that minimize or eliminate conflict with bears

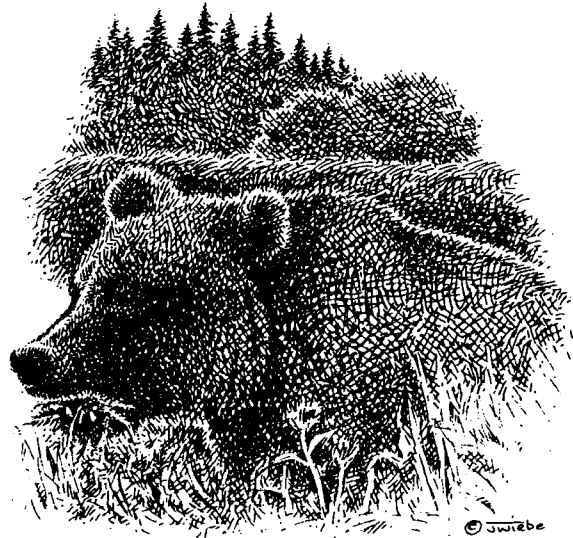
The conservation of grizzly bears, and the ecosystems and habitats they need for survival, demands commitment from all of us. We will need to change our attitudes and recognize that grizzly bears are an important part of our heritage. We may need to sacrifice the privilege to hunt, ski, hike, or fish in some locales in order to give some space to the grizzly bear. Are we prepared to do this?

“If the grizzly survives, it will only be because we decide that it should survive” (Van Tighem 1992).

Aldo Leopold was visionary in his pleas to conserve wild ecosystems and all that they contain. Let us commit ourselves to realizing a vision for the future, one that includes grizzly bears.

Wilderness is a resource that can be shared but not grow. Invasions can be arrested or modified in a manner to keep an area usable either for recreation, or for science, or for wildlife, but the creation of new wilderness in the full sense of the word is impossible.

Aldo Leopold



What is a Grizzly Bear?

Grizzly bears are carnivores — a group of animals that seems to fascinate us. We think of carnivores as large, powerful predators that have sharp teeth and long claws. We imagine them to have extraordinary hunting and sensory abilities — vastly superior to our own. We are in awe of carnivores, and feel not a little fear when we think of them. It is an exaggerated picture.

The common ancestor to all carnivorous mammals was a small, lithe, tree-dwelling hunter similar to modern-day martens. Known as miacids, they lived about 70 million years ago. Today, there are seven families of land carnivores: dogs, raccoons, weasels, mongooses, hyenas, cats, and bears.

Bears are the largest land-dwelling carnivores on the planet. And while they are classed as carnivores, they are more correctly considered to be omnivores. In fact, the diet of most grizzly bears consists of less than 15 percent meat, whether fresh or carrion. A grizzly's spring and summer diet is predominantly vegetation, roots, berries, insects and grubs, and in autumn expands to include nuts and fish, notably salmon.

There are eight species in the bear family (Ursidae), of which the grizzly bear (*Ursus arctos*) is the second largest member, smaller only than the polar bear (*Ursus maritimus*). Grizzlies (also called brown bears) are large and heavy-bodied, with powerful limbs. Their average weight is between 170-360 kg, but they can weigh up to 500 kg or more. While average adult grizzlies reach nose-to-tail lengths of 1.8 m, they have been known to attain 2.7 m. A grizzly bear's size depends in large part on its diet, which is determined by the location and quality of its habitat.

The long outer guard hairs of a grizzly's coat are often tipped with white, silver, or a cream colour, giving the bear the grizzled appearance its name denotes. Coat colour can be various shades of blond, brown, black, or a combination of these. Other external physical features, however, are more useful for distinguishing a grizzly bear in the wild. One is the large hump over the front shoulders; this is a muscle mass used to power the forelimbs for digging. Grizzly bears have a large, rounded head with a concave - or dished - facial profile, and small, rounded ears set well apart on the head.

The black bear has no shoulder hump and has a long, straight facial profile and large ears.



Tracks and claws also distinguish the two species. Grizzly claws, particularly on the front paws, are much longer than the black bear's. They evolved as digging tools — large, slightly curved, and up to 10 cm long. Grizzly bear toes are close together in a relatively straight line, while a black bear's toes are splayed in a more rounded arc. In general, grizzly tracks are larger than black bear tracks (and can be as big as 31 cm x 18 cm [14 x 8 inches]).

In spite of their large size, however, grizzlies can run fast - up to 65 kph over most terrain. As well, grizzlies have well-developed senses of smell and hearing, and their eyesight is likely not as poor as reputed.

Grizzly bears tend to be solitary, except for females with cubs, adults during mating season, and during times when they congregate at food sources, such as along rivers during salmon spawning runs. Observations of grizzlies under these conditions indicate that they are under stress and that they keep a close watch on the other bears. In spite of this, they are not considered to be truly territorial; while they have individual home ranges, these can overlap and, in general, are not aggressively defended. To avoid confrontations with each other, it is thought that they mark trees and trails as a form of communication. They may also use other visual signals, such as body postures (standing), head and ear positions; vocal signals, such as huffs, growls, and snorts; and marking of trails, trees, resting areas, and other sites.

Usually, the presence of humans puts a grizzly bear to flight, but they have the potential to exhibit aggressive behaviour, particularly in response to surprise or threats to cubs, food, or individual space, whether by humans or other bears. It has been postulated that because grizzly bears evolved in the more open spaces of plains and tundra regions, where there is a higher degree of visibility than in forested areas, these postural responses to threat were effective means of communication (Herrero 1985).

Low reproductive capacity is a major consideration in all grizzly bear population management programs. Females do not reach reproductive maturity until at least four years of age, and may produce young every three years after that. Because grizzlies rarely live longer than 25 years, in an average reproductive lifespan, a female grizzly may give birth to about eight cubs. The breeding season is from late May until mid-July.

Although fertilization may take place in early summer, the female grizzly employs a phenomenon called "delayed implantation," and the embryo does not implant in the uterus until November or December, when the female is in the den. Successful implantation depends on the physiological condition of the female at the beginning of the denning season. If she



has inadequate fat reserves to support both herself and the developing fetuses for the duration of her pregnancy, the embryos will not implant. This is one of the major reasons why habitat quality and diet are so important for the productivity of grizzlies.

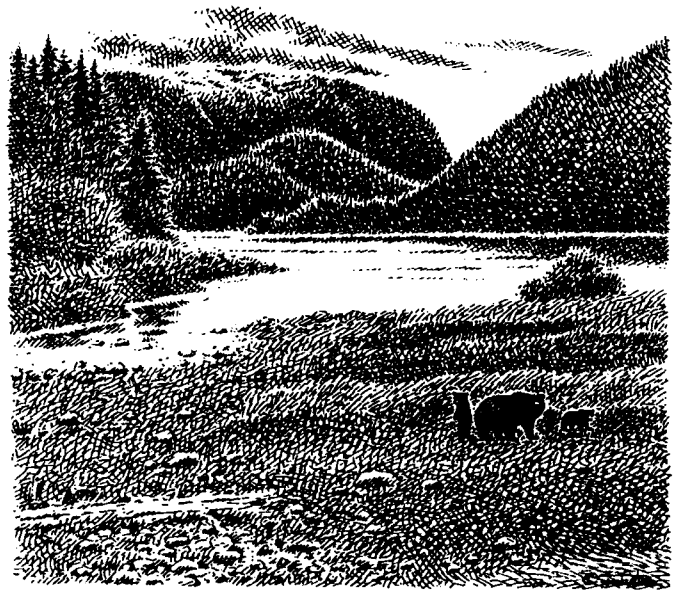
The gestation period lasts 229 to 266 days. One to four cubs, usually two, are born in the den January to March. At birth, the cubs are comparatively tiny at 20-25 cm long, and weigh a mere 0.5 kg. Cubs remain with the female for their

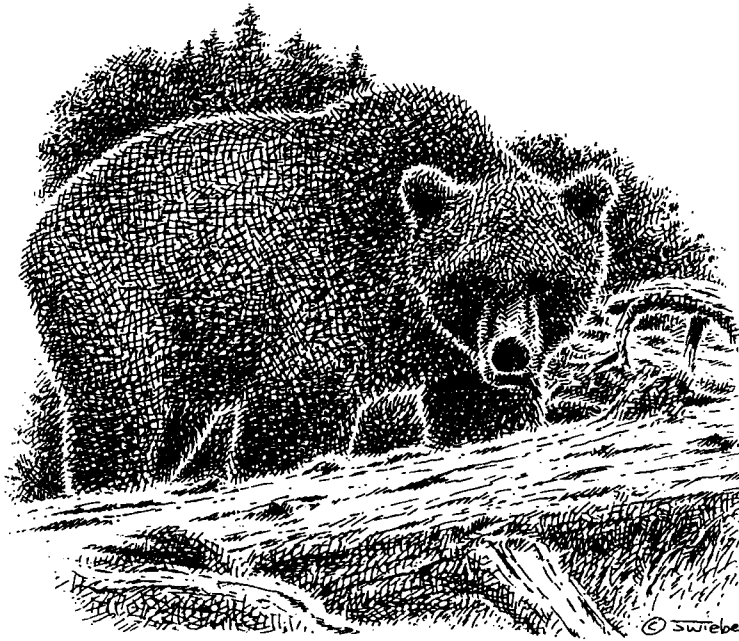
first two or three years, during which time she does not breed. This points to another reason why habitat quality is important for productivity. If the area is rich in bear foods, and relatively safe from sources of early mortality for young bears, females may aggressively reject two-year cubs and begin breeding again.

Grizzlies are found in a variety of habitats. In British Columbia, they occur in most areas except Vancouver Island, the Queen Charlotte Islands, and coastal islands. They use habitats ranging from estuaries to alpine meadows. Habitat use is influenced primarily by food availability, the presence of suitable resting, denning, and mating sites, and the presence of other bears. Home ranges for individual bears vary in size depending on the individual bear and on the locality, but may be as small as 50 square kilometres or as large as hundreds of square kilometres. The lifetime home range of a male grizzly bear can be thousands of square kilometres. Coastal bears tend to have smaller home ranges than interior grizzlies, probably because of richness of diet: coastal bears feed more frequently on salmon—a high-protein, high-fat food—particularly just prior to denning.

The diet of grizzlies includes a wide range of herbaceous vegetation (e.g., skunk cabbage, sweet vetch [*Hedysarum* spp.]), roots, sedges, horsetails, grasses, berries, insects and grubs, small and large mammals, carrion, and fish. A grizzly bear's diet varies seasonally, and can be significantly affected by local climatic conditions and human uses within a bear's home range.

While it is classed as one species, *Ursus arctos* is referred to as grizzly bear in Canada and other parts of North America, and as brown bear in Asia and Europe. Americans of the northwest states and Alaska also use the term brown bear. Some people refer to coastal grizzlies as brown bears and to Interior grizzlies as grizzly bears, to offer a further distinction.





Grizzly Bears and People

The association between people and grizzly bears goes back a long way, probably as far back as when the most recent ice age gripped the northern hemisphere some 10,000 years ago. Bears crept into our myths and legends, peopled our stories, and gave strength to our religions. One of the First Nations creation stories from the Stikine region (Patterson 1993) tells of the coming of a great flood; the people who jumped into the water became seals, while those who ran off into the forests became grizzly bears.

Throughout the ages we've had a unique relationship with these powerful animals. A guarded alliance may have existed in tenuous balance forever if humans had not tipped the scales.

Economic Values of Grizzly Bears

Grizzly bears mean many things to many people. Many people in British Columbia have never seen a grizzly and have no desire to do so. For them, it is quite enough knowing that grizzlies exist "somewhere out there" and that British Columbia is still relatively pristine and untamed enough to have grizzly bears. For others, the grizzly is a game species that provides a recreational hunting experience.

How much, in this context, are large carnivores such as grizzly bears worth in economic terms? In the continental United States, the cost of recovering grizzly bears between 1983 and 1990 averaged about \$2 million per year (Servheen 1990). Their 1992 recovery budget was over \$25 million. Even with that level of expenditure, there are serious concerns whether or not the current lower 48 states' population of fewer than 1,000 grizzlies can be maintained. This tells us that if we don't provide for the conservation of British Columbia's grizzly bears now, it will be considerably more expensive in the future, if it will be possible at all.



For ranchers and farmers, a grizzly can be a threat to livestock and property. Cattle grazing, sheep farming, livestock rearing, forestry and mining operations, backcountry recreation, aquaculture farms, fish camps, apiaries, and fruit orchards — each of these activities has had its share of conflicts with grizzly bears, directly or indirectly.

Although it is difficult to attach a monetary value to grizzly bears, we can to many of the activities that people undertake around bears or because of bears. The two types of economic values to consider are those that arise from contact or through off-site activities; they can be termed use values and non-use (or preservation) values.

Use Values — Use values can be characterized as consumptive or non-consumptive. Non-consumptive values do not necessarily mean that they don't have any impact; these are discussed later in this background paper. Hunting, whether for sport or subsistence, is a consumptive use. In recent years, 1200 to 1400 provincial residents annually have purchased grizzly bear hunting licenses, as have 500 to 700 non-residents. Residents spend an estimated \$1.75 million per year on grizzly bear hunting, while non-residents spend \$1.08 million, for a total of \$2.83 million annually to hunt grizzly bears.

Bear viewing is an example of a non-consumptive use. In a typical year, about 25 percent of British Columbians take trips or outings with the primary purpose of viewing, studying, or photographing wildlife in their natural habitat. This activity generates significant expenditures and represents substantial economic values for participants. Seeing a grizzly or a black bear is usually the high point of such visits. Some viewing is provided by licensed guide-outfitters. Although currently limited, this activity will likely increase in the future. Bear viewing, while a non-consumptive use, does have impacts upon the bears. A discussion paper produced by BC Environment in 1991 (*Planning for the Future: Managing Wildlife to 2001*) says, "Wildlife not only enhances the everyday life of most residents, it is a key contributor to the economic health of the provincial economy." Table 1 gives the estimated value of wildlife-related activities in BC.

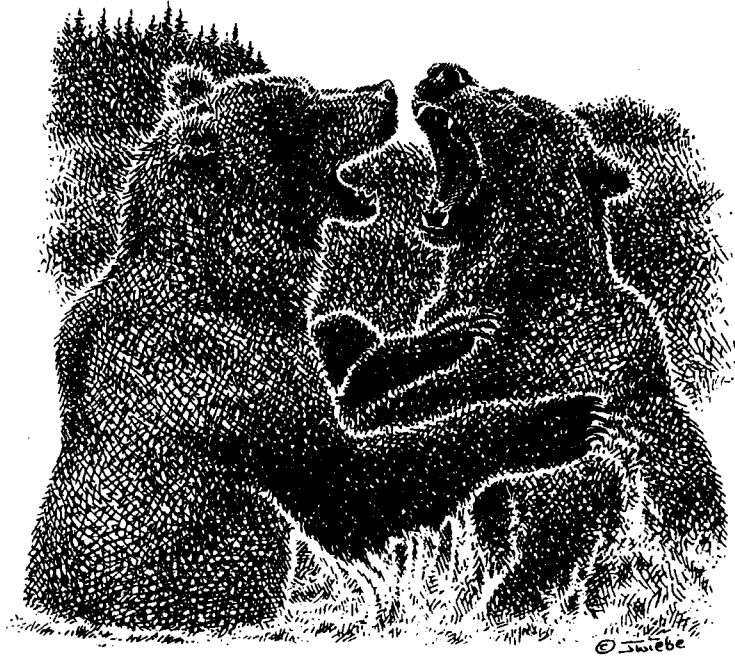
Other non-consumptive, highly sought-after activities associated with grizzly bears and other wildlife include reading books or articles, watching films and television, and purchasing toys, arts, and crafts. In a typical year, about 90 percent of provincial residents engage in such activities.

Table 1. Estimated Value of Wildlife-related Activities in BC				
Activities	Expenditures	Net Economic Value	*Gross Economic Value	Employment (Years of Work)
Residential¹	\$50,833,000		\$50,833,000	
Direct Use² (non-hunting)	\$505,775,000	\$134,848,000	\$640,623,000	10,153
Indirect Use³ (non-hunting)	\$54,518,000	\$104,314,000	\$158,832,000	
Hunting - Residents	\$125,022,000	\$61,906,000	\$186,928,000	1,376
Hunting - Non-residents	\$19,277,000		\$19,277,000	566
Trapping	\$9,289,000		\$9,289,000	84
Preservation Value		\$131,751,000	\$131,751,000	
TOTAL	\$764,714,000	\$432,819,000	\$1,197,533,000	12,179
This table is based on 1985 information; 1989 dollar equivalent *Gross economic value = expenditures + net economic value 1 Birdwatching, bird feeding, or other activities around one's residence. 2 Outings where the main purpose is to watch, feed, photograph, or study wildlife. 3 Outings where one happened to watch, feed, photograph, or study wildlife, but the main purpose of the outing was not wildlife-related.				

Non-use (Preservation) Values — Non-use values, also called preservation values, are those that individuals place on resources independent of their use. There are three components that make up such values:

- ☐ *Existence* values are those that individuals place on knowing that grizzly bears exist even though they may never encounter them.
- ☐ *Bequest* values are those that individuals derive from knowing that grizzly bears are being preserved for the use and enjoyment of future generations.
- ☐ *Option* value is the amount an individual would be willing to pay for the option to use the resource at some future date, independent of the cost of using that resource. Option values can be thought of as insurance policies against an uncertain future.

Economic studies show that preservation (non-use) values are as large as use values, and typically larger. The preservation values that British Columbia residents place on grizzly bears likely exceed use values because hunting and viewing are limited activities. Most importantly, a large proportion of British Columbians place a value on knowing that grizzly bears occur and are a symbol of the relatively pristine wilderness thought to be a trademark of our province.



Importance of Grizzly Bears to First Nations

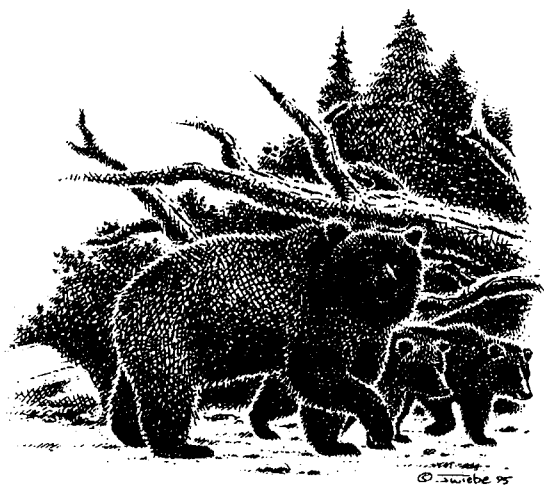
Although we have little written knowledge of the importance and use of grizzly bears to First Nations peoples, some of the old stories tell us that the great bear was treated with fear and respect. The grizzly is prominent in stories, ceremonies, songs, dances, and other cultural traditions of many First Nations peoples in British Columbia.

Their legends say that the grizzly was the most terrifying of animals. The grizzly bear was also the healer; it taught the people where to find roots and herbs and at what times of the year they were good to eat (Shepard and Sanders 1986). "In the old days, the [Shuswap First Nation] people were told [by their elders] not to hunt grizzly bears because, after they have been skinned, they look like human beings." (Bouchard & Kennedy, 1979) The bear was a popular choice for totems and many tribes had bear clans or cults.

The value of grizzly bears to First Nations is clearly as great or greater than any value attributed by post-modern European culture. The importance of grizzly bears to First Nations peoples is an area of knowledge that should be assembled for the benefit of all cultures.

STATUS AND DISTRIBUTION OF GRIZZLY BEARS

The grizzly bear (*Ursus arctos* spp.) was the most widespread bear species in the world. Two million years ago, the ancestor of all grizzly bears lived in the forests of Asia, where their range, at times, included almost the entire coniferous and deciduous forests of Asia and Europe. During warm interglacial periods of the Ice Age, retreating ice left vast areas of tundra-type, treeless vegetation. Some ancestral bears evolved to use this new resource, giving rise to the species *Ursus arctos*. About 50,000 years ago, these bears crossed the Bering land bridge and spread throughout North America, eventually evolving into the grizzly bears we know today (Servheen 1992). Two subspecies of North American grizzlies have been identified. The large coastal Alaskan grizzlies from Kodiak, Afognak, and Shuyak islands are called Kodiaks and are the subspecies *Ursus arctos middendorffi*. All other grizzly bears in North America belong to the subspecies *Ursus arctos horribilis*.



Researchers (Herrero 1970, 1972, 1978; Servheen 1992) postulate that for these early grizzlies to exploit the rich habitats of the periglacial periods, they had to modify their forest adaptations. Away from the protection of forest cover, physical and behavioural changes were necessary for the bears to protect their young from other bears, wolves, and several now extinct Pleistocene carnivores. A sudden burst of violence or an effective threat by the mother toward any perceived threat would have been important for the survival of her cubs (Servheen 1992). Herrero (1970) suggests that this behavioural adaptation of greater aggressiveness to protect cubs in the new habitat likely earned these bears the subspecies name "*horribilis*." The primary reason for this name, however, is that grizzly bears would eat people if they felt threatened by humans.

Global

Grizzlies were once abundant throughout Europe, Asia, North Africa, and North America, and they used a variety of habitats from arctic tundra to forests, prairies, and deserts. Today, their range has been halved. The number of grizzly bears has been severely reduced in western Europe and Scandinavia, where they now occur only in small, fragmented populations with uncertain futures. The North African subspecies was exterminated a century ago (Servheen 1992).

In Asia, grizzlies were widely distributed from Russia to the Japanese island of Hokkaido, and south through China, the Himalayas, and India. They have been extirpated from all but a few of these areas. While the Russian states may have the largest population in the world (estimated at about 100,000 in 1990), mortality rates from both legal and illegal activities are exceedingly high (Servheen 1990). Recent reports suggest that the high demand for foreign currencies and the lack of government controls, coupled with the tightening of legislation on poaching and illegal trade in bear parts in Canada,

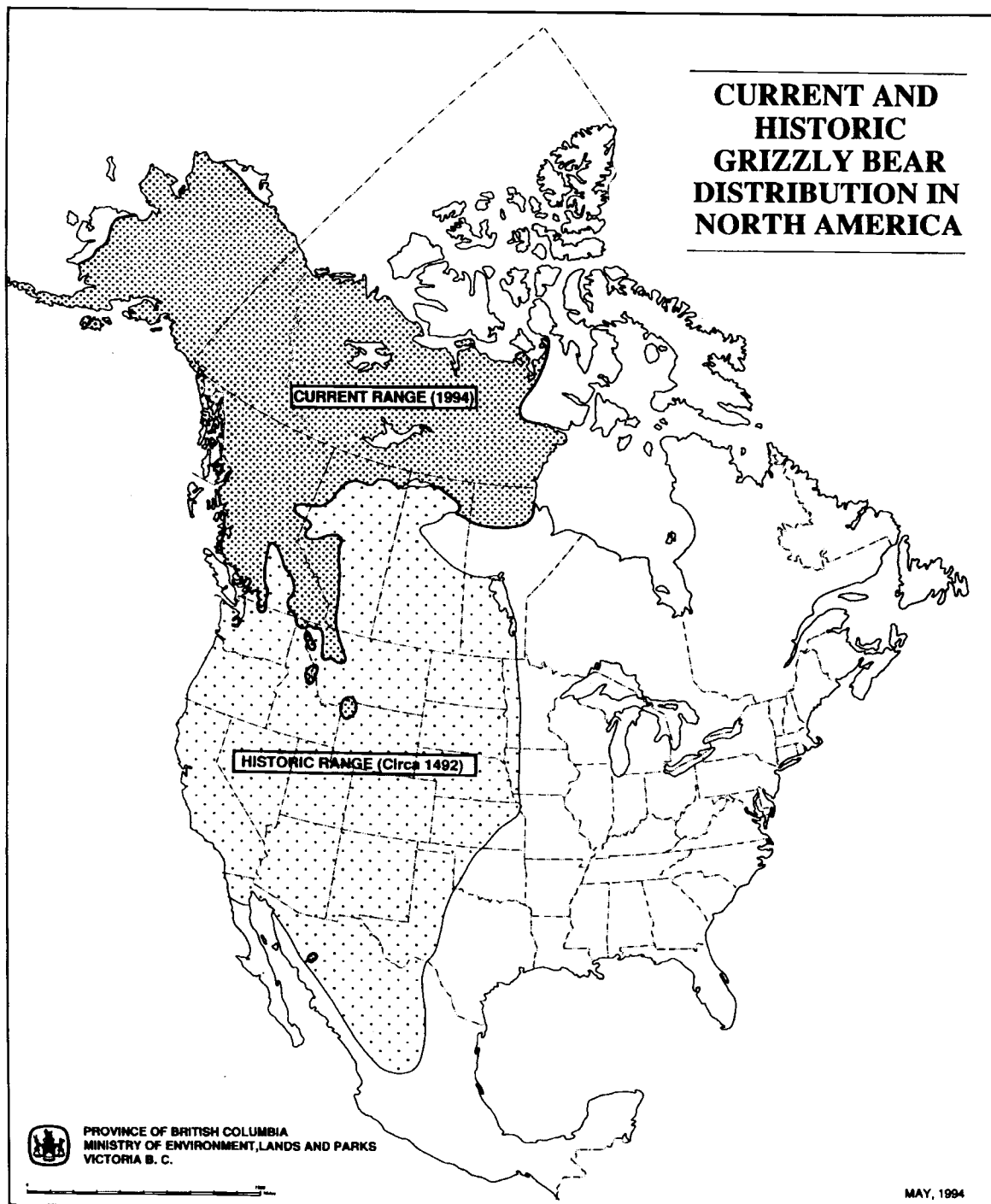


Figure 1. Current and historic grizzly bear distribution in North America

has shifted the pressure onto bears in Kamchatka and other parts of Russia. These factors could result in the decimation of those grizzly bear populations in the near future.

The grizzly's range in the continental United States has been reduced by 99 percent. The Mexican grizzly is regarded as highly endangered and is likely extinct. Few, if any, North American jurisdictions still have populations of grizzly bears approximating their original distributions. Worldwide, the grizzly has lost more than 50 percent of its range and numbers since the mid-1890s, largely because of human intolerance (Servheen 1990) and loss of habitat.



There seems to be a tacit assumption that if grizzlies survive in Canada and Alaska, that is good enough. It is not good enough for me... Relegating grizzlies to Alaska is about like relegating happiness to heaven: one may never get there.

Aldo Leopold

North America

Grizzly bears once occurred throughout western North America, numbering around 100,000, from the Arctic as far south as central Mexico and from the Pacific coast as far east as the west coast of Hudson Bay, down through the US to central Texas (see Figure 1).

Today, fewer than one thousand grizzlies, less than 1 percent of their original numbers, are thought to exist in the continental United States in six ecosystems (Figure 2). Four of these are contiguous with Canada. Also, there is a possibility that grizzly bears survive in a seventh ecosystem, the San Juan Mountains of Colorado.

1. *Yellowstone*: Entirely within the US, this population is heavily managed and subject to the kinds of pressures found in a popular US National Park. Although it is an isolated population, recent indications suggest the number of grizzlies may be increasing due to management practices.
2. *Selway-Bitterroot*: The presence of grizzly bears in this isolated area is uncertain.
3. *Northern Continental Divide*: This ecosystem contains the largest concentration of grizzlies in the lower 48 United States, numbering an

estimated 440 to 680. This ecosystem is shared between Montana, Alberta, and British Columbia.

4. *Cabinet-Yaak*: This ecosystem is shared between British Columbia, Montana, and Idaho.
5. *South Selkirks*: This ecosystem is shared between British Columbia, Idaho, and Washington.
6. *North Cascades*: This ecosystem is shared between British Columbia and Washington.

The latter four bear ecosystems depend very much on grizzly bear habitat and population management in British Columbia for their continued survival.

The grizzly bear was listed as a threatened species by the US Fish and Wildlife Service in 1975 (under the US *Endangered Species Act*). Recovery efforts are currently directed at establishing viable populations in the six ecosystems listed above. British Columbia is actively involved in these efforts.

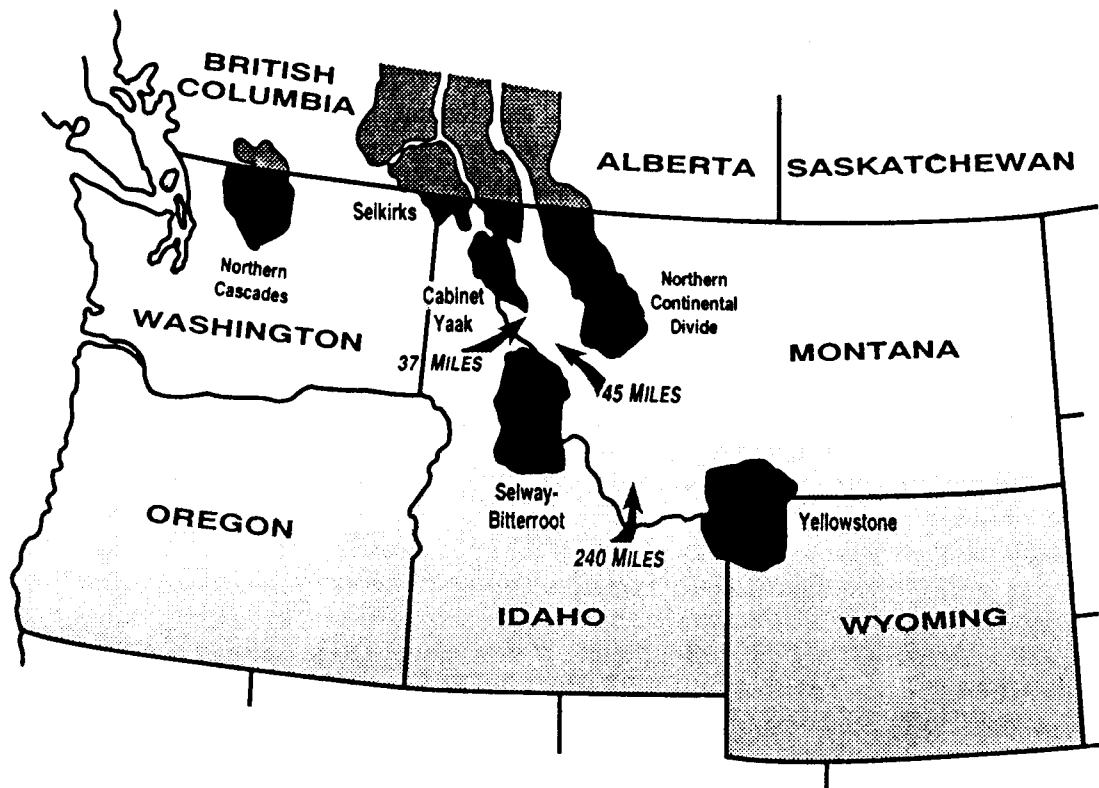


Figure 2. Shared Canada-US grizzly bear populations



Canada has an estimated 25,000 grizzly bears. Of these, 6,300 are estimated to occur in the Yukon, 5,000 in the Northwest Territories, and 800 in Alberta. The Alberta government has identified the provincial population as declining, and conservative measures have been taken to encourage recovery.

With an estimated 10,000 to 13,000 grizzlies, British Columbia has about half of all grizzlies in Canada, and one-quarter of all the grizzlies on the continent. The size of our grizzly bear population gives us a responsibility for the conservation of this species that extends far beyond our own boundaries.

Canada

The status of grizzly bears in Canada was reviewed in 1990 (Banci 1991) for the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Fourteen grizzly bear zones were designated (Figure 3). Twelve zones maintain current populations and, in two of these, grizzlies are considered extinct.

The following listed grizzly bear zones are not management zones, and should not be regarded as such. They were envisioned as broad areas or zones where the climate and landforms provided a common influence on grizzly bear behaviour, populations, vegetation, and land use activities. They were useful in identifying broad trends, impacts, and concerns. Grizzly bears may move considerable distances and could occupy different zones at different times of the year or in different years (Banci 1991).

Because no previous basis existed for assigning population status to the risk categories of COSEWIC, the status of grizzly bear zones was based on comparing current population estimates to the estimated current potential of a habitat to support grizzly bears (Table 2) (Banci 1991) (also see figures 5 and 6 for explanation of terms "historic potential" and "current potential").

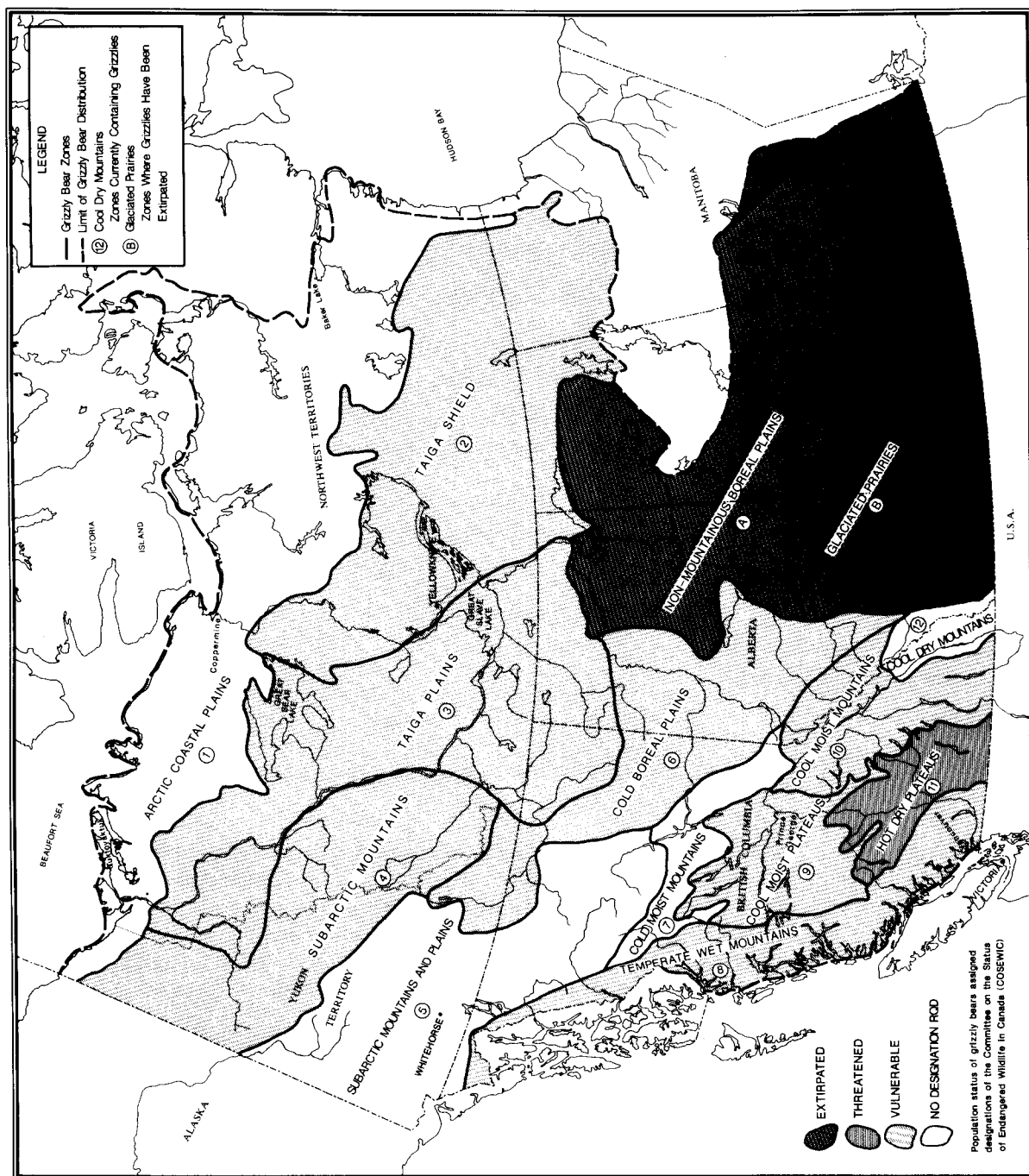


Figure 3. Grizzly Bear Zones of Canada (COSEWIC status designations)

Table 2. Historic potential, current potential, estimated current populations, and population status of grizzly bears within COSEWIC-designated grizzly bear zones.

Grizzly Bear Zone	Area (km ²)	Historic Potential	Current Potential	Estimated Current Population	Designation (Population Status)
Arctic Coastal Plains	754,905	2990	2990	2860	*not in any category
Taiga Shield	467,740	830	830	790	vulnerable
Taiga Plains	557,810	no estimate	1630	1520	vulnerable
Subarctic Mountains	397,372	no estimate	2600	2540	vulnerable
Subarctic Mountains and Plains	370,440	6060	6060	5680	*not in any category
Cold Boreal Plains	292,505	no estimate	1500	960	vulnerable
Cold Moist Mountains	92,500	3870	3870	2940	*not in any category
Temperate Wet Mountains	161,500	5870	5640	3310	vulnerable
Cool Moist Plateaus	127,300	1860	1730	1100	vulnerable
Cool Moist Mountains	129,300	no estimate	4700	2540	vulnerable
Hot Dry Plateaus	66,200	1040	570	140	threatened
Cool Dry Mountains	52,000	no estimate	1120	930	*not in any category
Boreal Lowlands (on map called Non-Mountainous Boreal Plains)	—	—	—	—	Extinct
Canadian Prairies	—	—	—	—	Extinct
*Populations not considered to be at risk by COSEWIC.					

Of the twelve COSEWIC grizzly bear zones with current populations, five are expected to have high impacts from human uses in the future: Arctic Coastal Plains, Subarctic Mountains, Subarctic Mountains and Plains, Cold Boreal Plains, and Temperate Wet Mountains. Much of these occur either wholly or in large part in British Columbia. In fact, British Columbia has all or a significant portion of most of Canada's grizzly bear zones.

The COSEWIC grizzly bear zones in British Columbia are based on and named after the ecoregion classification system. Ecosystem classifications (e.g., ecoprovince, ecoregion, ecosection) provide a framework for identifying grizzly bear management zones. The ecoprovinces of British Columbia are shown on the map in Figure 4. To avoid confusion, COSEWIC grizzly bear zones are referred to by their corresponding ecoprovince names.

Grizzly bears are extirpated in the Canadian Prairies Ecoprovince and in the Boreal Lowlands (Non-Mountainous Boreal Plains) Ecoprovince in Alberta, Saskatchewan, Manitoba, and NWT. This loss represents 24 percent of the grizzly bear's original distribution in Canada.

In most of the Canadian Prairies Ecoprovince, the primary cause of extirpation of grizzlies was due to the appropriation of land for cereal crops and ranching, which resulted in the hunting and poisoning of predators (including bears, wolves, wolverines, and foxes). These causes, along with the extir-



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ECOPROVINCES of BRITISH COLUMBIA 1994

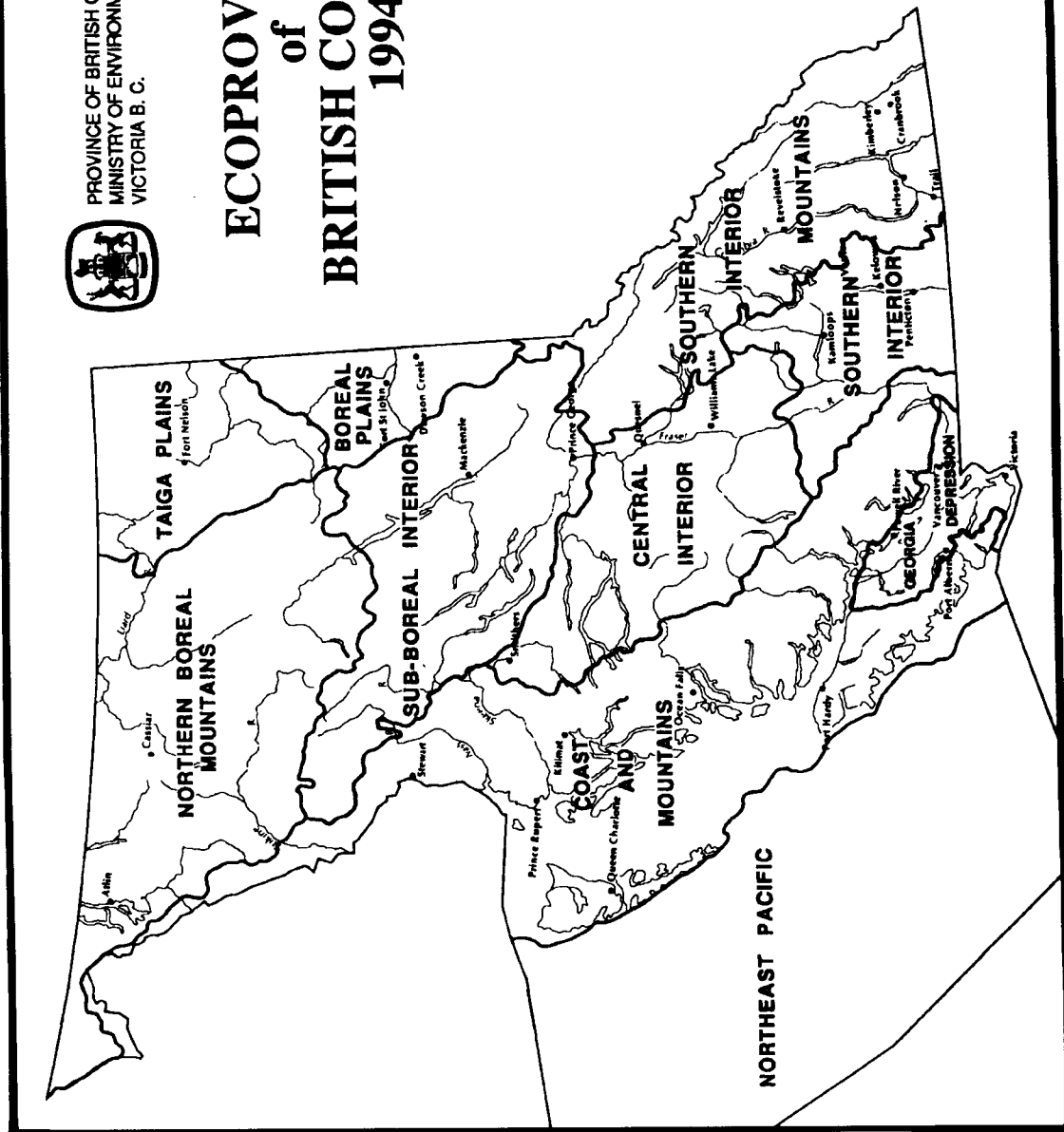


Figure 4. Ecoprovinces of British Columbia

COSEWIC Risk Categories

Vulnerable: Any indigenous species that is particularly at risk because of low or declining numbers, occurrence at the fringe of its range or in restricted areas, or for some other reason, but is not a threatened species.

Threatened: Any indigenous species that is likely to become endangered in Canada if the factors affecting its vulnerability are not reversed.

Endangered: Any indigenous species that is threatened with imminent extinction or extirpation throughout all or a significant portion of its range in Canada, owing to human action.

Extirpated: Any indigenous species no longer existing in the wild in Canada, but occurring elsewhere.

Extinct: Any species formerly indigenous to Canada but no longer existing anywhere.

Not in any category: A population deemed, after assessment, to be not at risk.



pation of buffalo and the general intolerance by people for large carnivores, were responsible for the grizzly's disappearance (Banci 1991).

Although the reasons for loss of grizzly bears from the Boreal Lowlands Ecoprovince are not as well documented, the primary factors were human intolerance and loss of habitat due to agriculture, increased settlement, and oil and gas exploration and development (Banci 1991).

COSEWIC listed the Plains/Prairies grizzly bear as extirpated, and grizzlies in the rest of Canada as vulnerable, but agreed to review the process for designating the status of a species that typically has a wide-ranging distribution (such as grizzly bears). That review may result in acceptance of the designations for grizzly bear zones.

British Columbia

Grizzly bears once ranged throughout the British Columbia mainland. They still occur in many parts of the province, including areas where there are concentrations of humans and development, but their numbers have been greatly reduced. Grizzlies also occur in pockets of coastal and mountain wilderness areas in northwestern and northcentral BC (e.g., Tweedsmuir/Kitlope/ Fiordland, Alsek/Tatshenshini, Alaska pan-handle links, Spatsizi/Stikine, Muskwa/Kechika, and Sustut/Babine (see Figure 6).

The COSEWIC status review recommended that grizzly bears in the Southern Interior Ecoprovince of British Columbia be designated as threatened. The population status of grizzly bears in all other ecoprovinces in which they still occurred was considered vulnerable, except for the Northern Boreal Mountains Ecoprovince, the northern portion of the Sub-boreal Interior Ecoprovince, and the southeast portion of the Southern Interior Mountains Ecoprovince, in which their status appeared relatively secure (see Figure 4).

Wildlife managers in BC found the results of the 1990 COSEWIC review sobering: Of the current Canadian grizzly bear range, 63 percent of the bear population was designated at risk, either vulnerable or threatened (Banci *et al.* 1994) and, because of the intensity of land use activities and associated kill-

killing of bears, risks to all grizzly bear populations remain high (Table 3). That may improve in British Columbia, given the province's current land use planning and management initiatives, such as Forest Renewal BC, the Protected Areas Strategy (PAS), the Commission on Resources and Environment (CORE), and with implementation of the Forest Practices Code. The province is proposing a grizzly bear conservation strategy in an attempt to ensure that the future scenario for British Columbia's grizzly bears is more optimistic than the trend portrayed by the 1990 COSEWIC assessment.

Table 3. Present and future (within next five years) impacts of land-use activities on grizzly bear habitat within British Columbia (modified from Banci *et al.* 1994).

ECOPROVINCE								
LAND USE ACTIVITY	Sub-Boreal Interior		Coast and Mountains		Central Interior		Southern Interior	
	Pres ^a	Fut ^a	Pres	Fut	Pres	Fut	Pres	Fut
Agriculture			L	L	H	H	H	H
Ranching and Grazing	L	L	L	L	H	H	H	M-H
Forestry	H	H	H	H	L-H	M-H	H	H
Herbicides/Pesticides	L-M	L-H	L-M	L-H	L-M	L-H		
Mining	H	H	M	M	L-H	L-H	M	M
Petroleum	H	H	M	M	L-H	L-H		
Hydroelectric Power	H	L	L	H	L-H	L-H	O-L	O-L
Commercial Fisheries ^b			M	M				
Land Alienation	H	H	H(l)	H(l)	H	H	H	H
Access	M	M	M	H	H	H	M-H	H
Recreation ^c	L	L	L	H	H	H	H	H
LAND USE ACTIVITY	Southern Interior Mountains		Northern Boreal Mountains		Boreal Plains		Taiga Plains	
	Pres	Fut	Pres	Fut	Pres	Fut	Pres	Fut
Agriculture	L	L			H	H		
Ranching and Grazing	M-H	M-H	L	L	L-H	L-H		
Forestry	H	H	O-L	O-L	L-M	M	L	L
Herbicides/Pesticides	L-H	H	L-H	L-M	L-M	L-H		
Mining								
Petroleum	H	H	H(l)	H(l)	M-H	M-H	H	H
Hydroelectric Power	H	H	O-L	M-H	O-L	H		
Commercial Fisheries ^b								
Land Alienation	H	H	L	L	L-H	L-H	O-L	O-L
Access	H	H	L	M	L-M	M-H	O-L	L-M
Recreation ^c	M-H	M-H	L	M	H	H	L	L
^a = Pres/Fut: Ratings reflect the relative impact of the land use activity within a grizzly bear ecosystem. A nil impact is indicated by "O," low by an "L," moderate by an "M," high by an "H," and H(l) denotes a high but localised impact. A range, such as "L-M," indicates that the land use activity varies in impact from low to moderate across the zone. A blank means the activity is absent or that the impacts have already occurred. ^b = Includes fish hatcheries and spawning channels. ^c = "And other human activity."								



All of grizzly bear country is faced with threats from increased human population and habitat alienation. When BC joined Confederation in 1871, about 40,000 people lived in the province. The 1990 census counted 3.13 million and, by 1994, BC's population had grown by another 4% to 3.25 million.

THE GRIZZLY'S WORLD

The reduction in grizzly bears worldwide is primarily due to loss of habitat. Loss of habitat is due to three major causes:

1. human population growth
2. the resultant increased demand for land and resources
3. intolerant attitudes of humans

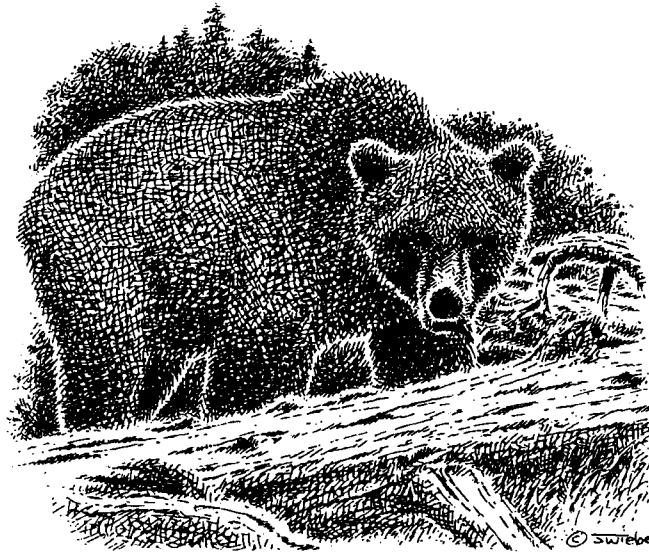
It took over a million years for the planet to attain a global human population of 1 billion, the census at the beginning of the last century (McNamara 1992). The second billion was added in 130 years, the third in 30 years, and the fourth billion in another 15 years. The current total of humans on the planet is some 5.7 billion. During this decade, the number of people will increase by about 100 million per year.

Our global biotic system has been depleted, exploited, polluted, and endangered simply by the number of humans living in the biosphere and by our demands. Our population continues to increase exponentially. Agriculture, forestry, mining, urban development, hydroelectric dams and river diversions, transportation and pipeline corridors, and a host of other land uses have modified entire landscapes and irrevocably altered the plant and animal communities of many ecosystems (Ojima *et al.* 1994). Human populations will continue to exert pressure on terrestrial and marine ecosystems as demands for space, food, fuel, fibre, and water continue to increase.

British Columbia has the fastest growing population in Canada, fuelled by immigration from other provinces and countries. When BC joined Confederation in 1871, the population was estimated to be about 40,000, of which over half were First Nations people. The 1990 census counted 3.13 million people, and the province's population is projected to reach 3.76 million by 2000 and 4.35 million by 2010. More people means increased contact with grizzly bears and greater alienation of natural resources. More contact also means increased bear/people conflicts.

Not all of the human population growth has been in Greater Vancouver or Victoria; it has occurred throughout the province. Outside of the Lower Mainland, the Southern Interior Ecoprovince is BC's most densely populated area and contains 11 percent of the total population of the province. It has the most rapid influx of people of all the ecoprovinces. The rapid growth rate has produced a 45 percent increase in population over the past 20 years (BC government 1993).

All of grizzly bear country is faced with threats from increased human population and habitat alienation. More people means more settlement and more automobile emissions, and it means more demands on the land for industrial and recreational uses. Over 22 million people visited British Columbia's provincial parks in 1993, and over 25 million in 1994. Annual use of BC Forest Service recreation sites is over 40 million user-days. Demands for both structured and non-structured recreational opportunities in or adjacent to wilderness and backcountry, such as hiking, kayaking, canoeing, skiing, golfing, camping, nature viewing, outdoor schools, vacation resorts and ranches, mountaineering, and river rafting, are escalating (BC Lands 1990).



The grizzly's world has been modified in all dimensions and reflects the threat of diminished biodiversity. During the past 150 years, we have seen a global increase of 25 percent in atmospheric carbon dioxide, a 100 percent increase in methane, and the introduction into our atmosphere of heat-trapping synthetic chemicals, such as chlorofluorocarbons (CFCs) and halons (HCFCs) (Root and Schneider 1993). We can guess, but we don't know, what impacts global warming will have on living systems, including the habitats required by grizzly bears. What we do know is that the environment may be changing too fast for evolution to keep pace and, even more than global warming, it will be this rapid rate of change that will cause major losses of species and habitats.

There is hope, despite such pessimistic assessments. British Columbia has a tremendous diversity of wildlife and habitats, more than any province in Canada. We still have the opportunity to safeguard our environmental heritage, including grizzly bears.

The biotic pyramid is composed of layers... each successive layer depends on those below it for food and provides food to the layers above. The lines of dependency for food and other services are called food chains. Each species, including ourselves, is a link in many chains. The pyramid is a tangle of chains so complex as to seem disorderly, yet the stability of the system proves it to be a highly organized structure... Structure means the characteristic numbers, as well as the characteristic kinds and functions, of all the component species. This interdependence between the complex structure of the land and its smooth functioning as an energy unit is one of its basic attributes.

Aldo Leopold



CONSERVATION OF GRIZZLY BEARS IN BC

British Columbians have to look for ways we as a society can conserve and maintain grizzly bears, their habitats, and their ecosystems. We must find solutions to the problems of loss of grizzly bears, loss of the habitats that support them, and loss of biodiversity in general.

Large carnivores, and grizzly bears in particular, require special consideration because they, like humans, occupy the top of the biotic pyramid. Providing for the largest carnivore is one way of helping ensure that sufficient habitat remains available for the other species in an ecosystem that do not require such large areas. Maintaining the habitats and ecosystems necessary to sustain grizzly bears is a good way to retain the “lines of dependency for food and other services” for a wide range of other animals and plants, and thus ensure that biodiversity is maintained throughout the ecosystem.

A strategy to conserve grizzly bears in BC would seek to maintain the complex of interdependent wildlife in ecosystems that support grizzly bears. Such a strategy would be consistent with the vision and goals stated in the *Provincial Wildlife Strategy to the Year 2001* (Wildlife Program 1994).

The vision of British Columbia’s Wildlife Program pays homage to the rich wildlife heritage of the province. It recognizes that this heritage provides social, cultural, spiritual, and economic values. The Provincial Wildlife Strategy’s chief goal is to maintain this legacy, and to encourage appreciation of the diverse values of wildlife while ensuring that this inheritance is passed on undiminished — in splendour or value — to future generations.

The primary goals of the Wildlife Program’s Provincial Wildlife Strategy are:

Goal 1 Maintain the diversity and abundance of native plant and animal species and their habitats throughout British Columbia.

Goal 2 Provide a variety of opportunities for the use and enjoyment of wildlife.

Goal 3 People and wildlife living in harmony.

The Wildlife Program's objectives for conserving grizzly bears in British Columbia are presented in the context of the above three goals. In order to conserve grizzly bears in BC, we will need to focus our efforts on these major goals:

1. Maintain the diversity and abundance of grizzly bear populations and ecosystems throughout British Columbia.
2. Provide a variety of opportunities for the use and enjoyment of grizzly bears.
3. People and grizzly bears living in harmony.

Maintain the Diversity and Abundance of Grizzly Bears and their Ecosystems

Conservation entails both a comprehensive approach, taking into account not only the species and the unique characteristics of the ecosystems that support it, but a second, conservative approach, opting for maintaining numbers of grizzly bears on the high side rather than the low as a hedge against natural catastrophes, diseases, and other unforeseen factors.

Conservation must also focus on landscape and ecosystem features that affect population size (such as available food) and distribution (e.g., barriers to dispersal), as well as on attempting to determine what constitutes a viable population. How many grizzly bears do you need to ensure that they will survive future uncertainties?

To achieve conservation goals, three management approaches are needed:

- ☐ Establish core grizzly bear areas and linkages, including travel corridors, to avoid isolating grizzly bear populations.
- ☐ Establish no-hunting zones in important core grizzly habitats, as identified in land use and resource management planning processes.
- ☐ In grizzly bear habitats not within core grizzly bear areas or other no-hunting zones, general habitat use guidelines, as set out in the *Forest Practices Code Guide Book for Identified Wildlife*, for instance, should be implemented.



In addition, more research on grizzly bears, their habitat requirements, ecosystems, genetics, and population characteristics is required.

To accurately assess the population dynamics of grizzly bears, we must consider the grizzly's reproductive rate, population age structure, recruitment rate (the number of cubs born that survive to reproductive maturity), survivorship, the ability to disperse, and the amount and quality of critical grizzly bear habitat and how it is distributed across the landscape.

Renowned conservation biologists, such as E.O. Wilson of Harvard, Paul Ehrlich of Stanford, and Michael Soule of UC Santa Cruz, among others, as early as the 1930s contended that the solution to ensuring the long term persistence of large carnivores, and biodiversity in general, is by the establishment of a network of large protected habitat cores connected with suitable linkages (Grumbine 1994; Mann and Plummer 1993).

We must be careful not to create “islands,” that is, isolated areas of protected grizzly habitat completely surrounded by human activity and development. A number of problems arise when a species becomes isolated. Islands fail to capture all the needs of a species over time. Barriers to dispersal prevent immigration, which helps maintain minimum population numbers for reproduction and genetic variability, and emigration, which allows the species to seek resources elsewhere during lean times or if there has been a change to its habitat from a fire or the effects of climate change. Isolating a species usually means that, in the short term it will be unable to recover after a natural or human-caused catastrophe; neither will it be able to adapt to changing conditions in the long term.

Some biologists believe the correlation between development and the decline of grizzly bear populations is direct and results from increased access, poaching, kills in defence of life and property, and collision mortalities. Whatever the reasons for a decline (or rise) in grizzly bear populations in a given area, we need to be as specific as possible and avoid making simple correlations.

To be effective at maintaining the interdependent wildlife and habitats in ecosystems that support grizzlies, core areas should be representative of available habitats and be large enough to maintain healthy populations of all the native wildlife species usually found in them, including insects, plants, fungi, and microorganisms. In this document, the protected cores together with associated multiple use management zones and linkages are termed “grizzly bear ecosystems.” While there are few practical examples to guide us, the appropriate sizes and locations of these ecosystems will be ecologically based, that is, determined by habitat quality, topography, and current land use activities.

Habitat Inventory and Mapping

Continental Overview

Based on biophysical habitat capability models developed by the Habitat Inventory Section of the Wildlife Branch, it is possible to describe the quality of ecosystems for grizzly bears as they were 200 years ago, 100 years ago, for the present day, and into the future (figures 5-7). Before we can understand the context in which grizzly bears exist in British Columbia today, we should have an understanding of estimated grizzly bear populations prior to contact with Europeans, during the major phases of exploration and development, as well as currently. Do we have the best grizzly bear populations left in North America? Did we once have? Will we be able to maintain healthy, genetically diverse populations for the future? This information is necessary to determine which areas of the province will best serve as grizzly bear core habitat areas. It is also necessary in order to develop cooperative grizzly bear management programs with adjoining jurisdictions.

Provincial Overview

Identifying prime grizzly bear areas for potential protection or special management will be addressed through existing land use planning and management processes, such as the Protected Areas Strategy (PAS), the Commission on Resources and Environment (CORE), Land and Resource Management Planning (LRMP), and the Forest Practices Code.

To provide information for provincial overview planning, both within the Wildlife Branch and for use by other agencies, it is imperative to have the information in an easily accessible and broadly understood format that can be utilized for a number of purposes and applications, such as a Geographic Information System (GIS) format. Biophysical habitat mapping has been included in a GIS for northeastern BC and needs to be extended to the rest of the province.

1. Biophysical habitat mapping for regional (CORE) and sub-regional (LRMP) planning processes.

Information used for PAS, CORE, and LRMP planning processes involves defining specific habitats at a sub-regional scale of 1:250 000. Although information is still preliminary, it remains an efficient tool for overview planning and implementation.

2. Mapping requirements for implementation at the operational level (Forest Practices Code) and to assess forestry and range activities.

To provide useful input into the Forest Practices Code, habitat requirements for grizzly bears must be identified and mapped. Information will be required at appropriate operational management scales so that grizzly bear population goals within each bear management area can be established. Few maps exist at the required level of detail for the province because of the time, specialised expertise, and expense involved in large-scale mapping. However, we cannot manage grizzly bear habitat at the landscape scale without first understanding what — and where — their specific habitat requirements are.

Objectives for grizzly bears will be incorporated into the requirements of the Forest Practices Code at the landscape level for forestry and range operations. Site prescriptions within landscape units will be incorporated through Pre-Harvest Silvicultural Prescriptions (PHSPs) to maintain specific shrub and tree cover for grizzly bears.

As well, sheep and range hazard maps outlining important grizzly bear habitats where grazing may have an impact have been completed at a scale of 1:2 000 000. For regions of concern, mapping will be conducted at more detailed scales.

Grizzly Bear Management Areas in BC

The Protected Areas Strategy (PAS) was introduced as government policy in 1992. One of the goals of PAS is to protect representative examples of the full range of the province's ecosystems, where possible. At the time, roughly 6 percent of the province had been set aside in parks and protected areas, but that 6 percent was not representative of all 100 of the province's terrestrial ecoregions.

PAS recognizes that in some areas of the province “the opportunity still exists to protect large, dynamic ecosystems, such as predator-prey systems and large wilderness areas. Long-term protection of these ecosystems requires that they be kept intact. Merely setting aside 12 percent of an ecosystem would not be adequate...”

One of the major management tools that needs to be completed is identification of grizzly bear populations and bear management areas throughout the province. Some prime grizzly bear habitats have been identified, such as the Khutzeymateen but, to date we do not have sufficient information or inventory to identify all the major grizzly bear populations or ecosystems in BC.

In British Columbia, some of the world's highest densities of grizzly bears occur on the coast in association with what are considered by many to be globally significant runs of salmon and sea-run trout. But there are also internationally significant grizzly bear ecosystems in the province's interior. Both the Southern Interior Mountains Ecoprovince and the mountains of the Sub-boreal Interior Ecoprovince maintain a diversity of ungulates (e.g., mountain caribou, elk, moose, deer, mountain goat, and sheep) and carnivores (e.g., grizzlies, black bears, wolves, cougars, and wolverines). Ecoprovinces that no longer maintain significant predator-prey systems, such as portions of the Central Interior, Southern Interior, and Boreal Plains ecoprovinces, do maintain some grizzly bears, although at lower densities (see Figure 6).

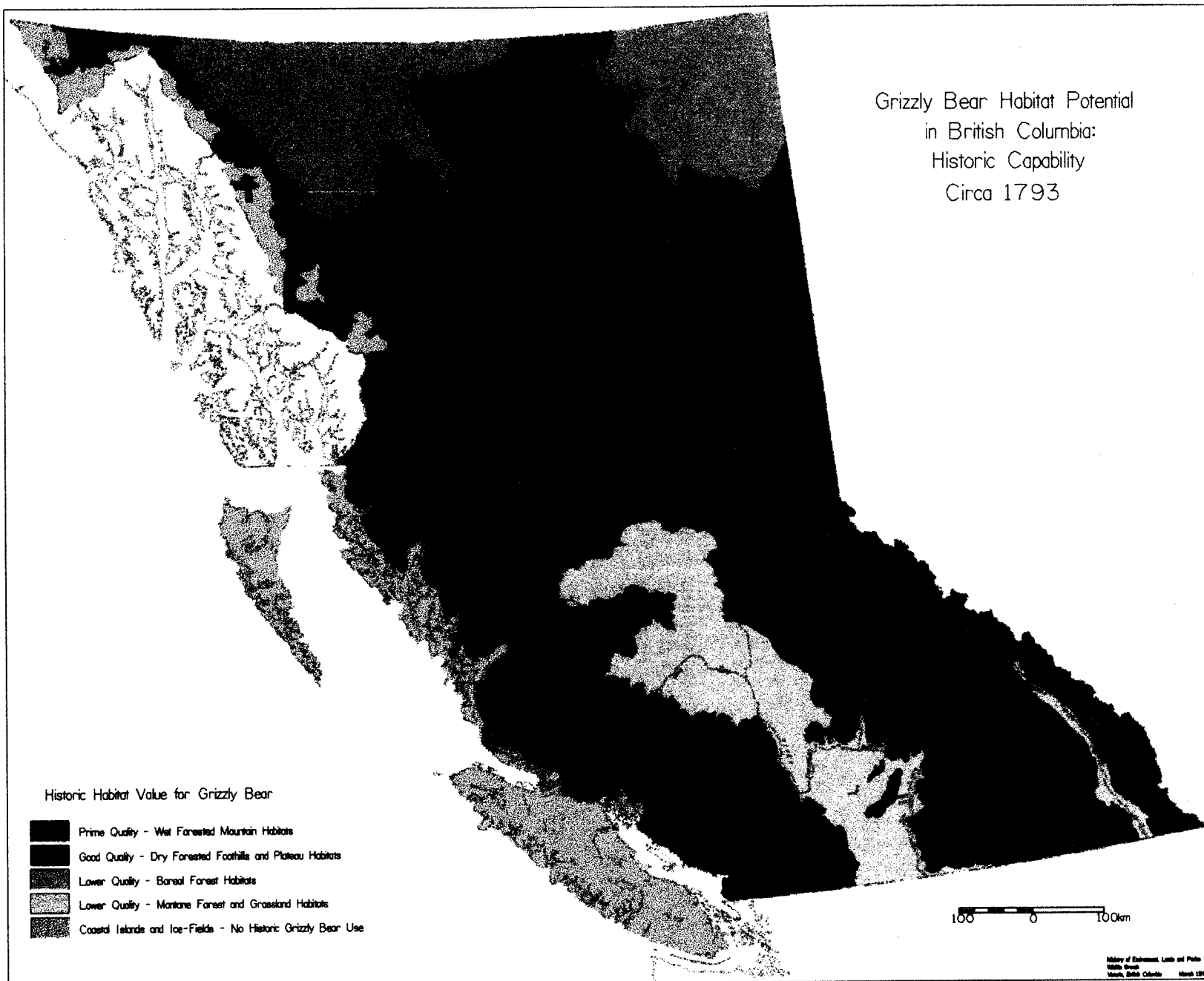
Existing protected areas in themselves, (most of which are provincial parks) may not be adequate for grizzly bear conservation for a number of reasons:

1. They are not sufficiently large.
2. They do not, for the most part, contain prime grizzly bear habitat or all of the ecological requirements of a grizzly bear population.
3. Many were not initially established with the purpose of representing the full range of ecological diversity in the province, but rather to capture scenic or recreational wilderness values (over 80 percent of our provincial parks were established before the current ecological classification systems were devised).

Some existing protected areas and some that will arise through the Protected Areas Strategy will be capable of maintaining significant grizzly bear protected cores (Figure 8). The ultimate objective is to have one large core for each of the province's grizzly bear ecosystems and to ensure that these are linked with sufficient habitats to support grizzly bear populations. Linkages must allow for the movement of grizzly bears and provide for all their needs throughout each season of use. Such a strategy will also help provide for the life requisites and dispersal needs of other wildlife.

Achieving core protected areas in some ecoprovinces will be difficult because of the extensive habitat alteration and alienation that has already occurred. For example, oil and gas exploration activity in the Boreal Plains Ecoprovince of northeastern BC has resulted in over 13,000 km² of seismic lines on hundreds of thousands of hectares. The impacts of hydroelectric reservoirs on grizzly bear habitat have been high in seven ecoprovinces that contain grizzly bears. Forestry activities have had significant impacts throughout the province in almost all ecoprovinces. Also, mining, agriculture, and grazing activities have modified grizzly habitat and are a source of many people/grizzly conflicts in much of the central and southern portions of British Columbia (Banci *et al.* 1994).

**Figure 5. Grizzly Bear Habitat Potential in British Columbia:
Historic Capability, Circa 1793**



Grizzly Bear Habitat Potential in British Columbia: Historic Capability, Circa 1793

At the time of European contact, grizzly bears were widespread across western North America — from the Pacific Ocean in the west to Hudson Bay and the Red River in the east, south into Mexico and the Sierra Madre, and north to the shores of the Arctic Ocean and Bering Sea.

In 1793, when Alexander Mackenzie led the first European expeditions across the Central Interior, British Columbia was still at its maximum capacity for supporting grizzly bears; even so, not all of the province's ecosystems were of high value for the great bears. It was in the wet forested mountains of the coast and interior, all of which supported salmon runs, where the highest values occurred. In the boreal forests of the northern plateaus and plains, and in the dry montane forests and grasslands, the habitat was of lesser value. Grizzlies, while present, were in low density and were most closely associated with riparian zones. Except for perhaps the occasional wanderer, grizzly bears never occurred on the coastal islands.

We are fortunate in British Columbia to have large tracts of forests and mountains that remain as wilderness or in a nearly wild state. These lands not only provide essential habitats for the province's grizzly bears, but also serve as vital continental links, connecting viable and intact grizzly bear habitats in Alaska, the Yukon, and the Northwest Territories to those in Washington, Idaho, Montana, and Wyoming, where populations of grizzlies are fragmented and vulnerable because of other land use priorities.

This map of BC's historic grizzly bear habitat values was based on evaluation of present grizzly bear use of habitats, extrapolated to the potential use of habitats that were present 200 years ago. The values are an average of all the major ecosystems within each of the 100 terrestrial ecosections (of major landscape subdivisions) in British Columbia. The map is only intended as an overview of the status of the historic grizzly bear habitats within the province. A more detailed inventory and mapping is required in order to determine where various specific habitats would have occurred within any region or ecosection.

Grizzly Bear Habitat Potential
in British Columbia:
Current Suitability -
1995

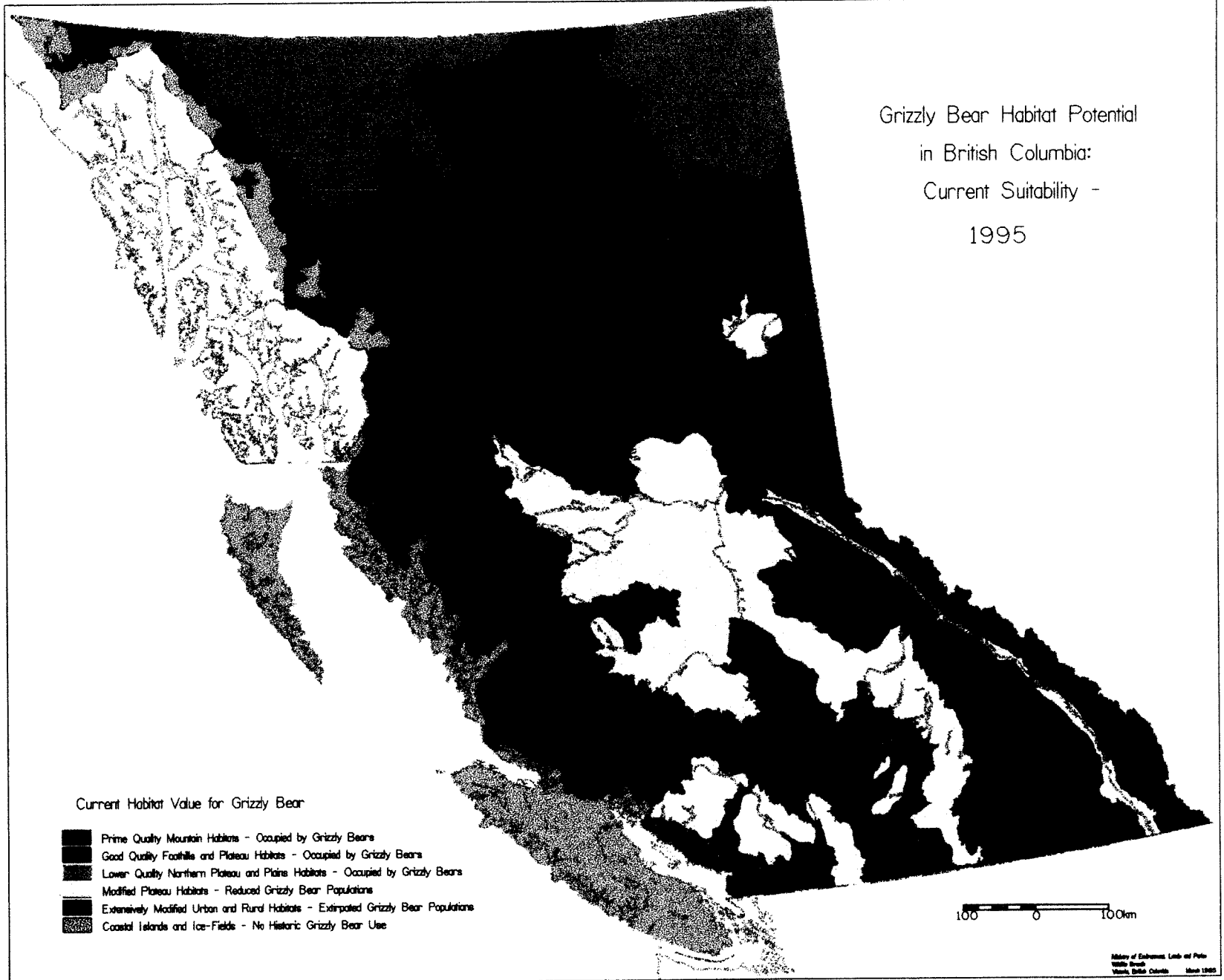


Figure 6. Grizzly Bear Habitat Potential in British Columbia:
Current Suitability, 1995

Grizzly Bear Habitat Potential in British Columbia: Current Suitability, 1995

At the time of European contact, grizzly bears were widespread across western North America — from the Pacific Ocean in the west to Hudson Bay and the Red River in the east, south into Mexico and the Sierra Madre, and north to the shores of the Arctic Ocean and Bering Sea. Today, nearly all of the southern and Great Plains populations are extinct, due to habitat exploitation, prey reduction (notably bison and salmon), and human intolerance of these magnificent animals. It is in the mountains of British Columbia, Alberta, the Yukon, and Alaska that grizzly bear populations remain relatively strong.

We are fortunate in British Columbia to have large tracts of forests and mountains that remain as wilderness or in a nearly wild state. These lands not only provide essential habitats for the province's grizzly bears, but also serve as vital continental links, connecting viable and intact grizzly bear habitats in Alaska, the Yukon, and the Northwest Territories to those in Washington, Idaho, Montana, and Wyoming, where populations are fragmented and vulnerable due to other land use priorities. Over much of the Central and Southern Interior, the Peace Lowland, and the South Coast of British Columbia, grizzly bear populations have been much reduced and, in some cases, extirpated. Although the forecast is that they may never again be allowed to regain their former abundance in those areas, in all but the urban centres, the habitat still has the potential to support grizzlies. The choice is clearly ours.

This map of BC's grizzly bear habitat values and population distribution was based on population estimates made by provincial wildlife biologists in 1993 and 1994. Current land use activities and grizzly bear numbers were considered in evaluating the present habitat quality. The values are an average of all the major ecosystems within each of the 100 terrestrial ecosections (or major landscape subdivisions) in the province. The map is only intended to be an overview of the status of current grizzly bear habitats in BC; more detailed inventory and mapping is required in order to calculate the amount of habitat remaining within any region or ecosection.

Grizzly Bear Habitat Potential
in British Columbia:
Possible Future Suitability
Circa 2065

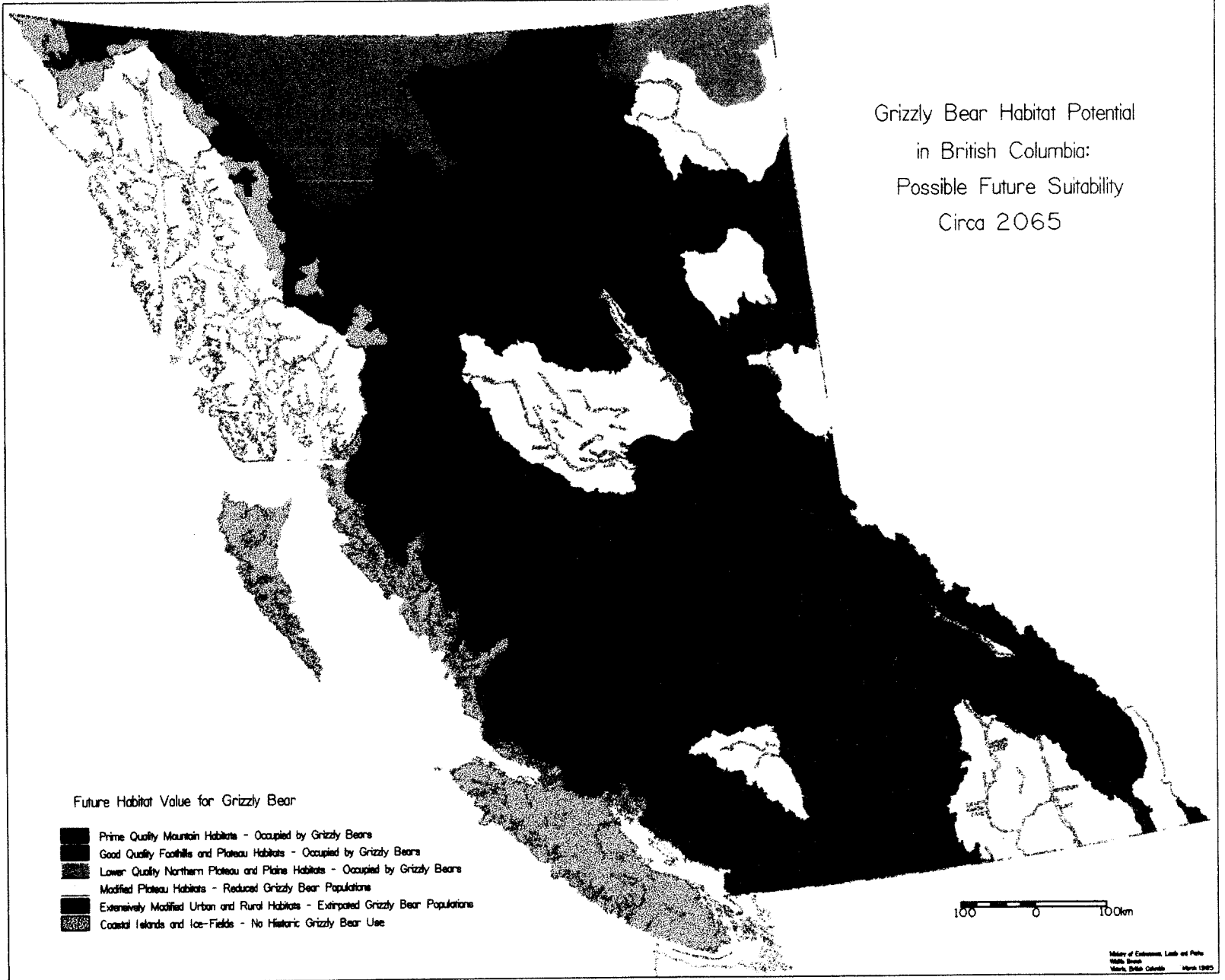


Figure 7. Grizzly Bear Habitat Potential in British Columbia:
Possible Future Suitability, 2065

Grizzly Bear Habitat Potential in British Columbia: Possible Future Suitability, 2065

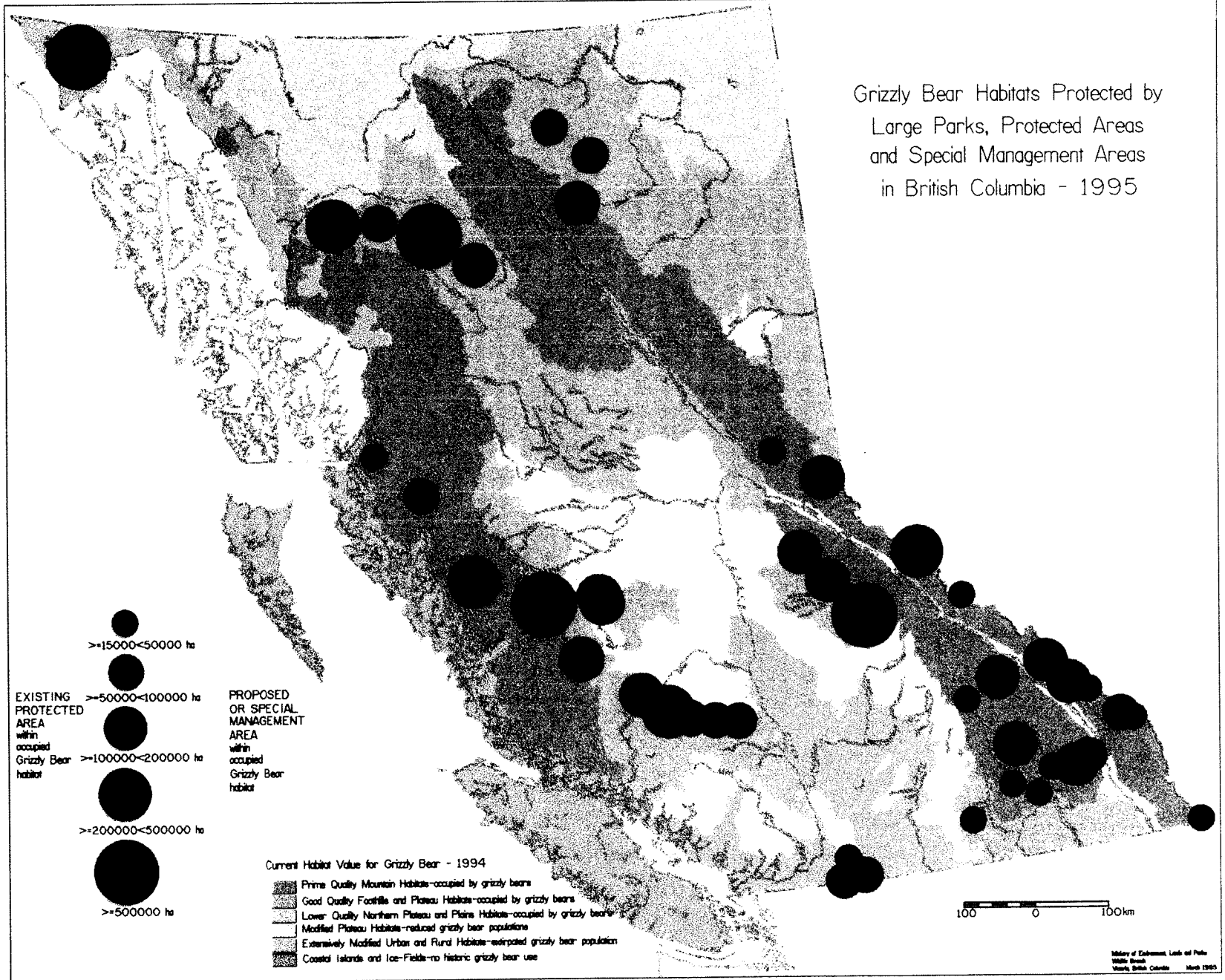
At the time of European contact, grizzly bears were widespread across western North America. Today, nearly all of the American West and Great Plains populations are extinct, due to habitat destruction or alienation, prey reduction, and human intolerance of these magnificent animals. Currently, grizzly bear populations remain relatively strong in the mountains of British Columbia, the Yukon, and Alaska. With British Columbia's human population currently at 3.7 million, the province's grizzly bear habitat is still capable of supporting at least 60 percent of the grizzlies that it did 200 years ago. But what about the future? When, as predicted, the human population in BC doubles to 7.4 million by 2065, will there still be grizzly bears or their habitat in the province?

This map of predicted grizzly bear habitat potential in BC was based on the assumption that by the year 2065, habitat conversion and people's concern about having such a large carnivore nearby will cause grizzly populations to be eliminated in all urban, rural, and agricultural areas. Such a reduction would be caused by doubling, even tripling, the population of all interior cities and towns, with major rural expansion into the valleys, such as the Lillooet, West Road, Slokan, Gerrard, Elk, and Flathead. A doubling of the human population would also mean increasing and upgrading all transportation facilities. All secondary highways would be improved and paved, and all railroads would be double-tracked, impeding the movement of bears. Perhaps the biggest impact on grizzly bears and their habitat would be the continued expansion of farming and grazing on the Interior and Alberta plateaus, converting all wetlands, riparian habitats, and deep soil areas into cultivated fields. With increased livestock, mostly an increase in domestic sheep, general intolerance of grizzlies will increase.

On the other hand, it is possible that the cold and rugged valleys of the Coast and Mountains, Southern Interior Mountains, and Northern Boreal Mountains areas would remain sparsely populated, much like the present. And with continued implementation of the Forest Practices Code, forestry management activities would not be as harmful to grizzlies. Likewise, carefully regulated and enforced hunting could also mean that hunting would have no significant impact on grizzly bear populations.

Predicting the future of a species involves more than looking at how the human population will expand and what resources they will exploit. The degree to which global warming will modify our temperate and boreal climates is unknown. If BC's climate gets warmer, farming on the plateaus and northern areas will expand greatly. If, however, the climate cools, mid-elevation farming will decrease. As well, future conservation ethics, the value that our descendants place on resources we are trying to manage for them today, and their tolerance to crowding are also very important, but probably cannot in any measure be predicted. Beyond any doubt, even though large wild areas will remain, when the human population of BC reaches 7.4 million, there will be a lot less habitat available for grizzly bears.

Grizzly Bear Habitats Protected by
Large Parks, Protected Areas
and Special Management Areas
in British Columbia - 1995



**Figure 8. Protected Areas and Special Management Areas
in British Columbia, 1995**

Protected Areas and Special Management Areas in British Columbia, 1995

We are fortunate in British Columbia to have large tracts of forests and mountains that remain as wilderness, or in a nearly wild state. These lands not only provide essential habitats for the province's grizzly bears, but also serve as vital continental links, connecting viable and intact grizzly bear habitats in Alaska, the Yukon, and the Northwest Territories to those in Washington, Idaho, Montana, and Wyoming, where populations are fragmented and vulnerable because of other land use priorities. Over the past 80 years, some of the wilderness that contains high value grizzly bear habitats has been protected by national parks, and provincial parks and recreation areas. More of it has been proposed as special management areas to benefit wildlife.

Against a background that depicts current grizzly bear habitat values and population distribution, this map shows established areas that are currently providing habitat protection for grizzly bears (orange circles) and areas that have been recommended through various provincial land and resource planning processes that will provide secured habitats for grizzly bears (green circles). It must be noted that this is not a map of existing or proposed grizzly bear sanctuaries. While a few of the protected areas are currently closed to grizzly bear hunting, the purpose of this map is not to present a strategy for hunting closures.

The coloured circles represent only an approximate location and size of the various protected areas and special management areas that are larger than 15,000 hectares (ha). All recreation areas (RA) are classified as proposed, however, in some cases they may appear on the map as existing protected areas when they adjoin an existing park and both areas are smaller than 15,000 ha. There are currently 12 areas between 15,000 and 50,000 ha, 11 between 50,000 and 100,000 ha, 14 between 100,000 and 200,000 ha, and eight areas larger than 200,000 ha.

Although at first glance there seems to be many areas protected for grizzly bears throughout the province, those parks, protected areas, and special management areas are spread quite unevenly across the land base. Many of the areas were set aside as protected or special management for backcountry recreation and aesthetics, not solely for grizzly bear security. In some cases, the best habitats may lie outside the protected areas. More detailed habitat inventory and, ultimately, habitat protection is required to make the current protected areas effective in securing the future of grizzly bears in British Columbia.

Although the designation of grizzly bear management areas needs further discussion, BC has a number of globally significant areas that are good candidates. The list below is not exclusive. To attempt to more fully restore the diversity of grizzly bear populations, it is important not only to protect grizzly bear core habitats in wilderness areas, but also in ecoprovinces that sustained major grizzly bear habitat losses in the past (e.g., the Southern Interior Ecoprovince).

Many of these potential grizzly bear conservation areas would not be land use designations but would employ management plans and activities that protect or enhance grizzly bear populations. The core habitats that are not protected areas would allow resource activities if they did not have a significant impact on grizzly bears or their habitats.

The following areas have been protected or have the potential to serve as core grizzly bear conservation areas; others will need to be identified.



1. In June 12, the BC government announced the establishment of the Khutzeymateen as a sanctuary for grizzly bears, the first area in Canada to be protected specifically for this species. Now a Class A provincial park, the Khutzeymateen is a coastal valley located northeast of Prince Rupert within the northern portion of the Coast and Mountains Ecoprovince. The Khutzeymateen (443 km²) is a diverse collection of glaciers, avalanche chutes, bogs, floodplains, an estuary, and extensive old-growth forest of coastal western hemlock, Sitka spruce, and mountain hemlock. The Khutzeymateen's river system supports runs of four species of salmon. Besides grizzlies, there are whales (orca), seals, wolves, wolverines, river otters, marten, deer, and a variety of waterfowl, shorebirds, raptors (e.g., eagles, hawks), and other birds. Surrounding the core park is a no-hunting area, total of 3,850 km² in the grizzly bear management zone.

2. Although grizzly bear populations are not high, the Kitlope represents a significant undisturbed watershed that might serve as a grizzly bear conservation area. This 3,887 km² watershed is further south in the same ecoprovince as the Khutzeymateen, along the central coast and west of Tweedsmuir Provincial Park. A lot of the terrain in the Kitlope is very steep and salmon streams are somewhat intermittent (that is, do not occur annually), but the area is large and remains in a nearly pristine condition. A one-year moratorium on grizzly bear hunting was declared in the Kitlope in March 1994, and was extended because of conservation concerns. In August 1994, nearly 82 percent of the watershed (3,170 km²) was declared a joint Haisla First Nation/British Columbia protected area. Its official designation and management will be determined at a later date.

Much of the grizzly bear habitat in the southern portion of the Coast and Mountains Ecoprovince has been alienated because of human settlement, forestry, and agriculture and in the northern portion because of extensive logging of coastal watersheds. Current grizzly bear populations in this ecoprovince are estimated to be 59 percent of its capability.

3. The recently designated Tatshenshini-Alsek Provincial Park is considered to be a potential grizzly bear ecosystem of national and international significance. The park abuts Kluane National Park Reserve in the Yukon and Glacier National Park in Alaska, and provides representation of the Northern Boreal Mountains Ecoprovince.

4. The Mitchell Lake/Niagara Protected Area (110,500 ha) between two provincial parks, Bowron Lake and Wells Gray in the Cariboo Mountains, constitutes a significant grizzly bear core habitat area on the eastern side of the Central Interior Ecoprovince.

5. Other populations have been identified in a number of Study Areas and Areas of Interest under the PAS and CORE processes. Protection may be achieved through decisions at the subregional land use planning level. Some of these include: areas linking BC to the Alaska panhandle (e.g., Taku River, lower Stikine River), areas in the northern interior (e.g., Kechika-Muskwa, Sustut-Babine, Spatsizi-Stikine, Omineca-Ospika), and areas along the central coast (e.g., Koeye-Namu, Ahnuhati-Kingcome). These and others need to be investigated for the possible establishment of grizzly bear core habitats and management areas.

Joint Canada-United States Grizzly Bear Populations

Canadian grizzly bear populations adjacent to the US border are essential to the recovery and long term survival of internationally shared populations. The (US) Interagency Grizzly Bear Committee (IGBC) was established in 1973 to develop a conservation and enhancement strategy for grizzlies in the lower 48 United States. The IGBC includes personnel from the US Parks Service, the US Forest Service, and the Fish and Wildlife departments of Montana, Idaho, Wyoming, British Columbia, and Alberta. The IGBC has recognized that, except for Yellowstone, viable grizzly bear populations cannot be maintained in the US without including grizzly bears and habitat provided by Canadian provinces (Peek et al. 1987).

Northern Continental Divide, Cabinet-Yaak, and the Southern Selkirks — The “Shining Mountains” mapping project constitutes the first ecological map that can be used to plan conservation strategies for wildlife species in eastern Washington, northern Idaho, northwestern Montana, southwestern Alberta, and southeastern British Columbia. The project encompasses three shared grizzly bear populations and was completed in cooperation with Montana and Alberta. It is a significant achievement because regional ecosystems were mapped irrespective of political borders. Political, administrative, and land use differences are still being examined in order to produce a truly cooperative management program for shared grizzly bear populations.

British Columbia has provided more than expertise in habitat mapping and ecosystem classification. For the past four years, the BC Wildlife Branch has assisted the US Fish and Wildlife Service in augmenting the Cabinet-Yaak grizzly population by supplying subadult female grizzlies. To date, four females have been moved; one of these has since died. The agreement stipulated a maximum of four subadult females, with a maximum of one per year to ensure no detrimental effects to the source population.

North Cascades Ecosystem — The North Cascades is another potential grizzly bear recovery area. The Canadian North Cascades falls within the southern portion of the Coast and Mountains Ecoprovince. It contains the Fraser Valley, Manning Provincial Park, and the Skagit Valley and Cascade provincial

recreation areas. Unlike the other three ecosystems shared across the southern Canada-US border, the numbers of grizzly bears within the Canadian portion have been severely reduced. This is due largely to extensive habitat fragmentation, in some cases by areas of human settlement, and to high levels of hunting, logging, and bear control between the late 1800s and the mid-1900s. The proposed recovery area contains high quality grizzly habitat, much of which is subject to a fair amount of backcountry recreational activity. Grizzly bear hunting has not been permitted in the area since the late 1960s.

An estimated 44 to 64 grizzlies could exist in the Canadian North Cascades recovery area. However, the current population for the entire ecosystem is estimated at less than 20 individuals. It is unlikely that, if left to themselves, they would recover naturally through reproduction or migration from adjacent habitats. Three grizzlies from the Lillooet Valley were relocated to the recovery area in 1990, two in 1991, and five in 1992-93. The one collared bear, an adult male, was translocated as a conflict bear in October 1992, but had returned to the Lillooet Valley by fall 1993.

Despite the fact that this bear did not remain in the transplant area and returned to its home range, his movements from the Manning/ Skagit area of the Cascades northwest to the Pemberton/Lillooet area - a distance of over 150 km as the crow flies - have given wildlife biologists some important information: grizzly bears may be able to cross major transportation routes (including the Trans-Canada Highway in the Lower Mainland area), and grizzlies may be able to pass through areas of high human use without apparent bear/people conflict. (There was a considerable amount of media coverage during the time of this bear's movement back to Lillooet, which may have predisposed the public to "looking out" for this bear.)

In addition, location and time of year are critical to the success of translocation. The Canadian North Cascades contains high use recreational areas for thousands of residents of the Fraser Valley, the Lower Mainland, and adjacent Washington. The area may very well be a test case for determining whether we can recover grizzly bears adjacent to heavily populated urban centres. To some extent, coexistence has already occurred, because grizzlies have always been present, albeit at low densities.



The Importance of Genetic Diversity

Why should we care about conserving grizzly bears from all ecoprovinces and habitats? The answer to this relates, at least in part, to biodiversity. A major component of biodiversity is the genetic diversity within a species. The designation of grizzly bear core habitats with suitable linkages will help ensure that we maintain the extent of genetic diversity in grizzly bears.

Species of wide distribution and typically low densities, such as grizzly bears, may exhibit local physical and behavioural adaptations and unique population dynamics. These differences may have a genetic basis. If we do not recognize that coastal grizzlies are different from interior mountains grizzlies, which are different again from barren ground grizzlies, we run the danger of losing genetically diverse and unique populations.

With our current state of knowledge, we cannot say that the eight ecoprovinces necessarily represent eight genetically distinct subgroups of grizzly bears. Grizzlies may move considerable distances and individual bears could occupy different ecoprovinces at different times of the year, or in different years. However, grizzly bears are constrained by the limits of the habitats they occupy and by human influences.

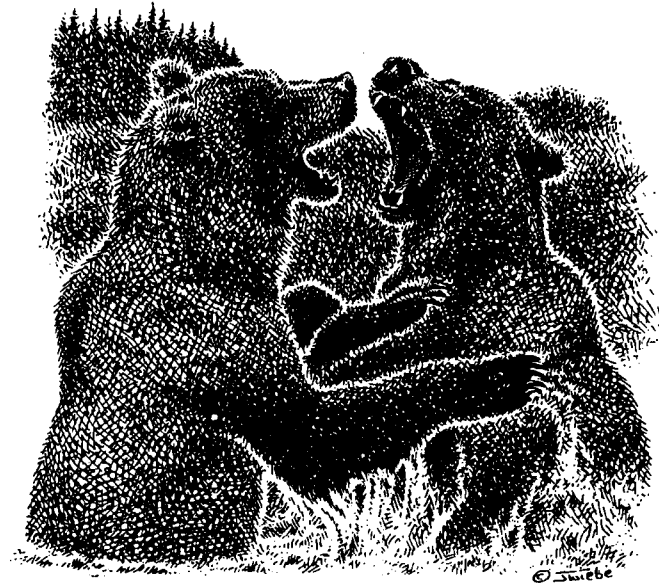
Sometimes populations that occupy ecologically different areas will evolve specific genetic traits. These may be evident in physical appearance, in behaviour, or they may not be overtly evident. Are southern interior grizzly bears different from northern interior grizzly bears? The importance of genetic variation can be difficult to understand because often we cannot readily discern it in an animal's appearance.

Some researchers have documented genetic variation throughout the geographic range of large carnivores, including bears, by analysing DNA in blood, skin, or tissue samples (Fain 1994; Knudsen and Allendorf 1994). Genetics can have important consequences during translocations, either for population recovery or for removing bears from sources of conflict. Matings between individuals that are characterized by different chromosome arrangements, or by limited genetic variability, can result in mortality of offspring or, at a later stage, in reduced fertility (Robinson and Elder 1993).

Just as importantly, specific genetic traits may impart advantages to a population that enable it to adapt to specific environmental circumstances that biologists are unaware of. The evolution of a population involves changes in gene frequencies. This genetic variation is important in providing genetic flexibility for adapting to changes in the environment (Futuyma 1979). It is one of the reasons why maintaining biodiversity (in relation to habitats and to populations) is so important.

An example of adaptive evolution is the polar bear, an evolutionary newcomer originating from a population of grizzly bears that, cut off from their usual habitat during a period of intense glaciation, adapted to extreme arctic conditions (Macdonald 1992). It is possible that grizzly bear populations in southern British Columbia have genetic traits that will allow them to adapt to altered habitats produced by global warming better than bears in coastal or northern habitats.

Another reason to maintain genetic diversity of grizzly bears may relate to their capacity to learn. This translates to changes in behaviour, allowing for



adaptations to new or changing environmental conditions. Over time, behaviours that result in successfully obtaining food and shelter and in reproducing may become prevalent.

Populations at the edges of their distribution range need special consideration because they typically have a higher genetic diversity (Ledig 1993). These “edge” populations are also the ones that are lost first as a species’ range retracts. Genetic diversity allows some individuals in populations to adapt to stresses caused by changes in habitat to recover from catastrophic environmental conditions resulting from large fires, floods, or tornadoes and it may facilitate recovery in reduced populations.

Because we do not know what genetic information is necessary for grizzly bears to adapt to changing environments, we should strive to maintain as diverse a range as possible. The long term success of our grizzly bear management program may not be determined by how many bears we have at any one time so much as by how much of the diversity in the grizzly’s genetic makeup we have been able to conserve.

There are two schools of thought on this. Some maintain that large grizzly conservation areas containing large grizzly bear populations give us a better chance of long-term viability of at least a given population of grizzly bears. The concern is that if an area is too small, there is a greater risk of loss due to unforeseen or unpredictable conditions. Should we fight to maintain a population size that we hope is likely to be viable because it is comparatively large? Or should we attempt to protect grizzly bear populations wherever they occur no matter in how many localities in an endeavour to maintain the known variability where it still occurs? That is, shall we strive for a situation in which the overall numbers of bears may increase in some populations, or one in which we have a larger number of grizzly bear conservation areas, each containing smaller populations?

Might it be better to sacrifice a “local” recovery rate (larger numbers) in favour of maintaining or increasing genetic diversity by protecting more, smaller grizzly bear core habitats?



The implications of the “fewer/larger vs. more/smaller” debate are whether to maintain fewer large grizzly bear conservation areas that could successfully conserve populations and hope to catch all the genetic variability in a given population (without actually knowing “how much is enough”), or to establish more, but smaller, conservation areas that will, hopefully, conserve a greater genetic diversity, albeit in smaller grizzly bear populations that might, ultimately, not be large enough to be sustainable.

Regardless, it is clear that better management of grizzly bear populations and habitats outside of core protected areas is critically important to long-term survival of grizzly bears.

Factors Influencing the Viability of Grizzly Bear Habitats

Forestry, agriculture, mineral and petroleum exploration and development, hydroelectric power development and reservoirs, commercial fishing and aquaculture activities, human settlement and burgeoning human population growth, poaching, overhunting in some areas, and increased recreational uses have opened up access to and affected the productivity and integrity of grizzly bear populations and habitats in British Columbia (Banci 1991).

Forestry

Forestry continues to be a major influencing factor in all ecoprovinces where grizzly bears are found. Until recently, habitats in the far north of the province had not experienced the same intensity of impacts as those in the central and southern ecoprovinces. However, forestry activities have been stepped up in the North. Large-scale cutting has increased, so the effects of forestry will increase dramatically in this region. Some of these result from increased road access, which has been shown to raise the chance of human/grizzly bear encounters — often resulting in bear mortality, increased poaching, and long-term disturbance or loss of availability at or near bear denning, resting, and feeding areas.

Logging confers some short-term benefits on grizzlies in some areas, such as in the growth of berry-producing plants and other bear foods on clearcuts, especially in the moist to wet sites. Most of the benefits associated with timber harvesting are negated by the intensive land use and management that follows (Mattson 1990). Probably the biggest impacts on grizzlies from forest harvesting result from the fragmentation, disruption, and alienation of their habitats; the increased presence of humans and domestic livestock that result with access; and human intolerance for bears.

Old-growth forest habitat is important for many wildlife species, either throughout their lives or during certain seasons, or for providing certain needs, such as denning or resting sites. In coastal areas, grizzly bears may require the attributes, or amenities, provided by old-growth forests for thermal cover, protection from the sun, during heavy rains, and for dens. We know less about the habitat needs of grizzly bears in the forests of interior British Columbia, particularly in the sub-boreal and boreal environments.

A variety of government initiatives are in place that address these issues, such as the Forest Practices Code, provincial review of all Timber Supply Areas

As surely as the sun rises tomorrow morning, grizzly country is wilderness country, and he cannot live without it. Man...has chosen...to fight the wilderness...to break nature to his needs... The grizzly can show us something of what it means to live in harmony with nature.

Andy Russell



(TSA), Protected Areas Strategy (PAS), Commission on Resources and Environment (CORE), and Land and Resource Management Planning (LRMP). For instance, under the Forest Practices Code, special attention will be given to Red- and Blue-listed and regionally significant species. Species accounts, or "ecological descriptions" are being written for 104 animal (including grizzly bears) and about 200 plant species. The Forest Practices Code Guide Books will consider three major aspects: biodiversity, riparian areas, and wildlife habitat areas.

These and other initiatives will include grizzly bears in forest management plans. Habitat management consists of identifying important grizzly bear habitats and protecting these from logging in an isolated fashion. Forest plans will establish Forest Ecosystem Networks (FENs) consisting of important core habitats and connecting corridors. These are still planned as part of the biodiversity component of the Forest Practices Code, but do not constitute grizzly ecosystem management in themselves. They must be implemented in such a way that considers the habitat needs of grizzly bears at all scales, from the stand level to the landscape level. They must also consider the habitat needs of grizzlies in relation to other species in the ecosystem.

Cattle, Sheep, and Agriculture

The alienation of land by the expansion of agricultural and ranching activities onto forested or clearcut land has not only eliminated grizzly bear habitat, it has resulted in grizzly bears being killed, either directly out of fear or with the intention to protect livestock, or indirectly because of poor husbandry practices and general intolerance of carnivores (Banci 1991). The loss of grizzly bears and their habitats from much of western North America, particularly in such locales as BC's Central Interior and Boreal Plains ecoprovinces, can be directly related to the extent of livestock grazing and agriculture.

The recent expansion of livestock into areas not traditionally allocated for that use is a major concern, as is the practice of grazing sheep and cattle in alpine and subalpine areas. These are important feeding habitats for grizzly bears in spring and fall, and contain vegetation that is highly sensitive to the kinds of disturbances caused by livestock grazing.

Another concern is the increase of small livestock, such as goats, pigs, and chickens, in rural settlements. If these animals are kept adjacent to grizzly habitat, they will attract grizzlies and become prey, resulting in conflicts.

Over the past five years, the Ministry of Forests has investigated the use of sheep as a vegetation management tool on clearcuts as an alternative to the use of herbicides. Operational trials have been conducted in several Interior forest districts with mixed results — generally unsatisfactory. Sheep-grazing can result in the displacement of grizzlies and other large carnivores, the habituation of grizzlies to sheep, and result in the destruction of grizzly bears. Interim interministry guidelines (Forests; Environment, Lands and Parks; Agriculture, Fisheries, and Food) for the management of sheep on these types of grazing operations have been developed. The implementation of these guidelines, in conjunction with yearly monitoring of all sites, may help in avoiding or mitigating the potential negative impacts. This is another practice that requires additional research and strict compliance with guidelines.

Compared with other land uses, agriculture is not extensive in British Columbia; less than 1 percent of the land has the combination of soil and habitat to support a wide variety of field crops (BC government 1993). However, most of the limited amount of high capability farmland is in the valley bottoms and is often the same land that is the best grizzly bear habitat. Ecoprovinces with the largest land areas being used for field crops are the Boreal Plains, Central Interior, Southern Interior, and the southernmost end of the Coast and Mountains and adjacent areas of the Georgia Depression ecoprovinces (Lower Mainland area). Much of this habitat is permanently lost to grizzly bears.

Mineral, Gas, and Petroleum Resources

Although the total land area disturbed by mining, gas, and petroleum development has been small relative to other land uses, extensive areas of some ecoprovinces have been subjected to intensive exploration, most notably for oil and gas in the Boreal Plains Ecoprovince and for coal in the Southern Interior Mountains Ecoprovince. The greatest impacts have occurred during the exploration phases, especially because of surface trenching, access roads, seismic lines, transmission lines, and the impacts associated with settlements that develop around mines.

The Sikanni-Beaton Plateau Ecoregion of the Boreal Plains Ecoprovince (from which grizzlies have been extirpated) is the main source of natural gas in British Columbia. Some six million hectares are held under permit for oil and gas development. Large-scale commercial production of gas and oil in this ecoprovince began in the late 1950s. By the end of 1990, over 13,000 km of seismic lines were shot (charges are “blown” to get seismic readings and the echoes are timed to get density readings); 20 percent of this activity occurred during summer 1994 (Canadian Petroleum Assoc.).

Disturbances in permafrost habitats can take centuries to recover. As a condition of their licence, permit, or lease, companies, in association with the BC Ministry of Energy, Mines, and Petroleum Resources, should be required to

use methods that minimize these disturbances and to undertake restorative work on grizzly bear and other wildlife habitats. Restoration may include replanting seismic lines and other methods of removing access into these habitats. Initiatives are under way for licensees to contribute to a fund to be used for restoration and for researching impacts on the vegetation and wildlife.

Hydroelectric Power Development

Dam construction projects and reservoirs have had severe effects on grizzly bear habitat and ecosystems. Initially, dams were comparatively small and were located adjacent to the areas of need, usually towns. Giant "megadam" projects greatly increased the storage capacity of reservoirs, but they drowned and alienated huge blocks of land, destroyed salmon runs, and forever altered adjacent and downstream ecosystems (Banci 1991).

Hydroelectric power development also affects grizzly bears because of the access developed and the habitat loss resulting from intensive vegetation management on Hydro rights-of-way. A total of 17,458 km of hydroelectric-related access occurs in British Columbia, of which some 10,000 km constitute the larger transmission lines (BC Hydro 1994).

Vegetation management practices on rights-of-way that are grizzly bear (and other wildlife) habitat and dispersal areas should be conducted, in cooperation with BC Hydro. Guidelines outlining where vegetation can be enhanced, and appropriate methods for doing so, should be developed using a pilot project in the Mica Dam compensation area of the Southern Interior Mountains Ecoprovince. Rights-of-way selected for enhancement for grizzlies should not be used as access routes for people.

Commercial Backcountry Recreation Development

Although the development of backcountry recreation facilities, such as year-round vacation resorts, ski hills, alpine villages, and golf courses, has not yet occurred to as great an extent in British Columbia as in other parts of the world, there is increasing pressure to do so because of the interest in backcountry recreation and because of the potential for jobs and tourism revenue. Such developments have the potential for negative impacts on grizzly bears and their habitats. People produce garbage, and garbage attracts bears. Because of human intolerance for grizzly and black bears, more bears are killed. In addition, the infrastructure required to support a high-use recreational facility includes access — roads must be built or upgraded to support increased traffic, and settlement — buildings are needed to service, house, entertain, and feed visitors. Cabins are built, followed by permanent vacation homes. Once the trails and roads are in, human activity expands to include hiking, camping, horse-riding, off-road (4-wheel drive, ATV, motorbike) vehicle use, mountain-biking, and berry-picking in summer, and snowmobiling, heli-skiing, or other modes of access during winter. A winter ski lodge can develop into a year-round facility with permanent residents. Popular recreational developments, such as golf courses and ski hills, located in prime bear habitats cannot be designed to have no or minimal impacts.

BC Lands has attempted to address the impacts of backcountry recreation in British Columbia in a policy that allows for licensing of commercial operators (BC Lands 1995).

Access

Increased access by humans constitutes one of the most critical impacts of industrial and recreational activity on grizzly bears. Transportation corridors in British Columbia — railroads, highways and paved roads, powerlines, oil and gas pipelines — total some 62,200 km (Bird and Rapport 1986). This number, which was tallied over eight years ago, does not include the extensive amount of non-paved access, such as logging roads, mine access roads, snowmobile and ATV trails, rights-of-way, seismic lines, and hiking and other trails.

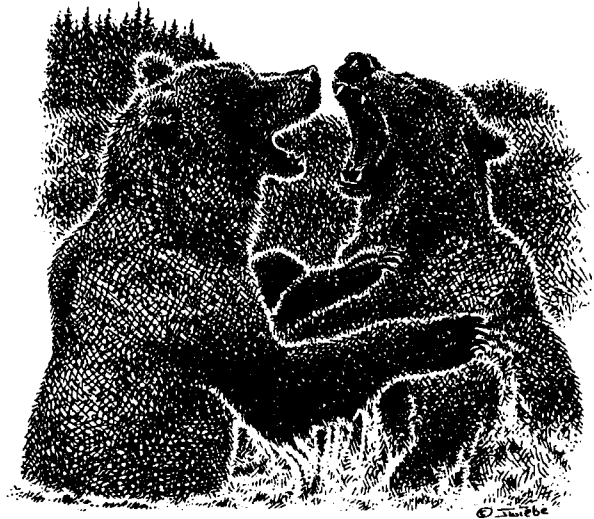
Roads and road densities have a major influence on grizzly bear populations and on their use of habitats. Impacts include the dissection and fragmentation of habitat and home ranges, and habitat loss and alteration. Provision of access is followed by roadkills, legal harvests, and poaching. Grizzly bears may be displaced from feeding habitats or may become habituated, disposing them to future conflicts with people. Roads and highways may interfere with dispersal because they are generally located in valleys and along ridges, which are also natural travel routes for bears.

Non-permanent access may also be detrimental to grizzly bears, through disturbance by airplanes and helicopters and by the presence of humans in non-roaded areas. Impacts can occur all year. In some areas with limited snow cover, bears in their dens can be disturbed by winter recreational activity, leading to den abandonment, cub mortality, and decreased survival (Goodrich and Berger 1994).

There are few places in British Columbia, if any, that are not accessible by surface vehicle, plane, helicopter, horseback, or foot. BC Environment has developed an interim strategy to address the affects of surface access in the northern Rocky Mountains in the Northern Boreal Mountains Ecoprovince, which is an area of international importance for wildlife and wilderness values. Regulations already in existence govern the use of all-terrain vehicles and general road-type motor vehicles. Similar strategies should be adopted for significant wildlife habitats throughout the province.

Long-term access management planning should be mandatory for all current and new land use activities under the Forest Practices Code. Plans should specify the types of roads to be built, their locations and intensity of use, and the road restrictions to be implemented during and after development.

Road-building by industries should be carefully planned adjacent to important grizzly bear habitats. Access plans should be a mandatory component for all BC Parks and Ministry of Forests developments, and a condition of licence for other backcountry endeavours.



How Conservation of Grizzly Bear Ecosystems Could Be Achieved

Grizzly bear management could be achieved through projects sponsored by Forest Renewal BC under the Forest Practices Code. Grizzly bear habitat management and forestry have a long history of conflict in British Columbia. Grizzly bears and the potential jeopardy to them from forest development were prominent issues in the controversies over the Khutzeymateen, Kitlope, White Grizzly, and Cariboo Mountains study areas. Grizzly bears and their habitat requirements and security were also prominent in the East and West Kootenay and the Cariboo CORE processes, several recent LRMP processes, and smaller plans, such as the Babine and Bella Coola Local Resource Use Plans (LRUPs). Wherever forest development and grizzly bears co-occur in British Columbia and there is not a coordinated approach to habitat management for bears, the potential for increased controversy exists.



Management of forested lands for grizzly bear values relies on a multi-spatial approach that has objectives and management techniques for each spatial scale and planning level from international through national, regional, sub-regional, landscape unit, stand, and microsite. This approach is based on ecological units that make sense from a bear's perspective, rather than from an administrative one. It relies on the use of Geographic Information Systems (GIS) to relate ecosection/biogeoclimatic zone data, Bear Management Areas, Landscape Units, and site/seral stages. This approach provides guidelines for local and regional planning and helps people set realistic objectives for both forestry objectives and grizzly bears. The details of this approach are being developed for implementation in the Forest Practices Code *Guide Book for Identified Wildlife Species*.

This approach fits into existing government land use and planning initiatives: PAS, CORE, LRMP, Landscape Unit planning, Access Management Planning, Forest Development and Range Planning, Pre-Harvest Silvicultural Prescriptions (PHSPs), and Stand-tending Plans.

Management of grizzly bears will require subdividing ecosections into Bear Management Areas (BMAs), which are ecologically based units appropriate for regional and subregional planning. BMAs are made up of a collection of Landscape Units (identified under the Forest Practices Code) and represent an approximation of a grizzly bear population, based on natural and human-created features. At the regional scale of planning, the primary focus of grizzly bear management on forest lands is to determine where Wildlife Habitat Areas (WHAs) are required and what management practices are appropriate within them according to the objectives for the Landscape Unit and any specific WHA within it. At the subregional scale, efforts will be made to protect, maintain, enhance, restore, and link grizzly bear habitats.

No-hunting cores of grizzly bear habitat identified as grizzly bear conservation areas, or sanctuaries, are not sufficient in themselves for the conservation of grizzly bears. Most of the grizzly habitat in British Columbia will continue to be shared with other uses. At the population level (Bear Management Areas), habitat will be managed to maintain connectivity with protected areas and important habitats, such as WHAs. With respect to forestry, this level of concern is often referred to as “higher level” plans.

At the stand level of planning, decisions are dependent on the landscape-level perspective and on an understanding of the patterns and processes of natural disturbances. If, for example, natural disturbance patterns have provided much of the early successional habitat that grizzly bears depend on, it may not be necessary to pursue special silvicultural practices on some of the managed forest stands. Some WHAs may be critically important habitat, designed to be part of Forest Ecosystem Networks (FENs). Others may be designed to restore habitat value degraded by past practices. Still others may have intermediate value worthy of special management, such as for non-conventional tree harvesting.

Key features that will be stressed are habitat and species requirements, including corridors for seasonal movement, security requirements, habitat restoration where required, access management, and range management in sensitive habitats.

Use and Enjoyment of Grizzly Bears

The second goal of the Provincial Wildlife Strategy is mirrored in grizzly bear conservation by the following three primary issues:

- 1) hunting grizzly bears
- 2) bear viewing
- 3) other uses of grizzly bears

Hunting Grizzly Bears

Can populations of grizzly bears sustain hunting and other uses and, if so, what are the sustainable levels of use?

Population Estimates and Hunting

Compared to other large mammals, grizzly bears have a relatively low reproductive rate and low recruitment. In British Columbia, they do not produce young until they are at least four years old, and there is generally a three-year period between litters. After factoring in natural cub mortality, which can range from a low of 15 percent to a high of 75 percent (Taylor *et al.* 1994), this translates to about eight cubs over a female's lifetime under average conditions. What helps to compensate for this small litter size and low recruitment rate is the considerable time and energy that female grizzly bears invest in nurturing, protecting, and educating their cubs.



Because of their low productivity, grizzly populations respond slowly to impacts that produce a change in status. We will not know how hunting or losses in habitat, or new access into a wilderness area, for instance, will affect the production and survival of young bears until additional litters are weaned and recruited into the population — a period of about six years. Given our present state of knowledge, responsible management demands that we are conservative in setting allocations for hunting grizzly bears.

Mortality rates for grizzly bears are a function of the productivity of a particular population. Under optimum conditions of low natural mortality and high productivity, Miller (1990) estimated a maximum sustainable hunting rate of 5.7 percent for grizzly bears in Alaska. The sustainable hunting rate will be lower where population productivity is lower or where natural mortality is high. Cubs of the year have the highest natural mortality rate. For adults, nutritionally related deaths are almost negligible and human-induced deaths are the primary mortality factor (Martinka 1970; Herrero 1982), with the exception of reproducing females in some areas or during periods of low habitat productivity (Knight *et al.* 1986). Occasional accidental deaths for all age classes occur. Most mortality involves the killing of females and cubs by adult males.

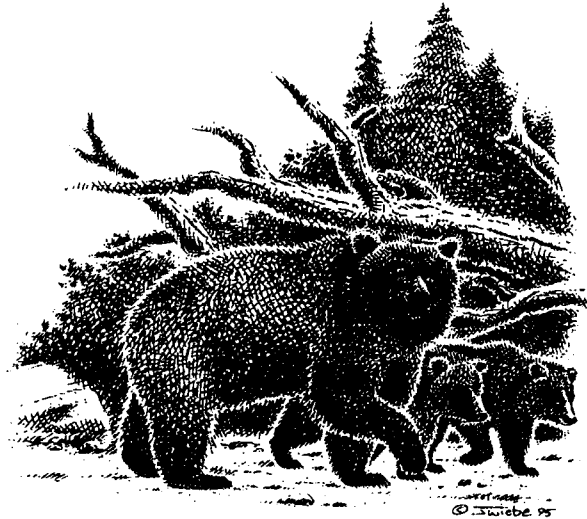
Until 1988, the Wildlife Branch based the annual allowable harvest of grizzly bears on a maximum sustainable mortality of 5 percent of the estimated population. Prompted by concerns of overharvest, a provincial grizzly bear harvest review was conducted in 1989. During 1984 to 1988, 52 of 118 man-

agement units had total kills that exceeded the annual allowable harvest. Cumulative female mortality indicated that overharvests of females had occurred in a number of management units. Area-concentrated kills, especially of females, were also identified. As a result of the review, the following management principles were recommended and adopted as general guidelines:

- ☐ The maximum provincial harvest level should be 4 percent of the total population, including kills from all sources.
- ☐ The maximum sex ratio in the harvest should be no greater than 1 female to 2 males (33 percent females).
- ☐ The unreported kill (natural mortality, accidental, illegal) is included in estimates of the total kill and standardized at 50 percent of the legal kill unless documentation indicates otherwise.
- ☐ Hunting seasons are not permitted in management units that support 25 or less grizzly bears unless such populations are contiguous with larger populations.

Hunting regulations and policy include:

- Cubs, females with cubs, and yearlings (up to two years of age) are protected.
- Baiting is not permitted.
- Hunting is prohibited in all national parks, ecological reserves, and some provincial parks.
- All grizzly bears killed by hunters or in conflict situations must be inspected by a wildlife official to determine sex, size, and age. After the kill date, a hunter has ten days to bring the pelt, evidence of sex, and the skull to a BC Wildlife official for inspection. A tooth is extracted to determine age.



Hunting Statistics

Wildlife Act regulations in British Columbia are administered at the management unit level in seven regions (see Figure 9). Hunting grizzly bears is not permitted in Region 2 (the Lower Mainland), and hunters in the Okanagan subregion are limited to one grizzly per five-year period. Hunting grizzly bears is allowed in 20 of the larger provincial parks, but each of these parks may have its own management regime. Most regions have both spring and fall seasons. The grizzly bear licence fee is \$75 for residents and \$500 for non-residents. Non-residents must be accompanied by a licenced guide-outfitter, unless covered by an "accompany-to-hunt" permit. Guide-outfitters are currently regulated by quotas or by administrative guidelines.

To avoid the impacts of area-concentrated kills, it is not only important to control the size of the harvest, but also its distribution. Limited Entry Hunting (LEH) is the province's lottery system for the allocation of limited hunt-



Region 1: Vancouver Island
 Region 3: Southern Interior
 Region 5: Cariboo
 Region 7: Omineca-Peace

Region 2: Lower Mainland
 Region 4: Kootenay
 Region 6: Skeena
 Subregion (8): Okanagan

Figure 9. Administrative Regions of BC Environment

ing opportunities to residents. LEH requires a great deal of work to allocate permits to hunters. Ongoing inventories and habitat and population assessments are required to enable implementation of this system. Currently, hunting grizzly bears by LEH is implemented in all regions of the province with the exception of portions of the Skeena and Peace-Omineca.

A scientific advisory panel consisting of experts in bear biology and conservation should be appointed to look at the biological aspects of hunting grizzly bears, including issues related to LEH.

Residents have taken 56 percent to 64 percent of the provincial harvest over the past five years. The distribution of the grizzly bear harvest between resident and non-resident hunters (guide-outfitters) is determined in an allocation process between the Guide-Outfitters Association of British Columbia and the BC Wildlife Federation, in consultation with regional Wildlife staff.

Have the restrictions recommended in 1989 had an appreciable effect on the numbers of grizzly bears harvested in the province? This issue is complicated by the fact that not all regions implemented the changes that were recommended. In any event, this question cannot be answered solely on information provided by harvest data. Some of the limitations of harvest data include:

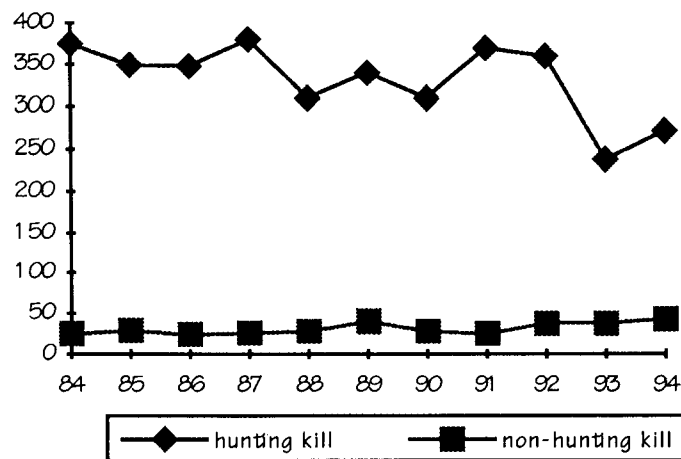
- ☐ *Small sample sizes* — It is not desirable to sacrifice a large number of grizzly bears simply in order to obtain a large sample.
- ☐ *Time lags* — There is a time lag between gathering and analysing data and the opportunity to use it to elicit an effect. Changes are often detected long after the effects have occurred.
- ☐ *Harvest data is acquired from animals that have been killed* — It is not easy or even necessarily desirable to link data acquired from dead animals to a living population. The data does not give a snapshot of the characteristics of a population. The problem lies in extrapolating what a living population is doing on the basis of killed animals. In particular, grizzly bear hunting provides a sample strongly biased toward older male bears.



Harvest statistics are not, in themselves, an indication of the status of a population. Information is also needed on the numbers of bears, their reproductive rate, and their survival rate, especially of cubs. Data can illustrate the occurrence of area-concentrated kills; however, indicated overharvests (anything greater than 4 percent of the population estimate) evident at the gross level of a management unit, ecoprovince, or the province can only indicate that it is possible that localized overharvests may have occurred. We need to examine the distribution of the kill, harvest characteristics (such as age and sex), hunter effort and success, and estimates of the density and productivity of the population because even a "safe" harvest at a gross landscape level can mask area-concentrated kills. It is becoming evident that we need to manage bears more holistically, that is, according to their population requirements and not to administrative management unit boundaries.

Analysis of harvests at the ecoprovince level (Banci 1991) for the years 1985 to 1989 showed that the allowable annual harvest of 4 percent had been exceeded in at least five of the eight ecoprovinces and, in all except one, the annual allowable female grizzly kill had been exceeded throughout most of the five-year period. At the provincial level, the harvest of female grizzlies exceeded 33 percent for 1984 through 1991, but not 1992 and 1993. The 1993 harvest of 238 grizzly bears is the lowest since detailed records have been kept (Figure 10). This low harvest could have been caused by a number of factors, including poor weather conditions and a general trend toward a more conservative approach to harvesting grizzly bears. The 1994 harvest level returned to a more normal provincial average.

Figure 10. BC Grizzly Bear Kills, 1984-1994



Population Estimation: The Fuhr and Demarchi Method

British Columbia is large, but its resources — both natural and financial — are finite. Counting all the individuals of a species or all species of wildlife is not only difficult, it is prohibitively expensive. What wildlife managers attempt to do is relate the relationships between population indicators (such as rich salmon rivers or huckleberry patches, which have good potential to attract and support grizzly bears on a seasonal basis) and numbers of animals determined from a few intensive studies, and then use those relationships and indicators to determine densities of populations in similar habitats elsewhere.

As well, we need to study and determine the impacts of various human activities and environmental changes on grizzly bear populations in different parts of the province (to calculate realistic capability reductions to arrive at population estimates).

A habitat-based approach to estimating grizzly bear populations, primarily for assessing the risks of various land-use activities, was developed (Fuhr and Demarchi 1990). Although it was not an objective, this method gained considerable importance in harvest management of grizzlies and, for that reason, is explained here in detail.

The objective of the Fuhr and Demarchi method was to estimate historic, potential, and current habitat capability for grizzly bears at different map scales. Habitat capability refers to the ability of the land to support grizzlies. This assessment involved a progressive stratification of the landscape from small scale to large scale using ecoregions, biogeoclimatic zones, and biophysical habitat units (that identify successional stages) as the stratification levels. Such a stratification was valuable because of its applicability for all wildlife species, not only grizzly bears.

Why were different map scales used? Small map scales (1:250 000 and 1:500 000) showed general ecological boundaries, ecoregion and biogeoclimatic zones/variants, and may have provided rough carrying capacity estimates for use at regional or provincial planning levels. However, they did not show the extent of specific habitat types important to grizzly bears, such as floodplains or avalanche chutes. Medium map scales (1:50 000 and 1:100 000) provided a more detailed stratification of ecoregion, biogeoclimatic zones/variants, and biophysical habitat units. Biogeoclimatic units also may have been further subdivided according to the importance of such habitat units, indicating the impacts of access and forest harvesting or other human activities.

Similar methods are used for mapping at large map scales (1:20 000 and 1:50 000), although carrying capacity estimates have not been calculated at this level of detail for the province. Large map scales permit habitat units to be given interpretations of potential season of use by grizzly bears and a subjective importance ranking.

To estimate grizzly bear numbers for both medium and small scale mapping, habitat units were ranked according to their potential degree of use as high, medium, low, or nil, depending on how well the habitat met the seasonal needs of grizzly bears and the suspected importance of the habitat in the bears' annual life cycle. The ranking was based on the experience of bear and habitat researchers. The next step was to confirm habitat quality and present use by grizzly bears in representative areas in the field.



The southern Flathead River drainage in southeastern British Columbia, the focus of a long-term telemetry project (McLellan 1989), was chosen as a study area. Relative ratings for habitat units were derived from the project and from discussions with other biologists, and in comparison with other areas (Fuhr and Demarchi 1990). The following ratings corresponded to these habitat potentials: 45 km²/bear - low; 15 km²/bear - medium; 5 km²/bear - high.

Calculations were made for current carrying capacity (by using the present forest succession [seral] state) and for potential carrying capacity (by using the seral state that is optimal for grizzly bears) on three sub-areas of the Flathead project area. Estimates of present carrying capacity compared closely to the population estimates that had been determined by radio-telemetry.

Subsequently, the Flathead Basin (southeastern BC) and the Hart Ranges (northeast of Prince George), were used to develop specific relationships between carrying capacity and ecoregion/biogeoclimatic units so that carrying capacity at small map scales (1:250 000 to 1:500 000) could be estimated without performing a detailed habitat stratification. The carrying capacity estimates for small scale mapping were derived from discussions with biologists and from comparisons with densities determined from intensive studies in other areas. These estimates are: 135 km²/bear - low; 45 km²/bear - medium; 15 km²/bear - high. Small and medium map scales have different relative habitat ratings because of differences in habitat stratification and map detail.

By extrapolating conclusions from the above studies, potential grizzly bear populations were estimated for the province at small map scales (1:500 000). Each biogeoclimatic unit within an ecoregion was ranked as high, medium,

low, or nil, providing a basis for comparing the values of various areas. Field confirmations of the predicted importance of habitat units to grizzly bears were conducted in several areas of the province.

The area of each biogeoclimatic unit was determined and relative carrying capacity for small map scales applied. Estimates of grizzly bear numbers were calculated, as was current potential (capability), or what the habitat is estimated to be capable of supporting today.

Regional wildlife management specialists were asked to estimate current numbers of grizzlies by "stepping down" (reducing estimates) current potential populations, taking into consideration land-use activities such as logging and grazing, cultural activities such as hunting and human/bear conflicts, and the impacts of habitat loss through alienation and fragmentation (Fuhr and Demarchi 1990). There were no clear criteria for this evaluation process because different levels of information had been made available to the regional biologists on the extent of impacts. (This is because in some areas there is considerable detail available about access, habitat uses and effects, and in others very little detail is available.) In essence, although estimates of current potential were based on the available habitat, estimates of current numbers were best guesses based on the experience and knowledge of Wildlife Branch biologists on how the distribution and abundance of grizzlies in their regions had been affected by land uses, hunting, and other human activities. These population estimates are revised as new information becomes available, particularly about bear use of different habitats.

The Fuhr and Demarchi method, in essence, says that where habitat is good, there should be more grizzly bears than where habitat is not as good. The method provided conservative quantitative estimates of grizzly bear densities. These estimates were not meant to derive allowable harvests, although, because of the lack of inventory data, they have been used for this purpose. The method was developed to provide a means of comparing grizzly bear numbers over time and between areas, and to identify areas of concern and potential over-harvesting that needed to be investigated further. Continued comparison of estimates provided by this method against field study will improve the model's estimates for similar areas. Such testing is a high priority for the wildlife research program.

Biological Effects of Hunting

Some researchers believe that hunting, or the selective harvesting of older males, increases cub survivorship because males have a tendency to kill cubs, and sometimes females (Taylor *et al.* 1994). Recently, however, the opposite has been suggested: that hunting grizzlies can lead to population reductions (Wielgus 1993). Wielgus based his hypothesis on two small relatively isolated bear populations: one in the Kananaskis watershed of southwestern Alberta, and the second in the Selkirk Mountains of British Columbia, Washington, and Idaho. The grizzlies in Kananaskis are a hunted population and the assumption was made that those in the Selkirks were not hunted. However, conservative hunting has occurred in the BC portion of the Selkirks.

Wielgus suggested that immigrant subadult males had flooded into the Kananaskis study area because hunting had removed the dominant adult males and the observed low cub litter size of 1.4 was a result of these immigrant males killing cubs. He hypothesized that adult females avoided food-rich habitats occupied by immigrant males, further impairing reproduction and the productivity of the population. A litter size of 2.2 and a higher repro-

Both sexes are vulnerable to hunting in autumn. Grizzly bears are often hunted in conjunction with "big game" species and bears are attracted to the gut piles left by hunters. Technically, hunting over gut piles constitutes baiting, an illegal activity, but enforcement is difficult. An amendment to the regulations to make it an offence to hunt bears by using dead wildlife as bait has been implemented. Illegal and defence of life and property kills are also high in autumn because the presence of carcasses attracts bears and leads to conflicts with people (Banci 1991).



ductive rate was reported for the Selkirk population and was attributed to the lack of trophy hunting in the region, although Wildlife Branch records show that grizzly bear hunting was historically present in this area.

Whether subadult males kill more cubs than do adult males has not been conclusively demonstrated, nor has a negative correlation between hunting and cub survival. There were no observations of sub-adult males killing cubs in the Wielgus (1993) study and, because of small samples and the lack of a truly non-hunted population, results must be interpreted cautiously. The Kananaskis litter size is the lowest reported for grizzly bears, suggesting that some other factor may be involved.

In other studies, there is no proven relationship between hunting and cub survival. There is no clear trend; documented litter sizes and cub survival rates in hunted populations are similar to those in non-hunted populations (Taylor *et al.* 1994). In Alaska, both moderately and heavily hunted populations had similar cub survival and reproductive rates, and no changes in litter size were associated with the period of increasing bear hunting and declining bear density (Miller 1993). Also in Alaska, Reynolds (1989) did not see any changes in cub production or survivorship with increased hunting. There may be, however, some unknown aspects of trophy hunting, such as the possible consequences of "selecting" against "successful" males by removing them from the population.

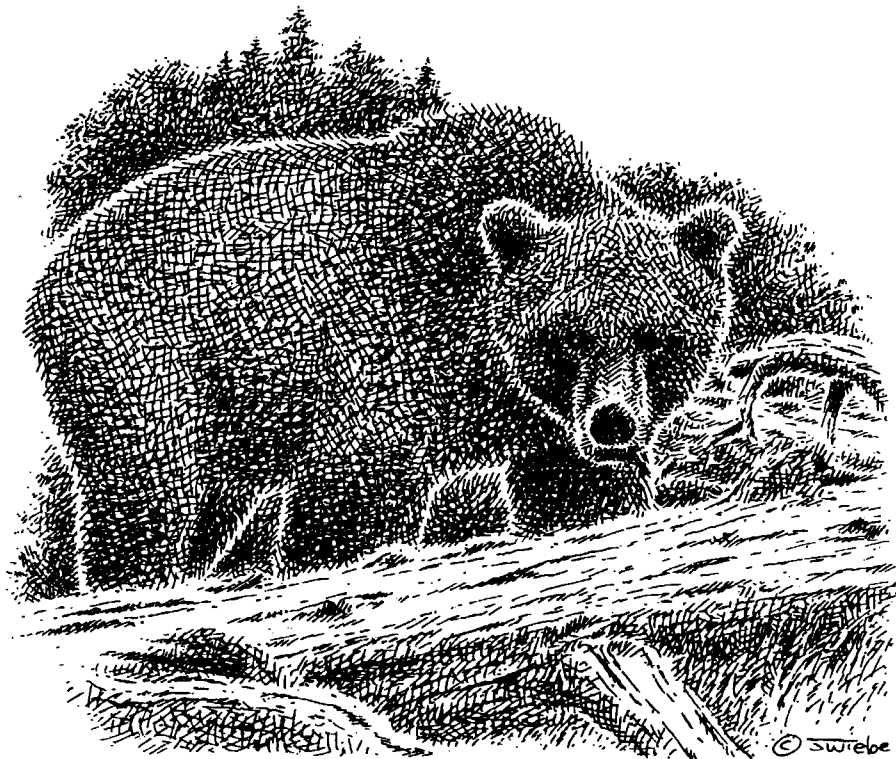
Hunting Seasons

Vulnerability to hunting varies among the sexes and in different seasons. With few exceptions, females are less vulnerable to hunting in the spring. In general, mature males and females without young leave their dens before females with yearlings and two-year-olds. Females with new cubs are the last to leave the dens (Craighead and Mitchell 1982; Pearson 1975). *Wildlife Act*

regulations state that there is no open season on any two-year-old or younger bear, or any bear in its company, thus protecting females with cubs and juvenile bears.

Non-Hunting Kills

Non-hunting kills of grizzly bears, such as by accidents, collisions with road or railway vehicles, kills in defence of life or property, and poaching, have been underestimated in every jurisdiction in western Canada (Banci 1991). Indications are that this mortality can be high. In Alberta during 1972-1987, non-hunting losses were about 32 percent of the total yearly kill (Nagy and Gunson 1989). Estimates of the unreported kill in British Columbia have ranged from 25 percent to 100 percent of the known kill, depending on the area and the extent of access (Banci 1991). In a review of 66 mortalities of marked bears in six study areas in BC and the US, 58 percent were non-hunting kills (McLellan 1990). If the assumption is made that for every two bears legally killed there is at least one unknown or illegal kill, five ecoprovinces were overharvested during the period 1985 to 1989, compared to three ecoprovinces if only legal kills are considered (Banci *et al.* 1994). Increased research with radio-collared bears will help answer some of these questions.



Bear Viewing

Seeing a grizzly in the wild is an experience that most people will cherish their entire lifetimes. British Columbia is in the relatively unique position to provide such an experience in settings where it is safe for both humans and bears. However, viewing bears has special considerations that the viewing of other wildlife does not.



Viewing can have a negative impact on the wildlife being observed. The mere presence of humans in grizzly bear habitat can have an impact on the bears. In general, wild bears that are unaccustomed to humans will avoid people, causing them to temporarily abandon important feeding or denning habitats. If human activity is long term and persistent, it can compromise the bears' survival. Some bears never get used to being observed or disturbed and may return at night or completely abandon favourable denning, resting, or food sites.

Human presence can also have an opposite, but possibly just as damaging, effect. It may cause a bear to lose its natural fear and avoidance of humans. This is termed habituation. Habituated bears are not necessarily also food-conditioned, but because they spend more time in association with humans they are more likely to become food-conditioned (Servheen 1992). A bear may feel secure enough to use otherwise avoided but important feeding sites, such as roadsides or railway tracks and increase the likelihood of it becoming a roadkill. Conversely, habituated bears in remote bear-viewing sites may return to a feeding or denning site. These

habituated bears are no less dangerous to humans. In fact, their proximity to humans increases the possibility of an injury, especially if the humans are careless or if a bear becomes aggressive. Habituation may also make a bear more vulnerable to hunters, and can predispose it to conflict with people elsewhere, making translocation an unsuitable option.

In some parks, grizzlies have become habituated to the mere presence of people hiking, subsequently learning to challenge hikers for their food (Jope 1985; Leonard *et al.* 1990). Human access routes and trails need to be well-planned so they don't impinge on a bear's feeding habitats, resting sites, travel routes, and denning areas.

Grizzly bears at the McNeil River State Game Sanctuary in Alaska have been purposely habituated in order to allow viewing at relatively close range under controlled conditions. Viewing opportunities are awarded through a lottery system; there is a one-in-ten chance of getting the opportunity to view some 65 bears fishing for salmon. The groups of humans are small, their behaviour is tightly controlled by a guide, and they are not allowed to stray from paths. This viewing situation is considered successful (to a large degree) because the habituated bears have not had the opportunity to conflict with humans elsewhere. However, some individual bears avoid the viewing area or seem to exhibit stress behaviours, while others don't seem in the least bothered by the presence of humans.

There is a subtle concern about habituating bears to people. Is a habituated grizzly still a “wild” bear? Do we have any business in changing the behaviour of a grizzly for our own pleasure? There may not be a situation in BC that approximates the conditions at McNeil River, but there are opportunities to view grizzlies in their natural ecosystems. The BC government should emphasize this ecosystem aspect in viewing bears, and discourage the development of specific, intensive viewing sites.

In the Khutzeymateen, a recently declared grizzly bear sanctuary on the coast north of Prince Rupert, BC Parks doesn’t expect the same kinds of pressures from human activity as occur at McNeil in Alaska. The Khutzeymateen is primarily a spring feeding area for the bears, although some denning occurs nearby. Feeding occurs throughout the estuary, so there is no intensive viewing area. Access to the Khutzeymateen will be allowed only in the company of specially licensed guides. The primary management goal is as a sanctuary, not to provide recreation.

Other Issues Regarding Grizzly Bears

Research sometimes causes concerns about its effects on grizzly bears. With current technology, the information to conserve populations can only be collected by intrusive means, such as by capturing, drugging, handling, and marking individuals. Research and immobilisation techniques have improved in recent years and minimize disturbance to the animals; fast-acting drugs with limited duration are now used over older, often dangerous tranquilising drugs. Break-away collars have been designed to fall off after a specified time period and, although they are expensive, satellite collars (monitored by satellite) are available that allow for monitoring without having to follow bears around on the ground. Also, when dealing with small populations of grizzly bears, it may be too risky to immobilise and collar animals.

Poaching and the Trade in Bear Parts

The trade in bear parts, especially gall bladders and paws, has contributed greatly toward the endangerment and extirpation or extinction of many Asian brown and black bear populations. In a survey on the Asian trade in bear parts, Mills and Servheen (1991) reported that traditional physicians considered bear gall bladder to be one of the most powerful medicines to prescribe for chronic diseases of the liver, gall bladder, spleen, and stomach.

Ursodeoxycholic acid (UDCA) is the active ingredient in bear bile. Bears produce this acid in significant quantities (Macdonald and Williams 1985), although it is also found in cow and pig gall bladders. UDCA has been synthesized in a form that is purer and cheaper than bear bile. However, Asian practitioners shun the synthetic version because they do not consider it to be “natural.”

Bear parts from legally killed bears in BC cannot be easily distinguished from those of protected endangered Asian bears. This has caused concern about possible impacts that the legal trade in BC may have on endangered bear populations in Asia. Because of this, and because of increasing evidence of poaching for bear parts here, the BC government banned (in 1993) the possession, trafficking, importation, and export of bear gall bladders and genitalia separated from the carcass or hide. Government has also banned trade in bear paws separated from the carcass or hide. A number of adjacent

jurisdictions have also banned this trade, including Alaska, the Yukon, Alberta, Manitoba, Ontario, Washington, Montana, California, and Oregon.

Although the ban has simplified enforcement, it has not eliminated the trade in bear parts. Covert enforcement investigations indicate that serious traders have gone underground, and that gall bladders are currently reported to be selling for \$1,000 each on the Vancouver market. Six cases are or will be in the courts and some 15 investigations are in progress. The illegal trade in bear — and other wildlife — parts is a highly lucrative business and involves organized criminals. A first offence under the *Wildlife Act* regulations nets the offender a maximum penalty of \$5,000 and/or six months in jail, per infraction. The fine rises to a maximum of \$10,000 for subsequent offences. These are minor deterrents considering the value of one gall bladder and that some traders deal in many items at a time. For example, a recent joint effort involving BC, Manitoba, Alberta, Oregon, and California enforcement agencies resulted in charges to one person who had an inventory of 35 to 40 bear gall bladders - about \$40,000 worth.

The primary target of criminals trading in illegal bear parts in British Columbia is the black bear. The more common reason for illegal killing of grizzly bears is for trophies. Poaching bears, for any reason, is a major concern. Programs such as “Wilderness Watch” and “Observe, Record, Report” allow residents to alert conservation officers to illegal activities. In association with the Canadian Police Research Institute and the BC Environment Enforcement Branch, researchers at Simon Fraser University are investigating the use of entomological forensics to identify and date bear mortalities. The technique has potential for all illegal wildlife kills and will be a tool for the successful prosecution of poaching cases.

Grizzly Bear Predation on Ungulates

Grizzly bear predation on young ungulates (moose, mountain goats, bighorn sheep, deer, elk, caribou) has been identified as a substantial mortality factor in some areas of the Yukon and Alaska. The position of the BC government is that grizzly bear numbers will not be reduced to increase ungulate survival.

People and Grizzly Bears Living in Harmony

The third goal of the Provincial Wildlife Strategy is mirrored in the conservation of grizzly bears by the following three primary issues:

1. prevention of conflicts between people and grizzly bears
2. education and information, communication, and consultation
3. international cooperation, shared populations

People in Conflict With Bears

Garbage Management

It takes little effort to convert a wilderness grizzly bear into a garbage-conditioned bear. The term “problem bear” erroneously places the blame on the bear when the problem is caused by people. Therefore, the onus for correction must be placed on people.

A garbage-conditioned bear is a doomed bear.

The association between human food and humans may be remembered for life (Herrero 1985). Poor garbage and human food management has a number of impacts on bears and on humans:

- ☐ Bears may become predisposed to aggressive or “nuisance” behaviour.
- ☐ The potential for illegal kills increases because of the accessibility of bears at garbage dumps.
- ☐ The health of grizzlies may be compromised through direct injury from broken glass and sharp objects, the consumption of toxic materials (plastic, petroleum products, medicines, chemicals), and tooth decay (Smith and Lindsey 1989).
- ☐ There is increased potential for human injury, death, and litigation because of poorly managed dumps and landfill sites.
- ☐ The costs, both in terms of tax dollars and to bears, of dealing with conflict bears are high.
- ☐ Viewing bears at dumps does not foster positive public attitudes. It does not contribute towards public education.

Prior to 1970, human food- and garbage-conditioned grizzlies accounted for the majority of bear-inflicted injuries to people in North America (Herrero and Fleck 1990). Garbage dumps that have had chronic grizzly bear conflicts include New Aiyansh, Mackenzie, Elkford, Revelstoke, Terrace, Stewart, and Kitimat, among others. In addition, there are a multitude of small, local dumpsites where frequent conflicts have occurred.

Conflict occurs wherever garbage and bears converge. The BC Forest Service manages some 1,300 recreation sites and 5,000 km of trails in backcountry and wilderness settings. Many of these sites are at lakes or along streams

where cleaning fish attracts bears. Waste bins in provincial parks and at highway rest stops are also points of potential conflict.

During the period 1989 to 1993, an average of 20 grizzly bears were destroyed each year because of conflict with humans. During the same time period, an average of 384 black bears were killed. The only message that can be delivered about the impact of human food and garbage on bears is this:

By not managing our garbage, we kill bears!

Every person who contributes to habituating bears by feeding them, by leaving garbage at campsites or along the road, by not handling food properly, by not taking care of fruit trees, pet foods, barbecues, or other attractants around the home or farm, is responsible for the loss of bears.

There have been notable improvements in the management of waste since 1980, including new equipment for hikers, better equipment and management methods at permanent and semi-permanent industrial camps and farms, and large-scale incinerators and electric fences (Banci 1991). There is no need to continue the habituation of bears to our garbage.

Translocation

During the period from 1989 to 1993, an average of 21 grizzly bears were translocated annually in BC. Prior to 1991, a yearly average of 80 black bears were translocated; this tripled by 1992 to a yearly average of 245.

Ministry policy allows for the translocation of grizzly and black bears only when there is a high probability of survival. Bears that have been habituated to people or to garbage are not good candidates for translocation because they will continue to search out this source of food. Injured bears, juvenile bears, and bears that pose a danger to humans are also not good candidates.

Translocating grizzly bears is expensive. Provincially, between 11 percent and 15 percent of the budgetary and time allocations for conservation officers involve dealing with conflict bears. Each translocated bear requires a minimum of three conservation officer-days and costs an average of \$1,800 to move. Moving bears by helicopter costs much more. When dealing with large, dangerous animals, there is always the possibility of injury to humans.

Translocation may be an appealing option, politically and publicly, but not all bears can be moved successfully. Success means much more than that the bear does not return to the same area to cause problems. It means the bear has adapted to its new surroundings, has learned to forage successfully, doesn't get killed or displaced by resident bears, and is able to reproduce successfully. Lack of funding and qualified personnel for collaring and monitoring programs has prevented the Wildlife Branch from determining when and where translocation is a successful practice.

Education, Information, and Consultation

Bear Safety

Bears have long been perceived as dangerous and undesirable. But what are the odds of being attacked by a grizzly bear? Each year in British Columbia, 30 to 40 people die from boating accidents, 250 to 300 from accidental falls, 6 to 13 from extreme cold, 2 to 6 from exposure, and 40 to 60 from drowning. It doesn't matter to most people that there is a greater chance of being killed by any of these causes than by being attacked by a bear. The perceived threat fosters high levels of intolerance and leads to the death or removal of grizzlies. "Peaceful coexistence" can occur between humans and grizzlies. It does, however, require us to develop a greater tolerance for grizzly bears.

Between 1978 and 1994, there were 27 attacks on people by grizzly bears in British Columbia, resulting in two deaths (Table 4). Black bears (*Ursus americanus*) have attacked 71 people, resulting in nine deaths. Many of the attacks by grizzlies were provoked and resulted from bears protecting cubs or food, from bears being surprised, or from bears being wounded and subsequently injuring a hunter. In a few cases, the reason for the attack was unknown.

Table 4. Incidence of attacks by grizzly bears and black bears in British Columbia, 1978 to 1994.

Years	Grizzly Bear		Black Bear	
	# people killed	# people injured	# people killed	# people injured
1978-82	1	8	2	22
1983-87	1	6	4	26
1988-94	0	13	3	23
Totals	2	27	9	71

To change our attitude, we need to learn more about the great bears. Many suburban British Columbians would be surprised to learn how close grizzly bears live to some of our towns and cities. The fact that a bear passes through an area does not mean that it will become a problem. It may live there, or it may be foraging while passing through the region.

The reality, however, is that we still have high numbers of conflict bears. The encroachment of humans into bear country and the increased loss of grizzly bear habitat for our own purposes brings us into conflict with bears more and more often. Grizzly and black bears are dangerous, and must be treated with respect. The current situation demands that we develop a more comprehensive bear safety program to be implemented province-wide.

A successful information and education program should be targeted to specific groups of people, whether they are hikers, urban residents, industrial or research users of backcountry, or hunters. There should also be a strong component for students, especially school children at the elementary level. In areas where bear/human conflicts are relatively common, these programs

should be delivered in such a way that the entire community is aware of who has local responsibility for administering the programs, such as a person hired specifically for community liaison or the local conservation officer.

Public Consultation

A major component of a successful strategy is effective public information and education. Public input through review of this document and as ongoing comment to a scientific advisory panel will help ensure effective communication.

First Nations — Input from First Nations communities should be solicited throughout many of the above programs and processes. Representatives from First Nations communities and organizations will be invited to participate in the decision-making.

More needs to be known and understood by non-natives about the cultural, traditional, and historical values of grizzly and black bears to British Columbia's first peoples. Consultation with First Nations groups will help to better understand these values and communicate this knowledge to the wider public to increase understanding throughout the province.

General Public — Grizzly bear conservation strategies should be integrated with many of the current resource management and land use planning initiatives (e.g., PAS, Land and Resource Management Plans (LRMP), Timber Supply Area [TSA] reviews), all of which have a public component.

Advisory Panel — A provincial Grizzly Bear Conservation Advisory Panel should be set up to invite representation from First Nations, the scientific community, conservation organizations, and the general public. All interested members of the public should be invited to review and comment on the grizzly bear conservation strategy.



Those who have packed far up into grizzly country know that the presence of even one grizzly on the land elevates the mountains, deepens the canyons, chills the winds, brightens the stars, darkens the forests, and quickens the pulse of all who enter it. History will judge our civilization not only by our pyramids and cathedrals, social programs and legislatures, judicial codes and symphonies, but also by our stewardship of the earth.

Paraphrased from John A. Murray, 1992. *The Great Bear*. Alaska Northwest Books, Seattle/Anchorage.



International Strategy

The eyes of the world will be on British Columbia's grizzly bear management program. In addition to the high international profile of our grizzly populations, these animals are listed in Appendix II of the Convention on International Trade of Endangered Species (CITES). CITES governs the movement of endangered species and wildlife parts (including live animals, ivory, rhino horn) across international borders and brings pressure to bear on jurisdictions that ignore this worldwide crisis.

Only in the last 20 years have significant efforts been directed toward grizzly bear conservation. These efforts have occurred primarily in the United States, where the species is listed as threatened under the US *Endangered Species Act*. The (US) Interagency Grizzly Bear Committee (IGBC) has the lead role in recovering grizzly bear populations in the lower 48 states. However, it is recognized that recovery in the contiguous US and on the eastern slopes of Alberta's Rocky Mountains is contingent on the continued existence of grizzly bears and their ecosystems in British Columbia.

Unless management efforts are undertaken at geographical scales comparable to those used by grizzlies, they will fail because the ecological needs of grizzly bears will not be met. The conservation of large carnivores in North America, including grizzlies, requires the cooperation of all jurisdictions in which they occur. The problem in achieving this type and level of coordinated activity is that there are no administrative mechanisms in place to support them. A continent-wide approach is essential for the long term security of grizzlies in North America.

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