BRITISH COLUMBIA
MINISTRY OF WATER, LAND AND AIR PROTECTION - 2002

Environmental Indicator: Wildlife Populations in British Columbia

Primary Indicator: ***Percentage of historical range where selected wildlife populations are extirpated or declining in British Columbia.***

Selection and Use of Indicator: The percentage of historical range where a selected wildlife population is declining or extirpated is a *state* or condition indicator. It shows the current status of species. For this indicator, three species were selected for which good trend information is available and for which the collective distribution covers a range of terrestrial habitats: Grizzly Bear, Woodland Caribou, and Columbian Sharp-tailed Grouse.

Data and Sources:

Table 1. Percentage of total historical ranges in which species are extirpated, declining, stable or increasing.

	Population Status or Viability: Area (km2)					Population Status or Viability: % Historic Range			
Species	Increasing	Stable	Declining	Extirpated[2]	Historic range (total)	Increasing	Stable	Declining	Extirpated
Caribou[1]	0	107,483	74,792	204,718	654,926	0	16	11	31
Columbia Sharp-tailed Grouse	0	92,230	30,210	34,698	157,138	0	59	19	22
	Excellent	Good	Threatened[3]	Extirpated	Historic range (total)	Excellent	Good	Threatened	Extirpated
Grizzly Bear	451,472	219,869	72,127	98,254	841,722	54	26	9	12

Source: Ministry of Water, Land and Air Protection, 2002.
Notes: [1] For caribou populations, the numbers of 'Increasing', 'Stable', 'Declining' and 'Extirpated' do not add up to the total historic area, because there are several caribou sub-populations for which the status is unknown (accounting for approximately 114,000 km^2), as well as an additional 154,000 km^2 where caribou occur sporadically.
[2] 'Extirpated' includes 9,094km^2 on the Queen Charlotte Islands that was the range of the Dawson Caribou subspecies, extinct since 1910.
[3] For Grizzly Bear populations, 'Threatened' includes both 'Poor' and 'Fair' population viability classes.

Methodology and Reliability: The methods for collecting data on these three species are described in detail under the individual secondary measures (below). The trend data used in these measures are extrapolated from surveys, where available, or estimated from local knowledge and ancillary information collected by regional wildlife staff. Population

status information was compiled for sub-populations or provincial ecosections as defined in Demarchi (1993).

References:

Demarchi, D. 1993. *Ecoregions of British Columbia*. British Columbia Ministry of Environment, Lands, and Parks. Victoria, BC.

Secondary Measure: ***Grizzly Bear population viability by population units.***

Selection and Use of Indicator: The Grizzly Bear (*Ursus arctos horribilis*) is a species of both national and international significance. While not an endangered species, the Grizzly Bear is under pressure from human activities. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated this as a species as Special Concern in Canada and the Conservation Data Centre has placed it on the provincial Blue list for species of conservation concern.

Grizzly Bears are a subspecies of the Brown Bear, which continues to have the widest distribution of any species of bear in the world. Due to a number of factors, Brown Bears have disappeared from much of their former range in North America, Europe and Asia. In Canada, Grizzly Bears once occurred from the Pacific coast east to Manitoba and north through the Territories. They are now primarily restricted to the Rocky Mountains and areas to the west, northern Alberta, and the Territories. British Columbia accounts for half of the Canadian Grizzly Bear population and one-quarter of the North American population.

The provincial government launched the Grizzly Bear Conservation Strategy in 1995 to ensure that Grizzly Bears and the ecosystems they depend upon are maintained over the long-term.

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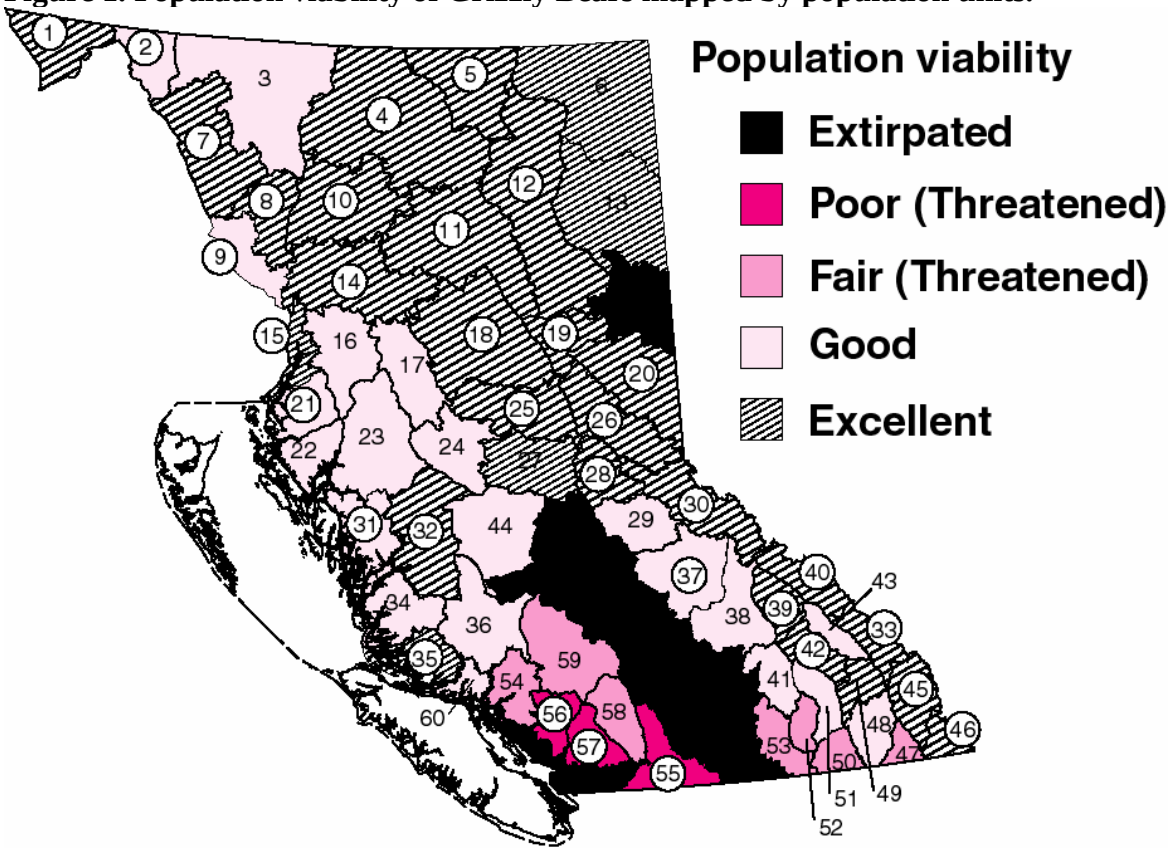
Data and Sources:

Figure 1. Population viability of Grizzly Bears mapped by population units.



Source: Ministry of Water, Land and Air Protection, 2002. Population units and corresponding map numbers are listed below. For size of population units, see **Appendix A**.

1	Tatshenshini	16	Cranberry	31	Kitlope-Fiordland	46	Flathead
2	Tagish	17	Babine	32	Tweedsmuir	47	Yahk
3	Cassiar	18	Omineca	33	Rockies Park Ranges	48	South Purcell
4	Muskwa	19	Moberly	34	Kwatna-Owikeno	49	Central Purcell
5	Hyland	20	Hart	35	Kingcome-Wakeman	50	South Selkirk
6	Taiga	21	Khutzeymateen	36	Klinaklini-Homathko	51	Central Selkirk
7	Taku	22	North Coast	37	Wells Gray	52	Valhalla
8	Edziza	23	Bulkley-Lakes	38	Columbia-Shuswap	53	Kettle-Granby
9	Lower Stikine	24	Francois	39	North Selkirk	54	Toba-Bute
10	Spatsizi	25	Nation	40	Central Rockies	55	North Cascades
11	Finlay-Ospika	26	Parsnip	41	Central Monashee	56	Squamish-Lillooet
12	Rocky	27	Nulki	42	North Purcell	57	Garibaldi-Pitt
13	Alta	28	Bowron	43	Spillamacheen	58	Stein-Nahatlatch
14	Upper Skeena-Nass	29	Quesnel Lake North	44	Blackwater-West Chilcotin	59	South Chilcotin Ranges
15	Stewart	30	Robson	45	South Rockies	60	Knight-Bute

Methodology and Reliability:

Grizzly Bear Population Units (GBPU): These are based on ecological characteristics of the landscape captured in the hierarchical classification system of ecoregions (Demarchi 1993) and further defined by natural or human-caused barriers such as mountain ranges, waterbodies, highways, and areas of intensive human development.

Viability Class: Each GBPU is assigned to a viability class. Viability is defined as the difference between the current population estimate and the estimated population that could be supported under ideal conditions (referred to as habitat capability). For example, populations with few animals compared to the estimated number that the area could sustain under ideal conditions would have a lower viability class than those whose present population estimate is closer to the habitat capability of the area. Viability can be reduced by habitat impacts or unsustainable human-caused mortality.

Each GBPU in the province has also been assigned a conservation status of either Threatened or Viable. The assigned status relates to the Viability Class. The following table shows the relationship between the viability class, the population estimate and the conservation status of GBPUs.

Table 2. Relationship between grizzly bear populations estimates, viability classes, and conservation status.

Population Estimate	Population Viability Class	Conservation Status
75–100% of minimum habitat capability	Excellent (A)	Viable
50–<75% of minimum habitat capability	Good (B)	Viable
25–<50% of minimum habitat capability	Fair (C)	Threatened
1–<25% of minimum habitat capability	Poor (D)	Threatened
0% of minimum habitat capability	Extirpated (X)	Extirpated

Source: Ministry of Water, Land and Air Protection, 2002.

Population Estimates: A population estimate is required to assign a viability class and conservation status to GBPU. Estimating the number of Grizzly Bears in a population is difficult because they occur at low densities, they use forested habitats and they tend to be solitary. Despite these challenges, recent population densities have been determined over an increasing portion of British Columbia through intensive inventory and research work (McLellan 1989, MacHutchon et al. 1993; Strom et al. 1999; Woods et al. 1999; Boulanger 2000; Boulanger 2001; Boulanger and Himmer 2000; Mowat and Strobeck 2000; Poole et al. 2001). New inventory information has allowed the refinement of viability estimates over the years. Although it would be expensive and time consuming to collect scientifically valid Grizzly Bear inventory data for all areas of the province a methodology, called the “Step-down model” was developed to calculate habitat capability.

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Step-down model for estimating Grizzly Bear populations

The model extrapolates population estimates from areas of known density based on an understanding of Grizzly Bear habitat use and human impacts on Grizzly Bear populations. It uses the Fuhr-Demarchi method (Fuhr and Demarchi 1990) to provide an estimate of the number of bears in an area based on its habitat capability. The Fuhr-Demarchi result is then modified using a "step-down" model that reduces the estimated population size based on a consideration of the impacts from various human activities. The following describes each of the four steps applied:

1. Determine the habitat capability of the area. Habitat capability is the number of bears that a given area would be expected to support under ideal conditions. Within an area, habitat capability is based on the assignment of habitat capability classes to each local habitat type and then multiplying the area of each habitat type by the densities associated with the habitat capability class. The habitat-specific densities used are based on a comparison with places in the province where grizzly bear density has been estimated through research and inventory.

2. Determine the habitat suitability of the area. Habitat suitability reflects the reduction in habitat capability from both direct habitat loss (caused by urban development, agriculture, roads, recreational facilities, mines, settlements, and garbage dumps) and habitat alteration (caused by such factors as forestry, grazing, and fire suppression).

3. Determine habitat effectiveness. Habitat effectiveness is a measure of habitat degradation, through habitat displacement and fragmentation, that reduces the number of bears that can be supported in the area. Habitat displacement results from disturbance to surrounding areas associated with roads and other human activities. Habitat fragmentation results from the division of the landscape into smaller, more isolated and less useable pieces through factors considered under habitat loss, alteration and displacement.

4. Determine human-caused mortality. This mortality reflects the loss of animals from the population over a minimum of the past 20 years due to human-bear interactions. Causes of mortality include poaching, human-bear conflicts, road and train kills, and hunting.

The magnitude of each impact was estimated from analysis of detailed maps and local knowledge of each area. The validity of the final population estimate depends on the availability of sufficient information about the habitat, habitat impacts and mortality to be able to assign appropriate numerical values. Every effort was made throughout the process to ensure that the resulting estimated population size is conservative in order to guard against overestimates.

Grizzly Bear Inventory Techniques

There are two main field research techniques used in BC that provide information about Grizzly Bears. Radio-telemetry gives detailed information about movements, reproduction, survival rates, habitat use and responses to human activities. DNA mark recapture provides information for population estimates and densities, as well as genetic data that can be used to examine gene flow among populations.

1. Radio Telemetry: This involves fitting a captured bear with a radio transmitter so the bear can be tracked over time. Information on animal movements and habitat use obtained from radio-telemetry studies help establish habitat capability rankings and densities for the Fuhr-Demarchi method. Although radio-telemetry studies are expensive, time consuming and cause some stress to study animals, they are a reliable source of useful data. Telemetry studies also provides an array of additional information, such as individual body measurements and condition, responses to human disturbance, reproductive and survival rates, and causes of mortality.

2. DNA mark-recapture: Mark-recapture techniques investigate the properties of a wildlife population by examining the properties of a marked sample of that population (Caughley 1977). Marked individuals can be identified in future capture efforts. There are numerous mathematical models that use the number of animals marked and the number of animals subsequently recaptured to estimate population size. Depending on the marking technique and the application, other information such as movements, dispersal patterns and mortality may also be estimated.

   DNA-based mark-recapture holds promise as a tool for estimating population sizes for many large mammals, including Grizzly Bears (Mowat and Strobeck 2000). Unlike most mark-recapture techniques, the DNA-based approach is non-invasive because the animals do not need to be caught. Hair is passively collected as bears brush their bodies along wire placed at hair collection stations in their habitat. The "mark" in this method is the unique DNA characteristics of each bear, evidenced in the hair sample. The number "marked" and the number whose hair samples are collected again are inputs to a model to estimate population size. Using this technique allows many more individuals to be tracked than using invasive capture techniques, however it can be difficult to obtain representative hair samples for a population of bears. This can lead to violation of the assumptions upon which the population model is based and compromise the resulting estimates. Further, it has been found that if there is low genetic variation within a population, there is the possibility of mis-identifying individuals, which would directly affect the resulting population estimate.

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Secondary Measure: ***Change in demographic trends of Caribou in British Columbia.***

Selection and Use of Indicator: The Caribou of North America belong to a single species (*Rangifer tarandus*), with four living subspecies and one extinct subspecies. Only one subspecies, the Woodland Caribou (*R. t. caribou*), currently lives within British Columbia. It is classified into three ecotypes (mountain, northern, and boreal), based on behavioural and ecological characteristics. Mountain Caribou are found within the 'Interior Wet Belt', primarily in the Cariboo, Selkirk, Purcell and Monashee Mountains of southeast BC (herds 1-12 on map in Figure 2.). The Northern Caribou in BC are found from the Yukon Border to the Western Chilcotin and east to the foothills of the Rocky Mountains (herds 13 to 40 on map). Boreal Caribou are found in northeastern British Columbia. Herds and ranges of this ecotype are less defined (see range on map).

Woodland Caribou herds 1 to 23, 40 and the Boreal eco-type have been designated as Threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). An extinct subspecies, the Dawson Caribou (*Rangifer tarandus dawsoni)*, was formerly found only on the Queen Charlotte Islands, but has been extinct since 1910 (Banfield 1974).

Mountain Caribou

There are only 1,900 animals belonging to the Mountain Caribou ecotype remaining in BC. This estimate is reduced from the 2000 estimate of 2,300 animals. This represents almost the entire global population of this ecotype, which has been placed on the provincial Red-list of Threatened species by the BC Conservation Data Centre and deemed Threatened by COSEWIC.

Mountain Caribou are dependent upon arboreal lichens for food during winter months. Adequate supplies of arboreal lichens grow only in old-growth forest, which have been fragmented and reduced in range by industrial logging. Based on habitat suitability and capability mapping, it is estimated that Mountain Caribou are now extirpated in 43% of their historic range. The province is currently developing a Mountain Caribou Recovery Plan with the vision "to enhance and maintain these caribou and their habitat in perpetuity throughout British Columbia's Mountain Caribou range." Current knowledge suggests that the long-term persistence of Mountain Caribou will depend upon maintaining a perpetual supply of large, contiguous areas of suitable summer and winter habitat, with little or no human disturbance so that caribou can spread out and avoid predators.

Northern Caribou

The population of the Northern Caribou ecotype in BC is estimated to be approximately 15,700 animals. Northern Caribou are dependent on an adequate supply of terrestrial or ground lichens for food during winter months. These caribou winter on windswept alpine slopes or in old, pine-dominated forests at lower elevations where they can dig, or "crater", through shallow snow to feed on the lichens. There is mounting concern over the quality and size of these habitats in the face of human activities such as logging. As with Mountain Caribou, long-term survival will depend on maintaining a perpetual supply of large contiguous areas of suitable summer and winter habitat, with little or no vehicle access and human disturbance. Recently, COSEWIC listed northern caribou herds 13 to 23 and 40 as nationally Threatened, and a recovery plan will be prepared for these caribou.

Boreal Caribou

Boreal Caribou range through northeastern BC and the adjoining wilderness of northern Alberta, Northwest Territories and the Yukon, extending eastward through northern portions of the prairie provinces, Ontario, Quebec and Newfoundland. Herds and ranges are not well understood. In BC, these caribou appear to live in small dispersed bands throughout the year. COSEWIC has also recently listed these animals as Threatened and a national recovery team has been formed to develop a recovery plan.

This indicator looks at the 42 herds of Northern and Mountain caribou in BC, as well as the range of the Boreal ecotype and the former range of the extinct Dawson Caribou subspecies. The Mountain, Northern and Boreal ecotypes are classified by demographic trend as 'Decreasing', 'Stable' or 'Unknown'. There is only one herd (Itcha-Ilgachuz) in British Columbia that is known to have increased over the past 5 years, although recent demographic data from the Chase herd suggest it may have increased also. For the purpose of this document, both herds are considered stable at this time. Herd size, associated threats, and COSEWIC rating for all herds are given in **Appendix B**.

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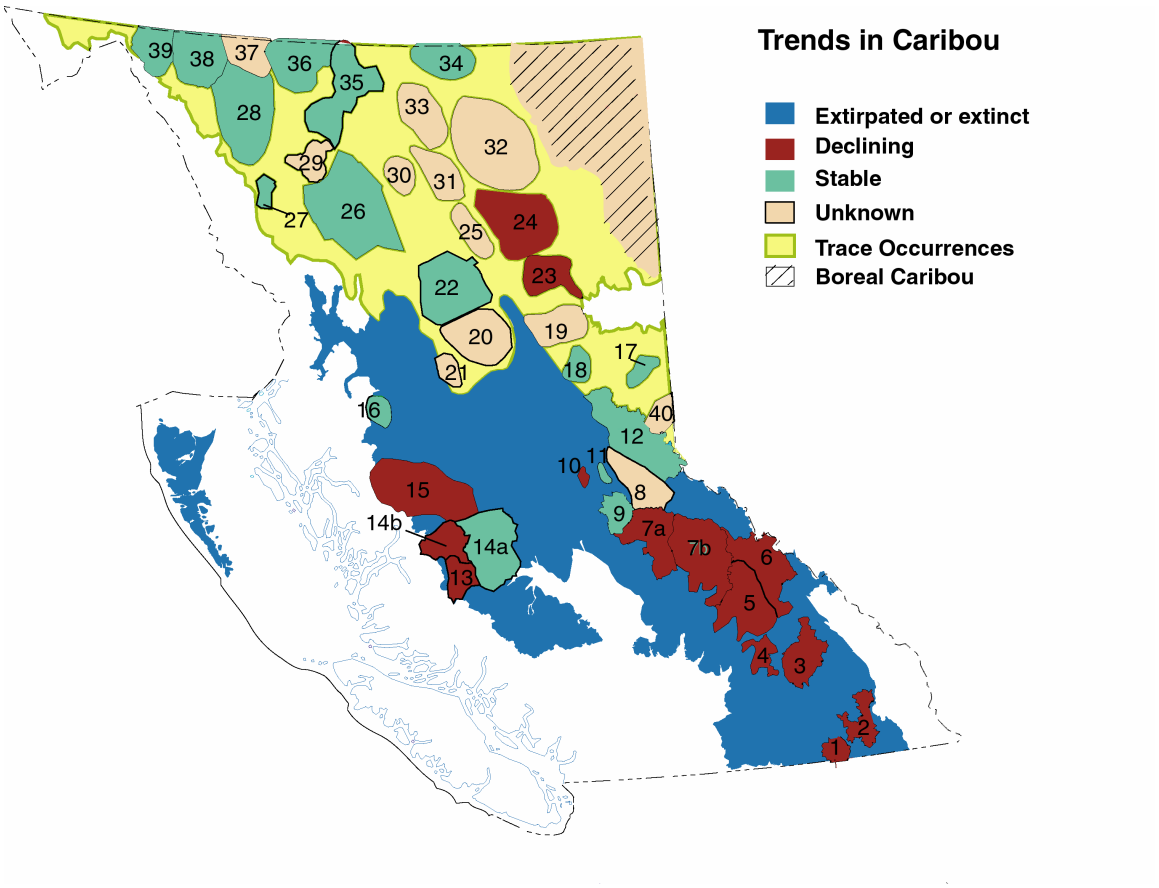
Data and Sources:

Figure 2. Demographic trends of Caribou in British Columbia.



The Queen Charlotte Islands are the range of the extinct Dawson's Caribou subspecies. The remainder of the map shows the status of 3 eco-types of the Woodland Caribou subspecies.
Note: The Itcha-Ilgachuz herd has increased over the past 15 years, as well as the last 5 years. Survey data are inconclusive whether the herd is increasing at this time. The Chase herd has been estimated as stable to increasing based on demographic analysis of calf recruitment and adult survival rates.
The stippled area is the range of Boreal caribou. Northern and Mountain Caribou herds ("N" and "M" respectively) are labeled as follows:

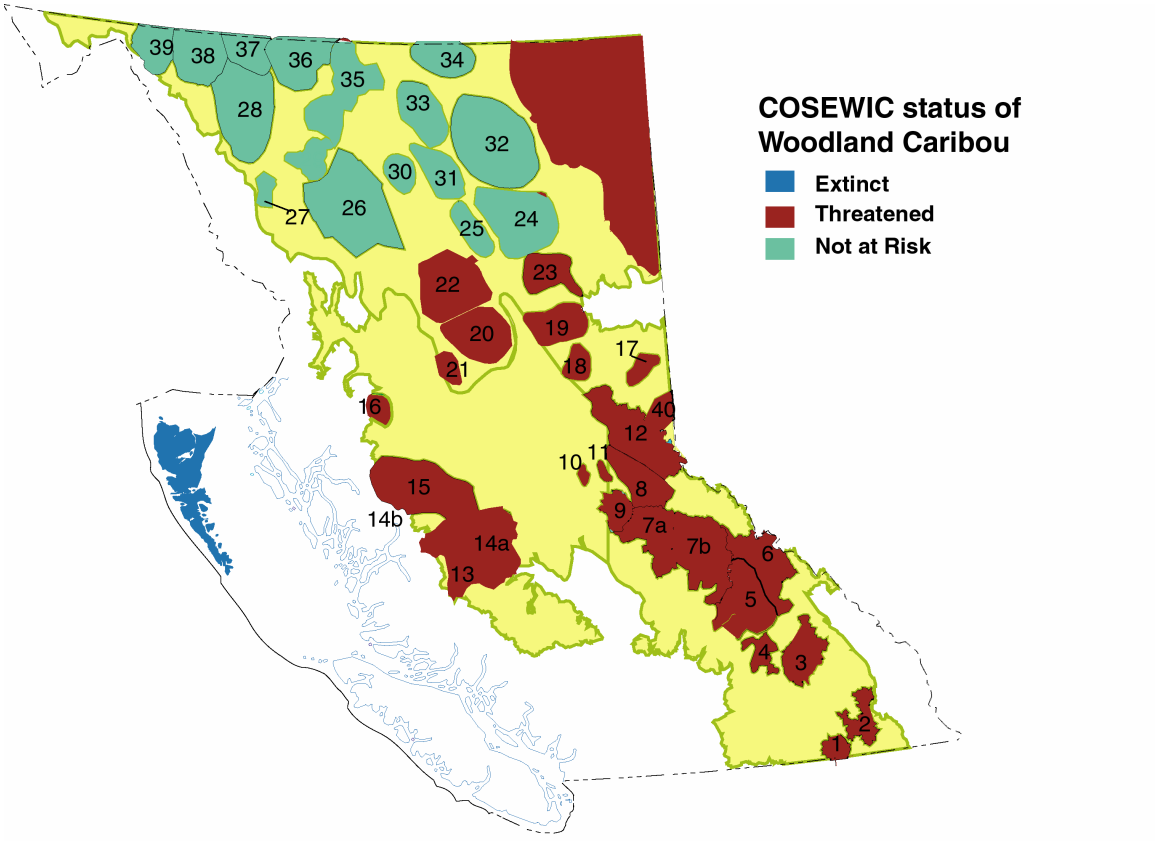
herd #	Eco-type	Herd Name	herd #	Eco-type	Herd Name	herd #	Eco-type	Herd Name
1	M	South Selkirks	14a	N	Itcha-Ilgachuz	27	N	Edziza
2	M	South Purcells	14b	N	Rainbows	28	N	Level-Kawdy
3	M	Central Selkirks	15	N	Tweedsmuir -Entiako	29	N	Tsenaglode
4	M	Monashee	16	N	Telkwa	30	N	Frog
5	M	Revelstoke	17	N	Quintette	31	N	Gataga
6	M	Central Rockies	18	N	Kennedy Siding	32	N	Muskwa
7a	M	Wells Gray North	19	N	Moberly	33	N	Rabbit
7b	M	Wells Gray South	20	N	Wolverine	34	N	Liard Plateau
8	M	North Cariboo Mtns.	21	N	Takla	35	N	Horseranch/Cry
9	M	Barkerville	22	N	Chase	36	N	Little Rancheria

10	M	George Mtn.	23	N	Graham	37	N	Jennings
11	M	Narrow Lake	24	N	Pink Mtn.	38	N	Atlin East
12	M	Hart Ranges	25	N	Finlay	39	N	Atlin West
13	N	Charlotte Alplands	26	N	Spatsizi	40	N	Belcourt

Source: Ministry of Water, Land and Air Protection, Biodiversity Branch, 2002.
Notes: M = Mountain Caribou; N = Northern Caribou. The stippled area is range of Boreal caribou.

Many populations of Woodland Caribou in British Columbia are considered threatened by COSEWIC (Figure 3). COSEWIC does not list individual herds but rather lists on the basis of large ecological areas. All of the caribou in the Southern Mountains National Ecological Areas, which occupies the lower two-thirds of BC, are listed as Threatened, as are all of the Boreal Caribou in Canada.

Figure 3. Committee on the Status of Endangered Wildlife in Canada status of caribou in British Columbia.



Northern and Mountain Caribou herds ("N" and "M" respectively) are labeled as follows:

Herd #	Eco-type[1]	Herd Name	herd #	Eco-type	Herd Name	Herd #	Eco-type	Herd Name
1	M	South Selkirks	14a	N	Itcha-Ilgachuz	27	N	Edziza
2	M	South Purcells	14b	N	Rainbows	28	N	Level-Kawdy
3	M	Central Selkirks	15	N	Tweedsmuir -Entiako	29	N	Tsenaglode
4	M	Monashee	16	N	Telkwa	30	N	Frog

5	M	Revelstoke	17	N	Quintette	31	N	Gataga
6	M	Central Rockies	18	N	Kennedy Siding	32	N	Muskwa
7a	M	Wells Gray North	19	N	Moberly	33	N	Rabbit
7b	M	Wells Gray South	20	N	Wolverine	34	N	Liard Plateau
8	M	North Cariboo Mtns.	21	N	Takla	35	N	Horseranch/Cry
9	M	Barkerville	22	N	Chase	36	N	Little Rancheria
10	M	George Mtn.	23	N	Graham	37	N	Jennings
11	M	Narrow Lake	24	N	Pink Mtn.	38	N	Atlin East
12	M	Hart Ranges	25	N	Finlay	39	N	Atlin West
13	N	Charlotte Alplands	26	N	Spatsizi	40	N	Belcourt

Source: Ministry of Water, Land and Air Protection, Biodiversity Branch, 2002.
Notes: M = Mountain Caribou, N = Northern Caribou. The stippled area is range of Boreal caribou. Herd size, and associated threats, and COSEWIC rating for all herds are available in **Appendix B**.

Threats to Woodland Caribou in British Columbia

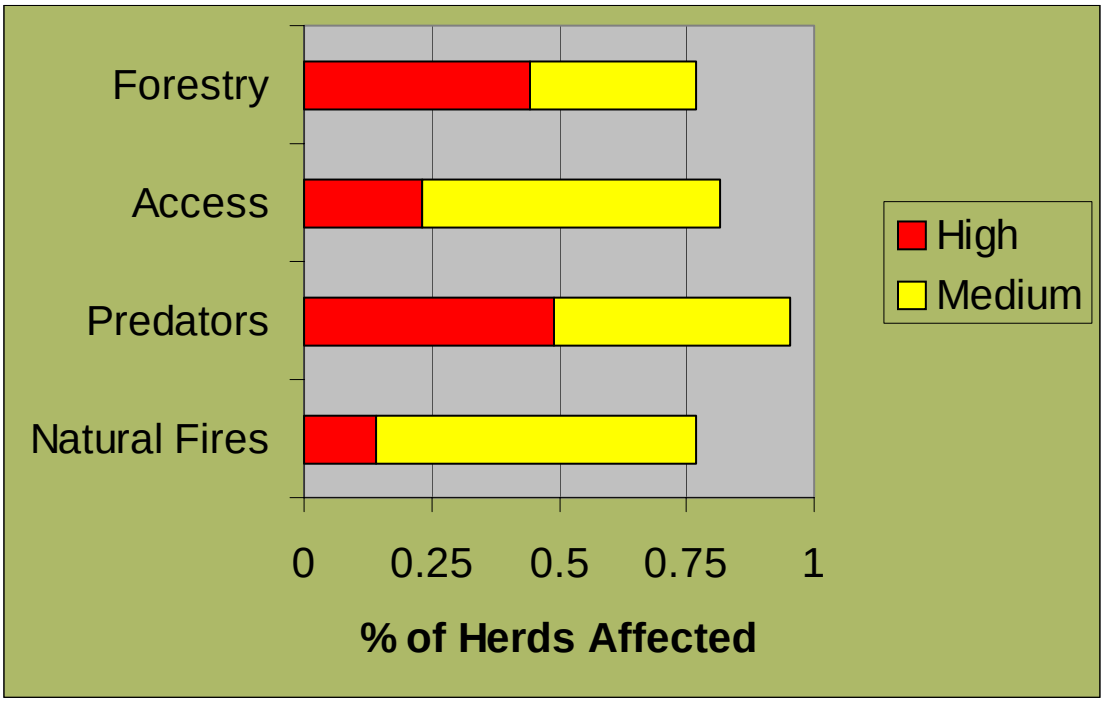
Threats to Woodland Caribou include predation (by wolves, cougars), industrial development (logging, mining, oil and gas extraction, and road building activities), and recreation (snowmobiling, heli-skiing). These can affect caribou directly, by decreasing their fitness as a result of stress, and indirectly, by decreasing the suitability of the ecosystems upon which caribou depend. The importance of different threats (High, Medium, Low) have been qualitatively assessed for each herd and summarized in Table 3. The relative magnitude of different threats, measured in the numbers of herds where threats were considered of High or Medium importance, is shown in Figure 4. Detailed information for each herd is available in **Appendix B**.

Table 3. Number of caribou herds for which selected threats are of High, Medium and Low importance in British Columbia. Row percentages shown in ( ).

	Number of herds by importance of threat		
Threats	**High**	**Medium**	**Low**
Forestry	19 (44)	14 (33)	10 (23)
Predation	21 (49)	20 (47)	2 (5)
Access	10 (23)	25 (58)	8 (19)
Natural Fires	6 (14)	27 (63)	10 (23)

Source: BC Ministry of Water, Land and Air Protection, Biodiversity Branch 2002.
Note: Boreal caribou are counted as one herd.

Figure 4. Relative magnitude of different threats to Woodland Caribou in British Columbia based on Table 3.



Notes: Colours indicate proportion of herds where the threat was identified as Medium or High importance. Boreal caribou are counted as one herd.

Methodology and Reliability: Estimating Population Size and Range: Over the past 30 years, population estimates of Mountain Caribou and Northern Caribou have been based on aerial surveys (total counts), telemetry studies, and mark-resight studies using radio-collared caribou. Based on this work, 42 herds, or sub-populations, have been identified. The range of each herd has been based primarily on tracking radio-collared animals from each herd, and supplemented by ancillary information obtained from regional staff, biogeoclimatic zonation, and identified habitats shown on capability/suitability maps. These ranges are periodically refined as new information is acquired. Less is known about Boreal Caribou, which do not appear to occur in discrete herds.

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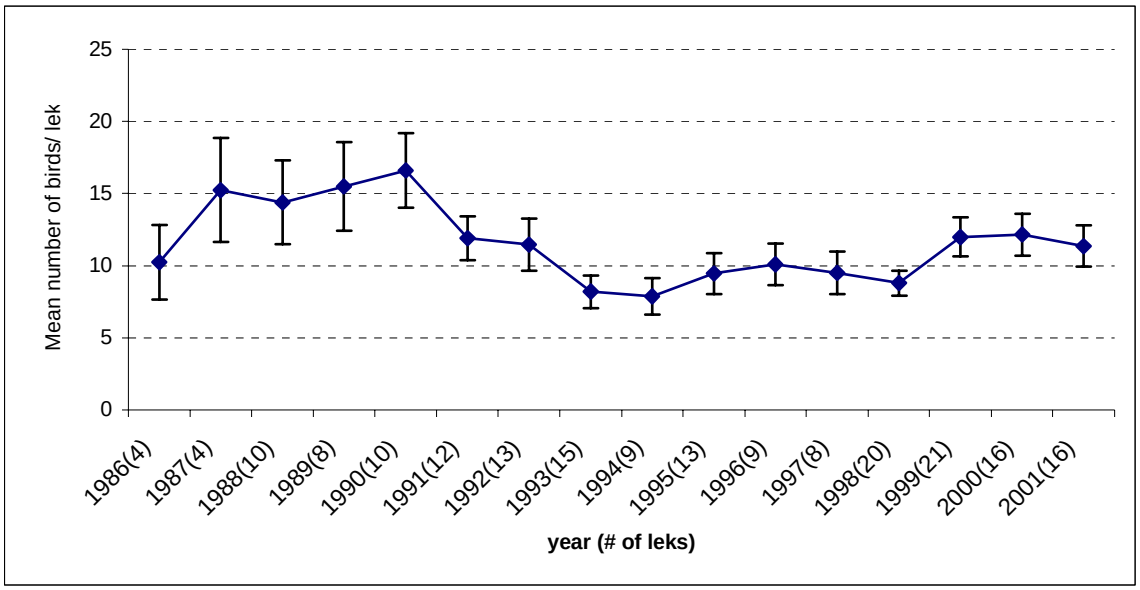
Secondary Measure: ***Change in Columbian Sharp-tailed Grouse range.***

Selection and Use of Indicator: There are six subspecies of the Sharp-tailed Grouse in North America. The range of the Columbian Sharp-tailed Grouse (*Tympanuchus phasianellus columbianus*), a subspecies commonly associated with sagebrush communities, is declining throughout British Columbia and the United States (Ritcey 1995, Saab and Marks 1992). In BC, the subspecies is associated with two distinct habitat types: medium and upper elevation climax grasslands with little or no sagebrush in the Bunchgrass (BG), Interior Douglas Fir (IDF), and Ponderosa Pine (PP) Biogeoclimatic zones, and sedge meadow complexes and seral grasslands resulting from harvesting or fires in lodgepole pine forests of the Douglas Fir, Sub-boreal Pine-Spruce, and Sub-boreal Spruce (SBS) (Ritcey 1995). The grouse are found in areas from the Fraser Basin ecoregion north of Prince George to the Southern Thompson Upland ecosection of Merritt. Populations have disappeared from the East Kootenay range, and breeding groups are no longer found in the Okanagan Valley. Populations in the Thompson Basin and Southern Thompson Upland ecosections are also of great concern. British Columbia has the responsibility to maintain this subspecies because the largest remaining distribution within North America is found in this province (Miller and Graul 1980).

The numbers of Columbian Sharp-tailed Grouse in southern BC have been declining due to human land-use activities, such as intensive agriculture, grazing, housing, and industrial development. Predation and hunting, where permitted, have also been considered important factors in the decline, but have not been studied extensively. In 1983, the Columbian Sharp-tailed Grouse was added to the provincial Blue list of species, due to concerns about reduction of the natural grassland habitats and the decline or loss of populations in the southern part of its range.

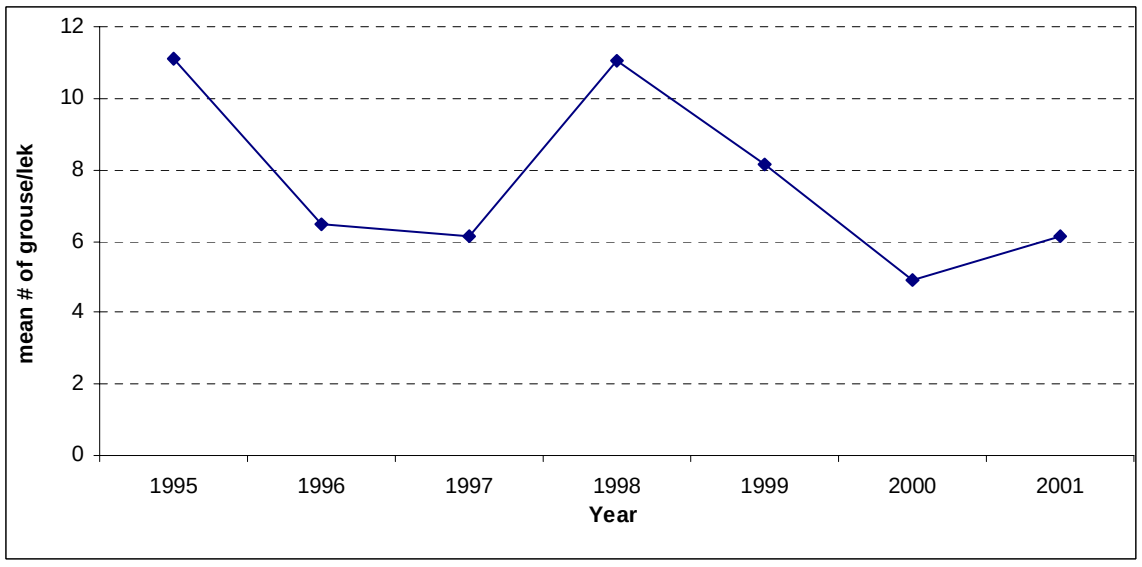
The most impact has been on populations in climax grasslands of the south-central Interior and they now constitute a small proportion of the total population in British Columbia (S. Cannings, pers. comm.). Assuming the attendance of males at leks (male courtship display sites) is an indicator of population trends, Sharp-tailed Grouse continued to decline in the southern interior until 1998 when populations appeared to stabilize. Leks in the Thompson-Nicola grasslands show a 32% decline in male lek attendance from numbers observed in 1990 when populations were at their most recent peak (Figure 5). Furthermore, of the 32 known lek sites, 13 (38%) have become inactive since 1986. In the Cariboo region, lek counts of grassland populations also show a decline in male attendance (Figure 6).

Figure 5. Average number of males attending leks in grasslands of the Southern Interior region of British Columbia. 1986-2001.



Source: Leupin, *in press*.

Figure 6. Average number of males attending leks in grasslands of the Cariboo region of British Columbia.

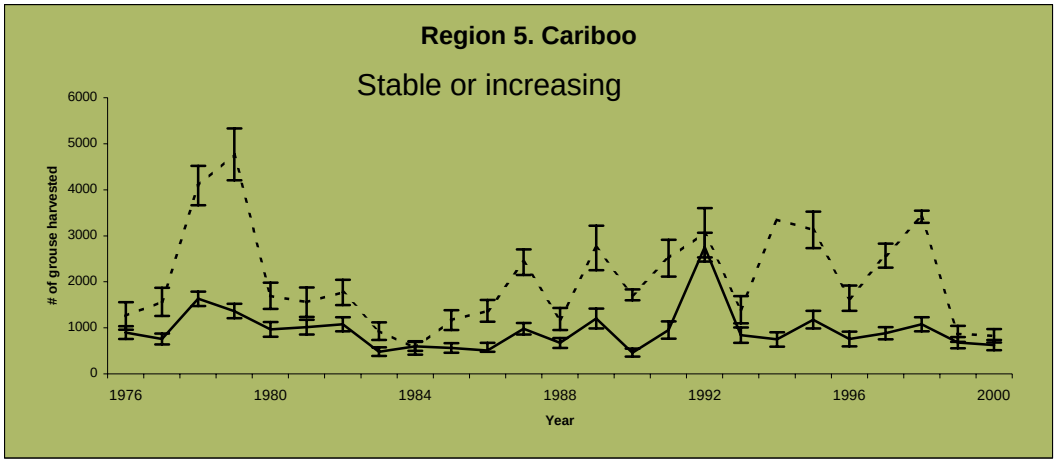


Source: Leupin, *in press*.

In contrast to permanent grassland populations, Columbian Sharp-tailed Grouse in forested areas in the south-central Interior are believed to have expanded in range and increased in numbers in the previous decade (Ritcey 1995; P. Dielmann, pers. comm.) The increases are believed to be a result of increases in habitat availability resulting from

large scale timber harvesting aimed at controlling beetle infestations that took place in 1987 (S. Cannings, pers. comm., K. McKenzie, pers. comm.) The increases in Sharp-tail Grouse numbers are reflected in the increases in hunter harvest in the years following timber harvest (Figure 7). Persistence of these populations is ephemeral, however, and guided by the distribution, size, and age of the blocks of timber harvested. As forests regenerate, and cutting intensity decreases it is expected that habitat suitability, availability and populations of Sharp-tailed Grouse will also decline (Ritcey 1995; Leupin, in press).

Figure 7. **Hunter (solid line) and grouse harvest (dashed line) estimates for Cariboo region of British Columbia.**

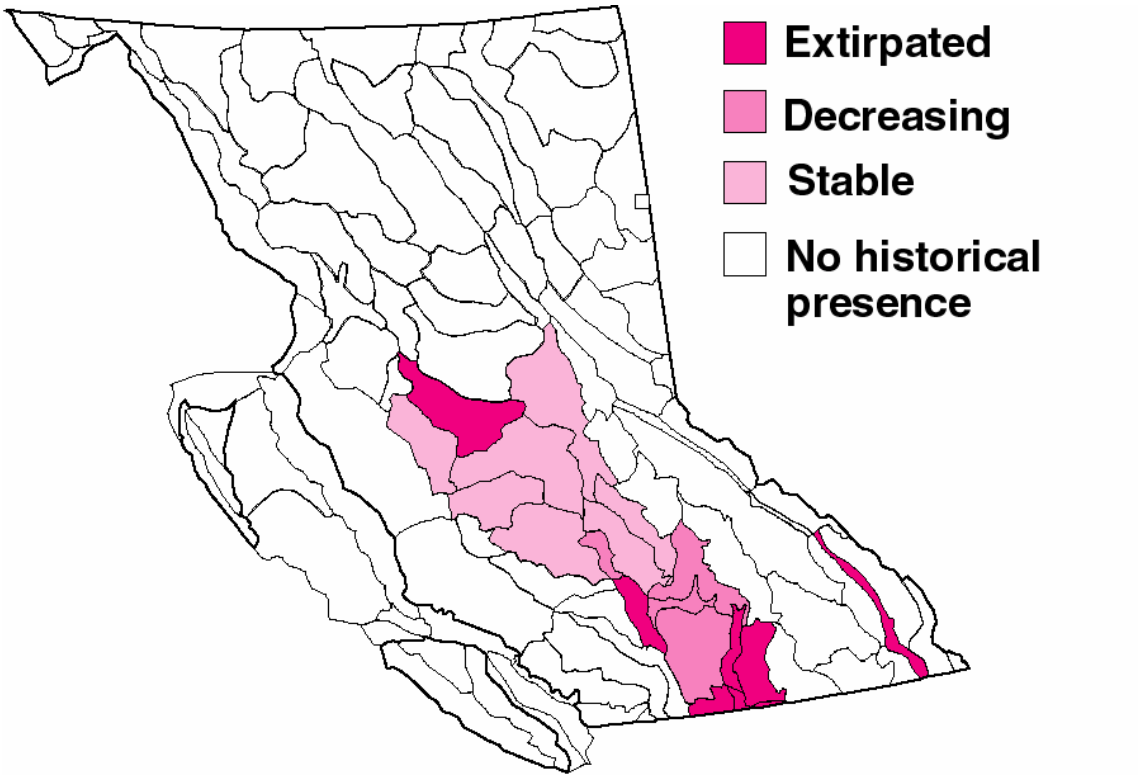


Source: Leupin, *in press*.

Over the past 50 years, the expanding human population in the Southern Interior has greatly affected the grassland ecosystem of BC. Urban and agricultural development, weed invasion, and off-road vehicle activity have further degraded this ecosystem. The primary indicator shows that Columbian Sharp-tailed Grouse are declining in 19% of their total historic range (the currently occupied range plus the historic range). If, however, the hectares of range where they are declining is shown as a percentage of only the currently occupied range, it increases to 25%.

Data and Sources:

Figure 9. Status of Columbian Sharp-tailed Grouse in British Columbia



Source: Ministry of Water, Land and Air Protection. 2002.

Table 4. Status of Populations of Columbian Sharp-tailed Grouse in British Columbia by Ecosection.

Stable Populations		
Ecosection	**Ecosection Code**	**Ecosection Area (km^2)**
Cariboo Basin	CAB	9,510
Cariboo Plateau	CAP	7,150
Chilcotin Plateau	CHP	15,530
Nazko Upland	NAU	20,220
Nechako Lowland	NEL	14,760
Nechako Upland	NEU	10,120
Western Chilcotin Upland	WCU	9,970
Quesnel Lowland	QUL	4,970
Total area		92,230
% historic range		59%
Populations that have declined from historic levels		
Ecosection	**Ecosection Code**	**Ecosection Area (km^2)**
Fraser River Basin	FRB	2,370
Northern Thompson Upland	NTU	9,750

Southern Thompson Upland	STU	15,180
Thompson Basin	THB	2,910
Total area		30,210
% historic range		19%
Locations where species is extirpated		
Ecosection	**Ecosection Code**	**Ecosection Area (km^2)**
Bulkley Basin	BUB	15,100
Eastern Kootenay Trench	EKT	4,540
Northern Okanagan Basin	NOB	2,470
Northern Okanagan Highland	NOH	8,220
Okanagan Range	OKR	2,590
Pavilion Ranges	PAR	438
Southern Okanagan Basin	SOB	790
Southern Okanagan Highland	SOH	550
Total area		34,698
% historic range		22%
TOTAL HISTORIC RANGE		156,700

Note: Ecosection codes are as designated in Demarchi 1993.
Source: Ministry of Water, Land and Air Protection. 2002.

Methodology and Reliability: Until 1993, hunting statistics, based on annual reports made by hunters, were the main source of data used to estimate population size. In the early 1990's concerns were raised about declines in Columbian Sharp-tailed Grouse numbers from hunting, predation and habitat loss and degradation. In 1993 the hunting season was closed in the Thompson Basin and South Thompson Upland ecosections.

In 1993, the status of Columbian Sharp-tailed Grouse in BC was the subject of a study that used results from lek counts and interviews with wildlife biologists and local residents to document the population in current and historic parts of it's range in BC (Ritcey 1995). Based primarily on lek counts, Ritcey (1995) estimated a minimum breeding population of 4600 birds.

Estimating Population Size From Lek Counts

Adult male Columbian Sharp-tailed Grouse congregate on leks where they display using both visual and aural courtship signals at dawn and, to a lesser extent, in the evenings during the breeding season in spring. Methods for estimating population size takere advantage of these seasonal congregations. Counts are made of the number of male grouse found at the leks. Typically, three separate counts are taken at each lek to account for any daily disturbance factors, such as the presence of hawks or coyotes. Since a large proportion of the male population will congregate at leks, the number of males is considered a very good value upon which to base an estimate.

To estimate the total breeding population, a lek density is determined for the area based on lek densities from similar areas where most or all of the leks are assumed to have been located. To determine the estimated breeding population or bird density for that area, the

estimated number of leks in the area is then multiplied by the average males per lek, and doubled to account for females. These estimates must take into account the condition of the surrounding habitat in which these grounds are found, as habitat suitability will influence numbers of breeding birds and hatch survival and, hence, fall recruitment.

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