

Wayward Course:

British Columbia Fails to Meet Protected Areas Standards for the Conservation of Grizzly Bear (*Ursus arctos*) Populations and Habitat in the Northern Great Bear Rainforest



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1. SUMMARY OF FINDINGS AND RECOMMENDATIONS

We examined Protected Areas proposed for by the North Coast Land and Resource Management Plan (NCLRMP) in the context of grizzly bear ecology, behavior and movements. We looked at the proposed Protected Areas in light of individual bear home ranges and movements, population densities, and effective population size. We present a quantitative comparison of British Columbia's management and protection proposals with other North American plans and practices. We concluded, that in its current form, the North Coast LRMP is dangerously inadequate and a threat to the ecological integrity of the North Coast rainforest landscape. Consequently, to insure long term ecosystem sustainability and maintenance of salmon and grizzly bear habitat, the North Coast plan requires:

1. Three additional Large (162 km²) Protected Areas (additional 486 km²) be added to the North Coast Plan to maintain Grizzly bear and salmon habitat, and
2. Nineteen (19) Medium sized (81 km²) Protected Areas (additional 1,539 km²) be added to the North Coast Plan. The addition of the Large and Medium Protected Areas will result in a total of about 3,260 km² of suitable North Coast grizzly bear and salmon habitat being managed for long-term sustainability. This amounts to 54% of existing suitable habitat (total of about 6050 km²) in occupied grizzly bear range; and
3. The twenty-two (22) additional Protected Areas be strategically located throughout the North Coast Plan area to provide a functional network of secure, long term protected habitats that ecologically compliment each other. Guidelines about spacing of Protected Areas and their relationship to bear security, movement (travel) and access are outlined in the text; and
4. Of the 2025 km² of additional protection necessary, at least 72% (1458 km²) will have to consist of productive forest in order to maintain historical ecological function in these landscapes. This may provide for conservation of productive forest proportional to its historical and ecological presence in the whole of occupied bear range.
5. What stands out in the North Coast Plan is the dramatic difference in strategy and vision for bears and their habitat between the scientifically and publicly based approach in Alaska, steeped in what is a huge protected and roadless habitat base (about 90%), and the full retreat, deference to the timber industry approach exhibited by British Columbia, where only 24 % of the NCLRMP land base is proposed for core protection.

2. INTRODUCTION

Giant trees that have lived for eighteen centuries. Salmon that pass by the base of those trees, wander the ocean for four years, and return to that very same riffle four years later. The largest bears in Canada, living as long as 35 years in a landscape that had been stable and predictable for centuries. These are some of the exceptional elements and events that define British Columbia's North Coast, an area known popularly as the northern Great Bear Rainforest. Extolling the virtues and values of the amazing temperate rainforests of North America has and will continue to fill volumes; yet we have only begun to understand how much is involved and how much could be lost.

As we developed this report it became apparent that local communities and the people of British Columbia require a grand vision in order to keep the North Coast landscape functional and intact. Our vision is one of local communities, monstrous old growth spruce and cedar, millions of relentless salmon, and massive grizzly bears existing harmoniously in perpetuity. This represents a sharp contrast with land and forest management practices in British Columbia, (see Horesji et al. 1998, Marchak 1999), including the North Coast Land and Resource Management Plan (NCLRMP) area (hereby referred to as the North Coast Plan).

Nowhere, and at no time in British Columbia's history, has there existed a greater opportunity for local people, sound conservation biology, and government oversight to come together to provide a sustainable future for a coastal rainforest.

Our vision is anchored by conservation science and lessons from recent and past history. We can only present it to the people, as we do here. It remains for all the people of the North Coast and British Columbia to listen to and consider the evidence, weigh the merits of our vision, and speak on behalf of their own interests and the interests of those remarkable occupants of the landscape that cannot speak for them.

This report was prompted by the North Coast Land and Resource Management Planning process launched by the government of British Columbia. The process has excluded most British Columbians and has progressed without science-based environmental impact assessment (Boyd 2003). We provide an independent analysis and perspective for a conservation strategy that is publicly inclusive and in keeping with contemporary conservation science.

The North Coast Plan area was initially defined by government and the timber industry to identify timber supply areas and their management. It encompasses about 16,175 km² of coastal influence landscape, of which about 66% (10,795 km²) is presently considered by the British Columbia Wildlife Branch to be occupied by grizzly bears (Figure 1). This report and our analysis are confined to the area defined by the province's wildlife staff as occupied by grizzly bears, however, grizzly bears may be found outside the recognized occupied area and historically, they are likely to have been common outside today's shrunken range.

Approximately 56% (6050 km²) of the area occupied by grizzly bears is considered habitat suitable for use by grizzly bears (Figure 2); the remainder (4745 km²) is considered largely unsuitable (Table 1) for use by grizzly bears.

The methods we used to arrive at these and other calculations in this report are presented in 3. METHODS.

3. METHODS

All GIS data were processed with ESRI Arc/Info 7.2 and ArcView 3.2 with Spatial Analyst extensions. All raster processing was accomplished at a resolution of 50 x 50 m.

The area occupied by grizzly bears was taken from a draft map, entitled Grizzly Bear, North Coast LRMP Ranked Watersheds, July 31, 2003, prepared by Ministry of Sustainable Resource Management. It is no longer on the government website, but is essentially the same as Map 6, Grizzly bear Occupied Area (December 15, 2004), North Coast LRMP, at posted on February 2, 2005 at

http://srmwww.gov.bc.ca/ske/lrmp/ncoast/docs/maps/Map_6_Grizzly_Bear_Occupied_Area.pdf,

Protected areas used in this analysis were those existing and proposed by the North Coast LRMP as of March 2005. They are taken from Map 3, Recommended Land Use Designations (December 15, 2004), North Coast LRMP, at

http://srmwww.gov.bc.ca/ske/lrmp/ncoast/final_landuse_recommend.htm, posted by the Ministry of Sustainable Resource Management, Skeena Region, dated February 2, 2005.

Suitable and unsuitable habitat was distinguished by defining unsuitable habitat as being greater than 45 degrees steepness and/or consisting of the following classes of land as defined in the B.C. Ministry of Forests forest cover data base and refined by the Small Scale Predictive Ecosystem Mapping Project (ssPEM), B.C. Ministry of Sustainable Resource management, 2002: not classified, ice field, alpine, rock, gravel pit, sand, clay bank, roads, and urban and other lands occupied by human infrastructure. Roads were designated as part of the land base occupied by human infrastructure. Paved and unimproved roads are included. It should be noted that the database is not considered comprehensive.

North Coast logging data was derived from British Columbia Ministry of Sustainable Resource Management TRIM (Terrain Resource Information Management) data and provincial forest cover data. Road and elevation data were derived from the provincial government TRIM database and input data for ssPEM. Elevation was employed to identify logging activity by elevation zone.

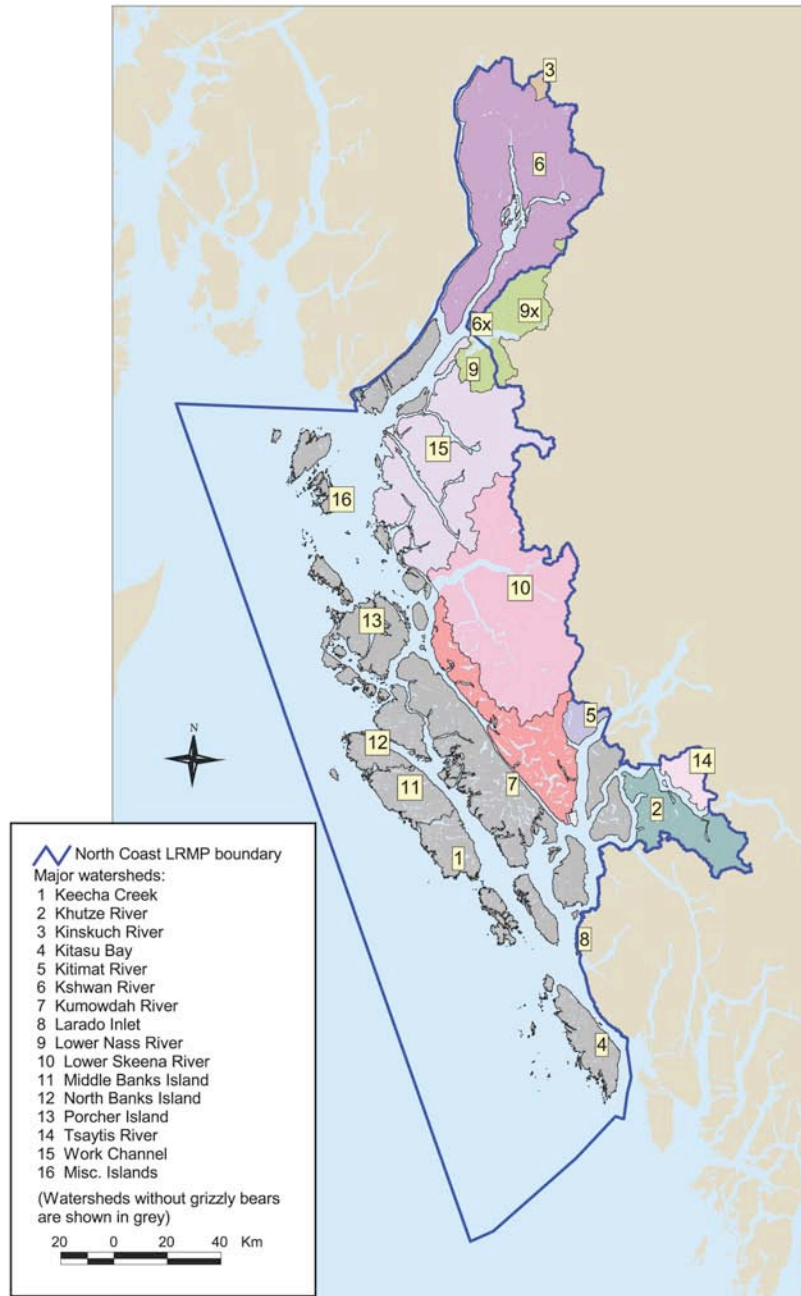


Figure 1. The North Coast LRM Plan area showing areas officially defined as presently occupied by grizzly bears.

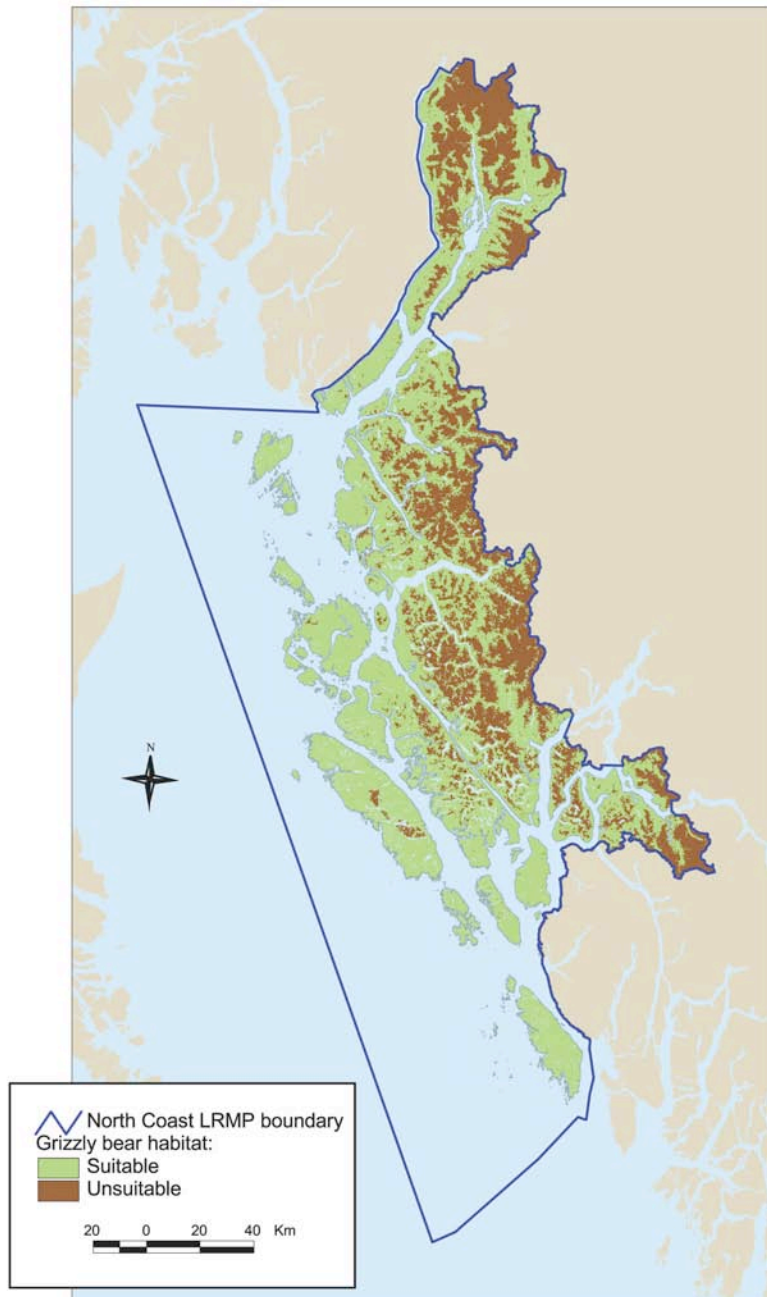


Figure 2. Suitable and unsuitable grizzly bear habitat.

4. PROTECTED AREAS: THE FOUNDATION OF LIVING ECOSYSTEMS

Analysis of the survival of North American grizzly bear populations since 1900 reveals that populations exposed to intense human population and industrial pressure have survived and remain potentially viable only because they are found in large public land ecosystems of which 50% or more is roadless and managed as Wilderness or National Park (Mattson et al. 1995; Horejsi 2003). British Columbia, despite 50 years of advance notice and consistent public and scientific expectations and demands for sustainable management of bear populations and their habitat, has followed the same destructive path, as have most American state governments. There are now at least eleven “threatened”¹ grizzly bear population “units”² in British Columbia and one quarter of this vast province is now without grizzly bears (8%) or occupied by threatened populations (16%). Inaction by wildlife and lands managers in British Columbia has grizzly bear populations racing toward extinction in more than 25% of the province (an increase in area of more than 200%) and threatened status in an additional 16% of the province (an entirely different set of threatened population units to those that exist now) by the year 2065 (B.C. MELP 1995; Horejsi et al. 1998).

At the other end of the land management spectrum is state and federal land management³ in Alaska. There are 7.9 million acres (31,970 km²) of occupied and suitable brown bear habitat in the Tongass National Forest, of which 7.5 million acres (94%) (30,352 km²) are classified roadless (U.S. Forest Service 1997). This vast, largely intact ecosystem exists because there is a national constituency and a legal process-driven approach (that is mandated to incorporate conservation biology) supporting land and wildlife planning and management actions. Alaska’s coastal ecosystems maintain the largest, most dense brown bear populations (Miller et al. 1997) in the western world.

¹ British Columbia management agencies and politicians equivocate around the status of bear populations by banishing the category “endangered” from official terminology. Many of the “threatened” populations (<100 animals) in the province would be considered endangered by the courts, the public and scientists in other jurisdictions. The Selkirk population, whose ecosystem is shared by Canada and the United States, is an example; U.S. management agencies and courts consider it endangered but in B.C. it is classified as “threatened”.

² British Columbia has artificially defined “populations” on the basis of administrative boundaries instead of using biological boundaries based on ecological, behavioral or genetic criteria.

³ The ecological integrity of Alaska’s public lands are now in jeopardy of decline. As the Bush administration enters its fifth year in office (2005) it has mounted a systematic attack on environmental protection legislation, which threatens Alaska’s and America’s pre-eminent endangered species and public land management status.

The Tongass provides a stark land and bear management contrast to the North Coast of B.C. In the face of scientific proposals (Gilbert et al. 2004) and public expectations to the contrary, B.C. land and wildlife managers continue on a narrow course of unsustainable resource extraction, bringing great harm to the fragile “iron triangle” of ecosystem productivity and stability represented by old growth forests, salmon and grizzly bears.

We examined the Protected Areas⁴ proposed for the North Coast Plan in the context of grizzly bear ecology, behavior and movements. We looked at these proposed Protected Areas (PAs) in light of individual bear home ranges and movements, population densities, and effective population size.

The average adult female annual home range size in the North Coast landscape can be approximated from the Khutzeymateen study, in which limited evidence suggested it was at least 53 km² (n=13) (MacHutchon et al. 1993). In coastal Alaska, a less topographically fragmented landscape than the North Coast, female annual home ranges averaged 522 km² (n=8) (Arthur and Schwartz 1999). Female home range size on the North Coast is somewhere in between these two estimates. Multi annual home ranges can be several times as large as annual ranges; their large size indicates considerable mobility as bear’s try to move through the landscape to find security and exploit foraging opportunities like salmon runs and berry abundance. Home range size and use appears to be a combination of localized use, occasional long-range excursions, and long-range movements within a drainage or to adjacent drainages. For example, 13 of 17 grizzly bears, including four of five adult females, moved between the Khutzeymateen watershed and adjacent watersheds (MacHutchon et al. 1993).

In spite of these seemingly large home ranges, on a daily basis undisturbed grizzly bears make relatively localized movements that range from an average of 4-5 km/day (Farley et al. 2001) down to about one km/day when bears are able to exploit concentrated and rich food sources (usually salmon spawning areas but also berry fields and avalanche chutes). Mattson (1991, 1993) initially proposed small scale Security Areas (SAs) as a means of providing grizzly bears, particularly females, with safe haven when human activity occurs in their vicinity or within their home range. Size alone distinguishes Security Areas from Core Wildlife Habitat designations such as large Protected Areas, which ideally consist of large blocks of permanently protected habitat. Mattson (1991, 1993) suggested a minimum area of 28 km² for SAs based on:

- a) demonstrated displacement and disruption of feeding by bears within two (2) km of major roads and four (4) km of developments, and

⁴ The British Columbia government has chosen the name “protected areas” to define public lands that have some form of protection from some kinds of industrial and non-industrial human activity. The province has specifically avoided the use of designations such as wilderness or refuge.

- b) the provision of security that would encompass a 24 - 48 hour foraging distance of about 1.8 km.

Observations of radio collared grizzly bears in interior rainforests like the Selkirk and Yaak ecosystems conform closely with this size Security Area; 88% of radio relocations of female bears in the Selkirks were in core⁵ habitats > 26 km². A further 6% were in core habitat >10 km² but < 26 km². In the Yaak ecosystem 74% of relocations were in core habitats > 26 km² and a further 15% of relocations occurred in core habitats >10 km² but < 26 km² (Wakkinen and Kasworm 1997).

In the current North Coast Protected Areas recommendations there are nineteen proposed and existing PAs (Figure 3, shown in color in Table 1) that contain adequate suitable habitat to provide minimum daily security habitat for bears at or above the lower end of the daily range of movements. Three of these (PAs #19, 32, and 68) are on the lower end of this scale and one other (Bishop, #6) could meet security requirements (around 26 km²) for bears whose daily range is on the upper end of daily foraging movements. Seven of the nineteen areas consist of 50% or less suitable habitat. Unsuitable habitat is of little ecological value but bears do move across it in very limited and specific locations; it is therefore not entirely without value and it may provide additional security by blocking access to bears and suitable habitat by humans and industry.

⁵ Core habitat was defined as any area outside the zone of influence (0.62 km) of any open road, gated road, motorized trail, or high use non-motorized trail (Wakkinen and Kasworm 1997).

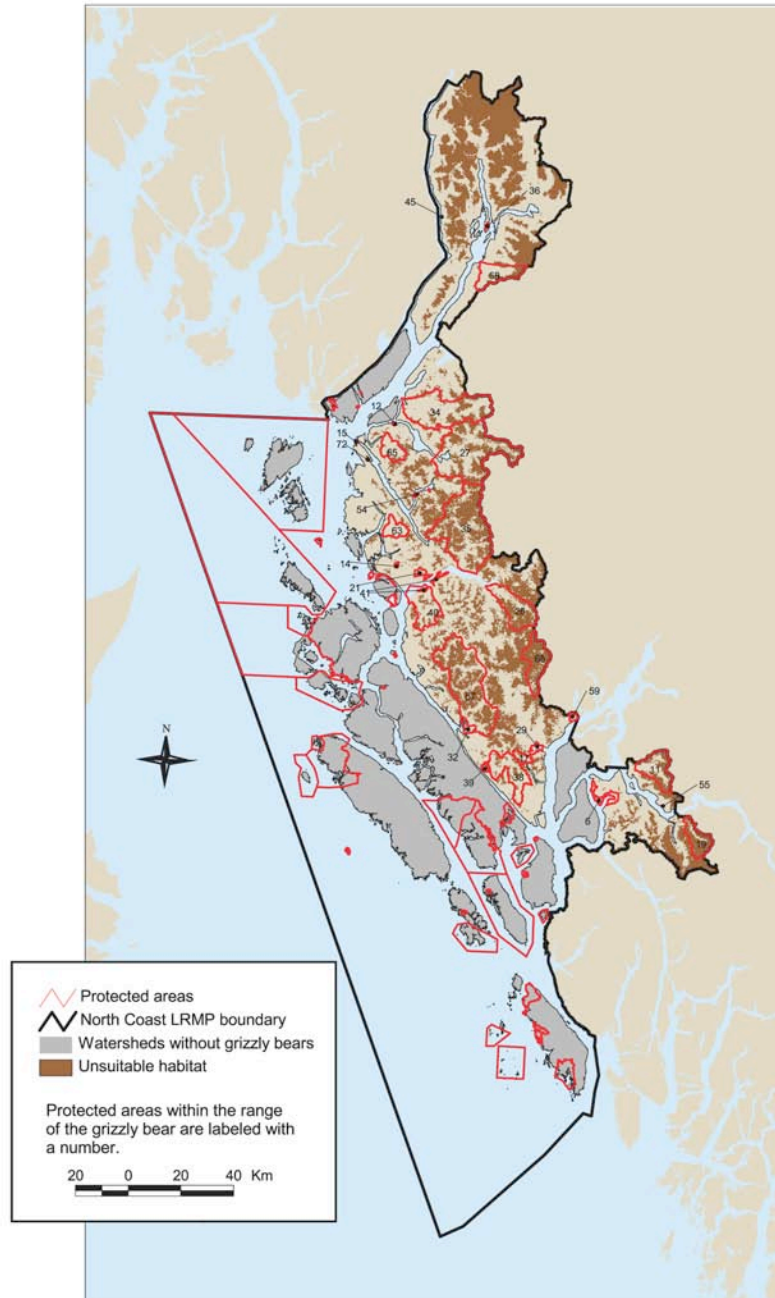


Figure 3. Protected Areas, proposed and existing, in the North Coast Plan area.

Table 1. Suitable and unsuitable habitat within existing and proposed protected areas (PA > 10km² of suitable habitat) within the range of the grizzly bear in the North Coast LRMP area, listed from north to south.

ID	Protected Area Name	Description	Total Land Area (km ²)	Suitable Habitat (km ²)	Unsuitable Habitat (km ²)	Percent Suitable Habitat (%)	Minimum Elevation of Suitable Habitat (m)	Maximum Elevation of Suitable Habitat (m)	Road Length (km)
58	Stagoo South	Proposed PA	108.7	64.9	43.8	60%	23	1213	0.0
34	Kwinimass	Proposed PA	334.4	224.4	110.1	67%	0	1731	18.3
27	Khutzeymateen	Existing PA	442.3	190.6	251.7	43%	0	2218	0.0
35	Khyex	Proposed PA	480.3	153.4	326.9	32%	0	1182	25.7
65	Union Lake	Proposed PA	62.3	44.7	17.7	72%	52	1085	0.0
63	Tuck-Woodworth	Proposed PA	48.7	44.7	4.0	92%	12	929	0.0
40	Lower Ecstall	Proposed PA	122.8	86.9	35.9	71%	0	1085	0.0
26	Khtada Lake	Proposed PA	158.3	53.2	105.1	34%	3	1193	0.0
68	Upper Ecstall	Proposed PA	132.4	11.7	120.7	9%	44	1874	0.0
57	Sparkling	Proposed PA	493.3	162.5	276.8	37%	0	1118	0.0
32	Klewnuggit Inlet Marine	Proposed PA	14.5	13.3	1.2	92%	0	801	0.0
38	Lowe-Gamble	Proposed PA	143.8	99.0	44.8	69%	3	862	0.0
6	Bishop Bay	Proposed PA	26.9	25.2	1.7	94%	0	950	0.0
11	Crab Lake	Proposed PA	125.1	50.4	75.1	40%	227	1490	0.0
19	Europa Lake	Proposed PA	87.6	10.4	77.2	12%	216	1656	0.0
Total			2727.4	1235.0	1492.6				44.0

To make Security Areas useful they must be readily accessible to bears in the area. Mattson (1991, 1993) suggested that Security Areas be no more than two days foraging range apart. A daily foraging radius for adult female bears of 4-5 km at the upper end would require protected areas to be within that distance of each other. To include bears with smaller foraging ranges, particularly those gathered around salmon spawning areas, protected areas would have to be closer together. A network of Security Areas using a 4-5 km daily foraging range would result in approximately 50% of an area being incorporated as Protected Areas.

Designating small PAs of 10 - 40 km² of suitable habitat can be beneficial if they are contiguous with or accessible from larger areas of suitable habitat and combine to form units that may be ecologically effective. Only one (#32) of the four proposed PAs (#32, 6, 19 and 68) in this size range (shown in white in Table 1) benefit from direct linkage by sharing a mutual boundary with larger areas. The other three areas fail to meet this threshold; Bishop Bay (#6), Upper Ecstall (#68) and Europa Lake (#19) have no linkage to other PAs in the North Coast Plan area. The size of Upper Ecstall (# 68) and Europa Lake (#19) is deceptive; even though each is 87 km² or greater in overall size, they are limited in effectiveness because they contain only 12% and 13%, respectively, suitable habitat and because they are largely isolated by substantial expanses of unsuitable habitat on all but one side. For example, although Upper Ecstall (#68) is geographically only a few kilometers from Khtada Lake (#26), the two are about 58 km apart if bears choose to move between them using suitable habitat. These two PAs are 20 and 38 km distant via suitable habitat from Sparkling (#57) and bears attempting to move between these areas will have to increasingly use pathways through an industrialized landscape that will impose a growing cost (Lidicker and Koenig 1996) on bears and the population.

Seven PAs (listed south to north, # 11, 38, 26, 40, 63, 65 and 58, shown in pink in Table 1) may contain suitable habitat sufficient to meet minimum annual home range size requirements. However, the utility for bear conservation of PA designation for two of these areas, the Stagoo South (#58) and Khtada Lake (#26), is compromised by geographic and functional isolation from other PAs. Two more areas, Union Lake (#65) and Tuck Woodworth (#63), are 16 km and 13 km distant, or about 2.5 and three days minimum foraging range, respectively, from the nearest other sizeable PA. These Protected Areas will increasingly become marginalized as the landscape surrounding them is industrialized⁶. The overall implications of these observations are that small PAs (less than annual home range size) are of marginal value in providing daily or even seasonal requirements for security of habitat and security from interactions with humans using managed forests unless they were to be so common as to provide a “stepping” stone network across the landscape (Groves 2003).

Four of the 19 proposed and existing North Coast Protected Areas (shown in green in Table 1) provide enough suitable habitat to meet the annual or multi annual home range size

⁶ Roaded and logged.

requirements of adult female grizzly bears. The most positive and functional Protected Area designations lie in the adjacency of Kwinimass (#34), Khytzeymateen (#27) and Khyex (#35) PAs; this may represent recognition of the significance of the relationship between ecological function and landscape size. In spite of this single example of synergism, the proposed North Coast Protected Areas system will not provide life-long protected habitat for most grizzly bears.

We investigated the relationship between commercially productive forest and the designation of Protected Areas (Table 2).

Table 2. The proportion of productive forest (PF) in areas occupied by grizzlies compared to protected areas in the North Coast Plan area.

Occupied by Bears			Protected Areas		
Suitable Habitat (km ²)	Productive Forest (km ²)	Percent Productive Forest (%)	Suitable Habitat (km ²)	Productive Forest (km ²)	Percent Productive Forest (%)
6020	4808	79	1246	897	72

It appears that Protected Areas are slightly biased against the protection of productive forest however the disparity is small and can be corrected as indicated below.

Four of the proposed and existing Protected areas (# 34, 27, 35 and 57, total 731 km² of suitable habitat) in the North Coast Plan equal or exceed the size of Large Habitat Conservation Areas (HCA; ≥ 162 km²) considered necessary to protect brown bears in the adjacent coastal Alaska Tongass National Forest (NF); two more North Coast proposed PAs (#40 and 38, total 185 km² of suitable habitat) meet the size requirement for Medium Habitat Conservation Areas (HCA; ≥ 81 km²) (Suring et al. 1993). In addition, there are 257 km² of suitable habitat protected in five PAs between 45 and 81 km² in size and 61 km² of suitable habitat protected in four smaller PAs (10 - 25 km²).

Ten Large HCAs and 27 Medium HCAs already exist in the Tongass National Forest and the wildlife viability strategy designed for the Tongass (Kiestler and Eckhardt 1994) proposes an additional 28 Large HCAs and 84 Medium HCAs, for a total of 38 Large areas and 111 Medium sized areas.

We calculated the number of large and medium sized Protected Areas necessary to secure grizzly bear habitat in the North Coast Plan area by correcting for the size of suitable occupied grizzly bear habitat in the North Coast Plan (6050 km²) relative to occupied Brown bear habitat in the Tongass National Forest (31,970 km²). The North Coast Plan falls far short of the seven

Large Protected Areas (HCAs) (North Coast proposed = 4) and 21 Medium sized Protected Areas (HCAs) (North Coast proposed = 2) necessary to meet minimum expectations for grizzly bear habitat viability even if we allow that those 7 PAs between 45 and 162 km² might function as Medium sized protected habitats. Table 3 compares the two conservation proposals.

Table 3. Existing and proposed conservation strategies in Alaska's Tongass National Forest (Habitat Conservation Areas, HCAs) and British Columbia's North Coast Plan area (Protected Areas, PAs) with corrections for size of suitable habitat available.

	Large HCAs (162 km ²)			Medium HCAs (81 km ²)		
	Existing	Proposed	Total	Existing	Proposed	Total
Tongass National Forest	10	28	38	27	84	111
North Coast Plan	1	3	4	0	2	2*
Corrected North Coast Plan	-	-	7	-	-	21
Shortfall in North Coast Plan	-	-	3	-	-	19

* If we include all areas between 45 and 162 km² as Medium HCAs this would = 7.

To provide adequate baseline protection for grizzly bear populations and habitat in the North Coast Plan area, our analysis indicates that the following additional amount of suitable habitat will need to be protected;

1. 486 km² in about three Large Protected Areas (each about 162 km²), and
2. 1539 km² in about 19 Medium sized Protected Areas (each about 81 km²).

Of the 2025 km² of additional protection necessary, about 72 % (1458 km²) should consist of productive forest in order to maintain historical ecological proportions and functions in these grizzly bear landscapes.

About 94% of brown bear habitat in the Tongass National Forest is currently roadless (U.S. Forest Service 1997). This represents the highest level of ecological protection and function possible and is currently accountable for the viable and high-density bear populations Alaska is proud of. It is arguable whether the proposed Wildlife Strategy for the Tongass (Kiestler and Echardt 1994), in which Habitat Conservation Areas would be designated for legal

protection, is adequate given that the scientists involved were all government agency employees who may be under agency pressure to temper their “science” with career and political concerns (Steel et al. 2004). In strictly practical terms, this might suggest that habitat protection measures could be strengthened in the Tongass National Forest, as has been suggested by others (Keister and Eckhardt 1994), which would widen the gap between conservation measures proposed by two very disparate jurisdictions claiming to have the same goal - to protect viable grizzly (brown) bears populations and their habitat.

It may not be remarkable that the conclusion that protection of about 50% of suitable grizzly bear habitat as a necessary minimum to achieve a reasonable prospect of maintaining population viability has been arrived at by two widely disparate means of analysis; 1) a more thorough analysis of habitat requirements as evidenced by the Tongass analysis and this report, and 2) an analysis of historical survival of grizzly bear populations in managed and roadless ecosystems, as presented by Mattson et al. (1995) (and later by Horejsi 2003 and Gilbert et al. 2004)

What stands out is the dramatic difference in strategy and vision for bears and their habitat between the scientifically and publicly based approach in Alaska, steeped in what is a huge protected and roadless habitat base, and the full retreat, and the deference to near full industrialization proposed by British Columbia in the North Coast Plan, where 76 % of the land base is proposed for industrialization.

For more than 15 years B.C. government ministries have been attempting to grapple with intense private demands to industrialize public lands. Each proposed initiative for scientifically sound land and wildlife conservation strategy has been undercut by political deference to the Ministry of Forests and the timber industry. The Protected Areas Strategy of 1990 began with a politically imposed cap on how much public land could be maintained in a fully functional ecological state. The Grizzly Bear Conservation Strategy of 1995 (B.C. Government 1995) was subverted by a dictum that ecosystem maintenance measures could not reduce long-term timber supply by more than four percent (4%). Land and Resource Management Plans, of which the North Coast Plan is but one of many, were similarly restricted to a shallow box of options produced by prior initiatives. In spite of the long history of land use conflicts, common to all these failures has been domination of the process by the Ministry of Forests, exacerbated by the presence of one or two biologists in Ministries responsible for wildlife, whose tenure spanned these initiatives and who continued throughout those years to advocate a politically acceptable “made in B.C.” version of conservation biology. To control this agenda, government and industry have captured the process by excluding: a) general public comment and input, b) international scientific research and evidence, and c) independent scientific analysis and debate.

Protected Areas (PAs) proposed for and existing in the North Coast Plan area fail by a wide margin to secure suitable grizzly bear habitat and do not provide for even a low probability of maintaining grizzly bear population viability over a reasonable time frame (one half logging rotation, about 100 years).

To what end ~~vail~~ the existing haphazard plan?

To what end do government, industry, and individual biologists and foresters engage in widespread and intensive industrialization of unique and ecologically functional landscapes? History and science have shown that the consequences are sharp declines in fish and wildlife habitat effectiveness and population viability with escalating risk of threatened and endangered status.

This report is a scientific analysis of the consequences of implementing the existing North Coast plan. The evidence demonstrates that a science based Protected Areas foundation is essential, and still possible, if grizzly bears and the landscape is to be protected. The evidence also shows that the present North Coast LRMP proposal is dangerously inadequate.

Our analysis of existing scientific data and management practices in North America indicates that:

1. Three additional Large (162 km²) Protected Areas (a total of 486 km² of suitable habitat) need to be added to the North Coast LRMP to maintain grizzly bear and salmon habitat, and
2. Nineteen (19) additional Medium sized (81 km²) Protected Areas (a total of 1,539 km² of suitable habitat) need to be added to the North Coast LRMP.
3. The supplement of these 22 additional Protected Areas (2025 km²) will result in a total of 3,260 km² of suitable grizzly bear and salmon habitat being managed for long-term sustainability in North Coast Plan area. This amounts to 54% of existing suitable habitat (total of 6050 km²) in occupied grizzly bear range.
4. These 22 additional Protected Areas be strategically located throughout the North Coast Plan area to provide a functional network of secure, long term protected habitats that ecologically compliment each other. Guidelines about spacing of PAs and relationship to grizzly bear security, movement and access are outlined in the above text and in Gilbert et al. (2004).
5. Of the 2025 km² of additional protection necessary, at least 72% (1458 km²) should consist of productive forest in order to maintain historical ecological proportions and functions in these occupied grizzly bear landscapes.

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APPENDIX A – ABOUT THE AUTHORS

Dr. Brian L. Horejsi is a wildlife scientist and forester. He earned a PhD in the behavioral ecology of large mammals from the University of Calgary and a bachelor of science in forestry from the Montana State University. He became active in wildlife research in the late 1960's. His research activities include an extended field study of the impact of the oil and gas industry on grizzly bears in the boreal forest and a recently completed evaluation of the status of the grizzly bear population and its habitat in southwest Alberta, where the oil and gas industry has been active for half a century. He has also conducted research on the impact of industrial, motorized access, recreational, and agricultural activities on bighorn and Dall Sheep, moose, caribou and black bears. In recent years he has been working with the public and non-government organizations as an advisor and analyst regarding the impact of government and industry land use practices on large mammal populations and their habitat. He is particularly active as a spokesperson for public and legislated decision making and use of the best available science in regulatory processes such as environmental impact assessment and forest development plans.

Dr. Barrie K. Gilbert is Senior Scientist (retired), Utah State University. After receiving his B.A. in Biology from Queens University in Kingston, Ontario, he earned a PhD in ecology at Duke University. His specialty is behavioral and conservation ecology, especially the application of behavioral science to management of human-wildlife interactions. His recent research has focused on the impacts of roads, access and recreation on bears and other carnivores, their habitat, and plans to minimize or eliminate these impacts at a protected area scale. He began studying bears in 1974 and started working with coastal B.C. bears in 1996, directing graduate studies there from 1997-2004. He has traveled by foot, boat and air into dozens of drainages on the central and north coast. His research experience has extended over 35 years and included studies of deer, moose, pronghorn, coyotes, African hunting dogs and black, brown, and polar bears. For the last 15 years he directed studies of human-bear interactions along salmon streams in Katmai National Park, AK, and in Southeast Alaska, and more recently in the coastal rainforests of British Columbia. Dr. Gilbert consulted for Canadian and U.S. federal, provincial and state agencies on forest wildlife conservation issues, grizzly bear responses to people, and habitat needs of bears.

The Authors have collaborated on several analyses of British Columbia land and wildlife management practices that culminated in the following;

1. Scientific Criteria for Establishment of Grizzly Bear Management Areas in British Columbia. 2004. Gilbert, B.K., L. Craighead, B. Horejsi, P. Paquet and W.McCrory. Panel of Independent Scientists, Victoria, BC. 16p. and
2. British Columbia's Grizzly Bear Conservation Strategy: An Independent Review of Science and Policy. 1998. Horejsi, B.L., B.K. Gilbert and F.L. Craighead. Western Wildlife Environments Consulting Limited. Calgary, Alberta. 64p.