Ecological relationships between Grizzly bears and forest management in the coastal-interior transition of British Columbia.

2006 Year End Report

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Project #: 06.W.BrG05

Prepared for:

Upper St'at'imc Language, Culture and Education Society

and the Lillooet Grizzly Bear Working Group

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Executive Summary

Little scientific information is available on grizzly bear numbers, density, and habitat use in the Lillooet area which lies near the southern edge of the grizzly bear's current range in British Columbia. Without this information, forest management and development activities cannot be properly evaluated for their positive and negative impacts on bear populations. This report summarizes the second field season of a multi-year, multi-partner study to collect detailed data on the movements and habitat use of grizzly bears in the Cayoosh and Whitecap study areas near Lillooet. Ten new GPS collars were deployed in May of 2006. Over 13,000 point locations were obtained. A sample of these locations were visited by trained field crews to collect site, vegetation and bear use data. Three collars stopped recording properly over the season, but the remaining seven collars functioned until denning. A further field season in 2007 is required to provide sufficient data to address project objectives.

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[Front page photo: bear habitat in an avalanche chute in Blowdown, July, 2006]

Introduction

Grizzly bears are rare in the study area and the Grizzly Bear Population Units (GBPUs) are classed as threatened. However, there is a lack of baseline ecological information supporting that status, including population distribution, trend, habitat selection and movements, and the specific relationship with a full suite of forestry activity (roads, harvesting, silviculture, livestock interaction). Increasing the knowledge and information available on these Grizzly bear populations and habitats is key to creating better resource management decisions for all resource users and the St'at'imc Nation.

This multi-year project has been designed to evaluate existing Grizzly bear "best management" practices in the coast-interior transition of southern BC through scientific investigation of local Grizzly bear ecology. The project will examine several hypotheses related to the impacts of forest development and landscape-level practices including forest road access, influence of harvesting and silviculture on forage supply, impacts of hydro-electric power generation, and bear use of habitats. Objectives will be met through a combination of capture, radio-collaring and monitoring of a representative sample of resident Grizzly bears, and the creation of a predictive model of habitat value based on spatially-explicit resource selection functions.

The 2004 field season was unsuccessful due to a number of technical and administrative difficulties which resulted in no bears being collared. In 2005, five Lotek GPS-Argos collars were placed on 3 female and 2 male Grizzly bears in the Cayoosh corridor. Although the satellite-linked collar technology was unstable on Grizzly bears, and the collars failed progressively over the summer, a total of 1343 telemetry locations were obtained. Detailed site investigations were then conducted at 53 sites to examine habitat use. The 2006 season is the second field season for this study and details are provided in this report. Project results will be used to revise forest management practices and create habitat restoration plans in the Bridge River area where applicable.

Goals and Objectives

Lillooet Grizzly Bear Working Group's mission statement is:

> ***Empowering local people to participate in grizzly bear population recovery and habitat conservation within the Lillooet area to ensure viable and healthy grizzly populations and habitats across their natural ranges.***

The objectives of this project are:

Objective 1: The primary objective is to provide an empirical basis for evaluating current Grizzly bear/forestry guidelines. This necessitates the identification of critical bear habitats and movement behaviors that are also of interest to the restoration activities related to the hydro-electric facilities in the Lillooet area. The data will enhance the quality of resource decisions related to Grizzly bears and will empower decision-makers to employ practical adaptive management approaches (e.g. by applying and monitoring special silvicultural practices to maintain Grizzly bear forage supply at a landscape level). The end result will be greater certainty in planning and decision making for results-based forest management, and healthier Grizzly bear populations.

Objective 2: The project will promote more effective and efficient use of forest resources by ensuring that timber netdowns for Grizzly bear habitat are applied only where necessary to meet population-wide or site-specific objectives.

Objective 3: The project will improve forest practices as they pertain to Grizzly bear conservation, thus potentially increasing market acceptability and market share through provision of a successful model of multiple-use. Empirical information specific to current best management practices and monitoring of appropriate population and habitat targets will enable certification by demonstrating sound species conservation and science-based management practices in a sustainable, adaptive management framework.

Objective 4: The project will examine historic information about Grizzly bear habitat and populations in the study area with the specific objective of setting appropriate population recovery targets and the potential for mitigative habitat restoration. An understanding current habitat quality, quantity and distribution (as demonstrated by collared animals and examined using habitat mapping) will be used to set the stage for subsequent habitat restoration planning. The focus will be on the change in habitat supply created by the construction of the Terzaghi and LaJoie dams on the Bridge River.

Objective 5: Although the project is centred in the Lillooet area, inferences and products will have broader utility throughout the coastal-interior transition in southern BC. Results will be made available to a wide range of users through continued multi-stakeholder involvement in project oversight, and development of products directed by a comprehensive extension plan that includes guidelines, public presentations and peer-reviewed publication.

Study Area

The study area is within the Lillooet Timber Supply Area (TSA) and the habitats represent a coastal to interior transition. The habitats vary from very dry Interior Douglas Fir Valley Bottoms (e.g. IDFdk2) through the higher elevation montane and subalpine Englemann Spruce Subalpine Fir forests and parkland areas (e.g. ESSFdk2) to the alpine tundra of the mountain tops. The study are lies with the St'at'imc Territory.

Methods

This project uses GPS-tracking collars to follow the movements of a subset of grizzly bears within the study area. Bears were heli-darted and fitted with a telemetry collar in early May. Every two weeks following capture until denning (May through Oct), GPS locations were downloaded using a command unit from a fixed-wing aircraft. A sample of these locations was then ground-checked by qualified field biologists. Plot sampling followed a detailed protocol to assess biogeoclimatic characteristics, vegetation characteristics and bear-use signs. This report summarizes the field results for the 2006 season. It is not a final project report.

Results

i. Spring Capture

Spring capture was very successful in 2006. Eleven GPS telemetry collars were purchased and programmed for placement into our study areas. Five of these collars were targeted for replacing the satellite-linked collars that failed in the 2005 field season in the Cayoosh study area. Of the previously collared bears, GM1, GF1, and the subadult GF3 were successfully relocated and re-collared (Figure 1). The collar for GM2 was located where it had dropped (it had slipped over the bear's head, but was also dysfunctional). The collar for GF2 was eventually located and it was determined that GF2 had died of natural causes. GF2 was the oldest bear in the study.

The eight remaining GPS collars were deployed as follows: 2 subadult males were collared in the Cayoosh study area bringing the total back up to 5 collared bears in this area; 6 collars were placed on adult bears in a new study area to the north of Anderson Lake, which we are calling

the Whitecap study area, with the collar recipients: a female + 3 cubs, a female + 2 cubs, a second female + 2 cubs, a lone adult female and an adult male accompanying her. This places 5 collars into the new Whitecap study area. The 11th collar was not deployed, but has been retained as a back-up collar.

Figure 1: Spring capture team: Tony Hamilton adjusts collar on GM1. Michelle McLellan records capture details. Pilot Clay Wilson assists. Bruce McLellan (not shown) immobilized the bear.

ii. Collars and Location Data

Two different types of GPS collars were used in 2006: Four of the collars were Lotek GPS_4400s programmed to search for and record 8 GPS locations per day (1 per 3 hours). The other six collars were Lotek GPS_4400m programmed to search and record 24 GPS locations per day (1 per hour). If all collars functioned at 100% capacity then the system has the potential to record 2,464 fixes every two weeks. The bears were located by aircraft every two weeks between 7 June and 30 October. The location data was downloaded remotely using a Lotek UHF data communication link when the aircraft was approximately 200m from the animal. Location data were then processed and mapped for each bear.

The fix success on the collars differed between the two study areas with an overall 51% success rate in the Cayoosh study area and a 62% success rate in the Whitecap study area (Table 1). Variation in collar success can be due to a number of factors including terrain, canopy closure and individual bear behaviour. Data suggest that two collars (GM1 and GF6) may be malfunctioning, and the collar on subadult GM3 may have dropped off early.

Table 1: Grizzly bear status and GPS collar fix rates, 2005 and 2006.

	Collar Type 2006	Reproductive Status 2006	Locations 2006 (3D)	Collar success 2006 (3D/fix attempt)	2005 Collar Success**
Stein-Nahatlatch					
GF-01	4400s	2 cubs*	756	58%	44%
GF-02	n/a	Dead	-	-	56%
GF-03	4400m	Subadult	2128	56%	53%
GM-01	4400m	Adult	301†	42%†	28%†
GM-02	n/a	Adult-Unknown	-	-	27%†
GM-03	4400m	Sub-adult	1902	54%	-
GM-05	4400s	Sub-adult	516	46%	-
GM-06	None	Young subadult	-	-	-
South Chilcotin					
GF-04	4400m	3 yearlings	2663	68%	-
GF-05	4400s	2 yearlings	848	68%	-
GF-06	4400m	2 two year olds	1337†	57%†	-
GF-07	4400s	Young Adult	676	52%	-
GM-04	4400m	Adult	2544	65%	-
Total			13671	59%	49%

*Only one cub was seen between August and October.
† Corrected to exclude post-collar-failure attempts.
**Argos-uplink collars

iii. Field Plot Data

Between 7 June and 31 October, 147 Grizzly bear use locations and 146 paired random locations were visited to collect microsite attributes according to the protocols established for this study. Variables considered at these plots include the identification of plant species, percent cover and plant phenology, site variables including slope, aspect and ecosystem classification, and bear use measurements including feeding, bedding, digging, caching and other bear activities. Bear seasons were determined for each bear independently based on activities in plots and movement to certain habitat types in which particular food sources are available. Seasons identified include Herb/Bulb, Early Fruit, Berry, and Post-Berry seasons (Figure 2). Plots in 2006 over-represented the post-berry season and underrepresented the Herb/Bulb season. Sampling will be corrected in the 2007 by an earlier field start to ensure sufficient early season data is obtained.

Collar location and plot data are also being examined with respect to the Biogeoclimatic (BEC) zones used by the bears (Figure 3). Bear use of particular zones and variants will inform revisions to best management practices for resource development.

Figure 2: The relative proportion of GPS bear locations to use plot locations for 2005 and 2006 during the different bear seasons. Error bars indicate standard error.

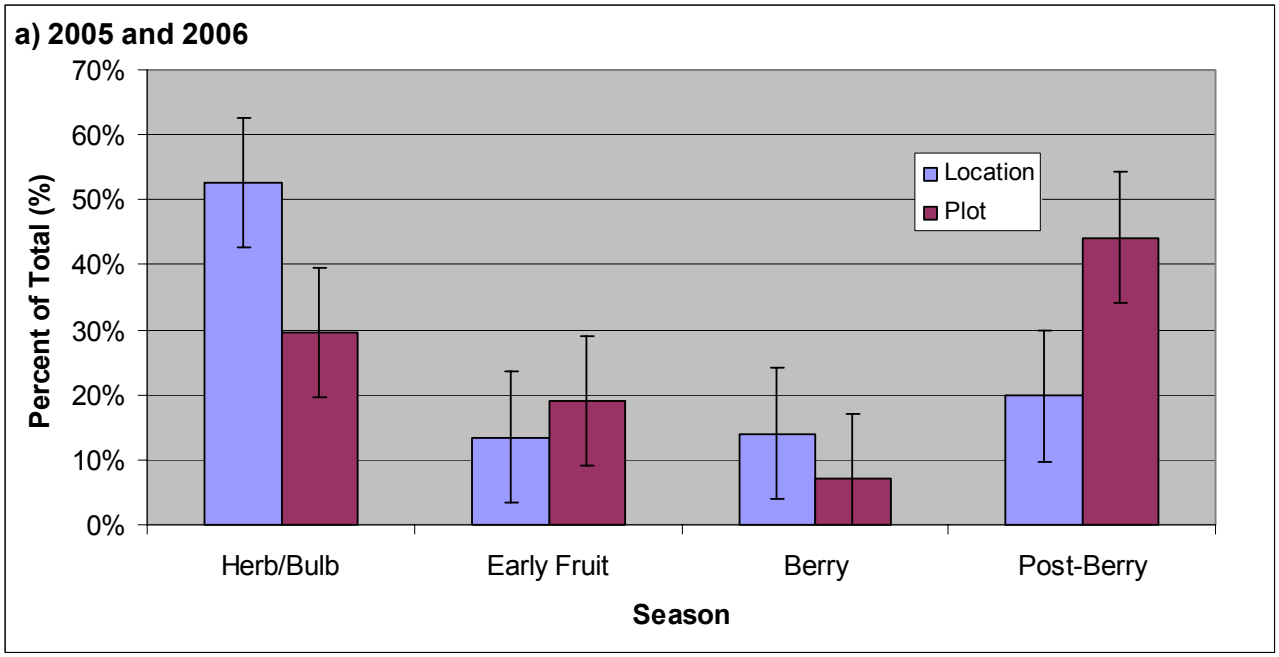
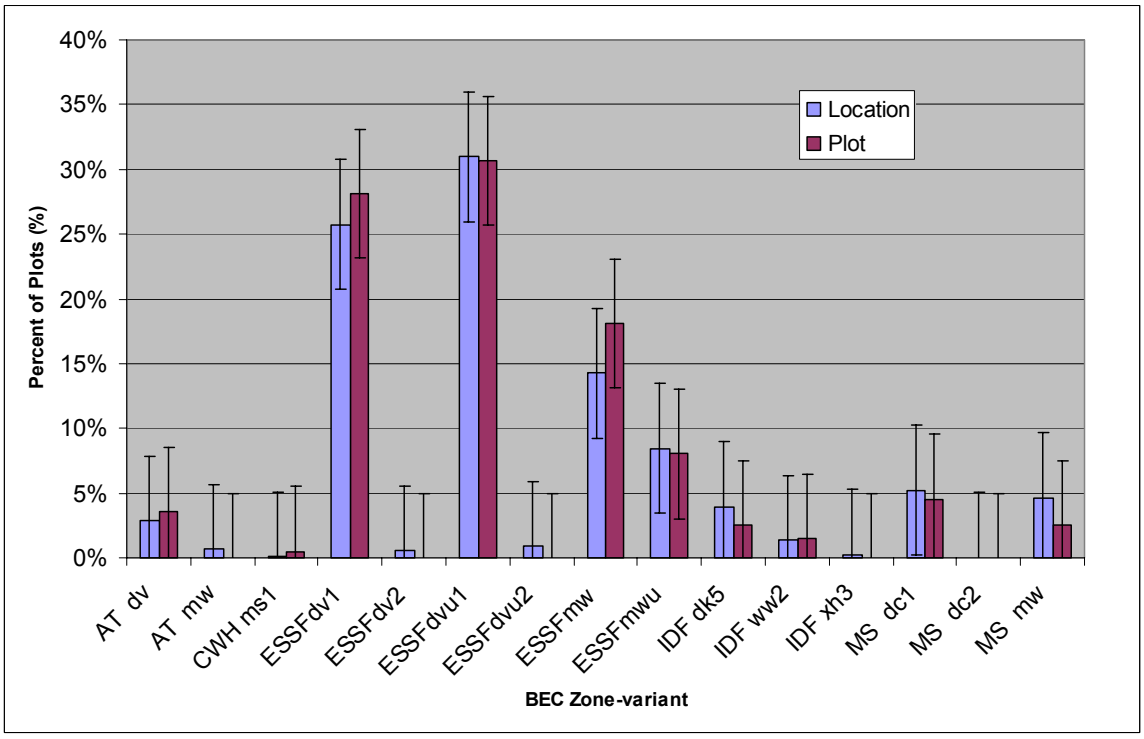


Figure 3: Use and plot sampling of various BEC zone-variants. Error bars mark Standard error of the mean.



iv. Forest Resource Management

Many variables interact to determine whether a particular site contributes to effective bear habitat. Forty forest harvesting openings in the Cayoosh study area were visited in 2006 to qualitatively examine how bear forage, site characteristic and harvesting prescriptions interact. This preliminary field work suggests that BEC, site series, stocking levels, canopy closure, and forage response are closely related (figure 4). These factors combined with block layout and road access impact the effectiveness of the habitat for bears. GIS analysis is currently underway to examine how bears may be using forest openings by comparing the collar locations with forest cover and opening data layers. Further field work is planned in 2007 to contrast used versus unused forest openings to identify what opening characteristics promote bear use and which harvesting and silviculture practices influence effectiveness.

Figure 4: An example of a forest opening in the fall of 2006 showing the *Vaccinium* spp. berry production (red shrubs) in a harvest opening with low conifer stocking. This canopy is not likely to close fully, thus providing high quality bear forage over many decades.

v. Stable Isotope Analysis

Naturally occurring stable isotopes of carbon (C), nitrogen (N), and sulfur (S), obtained from hair or bone samples, can be used to determine the components of a bear's diet and the nutritional importance of certain food items. Investigation into the application of stable isotope analysis, including scope, costs and limitations of the science, will be undertaken in early 2007 to inform this project. It is our intention to pursue stable isotope analysis on hair and bone samples for bears within the study area.

vi. Historic Bear Populations

Understanding the factors that impacted the Grizzly bear populations in the past is critical to setting realistic recovery targets for the Stein-Nahatlatch and South Chilcotin GBPUs within the study area. An intensive search for historic information on Grizzly bears in the Lillooet area was undertaken to further work initiated on this topic in 2003. Resources identified include a pivotal 1949 Geology Master's thesis[1] which provides detailed information on conditions in the Bridge River Valley pre-water impoundment. A search for bones from pre-1960 trophy bears was initiated, and is currently ongoing, but so far has not identified suitable material. If bones can be obtained, then a comparison of pre-dam diets with current diets could be performed using stable isotope analysis techniques.

An assessment of the bear habitat lost under the reservoir footprint has been delayed due to restrictions on accessing particular map products of the footprint area. This has also delayed the related fish and ungulate assessments which relate to the ecosystem map. A report on the footprint impacts for bears will be completed once protocols for accessing the map can be established.

Discussion

The 2006 field season results show a marked improvement over the 2005 season when the satellite-linked tracking collars failed. The increase in data will provide a strong basis from which to proceed with analysis once all the field data is collected. Because wildlife movements and behavior can be affected by annual variation in weather and vegetation phenology, the results of single years should not be used to project overall study results. However, these results guide researchers in planning to improve study design and data collection to address apparent gaps in data. A further successful field season in 2007 is required and planned to provide adequate information on which to base recommendations.

The spring capture for 2007 is planned for May. Five new Lotek GPS collars of the types used in 2006 are on order. Three of these will be targeted to replacing the collars that malfunctioned in 2006 (GM1, GM3 and GF6). Replacement of these collars is preferred to capturing new animals because the opportunity for multi-year data on individuals improves knowledge on individual variations across years. Although GM1 has now broken two collars, having data on an adult male for the Cayoosh study area is of paramount importance. The decision whether to collar GM1 or a different adult male will depend on spring capture success. In 2006, GM1 was the only adult male encountered during spring capture in the Cayoosh so no alternative was available. The two new collars will be targeted to female bears in the Cayoosh study are to increase sample size. Reliable sightings from 2006 suggest that two more females could be collared to improve data quality. The remaining collar (spare from 2006) and VHF cub collars will be deployed if and when appropriate, based on the expertise of the capture-crew.

[1] Wood, G.A. (1994) The Bridge River Region – A Geographical Study. Master's Thesis. Dept. Geology & Geography. University of British Columbia.

Recommendations

Public education remains a critical link in the conservation of grizzly bears and should continue to be part of ongoing grizzly bear research. Recommendations based on the data from this project will be developed in 2008.

Acknowledgements

The following people participated as members of the Lillooet Grizzly Bear Working Group (GBWG) in 2006:

Larry Casper, Natural Resources Coordinator, Lillooet Tribal Council
Tony Hamilton, Bear Specialist, Ministry of Water, Land & Air Protection
Sue Senger, Landscope Consulting Corp., Project Coordinator
Bruce McLellan, Research Ecologist, Ministry of Forests
Clayton Apps – Associate Member – Aspen Wildlife Research, DNA project lead
Don Brown – Associate Member – Ainsworth LP, Planner

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Upper St'at'imc Language, Culture, and Education Society
Lillooet Tribal Council
Lillooet TSA Association
BC Hydro Bridge Coastal Fish and Wildlife Restoration Program
Habitat Conservation Trust Fund
Ministry of Water, Land & Air Protection
Ministry of Forests
Bridge River Lillooet Newspaper
St'at'imc Runner Newspaper
Fraser Basin Council

Appendix 1: Financial Statement

Project # 06.W.BrG05

	Budget		Actual	
	BCRP	**Other**	**BCRP**	**Other**
Income				
Total Income by source	$115,000.00	$154,500.00	$115,000.00	$169,905.00
Grand Total Income	$269,500.00		$284,905.00	
Expenses				
Project Personnel				
Consultant Fees	$94,000.00	$20,000.00	$99,816.31	$31,734.25
Materials & Equipment				
Misc. Equipment		$3,728.00		
bear collars	$16,000.00	$60,000.00		$76,224.66
Heli/pilot/fuel		$40,060.00	$10,090.94	$26,517.26
fixed wing		$28,500.00		$26,713.72
Travel expenses		$2,212.00		$8,302.23
Administration				
accounting, space, phone:	$5,000.00		$5,000.00	
Total Expenses	$115,000.00	$154,500.00	$114,907.25	$169,492.12
Grand Total Expenses	$269,500.00		$284,399.37	
Balance	$0.00		$505.63	

* Any unspent BCRP financial contribution to be returned to: BC Hydro, BCRP
6911 Southpoint Drive (E14)
Burnaby, BC V3N 4X8
ATTENTION: JANICE DOANE

Appendix II: Performance Measures- Actual Outcome Project # 06.W.BrG05

Performance Measures – Target Outcomes													
Project Type	**Primary Habitat Benefit Targeted of Project (m^2)**	**Primary Target Species**	**Habitat (m^2)**										
			Estuarine	In-Stream Habitat – Mainstream	In-stream Habitat – Tributary	Riparian	Reservoir Shoreline Complexes	Riverine	Lowland Deciduous	Lowland Coniferous	Upland	Wetland
Impact Mitigation													
Fish passage technologies	Area of habitat made available to target species												
Drawdown zone revegetation/stabilization	Area turned into productive habitat												
Wildlife migration improvement	Area of habitat made available to target species	Identification of barriers to movement											
Prevention of drowning of nests, nestlings	Area of wetland habitat created outside expected flood level (1:10 year)												
Habitat Conservation													
Habitat conserved – general	Functional habitat conserved/replaced through acquisition and mgmt	Identification of critical habitat for conservation measures											
	Functional habitat conserved by other measures (e.g. riprapping)												
Designated rare/special habitat	Rare/special habitat protected												
Maintain or Restore Habitat forming process													
Artificial gravel recruitment	Area of stream habitat improved by gravel plmt.												
Artificial wood debris recruitment	Area of stream habitat improved by LWD plcmt												
Small-scale complexing in existing habitats	Area increase in functional habitat through complexing												
Prescribed burns or other upland habitat enhancement for wildlife	Functional area of habitat improved												
Habitat Development													
New Habitat created	Functional area created												

Appendix III: Confirmation of BCRP Recognition

Eight presentations on the project were completed the 2006-07 fiscal year. An example of the funding slide is provided below. Newspaper updates and advertisements for sighting record contributions were provided in the Bridge River Lillooet Newspaper and the St'at'imc Runner. Although funding agencies are always recognized during interviews, newspaper update length and content is at the discretion of the editor. Ongoing community interactions are vital to the success of Grizzly bear management in the Lillooet area and all team members participate in promoting bear issues within their various networks. Members of the working group are also involved in ongoing Government-to-Government negotiations to provide information on grizzly bears.

Example of slide used in presentation: