

BANFF NATIONAL PARK: SCIENCE AND POLICY IN GRIZZLY BEAR MANAGEMENT

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Abstract: Grizzly bears (*Ursus arctos*) in Banff National Park, Canada, and the surrounding ecosystem exist in one of the most developed and politically complex environments where the species persists. Human development and activity have significantly stressed the grizzlies' population and habitat. The Canadian National Parks Act was amended in 1988 to ensure the ecological integrity of nature. When a federal task force (Banff-Bow Valley Study) was established in 1994, status of grizzly bears was used as a fundamental indicator of terrestrial ecological integrity. Also in 1994, the Eastern Slopes Grizzly Bear Project (ESGBP) was formed as a multi-stakeholder partnership between 4 societal segments: national and provincial governments, business, conservation groups, and academic researchers. The primary mandate was to scientifically define through research the cumulative effects of human development on the regional grizzly bear population. An ESGBP Steering Committee meets quarterly to set research policy, primarily by using strategic targeting and knowledge of the policy and management process to design input into the Banff-Bow Valley planning process. Strategic targeting indicated the importance of analyzing preliminary data on mortality, habitat effectiveness, habitat security, habitat quality, and landscape linkages. ESGBP data on these topics significantly influenced policy decisions because we: (1) took a multi-stakeholder and interagency approach to research, (2) established a solid public understanding of the issue before discussion of solutions, (3) provided the messages as experts outside government, (4) involved key decision makers directly in developing the park management plan, and they understood our concerns and contributed solutions, (5) provided specific targets and goals that could be incorporated into policy, and (6) were persistent and timely in presenting our results (goals and targets) and their implications.

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Scientific knowledge is fundamental to manage and conserve grizzly bears. Conservation-oriented scientists often wish that what they believe are the implications of their research would be translated into policy changes and management actions. However, to think that science alone will result in desired objectives in public policy would be naive and may be counterproductive. Successful grizzly bear management and conservation, while grounded in science, is basically a problem solving art requiring a broad base of public and political support (Peyton et al. 1999). Science, values, and politics combine to form public policies regarding management and conservation of bears (Kellert 1994). An effective approach to influence public policy is based on awareness and integration of science, public values, politics, and socioeconomic factors. This awareness is used to inform policy alternatives and to attain goals (Franklin 1995). Kellert (1994) cogently argues that the wildlife policy process is multidimensional, interactive, and dynamic and therefore is extremely complex and subtle. "The recognition and understanding of bear policy as a complex web of interacting scientific, valuational, and political forces can enhance the chances for developing more successful policies, as well as increase the opportunities for greater professional effectiveness and a sense of control over the policy process" (Kellert 1994:43).

Decision-making processes within land management agencies respond to many forces and do not adapt quickly to change or to new information. Existing policies therefore have inertia because often they have evolved to bal-

ance many different forces. Given the resistance to change and the complex nature of policy decisions, scientists interested in influencing wildlife policy need to understand the decision process and to think strategically (Clark and Brunner 1996, Servheen 1998). However, "scientific research often does not focus on policy-relevant issues, and it may not be presented in terms that are useful or even understandable to decision makers" (Clark 1994:579).

To increase chances of achieving desired future conditions, the fundamental of planning, Servheen (1998) recommends a strategic planning approach. Identifying and prioritizing threats is fundamental, as is developing means to address them (Servheen 1998, Peyton et al. 1999). Threats may potentially affect major factors important for population survival—including mortality, survivorship, natality, habitat, linkages, monitoring, and public and political support, or the lack thereof. Servheen (1998) recommends using strategic targeting to identify, prioritize, and act on perceived threats. The mandate to do these things must come from relevant policy.

Clark (1994:589) cautions that "shared knowledge cannot obviate the conflicts that arise from inherent differences in values and perspectives," and that prediction is not always possible in a rational and scientific sense because all variables and their interactions are seldom understood. Given these limitations, Brunner and Clark (1997) recommend a practice-based approach in ecosystem (grizzly bear) management. Here, change is initiated at a relatively small scale through prototyping. A prototype is a trial change, a sort of controlled experiment, in a

system. If successful, this change can be implemented elsewhere (Brunner and Clark 1997).

Our paper examines the development of one such prototype, a new management policy regarding grizzly bears in Banff National Park (BNP), Canada (Parks Canada 1997). This new and significantly different policy was influenced by research results and management recommendations made by a major, multi-stakeholder research effort, The Eastern Slopes Grizzly Bear Project (ESGBP).

ESGBP AND GRIZZLY BEAR MANAGEMENT POLICY FORMATION

The ESGBP began in 1994 as a partnership between 4 major societal sectors: national and provincial governments, businesses, conservation groups, and academic researchers. Representatives from these sectors compose a Project Steering Committee that sets policy regarding research and informs supporters regarding results (Herrero et al. 1998). The Steering Committee coordinates a major research effort with the primary objective to understand the cumulative effects of human development on ecology of grizzly bears in and around BNP. Because of wide-ranging movements, especially of males, many grizzly bears enter numerous land jurisdictions each year. They exist in one of the most developed landscapes in North America where grizzly bears survive. Approximately one million people live within a few hours drive of the Park. Millions of tourists annually visit the Park and surrounding area. BNP is the most developed national park in North America, but it still provides protection and habitat for a geographically shared grizzly bear population estimated at 60–80 individuals. It is also part of a significantly larger regional grizzly bear population.

The Canadian Federal Government, responding to concerns about effects of development on the ecological integrity of the Park, established a major task force in 1994 (Banff–Bow Valley Study) to report, by 1996, on the status of the Park and to provide recommendations for the future. Additionally, the federal government was mandated to revise the BNP Management Plan within 6 months of receiving the report of the task force. The status of large carnivores, especially grizzly bears and wolves (*Canis lupus*), was identified by the task force as a key indicator of ecological integrity. The ESGBP was asked to prepare a detailed report on the status of the grizzly bear population and habitat; at the time the report was prepared, our research results regarding grizzly bears were preliminary. We examine the nature of our data, conclusions and recommendations, and how they interacted with other policy issues and influenced policy decisions in rewriting the BNP Management Plan. We describe the interaction between scientific data, other societal forces, and

new management actions related to grizzly bears as evidenced by changes in policy.

GRIZZLY BEAR POPULATION, HABITAT, AND LINKAGE ZONE ANALYSIS

The Banff–Bow Valley Task Force asked the ESGBP to prepare a report on the grizzly bear population and associated habitat, focusing on the intensively developed Banff–Bow Valley area. At that time we had only 2 years of research data. Valid and statistically reliable estimates of population parameters for grizzly bears require 5–10 years of data (Hovey and McLellan 1996).

Consequently, we used 4 techniques to derive estimates of grizzly bear population and habitat status (Gibeau et al. 1996). We:

1. Summarized and analyzed data on grizzly bear mortalities in BNP from 1971 to 1995;
2. Analyzed (Weaver et al. 1987, USDA Forest Service 1990, Gibeau 1998) the effects of development and human activities on grizzly bear habitat effectiveness in Banff, Kootenay and Yoho National Parks;
3. Conducted a security area analysis (Mattson 1993; Puchlerz and Servheen 1994) to determine size and quality of secure habitat units available to grizzly bears in Banff National Park and the Central Rockies Ecosystem in 1950, 1995, and under a future growth scenario, and;
4. Conducted a linkage zone analysis (Servheen and Sandstrom 1993) for areas along the Trans-Canada Highway where combinations of landscape features suggested reasonable probability for grizzly bears being able to cross. Linkage zone analysis was performed for 1950, 1995, and under a future growth scenario.

Mortality Analysis

Analysis of the mortality database showed a minimum of 73 recorded mortalities and removals for Banff Park from 1971 to 1995. This minimum estimate later increased to 107 (Benn 1998). The estimate of the average annual number of mortalities and removals for this period was high for a protected area (2.92/year or 3.65–4.87%/year of the population based on 60–80 bears). The Province of Alberta established a harvest target of 2% of an area's grizzly bear population estimate and currently manages the population to keep total mortality at roughly 4% to allow for population growth (Nagy and Gunson 1990). Using a population estimate of 60 or 80, this would allow an average annual mortality and removal rate of 1.2–1.6/year. Five-year average annual mortality/removal numbers ranged from 1.6/year to 6.2/year. Mortalities have been decreasing since 1981, probably because of improved

garbage management. Given the grizzly bears' low reproductive capability, this decrease in number of mortalities may also have been from a significant decline in the local bear population following high annual mortality prior to this period.

Knight and Eberhardt (1985) reported that the death of 1 or 2 adult females could have significant, negative population consequences for Yellowstone grizzlies. In BNP, the female cohort accounted for 56% (24 of 43) of all known mortalities and removals since 1971, and 88% (16 of 18) since 1983. This is the highest percentage of female mortality and removal for a 10+ year period known to have been reported for any grizzly bear population.

Mortality type analysis revealed problem bear control accounted for 71% of grizzly bear mortalities, followed by highway and railway kills (17%), unknown (8%), and natural death (3%). Over 90% of grizzly bear mortalities in Banff Park occurred in front-country areas, within a 500 m zone surrounding roads and human infrastructure.

Habitat Effectiveness

Habitat effectiveness modeling is the major component of cumulative effects analysis developed to quantitatively and qualitatively assess effects of human actions on grizzly bears and their habitat. Results indicated that a significant portion of the landscape was only moderately productive grizzly bear habitat (Gibeau 1998). The disturbance component of the model suggested that much habitat in Banff National Park is underutilized by bears to avoid people. Overall, the model suggested that the ability of the landscape to support grizzly bears was significantly reduced.

Habitat Security

There is a strong case to preserve areas where grizzly bear encounters with humans will be minimal: where bears can meet their energetic requirements and avoid people. Such security areas would foster the wary behavior in grizzly bears that most managers consider desirable. Security area analysis uses GIS (geographic information system) technology to identify areas that are functional at the scale of individual foraging bouts for adult female bears. Results of this analysis showed a progressive apparent loss of security areas and habitat quality starting with 1950 through the present and into the future, depicting an ever-increasing deterioration of habitat within Banff National Park (Gibeau et al. 2001). Fragmentation and insularization of core habitat within the Banff Park landscape was evident, coincident with a loss in the ability to foster wary behavior in grizzly bears.

Linkage Zone Analysis

Linkage zones are areas in which combinations of land-

scape structural factors allow wildlife to move through and live in areas impacted by human actions. Linkage zone analysis assesses the degree of habitat fragmentation caused by the cumulative effects of human actions in an area. A model to predict linkage zones was developed in the USA to identify and quantify areas of potential carnivore crossing and use in mountain valleys (Servheen and Sandstrom 1993). Results for Banff showed a dramatic decrease in potential crossing areas over time. Fencing of the Trans-Canada Highway significantly affected the ability of grizzly bears to move across the Bow River Valley. Implications of such a barrier are unknown, although the Trans-Canada Highway could profoundly affect grizzly bear passage across the Bow River Valley and ultimately movement throughout the Central Canadian Rocky Mountains.

Analysis summary

The combined results of our 4 analyses, though preliminary, demonstrated converging evidence that the grizzly bear population and habitat in the Banff-Bow Valley, BNP, and the Central Rockies Ecosystem were seriously stressed by the combined effects of people's development and activities (Gibeau et al. 1996). The situation was deemed urgent, especially for BNP, which is designated as a protected area. A better policy regarding grizzly bear management and conservation was warranted.

THE POLICY DECISION PROCESS

The Canadian National Parks Act requires that a management plan with public input be prepared for each national park. These plans must reflect the policies and legislation of the Canadian federal government. A management plan guides the overall direction for the park for a 10 to 15 year period and serves as a framework for all land use and management decisions.

The first management plan for BNP was approved in 1988, based on consultation and research that occurred in the 1980s. By 1994, the recommendations in the plan were being repeatedly questioned. Developers and those with commercial interests in the park viewed Parks Canada as overly zealous in adhering to its mandate of protecting park resources. In contrast, environmentalists felt that too much use and development was being permitted and questioned the long-term ecological integrity of the park.

In 1994, the Minister responsible for Parks Canada appointed the Banff-Bow Valley Task Force to review available information on BNP, facilitate public examination and discussion of the information base, and recommend ways to maintain the long-term ecological integrity of the park while allowing appropriate levels of development and use. These recommendations were to be made di-

rectly to the Minister, who would then incorporate them into a new management plan for the park. Tabling of recommendations and partial implementation occurred in October 1996 when the minister immediately appointed 5 members of the public to an Implementation Advisory Group, chaired by the Assistant Deputy Minister for Parks Canada. The advisory group reviewed over 500 recommendations and identified the principles and actions to be incorporated into the park management plan. By January 1997, a draft park management plan was available for review and discussion; the Minister approved a new park management plan that April.

The new park management plan, with its high public support, was strongly based on quantitative scientific information and contained specific habitat effectiveness targets for each bear management unit and a grizzly bear annual mortality target of $\leq 1\%$ of the estimated population. These targets were directly derived from ESGBP research findings and recommendations. The plan contained an array of actions, some based on other quantitative scientific input. Over the long-term, the plan will result in improved carnivore habitat effectiveness, improved wildlife corridors and linkages, reduced human-caused mortality, and reduced habituation of bears to humans. Many specific recommendations, positive for grizzly bears and other sensitive large carnivores, have been implemented as of 1999. A bison (*Bos bison*) paddock has been removed and a horse corral relocated. The Town of Banff completed a new community plan that reduced the area of the town by 17% and capped development. A growth management strategy for the town is also now in place. Bicycle use was terminated in the Bryant Creek area. Some backcountry campgrounds were removed and some short trail connections were closed. An environmentally sensitive site was established in the montane zone where bicycle use is not permitted and trail use is aggressively discouraged. Parks Canada also served notice that it intends to shut down summer use of the sightseeing gondola at Lake Louise. This currently carries (on average over the last 5 years) 75,000 people/year into high quality grizzly bear habitat. Actions resulting from the new management plan are a success story concerning scientific information changing the direction taken by an agency that manages a large tract of natural land.

Integrating Science-based Knowledge and Policy Development

Six identifiable dimensions of the ESGBP research influenced the development of a sound management plan. Such components are applicable in designing research to influence wildlife planning.

1. *Take a multi-stakeholder and interagency approach to research*—Early in the research, the ESGBP determined

that the involvement of a multi-stakeholder, interagency steering committee was essential (Herrero et al. 1998). This committee provided strategic direction for the project and helped to focus the research on regional-scale cumulative effects of development on grizzly bears. Members on the committee included representatives of the major government agencies that managed land in the Eastern Slopes area and those who could affect grizzly bear habitat by their activities, such as ranchers, the logging industry, the oil and gas industry, and recreational users. Additionally, the Parks Canada's representative on the Steering Committee (the second author of this paper), ultimately became the main author of the park management plan. Familiarity with the ESGBP enabled her to promote the recommendations of the ESGBP with senior park managers and support their incorporation into the plan.

Because influencing public policy was a project objective, we involved stakeholders outside of the research community early in the scientific research. This provided relevance for the research and reminded us how the research results were relevant to and used by others. It also enabled others, particularly land managers, to understand and buy into the research early on and to influence the design and analysis of research so it met their needs.

2. *Establish a solid public understanding of the issue before discussing solutions*—Too often, people involved in establishing policy or writing plans, are quick to outline solutions. More time needs to be invested in discussing the issue, prior to identifying options to resolve, so that there is a solid acceptance of the problem and understanding of the issue.

Senior land managers and the public generally do not read scientific articles. What they hear tends to be through the media when scientists respond to an action a land management agency or developer is proposing. However, during the Banff–Bow Valley Study there were many public presentations of scientific information regarding the current state of the ecosystem and specific wildlife species. Scientists communicated their findings to a broad audience. ESGBP and a wolf research project consistently described important aspects of the status of the terrestrial ecosystem. This public exposure and examination of scientific information led to a wide cross-section of interest groups accepting the problem of loss of ecological integrity of the park, particularly as it relates to carnivores. It was established that past and current management practices that allowed development inside and outside the park had a negative effect on ecosystems in the park and the surrounding region. The messages were consistent and repeated numerous times, especially emphasizing the problem of mortality and declining security of habitat for bears and wolves.

3. *Use experts from outside of government to present*

information—The information presented by scientists during the Bow Valley Study generally was not new. Most of the scientists had been conducting research in the park for some time. Parks Canada had provided much of the information to the public before; however, in the past it had not been viewed as credible or had not been heard. The Bow Valley Study gave a focus for information sharing and the public knew decisions would result, and so people listened more intently. The information also was more credible in the public's mind because government employees did not provide it. Further credibility was given by external peer review by respected scientists not associated with the ESGBP.

In Canada and the USA, there is a distrust of government and government employees. Agencies need to seek the assistance of credible individuals outside of government to publicly discuss scientific information. No matter what the credentials, government employees lack the necessary public credibility. Working with external experts helps public acceptance of findings.

4. *Involve key decision makers in developing park management plans*—The usual process for park management is to prepare a plan at the park level with park staff, including the Superintendent, and the public. This is followed by plan approval by senior Parks Canada managers who recommend for approval to the Minister responsible for Parks Canada. This is usually a lengthy process in which key aspects of the plan must be defended and are frequently changed.

Because of the profile of BNP and the Bow Valley Study, key decision makers within Parks Canada were involved in developing the plan. Consequently, the plan received approval in a very short time, with very few changes, and was strongly defended and supported by senior management of the organization. Consequently, having senior managers involved early in the planning process was very valuable. In many instances this will not be possible; however, it will be important to identify issues that can become obstacles and ensure that senior managers are familiar with them and their scientific background.

5. *Use specific targets and goals from the scientific community that can be incorporated into policy*—Frequently, scientific information about ecological processes is quite nebulous; it outlines generalities or trends. Senior land managers prefer something more definitive; they expect specific goals or targets to which the organization should be headed and toward which progress can be measured.

In this situation, the researchers conducting the ESGBP were able to define specific targets that could be turned into policy direction. They were able to demonstrate the long-term implications of human-caused mortality of grizzlies, including management actions required to increase survival of habituated bears. A target was suggested and

incorporated into the management plan of reducing the annual number of grizzly bears killed from human activity to <1% of the population. This resulted in changes in the bear management plan, better management of roadside bear situations, and programs of aversive conditioning.

Targets also were set for habitat effectiveness for each carnivore management unit (CMU; these are the same as bear management units). Implementing these will require a concerted effort to manage human use, particularly in backcountry areas. Some actions have been undertaken taken, such as eliminating bicycles from certain areas, discouraging use of some trails by removing trailhead signs and eliminating trail maintenance, and closing some backcountry campsites. Considerable dialogue must take place with users so they understand the concept of habitat effectiveness and to identify ways that human use can be managed. This will include relocating trails and establishing quotas and a reservation system. Although it is unlikely that the targets will be met for all CMUs, Parks Canada must be able to demonstrate that it is actively taking significant steps to improve carnivore habitat effectiveness from where it was in 1997. These targets will make it easier for the public and Parks Canada to measure progress in achieving the policy direction outlined in the management plan.

6. *Be persistent and timely*—Scientific-based recommendations were incorporated into policy partly because of the persistence of scientists, who viewed the Bow Valley Study as an opportunity to influence land use decisions. They gave priority to the study and fitted their research findings within the information-gathering structure provided. Two lessons emerged. First, scientists need to take advantage of opportunities to influence decisions even when those opportunities arise prior to the research being completed and even under stringent deadlines (See Herrero et al. 1986 for another example of this in grizzly bear management). The second lesson was that policymakers need to create opportunities for scientific information to be shared with those outside the scientific community who can influence decision making.

Scientists can not be passive players, hoping that by publishing research they will influence decisions, or by writing the occasional letter, or by talking to managers through the media, or by pounding the table at public meetings. Scientists need to adapt their behavior to the process of information gathering or decision making that is being used.

IMPLEMENTATION AND MONITORING

The approval of the new management plan in April 1997 was a beginning. Implementation of many of the actions

identified has proceeded. A concerted effort by Parks Canada staff has resulted in closing or relocating some facilities and roads, establishing public advisory groups, developing a new community plan with a low-growth strategy, and modifying and restricting backcountry use. To achieve grizzly bear management targets, more and difficult changes will be needed. Additional research, developing an interactive computer habitat effectiveness model, and extensive consultation with backcountry users is required before management can implement further actions, which may result in trail-use quotas, eliminating or relocating campgrounds, seasonal closures, etc.

Although there is widespread public support for the management plan, there are groups and individuals questioning specific actions that will directly impact them. To gain support for actions that will directly affect groups and individuals, a major communication effort is being pursued to assist those who will be affected and the general public in understanding the scientific basis and rationale for the action. Because of the public exposure the research scientists received in the past, the special interest groups are requesting presentations from the researchers rather than from Parks Canada staff. There is need for ongoing commitment of ESGBP researchers to be involved in communicating with the public to help implement plan recommendations.

Although the first phase of the ESGBP ended in 1999, information on the grizzly bear population and the effects of land use on their survivorship and activity must continue to be collected. Parks Canada will need evidence that the various actions that have been taken are actually reversing past trends concerning inadequate habitat effectiveness and security and undesirable grizzly bear mortality. Monitoring must be conducted regionally. Decisions have not been made as to the intensity of data collection, funding sources, and the agencies involved.

CONCLUSIONS

Many researchers who study wildland species such as grizzly bears do so because of strong interest in wildlife conservation. These scientists may be passionate regarding what they perceive to be the need for policy makers to respond to their findings by changing population, habitat, and behavioral conditions toward a more sustainable and respectful state. However, policy makers for land and wildlife management agencies work in a professionally complex environment where a host of societal interest groups try to get their findings or desires translated into supportive policies and management actions.

We have identified 6 primary reasons why the ESGBP succeeded in translating many of its research findings and management recommendations into policy and manage-

ment changes. Fundamental to this success was having supportive policy and legislation regarding the importance of maintaining ecological integrity. The ESGBP argued that the population and habitat status of grizzly bears were good indicators of aspects of terrestrial ecological integrity in BNP. Within this framework, the ESGBP recommended measurable, scientifically-determined population and habitat targets. Senior park planners accepted these recommendations, partly because they had been involved and informed throughout the research process and because the findings and recommendations were supported by scientific peer review. Existence of the ESGBP multistakeholder, interagency steering committee and its dialogue was fundamental to encouraging policy changes supportive of many of the grizzly bear management recommendations made by the ESGBP. The willingness of ESGBP researchers to present inferences based on incomplete data also was important in influencing policy changes. Policy review processes most often evolve independently of research. Researchers interested in influencing policy and management must sometimes be willing to draw inferences from incomplete data, usually at awkward times. The senior author had previous experience of this regarding grizzly bears and was able to apply this experience (Herrero et al. 1986).

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