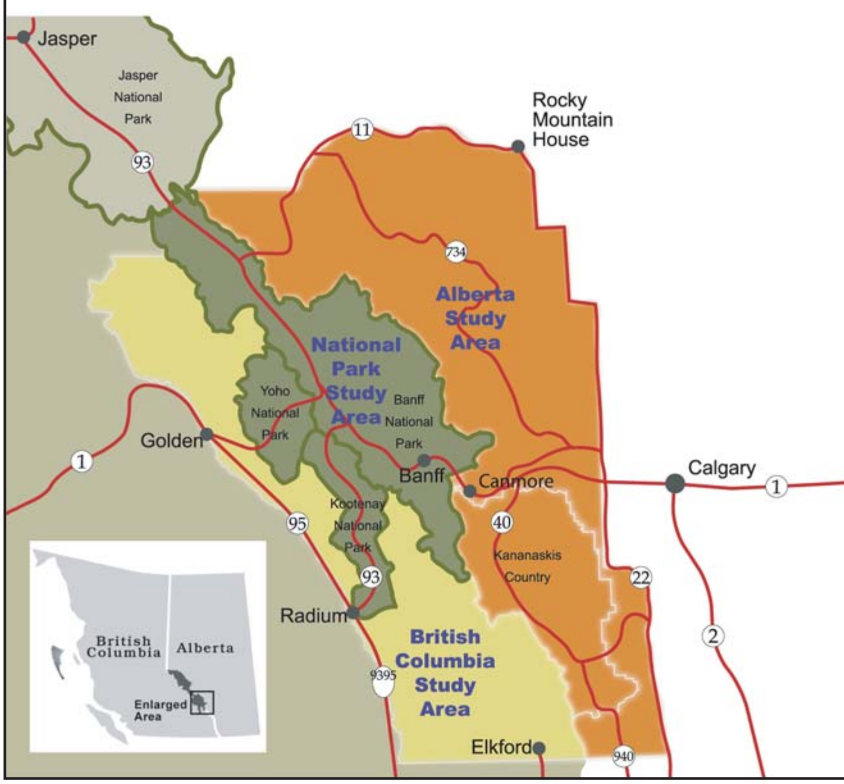
CHAPTER 15

MANAGEMENT RECOMMENDATIONS: EASTERN SLOPES GRIZZLY BEAR PROJECT FINAL REPORT



ESGBP

15. MANAGEMENT RECOMMENDATIONS: EASTERN SLOPES GRIZZLY BEAR PROJECT FINAL REPORT

Please see pages *vii* to *xviii* of the Summary for an outlined, short version of this chapter. Also note that we recommend priority 1 (P1) for implementation within 2 years, and priority 2 (P2) for implementation within 5 years.

1. DEMOGRAPHY AND MONITORING

Goal: To achieve a sustainable human-caused grizzly bear survival/mortality rate throughout the Central Rockies Ecosystem (CRE) that is scientifically documented by collecting adequate data, with an established level of acceptable risk that supports a high probability for the long-term survival of grizzly bears in the CRE.

1a. Establish science-based survival (mortality) rate targets for adult female bears that would have a high probability of supporting population growth or maintenance (lambda ≥1) for each grizzly bear population management unit in the CRE. (P1)

We congratulate managers in the Bow River watershed (BRW) portion of the CRE for achieving a 95% survival rate (5% mortality rate), 1994–2002, for adult female grizzly bears (Garshelis et al. 2005). This high survival was key to a highly probable positive population growth rate (λ) during this time period. A survival rate of 91% for the BRW should prevent population decline, although this target would be risky, as it does not consider either environmental stochasticity or sampling error. A safer target and the one we recommend would be to maintain the 95% survival rate for adult females that we documented (Garshelis et al. 2005).

This adult female survival rate also represents the best target, until new research demonstrates otherwise, for the larger portion of the CRE and population management units that exist beyond the BRW. From a biological perspective population management units would be based on bear populations that have free genetic exchange within a unit and much less exchange with other units. Such population units would be mostly "closed." The extent of gene flow between units can be determined by collecting DNA samples (Proctor 2003, Proctor and Paetkau 2004). Jurisdictional boundaries between federal and provincial areas will complicate integrated management of biologically-based population units.

Maintaining a high rate of grizzly bear survival will likely become more difficult in the future, as mortality data from the BRW, 2003–2004, suggests (Chapter 5.2, this report). Vision, funding, personnel, public support and commitment will be needed to prevent an increased human-caused mortality rate and population decline and to know if this is occurring.

Grizzly bears in the BRW had a reproductive rate that was at the low extreme of all populations studied in North America (Garshelis et al. 2005). It is doubtful, at least in the short term, that this rate can be raised. Therefore management efforts to maintain high demographic vigor (λ) should be focused on survival. Given what appears to be a low population density, and hence abundance in the BRW (Chapter 5.3, this report), achieving high survival, especially of adult females, is necessary for population persistence. Male mortality has little direct effect on population growth, unless breeding is affected or unless losses of males affect the mortality rate of females.

1b. Monitor survival/mortality rate and reproduction in the Bow River Watershed. (P1)

We recommend monitoring survival/mortality and reproductive rate for adult female grizzly bears in the BRW. This rate should be evaluated against target values. This approach would be desirable in the BRW because of the large amount of human use and development and therefore the chance of unsustainable mortality and the need to know if this is occurring. Scientifically designed research that includes capturing, radiomarking and monitoring a representative sample of grizzly bears would provide the most reliable assessment of survival, reproduction and growth rate. This approach also allows for informed interventions and helps to set demographic targets. Without having taken this approach we would not have discovered the high survival rate and low reproductive output in the BRW, 1994–2002.

To assess whether the goal of maintaining a non-declining grizzly bear population is being met, we recommend that managers continue to monitor survival and reproduction in the BRW using a sample of radiomarked females similar to ours (~15 bears/year; Garshelis et al. 2005). Maintaining such a sample of radiomarked grizzly bears for multiple years is the most scientifically defensible means of monitoring survival and reproduction. Since this is an expensive and invasive approach it should only be used when information regarding grizzly bear population dynamics is judged to be critical as in the BRW and the Yellowstone Ecosystem in the United States (Schwartz et al. In press).

Survival could also be crudely monitored without radiomarking, just by counting known dead grizzly bears (Garshelis et al. 2005). Benn and Herrero (2002) did this for Banff National Park while we conducted the ESGBP telemetry study. They documented a decline in mortality, concomitant with dramatically improved human food and garbage management and more protective management policies. Using their data as a baseline representing positive population growth, management authorities in Banff National Park could strive to ensure that total mortality did not increase beyond this (Garshelis et al. 2005). Radiotelemetry, though, would be a more reliable means of obtaining mortality data and is the method we recommend for the BRW. Maintaining a representative, radiomarked sample such as we had would also allow for monitoring of reproduction, population growth (λ), and important aspects of movements, landscape use and interactions with humans. Longitudinal study of radiomarked bears will not give a point estimate of population size.

1c. Develop and apply non-invasive DNA "capture-recapture" designs to calculate and monitor relative abundance, derive population estimates against which to evaluate human-caused mortality, and as one means of documenting distribution changes. (P1)

For the majority of the CRE, where longitudinal study of radiomarked bears is neither desirable nor feasible some means is needed to scientifically estimate population size and mortality rates for different management units. Without radiomarked bears only human-caused mortality can be estimated. In the BRW 1994–2002, known, human-caused mortality was 75% and 86% of adult female and adult male mortality, respectively. Based on this, total mortality rate could be estimated but one would have to assume these figures were valid estimates for other population units. This lack of precision would have to be taken into account in managing human-caused mortality. Acceptable human-caused mortality rates for a given management unit should be a percentage of the most scientifically defensible population estimate. The desirable human-caused mortality rate should be one that, combined with the natural mortality rate, supports a high probability of population growth or maintenance. Unless individual animals are being monitored over time, 45–51% of grizzly bear mortality has been found to be unreported (McLellan et al. 1999). This needs to be taken into account in setting targets for known, human-caused mortality.

We recommend continuing to develop and use DNA capture-recapture sampling methods that have revolutionized researchers' ability to estimate relative abundance and population size of grizzly bears, and to document distribution (Poole et al. 2001, Boulanger and McLellan 2001, Boulanger et al. 2002, 2004a,b). There are, however, important issues to be resolved, especially regarding use of DNA capture-recapture methods for deriving population estimates. The primary unresolved issues relate to choosing a sampling grid design and number of hair-capture session repetitions that potentially would yield a sufficiently robust and precise population estimate (Boulanger 2004a, b). In British Columbia, population estimates with coefficients of variation of less than 20% have been obtained with intensive sampling designs (Poole et al. 2001, Boulanger et al. 2002). Issues regarding closure (especially when radiocollared animals are not also part of the study), possible heterogeneity of the samples related to differences between males and females, age, and individuality, remain to be fully resolved (Boulanger et al. 2004a, 2004b). Also specific to the CRE, there is significant use of electric fences. Bears that have experienced electric fences may be less likely to go under or over knee-high barbed wire that is intended for hair collection. This could be another source of sampling bias. However, DNA capture-recapture designs are promising and should be regularly and carefully evaluated and used in the CRE. If they can be demonstrated to provide the demographic information needed to sustainably manage grizzly bears then this could eliminate most of the need to capture and radio-collar bears. The Province of Alberta is currently developing, using and evaluating DNA capture-recapture research designs in the Alberta portions of the CRE and elsewhere (personal communication: Gordon Stenhouse, Foothills Model Forest, Hinton, Alberta). We also recommend that habitat-based density models be developed to be able to extrapolate density from areas where DNA capture-recapture population estimates are available to ecologically similar, but unstudied, other areas. This would allow for habitat-based population estimates, and combined with data on human-caused mortality, estimation of sustainable mortality rates.

DNA sampling is also the method of choice for determining grizzly bear distribution. We recommend that it be used along with other means to assess whether potential grizzly bear habitat is occupied.

1d. Use annual counts of females with cubs as a coarse index of population trend. (P2)
Annual counts of the number of females with cubs of the year have been used in the Greater Yellowstone Area to derive a minimum population estimate, and also as an index whose year to year direction reflects population trends (Knight et al. 1995, Haroldson 2004). From the minimum population estimate derived from analyzing annual counts of females with cubs, annual allowable human-caused female mortality has been derived (Haroldson 2004). The ESGBP recorded annual counts of females with cubs of the year (Gibeau and Stevens 2003). However, since visibility is less in the BRW versus the Yellowstone Area, we only recommend this method in the BRW for coarse trend monitoring.

1e. Have periodic scientific peer review and inform the public regarding the scientific basis for grizzly bear population estimates. (P1)
Because grizzly bears in the CRE are secretive, hard to see, occur at low population densities, and have large home ranges it will always be difficult to derive population estimates. However, such estimates are essential to determine annual allowable total and human-caused mortality. We recommend that the science used to make such estimates be explicit, subject to periodic scientific peer review, and be made public.

1f. Given the extremely low reproductive output of grizzly bears studied in the Bow River watershed, use research to better understand the reasons. (P2)
Our demographic research showed that grizzly bears in the BRW and probably the rest of the Alberta portion of the CRE have little resilience, the ability to recover abundance after numerical decline (Weaver et al. 1996, Garshelis et al. 2005). A low reproductive rate and population density determine this. Our research has not clearly revealed the cause of the extremely low reproduction. Extensive research has demonstrated that reproduction is fundamentally controlled by nutrition and especially by the availability of high energy foods (Rogers 1976, Stringham 1990, Ferguson and McLoughlin 2000, Chapter 8 this report). It is widely believed that decades of fire suppression have made habitat less productive for species such as grizzly bears (Hamer and Herrero 1987, Hamer 1996, 1999). This is because many of the high energy foods found in the CRE, such as berries and ungulates, become abundant post-fire and then decline with succession. Research regarding high-energy grizzly bear foods such as ungulates and berries should be carried out and focused on better understanding their role in nutrition and reproduction. A negative influence of humans and development on habitat use may also be depressing reproduction (Chapters 11 and 12, this report).

1g. Continue research regarding body condition and reproductive hormones. (P2)
In an effort to seek potential explanations for low cub production by Eastern Slopes grizzly bears, a comparison of select health parameters was made between Eastern Slopes and Foothills Model Forest (FMF) Grizzly Bear Project bears. The parameters considered were body condition as a reflection of nutrition and reproductive hormone levels as a reflection of reproductive function. The working hypothesis was that reduced reproductive output in ESGBP grizzly bears was a result of low energy uptake causing diminished reproductive function (Chapter 8, this report).

Results from a comparison of body condition and reproductive hormone concentrations between ESGBP and FMF bears were consistent with the hypothesis that reduced reproductive output (long interval between litters and low reproductive rate) in Eastern Slopes grizzly bears was a result of low energy uptake (especially in males) causing diminished reproductive function. Converging results, supporting the idea of low energy uptake, came from our preliminary study of grizzly bear diet using stable isotopes (Chapter 8, this report). We recommend continuing these lines of research to try to better understand the low reproductive output in Eastern Slopes grizzly bears.

2. MORTALITY: RECORDING, UNDERSTANDING AND MANAGING

Goal: To document, evaluate, understand and sustainably manage grizzly bear mortality.

2a. Document, analyze and report annually on grizzly bear mortality in the Central Rockies Ecosystem. (P1)

One of many reasons for recording and analyzing grizzly bear mortality rates in the CRE is because most mortality is human-caused and therefore can be influenced by management actions (Benn 1998, Benn and Herrero 2002, Garshelis et al. 2005, Chapter 6 this report). Known, human-caused grizzly bear mortality has been regularly recorded in all jurisdictions. However, in the past, record keeping has been in different formats, there have been significant errors of omission and analysis has been infrequent (Benn 1998, Benn and Herrero 2002). Given the fundamental role that survival has in grizzly bear population persistence, records of mortalities should be thorough and precise throughout the CRE. Biological and human-related important details should be recorded in exactly the same manner within each jurisdiction. This would facilitate CRE-wide annual assessment and reporting such as is done for the Greater Yellowstone Ecosystem (see Haroldson 2003, p. 28, Table 13 for an excellent example. This is reproduced in Appendix 1.) We recommend that Parks Canada, Alberta, and British Columbia meet and decide how best to develop and manage this database and annual analysis. Annual reporting should be a conjoint effort. This should be used to inform researchers, agencies, industry and the public.

Accurate biological data needs to be supplemented with human-related information regarding cause of death, location, distance to access, condition of access at time of mortality, mode of travel of person responsible for removal of bear, presence or absence of human food attractants and natural foods, and what role if any human artifacts and behavior played in the mortality (Benn 1998, Benn and Herrero 2002).

2b. Develop programs to be able to manage each significant source of grizzly bear mortality in a responsive way with annual reports and annual review of mortality management programs and their success related to cause-specific mortality. (P1)

The adverse effect that unsustainable, human-caused mortality has on grizzly bear populations is often developed through the cumulative effects of many factors. Human-caused grizzly bear mortalities in the BRW are associated with a variety of human activities (Benn 1998, Benn and Herrero 2002, Chapter 6 this report). Human activities associated with mortalities are influenced by landscape management policies such as grizzly bear and ungulate hunting, human food and garbage management, recreational developments and associated activities, and access. Science can be used to derive estimates of sustainable human-caused mortality rates for management units. Achieving these mortality rate targets involves influencing people and their actions in grizzly bear habitat.

Given that increased development and human activities will increase contact with grizzly bears (Chapter 13, this report), we will have to become better at managing potentially lethal human actions for the bears to survive at sustainable rates. Human behavior will have to change to maintain high survival rates for grizzly bears as more people and development occupy the landscape. Changing human behavior will likely involve decreasing individual rights and privileges that are currently enjoyed related to landscape development and unrestricted use (McLellan 1998). Managing the impacts of individuals may prove to be more difficult than managing impacts of industry (McLellan 1998).

Specific programs should be developed to help manage each major source of human-caused grizzly bear mortality so as to maintain or bring overall human-caused mortality to sustainable target levels. Our research shows major human dimensions associated with grizzly bear mortalities are: grizzly bear and ungulate hunting, recreation, and problem wildlife (addressed primarily by human food, garbage, and livestock management), First Nations (need to develop dialogue), high speed highways and railways, and research on grizzly bears (Benn 1998, Chapters 6.3 and 6.4 this report).

2c. Use understanding of spatial aspects of grizzly bear mortality in the CRE for input into planning human activities that have a significant grizzly bear mortality probability so as not to exceed the established human-caused, mortality rate limits for each management unit. (P2)
Knowledge of the characteristics of locations where human-caused female grizzly bear mortalities have been concentrated may be used to inform land and grizzly bear management decisions (Chapter 6.6, this report). Managers may choose to carefully monitor mortalities in these areas and in some cases take steps to decrease such mortalities. Lake Louise is one such area where steps are being taken to decrease the high level of human-caused mortalities of female grizzly bears (Benn 1998, Benn and Herrero 2002, Nielsen et al. 2004).

Access management is a key issue in planning for grizzly bear persistence. Grizzly bear mortalities cluster near motorized access (Benn 1998, Benn and Herrero 2002, Nielsen et al. 2004, Chapter 6.4 this report). The low levels of habitat security (Chapter 12, this report) for grizzly bears in the CRE should be addressed through access management. In portions of the CRE where grizzly bear hunting exists and there is area concentrated mortality (Chapter 6.6, this report), specific restrictions such as access control, could be used to achieve human-caused female mortality rates that would support population growth or maintenance. The most accepted approach to manage access to provide for grizzly bear security is to apply open motorized road-density standards.

As would be expected, landscape attributes relating to human use, such as roads, trails, and terrain, correlated well with the locations of human-caused grizzly bear mortalities (Benn 1998, Nielsen et al. 2004). Spatial mortality models, like those presented in this report, can be used as a basis for management of humans in grizzly bear habitat and the identification of potential restoration (road access control or deactivation) sites. Moreover, incorporation of risk models with existing animal occurrence models (e.g., Nielsen et al. 2002, 2003) may prove useful for assessments of population viability (Boyce and McDonald 1999) and attractive sink dynamics (Delibes et al. 2001, Naves et al. 2003). We suggest that risk models be integrated with habitat models for identifying key habitat sinks and secure areas for active management and protection respectively.

3. HABITAT: DISTRIBUTION, SELECTION, SECURITY, CONNECTIVITY

Goal: To define and implement habitat standards that would support grizzly bear persistence.

3a. Using the best available data on landscape selection by especially female grizzly bears, work toward CRE-wide identification and protection of grizzly bear habitat. (P2)
If too many bears are dying in a management unit to support population growth or maintenance then managers often can lower mortality rates through management actions such as cessation of grizzly bear hunting, improved management of ungulate hunting, better recreational management, or better management of people’s food and garbage. Population recovery should occur provided that carrying capacity has not been lowered by habitat loss. Habitats are usually difficult or impossible to rehabilitate following development, especially of permanent facilities and other infrastructure. Yet habitat is fundamental to supporting any animal population.

ESGBP researchers have developed models representing habitat selection at coarse and fine scales within the CRE (Chapter 10, this report). We have shown that “scale-dependent” habitat selection occurs and that grizzly bears simultaneously select for components of habitat at several different scales. A case can be made for giving extra protection to habitats that grizzly bears select, especially habitats selected by females. We recommend this be done based on our research findings. To assure that selection has been for productive habitats, reproduction and survival in these areas could be monitored.

In applying seasonal resource selection functions to the eastern slopes landscape, we identified 4 geographic areas that had a concentration of high probability of adult female occurrence and also had a relatively high density of human-caused grizzly bear mortalities (Chapters 6.6, and 10.3, this report). These areas were: 1) around Lake Louise, 2) from the Red Deer River/Ya Ha Tinda area, south to and including the Burnt Timber drainage, 3) around Banff townsite, and 4) along the Canmore/Bow River corridor as far east as the Kananaskis River drainage and the Old Fort Creek drainage, and extending south to include the Wind Valley and the Evan-Thomas Recreation Area. We also identified numerous smaller pockets with high probability of female grizzly occurrence distributed throughout the study area but especially south of the Trans Canada Highway. Each of these 4 areas, which had a concentration of high probability of adult female use and significant human-caused mortality density, is a candidate for management that will allow for grizzly bear habitat use with minimal human-caused mortality risk. This will be challenging to achieve because of extensive human use in these areas.

3b. Using the best available science establish habitat security targets that would support human-caused mortality rate goals. (P2)

How much habitat should be "protected" to support grizzly bears is a fundamental question. Grizzly bear needs are only one factor entering into land use planning decisions. However, land planners cannot ignore grizzly bear needs if the bears are to persist. Grizzly bears need security. This means having opportunity to live in areas where mortalities do not exceed a sustainable level. To attain this will require managing the landscape where grizzly bears live such that the frequency and potential lethality of encounters with humans yields a sustainable rate of grizzly bear mortality (Mattson et al. 1996). This entails managing human use, access and potential lethality, and monitoring human-caused mortality rates for grizzly bears.

For each jurisdiction in the CRE we calculated the percentage of the productive landscape that had undisturbed (without roads or trails) and connected minimum size units of 9 km^2, the mean size of an adult female's daily foraging area (Gibeau et al. 2001, Chapter 12 this report). The percent of productive land base where adult female grizzly bears have a low probability of encountering people (secure) depends on the amount of productive land available to a bear and the extent of human influence on that land. British Columbia provincial lands had the largest percentage of secure habitat (50%), followed by Alberta provincial lands and national parks with 43% secure habitat in both, and Kananaskis Country with 36%. None of these areas met the current target level of 68% considered to be adequate security set by the US Department of Agriculture Forest Service in the Northern Continental Divide grizzly bear ecosystem in northwest Montana (US Department of Agriculture Forest Service 1995).

We recommend management intervention throughout the CRE, primarily access management, to increase secure habitat to 68% with priority being given to habitat most selected for by females and where mortality has been concentrated, such as nearby Lake Louise developments and other areas we have identified (Chapters 6.3, 6.5, and 6.6, this report). The bottom line is maintaining a high rate (≥91-95%) of adult female survival. We caution that there can be decade long time lags between habitat changes and detectable population effects (Doak 1995). Maintaining low human-caused mortality rates can be expensive as it may require thousands of hours of professional work to try to teach individual female grizzly bears that being near certain developments is not good for them. An alternate approach would be to provide female grizzly bears with greater security. Monitoring changes in grizzly bear habitat security over time is a useful indicator of human influence on land.

3c. Maintain, restore or mimic ecological processes in order to recreate plant and animal communities that are more similar to those grizzly bears experienced in the CRE when First Nation peoples were the only humans. (P2)

Grizzly bears and other animals in the CRE live primarily in mountainous forested environments dominated by coniferous trees. Until about 125 years ago fire was the primary natural disturbance influencing the structure and composition of such plant communities (White 1985). Animals and plants co-evolved to live with fire. Fire created vegetation resources for certain animals. Grizzly bears in the CRE forage extensively on critical, high caloric density foods such as berries, ungulates and ants in the early seral stages after fire (Hamer and Herrero 1987, Hamer 1996, 1999). Wildfire suppression has been extensive in the CRE. In the national parks a combination of wildfire (in Kootenay National Park) and prescribed burns (Banff National Park) is being used to allow or mimic fire's role in structuring plant communities. In most British Columbia and Alberta lands that are part of the CRE the forest is harvested. While this creates early seral stage vegetation it may also negatively influence cover (Oldershaw 2001). The major negative factor for grizzly bears related to forest harvest is increased human vehicular access and related increased grizzly bear morality risk (Benn 1998, Chapter 6.4 this report).

Performance criteria to measure the success of ecological restoration are challenging to define. We recommend that where possible, managers allow for or mimic effects of natural fire regimes within landscape units. Target values should represent the historic fire cycle and approximate proportions of different seral stages associated with those cycles.

While ecological restoration can create the habitat needed to support grizzly bears and other species that co-evolved with fire there will be many human elements in the CRE landscape that were not part of historic ecosystems. We cautiously support human-caused environmental changes such as limited developments in habitats that provide few resources for grizzly bears or other sensitive species as long as such developments can be demonstrated to not adversely affect ecological restoration or sensitive species.

3d. Apply both coarse and fine scale selection models to landscape management to insure that habitat important to female grizzly bears is conserved. Also, support the Integrated Decision Tree Approach for habitat mapping. (P2)

ESGBP models that showed selection for greenness are useful as a coarse habitat management tool (Chapter 10, this report). Land managers can monitor across decades broad changes in greenness and human activities in grizzly bear security areas that have high greenness values. Loss of greenness could be used as an early-warning signal to precipitate management action or habitat enhancement. Models based on finer scale vegetation patterns (Chapter 10.3, this report) provide ecological correlates with bear presence, thereby allowing for active management of specific ecological attributes, levels of human use in important habitats, or other actions identified as necessary. We recommend both coarse and fine scale management approaches to ensure habitat used by female grizzly bears is conserved.

We also recommend newer habitat mapping techniques such as the Integrated Decision Tree Approach (IDTA) that is currently being used by Alberta Sustainable Resource Development (Franklin et al. 2001). This technique has the potential to significantly improve habitat mapping resolution and precision.

3e. Begin to systematically restore grizzly bear habitat in the CRE. (P2)

The number of humans and our footprint in the CRE will continue to increase (Chapter 13, this report). Therefore we must balance human activity with acceptable grizzly bear mortality rate limits to have a high probability of population persistence. To do this the ESGBP Population and Habitat Viability Workshop recommended restoration of grizzly bear habitat at a rate of 2% annually until security and survival targets are met for the CRE (Chapters 5.1, 6.4, 12, this report). Restoration should focus on managing access, primarily by seasonally or permanently closing and possibly reclaiming motorized access routes currently located in productive habitat. The ESGBP supports this PHVA workshop recommendation. We realize that industrial and recreation uses of areas considered for restoration will have to be considered.

3f. Establish and apply targets for grizzly bear distribution, habitat connectivity and fragmentation. (P2)
In the Greater Yellowstone Area one management goal aims for a condition in which grizzly bear occurrence is continually distributed throughout available habitat (Pyare et al. 2004). We recommend this goal for grizzly bear habitat in the CRE. Success could be monitored by periodic DNA (through hair and scat collection) and other sign of occurrence monitoring (please see recommendation 1c). A primary requisite to attain this goal is the prevention of habitat fragmentation that may preclude grizzly bears from dispersing freely throughout potential habitat. Habitat fragmentation has been extensive in the CRE (Chapters 7 and 12, this report). A primary human-caused barrier to grizzly bear movement in the CRE appears to be the Trans Canada Highway. Genetic connectivity across the TCH is mediated by male movement but demographic connectivity is fractured because female movement is limited. (Chapter 7 this report, Proctor and Paetkau 2004). Considering the peninsular shape of the remaining distribution of grizzly bears in southwestern Canada, we recommend that the long-term fragmentation potential from the major east-west highways such as the TCH be mitigated by creating wildlife crossing structures aimed at enabling freer female movements. Parks Canada in Banff National Park has pioneered construction and study of crossing structures on the Trans Canada Highway (Clevenger 2003). Human use around crossing structures must also be minimized to encourage grizzly bear use. Effectiveness of restoration efforts can be measured using the same genetic tools used to document fragmentation (Chapter 7, this report), and by deployment of GPS radio monitoring.

4. BEAR-HUMAN CONFLICT: AVOIDING AND MANAGING

Goal: To work toward minimizing human-grizzly bear conflict and to provide for safety for grizzly bears and humans.

4a. Develop and enforce regulations related to human food and garbage attractants throughout the CRE. Encourage public involvement using the bear smart community model and other community involvement approaches. (P2)
Probably the single most important contributor to grizzly bear and human conflict is the attraction of our foods and garbage (Benn 1998, Herrero and Higgins 2003). Almost anything edible by humans or our domestic animals, or even residues of cooking or eating, may attract a bear and result eventually in the bear being killed or removed. The national parks, most provincial parks, and the town of Canmore have adopted strong regulations and effective garbage storage technology to minimize attracting bears. We recommend communities and households throughout the CRE be encouraged to implement similar programs that focus on management of foods and garbage that attracts bears.

4b. Maintain and evaluate aversive conditioning programs, especially for female grizzly bears. Consider alternatives that may be more cost effective. (P1)
In the CRE most habituation of grizzly bears increases mortality risk and is therefore unacceptable (Herrero et al. 2005). This is true even if the bears are not human food-conditioned. Aversive conditioning of habituated females has been fundamental in keeping them away from areas where they could get in to trouble such as roadsides and campgrounds. In the BRW the apparent success of aversive conditioning has underlain the achievement of a high adult female survival rate (Benn and Herrero 2002, Garshelis et al. 2005). Aversive conditioning, which is a tool for training individual grizzly bears, has required hundreds or even thousands of around-the-clock hours from professional staff (pers. comm. H. Morrison, Park Warden, Lake Louise, Banff National Park). In developed landscapes with mortality risk, aversive conditioning is expensive yet essential in order to achieve high survival of adult female grizzly bears. One dimension of its success can be gauged by monitoring female survival rates. Another is by monitoring the costs of such programs. We recommend continued funding for implementing and evaluating such programs.

We also recommend evaluation of habitat management, seasonal use restrictions and other approaches as potentially more cost effective means of addressing the problem of potential habituation.

4c. Develop integrated CRE-wide monitoring of grizzly bear-human conflict to serve as a basis for corrective management actions. Report results yearly. Analyze every 5 years. (P1)
The success of human food and garbage management and all grizzly bear-human conflict management should be monitored by keeping and each year reporting records of bear-human conflict and related human-caused mortalities throughout the CRE. A common format for documenting conflict should be adopted by all jurisdictions in the CRE and integrated annual reporting should occur. This is discussed in more detail in recommendations 2a, 2b and 5a.

4d. Inform the public regarding grizzly bear activity in high human use areas. Continue with periodic use restrictions related to human safety or grizzly bear needs. Continue to experiment with removing natural attractants such as wild berries from high human use areas. (P1)
There are low rates of grizzly bear-inflicted injury to people in the CRE (Herrero and Higgins 1999, 2003). This has been achieved primarily by isolating people's food and garbage from grizzly bears and informing the interested public regarding safety around bears. Despite such efforts there have been bear-inflicted deaths and serious injuries. Informing the public about grizzly bear activity in high human use areas is basic, as are periodic use restrictions for areas where the nature of grizzly bear activity either creates unacceptable potential danger to humans, or where the bears need seasonal access to resources such as berries or an elk carcass. Such practices should continue, with success being measured by a paucity of grizzly bear-inflicted human injuries and low bear-human conflict frequency.

Landscape managers in the Bow Valley have developed and tested various means of removing natural grizzly bear attractants such as Buffaloberry (*Shepherdia canadensis*) from high human use areas (personal communication: Steve Donelon, Alberta Community Development, Canmore, Alberta). This approach, provided that habitat restoration elsewhere results in no net loss of habitat, should contribute to human and grizzly bear safety. We recommend continuing to develop and evaluate this approach.

4e. Continue to monitor human use and to document its relationship with grizzly bear landscape use and mortality probability. (P2)
The ESGBP has conducted one of the most extensive studies of the effects of human developments and activities on grizzly bears (Gibeau 2000, Gibeau et al. 2001, 2002, Chapters 11 and 12 this report). Results have informed management decisions, especially in the Lake Louise area. However, human land use patterns and their intensity change over time, especially with changes in landscape development such as near Canmore. Monitoring human use in selected areas where there are radiomarked grizzly bears can provide insights regarding grizzly bear response to elements of human use and landscape features (Donelon 2004). This understanding can contribute to more informed management decisions. We recommend continuing research regarding human use and grizzly bear landscape use and mortality probability.

5. INTERAGENCY COORDINATION AND COOPERATION

Goal: To support agencies working together toward coordinated, integrated data collection related to grizzly bear research and management. At the same time to recognize agency jurisdictional autonomy.

5a. Work toward coordinated, integrated data collection and grizzly bear management, yet retain jurisdictional autonomy. (P1)
Many grizzly bears in the CRE spend time in several different management jurisdictions (Chapter 9, this report). This is because they have large home ranges, especially in the Alberta, eastern portion, of the CRE. This results in portions of populations being shared between management jurisdictions. The long-term viability of grizzly bears in any management unit is enhanced, and perhaps depends upon, grizzly bear survival rates in adjacent units. While population estimates for the CRE as a whole lack precision, the ESGBP Population and Habitat Viability Workshop estimated 175 grizzly bears in the Alberta portion of the CRE and 276 in the BC portion for a total estimate of 451 (Herrero et al. 2000: p.38).

To monitor the status of grizzly bears in the CRE and different population management units within it, we recommended all jurisdictions adopt a common format for recording mortality and grizzly bear-human conflict. This common format would allow for CRE-wide assessment of mortality and conflicts (see recommendations 2a and 2b). It would help to identify actions needed to address problems and could serve as a basis for dialogue between agencies. This has been done and is successful for quantitatively tracking different sources of bear-human conflict, knowing where to place management priorities, and being able to evaluate problems within and between jurisdictions in the Greater Yellowstone Area (Gunther et al. 2004).

Coordinated and integrated management by current jurisdictions was recommended after past assessments of grizzly bear management in the CRE (Dueck 1990) and the national parks (Herrero 1994). Under this system, each jurisdiction would continue to maintain its unique management programs including forestry and hunting outside of national parks, and protection within. The success of conserving grizzly bears in various management units in the CRE could be measured by monitoring human-caused mortality rates for adult female grizzly bears, and comparing these rates to ones predicted to sustain population maintenance or growth.

Either Parks Canada, Alberta, or British Columbia could take the lead toward more integrated data collection and analysis. Wherever leadership emerges, annual reporting would have to be approved and participated in by all jurisdictions for widespread credibility and to ensure respect for individual agency mandates.

Perhaps ideally there would be a high level, integrated, interagency management team that set coordinated policy for grizzly bear persistence, yet respected individual jurisdictions throughout the region. This has been the function of the Interagency Grizzly Bear Committee (IGBC) responsible for overseeing grizzly bear recovery in the Greater Yellowstone Area. It has been effective in directing and accomplishing demographic recovery.

5b. The CRE should remain as one geographic area for interagency coordination related to grizzly bear management. (P1)

DNA sampling of individual grizzly bears has been used to develop concepts of population units in southern Alberta (Proctor and Paetkau 2004) and British Columbia (Proctor 2003). The CRE landscape bounds grizzly bears along its human-dominated eastern flank, Alberta’s prairie, and its human-dominated western flank, the Columbia Valley of BC. However, its north and south boundaries are watersheds that filter but don’t restrict gene flow (Herrero et al. 2000, Proctor and Paetkau 2004). North-south demographic isolation, mediated by conservative dispersal by female grizzly bears (McLellan and Hovey 2001) in response to highways, is occurring in the CRE as a result of the Trans Canada Highway, and Highway 11 (Proctor and Paetkau 2004).

Defining management units along genetic lines, except where the units are fully isolated, will inevitably involve choice regarding how much isolation is necessary to treat bears in a given area as being distinct enough to become a management unit. From the point of view of representing distinct population units the CRE will probably not prove to be ideal. However, due to the history of research (Komex International 1995) and an interagency liaison group focused on the CRE (the Central Rockies Ecosystem Interagency Liaison Group), we recommend that the CRE remain as one appropriate unit for interagency coordination related to grizzly bear management.

6. PLANNING, MANAGEMENT, STRATEGIES AND PROCESSES

Goal: To continue to develop research, planning and management structures and products that will support and guide actions to achieve a non-declining grizzly bear population in the CRE.

6a. Continue to develop and detail agency specific and CRE-wide conservation strategies for grizzly bears. (P2)

The successful recovery of the Greater Yellowstone Area grizzly bear population has been achieved as a result of extensive planning, management, and legally mandated (under the Endangered Species Act) interagency coordination, all focused on the task of grizzly bear population recovery. The Interagency Grizzly Bear Committee has published their conservation strategy for grizzly bear recovery in the greater Yellowstone Area (Servheen 2003). This document is intended to guide management and monitoring of the recovered grizzly bear population. Topics include standards for the population and habitat and their monitoring, grizzly bear-human conflict management, and information and education policies. The IGBC conservation strategy is richly detailed and explicit regarding defining, monitoring and implementing recovery.

Banff National Park (2004) has published a framework for the conservation of grizzly bears. This document offers comment on strategic direction for grizzly bear management. It currently lacks the rich and important detail and specificity of the IGBC conservation strategy. We recommend it continue to evolve in that direction and that within 2 years a more detailed document be released. Complementary conservation strategies should be developed for the Alberta and British Columbia portions of the CRE. The Alberta grizzly bear recovery plan, if accepted by the provincial government, should fill this niche for Alberta (Alberta Grizzly Bear Recovery Team 2004). We have stressed the need to integrate grizzly bear conservation planning across jurisdictions.

6b. Encourage peer-reviewed publication of research regarding grizzly bear management and its scientific basis. Consider periodic program review by highly qualified scientists of the scientific basis for management. Provide opportunities for public comment and information exchange. (P2)
Because of the controversy inherent in grizzly bear management it needs to be supported by peer-reviewed, journal-published, scientific research. Peer review is a fundamental evaluation of the rigor of research or management. To further convince the public that researchers have done a good job of understanding variables influencing grizzly bear persistence and applying this to management, we recommend periodic external review by highly qualified scientists. This would be a form of broader peer review.

In British Columbia decisions related to grizzly bear hunting have generated international attention. The BC provincial government chose to have their grizzly bear population management scrutinized by a small group of population biology experts from the International Association for Bear Research and Management (the IBA), the professional association of persons involved in grizzly bear research and management. The IBA review was rigorous, published, and freely available (Peek et al. 2003). This helped to convince some people that the science was right for estimating grizzly bear population numbers to determine potential harvest rates. It did not address the issue of whether or not there should be grizzly bear hunting. This is a broader, societal issue. Scientists can predict numerical, behavioral and other biological effects of hunting, but these don’t directly address the ethical issue of hunting.

6c. Design access and facility management and planning to support grizzly bear persistence. (P2)
Maintaining the current distribution and abundance of grizzly bears in the CRE will demand bold thinking by contemporary landscape managers, for their decisions today will largely define the future of grizzly bears in the next several decades. We recommend that resource managers help society recognize that there are clear trade-offs between the level and intensity of our landuse footprint and the viability of grizzly bear populations. Recognition of these trade-offs can lead to productive discussions about acceptable thresholds for such landscape variables as road density and use, back-country visitation, and habitat area and connectivity. Clear recognition of trade-offs between social, economic, and ecological indicators, such as grizzly bear populations, is key to exploring best practice options. For example, if managers can agree that mortality along roads is a key “driver” in the grizzly bear story, then the merits of access management become a logical “what-if” scenario to explore. Not allowing the public to travel on certain roads is often controversial. However, it is a good example of the types of alternative scenarios that must be evaluated if we are to increase the likelihood of having healthy grizzly populations and the ecosystems needed to support them.

6d. Target research to address threats that have critical knowledge gaps. (P1)
Strategic targeting is a term that has been used to describe focusing research toward understanding the threats to bear populations (Servheen 1998). Grizzly bear research is expensive and yet essential to inform and support management actions. We recommend research be designed to address knowledge gaps where answers are needed for making or supporting management decisions related to threats to grizzly bears in the CRE.

7. PUBLIC, BUSINESS AND FIRST NATION INVOLVEMENT AND INFORMATION EXCHANGE

Goal: To continue to refine processes for informing and involving various societal sectors in grizzly bear management.

7a. Refine and expand societal understanding and involvement in grizzly bear management. (P2)
We define ourselves partly by our relationship with nature. Pests, beautiful, inspirational---all these are legitimate perceptions of grizzly bears. Conflict is not so much between grizzly bears and people as between different groups of people with different values. Possible resolution may evolve from recognizing the dynamic tension among people with different values and to try to ease this tension by informing, involving, and encouraging communication between concerned individuals. Respect for grizzly bears and the ecosystems that support them should be a goal. This could evolve into esteem for the bears and for nature and could contribute to a sustainable society.

Grizzly bears are a public resource. They will survive or die out in the CRE depending upon public land management policies and actions. To support grizzly bear survival people are being asked to behave in certain ways to accommodate what scientists understand to be the needs of grizzly bears and what planners think is necessary and politically possible. The scientific rationale for managing human use to support grizzly bear population persistence needs to be shared and discussed with the public. A more open, sharing and involving land use planning process could help build support for management decisions (Brunner and Clark 1997, Primm and Wilson 2004). Current research in Banff National Park is documenting different beliefs related to grizzly bear management. One aim is to find common ground (Chamberlain and Rutherford 2005). The management of this species will always be controversial (Cooper et al. 2002) because the needs of grizzly bears influence what people can do on the land in the CRE.

We recommend creation of more opportunities for the public to become informed and involved regarding grizzly bear management issues in the CRE. Management agencies have primary responsibility in this regard. To supplement their efforts in the CRE we recommend widespread dissemination of the ESGBP final report results and regular public contact by the ESGBP Implementation Committee (please see recommendation 9). Grizzly bear conservation will be strongest when it is both top down (strong government support) and bottom up (strong involvement of grassroots interests) (Primm and Wilson 2004).

7b. Establish a mechanism to maintain some of the public involvement and information that were part of the Eastern Slopes Grizzly Bear Project. (P2)
The ESGBP Steering Committee met about 3 times a year for 9 years. Attendees were representatives of major donors from business and industry, researchers, government, conservation groups and other stakeholder groups. Meetings usually had a cooperative and open spirit with a frank exchange of information and ideas. Through public presentations and our website, www.canadianrockies.net/Grizzly, and the newsletters of Steering Committee member organizations, we shared findings with supporters and the public. Some tangible evidence of communication success, at least within the Steering Committee, can be implied from the project's having been funded by the Steering Committee and other sources for 11 years. Communication with interested parties was a fundamental part of the ESGBP. This communication should continue through the project's implementation phase and be spearheaded by the Implementation Committee (please see recommendation 9).

7c. Develop further communication with First Nations regarding grizzly bear mortalities, ecology and management. (P1)
Significant numbers of grizzly bear mortalities occurred on First Nation lands. Some were unintentional and related to food or garbage attractants (Chapters 6.2 and 6.4, this report). The ESGBP was unsuccessful in attempts to discuss grizzly bear issues with First Nations. We recommend that this is important communication that needs to be done.

8. FUNDING TO MAINTAIN GRIZZLY BEARS

Goal: To adequately fund research that will inform and support maintaining a non-declining grizzly bear population in the CRE.

8a. Adequately fund research, management and planning directed toward long-term maintenance of grizzly bear populations. Use multi-stakeholder funding approaches developed by the ESGBP to do this. (P1)
Development and use of the CRE will continue. To plan for and manage the effects of development on grizzly bears will require research, understanding, and monitoring that is integrated into management and planning. Grizzly bear-human conflict prevention and management require funding to be successful. One of the strengths of the ESGBP has been its ability to raise funds from diverse sources including business and industry, foundations, government, academia, and conservation groups (Herrero et al. 1998). This has allowed research to be carried out over multiple years and across jurisdictional boundaries. This regionally integrated and multi-stakeholder approach to funding grizzly bear research and monitoring is a model that should be continued. Such a multi-stakeholder funding proposal could be developed by the Central Rockies Ecosystem Interagency Liaison Group (CREILG), or it might come from a business, conservation or university group.

9. IMPLEMENTATION OF ESGBP MANAGEMENT RECOMMENDATIONS

Goal: To achieve the goals and to implement the management recommendations of the ESGBP

9a. Form an ESGBP implementation committee. (P1)
This group would have representatives for the diverse interests of members of the ESGBP Steering Committee. Initiative to form it would probably have to come from outside of government. Once formed it should create an implementation strategy and structure. Such an approach would take advantage of the 11 years of effort that have gone into the ESGBP, its results, its public profile, and the need for action to conserve grizzly bears in the CRE. Communication with a wide audience would also be an important task for this committee. This group would work closely with Alberta's Grizzly Bear Recovery Team. One model for this group could be the Prairie Conservation Action Plan Implementation Committee lead by Ian Dyson of Alberta Sustainable Resource Development in Lethbridge. In the approximately 16 years since completion of the first Prairie Conservation Action Plan (World Wildlife Fund Canada 1988), regular, yearly progress has been made toward its implementation.

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