East Kootenay Elk Management Plan 2005-9

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Executive Summary

Declining elk populations in the East Kootenay, characterized by distorted bull to cow ratios and low calf recruitment, led to intense public controversy during the mid 1990s. In response, the BC Ministry of Environment, Land and Parks initiated various hunting restrictions and hired an outside consultant to independently assess elk harvest management in the region and province. The resulting report provided short- and long-term recommendations for managing elk hunting as well as a list of recommendations to promote recovery of the Kootenay elk herds (Raedeke 1998).

Raedeke (1998) recommended that a formal elk management plan be developed for the East Kootenay. A plan was required to clearly articulate management objectives and options, to provide a level of certainty for hunters and guide-outfitters, and to direct government and public efforts in areas of population and habitat management. The result was the *East Kootenay Elk Management Plan 2000-2004* (Bircher et al. 2001).

The status of the elk population in the East Kootenay changed considerably during 2000-4 and the BC Ministry of Water Land and Air Protection (WLAP) requested a formal review and revision of Bircher et al. (2001) to guide elk management during 2005-2009. This report presents an updated elk management plan, based on extensive public consultation, professional input, and recent harvest and population data.

Since the last management plan was completed, all evidence pointed to a substantial recovery of the elk population in most of the East Kootenay. Although survey data were insufficient to estimate absolute elk abundance, both bull-to-cow and calf-to-cow ratios increased to levels that were higher than objectives set by Bircher et al. (2001). Many hunters reported that population recovery throughout the East Kootenay had been uneven. We heard most commonly that the population north of Radium had not recovered since 2000, as well as the upper Elk Valley, Flathead Valley and the upper Kootenay Valley.

Available evidence suggested that the primary reason for the recovery of the elk population during 2000-4 was a succession of mild winters. Secondarily, continuing restrictions on calf-cow hunting and perhaps lower cougar populations also contributed. In addition, the 6-point bull season had been very successful in achieving population objectives (principally bull escapement as measured by bull-to-cow ratios), and had resulted in almost universally high hunter satisfaction. Hunters reported excellent hunting experiences, although the 6-point restriction did not guarantee success.

Unfortunately, an increasing elk population resulted in higher forage and improved pasture losses to private landowners. A primary response to these losses was an increase in fencing of private land, which in turn increased pressure on remaining unfenced private land and adjacent crown ranges. During public consultations there was almost universal support among all stakeholders for measures to reduce losses on private land due to wildlife depredation.

Another common theme during consultation was concern regarding the continuing deterioration of crown range, although there was little agreement on the relative importance of various factors. Most hunters were adamant that there were too many cattle on crown ranges, that grazing practices were poor (little or no rotation), that cows remained on ranges too late into the fall (reducing standing crops available for wintering ungulates), and that there was little or no enforcement of grazing tenure privileges. The agricultural community was equally convinced that expanding elk and deer populations were contributing to range deterioration. Some stated that cattle stocking rates and season grazing lengths were being reduced while elk numbers were increasing. Professional Agrologists and biologists familiar with the crown range of the East Kootenay were concerned about the condition of grassland ecosystems and reported widespread deterioration of grassland habitats and, in particular, shrub communities.

Forest in-growth and encroachment was another topic of concern with respect to crown ranges. The area treated under ecosystem restoration initiatives during 2000-4 did not keep pace with the estimated rate of in-growth of approximately 3000 hectares per year.

Based on public consultation, professional input, and analysis of harvest and population data, we made the following recommendations:

Population Management Recommendations

1. Use sex-age-kill analysis to address knowledge gaps regarding elk population status and structure and to explore the sustainability of the 6-point bull elk season under current management.
2. Expand the inventory program to address specific data gaps; specifically, data required for population modelling and to assess the status of the population outside the Trench.
3. Continue to manage for a post-hunting season observed ratio of >20 branch-antlered bulls per 100 cows unless further population analyses suggest that the ratio should be increased.
4. Manage for a post-hunting season observed ratio of >25 calves per 100 cows. If observed ratios fall below this objective for 2 consecutive years, the antlerless harvest should be reduced and other possible causes for the low calf-to-cow ratio should be investigated.
5. Consider transplantation trials of non-migratory elk into suitable but unoccupied areas elsewhere in the subregion where sufficient volunteer effort is available.

Harvest Management Recommendations

1. Continue the general open season on 6-point bulls unless data indicate a levelling off or decline in absolute harvest *and* indications of breeding disruption.
2. Expand private land antlerless LEH hunting opportunities to nearby crown ranges below 1100 m, in areas of the Trench where depredation is most chronic, private lands are not fenced and where crown ranges are degraded as a result of over-utilization by elk.
3. Establish a monitoring program to assess the effectiveness of the hunt in meeting private and crown land objectives.
4. Discontinue the expanded hunt if observed calf-to-cow ratios fall below 25 calves per 100 cows for 2 consecutive years.
5. Consider expanding the antlerless LEH after 3 years to include 3-point bulls if the antlerless hunt is meeting population and harvest objectives but is failing to meet habitat objectives (see below).
6. Begin authorizing summer elk hunts on private land on a case-by-case basis and consider expanding summer hunts after 5 years if objectives related to private land depredations are not being met.
7. Consider lifting the prohibition on access fees associated with LEH permits.

Habitat Management Recommendations

1. Improve the condition of crown ranges by managing grazing allocations to approximately 25% livestock and 25% wildlife utilization (with 50% for conservation to ensure the sustainability of the resource). If this allocation objective is impractical to monitor, then related surrogate objectives should be developed and sufficient resources allocated to collect required information.
2. Conduct detailed forage assessments and assess ecosystem health of crown range in priority (i.e., high-conflict and degraded) areas to support recommended changes to forage utilization.
3. Develop an inter-agency procedure for responding to, and implementing the recommendations designed to restore and manage crown range ecosystems. This procedure should include: a) range supply reviews (RSR) at 5-year intervals; b) strategies with which WLAP responds to recommendations for reduced use by wildlife (e.g., harvest and access management); c) a dispute resolution mechanism to minimize interference in local crown management and livestock allocation decisions; and, d) clear accountability for management successes and failures.
4. Focus ecosystem restoration efforts on removing barriers to substantial increases in effort, including: a) Convincing government(s) to make a political commitment to a multiyear, secure program of range restoration; and, b) improving inter-agency cooperation by establishing a joint-agency office of range health.

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1. Introduction

Declining elk populations in the East Kootenay, characterized by distorted bull to cow ratios and low calf recruitment, led to intense public controversy during the mid 1990s. In response, the BC Ministry of Environment, Land and Parks initiated various hunting restrictions to limit the harvest of elk. Public concern continued and in 1998 the Ministry hired an outside consultant to independently assess elk harvest management in the region and province. The resulting report provided short- and long-term recommendations for managing elk hunting as well as a list of recommendations to promote recovery of the Kootenay elk herds (Raedeke 1998).

Raedeke (1998) recommended that a formal elk management plan be developed for the East Kootenay. A plan was required to clearly articulate management objectives and options, to provide a level of certainty for hunters and guide-outfitters, and to direct government and public efforts in areas of population and habitat management. The result was the *East Kootenay Elk Management Plan 2000-2004* (Bircher et al. 2001). The report contained 22 key management recommendations and was approved by the Ministry of Environment, Lands and Parks in 2000.

The status of the elk population in the East Kootenay changed considerably during 2000-4 and the BC Ministry of Water Land and Air Protection (WLAP) requested a formal review and revision of Bircher et al. (2001) to guide elk management during 2005-2009. This report presents an updated elk management plan, based on extensive public consultation, professional input, and recent harvest and population data.

2. Methods

Public Consultation

Public input was solicited throughout the development of the management plan and was summarized in a separate document (Morley and Wilson 2004; Appendix I). Open houses were held in Invermere, Cranbrook and Fernie during August-October, 2004. Attendees were invited to talk individually with biologists, to offer comments and to ask questions during an evening presentation. Written submissions were received at the open houses and were also received via fax, e-mail and a web-based form on the WLAP website. Finally, a number of stakeholder meetings were also held in October.

The public were asked to focus on the following questions related to the management of elk in the East Kootenay:

1. Are the vision and goals articulated in the 2000-4 elk management plan still appropriate?
2. What have been the successes and failures of elk management in the East Kootenay since the original plan was implemented?
3. What additional issues regarding elk management are of concern?
4. To what extent were management objectives and strategies identified in the 2000-4 elk management plan implemented?
5. What data and assumptions that led to the 2000-4 objectives and strategies need to be reconsidered?
6. What objectives and strategies from the 2000-2004 plan need to be revised?
7. What options are available to deal with any new and revised objectives and strategies?

Comments received from public participants were collated and circulated as a separate report (Morley and Wilson 2004; Appendix I).

Information Review

We reviewed recent scientific and management literature relevant to the issue of elk management in the East Kootenay. Bircher et al. (2001) and Raedeke (1998) provided extensive literature reviews; therefore, rather than repeating information adequately covered in those reports, we focussed on new information that became available during 2000-2004.

We also interviewed several professional biologists and agrologists regarding their perspectives on elk management past, present and future (Table 1).

Table 1. Names and affiliations of technical experts interviewed during the development of the elk management plan.

Name and Position	Affiliation
Sue Crowley, Ecosystem Biologist	Ministry of Water, Land and Air Protection, invermere
Rieva McCuaig, P.Ag., Resource Stewardship Agrologist	Ministry of Agriculture, Food and Fisheries
Dave Dunbar, R.P.Bio., Section Head Science and Allocation	Ministry of Water, Land and Air Protection, Cranbrook
Bob Forbes, R.P.Bio., Former Section Head	Ministry of Water, Land and Air Protection, Cranbrook
Jody Kekula, P.Ag., Range Supervisor	Ministry of Forests, Cranbrook
Dr. Walt Klenner, Research Wildlife Habitat Ecologist	Ministry of Forests, Kamloops
Val Miller, P.Ag., Former Invasive Plant Specialist	Ministry of Forests, Nelson
Jeff Morgan, SRM Officer - Ecosystems	Ministry of Sustainable Resource Management, Kamloops
Darrell Smith, P.Ag., Program Manager	East Kootenay Conservation Program, Invermere
Irene Teske, R.P.Bio., Wildlife Biologist	Ministry of Water, Land and Air Protection, Cranbrook

3. Management Outcomes 2000-4

In the following section we present Bircher et al.'s (2001) management objectives and available information related to the outcomes of those objectives during 2000-4.

Population Management

Objective 1: Increase the sub-regional elk population to 25,000 (±20%). Within the constraints of habitat supply and private landowner tolerance, develop population objectives for each Elk Management Zone.

Since the last management plan was completed, all evidence pointed to a substantial recovery of the elk population in most of the East Kootenay. Inventory surveys were insufficient to determine whether or not the population objective of 25,000 had actually been met. Surveys of subunits of winter ranges within selected Management Units were flown in 1992, 1997, 1998, 1999, 2001, 2003 and 2004 (Simpson 1992, Halko and Hebert 1997, 1998, 1999, 2001, Beswick and Fontana 2003, 2004). Survey methods were similar among years, although the management units, winter ranges and winter range subunits flown varied between years due to a variety of factors such as weather and available resources (Beswick and Fontana 2004). As a result, estimates of absolute elk abundance in the East Kootenay were impossible to establish.

Elk management zones were not clearly defined, nor were specific population objectives developed for them. Some hunters inferred that the overall population was approaching the target of 25,000 based on anecdotal references to past observations of elk abundance and/or hunting success.

Many hunters reported that population recovery throughout the East Kootenay had been uneven. We heard most commonly that the population north of Radium had not recovered since 2000, as well as the upper Elk Valley, Flathead Valley and the upper Kootenay Valley.

Objective 2: Manage for a post-hunting season observed bull-to-cow ratio of greater than 20 bulls per 100 cows.

Inventory data collected during 2000-2004 indicated a recovery in bull-to-cow ratios (Figure 1). These data were collected during aerial surveys and the same cautions as those mentioned above apply: the management units, winter ranges and subunits varied between years. The differences between years can directly affect the ratios observed because of differential habitat use by bulls and cow groups (e.g., bulls are often observed in timber farther from agriculture areas than are cow groups; Beswick and Fontana 2004). A cautious interpretation of these data still suggests that the bull-to-cow ratio met Bircher et al.'s (2001) objective, at least in areas where surveys were conducted. One caution is that recent surveys have been conducted in the Trench near agricultural land where antlerless depredation hunts have been authorized. The harvest of cows in these areas might skew upwards both the bull- and calf-to-cow ratios (see below).

Objective 3: Increase and maintain post-season calf-to-cow ratios of greater than 30 calves per 100 cows.

Inventory data also suggested that the objective of maintaining a calf-to-cow ratio of >30 was also met during 2000-2004 (Figure 1). The recovery in calf-to-cow ratios was probably the single most important factor in the recovery of the East Kootenay elk population during 2000-2004. It was suggested during the public consultation that calf-to-cow ratios were probably higher among the non-migratory population because of forage quality and perhaps lower predation. This is plausible, but it cannot be corroborated because it was impractical to acquire post-season calf-to-cow ratios on migratory and non-migratory elk herd separately (because they share the same winter range). Of course, the forage and predator benefits afforded to non-migratory elk (if they occur) would have been occurring before 2000 when calf-to-cow ratios were very low. If so, then the observed increase could only occur if the relative proportion of the non-migratory herds observed on surveyed winter ranges had increased several fold. Although many would argue that non-migratory herds have increased substantially in relation to migratory herds over the past 5 years, there is little chance they have increased on the order of that required to completely explain the increase in calf-to-cow ratios.

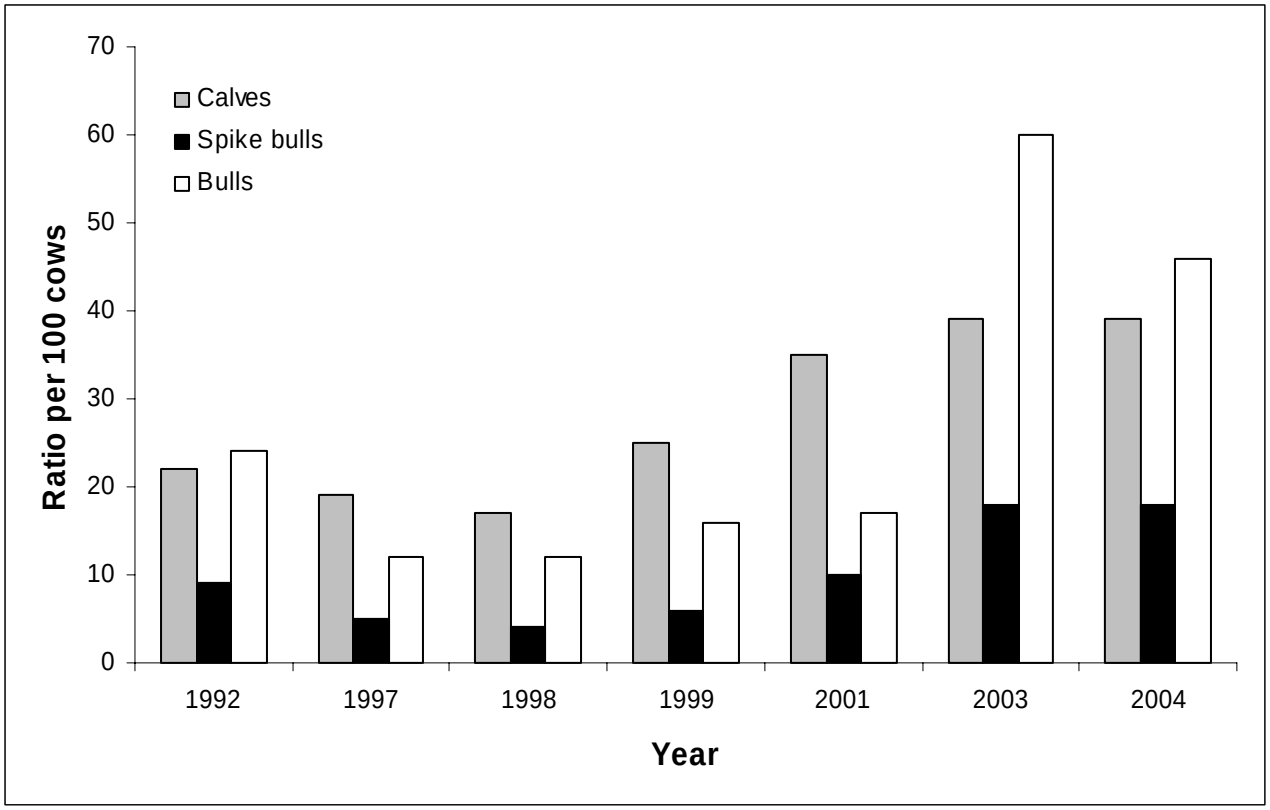

Figure 1. Number of calves, spike bulls and bulls per 100 cows observed during aerial surveys of select management units, winter ranges and subunits during 1992-2004, as reported by Beswick and Fontana (2004).

<u>Objective 4</u>: Liberalize the harvest regulations for carnivores… if it is determined that predation… is a significant factor preventing elk population recovery.

Raedeke (1998:38) suggested that population growth of the East Kootenay elk population was limited primarily by the survival and recruitment of calves, and that "both habitat and predation are likely major causes." He also cited the possible role of the two prior severe winters. Raedeke (1998) recommended that the ultimate cause of low calf-to-cow ratios be investigated. Fortunately, we were provided with a correlative natural experiment during 1998-2004 as calf-to-cow ratios returned to higher levels. There was widespread agreement during the public consultation that range conditions had deteriorated since 1998. Although cougars had been hunted liberally through the late 1990's and were probably lower by 2004 than when Raedeke (1998) proposed the predator hypothesis, the harvest of other predator populations had not changed significantly and there were consistent suggestions that some predators had increased (grizzly bears and wolves in particular). Therefore, anecdotal evidence for either the habitat or the predation hypotheses was weak.

Although Raedeke (1998) suggested that habitat and predation were the probable causes of low calf-to-cow ratios, he also noted that the problem of low ratios was common at that time throughout western North America. Other jurisdictions are characterized by significantly different habitat characteristics (typically more cultivated range) and predator-prey systems (including the absence or near-absence of grizzly bears and wolves), which suggests that the phenomenon of low calf-to-cow ratios (and their subsequent recovery) were relatively insensitive to habitat quality or to the structure of predator-prey dynamics, and were more likely related to broader-scale phenomena, such as sub-continental weather trends.

The winter severity hypothesis is consistent with work from other jurisdictions. Radio-collared elk calves in Yellowstone National Park had lower summer survival (due to predation and correlated late births and low birthrates) and lower winter survival (due to malnutrition) during severe winters and when populations were larger (suggesting both an additive and compensatory population effect of severe environmental conditions; Singer et al. 1997). The dynamics of multiple predator-multiple prey systems are extremely complex and

poorly understood (e.g., Kunkel and Pletscher 1999). Predation and winter conditions are also known to interact. For example, Mech et al. (2001) found that several indices related to wolf predation success on elk were higher during severe winter conditions than during subsequent mild winter conditions.

For all of these reasons, we suggest that a succession of mild winters was the primary reason that calf-to-cow ratios recovered during 1998-2004.

Objective 5: Enhance the inventory program.

The inventory program was, in fact, reduced during 2000-2004. There were specific recommendations in Bircher et al. (2001) to conduct comprehensive surveys every 5 years beginning in 2001, to validate the Idaho sightability model, to radio-collar an additional 50 elk, and to continue to refine population models. Only the recommended strategy of conducting annual absolute abundance/composition trend surveys was completed during 2000-2004, and resources were insufficient to maintain year-to-year consistency in survey intensity. Additionally, there were no attempts to collect fecundity data or to survey the suitability of available habitat.

Objective 6: Develop a contingency plan to direct non-government organization sponsored supplemental feeding of elk populations during very severe winters.

A contingency plan was not developed; however, it was not needed because winter conditions were not severe during 2000-4. Winter feeding is a controversial management practice, both regionally and internationally. Supplemental winter feeding can increase overall survival rates (Peek et al. 2002) and early calf development (Smith et al. 1997); however, feeding is broadly considered among biologists to be antithetical to the founding principles of wildlife management (Peek et al. 2002) because it promotes a dependence of wildlife on human intervention and creates a disincentive to properly manage wildlife habitat.

Although supplemental feeding can increase over-winter survival, it can also lead to incidental mortalities as a result of railway and highway collisions. Because of the large volumes of forage required and the distribution of winter ranges, feeding often occurs near major transportation corridors in valley bottoms. Smith (2001) identified other negative consequences of winter feeding programs, including: cost, habitat impacts near feeding sites and disease transmission.

Winters in which large numbers of ungulates die are natural events and are in part responsible for regulating ungulate numbers. Widespread winter feeding of elk in parts of the United States (e.g., National Elk Refuge, Jackson, WY) and of red deer in parts of Europe (e.g., Austria) is largely in response to the political desire to maintain ungulate populations at levels above the carrying capacity of remaining winter range (Peek et al. 2002). This is considered the "best of a bad situation" by biologists, who prefer to maintain adequate habitat to sustain ungulates at desired population levels. It is also very expensive; daily rations of pelleted alfalfa at the National Elk Refuge have varied between 5.4 and 9.6 kg/head (Peek et al. 2002).

Unlike the US and Europe, most of the winter range in BC is on public land (although there are areas of high quality winter range on private land in the East Kootenay). Proper management of these extensive winter ranges makes widespread winter feeding unnecessary.

We agree with Bircher et al. (2001) that winter feeding programs, even during severe winters, are a poor and likely ineffective strategy. A massive feeding program would be required to significantly increase the survival of the elk population in the East Kootenay during a severe winter. Supplemental feeding did occur during 1996-7 but was insufficient to compensate for the severe winter conditions. We agreed with the biological principle that the availability and quality of winter range should be sufficient to sustain the elk population at desired levels through severe winter conditions, without supplemental feeding.

Objective 7: Reduce agricultural damage caused by elk.

This objective is largely covered by harvest and habitat management recommendations (see below); however, the agriculture community continued to suffer forage and improved pasture losses due to wildlife depredation during 2000-2004. Assessed losses under the East Kootenay Wildlife Damage Pilot Project (administered by the Kootenay Livestock Association) averaged 30%. Representatives from the agriculture community who participated in the public consultation were adamant that additional measures were required to reduce losses, although the community was willing to accept some use by elk.

***Objective 8*: Reduce vehicular and train collisions with elk.**

High deer and elk mortality rates were observed during the severe winters of 1996 and 1997. Because of ploughing and the resulting high snow banks, many animals were trapped in rail corridors and on roads. Efforts were made to have rail engineers maintain records of wildlife injuries or kills and a Provincial tracking system was developed. WLAP staff were also concerned that round bales were being unloaded and left near rail lines by volunteers. Apparently, this feeding led to an increase in wildlife injuries and mortalities. Railway and highway contractors were asked to plough wide areas and runouts on corners to serve as escape routes. In addition, the BC Ministry of Transportation was to keep track of wildlife injuries and mortalities.

***Objective 9*: Maintain, enhance and promote opportunities to appreciate, study and view elk in the natural habitats.**

Pamphlets were developed with funding from the Federation of BC Naturalists and BC Wildlife Watch. Commercial recreation applications are reviewed for impacts on elk.

Notably, we received no written or verbal submissions during the public consultation regarding the non-consumptive uses of elk. However, elk are clearly an important feature of the East Kootenay landscape for residents and non-residents alike. Elk are an icon throughout the region and are commonly featured in photographs and art depicting the East Kootenay experience. The cultural and economic significance of non-consumptive uses should not be underestimated.

***Objective 10*: Encourage investigation of competition between elk and other wild ungulates, especially mule deer and Rock Mountain bighorn sheep.**

No new studies were initiated regarding the interaction of elk with mule deer and bighorn sheep; however, an issue that has emerged over the past 5 years is the role that expanding populations of deer, elk and moose may be playing in the decline of mountain caribou. The "alternate prey" hypothesis postulates that predators of mountain caribou have responded numerically and spatially to expanding ungulate populations, and are incidentally preying on mountain caribou, whose primary anti-predator strategy has historically been to exist at low densities in habitats infrequently visited by predators (e.g., Bergerud and Elliot 1986, Seip 1992). The hypothesis has usually been applied to wolf-moose systems, although cougars are assumed to respond numerically to changes in deer populations (e.g., Sandell 1989). The mountain caribou subpopulation in the south Purcells is estimated to be 17 animals (Kinley 2004) and, as a result, the subpopulation is a current focus of recovery efforts (MCTAC 2002). Subpopulations farther north are larger, but all are in decline (Wittmer 2004).

Moose harvest in the Revelstoke area was increased in 2004 to address mountain caribou recovery efforts there. Additional measures will likely include increasing harvests of other ungulates and a reduction in ungulate winter range management in areas adjacent to mountain caribou habitat.

Harvest Management

***Objective 1*: Optimize hunting opportunity within the constraints of population and demographic objectives.**

The main strategy associated with this objective was the maintenance of the 6-point bull elk harvest strategy. This was seen as a way of minimizing harvest without restricting hunter participation via limited entry hunting (LEH). Bircher et al. (2001) recommended that the outcomes of this strategy be evaluated after 4 years, and if population objectives had been achieved, to then provide additional recreational opportunities.

As of 2004, the 6-point bull season had been very successful in achieving population objectives (principally bull escapement as measured by bull-to-cow ratios), and had resulted in almost universally high hunter satisfaction. Hunters reported excellent hunting experiences, although the 6-point restriction did not guarantee success. Hunter success data suggest that both total harvest (Figure 2) and hunter success were continuing to improve as of 2003 (Figure 3). The harvest of bulls had reached 55% of the peak 1976-2003 harvest by 2003, based entirely on 6-point bulls. The same trend in hunter success and total harvest (but to a

smaller extent) was also evident north of Radium and in the Flathead where hunters had expressed concern about the recovery of elk populations.

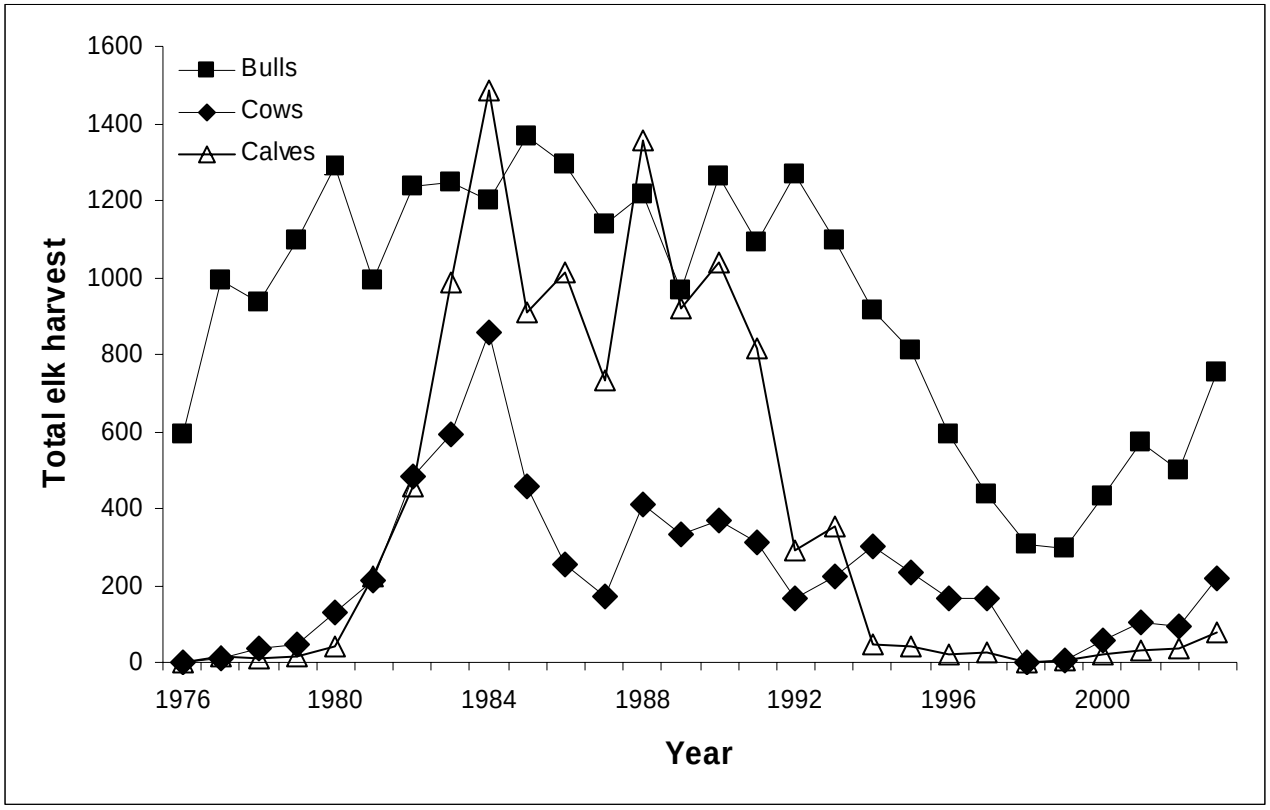

Figure 2. Total elk harvest in the East Kootenay sub-region, 1976-2003, by age-sex class.

Although Bircher et al. (2001) suggested that a standard, sub-region wide harvest regulation was preferable, many hunters expressed the opposite sentiment, requesting that regulations should in fact be more responsive to local and seasonal conditions (e.g., acknowledge the slow recovery of elk north of Radium or in response to severe winters).

There were some concerns expressed by the public regarding the continuation of the 6-point bull season. Many thought that the recovery in the elk population had been obvious a number of years ago, and that the Province had been slow to respond with additional hunting opportunities, instead waiting for the development of a new elk management plan.

Others expressed concern that continuing to harvest only 6-point or better bulls might have both short- and long-term consequences. The main short-term concern is related to behavioural disruption during the rut by killing herd bulls. Raedeke (1998) noted that only 22% of bulls were harvested during the rut and that his analysis of pregnancy rates and the timing of the rut indicated no significant shift between 1984 (pre 6-point season) and 1997. Still, Raedeke (1998) expressed concern about the long-term effects of a 6-point bull elk season. Changes in seasons since then have shifted the entire harvest period to the rut. Unfortunately, the collection and analysis of uteri from harvested cows did not occur during 2000-2004 and we were unable to determine whether there had been any shift in the peak of the rut or in pregnancy rates subsequent to 1997.

The mature bull-to-cow ratio required to achieve early, synchronous and successful breeding is unknown (Stalling et al. 2002); however, Noyes et al. (1996) reported an early, synchronous rut and high pregnancy rates in a captive herd of 18, 3-year-old bulls per 100 cows. The breeding seasons shifted even earlier and become more synchronous as bulls aged to 5 years. Noyes et al. (1996) recommended that harvest strategies should ensure that bulls ≥3 years old are retained in the population.

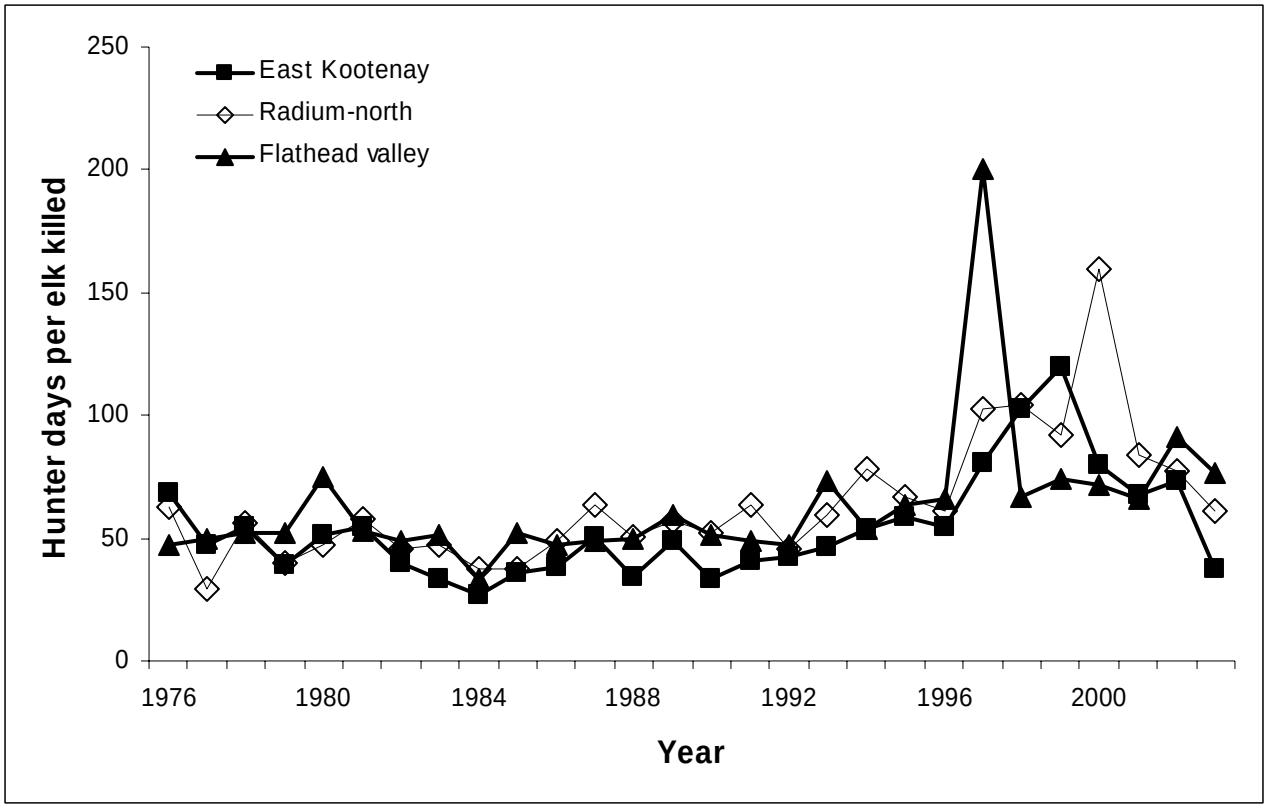

Figure 3. Success of elk hunters in the East Kootenay subregion, 1976-2003 for the entire subregion and for Management Units north of Radium and the Flathead valley.

A harvest strategy that selects only 6-point or better bulls likely achieves a breeding population of primarily ≥3 year-olds. A study of incisors from 205 harvested bulls in Nevada found that the point class of bulls was a poor predictor of age, with nearly 80% of bulls over one-year old being 6-points or better; however, only at age 5 did average point class exceed 6 (Nevada Department of Wildlife, *unpublished*).

An obvious cost of the 6-point bull general open season is that it reduces the escapement of older bulls and reduces hunting opportunities for "trophy" animals, compared to a hunting strategy based primarily on LEH. Noyes et al. (1996) provided evidence that the timing and synchrony of the rut, as well as pregnancy rates, improved when older bulls (e.g. 5-year-olds) were the breeders. Early and synchronous ruts can make populations more resilient to severe winters and predation (Singer et al. 1998).

Although elk in the East Kootenay are typically surveyed after the hunting season, the rate of escapement by 6-point bulls cannot be determined reliably because they are difficult to distinguish during aerial surveys; however, there are anecdotal reports of 6-point or larger bulls on winter ranges.

Carpenter and Gill (1987) outlined many possible negative consequences of using antler-point restrictions in general to increase bull-to-cow ratios. They argued that if hunting mortality was compensatory instead of additive to natural mortality (as it might be when the population is near carrying capacity), then antler-point restrictions might result in actual declines of the bull class that the restrictions are targeting to increase. From data available for the East Kootenay, there was no evidence that this had occurred during the history of the 6-point season.

There are also longer-term evolutionary concerns related to the 6-point bull season. Could the continued harvest of 6-point bulls lead to a population with smaller antlers? A link between hunting pressure and a reduction in horn size was studied in an Alberta bighorn sheep population (Coltman et al. 2003). This was the first study of its kind, and the Ram Mountain sheep population had been subjected to heavy hunting pressure and a full-curl restriction for 30-years. In addition, bighorn sheep populations are typically isolated from one another. These factors make it more likely that an effect of hunting pressure on horn size would be expressed.

As long as the elk population of the East Kootenay remains relatively large and continuous with other populations, and as long as un-hunted refugia remain (e.g., national parks, the Coal Block, private land), there will likely be sufficient genetic exchange to ensure the continued existence of 6-point or better bulls.

Objective 2: Improve effectiveness and timeliness of the provincial harvest data collection system.

No progress has been made on achieving this objective.

Objective 3: Implement appropriate harvest strategies to reduce elk numbers/distribution in chronic damage areas.

An early antlerless hunting season on private land was implemented in 1999, as was recommended by Bircher et al. (2001). According to some in the ranching community, the results of this hunt have been limited. The most common concern expressed is that the hunt is limited primarily by the size of the private land base and its ability to safely sustain sufficient hunting effort. Ranchers also reported that elk were being only temporarily harassed off of private land and onto adjacent areas where hunting was prohibited (e.g., crown range, native reserves, across the international boundary). Some hunters expressed frustration that some ranchers who were complaining about elk depredation were unwilling to allow hunting on their property.

The effect of the current level of antlerless harvest on the overall population of non-migratory elk is questionable. The hunt was not designed to reduce significantly the elk population in the Trench, but rather to target and reduce a small segment of the population that was having an impact specifically on private land. Data do not yet suggest that the extent of private land is limiting the success of the antlerless hunt, because the success of hunters actually increased as more permits were issued and, presumably as the population expanded between 1999 and 2002 (Figure 4).

Habitat Management

Objective 1: Manage habitat suitability to sustain 25,000 (±20%) elk, excluding privately owned and leased agricultural lands.

One of the fundamental problems related to managing habitat to sustain a target elk population is that different government ministries are responsible for different aspects of crown land management; setting population objectives for wildlife is the responsibility of WLAP while managing Crown range used by livestock is administered by the Ministry of Forests. The Ministry of Agriculture, Fisheries and Food does not have any legislative authority regarding Crown land.

The Range Program in MOF has multiple objectives, including managing habitat for wildlife. Current objectives in the Trench call for the allocation of crown forage to 50% for conservation, 25% for livestock and 25% for wildlife (Gayton and Hanson 1998); however, calculations of carrying capacity in Bircher et al. (2001) either did not consider this allocation (based on broad-scale habitat capability-suitability mapping, although carrying capacity estimates per km were very conservative) or inferred a misallocation towards cattle (based on forage production; Gayton 1997). In short, there was a clear disconnect between the setting of a sub-region-wide elk population target and the calculation of actual carrying capacity based on agree-upon allocation ratios and required data on range productivity (J. Kekula, pers. comm.). Widespread degradation of crown ranges reported by all stakeholders strongly suggested that Crown ranges within the East Kootenay were most, if not all, currently over-allocated and that conditions were deteriorating. However, both cattle and wild ungulates exhibit habitat preferences that result in over-utilization in some areas while other areas with ample forage are not used (J. Kekula, pers. comm.).

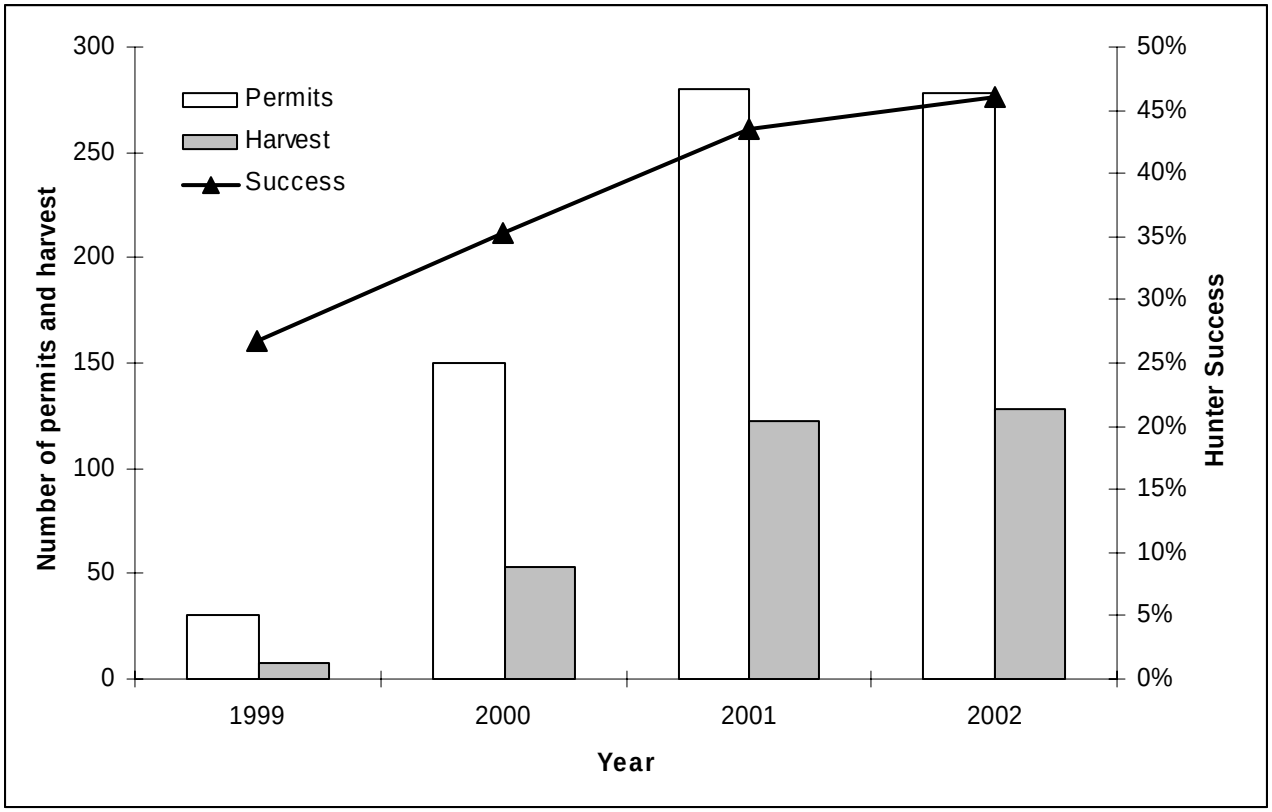

Figure 4. Number of permits, harvest, and hunter success (harvest/permits) resulting from private land depredation hunts (limited entry), 1999-2002.

Predictably, there was little agreement among stakeholders on the cause of the crown range deterioration. Most hunters were adamant that there were too many cattle on crown ranges, that grazing practices were poor (little or no rotation), that cows remained on ranges too late into the fall (reducing standing crops available for wintering ungulates), and that there was little or no enforcement of grazing tenure privileges.

The agricultural community was equally convinced that expanding elk and deer populations were contributing to range deterioration. Some stated that cattle stocking rates and season grazing lengths were being reduced while elk numbers were increasing.

Professional Agrologists and biologists familiar with the crown range of the East Kootenay were concerned about the condition of ecosystems used by cattle and ungulates (S. Crowley, J. Kekula, R. McCuaig, D. Smith). Several reported widespread deterioration of grassland habitats and, in particular, shrub communities. They cited examples where exclusion fencing for cattle had failed to restore riparian communities (suggesting over-utilization by wild ungulates), but also noted social and economic barriers to the implementation of more rational livestock grazing policies.

Current range condition is a linked but a separate issue from forest in-growth, encroachment, and the consequent calls for ecosystem restoration. Gayton (1997) examined paired aerial photos from 1952 and 1990 in 3 representative areas of the Trench and inferred the loss of 3000 ha of grassland annually. This suggested that each year resulted in the loss of enough forage to support >800 cattle or >4000 elk (assuming an average loss of 575 kg of forage lost/ha of land shifting from grassland to forest and 360 kg/AUM).

We heard from many stakeholders in the hunting community that there was suitable, high elevation summer range in several drainages, but that elk use of these areas had not recovered. Possible factors suggested to us that could be contributing to the low use of suitable, historically used summer ranges included:

1. Heavy harvest in the late 1980s led to the loss of lead cows and the social memory of distant, suitable summer range;

2. Suitable habitat between summer and winter ranges had deteriorated due to forest in-growth associated with continuing fire suppression and/or reductions in forest harvesting and associated shrub or grass (including seeding) responses, disrupting habitat use patterns between distant ranges;
3. Conversely, use of the traditional natural openings in back basins, avalanche chutes, etc. was disrupted by creation of suitable habitat by logging at lower elevations closer to the winter ranges;
4. The natural range of elk contracted when the population was low, and the population had not increased sufficiently to push elk into more distant ranges;
5. The relative forage availability and safety from predators afforded by low elevation range had reduced the proportion of elk migrating into the backcountry; and,
6. Predator abundance in some areas was preventing the recovery of elk herds.

The observed distribution of elk could be due to one or more of these factors and their interactions.

Objective 2: Implement the recommendations contained in the final report of the East Kootenay Trench Agriculture Wildlife Committee (EKTAWC).

Gayton and Hansen's (1998) recommendations focused broadly on restoring range health and the extent of open forest and open grassland ecosystems in the East Kootenay. Although stepping through the current status of all of the Committee's recommendations was beyond the scope of this report, stakeholders agreed that the recommendations had not been implemented satisfactorily. This was a disappointment to many, in view of the cost and effort of producing the report and the associated recommendations.

There was widespread agreement amongst stakeholders that range health had deteriorated during 2000-2004, partly due to lower than average moisture conditions in the Trench, but also due to continued over utilization. Additionally, the area treated under ecosystem restoration initiatives was inadequate to reverse the estimated pace of forest in-growth of approximately 3000 hectares per year (Figure 5). The decrease in area burned during 2002 and 2003 was largely a function of spring weather conditions rather than declining funding; however, the decrease in mechanical treatments was largely due to the cancellation of the Grazing Enhancement Fund (J. Kekula, pers. comm.).

The effectiveness of ecosystem restoration treatments is a topic of much discussion, and forage productivity of "restored" ecosystems can take several years to recover from treatments (J. Kekula, pers. comm.). In addition, proper management is required while ecosystems are recovering; for example, it is important to rest recently treated areas from grazing.

Objective 3: Support designation of the NDT 4 Ecosystem Restoration objectives of the Kootenay-Boundary Land Use Plan as a higher level plan under the Forest Practices Code.

The Kootenay-Boundary Higher Level Plan was signed-off as a legal order in 2000. The restoration and maintenance of "Fire-maintained ecosystems" (NDT 4) are listed as legal objectives in the Order.

Objective 4: Undertake habitat enhancement projects on high capability sites in NDT 3 ecosystems in cooperation with forest licensees and Ministry of Forests.

Habitat enhancement in NDT 3 was limited.

Objective 5: Implement habitat management strategies designed to provide intercept habitat and attract wintering elk away from private agricultural lands.

We are unaware of any projects to create intercept ranges during 2000-2004. There is some question regarding the usefulness of intercept ranges. There were anecdotal reports elk using the intercept range at Buck Lake near Newgate moved back and forth between agricultural fields and the intercept range.

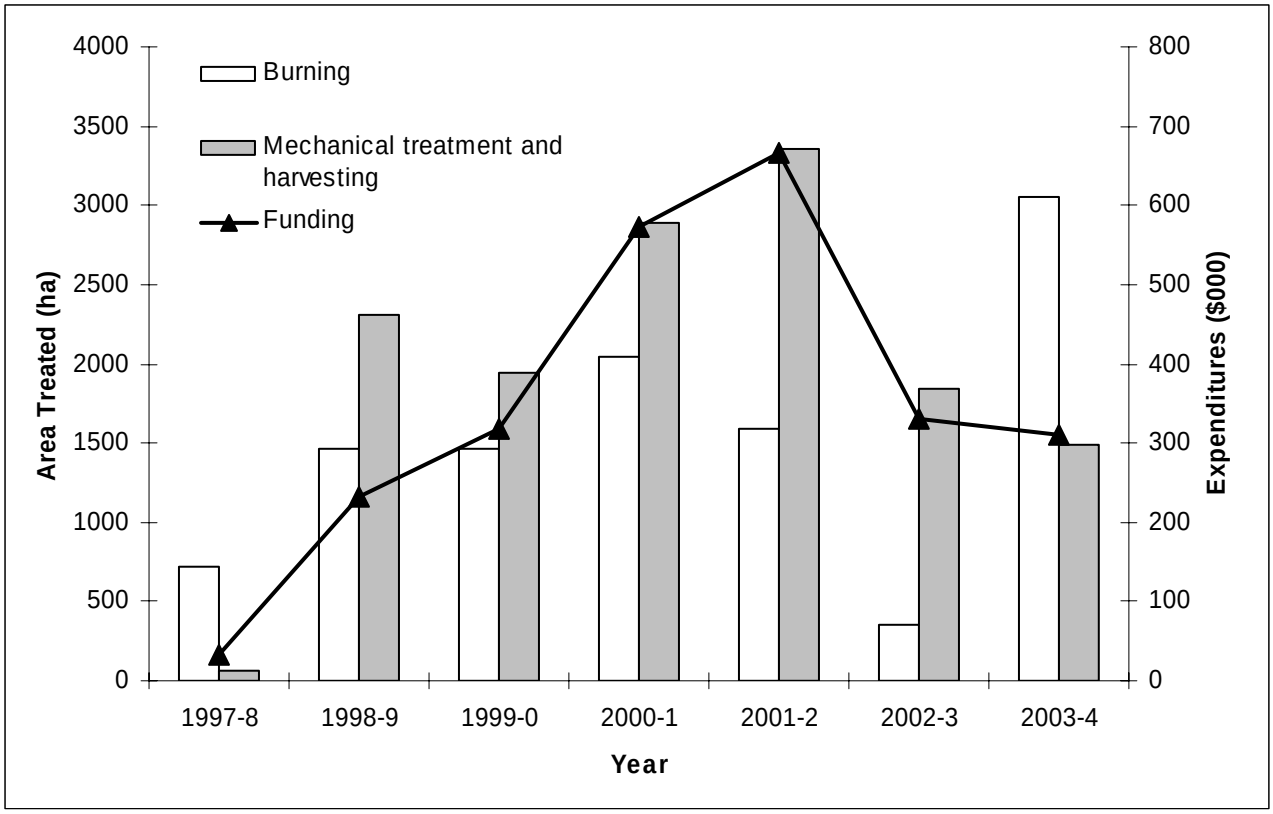

Figure 5. Summary of ecosystem restoration activities in the East Kootenay, 1997-2004. The pace of ecosystem restoration exceeded the estimated rate of forest in-growth (3000 ha, Gayton, *unpublished*) during 1998-2002 but not during 2003-4 (data provided by BC Ministry of Forests).

***Objective 6*: Continue working toward the development of a multi-agency co-ordinated access management plan for the East Kootenay.**

Access management was reviewed throughout the East Kootenay, with an emphasis on the Golden area, Cranbrook-west, and the Elk Valley. Draft reports were prepared (*Golden Backcountry Recreation Access Plan* and *Southern Rocky Mountain Management Plan*) but have not been finalized. The issue remains extremely controversial.

The direct and indirect effects on elk populations of increasing road densities and subsequent human access are well-studied and universally negative (see review Roland et al. 2004).

***Objective 7*: Undertake a review of the current strategy and individual plans for management of Wildlife Management Areas and private lands managed by the Wildlife Program.**

A review of current strategies and individual plans for Wildlife Management Areas is now underway.

***Objective 8*: Protect critical private land wildlife ranges (versus Crown ranges used by livestock).**

The situation with winter ranges located on private land deteriorated during 2000-2004 because of fencing by land owners. A total of 220 km of fencing by 93 landowners covering 4673 ha has occurred in the Trench (F. Street, pers. comm.). The subsequent loss of forage for elk in turn increased pressure on unfenced private land and on Crown range.

There was little progress on more innovative methods to deal with private land winter ranges, although the BC Ministry of Sustainable Resource Management is currently reviewing a number of incentive programs used in other jurisdictions and is planning to make recommendations (following extensive consultation with stakeholders) for possible implementation in BC in 2005 (J. Morgan, pers. comm.).

<u>Objective 9</u>: Cooperate with a multi-agency strategy to combat the spread of noxious weeds on Crown and private land.

In winter 2004, a provincial inter-agency committee was struck, chaired by the Ministry of Agriculture, Fisheries and Food, and funding to control invasive plant species was increased. In June 2004 WLAP announced an Invasive Plant Advisory Panel and increased funding for noxious weed control. The Ministry of Forests is the agency responsible on Crown Land but delivery of their program was centralized in Kamloops, and staffing and resources were subsequently reduced (Val Miller, pers. comm.). Individual agencies have responded to the ongoing issue of noxious weeks and other aggressive alien invasive plant species. For example, WLAP has taken steps to control noxious weeds on some lands that they are responsible for managing, as has the Nature Trust.

There are efforts underway to pool available funding under the Regional District of East Kootenay inter-agency weed committee. This would coordinate efforts among government and other stakeholders, such as the Regional District of East Kootenay, Tembec Inc., Canadian Pacific Railways, BC Hydro and Transcanada Pipelines. Noxious weed control efforts would be directed towards both public and private land.

Predictably, the scale of the noxious weed problem outstripped funding available to deal with it during 2000-4. Continuing range deterioration also increased the susceptibility of grassland to invasive plants.

4. Management Plan 2005-9

The following proposed management plan is based on information available to August 2004. We recognize that circumstances can change substantially in a relatively short time, and we recommend that managers be given the freedom to modify the plan within the expected 5-year time horizon, based on monitoring results and unforeseen events that might influence the elk population. Such events could include periods of severe weather, disease outbreaks, abrupt changes in habitat conditions and indications of increased predation.

Population Management Analysis

Population Targets

Both we and some stakeholders questioned the logic of establishing a sub-regional elk population objective. The aerial survey inventory required to estimate the overall population with confidence (*e.g.*, ±20%) would require a substantial, on-going commitment. Although the first question asked by stakeholders was often, "how many elk are there?" the management value of knowing the actual answer is relatively low. Rather, the population target represents a surrogate for other, more relevant objectives related to population health and hunting opportunities. For example, hunters want to be assured that there are enough elk to meet their principle objective of good hunting opportunities, regardless of the actual population size.

Wherever possible, we have stressed the development of objectives that are directly related to desired outcomes. We contend that, if the elk population has a healthy age structure and is providing good hunting opportunities within the limits of available habitat, then whether the population is achieving a certain size matters very little. It was universally presented to us during the public consultation that stakeholders do not want to return to the days of large-scale control measures that affect the entire elk population when finer-scale interventions to address specific objectives would be more effective. We recommend de-emphasizing the management of the elk population to a specific number and instead recommend adopting objectives that are more closely related to the goals outlined in Bircher et al. (2001) and in this plan. Resources for data collection should be allocated first to addressing these objectives.

Although we recommend de-emphasizing a sub-regional population target, there are legitimate reasons for increasing resources dedicated to collecting specific population data. We strongly agree with both Raedeke (1998) and Bircher et al. (2001) that WLAP should explore the use of cohort reconstruction analysis (also known as sex-age-kill or SAK models; Bender and Spencer 1999) to address knowledge gaps regarding population status. SAK models derive estimates of population size based on:

1. Estimated harvest of males: available from the summary statistics data base;
2. Estimated total mortality rate: usually the proportion of yearling bulls (from annual survey data) is substituted for this parameter (Raedeke 1998);
3. Estimated proportion of total mortality associated with harvest: this requires knowledge of natural versus hunting mortality rates; usually estimated from studies of radio-collared elk;
4. Estimated sex ratio of adult females to adult males: available from survey data conducted prior to the hunting season;
5. Estimated ratio of juveniles to adult females: also available from survey data; and,
6. Estimated finite rate of population change: based on year-to-year changes in elk observed on survey flights.

As Raedeke (1998) notes, such an analysis could be conducted largely with existing data already being collected by WLAP, and the data demand of the analysis could guide future investments in data collection. For example, the analysis requires pre-hunting season assessments of bull-to-cow ratios. Resources could also be directed towards validating the assumptions made in the model. There is also a need to increase survey efforts outside the Trench, in order to better assess the status of elk in specific areas of the subregion. Of course, the more data collected, the smaller the confidence intervals associated with parameter estimates,

which results in more accurate and timely management responses. Without adequate collection of reliable data, managers are forced to rely on anecdotal information from ranchers, wildlife clubs and others. This is a recipe for continuing conflict among user groups.

We recognize that elk populations have not recovered evenly throughout the East Kootenay. North of Radium, in the Flathead and at higher elevations in many drainages, current management should continue until there is clear evidence that elk herds have recovered. Although there were many at the public consultations who called for wide-spread predator control or elk transplants in these areas, we recommend allowing elk population to return through continued restrictive harvest management. There is little evidence that predators are inhibiting the recovery of the elk population overall (although there might be predation "hot spots" that could be addressed). Transplanting has been a viable strategy in other parts of the province (Vancouver Island and the adjacent mainland) and could be attempted in the East Kootenay. Because of the large effort required, transplant trials would have to rely primarily on volunteers.

Sex-age Ratios

Clearly the ratio of branch-antlered bulls to cows is a critical ratio for management, both in terms of identifying the health of the elk population and for quantifying hunting opportunities. We believe that the previous target of >20 bulls per 100 cows was achieved primarily through the continued application of the 6-point bull season. In fact, given the age-sex structure of elk populations, it is difficult to foresee how this objective could not be met under a 6-point bull season. As Raedeke (1998) noted, the 6-point season is largely "self-regulating" because the harvest strategy ensures continuous recruitment of bulls into the 6-point class. Conversely, but just as importantly, there is little chance that the population could sustain a 6-point general open season with *only* 20 bulls per 100 cows. That is, bull-to-cows ratios need to be high to ensure sufficient recruitment into the 6-point class to meet the expectations of hunters.

Based on this logic, the objective of >20 bulls per 100 cows is lower than would be expected under a 6-point only season and probably lower than would be required to sustain a 6-point general open season at the current absolute harvest level of >700 bulls/season. However, we do not suggest altering this objective unless further population modelling suggests that a higher objective is required to conservatively sustain the harvest of 6-point bulls at a certain absolute level. For example, cohort reconstruction analysis could be used to estimate the sex ratio of adult females to males required to sustain a certain absolute harvest of males in a population of a feasible size.

We expect that the 6-point bull season will continue to generate high bull-to-cow ratios, but that the >20 bulls per 100 cows ratio will again become an important objective if hunting opportunities are expanded in some way to allow the harvest of younger bulls (see below).

Calf-to-cow ratios are critical to the health of the elk population (Raedeke 1998). Unfortunately, they are also difficult to manage. As argued above, much of the year-to-year variation in calf-to-cow ratios can be explained by winter severity, rather than by habitat condition or predation rates (although all three factors can interact). Low calf-to-cow ratios during mild winters can be a reliable indicator of relative levels of predation (D. Janz, pers. comm.). Rather than actively managing to a calf-to-cow ratio, low ratios must trigger changes in harvest management; most notably, a reduction in any allowable antlerless harvest.

Population Management Recommendations

1. Use sex-age-kill analysis to address knowledge gaps regarding elk population status and structure and to explore the sustainability of the 6-point bull elk season under current management.
2. Expand the inventory program to address specific data gaps; specifically, data required for population modelling and to assess the status of the population outside the Trench.
3. Continue to manage for a post-hunting season observed ratio of >20 branch-antlered bulls per 100 cows unless further population analyses suggest that the ratio should be increased.

4. Manage for a post-hunting season observed ratio of >25 calves per 100 cows. If observed ratios fall below this objective for 2 consecutive years, the antlerless harvest should be reduced and other possible causes for the low calf-to-cow ratio should be investigated.
5. Consider transplantation trials of non-migratory elk into suitable but unoccupied areas elsewhere in the subregion where sufficient volunteer effort is available.

Harvest Management Analysis

The 6-point Bull Elk Season

There was little public support for altering the 6-point general open season for bull elk. We recommend that this season remain the cornerstone of the harvest strategy for elk in the East Kootenay. As of 2003, both total harvest and hunter success were still increasing. This was a continuing result of a very conservative harvest strategy for bulls (leading to high rates of recruitment into the 6-point class) and several years of mild winters, high fecundity and successful recruitment.

Increasing harvest and increasing hunter success together is unlikely to continue over the long-term. Habitat abundance and quality ultimately set the upper limit on elk populations. We expect the absolute harvest of 6-point bulls to level off as the effects of density-dependent factors begin to affect the structure of the elk population in different areas of the East Kootenay. Hunter success might stabilize or decrease, depending on the response of hunters to the growing scarcity of 6-point bulls.

There are three scenarios that could then emerge under a continuing 6-point harvest:

1. The absolute harvest of 6-point bulls stabilizes because hunter effort falls, resulting in harvest that balances recruitment into the 6-point class;
2. The absolute harvest of 6-point bulls stabilizes despite high hunter pressure because escapement of 6-point bulls declines; or,
3. Sustained high hunter effort results in a continuing high harvest of 6-point bulls but with lower escapement, leading to breeding disruption and demographic consequences that ultimately lead to population declines and lower harvest (note that this assumes that 6-point bulls that are currently escaping harvest contribute disproportionately to breeding in subsequent years).

Predicting which of these scenarios is likely to occur is difficult without knowing the current escapement of 6-point bulls, their disproportionate contribution to breeding, and the disruption that might occur if a larger component of this class were to be removed. There is also the complicating factor of anticipating hunter response. Of course all of this would be occurring within the context of other hunting regulations, interactions among factors and time lags.

In addition, the population is always vulnerable to stochastic events, such as severe winters. Mature bulls (weakened by the rut) and calves typically suffer disproportionately in severe winter conditions. This could result in lower harvests of 6-point bulls over many subsequent years.

As the harvest begins to level off, it will be important to have the resources available to look at other indicators of population health and status, such as calf-to-cow ratios, the timing of the rut, breeding synchrony and pregnancy rates. These indictors would provide evidence of any breeding disruption caused by possible over-harvest of 6-point bulls. With the exception of calf-to-cow ratios, collecting these data would require the harvest of at least 100 cows during November (to ensure adequate foetal development for analysis). As a result, some migratory cows would be included in the harvest. Clearly the expense and potential population impact of collecting and analyzing these samples suggest that other, less invasive (but also less effective) indicators of herd health should be considered first.

In addition to calf-to-cow ratios, monitoring average age of harvested bulls might also be useful. This would require the collection and inspection of tooth samples. Because point class is a poor predictor of bull age, monitoring any shifts in the harvest to younger-aged bulls via tooth analyses could provide an early detection

of over-harvest of bulls. This, coupled with low calf-to-cow ratios in mild winters and low indices of 6-point bull escapement, could suggest breeding disruption.

Limited Entry Antlerless Hunts

The primary purpose of the LEH for antlerless elk on private land is to reduce that portion of the elk population that is depending primarily on private land for forage. This is accomplished by reducing the number of elk living in and around domestic forage crops and secondly, by harassing elk out of these areas.

We received sufficient feedback to suggest that, from the perspective of private landowners, this hunt has failed to meet this objective. Three explanations were offered to explain this failure:

1) The hunt was simply too restrictive (i.e., not enough permits) to sufficiently affect the population,
2) Elk responded to the hunt by vacating private land or using it only under the cover of darkness; and,
3) The extent of private land and its capacity to accommodate hunters limited the success of the hunt (i.e., safety, time required of landowners, etc.).

To further complicate the issue, the use of private lands is likely influenced by short-term (e.g., moisture) and longer-term (e.g., utilization) influences on the quality of surrounding crown range. Indications are that both these influences worsened during 2000-2004, with the exception of late summer 2004 when moisture conditions improved and there were anecdotal reports that many elk remained at higher elevations and further from agriculture lands than in recent years.

As a result, we suggest that LEH hunts on private land alone are not going to be sufficient to address the private land depredation issue. Both population *and* crown land habitat measures should be part of the effort to address private land depredation. Objectives for the hunt should be related to desired outcomes with respect to the magnitude of private land depredation as well as crown range utilization and recovery (see Habitat Management below).

We recommend that the antlerless hunt be expanded to include crown ranges <1100 m in areas of the Trench where:

1. Depredation is most severe;
2. Private lands are not fenced;
3. Crown range conditions are degraded; *and*,
4. Utilization by elk exceeds their allocation (see Habitat Management below).

The goal of the antlerless hunt would then become twofold: to reduce private land depredation and to restore the crown range allocation for elk. However, before the antlerless hunt is expanded, objectives related to private land depredation, and methods to assess whether the hunt is meeting objectives, need to be negotiated and developed. Specifically, landowners need to be engaged in determining:

1. How depredation by elk should be measured and monitored (i.e., what are the indicators?); and,
2. How much elk use of private land is acceptable (i.e., what are the thresholds?).

In other words, the antlerless hunt should not be expanded until there is a system in place to evaluate its effectiveness in meeting the objective of reducing private land depredation.

This hunt should conclude by 1 October to minimize the impact to migratory elk returning to winter ranges. If calf-to-cow ratios again fall to <25 calves per 100 cows for 2 consecutive years (based on aerial survey data), the hunt should revert to a private land-only hunt.

The number of permits (and expected harvest) should change adaptively based on the indicators in relation to benchmarks. That is, there should be a clear link between the hunting allocation and the effectiveness of the hunt in meeting objectives.

We expect this recommendation to be controversial and there are uncertainties associated with the possible outcomes. We have a number of specific concerns:

1. Elk likely demonstrate some flexibility in their use of migratory and non-migratory strategies. Focussing harvest on the non-migratory population might lead to recruitment into that population of some migratory elk (something that is likely happening without the additional hunt). As a result, we cannot provide any assurance that the antlerless hunt will have no impact on migratory populations, although it should be minimized by the early closure date.
2. Expanding the hunt to include crown ranges might lead to a primarily crown range hunt, rather than a private land hunt, again failing to address the original motivation for the harvest. Clearly the continued cooperation of land owners to allow access to hunters is critical to the success of the hunt.
3. Because any harassment of elk on private land occurs after most of the damage has occurred (i.e., the spring and summer forage growth season), the strategy relies mostly on the long-term reduction of non-migratory populations to generate benefits to landowners. The result might be continued losses and frustration among landowners in the short-term.

A more radical approach to directly address private land depredation would be to authorize summer elk hunts on private (unfenced) land. This could be considered on a case-by-case basis, or could be more widely implemented if an expanded antlerless hunt does not meet objectives during the 5-year horizon of this plan. This hunt would be controversial with the non-hunting public because young elk calves would be shot or orphaned. As a result, the justification for these hunts should be cleared documented.

It was suggested during the public consultation that the prohibition on access fees associated with the LEH season could be lifted to provide private land owners with an incentive to allow hunting on their land. At present such fees are not illegal in British Columbia but are a special restriction on these LEH permits.

Other Hunting Opportunities

There was a significant minority of hunters who felt that their hunting opportunities had not improved commensurately with the size of the elk population. In general, this group advocated <6-point bull general open seasons or additional late-season opportunities with combinations of 6-point and small bull restrictions. Hunting for meat was given as their main objective. We agree that bull-to-cow ratios have recovered to the point that the population (at least in the Trench and Elk Valley) could probably sustain some harvest of younger bulls. We recommended caution in implementing a hunt on <6-point bulls for the following reasons:

1. Harvest of younger bulls will impact directly on the quality and perhaps the sustainability of the 6-point general open season. Our discussions with stakeholders suggested that most were unwilling to make that trade-off.
2. Expansion of the antlerless hunt could have a significant impact on non-migratory elk herds in areas of the Trench. Any additional hunting opportunities should be considered only after the effects of the antlerless hunt can be assessed.

We recommend that a limited entry hunt for 3-point bulls not be considered until the following conditions are met:

1. After the impact of the expanded antlerless hunt is monitored and assessed for at least 3 years;
2. The antlerless hunt is meeting harvest objectives but private land depredation problems have not been satisfactorily reduced (see below);
3. Crown range utilization by non-migratory elk is higher than its 25% allocation (see below); and,
4. The hunt occurs only <1100 meter elevation to avoid targeting migratory elk.

Many of our discussions with hunting stakeholders centred on the allocation of hunting opportunities among groups. Bow-hunters requested a bow-only season and also called for expanded opportunities to hunt <6-point bulls during the regular season. There were also requests for additional (or in some cases, reduced)

opportunities for youth, senior and disabled hunters. We considered it beyond our mandate to reconcile these competing demands; however, there were some notable themes that emerged from our discussions:

1. Restricting hunting to certain groups is an acceptable way to expand opportunities to those hunters who might be prevented from enjoying opportunities during the regular seasons (e.g., seniors, disabled);
2. Bow seasons can provide expanded hunting opportunities without significantly increasing the harvest; and,
3. Opportunities for exclusive seasons are limited (without reducing opportunities currently enjoyed by others) as long as the length of the overall season is limited the same period as it is now. We recommend that any expansion in the overall length of the season occur prior to 1 September, rather than extending the season later in the fall (to reduce pressure on migratory elk).

Harvest Management Recommendations

1. Continue the general open season on 6-point bulls unless data indicate a levelling off or decline in absolute harvest *and* indications of breeding disruption.
2. Expand private land antlerless LEH hunting opportunities to nearby crown ranges below 1100 m, in areas of the Trench where depredation is most chronic, private lands are not fenced and where crown ranges are degraded as a result of over-utilization by elk.
3. Establish a monitoring program to assess the effectiveness of the hunt in meeting private and crown land objectives.
4. Discontinue the expanded hunt if observed calf-to-cow ratios fall below 25 calves per 100 cows for 2 consecutive years.
5. Consider expanding the antlerless LEH after 3 years to include 3-point bulls if the antlerless hunt is meeting population and harvest objectives but is failing to meet habitat objectives (see below).
6. Begin authorizing summer elk hunts on private land on a case-by-case basis and consider expanding summer hunts after 5 years if objectives related to private land depredations are not being met.
7. Consider lifting the prohibition on access fees associated with LEH permits.

Habitat Management Analysis

Crown Range Management

It cannot be overstated that the current deterioration of grassland ecosystems on crown lands is an ecological tragedy. It is not just the economics of the local ranching industry and habitat for elk and deer that are affected by range deterioration. Grasslands are a rare ecosystem in BC and are home to over 30% of species considered at risk in the province (BC Conservation Data Centre, srmwww.gov.bc.ca/cdc). Gayton and Hanson (1998) made extensive recommendations to reverse the decline of range in the Trench; however, the majority of the recommendations have not been implemented.

The reasons for the continuing deterioration of crown range are many and have a long history (Wikeem and Ross 2002). Equally complex is the challenge of removing barriers to improving range management and condition. We stratified threats to crown range into 3 categories:

- Moisture: Range conditions are influenced by seasonal and annual moisture conditions, and well as longer climate trends. Moisture is a primary determinant of range productivity (Gayton and Hansen 1998) and, hence, of seasonal carrying capacity for both livestock and wildlife. Unfortunately, there is little that can be done to manage this primary influence of productivity.
- Allocation: Regional agrologists argue convincingly that poor range conditions are widespread and that the primary cause is over-utilization of preferred areas. They are also convinced that overgrazing

is a result of over-utilization by livestock and/or elk and/or deer, depending on the site (J. Kekula, pers. comm.). Most of the problems and proposed solutions we heard in public meetings could aptly be called "finger-pointing." The primary barriers to instituting a rational approach to range management and allocation by Ministry of Forests are:

1. Resources required to assess range conditions and to make defensible recommendations;
2. Economic and cultural pressure to maintain unsustainable livestock allocations in the context of current range conditions;
3. Government wildlife policies and targets that are not linked to habitat condition and range allocations; and,
4. The inherent difficulty in managing wildlife populations in relation to site-specific range conditions (e.g., shifting habitat use patterns of elk herds in response to multiple factors).

- Available Forage: The problem of open range and open forest being lost to forest in-growth is well known and documented (Gayton and Hansen 1998). Attempts to reverse forest in-growth and encroachment have been only partly successful. If current ecosystem restoration efforts are not increased immediately and substantially (several times the current effort), we are likely to see continuing social and economic upheaval, as well as significantly worse ecological conditions for at least the next 2-3 decades.

Gayton (*unpublished*) calculated that 3000 ha of grassland are converted to forest every year, based on interpretation of air photos taken in 1954 and 1990 in select areas of the Trench. Based on this calculation and the extent of NDT 4 ecosystems in the East Kootenay, 60% of grassland habitat has been lost as a result of forest in-growth during the past 50 years. There are a number of assumptions on which this estimate is based. For example, it assumes that the 3 study areas examined are representative of the Trench as a whole, that forest growth has been linear and that the situation in 1954 represents the appropriate target for what ecosystem representation is attempting to achieve.

Of course there is no evidence that range conditions that existed in 1954 resembled historic (e.g., pre-contact) conditions. Some have questioned whether the ecological characteristics that are sought through widespread ecosystem restoration are "natural", or more importantly, achievable (e.g., Klenner and Arsenault, *in review*). Areas where forest in-growth is most pronounced could indicate areas that historically were forested. The effort required to "restore" these areas could be impractical. Therefore, barriers to ecosystem restoration might not only be socio-political, but also ecological.

Regardless of historic conditions, the pace of ecosystem restoration needs to be increased if public expectations are going to be met regarding exploitation of the land base. Steps and barriers to implement a comprehensive and coordinated ecosystem restoration effort have been documented elsewhere (e.g., Rocky Mountain Trench Ecosystem Restoration Steering Committee 2000).

Recent suggestions to increase the pace and coordination of restoration efforts include the creation of a joint-agency office of range health that, among other duties would coordinate ecosystem restoration activities. Because the Ministry of Forests administers the legislation necessary to facilitate ecosystem restoration work, it is essential that the Ministry take a central role. There was also the suggestion that range conditions need to be assessed every 5 years in a manner similar to a timbers supply review (TSR). Baseline information from a Range Supply Review (RSR) would reduce uncertainty regarding sub-region-wide range allocations.

The focus of our recommendations is related to the issue of allocation. Once again we recommend de-emphasizing broad-scale quasi-calculations of carrying capacity because we see them as largely indefensible and therefore a flashpoint for continuing conflict. Carrying capacities also tend to under-emphasize the link between behaviour and impact. That is, the impact an animal has on the range is dependent on its behaviour. Range management practices and elk migratory patterns can have significant effects on the ability of range to support animals. Properly managed, cattle can be used to condition forage for elk and actually increase the number of elk that can be supported, if that is the objective (Vavra and Sheehy 1996). We recommend tying objectives directly to the future desired conditions of crown ranges. Setting these desired conditions with

respect to wildlife values has been delegated to WLAP by the Forest and Range Practices Act. Range Use Plans will have to accommodate these future desired conditions when the subregional UWR plan is approved. This has the potential to improve range conditions in many areas throughout the East Kootenay.

The extent and condition of ungulate winter range in relation to the size of the elk population determines the population effect of severe winter conditions. The effect of the last severe winter (1996-7) was dramatic. Since then both the extent and condition of winter range has declined and the elk population has increased. As a result, the effect of similar severe conditions occurring in the near future can be expected to have a more dramatic effect on the elk population than that observed in 1996-7.

Private Land

Depredation of private land crops and elk and other wild ungulates was one of the principal themes of our public consultation. There was almost universal agreement that steps must be taken to address the issue. The increased use of fences to reduce private land depredation problems could have long-term consequences for wildlife, if additional areas are fenced and existing fences maintained. These problems include:

- Loss of winter forage;
- Disruption of migration and movement corridors; and,
- Reduced access to adjoining crown ranges.

The best solution to these problems is to reduce the incentive for farmers to fence by reducing agricultural damage. There is anecdotal evidence that the poor condition of crown range has lead to higher use of agricultural valley bottom lands by elk and other wild ungulates. Therefore, the link between rational crown range management and private land damage control should be recognized in management.

The principal approach to reducing agricultural crop depredation problems should first be to improve the success of the LEH antlerless hunt. Secondly, recommendations from the BC Ministry of Sustainable Resource Management are expected regarding possible incentive programs related to private land stewardship. Incentive programs are likely to placate some landowners who continue to suffer damage and wish to avoid fencing their properties. Unfortunately, the benefits of these initiatives are unlikely to result in immediate reductions in damage. We make harvest recommendations above that could be implemented in 3 years if the expanded antlerless hunt fails to meet objectives.

Habitat Management Recommendations

1. Improve the condition of crown ranges by managing grazing allocations to approximately 25% livestock and 25% wildlife utilization (with 50% for conservation to ensure the sustainability of the resource). If this allocation objective is impractical to monitor, then related surrogate objectives should be developed and sufficient resources allocated to collect required information.
2. Conduct detailed forage assessments and assess ecosystem health of crown range in priority (i.e., high-conflict and degraded) areas to support recommended changes to forage utilization.
3. Develop an inter-agency procedure for responding to, and implementing the recommendations designed to restore and manage crown range ecosystems. This procedure should include: a) range supply reviews (RSR) at 5-year intervals; b) strategies with which WLAP responds to recommendations for reduced use by wildlife (e.g., harvest and access management); c) a dispute resolution mechanism to minimize interference in local crown management and livestock allocation decisions; and, d) clear accountability for management successes and failures.
4. Focus ecosystem restoration efforts on removing barriers to substantial increases in effort, including: a) Convincing government(s) to make a political commitment to a multiyear, secure program of range restoration; and, b) improving inter-agency cooperation by establishing a joint-agency office of range health.

5. Implement Ministry of Sustainable Resource Management recommendations regarding wildlife habitat incentives and co-management on private land.

Outstanding Issues

As would be expected, a number of issues arose during the public consultation and our analysis that were beyond our mandate to analyze and to provide specific recommendations. These issues need to be explored more thoroughly in cooperation with other line ministries and a broader group of stakeholders:

Access management: This issue was important to many if not most of those participating in the public consultation. Clearly access influences both the size of the absolute elk harvest and well as its distribution, but recommendations regarding access management require broader public consultation as well as the involvement of other agencies (e.g., Ministry of Sustainable Resource Management).

Hunting methods: Many submissions were received regarding specific hunting methods, such as archery and black powder hunting, junior hunting; disabled person seasons, etc. Harvest methods can be used to promote safety, to increase the harassment of elk, to prolong season openings, to reduce harvest rates and to increase hunter participation; however, allocating opportunities among user groups is not principally a technical issue and is best addressed through groups such as the East Kootenay Hunter Opportunity Committee.

Livestock grazing: Livestock grazing was perceived by many attending the public consultations to be most important factor that had led to the poor conditions of crown ranges. Specific problems mentioned included:

- Resistance to rotational and deferred grazing management;
- Poor enforcement of crown leases;
- Over-utilization; and,
- The role of cattle in the spread of noxious weeds.

The quality and extent of crown ranges directly influences habitat available for elk; however, addressing the specifics of these issues must largely be deferred to Professional Agrologists and other ministries, namely the Ministry of Forests and the Ministry of Agriculture, Food and Fisheries.

Mountain caribou recovery efforts: The Province's commitment to the recovery of mountain caribou might generate consequences for elk population management in areas of the east Kootenay that are adjacent to mountain caribou habitat (i.e., south Purcell Mountains and north of Golden). Recommendations for caribou recovery are being addressed in Provincial and regional (i.e., South Kootenay and North Kootenay Recovery Implementation Groups) processes.

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