CHAPTER 13

IMPLICATIONS OF HISTORICAL, CURRENT, AND LIKELY FUTURE TRAJECTORIES OF HUMAN LAND USES AND POPULATION GROWTH TO GRIZZLY BEARS IN THE ALBERTA PORTION OF THE CRE
13. IMPLICATIONS OF HISTORICAL, CURRENT, AND LIKELY FUTURE TRAJECTORIES OF HUMAN LANDUSES AND POPULATION GROWTH TO GRIZZLY BEARS IN THE ALBERTA PORTION OF THE CRE

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ABSTRACT
A progression of landuses developed and deployed during the 20th century in Alberta were responsible for significant economic growth and human population expansion, but also lead to the loss of grizzly bear habitat throughout much of the province. The dominant “bear-incompatible” landuses accounting for landscape conversion have included cropland agriculture, livestock grazing, and urban, suburban, and acreage expansions. Other landuses, most notably forestry, hydrocarbon industry, and the recreational sector, have left their anthropogenic footprint extensively across historic and current grizzly habitat, but their influences on grizzly bears are expressed more in terms of increased bear mortality than in lost habitat. Collectively, these landuses require an impressive network of linear features (major roads, minor roads, hiking/biking trails, transmission lines, seismic, pipelines, etc.), now in excess of 1 million km in Alberta, which in turn have created an access infrastructure that permits Albertans to travel extensively throughout the boreal and foothill forest communities of Alberta. Against this historic back-drop, the Central Rockies Ecosystem represents important remaining but threatened habitat for Alberta’s grizzly bears.

The loss of actual grizzly bear habitat area in recent decades is relatively small and mostly confined to the periphery of current habitat distribution. These incremental losses generally express themselves as livestock range improvement projects, acreage complexes, front-country accommodations, and a host of small, yet numerous features of the energy sector. More insidious, from a grizzly bear mortality probability perspective, is the rapidly increasing presence and activity of humans along and proximal to the existing and expanding transportation networks in remaining grizzly bear habitat. Increasing visitation rates by humans for recreational (hunting, camping, hiking, biking, trail riding, off-roading) and non-recreational (personal and commercial driving) purposes have lead to an increase in the number of bear-human encounters, and the frequency by which these encounters result in the intentional or unintentional death of bears.

The issue of bear/human encounters in the Central Rockies Ecosystem will intensify given the certain expansion of mountain and foothill commuting towns such as Canmore and Bragg Creek and the mobility and increase of a Calgary population approaching 1 million. Whereas Calgary has grown by an average annual rate of 4% in area and 2.5% in population during the past several decades, the growth of some of its satellite communities and acreage complexes has been even higher. If these growth rates persist in the coming decades, the City of Calgary will contain ~1.5 million people by 2030 and the Central East Slope commuting towns will be home to greater than 100,000 foothill and mountain residents. As this young, prosperous human population satisfies its increasing appetite for front-country and back-country recreational pursuits, the attendant bear mortality may overwhelm the conservative reproductive rates exhibited by grizzly bear females in this region. The current 3.1 million visitors (resulting in 7.7 million visitor days March 2004–March 2005) traveling through the entrance of Banff National Park is likely to grow to 10 million annual visitors by 2030, and this growth is likely to be accompanied by increased levels of both front-country and back-country recreational activities. While much of the current pressure of human residential expansion occurs along and proximal to the Bow River Corridor, it is likely that acreage complexes and commuting towns will expand in a southern direction along the eastern front ranges of the Rockies, as traditional cattle grazing operations are lost to poor economic performance and subdivision opportunities. Unless managed effectively, the combined mortality rate caused by intentional (legal hunting, poaching, self-defense) and unintentional (vehicular mortality, bear destroyed because of adverse interactions with humans) events threatens the future of grizzly bears.

As the area, length and intensity of linear features in Alberta continues to grow, it is becoming increasingly clear that access management has been neglected across large tracts of remaining grizzly bear habitat. The
current situation, with few exceptions, where all Albertans can travel any way, for any reason, at any time, across an expanding network of roads, trails, seismic lines, pipelines, and transmission lines, is untenable to the longterm maintenance of a healthy regional grizzly bear population. Creating awareness by Albertans of the need to maintain adequate amounts of relatively undisturbed habitat for sensitive species such as grizzly bears remains an enormous, but essential, challenge.

INTRODUCTION

The East Slopes of southwestern Alberta provide important habitat to two widely recognized and charismatic mammals. For the grizzly bear the East Slope Region represents a remnant of habitat that once spanned all the province’s biomes. Relative to the early 1800’s, when the population was many thousands, today’s grizzlies number fewer than a thousand (Kansas 2002, Stenhouse et al. 2003), and are restricted to a small portion of their original distribution.

In contrast, the trajectory of distribution and density of humans has been the mirror opposite. During the past two centuries, the human population has increased by multiple orders of magnitude, and their distribution has expanded to occupy all but the most inhospitable habitat types.

These opposite trajectories are not coincidental but historically reflect a very direct, incompatible, and unbalanced relationship between the two species. As the human population expanded across Alberta, its technological ability to convert native plant communities into a suite of landuse practices (croplands, grazing lands, towns, cities, recreational infrastructure, forestry and energy sectors, road networks) created a bow wave of conflict that reduced bear populations directly through mortality, or indirectly through loss of preferred habitat types.

Today, grizzly bears are restricted to about one-third of the province (Kansas 2002, Herrero and Higgins 2003), and to mountain and foothills habitats, much of which is designated as either federal or provincial parks. The pressure by humans and their landuses on remnant bear populations has not subsided. Most problematic to wildlife managers is the recognition that Alberta’s rapidly expanding human population looks enviably to the mountains and foothills as an idyllic environ in which to live, recreate, and conduct landuse.

Relative to other regions supporting grizzly bear populations, grizzly bears in the Alberta portion of the Central Rockies Ecosystem (CRE) (Figure 1) (Komex International 1995) live in and nearby one of the most developed and populated landscapes in North America (Gibeau 2000, Herrero et al. 2000). The human population of nearby Calgary grew by 16% between 1996 and 2000, and now exceeds 900,000 (Statistics Canada, 2001). Nearby Banff National Park receives 7.7 million visitor days per year (Personal communication Dave Dalman and Frank Grigel, Parks Canada, Banff and Calgary, respectively) and its visitorship is growing by ~2.8% annually (Banff National Park Census data). There is little grizzly bear habitat in the Alberta portion of the CRE that is secure, where a female grizzly bear can meet her daily needs without encountering people or some risk of human-caused death (Gibeau et al. 2001, Nielsen et al. 2004). Because grizzly bear in the CRE have low density, conservative reproduction, and large home ranges (et al. 2005) their human-caused mortality rate must remain low if populations are to persist (Herrero et al. 2000). Bear managers often use a target of not more than 4% human-caused mortality per year (with not greater than 30% of this mortality being females) as one that will sustain a non-declining grizzly bear population (Harris 1986). Currently, the grizzly bear population inhabiting the Bow River Watershed areas of Banff National Park and Kananaskis Country, where they are not legally hunted (except by Treaty Indians), appears to have a slight positive trajectory (Garshelis et al. 2005). However, population data indicate that if the adult female survival rate declines from 95% to 90%, this would likely lead to a population decline. A source/sink structure may exist within the broader CRE grizzly bear population with the Bow River watershed population being the source and other portions of the CRE with possible greater mortality being a sink (Stenhouse et al. 2003).

Landscape access and landuse density are primary variables that have been shown to correlate with human-caused grizzly bear mortality (McLellan 1989, USDA Forest Service 1990, Benn and Herrero 2002). Grizzly bear mortality is a function of the frequency of encounters with people and the potential lethality of these encounters (Mattson et al. 1996). Legal hunting for grizzly bear is the primary human-caused source of grizzly bear mortalities in the British Columbia portion of the CRE. In B.C., the landscape is more productive, and appears to produce enough grizzly bears that hunting is a viable management option (Peek et
al. 2003). In Alberta south of the Bow River, there is almost no grizzly bear hunting, since the bear population cannot support it (Nagy and Gunson 1990). Here human-caused mortalities and removals are associated with bears getting into trouble over human-food attractants, being shot in self-defense by ungulate hunters, being hit on highways, killing livestock, being poached, and other associations that are perceived to threaten human activities (Benn 1998, Gibeau and Herrero 1994 – 2002, Gibeau and Stevens 2003). Even in areas where grizzly bear hunting does not exist, such as the Yellowstone Ecosystem and Kananaskis Country, people with firearms, such as ungulate hunters, pose far more danger to grizzly bears than do unarmed hikers. Killing of grizzly bears in self-defense associated with ungulate hunting has become the greatest source of human-caused grizzly bear mortality in the Yellowstone Ecosystem (Kaminski, T., US Forest Service, Montana; personal communication). Road access is the primary landuse factor that increases the number of people in grizzly bear habitat.

In the CRE, grizzly bears exist in a multiple use landscape that is experiencing greater development pressure each year. Personal recreation and commercial activities such as forestry, oil and gas, residential development, and tourism and recreation continue to increase road and trail access to grizzly bear habitat. Roads not only increase mortality risk for grizzly bears, but compromise habitat use (McLellan and Shackleton 1988, USDA Forest Service 1990, Mace et al. 1996, Gibeau 2000). They also fragment habitat and populations thus further stressing population viability (Proctor 2003). Resource development is fueling rapid regional human population growth that, through positive feedback, creates more pressure for development. Maintaining grizzly bears in the Alberta portion of the CRE in this context will require landscape development and use planning and management that takes into account the needs of grizzly bears. These needs can best be respected by managing human-caused grizzly bear mortality rates at sustainable levels. To do this will require maintaining landscape conditions such as access density that are known to support low human-caused grizzly bear mortality. Grizzly bear hunting could be banned in the British Columbia portion of the CRE, as it has been in most of Alberta south of the Bow River, but this would only delay the need to manage access and industrial uses.

Figure 1. The Canadian Rockies Ecosystem (CRE). Graphic prepared by Scott Jevons.
CHANGING LAND USE AND INCREASING HUMAN POPULATIONS

As grizzly bears face an increasingly uncertain future in Alberta (Figure 2), resource managers struggle to find new ways of conveying a message to Albertans about the clear trade-offs occurring between expanding landuse practices and sustainability of regional grizzly bear populations. The data that follow are intended to help tell a compelling story about historic, current, and likely future trends in landuses in the East Slopes Grizzly Bear Study area.

Figure 2. This Darksky satellite image (1990’s) illustrates the belt of intensive landuse (shown as light emissions associated with the energy sector, transportation networks, settlements, cutblocks, and agricultural matrix) proximal to the foothill and mountain habitats of the grizzly bear in Alberta. In comparison to lands further east, the cordilleran distribution (shown in yellow) of today’s grizzlies is relatively pristine, yet the landuse footprint in the Crowsnest, Bow, and Athabasca River valleys is clearly emerging in the image above.

THE EXPANDING METROPOLIS OF CALGARY AND SURROUNDING COMMUNITIES

The city of Calgary has enjoyed remarkable population growth during the past several decades (Figure 3), much of which has been fueled by the prosperity of the province’s energy sector. As Calgary’s population has expanded, so has the footprint of this urban centre (Figure 4), consuming surrounding native grasslands and agricultural fields at a startling rate (Figure 5). The peripheral growth has occurred in all directions, but has been particularly noticeable to the south and along its western borders where the city creeps west into the foothills. If Calgary continues its growth trajectory at historic rates, it would become a metropolis of 2 million people by 2030 (Figure 3), a realization that should cause concern as to where these people will reside and enjoy their recreational activities. Human census data from Statistics Canada (2001) indicates that ~100,000 people reside in and around the communities of the East Slope between Sundre to the north and the Crowsnest Pass to the south.

Figure 5 illustrates the historic growth of the urban footprint of the greater Calgary region between 1924 and 1998 (the red dots are geographic markers along the Bow River that assist the reader with orientation). If Calgary continues to grow at the rate observed during the past several decades, the city will quadruple from its current footprint of 394 km² within 3 decades (Figure 6). If the Greater Calgary Region were to reduce its footprint growth to 3% annually (a 33% reduction in growth relative to historical rates), the footprint in 2030 would be 2.5 times as large as today (Figure 7). It is interesting that Calgary continues to grow outward (suburbia, subdivisions) at a rate higher than it is growing upward (apartments, condominiums), and hence continues to decline in human density throughout the past century (Figure 8).
Figure 3. Historical and projected (at 2, 2.5, and 3% annual growth) future population of Calgary. Historical data provided by Statistics Canada.

Figure 4. Historical and projected (at 2, 2.5, and 3% annual growth) future footprint (km$^2$) of Calgary. Historical data based on air photo chronosequence.
Figure 5. A comparison of the urban perimeter of Calgary in 1924 (18 km², 7 mi²) and 1998 (394 km², 154 mi²), right. The white box found in the left photo is a section (1 x 1 mile; 1.6 x 1.6 km). The image on the right shows the progressive perimeter of Calgary (based on aerial photos) at several points of this chronosequence.

Figure 6. Calgary’s historic growth (1924 to 1998) and projected future footprint if growth occurs at 4.5% annually.
Figure 7. Calgary’s historic growth (1924 to 1998) and projected future footprint if growth occurs at 3% annually.

Figure 8. Calgary’s historical pattern of human density (number of people per square kilometer).

With a relatively affluent human population, both among young professionals and retirees, many families are choosing to live in smaller communities nested along or inside the Canadian Rockies. For some, these communities represent a year-round residence, whereas for others they offer condominiums for seasonal vacations. This trend has been fueled by the advances of electronic communications that has made telecommuting an effective and efficient lifestyle option. A good example of such a desirable tele-commuting
venue is Canmore (Figure 9): during the past 30 years, the footprint of Canmore has increased by approximately 4 times (Figure 10) and the population by over 600% (Figure 11).

![Figure 9. Looking down on Canmore from Wind Ridge.](image)

Figure 9. Looking down on Canmore from Wind Ridge.

![Figure 10. These two air photos of Canmore (1950 left and 1999 right) illustrate the rapid growth trajectory and the fragmentation of an important wildlife movement corridor along the Bow River valley. Issues include direct loss of bear habitat, increased human population and associated recreational pursuits that place humans in greater contact frequency with bears.](image)

Figure 10. These two air photos of Canmore (1950 left and 1999 right) illustrate the rapid growth trajectory and the fragmentation of an important wildlife movement corridor along the Bow River valley. Issues include direct loss of bear habitat, increased human population and associated recreational pursuits that place humans in greater contact frequency with bears.

From the standpoint of grizzly bear conservation, the absolute number of people in and near grizzly bear home ranges is far more important than the loss of native habitat caused by expanding human communities. To illustrate this point, the historical and future projected human populations at three spatial scales are presented below. The populations of each of Alberta, Calgary and Canmore are all expected to grow considerably during the next half century, but greater growth (in percent) is anticipated to occur in Calgary than in Alberta, and the greatest growth (in percent) is anticipated to occur in the mountain resort community of Canmore.
Figure 11. Historical and future projected human populations at 3 spatial scales. Canmore (within current Grizzly Bear distribution), Calgary (proximal to Grizzly Bear distribution), and Alberta. Best fit lines are fitted to historical data and used to project future (2000–2050) annual growth of 3.5% (Canmore), 2.0% (Calgary), and 1.8% (Alberta).
AN EXPANDING WAVE OF RURAL RESIDENTS

With increasing appetite, Calgarians, Albertans and others are looking to build homes and reside in the foothills of the Rocky Mountains in Alberta. Located within reasonable commuting distance to Calgary, foothill communities such as Bragg Creek, Water Valley, Canmore, Millarville, are experiencing a rapid increase in the density of acreage dwellers or condominiums. This expanding wave of “rural residential” is consuming habitat previously used by grizzly bears, and placing humans and bears in much greater proximity. As acreage complexes emerge, they serve as focal points that in turn increase levels of mountain biking, fishing, hiking, trail riding, and hunting. Not surprisingly, conflict interactions between grizzly bears and humans increase in direct proportion to intensity of recreational activity (Mattson et al. 1996). Some of these unfortunate encounters will lead to the destruction of individual bears, further eroding the ability of the regional grizzly population to persist.

The Miistakis Institute of the University of Calgary has recently completed some revealing time-series evaluations of building structures within all quarter sections (0.5 x 0.5 miles) that comprise the Municipal Districts of the East Slopes of the Alberta Rockies (Rocky View, Foothills, Ranchlands, Pincher Creek, Willow Creek, and Cardston) (Duke et al. 2003). Although not all of the structures found within this study area are rural residences, most of the growth during the past 50 years can be attributed to residential development.

Whereas building structures have been growing by an average of 2.5% annually during the past 3 decades (Figure 12), much of the growth and density is clearly expanding outwards from the major urban centres and further into the foothill environs (Figure 13, Figure 14).

![Figure 12. Temporal trends in number of building structures in each quarter section within the Municipal Districts of the Alberta's East Slopes (Rockyview, Foothills, Ranchlands, Pincher Creek, Willow Creek, and Cardston). Data prepared by the Miistakis Institute.](image-url)
The time-series of photos below (Figure 15) illustrate the landscape transformation that has occurred in the Bragg Creek region during the past several decades. Although the initial landscape conversions were associated primarily with agricultural cultivation, subsequent growth of acreage complexes triggered significant human population growth, and landscape fragmentation.
Figure 15. These two photographs (of approximately similar scale) of the hamlet region of Bragg Creek, one is 1950 (left) and one in 1997 (right), illustrate the growth of the community during a five decade period. In addition to the actual hamlet, much growth of rural residential complexes has occurred in the surrounding foothills landscapes surrounding Bragg Creek (see below).

Figure 16. This air photo, taken west of Bragg Creek in 1997, illustrates the fragmentation and loss of grizzly bear habitat associated with the expansion of acreage complexes. The main east-west road in this photo leads west to a popular staging area for hikers, bikers, hunters, and skiers on the border of Kananaskis Country. Some of these recreationalists will encounter grizzly bears during their recreational pursuits, and the outcome of some of these encounters will lead to the destruction of individual grizzly bears. This local effect will combine with other regional effects in a classic cumulative effects scenario decreasing grizzly bear range and increasing mortality probabilities.
EXPANDING APPETITE FOR RECREATIONAL OPPORTUNITIES

Affluent, relatively young and active, residents of Calgary, Cochrane, Canmore, and other foothill communities are increasingly looking west to the mountains to hike, mountain bike, ski, fish, hunt, or for recreational motoring (Figure 17, Figure 18). These activities can only be accommodated with an appropriate transportation network, which takes many forms (Figure 19). Much of the demand for recreation is met by the mountain landscapes in and surrounding Kananaskis Country, Canmore, and Banff; all areas that have historically provided valuable habitat for grizzly bear. Figure 20 illustrates the increasing amount of demand for these recreational and other activities in Banff National Park.

Figure 17. Although Calgary represents a relatively small portion of the overall landscape, it houses a large and growing human population that pursues a suite of recreational opportunities beyond its urban borders.

Figure 18. Trail riding is a popular and growing recreational landuse in the foothills of southwest Alberta (left). The total footprint of ski resorts has increased substantially during the past several decades.
Figure 19. The transportation network is not restricted to roads built to move commercial goods, but also takes many other forms (trails, ski runs, rivers) that serve a diversity of recreational activities.

![Transportation network diagram]

Figure 20. Between 1990 and 2000, visitation to Banff National Park grew from 3.54 million to 4.56 million visitors, representing an average annual growth of 2.85% (Banff National Park Census data). If this rate of growth continues, visitation to Banff will increase by at least 2.25 times during the next three decades.

Although many of the visitors to Banff National Park do not venture far from their cars or the major road network, they do represent an important mortality source to grizzly bears because of bear-vehicle collisions. Furthermore, even if the percent of visitors to Banff who chose to enter the back-country remains constant, Banff will witness an approximate 225% increase in the number of people using the established trail network by 2030. A small percent of these hikers and campers will encounter grizzly bears and these encounters will increase as visitor numbers climb.
Commercial forestry is conducted on portions of the public forests in southwest Alberta, but not within provincial or federal parks. Of the approximately 1.65 million hectares of forests found along the east slopes of the Rockies from the US border to the northern extent of the Red Deer River drainage basin, approximately 48% is part of the active commercial forest landbase (Bev Wilson, Alberta Natural Resources Service, personal communication). Of these commercial forest lands, an additional 31% is not eligible for logging under current regulations because of forest stands that are too close to water, too steep, or inaccessible. This means that about 33% of the total forest landscape of East Slopes region will observe some form of logging under current regulations during the next forest rotation (~100 years). Although actual harvest volumes can vary from year to year, the sustained yield harvest of softwood and hardwood is approximately 550,000 m³ and 38,000 m³, respectively.

The actions of forestry have two important, and distinctively different, effects on grizzly bears in the CRE of Alberta. First, logging has created a more heterogeneous forest landscape and increased the amount of herbaceous vegetation available as forage to grizzly bears (Figure 21, Figure 22). Similarly, the increase in young forests and herbaceous vegetation can increase the capacity of the landscape to support ungulate populations, and hence prey for grizzly bears. As long as reasonable amounts of escape cover are maintained in a managed forest landscape, the habitat effects of the forest sector can be beneficial.

Counter-acting these potentially beneficial effects of logging are the indirect consequences of the haul roads and in-block roads built by the forest sector to access and remove wood fiber (Figure 21, Figure 22). As density of these linear features increase, so does visitation by people in the industrial, hunting, recreational, and poaching sectors. As discussed in greater detail later in this report, the various human activities associated with roads are “the” key factor leading to high levels of grizzly bear mortality in much of southwest Alberta. If forestry operations and grizzly bear populations are to persist both in time and space, it will become necessary for resource managers to minimize the construction of roads and to implement some form of access management along the increasingly abundant forestry roads in the region.

Figure 21. Infra-red photo of cutblocks in Alberta illustrating increased levels of landscape heterogeneity and inblock roads. Although many of these roads are effectively reclaimed by the forest sector, some are not because they provide useful access by the forest sector for post-harvest silvicultural treatments, are used by the energy sector to access drilling sites, or are maintained by the recreational community by repeated re-use. Photo from the AME Photo Library.

Figure 22. Whereas the forest sector can increase the amount of young herbaceous vegetation and hence forage availability (left), the accompanying road networks often lead to increased levels of bear mortality. Photo from the AME Photo Library.
OIL AND GAS EXPLORATION AND EXTRACTION

As with forestry, the energy sector harvests trees as they construct pipelines, wellsites, processing plants, and seismic lines. The resultant herbaceous vegetation can benefit grizzly bears through an increase in forage and improved ungulate habitat (Figure 23).

However, these same linear features (wellsites, roads, pipelines) also fragment the landscape and allow greater access to the landscape by humans and their activities. The very features, such as pipelines, that can provide abundant and favorable forage for grizzly bears, can also serve as an efficient means for bears to be observed and killed.

Whereas the historical well drilling trajectory in Alberta’s East Slopes has been one of exponential increase (Figure 24), declining reserves of conventional oil and natural gas are thought to bring a reduced future level of exploration for these reserves in the East Slopes of Alberta (Shad Watts, Alberta Energy, personal communication). As conventional gas reserves become exhausted, the energy sector has become increasingly interested in tapping unconventional gas reserves, which has lead to the arrival of a new member of Alberta’s hydrocarbon sector – that of coalbed methane extraction. Much remains to be learned about the distribution and recovery technologies for this new and important non-renewable resource, but it would appear likely that significant levels of exploration and extraction of coalbed methane will occur along Alberta East Slope foothill communities in coming decades.

Figure 23. An active well drilling site (left) and clearing associated with the installation of a pipeline (right). Photo from the AME Photo Library.

Figure 24. Historical pattern of wells drilling activity in the Oldman River Drainage Basin. Data provided by Alberta Energy and Utilities Board.
LIVESTOCK GRAZING IN THE FOOTHILLS

For Alberta’s provincial cattle herd of 6 million, the leased lands of the east slopes of the Rockies provide approximately 186,000 animal unit months of grazing (Mike Alexander, Alberta Environment, personal communication) (Figure 25). These lands provide important foraging opportunities for cattle, but also place livestock and grizzly bear in proximity. Over the past several decades, the expansion of livestock grazing and associated activities into the foothills displaced grizzly bear from much of their historic foothill range. Whereas the rate of forest clearing on public lands has generally declined in recent decades, deforestation of traditional grizzly bear habitat continues today in some areas (Figure 26). Whereas some ranchers remain opposed to the maintenance of grizzly bear populations on public lands used for livestock production, others have demonstrated both desire and ability to coexist with grizzly bears. One key is keeping attractants such as grain and carcasses away from bears. Another is maintaining healthy grassland ecosystems. In recent decades, stocking densities of cattle on leased foothills land have often been reduced to ensure the health of foothill rangelands.

Figure 25. The east slopes of the Rockies in southwest Alberta provide grazing opportunities for livestock. Photo from the AME Photo Library.

Figure 26. An example of deforestation of white zone crown land northwest of Bragg Creek in the 1990s for purposes of range improvement to enhance cattle stocking rates. Photo from Alberta Air Photo Library.
ROADS, ROADS, AND MORE ROADS

If there is one recurrent feature of human-dominated landscapes that is highly correlated with declining grizzly bear populations along the Rocky Mountains in North America, it is road density. Roads bring fast moving cars causing vehicular mortality to grizzly bears. Roads also bring poachers, legal hunters, and a diversity of recreationalists. Many of these roads owe their origin to the forest and energy sector, and although management plans suggest a reclamation priority, much of this linear feature network persists for lengthy periods to satisfy resource industries and a growing demand from the recreational community (Figure 27, Figure 28).

Figure 27. The commercial transportation network continues to grow in the foothills landscape of western Alberta, and it takes many diverse forms based on moving people, electricity, wood fiber, hydrocarbons, livestock, crops, and aggregate materials across the landscape.

Figure 28. Many roads built in grizzly bear habitat today are constructed by the private sector. Among these, roads associated with the forestry and energy sectors, and acreage developments, are dominant features. Photo from the AME Photo Library.
The ongoing construction of rural residences and associated acreage road networks in the foothill regions of the Alberta portion of the CRE is well illustrated in the Municipal District of Rocky View (Figure 29). As of the early 2000’s, Rocky View was home to ~11,000 acreage residents occupying ~3,600 acres. If this current acreage population were to continue to grow at 4% annually (actually a lower growth rate than has been observed in recent years), and the associated roads (both driveway and acreage common roads) required for each new acreage is 200 m, then this municipality would have built ~150 new acreages and 30 km of associated road length in 2000. By 2030, though, the number of new annual acreage homes would be 490 and the associated road network would be 100 km. It has been precisely this pattern of incremental growth of rural residences and transportation networks that has contributed to the transformation of the landscape observed during the past three to four decades.

![Annual Rural Residential Trajectory for New Homes and New Acreage Roads](image)

Figure 29. Projected development trajectory for new acreages and associated road networks for the MD of Rocky View (2000 to 2030).

**CONCLUSIONS**

Grizzly bears and humans in Alberta have shared a dynamic history that has probably spanned 10,000 years. However, during the past 200 years, the distribution and abundance of grizzly bears has been radically reduced, while that of humans has dramatically increased. This grizzly bear trajectory has occurred in general because of loss of preferred habitat and specifically because of increased mortality associated with hunting, poaching, road and rail collisions, and removal of problem bears.

The CRE represents a key remaining habitat for grizzly bears in Alberta, but this landscape is experiencing a rapidly increasing anthropogenic footprint and activity level associated with a wide suite of human landuse practices. Assuming the area and intensity of activities/footprints such as hiking, fishing, mountain-biking, settlements, back-country resorts, acreages, forestry, oil and gas development and associated road and trail networks continues to increase at their forecasted trajectories, grizzly bear mortality rates will almost certainly increase.

Where no grizzly bear hunting occurs (most of Banff National Park and Kananaskis Country), the grizzly bear population in the Bow River Watershed appears to sustain itself while subjected to current mortality rates. With continued human population growth and development, maintaining current levels of mortality, even in unhunted portions of Banff Park and Kananaskis Country, will become increasingly difficult - yet is essential to prevent population decline (Garshelis et al. 2004). Within the CRE north of the Bow River current grizzly bear mortality appears to be too high to maintain current population levels (Stenhouse et al. 2003).
Maintaining the current range and populations 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. Ultimately, resource managers must 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 becomes a logical “what-if” scenario to explore. Not allowing the public to travel on all roads at all times is currently a difficult landuse alternative for society to consider. 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.

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