

# Mountain Pine Beetle Management in Canada's Mountain National Parks

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## Abstract

Coordinated efforts using an ecosystem-based management approach to forest health have, to date, mitigated the expansion of mountain pine beetle populations in the mountain national parks, resulting in the short-term protection of commercial forests in Alberta. Joint approaches to implementing a regional forest management strategy and incorporating communications in all aspects is gradually building public support for the use of fire as a management tool. Numerous benefits to society include directly reducing the mountain pine beetle populations, reducing beetle habitat, renewing forest health, improving wildlife habitat, reducing susceptibility to wildfire and future insect and disease infestations and providing effective management of public lands for future generations.

## Introduction

The mountain pine beetle, *Dendroctonus ponderosae* Hopkins (Coleoptera: Scolytidae), is a native insect in the southern Rocky Mountains and is part of the natural processes of forest disturbance. Measuring only 5 -7 mm or about the size of a grain of rice, it is also the bark beetle that has had the greatest economic impact on the forest industry of western North America. With the mountain pine beetle epidemic devastating the commercial forests of British Columbia (BC), it is not surprising that the Province of Alberta and its forest industry want to stop the beetles at the continental divide that is also the provincial boundary and the location of the mountain national parks.

Historically there have been several outbreaks of mountain pine beetles in the mountain national parks. From 1929 to 1943 in Kootenay National Park of Canada, approximately 65,000 ha of pine forest with 85% mortality was affected. There was a small population expansion in Yoho National Park in the 1930s. In Banff National Park of Canada between 1940 and 1943 approximately 4,000 ha with 1% mortality was affected and between 1979 and 1983 there were 162 trees colonized in the Upper Spray River area. In Waterton Lakes National Park of Canada between 1977 and 1986, there was extensive colonization of the pine forest by mountain pine beetles, resulting in 50% mortality of the pine trees. Wildfire followed the beetles and has limited the potential for mountain pine beetle population growth in the near future. Until 1999 there were no records of mountain pine beetle in Jasper National Park of Canada.

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The current expansion of beetle populations began in the early 1990s, driven by several precursors. The process of fire has been virtually eliminated from the national parks and surrounding landscapes in BC and Alberta through fire suppression for the past 80 years. This has resulted in large areas of pine forest of prime age (80-120+ years old) for hosting mountain pine beetles. There have been successive winters of mild temperatures that have been conducive to mountain pine beetle population growth and reduced over-winter mortality. And there is a large population of mountain pine beetles in the adjacent, upwind areas of the mountain national parks.

Mountain pine beetle green-attack trees were observed in Banff National Park in the Brewster Creek and Healey Creek areas in 1997. The conditions at the Brewster Creek location were not conducive to population growth. However, the Healey Creek population was growing at a rate of 3:1 (3 green-attack trees to each red-attacked tree). The population was noted further east on Mount Norquay in 1998 and further east again on Tunnel Mountain and the Fairholme Bench the following year. By 2001, the mountain pine beetle populations on Tunnel Mountain and the Fairholme Bench were expanding at a rate of 7:1. An estimate of >8000 colonized trees was determined from intensive field surveys resulting from the 2002 flight and >1000 green-attack trees were identified in Canmore, outside the national park in 2002.

In Jasper National Park in 1999, approximately 20-30 trees were attacked in the Smoky River area, with no successful brood development and 6-12 trees were attacked in the Miette River Valley in the area of the Yellowhead Pass. In 2003, <300 trees were identified, cut and burned in the adjacent Wilmore Wilderness area of Alberta and 50 additional green-attack trees were identified in the Yellowhead Pass area.

## **Policy Background**

Parks Canada's "Guiding Principles and Operational Policies" (Section 3.2.3) (Parks Canada 1994) states that: "National park ecosystems will be managed with minimal interference to natural processes. However, active management may be allowed when the structure or function of an ecosystem has been seriously altered and manipulation is the only possible alternative available to restore ecological integrity." Policy (Section 3.2.4) further states that: "Provided that park ecosystems will not be impaired, the manipulation of naturally occurring processes such as fire, insects and disease may take place when no reasonable alternative exists and when monitoring has demonstrated that without limited intervention:

- there will be serious adverse effects on neighbouring lands; or
- major park facilities, public health or safety will be threatened; or
- the objectives of a park management plan prescribing how certain natural features or cultural resources are to be maintained cannot be achieved."

The exclusion of fire for over 80 years has significantly altered the forests and wildlife habitat of the mountain national parks and created conditions that are ripe for mountain pine beetle colonization. Fire suppression has also resulted in a build-up of forest fuels creating desirable conditions for wildfire that could threaten neighbouring communities. In addition, the mountain national parks form the margin between the mountain pine beetle epidemic conditions in BC and the commercial forests in the Province of Alberta. Therefore, the conditions for ecosystem manipulation and active management are met in the mountain national parks.

Parks Canada policy (Section 3.2.5) further states that: "Where manipulation is necessary it will be based on scientific research, use techniques that duplicate natural processes as closely as possible and be carefully monitored." A goal stated in the management plans for all mountain national parks is to restore 50% of the historic fire cycle in order to achieve ecosystem restoration. As fire is the key process that has been disrupted by management practices, the use of fire is the key management tool for restoring ecological integrity. The problem is, therefore, defined as a forest health/old tree problem due to fire suppression. The benefits of correcting the ecological problem include a reduction in mountain pine

beetle populations and habitat, a more diverse forest that is more resilient to insect and disease attacks, improved habitat conditions for wildlife, reduced threat of wildfire and potentially increased biodiversity.

## **Management Approach**

Annual monitoring was replaced with aggressive monitoring for mountain pine beetles in 1998, in cooperation with the Canadian Forest Service, the Province of Alberta and Parks Canada. Mountain pine beetle risk and susceptibility mapping was undertaken jointly by Parks Canada and the Province of Alberta with the cooperation of the forest industry in Alberta. Mapping revealed large expanses of prime beetle habitat crossing many land management boundaries and embracing different land management objectives. It was clear that management of the issue needed to occur on a coordinated, regional or ecosystem basis, in partnership with all land managers.

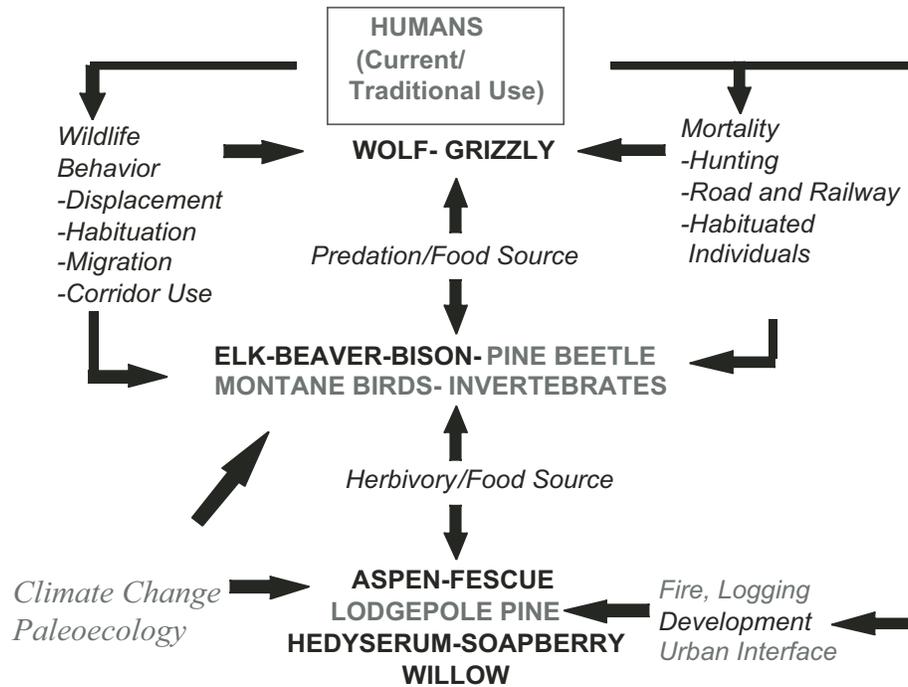
Parks Canada resequenced its proposed prescribed burns to address the increasing concern about the population growth of mountain pine beetles. A “Regional Forest Management Strategy” Environmental Screening for Banff National Park (Parks Canada 2002) was prepared and submitted for public review. The strategy identified an adaptive, ecosystem-based management approach to be undertaken by Parks Canada in cooperation with the Province of Alberta and the Alberta forest industry, with an annual scientific and public review of the results of management actions and proposed next steps.

In addition, a management area east of the town of Banff along the eastern portion of the national park was identified for active management and control of the expanding mountain pine beetle population. In this area, Parks Canada undertakes direct actions to manage the mountain pine beetle, including intensive monitoring, cutting and removal or burning of green-attack trees, pheromone baiting to concentrate beetle flight dispersal to areas where trees can be cut and removed or burned, development of fire guards to safely implement prescribed fires and the use of prescribed fires to reduce beetle populations and habitat. This program is supported by applied research.

West of Banff, the mountain pine beetle population is being intensively monitored and prescribed fire plans will be implemented according to the restoration of the historic fire cycle. Currently, beetle populations are small in size and slow growing. If beetle populations in this area begin to increase rapidly, prescribed fire use may be accelerated to reduce the beetle population and available habitat. The western area, however, is important as a benchmark for scientific research to better understand mountain pine beetle ecology, related ecosystem management processes, the effects of management of actions and public perceptions.

Regionally, Parks Canada is also following a two-pronged approach to addressing forest health and the management of mountain pine beetle populations. First, a proactive approach is being used to reduce the susceptibility of the forest to mountain pine beetle colonization. The Canadian Forest Service SELES-MPB Model (Fall et al. 2004) is being applied to examine probable pathways for the spread of mountain pine beetles. This model has shown that the Yellowhead Pass and the Athabaska River valley are the likely routes through Jasper National Park to the commercial forests of Alberta. In conjunction with this model, the application of an Insolation Model shows that green-attacked trees follow a very narrow band of insolation values (185,000-196,000 watts/m<sup>2</sup>). This model has been used in the Bow River valley in and adjacent to Banff National Park to prioritize beetle field survey locations.

Parks Canada’s second approach is to apply a “long-term ecosystem states and processes strategy” toward reducing the amount of beetle habitat. This strategy recognizes that the mountain pine beetle problem is primarily an old tree/forest health issue, and that there are many other inter-connected concerns that also must be addressed. Banff National Park is one of the core-protected areas in the Central Rockies Ecosystem. Ecological integrity of the park is inter-dependent with the surrounding areas. Management actions must take into account the bio-physical and human inter-relationships in order to achieve the objectives of preventing or reducing the impacts of current mountain pine beetle colonization and reducing the risk of future population and range expansions. The following ecosystem model (Fig. 1) identifies the linkages that need to be considered in Parks Canada’s management approach.



**Figure 1.** Ecological Indicators for Eastslope Central Rockies Ecosystem.  
 (Source: 1999-2004 reports from the Montane Ecosystem Science and Stakeholder Workshops held in Banff National Park, Canmore and Sundre, Alberta.)

For example, along with lodgepole pine and mountain pine beetles, trembling aspen is a primary indicator in this ecosystem model. Objectives identified in the Park Management Plans and in on-going stakeholder reviews require that long-term patterns of wildlife habitat maintenance, including aspen regeneration, occur in areas thinned or burned as part of the mountain pine beetle initiative. However, aspen will only recover after a fire if the density of elk is less than 1 elk per square kilometer (White, 2003). At this density, elk browsing levels will enable aspen suckers to reach the critical height of 2 m to ensure their survival. Through the Banff Elk Management Strategy (Parks Canada 1999) and the establishment of the Fairholme Wolf Pack, unnaturally high levels of elk were reduced to levels that would permit regeneration of aspen, and enable the use of prescribed fire. The predator-prey relationships were dynamic, moving from high prey and low predator numbers in the early 1990s, to high prey and high predator numbers, to low prey and high predator numbers and then as wolves dispersed, to the current situation of low predator and low prey numbers. Thus, wolves are critical to the maintenance of elk population densities that would permit regeneration of aspen after the use of prescribed fire. However, in the on-going situation of low predator and prey numbers, a natural condition, and with the intense level of human activity in the Bow Valley, there are many opportunities for wide ranging wolves to be killed, with the potential of having no wolves in the Bow Valley. If this should occur, it is important that there are other areas where wolves could disperse from, to re-colonize the Bow Valley thus keeping the elk population in check. As a result, the Province of Alberta has expanded their wolf registry system to include all of the areas adjacent to the eastern boundary of Banff National Park and is cooperating with research efforts that will enable the maintenance of predator-prey relationships at the ecosystem scale.

Linking mountain pine beetles with wolves and elk is characteristic of current ecosystem-based management approaches. Many other wildlife species, such as grizzly bears, are also dependent on applying ecosystem-based strategies to address the mountain pine beetle/forest health issue. Currently, carnivore use of forested wildlife corridors near park town sites is a serious constraint to beetle management actions that require thinning, burning and green-attack tree removal. The proactive, ecosystem-based approach links the main management tool of fire with the mountain pine beetle population expansion and related societal benefits of reduced susceptibility to wildfire, improved wildlife habitat and ecosystem restoration, and ensures consultation and communications with all stakeholders, affected communities, interest groups and the public. Fuel thinning and fireguards are essential in order to use prescribed fires safely. The proactive approach creates these safety requirements with a combination of tree harvesting, where possible and cutting and/or burning. Results are monitored and management actions are adapted accordingly, based on scientific and public reviews.

The proactive approach is used in combination with a reactive approach that includes intensive monitoring, consultation and communications, pheromone baiting, removal, or cut and burn of green-attack trees in the management area, and again more communications, which is a key element at all stages of the management approach.

## **Organization**

A senior management level Strategic Direction Council was established to oversee the management of the mountain pine beetle/forest health issue in Alberta. The Council members represent the Canadian Forest Service, Alberta Sustainable Resource Development, Alberta Community Development, the forest industry with adjacent Forest Management Agreements, and Parks Canada. The Council provides broad policy direction and priorities, ensures coordination through over-arching direction on prevention, detection and control, and facilitates communications through development of a common understanding of the approach, ensuring effective communications among agencies and industry, as well as between the strategic and operational committees. A Joint Communications Plan has been developed to coordinate all communications activities around the mountain pine beetle and forest health.

The Mountain Pine Beetle Strategic Direction Council policy states: “Federal and Alberta governments and other land management partners work collaboratively with respect to forest management to protect the economic value of the provincial forest and achieve ecological integrity objectives of the national and provincial parks and protected areas. Actions include an aggressive short-term approach to control mountain pine beetles in areas of high risk, and the development of a long-term strategy to create greater vegetation diversity across the landscape, working cooperatively with industry, interest groups and local communities.”

At the working level, staff participates in the West Yellowhead and the Central-South Operational Coordinating Committees. Additional representation on these committees includes Alberta Fish and Wildlife, communications staff from all groups, First Nations, and the Yellowhead Committee, Mount Robson Provincial Park. The BC Forest Service and the Alberta Fire Operations Unit receive the record of the meetings. Sub-committees for prescribed fire, mountain pine beetles, communications and wildlife also coordinate their efforts around the broader concerns of forest health and ecological integrity.

## Current Situation

**Banff National Park of Canada:** Over-winter mortality in 2002 was high. Of the green-attack trees identified through intensive field surveys, 2725 trees were removed, 5400 ha of mountain pine beetle habitat were burned, 524 pheromone baits were set for the 2003 flight and 945 green-attack trees from the 2003 flight were identified through intensive field surveys in the fall of 2003.

**Jasper National Park:** There has been generally poor brood development, with an increase from 6 trees to 12 trees attacked in the Miette River valley/Yellowhead Pass area. There was no expansion of the population from the 20-30 trees attacked in the Smoky River area in 2002. Approximately 27,000 ha of prime age lodgepole pine/beetle habitat were burned, providing an effective fireguard on the south side of the Athabaska River valley. The proposed prescribed burn in Mount Robson Provincial Park, BC did not occur due to the extreme fire season in BC.

**Yoho National Park:** The mountain pine beetle population is increasing, especially in the west side of the park.

**Kootenay National Park:** Mountain pine beetles are doing well in the south and in some areas are attacking smaller diameter trees. The beetle population is becoming host limited and static. Approximately 15,300 ha of lodgepole pine were burned in the north end of the park in 2003.

**Waterton Lakes National Park:** Previous mountain pine beetle activity and wildfire have limited host availability in Waterton Lakes National Park. There were no green-attacked trees identified in 2003.

## Proposed Actions for 2004

Parks Canada will:

- continue intensive monitoring with the Canadian Forest Service and the Province of Alberta;
- continue to undertake research in support of an integrated, ecosystem-based, adaptive management approach;
- continue fire guard coordination and development;
- continue active management along the east boundary of Banff National Park;
- continue the development and implementation of the communications program;
- continue to work with the provinces of Alberta and BC, industry, stakeholders, interest groups, communities and the public to ensure a coordinated, regional ecosystem-based program to the management of regional forest health.
- continue to work with Mount Robson Provincial Park to mitigate the expansion of mountain pine beetle populations, encourage the use of prescribed fire and increase communications with the public.

## Summary

To date, the expansion of mountain pine beetle populations in the mountain national parks of Alberta have been mitigated, resulting in short term protection of the commercial forests in Alberta. In addition, coordinated efforts are resulting in improved opportunities for multi-jurisdictional ecosystem-based management. A joint approach has successfully incorporated communications in all aspects of managing forest health and the mountain pine beetle population expansion leading to increasing awareness and understanding by the public. The careful implementation of prescribed fire and management of wildfire is gradually building public support for the use of fire as a management tool that provides numerous benefits for society, including, directly reducing the mountain pine beetle populations, reducing beetle habitat, renewing forest health, improving wildlife habitat, reducing susceptibility to wildfire and enabling prescribed fire to be used safely.

The program to date has resulted in strengthened inter-agency and industry working relationships and effective management of public lands for future generations. The results to date confirm the theory

that dealing with the growth of mountain pine beetle populations early and before the population moves beyond the incipient stage of growth can be effective in preventing epidemics. In national parks where the conditions for active management can be met, ecological integrity objectives can be met along with a wide range of additional public benefits.

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