



Mountain Pine Beetle Management Strategy

May 2002

Executive Summary

This document outlines SRD strategies to manage mountain pine beetle threat and impact to Alberta's economy, environment and society. The strategies focus on all forested Crown lands of Alberta including prime protection zones; Willmore Wilderness Park; and provincial parks and protected areas excluding Cypress Hills Provincial Park. The document also addresses various management tactics and implementation guidelines.

The mountain pine beetle is no doubt the most destructive pest of lodgepole pine forests. Alberta has experienced only two outbreaks in its recent history. However, the current trend in Banff National Park indicates Alberta is facing another mountain pine beetle outbreak in near future.

This insect is a temperate pine forest pest with a range extending from Mexico to central BC; the eastern edge of the beetle distribution lies along the southern Rockies near the Alberta-BC border. The majority of lodgepole pine forests in BC and almost the entire lodgepole pine forests in Alberta are outside the normal mountain pine beetle range of distribution. Therefore, outbreaks of the mountain pine beetle are not only detrimental to Alberta's economy and social values, but may have detrimental impacts on Alberta's natural environment. The current mountain pine beetle hazard in Alberta's pine forests is extreme. To avoid massive pine forest destruction, new mountain pine beetle infestations must be detected and controlled.

The document describes two strategies: short-term beetle focus and long-term pine focus. The short-term strategy includes an initial phase of detecting and destroying new infestations, and a second phase of containing outbreak populations from further spread. It is a forest pest emergency and extraordinary measures may be implemented under the *Forest and Prairie Protection Act*. Land and Forest Division develops a mountain pine beetle emergency preparedness and response plan in partnerships with other resource management agencies and forest companies. The long-term strategy is to reduce future threats of mountain pine beetle outbreaks by replacing susceptible contiguous mature lodgepole pine stands with less susceptible stands of mixed species and age classes.

Various mountain pine beetle management tactics are described including detection and monitoring, control, prevention, communications, and research and development. Implementation guidelines describe requirements for an emergency preparedness and response plan and for a long-term forest landscape management plan.

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Introduction

The purpose of this document is to outline Sustainable Resource Development (SRD) strategies to manage mountain pine beetle threat and beetle impact to Alberta's economy, environment and society. The strategies focus on all forested Crown lands of Alberta including prime protection zones, provincial parks and protected areas, and Willmore Wilderness Park. The document also addresses various management tactics that can be implemented to manage the mountain pine beetle. The "Mountain Pine Beetle Management Guide" by Land and Forest Division, SRD, describes detailed methodologies of management tactics.

The mountain pine beetle, *Dendroctonus ponderosae* Hopkins, is the most destructive pest of mature lodgepole pine forests in North America. It is a small bark beetle and its larvae feed in the phloem of the tree. The beetle introduces blue-stain fungi when attacking the tree. The action of blue-stain fungi and larval feeding can kill the tree within one month of the attack. Periodic outbreaks of this insect destroy millions of hectares of pine forest in British Columbia (BC) and western US.

The BC Government Caucus Task Force report (2001) indicates that the current outbreaks in west central BC are affecting more than 5.7 million hectares, which is an area equivalent to twice the size of Vancouver Island. Estimates suggest that the mountain pine beetle has already killed more than \$4 billion worth of timber. The potential beetle damage in economic terms is predicted to be in the billions of dollars.

Alberta has been fortunate to experience only two outbreaks in its recent history resulting from high beetle population levels in BC and Montana in areas near the borders in southern Alberta. Since 1985, no sustained beetle populations have been detected in the province until an infestation was discovered in 1997 in Banff National Park. The number of beetle-infested trees in Banff National Park has increased exponentially over the last three years. This situation alerted SRD to prepare for aggressive actions against any beetle infestation that may occur outside this national park.

The mountain pine beetle is a temperate pine forest pest with a range extending from Mexico to central BC; the eastern edge of the beetle distribution lies along the southern Rockies near the Alberta-BC border where the effect of the maritime climate ends. Thus, the majority of lodgepole pine forests in BC and almost the entire lodgepole pine forests in Alberta are outside the normal mountain pine beetle range of distribution (Figure 1.)



Figure 1. Distribution of Lodgepole Pine and Mountain Pine Beetle.

The mountain pine beetle occasionally invades pine forests in a narrow area along the eastern slopes of the Rockies in southern Alberta when consecutive mild winters and hot and dry summers occur. However, the recent surveys in BC indicate that the mountain pine beetle in central BC appears to be expanding its range northward due to more frequent mild winters in that region (Allan Carroll, CFS, personal communications). Alberta is experiencing a similar climatic trend, and the mountain pine beetle range may expand eastward into the Foothills area in the future.

It is important to note that the present Alberta's lodgepole pine forest ecosystem has evolved without the presence of the mountain pine beetle. Therefore, outbreaks of the mountain pine beetle may have detrimental impacts on the native fauna and flora, as well as the watersheds, soils, water quality and natural ecosystem succession.

The mountain pine beetle attacks and kills healthy mature lodgepole, limber, and whitebark pines. Pine forests in Alberta are generally getting older due to an effective wildfire management program. Large areas of lodgepole pine forests that have originated from forest fires in early 1900s are also becoming susceptible to mountain pine beetle attacks. Therefore, the current mountain pine beetle hazard in Alberta's pine forests is extreme. To avoid massive pine forest destruction, new mountain pine beetle infestations must be detected and controlled.

Strategy

Areas of the mountain pine beetle infestations can easily quadruple in size from one year to the next, and the beetle can exponentially build up its population within a few years. Therefore, any occurrence of the mountain pine beetle in Alberta will be treated like that of a wildfire focusing on early detection and immediate control. A long-term strategy of prevention and hazard reduction are also key components of the mountain pine beetle management program.

Alberta Sustainable Resource Development, Land and Forest Division is the lead agency coordinating the management of mountain pine beetle in Alberta with cooperation from other SRD Divisions, especially resources from Forest Protection Division. Collaborations with forest industry and other departments such as Community Development and Transportation are also essential to manage the mountain pine beetle.

Short-term strategy (beetle-focused/risk-focus strategy): The initial phase is to detect and destroy new mountain pine beetle infestations. The second phase is to contain outbreak populations from further spread.

All new mountain pine beetle infestations on Alberta's Crown land are to be destroyed. This goal applies to all forested Crown lands of Alberta including prime protection zones; Willmore Wilderness Park; and provincial parks and protected areas excluding Cypress Hills Provincial Park. However, certain control methods and sanitation activities may not be compatible with land management objectives of these lands, therefore, most suitable control methods are used to minimize adverse effects to other protected resources in these areas.

The mountain pine beetle infestation is a forest pest emergency and extraordinary measures may be implemented under the *Forest and Prairie Protection Act*. Land and Forest Division develops a mountain pine beetle emergency preparedness and response plan at the Forest Area level in conjunction with Community Development, Forest Protection Division, Fish and Wildlife Division, and forest industry.

If an infestation is detected either on private, municipal or federal lands such as national parks and Indian reserves, the landowner, the land manager, or the local Band Council will be requested to take appropriate actions. SRD makes every effort to influence the federal government's mountain pine beetle management priority on the federal lands. Land and Forest Division implements public awareness and education programs, and provides expertise to control beetle infestations in these lands.

Despite all control efforts, beetle infestations may reach outbreak levels, especially when outbreaks occur in adjacent jurisdictions. Land and Forest Division may then determine that infestations cannot be brought under control, and shift the operations to contain the outbreak. Then the focus will be on the leading edge of the outbreak to minimize the beetle spread to adjacent susceptible pine forests. Forest companies may be requested to implement sanitation cut harvesting in the priority beetle control areas.

Long-term strategy (pine- focused/susceptibility- focus strategy): Reduce future threats of mountain pine beetle outbreaks by replacing highly susceptible contiguous mature lodgepole pine stands with less susceptible stands of mixed species and age classes.

Land and Forest Division in conjunction with Fish and Wildlife Division, Forest Protection Division, Community Development, Parks Canada and forest companies develops a landscape management plan for each high beetle hazard area. The goals of the plan are to reduce beetle susceptibility and improve various qualities of forests at a landscape level. The current state of contiguous mature pine forests has altered natural fire fuel breaks and wildlife habitats including those of grizzly bear, elk, and wolf. Therefore, the management plan evaluates and complements other resource management needs, and incorporates management options such as use of prescribed fires, selective harvesting and clearcut harvesting followed by objective-driven reforestation.

Management Tactics

Detection and Monitoring

- Aerial Survey

Aerial survey is the most efficient detection method for covering large areas susceptible to the beetle. Aerial surveys are annually carried out in areas where beetle activities are either detected or suspected. However, aerial surveys can detect only trees attacked by the mountain pine beetle in previous years. It is very difficult to detect current year's attacks during an aerial survey, since the attacked trees do not show color changes until the following summer. During aerial surveys, the exact locations of suspected beetle-killed trees are recorded for ground surveys.

- Ground Survey

Ground survey is the only method to detect current year's beetle infestations. It is a costly operation and is only carried out in the suspected areas of infestations. Ground surveys can be carried out for various objectives, including identifying all current year's infestations for single-tree treatment, assessing over-wintering beetle mortality, and demarcating sanitation cut boundaries.

- Pheromone Bait Monitoring

Pheromone baits can be used to monitor presence of mountain pine beetle populations and changes in beetle activity in a given area. Objectives of the pheromone bait program are to establish priority and intensity of aerial survey programs, and monitor effectiveness of control operations. Therefore, once active infestations are persistent in an area, this program loses its value. All baited trees and surrounding pine trees are inspected and the beetle population at each bait site must be destroyed prior to the beetle emergence in the following season. The Land and Forest Division strictly controls the use of pheromone baits in forested Crown Land.

Control

- Single-Tree Treatment

The early stage of an infestation starts with a few spots of infested trees. These trees can be individually treated. Fall and debark infested trees at the infestation site, and debark stumps of the trees. Infested trees can be mechanically debarked or chipped, depending on the site accessibility. If it is fire safe, the infested trees can be felled, bucked, piled and burnt near the infestation site. Make sure all the bark on every felled tree is burned. Stumps should also be burned or debarked. The Land and Forest Division plans and schedules all burnings in consultation with the local Forest Fire Centre.

As the infestation builds up, the number of infested trees requiring treatment also increases. Then the single-tree treatment can create considerable stand openings.

The single-tree treatment is the main control method used in the environmentally sensitive areas such as ecological reserves, wilderness areas and critical habitats for endangered species.

- Treatment with Monosodium Methanearsenate (MSMA)

MSMA is a registered pesticide for mountain pine beetle treatment. It is a herbicide with an insecticidal property that is designed to kill trees and destroy the beetles in the trees. It must be applied within three to four weeks of beetle attack and before blue-stain fungi kill the tree. Since it is difficult to achieve 100% control with MSMA, this method can be considered during the second phase to contain populations. Advantages of MSMA are cost effectiveness and having dead trees left behind for certain wildlife habitats.

- Prescribed Fire

Prescribed fire is one of the important tools for mountain pine beetle management. It can also achieve other land management objectives such as creating fuel breaks and habitat improvement. However, for prescribed fire to be effective in mountain pine beetle control, the fire intensity must be high enough to boil the phloem of pine trees. Due to the nature of this operation it is difficult to be implemented within a certain time frame. Therefore, prescribed fire is an added option to single tree treatment and sanitation cut operations. The Forest Protection Division conducts all prescribed burn operations.

- Sanitation Cut

Sanitation cut can be implemented in conjunction with forestry operations to harvest an individual infested tree or a large number of infested trees and surrounding susceptible trees. The accessibility, number of infested trees, and impacts on other resources and land uses need to be considered. Helicopter logging can be considered to individually harvest infested trees. The harvested trees must be processed before the beetle emergence in the following summer. The Land and Forest Division may authorize use of pheromone baits to attract beetles into the areas where trees are scheduled to be harvested and processed prior to the beetle emergence in the following season.

Sanitation cut can be considered in prime protection zones, provincial parks and protected areas to protect or enhance certain land management objectives such as recreation, campground safety and wildlife management.

Prevention

- Regulatory Actions

The *Forests Act, Timber Management Regulations* restrict or prohibit imports into or movement within Alberta of coniferous logs or other coniferous forest products with bark attached. Pine logs and pine products with bark attached originating from BC, the western United States and Cypress Hills in Saskatchewan are not allowed to enter Alberta from June 1 to September 30, i.e., during the period of mountain pine beetle dispersal activity. Pine logs and products may be allowed to enter from October 1 to May 31 depending on the individual risk assessment. Hauling beetle-infested logs from cutblocks during a sanitation cut or a salvage operation is also restricted to the months of October to May.

- Inter-Agency Negotiations

Incoming beetles from outbreaks in adjacent areas in BC or in national parks largely influence mountain pine beetle activities in Alberta. Land and Forest Division closely monitors the mountain pine beetle conditions in these areas, and negotiates with BC Ministry of Forest and Parks Canada to reduce the risk of mountain pine beetle movement to high-hazard pine forest areas of Alberta.

- Lodgepole Pine Forest Management

The long-term strategy is to reduce future threats of mountain pine beetle outbreaks at a landscape level by replacing high-hazard contiguous mature lodgepole pine stands with less susceptible stands of mixed species and age classes. Forest management practices must consider creating a “beetle-smart” landscape to reduce the risk of mountain pine beetle outbreaks, especially in the areas within 100 km of the BC border along the eastern slopes. Common objectives include desirable age and species mix over the landscape; maintain existing accesses to high-risk areas; and reducing pine component of high-hazard stands. Introducing fires into the landscape is one of the important options to be considered, especially in protected areas and other areas where commercial forestry operations are not permitted.

Communications

- Public and Media Communications

SRD proactively informs the general public about the current conditions, proposed projects, their implementation and the progress. It is important to make the public aware of the problem and what action is deemed necessary before any major control program is implemented. The Communication Division, in consultation with the Forest Management Branch and forest areas, develops a communications plan to determine the extent and mechanism of keeping the general public informed. It also identifies the spokespersons for dealing with the media and public inquiries.

- Reporting

Annual mountain pine beetle monitoring and infestation survey data and control operations are summarized in a SRD annual report: Forest Health in Alberta. The SRD Forest Health web site also provides up-to-date survey data, proposed management plans, progress and results of control operations, and biology of the insect. A pest alert may be issued to target clients in a specific high-risk area.

- Awareness and Education

SRD ensures that science-based facts are always available to the general public, forest industry, special interest groups and politicians. It provides publications, general information sessions and technical workshops to increase the understanding of mountain pine beetle threats and management strategies in Alberta.

- Inter-Agency Coordination

The mountain pine beetle also affects other resources and land use activities such as recreation opportunities, tourism and wildlife habitats. It is important for Alberta Government to have consensus among provincial departments and divisions handling these issues. SRD works with other government agencies to ensure that a common message is developed. The agencies affected by the beetle include the departments of Community Development; and Transportation; municipal districts and counties.

Research and Development

Alberta currently depends on mountain pine beetle research and technology development carried out elsewhere. This is mainly because the infrequent occurrences of mountain pine beetle outbreaks in Alberta are not conducive to a research environment. However, some research carried out in other areas with more frequent beetle outbreaks may not be applicable under the local conditions found in Alberta. Consequently, research carried out elsewhere or new technology has to be modified and/or validated before applying in Alberta. The following are some basic research questions that need to be answered:

- Host Tree Species Susceptibility

Alberta is at the western limit of jack pine distribution in Canada where this species hybridizes with lodgepole pine. If mountain pine beetle is successful in attacking the hybrid jack-lodgepole pine it may pose a threat to jack pine as well. We need to evaluate this mountain pine beetle risk to jack pine.

- Mountain Pine Beetle Virulence and Survival

Many fundamental behavioural questions need to be answered. Could it be that the mountain pine beetle is more virulent in its northern boundaries than in the south?

Because of the harsher environmental conditions found at its northern limits of distribution, mountain pine beetle perhaps has to succeed in killing its host to ensure its survival. What are the factors limiting mountain pine beetle distribution in Alberta? Does mountain pine beetle behave the same way under northern conditions in Alberta?

- Decision Support System

A Decision Support System (DSS) for mountain pine beetle management needs to be developed for Alberta. The DSS provides the land manager with accurate directions to minimize environmental, social and economical impacts of the mountain pine beetle. The DSS should have components to identify forest stands at high risk of mountain pine beetle damage, to predict the spread pattern of beetle infestations under a given set of conditions, to prioritize the pine stands for harvesting and to develop more accurate landscape management plan.

Implementation Guidelines

The following indicate some key activities for implementing this strategy.

Emergency Preparedness and Response Plan:

The mountain pine beetle is a natural resource emergency to Alberta, since it is an uncommon disturbance to the Alberta's pine forests, and may cause detrimental impacts to the environment and economy. Each mountain pine beetle infestation needs to be treated as an emergency. In any emergency situation preparedness and quick response are key factors. In partnerships with all resource management agencies and forest companies an emergency preparedness and response plan must be developed for a landscape unit. This unit is defined at the forest area level as a beetle management unit. The plan describes key decision making processes and accountability for supplies, resources, and communications. Three eastern slopes forest areas will complete response plans by August 2002.

1. The plan identifies, but not limited to, the following:
 - The beetle management unit the plan covers and a description of the resources within this unit;
 - Scope and objectives of the plan;
 - The local reporting mechanism;
 - Command and decision making structures;
 - Federal-provincial negotiation framework;
 - Available resources for surveys, mapping and controls;
 - Deployment mechanisms of survey and control crews;
 - List and contact information of expertise for forest insects, fire, wildlife, parks and protected areas, and recreation;
 - List of available equipment from all sources;
 - Access to potential infestations;
 - List of potential stakeholders; and
 - The public communication structure.

2. Land Designation for Various Management Restrictions

Certain mountain pine beetle management tactics may not be compatible with land management objectives. The plan pre-identifies management tactics that can be used for each designated land unit, e.g. forest management units, forest land use zones, wilderness areas, natural areas, provincial parks and recreation areas, critical wildlife habitats and stream buffers. It should also identify commercial and recreational activities in the unit.

3. Target and Measurement Criteria for Control Activities

During the first phase of “Detect and Control” operation the targets are:

- All new infestations must be detected (100% detection) in the first year of occurrence of symptoms visible from the air (red foliage). This usually happens in the second year of infestation because in the first year of infestation the symptoms are not visible from the air. When a new infestation is detected surrounding area is ground surveyed and all the infested trees in the area are detected. Although the detection target is within the second year of infestation, considering the size of forested areas, third year detection is better than infestations being undetected. However, it is not acceptable to have an infestation undetected for over three years.
- All known current infestations must be destroyed (100% control). Thus no trees in the area will turn red in the following summer. Newly detected infestations are not used in measuring the success of beetle control.

Containing an outbreak

Mountain pine beetle infestations reaching outbreak levels cannot be brought under control by the initial phase of detecting and destroying new mountain pine beetle infestations. The focus of operations shifts to the leading edge of the outbreak to contain and minimize the beetle spread to adjacent susceptible pine forests. This second phase of operation is activated by the Manager of Forest Health Section in consultation with LFD executives. It will be based on the assessments made by forest health officers and recommendations from the Forest Area Manager.

Forest companies may be requested to implement sanitation cut harvesting in the priority beetle control areas in order to contain the outbreak.

A Long-Term Forest Landscape Management Plan

A long-term forest management plan for the same management unit also needs to be developed to reduce future susceptibility of pine stands to mountain pine beetle infestations. Current high hazard contiguous mature lodgepole pine stands need to be replaced with less susceptible stands.

Scientific criteria are available to identify stand susceptibility, however, current Alberta Vegetation Inventory does not provide necessary data to evaluate stand susceptibility scientifically. Therefore, use of a common sense approach to target over-mature high density pine stands is required. Detailed stand assessments for susceptibility are also required during the planning of timber harvesting, stand thinning, and prescribed fires. Detail Forest Management Plans must incorporate the long-term mountain pine beetle management strategy. Research and technology development will provide better tools for future forest management planning.

Land and Forest Division in conjunction with other SRD divisions, Community Development, Parks Canada and forest companies develops a forest landscape management plan for each beetle management unit. The goals of the plan are to reduce beetle susceptibility and improve various qualities of forests at a landscape level. The plan will evaluate and complement other resource management needs such as fire fuel breaks and wildlife habitats, and incorporate management options including use of prescribed fires, selective harvesting and clearcut harvesting followed by objective-driven reforestation.