

Provincial Bark Beetle Strategy: Technical Implementation Guidelines

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Abstract

This paper outlines the measures undertaken to cope with the largest mountain pine beetle infestation in the recorded history of British Columbia. Rapidly expanding infestations in several areas of the province have made it necessary to develop a provincial strategy with these main objectives: minimize the spread of beetles; minimize the loss of timber value; and minimize the loss of Crown revenue. Based on sound biological and forest management principles, the Province of British Columbia has developed a system for allocating the distribution of resources to affected areas. The Provincial Bark Beetle Strategy is comprised of Technical Implementation Guidelines and their respective components. They summarize the approach being taken to bark beetle management in British Columbia today.

Introduction

British Columbia (BC) is currently dealing with the largest mountain pine beetle (*Dendroctonus ponderosae* Hopkins) infestation in the province's recorded history. Mountain pine beetle has affected 9 million ha of mature lodgepole pine (*Pinus contorta*) stands and has killed over 108 million cubic meters of pine to date. The infested area spreads across both the northern and southern interior of BC. As mountain pine beetle continues its expansion, the area and volume impacted are projected to increase significantly, as more than 1 billion cubic meters of mature pine are at risk of infestation in the interior of the province.

The mountain pine beetle infestation has been characterized as a provincial "natural disaster" and is now at risk of spreading to other provinces. The infestation has created a forest management crisis that has serious implications for continued management of our forest asset. Lodgepole pine harvest represents the largest component of the provincial forest inventory in the interior of the province and is the single largest contributor of any species to overall provincial harvest levels. This species is therefore a critical part of our present and future asset base.

The provincial government has recognized that the beetle epidemic warrants a unique focus. The need for a provincial strategy has been emphasized by several factors:

- There are rapidly expanding infestations in several areas of the province;
- There is a clear realization that some areas are no longer appropriate for mitigation actions;
- There are limited management resources (funding and logging capacity);
- There is a need for consistent management across the province; and,
- There is a need for clear, consistent application of a coordinated response.

As a result, the Province has embarked on the development of a provincial strategy with the following objectives: minimize the spread of beetles; minimize the loss of timber value; and, minimize the loss of Crown revenue.

Mountain Pine Beetle in BC

As of 2003, 4.2 million ha of red attack were recorded through aerial overview surveys in the province (Fig.1). This figure has more than doubled since 2002. A close look at the lodgepole pine inventory reveals that the average stand age will continue to increase under the present disturbance regime until approximately 2010, after which the proportion of susceptible pine is projected to decline. Mountain pine beetle activity appears to be positively correlated with the increase in the amount of susceptible pine (Fig. 2).

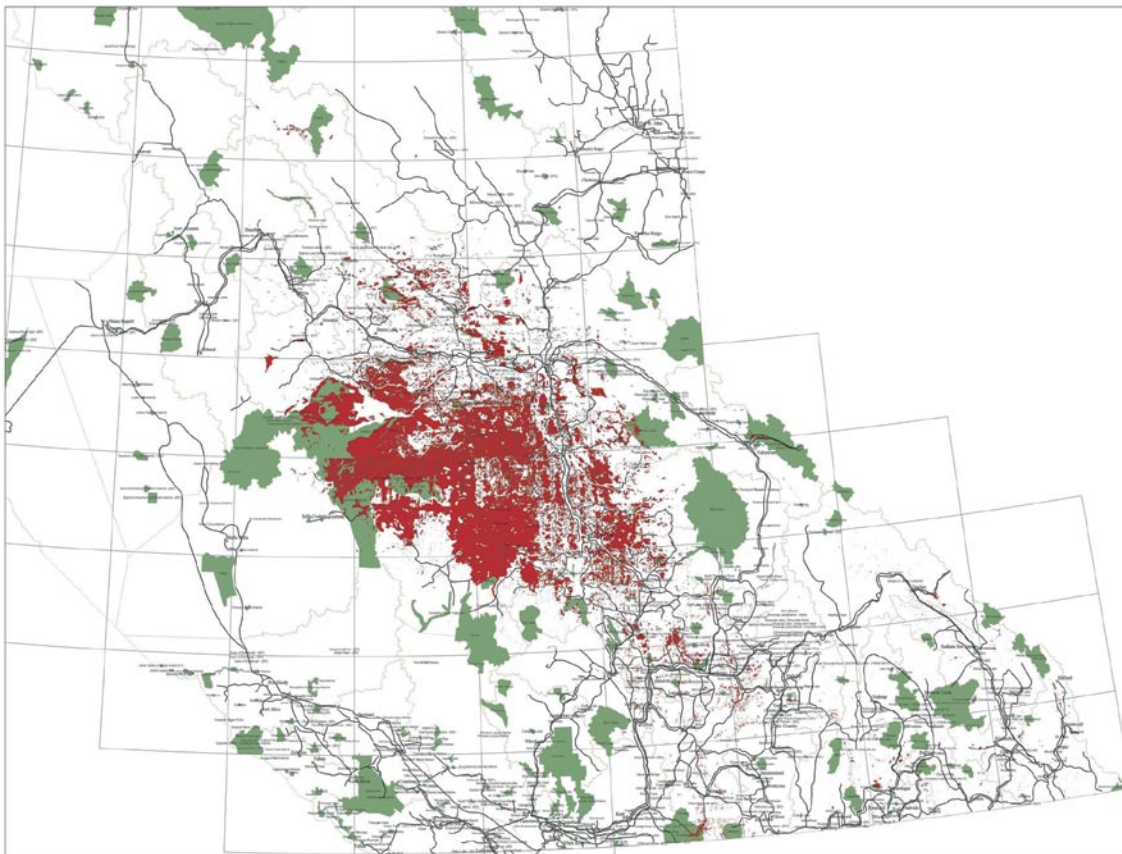


Figure 1. First draft of mountain pine beetle attack in 2003, plotted October 8, 2003 (Northern Interior Forest Region and Southern Interior Forest Region).

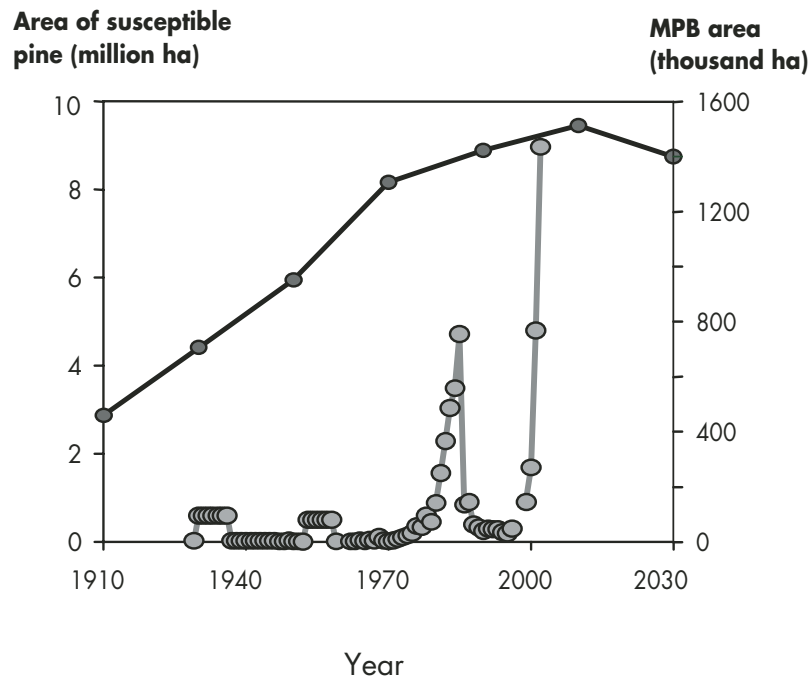


Figure 2. Estimated area of mountain pine beetle-susceptible pine (solid circles - million ha) and of mountain pine beetle (MPB) outbreaks (empty circles - thousand ha) in BC. Gap is a result of no survey conducted in 1996.

Overall Approach

The provincial strategy developed by the Ministry of Forests and the Forest Industry Emergency Bark Beetle Task Force is intended to provide an overall framework to guide forest management and mitigate damage to timber supplies, while minimizing the risk of future catastrophic outbreaks. Its development is a dynamic phenomenon, laid over an already complex mix of land uses, tenures, ecosystems and economic circumstances. It will provide general guidance to government and industry in allocation of resources, development and approval of Defined Forest Area Management (DFAM) Forest Health plans and bark beetle management strategies, and enable the most effective local actions to occur in a provincial context. Research and field experience in mountain pine beetle control indicate that success in suppressing infestations is dependent on the strategies and tactics employed, the effort expended on the control operation, and the point in the outbreak cycle when control is initiated. The key elements of bark beetle management are as follows:

- Rating stands for susceptibility and risk of depletion;
- Annual detection surveys and mapping of infestations;
- Annual assessments of rates of change in infestation levels and spread; and,
- Prompt, appropriate and thorough action on all infestations where suppression or control to some degree is feasible.

Technical Objectives

The main objective is to provide a technical approach for bark beetle management based on the fundamental elements of bark beetle–host interaction and proven tactics to prevent or mitigate losses. The provincial approach is designed to concentrate limited resources where management can have an impact, and identify situations where it is impossible to affect the course of infestations and tree mortality.

Overall, the strategy must be biologically based to a great extent, while recognizing that other resource management objectives and issues must be integrated (Fig. 3).

In the endemic state, beetle populations occur primarily in single trees or small, scattered groups of trees. During the incipient (pre-epidemic) phase, the infested spots grow in size and number, and tend to coalesce into large patches. As the outbreak expands, the patches extend over the landscape and small spots or individual infested trees are found at the leading edge of large outbreaks, or in areas where populations are just beginning to build. Hence, the ratio of infested spots to infested patches at the landscape level can be used as a measure of the stage of an infestation. The following table (Table 1) attempts to illustrate the change in beetle infestation dynamics. These general relationships are the foundation for the broad management zones.

Strategy assignment occurs on two levels: landscape level beetle management units (BMUs) and broad provincial zonations. The overall intent of establishment of BMUs and zonation is to clarify where and when specific management strategies and tactics are appropriate.

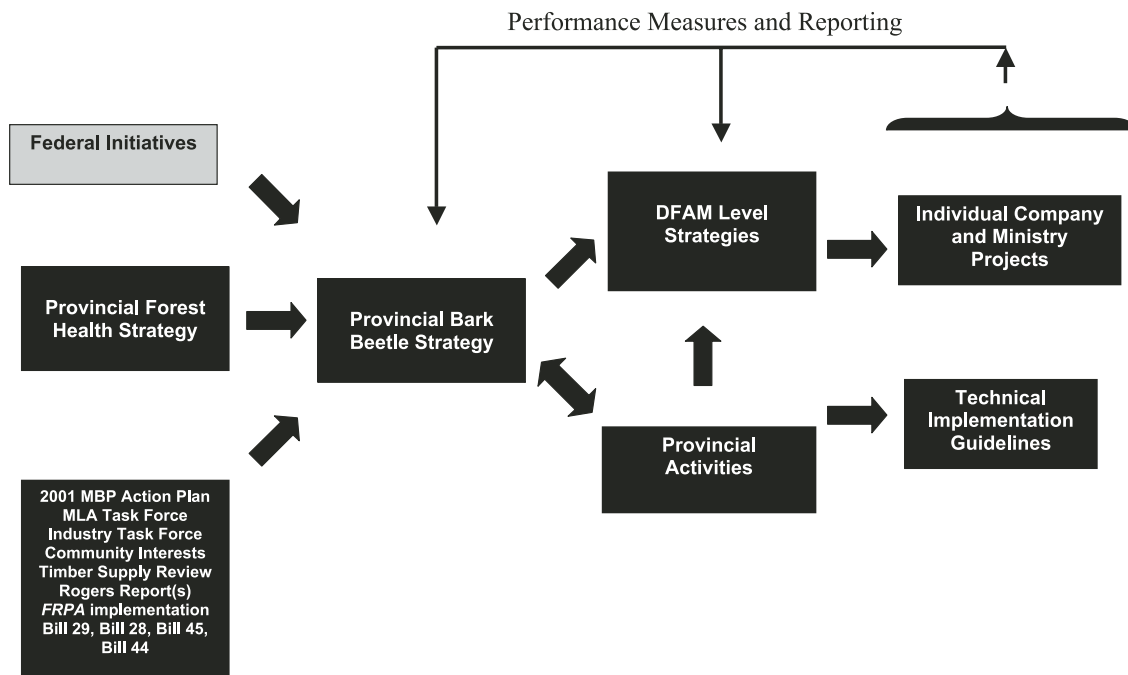


Figure 3. Framework for mountain pine beetle management activities in the province.

Table 1. General infestation dynamics.

% of infestation in patches	High	Old infestations; high red, high grey; > 4 yrs
	Moderate	Ongoing active infestation; many patches; interspersed spots
	Low	New infestation; "leading edge"; many spots; few patches
		Low Moderate High
		% of infestation in spots

BMU Strategies

A BMU is a planning and reporting unit for operational beetle management. Its purpose is to facilitate the implementation of beetle management activities. Resource management objectives should be consistent throughout the unit. Strategies should be evaluated for compatibility with adjacent BMUs.

BMU boundaries are customarily congruent with the boundaries of Landscape Units. The strategy, and, therefore, the recommended treatment options, is selected after consideration of the status of the outbreak in the BMU and the estimated feasibility of achieving specific objectives inherent in the BMU strategies available. Primary considerations include the following:

- Current status of the outbreak;
- Potential for further spread and intensification;
- Access;
- Harvesting/milling capacity; and,
- Availability of other suppression resources.

Figure 4 illustrates the assigned BMUs to the Interior Emergency Bark Beetle Management Area as of 2003.

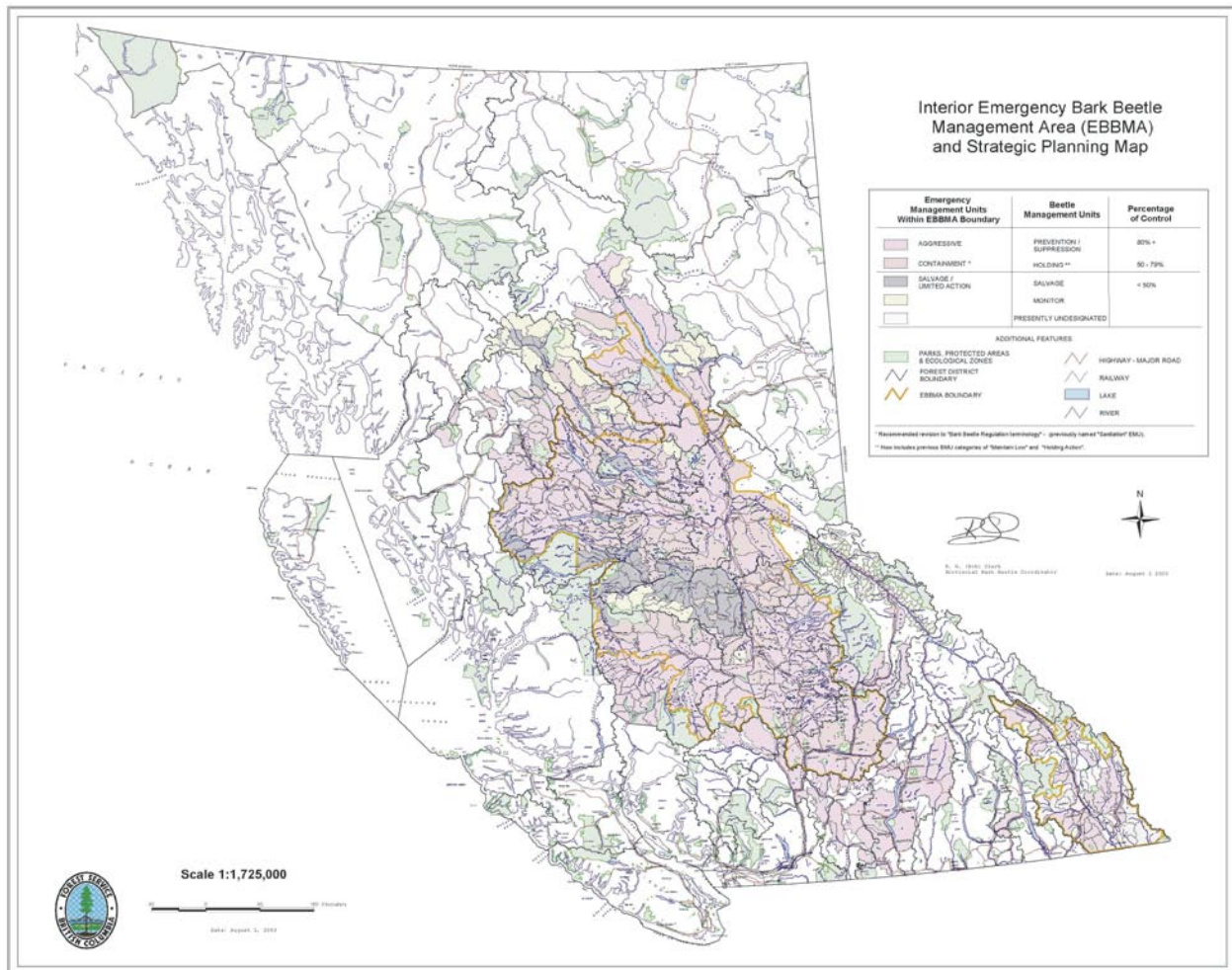


Figure 4. Interior Emergency Bark Beetle Management Area (EBBMA) and Strategic Planning Map.

There are four possible BMU strategies (Table 2). These strategies are selected based on the level of outbreak in an area and the estimated effectiveness of selected treatments in achieving stated objectives.

Suppression/Prevention: This is the most aggressive strategy. It is selected when the infestation status is such that aggressive direct control actions are expected to keep an area at low level of infestation. Areas are not infested or are lightly infested, and resources for direct control or harvesting and milling capacities equal or exceed the amount of infestation. Objectives are to harvest or treat more than 70% of all infested material in any given year. The intent of the strategy is to reduce or keep the outbreak to a size and distribution that can be handled within “normal resource capability”.

Holding: The intent of this strategy is to maintain an existing outbreak at a relatively static level. It is a delaying strategy until adequate resources are available or access created that allow for a more aggressive approach, or to reduce overall loss while waiting for a killing climatic event. This is appropriate in areas with chronic beetle infestations that are too large to deal with using single-tree treatments or where access is poorly developed for directed harvesting. The objective is to harvest or treat approximately 50% of currently infested material in any given year.

Salvage: Salvage is applied to areas where management efforts would be ineffective in substantially reducing the beetle populations and subsequent levels of damage. Such areas have extensive outbreaks covering a large proportion of susceptible stands. The objective in this case is to salvage affected stands and minimize value loss. This strategy may also apply to areas containing small volumes of pine or areas where the pine is marginally economic – that is, where control is not worth the effort that would be expended and the objective is to salvage whatever values are there.

Monitor: This strategy is applied to areas where management efforts would be ineffective in substantially reducing the beetle population and subsequent levels of damage, or where there is no short-term (less than 5 years) possibility of salvaging dead timber. This may be due to management constraints such as wilderness area, park or ecological reserve, or because access cannot be put in place before substantial merchantable degradation of the dead material occurs.

Table 2 illustrates general BMU strategy criteria, with the exception of “Monitor”. Some criteria for assigning BMU strategies are found in Table 3. Examples of BMU characteristics under the various strategies are found in Table 4.

Table 2. Objectives for beetle population removal for the four BMU strategies.

Strategy	% Current infested area to treat ¹ .	Comments
Suppression/Prevention	~80	Address all current attack within two years, stand proofing, other actions. The intent is to “control” the outbreak in that area and stop spread.
Holding	50-70	Address the largest proportion of newly infested material, at least close to the rate of expansion. The intent is to maintain beetle populations at a level that can be dealt with annually without huge expansion.
Salvage	<50	The priority is to salvage timber previously attacked to minimize value loss. Relevant in areas where suppression or holding actions are no longer appropriate or feasible.
Monitor	0	No action is required beyond monitoring and recording. This is most appropriate in parks and ecological reserves and in inoperable areas where the outbreak has peaked, salvage is not possible, and there is no chance for any mitigation of further loss.

¹ Based on estimates from the most current annual aerial overview.

Table 3. General BMU strategy criteria.

Factor	Factor Definition		
	Suppression	Holding	Salvage
Green: red ratio (average for the BMU)	<10: 1	<10: 1 i.e., - not adjacent to an overwhelming source of beetles.	>10: 1 i.e., indicative that large populations have dispersed in from adjacent BMUs and that populations will expand at a rapid pace.
Harvest/ treatment capacity	≥ estimated green attack	≤ 2X estimated green attack	2-3X estimated green attack (or greater once ground probe information is evaluated).
Infestation distribution	Mostly spots with relatively few patches.	Mix of small spots, small and medium patch infestations.	Small and medium patches with some small spots.

Table 4. Characteristics of four BMU strategies.

Characteristic	Strategy			
	Suppression/ Prevention	Holding	Salvage	Monitor
% Current infestation to treat	~≥80	~50-70	~≤50	0
Hazard rating	All	Mod – High	Mod – High	All
Road access	Required	Need in short term	Short term or planned	Not necessary
Infestation status	Light – low outbreak	Low outbreak to outbreak	Extensive outbreak or collapsed	N/A
Spot: patch	High	High-Moderate	Low	N/A
Estimated chance of controlling beetle	High	Moderate	Nil – Low	N/A

Provincial zones

Provincial bark beetle management zones allow rational allocation of resources to support aggressive actions in areas where management will have the greatest impact. Management zones are based on the consideration of the following factors:

- Host availability and other resource information;
- Provincial status of infestations based on overview survey;
- Infestation trends;
- Existing or potential access; and
- Management objectives and non-timber values and considerations.

Management zones are also identified by the Provincial Bark Beetle Co-ordinator to determine where special operations and regulations are applicable. These broad classifications are useful in high-level allocation of resources. There are three provincial bark beetle management zones reflecting different levels of infestation and management effort.

Aggressive Management

- Majority of BMUs in this zone are suppression;
- Leading edge of large outbreak or contain arising infestations;
- All beetle management strategies and tactics (including detailed aerial surveys and single tree treatments) are applicable in the appropriate situation; and
- High amounts of moderate to high hazard stands remain uninfested.

Containment

- It is biologically feasible to at least hold infestations static with vigorous directed harvesting and limited single-tree treatments. Primary management activity will be directed harvesting (large and small blocks) of currently infested trees.
- Containment baiting would be utilized wherever appropriate; and
- Only limited use of direct control methods such as single-tree treatment would be contemplated.

Salvage/Limited Action

- No suppression or containment of beetle populations;
- Salvage/rehabilitation of stands as possible;
- Minimal impact on beetle population intensification or spread;
- Infestation has outstripped management resources; and
- Little or no single-tree treatments or probing for levels of green attack.

A generalized idea of when the three zones are appropriate (based on the stage of outbreak) is given in Figure 5.

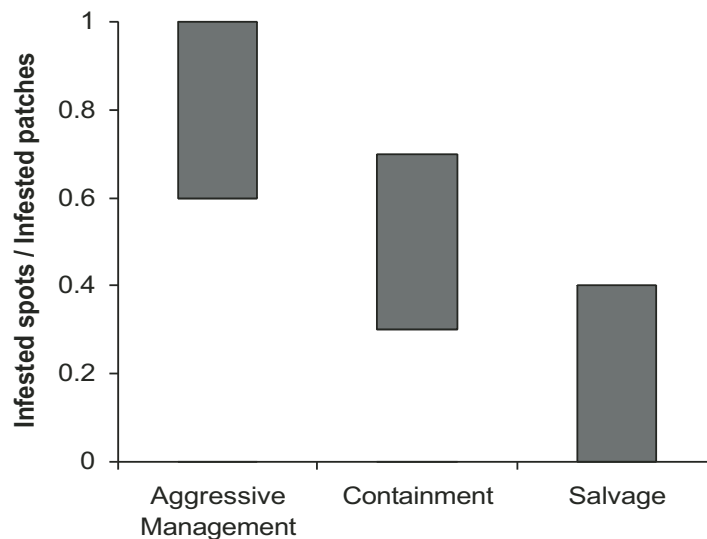


Figure 5. Provincial zone characteristics (based on stage of the outbreak).

Beetle Management in Parks

The objective of insect management in forests outside of parks and protected areas is to minimize losses to resource values. The objective of insect management inside parks and protected areas is to allow natural processes to prevail; however, to maintain protected area values or to prevent cross boundary spread of insects to adjacent crown forests, insect management in parks and protected areas may be required.

Conclusions

This paper summarizes the approach being taken to bark beetle management in BC, and presents guidelines and criteria for determining relevant area-specific strategies and the beetle management unit and zone level of planning. The recommendations arising from these guidelines and criteria are based on biological principles, and should direct resources to areas where an impact on infestations is possible. However, other resource management imperatives, economics or logistics may well overlie these recommendations and modify priorities. The priorities set by the use of this document should serve as a basis of discussion to provide a consistent and rational approach to beetle management across the province.

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