

Public and Expert Understandings of  
Mountain Pine Beetle in Alberta

Final Report on Survey Results  
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## Executive Summary

The goal of this study was to provide guidance to resource managers and decision-makers on the public response to potential mountain pine beetle (MPB) management options in Alberta; such guidance would assist in developing management and communication strategies. In 2009, a mail survey was conducted of residents ( $n = 1,303$ ) of forested regions of the province and an internet survey was conducted of experts ( $n = 43$ ). To obtain samples of residents, we divided the western forested portion of the province into 3 regions with different histories and current status of MPB infestations: southwest, west-central, and northwest. The experts consisted of provincial government and forest industry managers of industrial Crown lands and of provincial parks and protected areas in the study regions, as well as at head offices in Edmonton.

The survey included questions pertaining to perception of risk, attitude toward the MPB, acceptability of management options, satisfaction with response to the MPB infestation, trust in government and the forest industry, awareness of MPB and its management, sources of MPB information, and demographic data. The following provides a summary of the survey findings.

- The MPB outbreak is an important issue for residents; they perceive it as having negative impacts on forests and communities.
- Residents believe MPB is impacting biodiversity and is an ecological disaster; they do not view it as having benefits for forests.
- Loss of non-timber values (scenic quality and wildlife habitat) were of about as much concern to residents as the loss of forests as an economic resource.
- Most residents in areas affected by the MPB want action to control it. Few support letting it run its course, and most support doing all that can be done to stop the MPB.
- Residents rated most control options as acceptable, and they viewed most options as effective.
- Prescribed burning of areas unaffected by the MPB was the only control option that was not rated as acceptable by a majority of residents. Harvesting activities (salvage logging, harvesting infested areas, and adjusting harvest plans) received the strongest support.
- There were few differences in the acceptance of control options for Crown lands used by the forest industry and of control options for parks and protected areas. Although there was less support for harvesting activities in parks and protected areas, these were still rated as very acceptable by a substantial percentage of respondents.
- Most residents were somewhat satisfied with the overall response to MPB in Alberta.
- A high number of no opinion and neutral responses on questions concerning satisfaction and trust of specific agencies suggests that residents are unfamiliar with the response of individual agencies and industry in their regions.
- There were mixed responses on statements related to trust in the provincial government and the forest industry. Residents were divided on agreement that the provincial government does a good job of providing information and that they trust the government to implement a responsible and effective MPB program. Similarly, there were mixed responses to statements that the forest industry is

- doing a good job of managing the spread of MPB and that they trust the industry to adjust management practices to minimize MPB impacts.
- Most residents agreed that MPB controls are in the best interests of Albertans and that the provincial government is committed to reducing impacts, but fewer agreed that the provincial government is open to new ideas and considers all relevant points of view.
  - Most residents used the media for information, but the media was not a very trusted source of information. The forest industry and non-government environmental organizations were also among the least trusted sources of information. The provincial government was the most trusted source of information for many respondents.
  - Most residents' direct experience with the MPB involved having seen affected areas; few reported having the beetle on their property.
  - Residents were poorly informed about some basic MPB information, although almost all had been exposed to media messages. The one message that nearly all respondents were aware of was that mild winters are a major factor in the current outbreak. About half of respondents indicated they had moderate knowledge about MPB, and only about 6% indicated they were well informed about management in their respective regions.
  - There were some notable differences among the regions. Respondents in the northwest viewed impacts on forests and communities more negatively than respondents in the other regions. They also rated loss of the forest as an economic resource of greater concern, whereas respondents in the other regions had greater concern about loss of scenic quality. The respondents in the southwest differed from those in the other regions in several respects. Although respondents in the southwest had a negative view of the beetle, their views were less negative than those of respondents in the other regions. They were less accepting of harvesting activities to control the MPB and also viewed harvesting activities as less effective in controlling the MPB than respondents in the other regions. More respondents in the southwest also thought it unlikely that current controls will stop the spread of MBP, viewed natural processes as the only effective means of controlling the beetle, and believed that climate change will be a major contributor in future MPB outbreaks. Respondents in the southwest also seem to have a more negative view of the forest industry.
  - Land managers and residents were similar in several respects. They both had a negative view of the MPB, with a majority, for example, viewing it as a threat to biodiversity and an ecological disaster. A majority of both managers and residents supported harvesting activities (thinning uninfested areas, harvesting infested areas, adjusting harvest plans, and salvage logging) to control the MPB in lands used by the forest industry and in parks and protected areas. A majority of both managers and residents rated these controls as effective in controlling the MPB. Letting the MPB run its course was not acceptable to the vast majority of residents and managers.
  - There were also notable differences between the land managers and residents. Managers were less concerned about non-timber impacts (scenery, wildlife, and recreation) of MPB on forests. Managers' greatest concern was the potential

economic impact. Managers were more supportive than residents of harvesting activities in controlling MPB on Crown lands used by the forest industry but were less supportive than residents of the harvesting activities in parks and protected areas. Managers expressed a higher level of satisfaction with the overall response than the public and were more satisfied with provincial government and forest industry responses. Managers also expressed higher levels of trust in the provincial government and forest industry, and more agreed that the response reflected their values and opinions.

There are management implications of many of these findings: lack of public knowledge and communication with the public, regional variation in survey responses, and differences between land managers' and the public's responses.

- Public education and management response should be tailored to local concerns and contexts. Tailoring responses that address regional concerns (e.g., developing management strategies that explicitly address scenic quality in the southwest and economic impacts in the northwest) is likely to be more acceptable in the long term than a uniform response across the province.
- Land managers should be cognizant of how their judgments of MPB differ from the public's. Land managers are focused on traditional forest management concerns (economic impacts and fire risk), and these preoccupations will inevitably influence communications and management strategies. Although the public might agree with these traditional forest management outcomes, they have additional concerns that, if not given adequate attention, could serve as a source of dissatisfaction with the response to MPB.
- The provincial government was the most trusted source of information for many respondents, suggesting an opportunity for government to communicate directly with residents. Respondents' comments also provided an indication of the types of information that people wanted. Some residents, particularly in the northwest, requested help in identifying MPB-infested trees on their property and controlling MPB on their own land. There was also a desire for more updates on the MPB situation, MPB management, and the progress of MPB control.
- There also appear to be opportunities for building trust relationships between managers and the public. These include hosting community events such as workshops on MPB identification and management on private property, and tours of treated areas. Demonstrating how non-timber considerations (especially scenic quality and wildlife habitat) are incorporated into management strategies, discussing benefits of management options, and acknowledging uncertainties are potential means to improve communications and continue building trust. Including forest health officers, scientists, wildlife biologists, and other experts in public events provides the opportunity for the public to hear the latest information and have their questions answered by those most knowledgeable.
- The sense of urgency in responding to the MPB appears to be shared by the public and is probably an important influence on the current acceptance of management strategies. As the sense of urgency diminishes, however, openness and trust relationships are likely to become integral to continued support of MPB management.

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## 1.0 Introduction

The mountain pine beetle (*Dendroctonus ponderosae*) is endemic to lodgepole pine (*Pinus contorta*) forests of western Canada. However, the province of British Columbia (BC) has recently experienced the most extensive outbreak of the insect ever recorded in North America (Taylor and Carroll, 2004). Since the 1990s, the outbreak has increased exponentially in BC, infesting more than 13 million hectares of primarily public land by 2007 (British Columbia Ministry of Forests and Range, 2007). Recently, the beetle has extended its range into the neighbouring province of Alberta and has shown potential to infest other tree species.

The mountain pine beetle (MPB) can have profound economic, social, political, and ecological implications for people living, working, and engaging in recreation in and near susceptible forests. In response to the MPB threat, Alberta Sustainable Resource Development (ASRD) developed an MPB management strategy that outlined the objectives and guiding principles of ASRD's response, and that defined management principles, priority management zones, and tactics to mitigate the impacts and spread of MPB (Alberta Sustainable Resource Development [ASRD], 2007a). ASRD also developed an action plan outlining the specific steps it was taking to manage and mitigate the MPB's impacts (ASRD, 2007b).

The Foothills Research Institute (FRI) implemented a Mountain Pine Beetle Ecology Program in 2007 to carry out focused research and investigations related to infestations of MPB in Alberta. One area of concern highlighted by the program is a need to understand forest management implications and options associated with MPB infestations. Understanding management options should include examination of public understanding and acceptance of such options. Multiple perspectives on natural resource management issues are common within communities. The public's views of MPB may differ substantially from that of experts and decision-makers, leading to potential conflict over management alternatives (Flint, McFarlane, and Müller, 2009). Without support of the public, especially residents in communities that might be impacted by MPB, implementation of forest management options may be met with controversy (Shindler, Brunson, and Stankey, 2002). However, public support is not as simple as educating the public about the science and rationale of options. Even when facts are agreed on, other influences — such as perceptions of management options, personal experiences, and trust in resource management agencies — shape judgments of acceptability. Thus, understanding perceptions, attitudes, knowledge, and preferences of local stakeholders affected by the MPB is critical to effective management and communication.

### 1.1 Objectives

The goal of this study was to provide guidance to resource managers and decision-makers on the public's response to potential MPB management options in Alberta and to assist them in developing communication strategies. The specific objectives were to:

1. identify MPB messages communicated to the public via the media;
2. examine public perceptions of the MPB and of options for its management, knowledge of MPB, and preferred means to receive MPB information;
3. examine experts' and decision-makers' perceptions of the MPB and of options for its management, views of media coverage and the public's knowledge and

- appropriate role in MPB management, and preferred means to receive MPB information;
4. compare the public's and the experts' and decision-makers' perceptions of MPB and of options for its management, and other factors; and
  5. identify implications for communicating with and involving the public in MPB management, and the acceptance of management options.

This study consisted of three components: an analysis of MPB in Alberta newspapers; a survey of residents in areas of Alberta affected by MPB; and a survey of MPB experts and decision-makers. A final report on the media analysis, addressing the first objective, was submitted to the FRI in 2009. This report provides results from surveys of the Alberta public and experts, and it addresses objectives 2 to 5 (above).

## 1.2 Relevant Literature

Recent bark beetle infestations in western North America, Alaska, and Europe have drawn attention to the human dimensions of such infestations. Studies of the human dimensions of the MPB infestation in western Canada (BC) have focused on particular aspects of the infestation such as economic impacts (Patriquin, Wellstead, and White, 2007), community vulnerability (Parkins and MacKendrick, 2007), and attitudes and management preferences of local residents and national park visitors (McFarlane, Stumpf-Allen, and Watson, 2006; McFarlane and Watson, 2008). Although these studies have provided valuable information relevant to policy and management, public perceptions of MPB management on provincial Crown lands in Alberta have not been studied.

Variation in the biophysical and socioeconomic characteristics of infested areas (Flint, 2007) suggests that impacts and public response are unlikely to be uniform across the landscape. Several studies have found variation in community vulnerability and response to infestations, public perceptions of risk, and acceptability of response options. This suggests that the human dimension of forest insect disturbance is complex and dynamic. Studies of public perceptions of MPB infestations in Banff and Kootenay national parks showed that local residents and residents of a large urban centre (Calgary) supported controlling MPB populations in the parks (McFarlane et al., 2006). However, when presented with specific management options, residents showed a preference for reactive options (such as harvesting infested trees or using prescribed burns on infested areas) rather than for proactive approaches aimed at reducing MPB habitat (removing or burning susceptible areas that were not yet infested). Abrams, Kelly, Shindler, and Wilton (2005) found similar results in a study of forest health in Oregon and Washington states. The public supported actively managing for forest health, but there was variation in the level of support for specific management practices. In a study of public perceptions of MPB management options in BC, the public supported salvage logging and preferred replanting harvested areas with mixed species, although they knew little about the specific details of what was being done to manage the infestation (Meitner, Berheide, Nelson, and Sheppard, 2008). In contrast, tourists visiting a national park in Germany showed a slight preference for granting spruce bark beetle (*Ips typographus*) a right to exist in the park and were disinclined to support control measures, suggesting tourists may accept the beetle as a natural disturbance agent (Müller and Job, 2009). Flint (2006)

showed that, at different stages of a spruce bark beetle (*Dendroctonus rufipennis*) outbreak in Alaska, communities' perceptions of impact varied, both spatially and temporally. The study concluded that the dynamic nature of the infestation (timing and magnitude) contributes to variation in local community response and willingness to accept particular control measures. The variation in support for beetle management options in these studies highlights the importance of understanding the public response in different contexts and circumstances.

In addition to a dynamic public response, perceptions of MPB and judgements of an acceptable response may differ between the public and MPB experts. Several studies suggest that the public tends to perceive impacts from risks to ecosystems differently than experts (e.g., Lazio, Kinnell, and Fisher, 2000; McDaniels, Axelrod, Cavanagh, and Slovic, 1997; Parkins and MacKendrick, 2007; Zaksek and Arvai, 2004). The public does not necessarily accept control measures aimed at achieving agency objectives (Shindler et al., 2002). How experts perceive the public's understanding of MPB and how they view the public's role in resource management can influence experts' interactions with the public. For example, experts who view public concerns as value-laden and misled by interest groups tend to view the public as having misplaced priorities and as being poor decision-makers (Young and Matthews, 2007). Thus, they may dismiss public concerns as uninformed and irrational. Rather than dismissing public concerns, experts should understand how public perceptions differ from their own and address these differences in management options and communication strategies (Shindler et al., 2002). Moreover, research on the perception of risk shows that, although the public may have a different perspective on risk than experts, these views are not irrational or misguided (Slovic, 1987). Public perspectives of environmental risks (such as the MPB) are often affected by issues of equity, control, and trust, as well as past experiences with land management agencies. Whereas technical experts base their judgments on probabilities of harm or impact, lay people base their judgments on a broader set of concerns.



## 2.0 Methods

### 2.1 Sample Regions

To obtain samples of residents from affected areas of Alberta, we divided the western forested portion of the province into 3 regions — southwest, west-central, and northwest (Fig. 1) — reflecting differences in historical and current MPB infestations. These regions represent the forested areas in the province with suitable MPB habitat and are therefore vulnerable to MPB infestation.

We obtained the level of economic dependence on the forest sector for each region from work conducted by W.A. White and M.N. Patriquin (personal communication, July 14, 2010). The level of forest dependence is based on the percentage of the economic base that is associated with the forest industry for each census subdivision (CSD) (Stedman, White, Patriquin, and Watson, 2007). For this study, we classified CSDs in the 3 study regions as high (50% and more), moderate (25% to 49%), low (1% to 24%), or no (0%) forest dependence.

The southwest region runs from the Alberta–United States border in the south to just north of Highway 1; the western boundary is the limits of the mountain national parks, and the eastern boundary roughly follows the divide between forest and prairie (roughly to the west of and parallel to Highway 22). The major population centres are Canmore and surrounding area, and the municipality of Crowsnest in the south. The southwest study region is experiencing a current outbreak and has a history of MPB outbreaks. The first was recorded in the 1940s and another started in the 1970s and continued into the 1980s. The current infestation began in 2002. The southwest is the least forest-dependent of the 3 study regions. None of the 5 CSDs constituting the region are classified as moderate or high forest dependence, 3 are classified as low, and 2 are classified as having no forest dependence. Only 0.2% to 3.0% of the economic base of the 3 CSDs with low dependence was associated with the forest industry.

The west-central region encompasses the area from just north of Highway 1 in the south to just north of Highway 16 in the north; the western boundary is the mountain national parks, and the eastern boundary is near the forest/prairie divide. The major population centres are Hinton, Edson, and Rocky Mountain House. At the time of our study, the west-central region had no historic or current outbreaks of MPB, but there is a high potential for beetle population growth in the region. Of the 16 CSDs constituting the west-central region, none are classified as high forest dependence, 9 are classified as low, 2 are classified as moderate and 5 (31%) have no forest dependence. Forest dependence of the 11 CSDs with low or moderate levels ranged from 2.0% to 44.3%.

The northwest region starts in the south just north of Highway 16 and ends in the north at Paddle Prairie, with the Alberta–British Columbia border as the western limit and a staggered eastern boundary that goes to approximately the centre of Slave Lake. The major population centres are Grande Prairie, Grand Cache, Peace River, and Whitecourt. The northwest region had no history of MPB but, at the time of our study, was experiencing a large outbreak resulting from long-range dispersal of beetles from BC in 2006. Of the 42 CSDs constituting the region, 86% have some level of forest dependence: 30 are classified as low and 7, as moderate. None of the CSDs are classified as high dependence. Six (14%) are classified as no forest dependence. Forest dependence for the CSDs classified as low or moderate ranged from 1.2% to 45.0%.

All of the regions were subject to MPB management. The strategies included single-tree treatments such as “cut and burn,” harvesting areas of infested trees and processing the trees to kill the beetles, forest industry adjustment of harvest plans to log healthy but susceptible areas before they were attacked, and prescribed burning.

## **2.2 Samples**

A sample of residents from the 3 regions was recruited by telephone in 2009 to participate in a mail survey. In total, 5,647 qualified respondents were contacted. (Respondents had to be 18 years of age or older, and equal numbers of men and women were sought.) Of these, 1,994 agreed to participate in a mail survey: 643 from the southwest region, 649 from the west-central, and 702 from the northwest.

At the same time as the public was surveyed by mail, land managers (from the provincial government and forest industry), Parks Canada MPB specialists, decision-makers (local municipal leaders), and scientists were surveyed via the Internet. Samples for these groups were obtained using a variety of methods. We asked members of the FRI MPB Activity Team to provide names and email addresses of land managers (provincial government and forest industry) of industrial Crown lands as well as provincial parks and protected areas in the study regions and at head offices located in Edmonton. Parks Canada provided a list of staff responsible for MPB management in Jasper, Banff, and Waterton Lakes national parks. The chief administrative officers and mayors or reeves of towns and municipalities in the study regions were identified using the Internet. Finally, MPB scientists were identified through searches of published reports and journal articles and of scientists funded by the Canadian Forest Service (CFS) Mountain Pine Beetle Initiative as well as communication with CFS scientists, who provided names of other scientists conducting research on MPB.

## **2.3 Questionnaire**

The questionnaire was developed in consultation with the FRI MPB Advisory Group. It included questions pertaining to perceptions of risk, attitude toward the MPB, acceptability of management options, satisfaction with management measures in response to MPB infestation, trust in government and the forest industry, awareness of MPB and its management, sources of MPB information, and demographic data about the respondent. The questionnaire also included an area for respondents to comment in an open-ended manner on MPB and its management in Alberta. Survey packets were mailed on September 4, 2009. They contained the questionnaire, a cover letter explaining the purpose of the survey, and a postage-paid business reply envelope. A reminder post card was mailed on September 18, and another complete survey package was mailed on October 14 to people who had not responded.

Table 1 provides a summary of the mail survey response. The returns for the mail survey were 473 from the southwest, 424 from the west-central, and 406 from the northwest. This level of response gives a sampling error of less than  $\pm 5\%$ , 19 times out of 20. After adjusting for questionnaires returned because of bad addresses, the response rates (percentage completed) were 74% (southwest), 66% (west-central), and 59% (northwest). Considering that there were 1,303 completed surveys out of 5,694 initial telephone contacts, the overall response rate was 23%.

The questionnaire for the land managers, decision-makers, and scientists included some questions from the public survey and some unique questions. It was administered via the Internet using Zoomerang® survey software. Invitations to participate in the survey were sent by email on September 10, 2009. Reminder emails were sent to non-respondents on September 18 and October 1. Each person could answer the survey only once. There was considerable variation in response rates, with municipal leaders having the lowest (26%) and Parks Canada officials the highest (64%) (Table 2). The low response rate or small sample sizes from the scientists, Parks Canada officials, and municipal leaders unfortunately prevents us from reporting these results. Thus, we use results from the land managers of provincial industrial Crown lands as well as provincial parks and protected areas to represent an expert sample.

Table 1. Mail Survey Response

Sample region	Canada Post household counts	Number of surveys mailed	Number of surveys undeliverable	Number of surveys completed	Response rate (%)	Sampling error (%)
Southwest	15,300	643	6	473	74	4.4
West-central	17,512	649	9	424	66	4.7
Northwest	38,241	702	16	406	59	4.8

Table 2. Internet Survey Response Rate

Group	Number of invitations sent	Number of surveys undeliverable	Number of surveys completed	Response rate (%)
Scientists	20	0	7	35
Municipal leaders	82	2	21	26
Land managers (provincial government, forest industry)	68	1	43	62
Parks Canada officials	14	0	9	64

## 2.4 Data Analysis

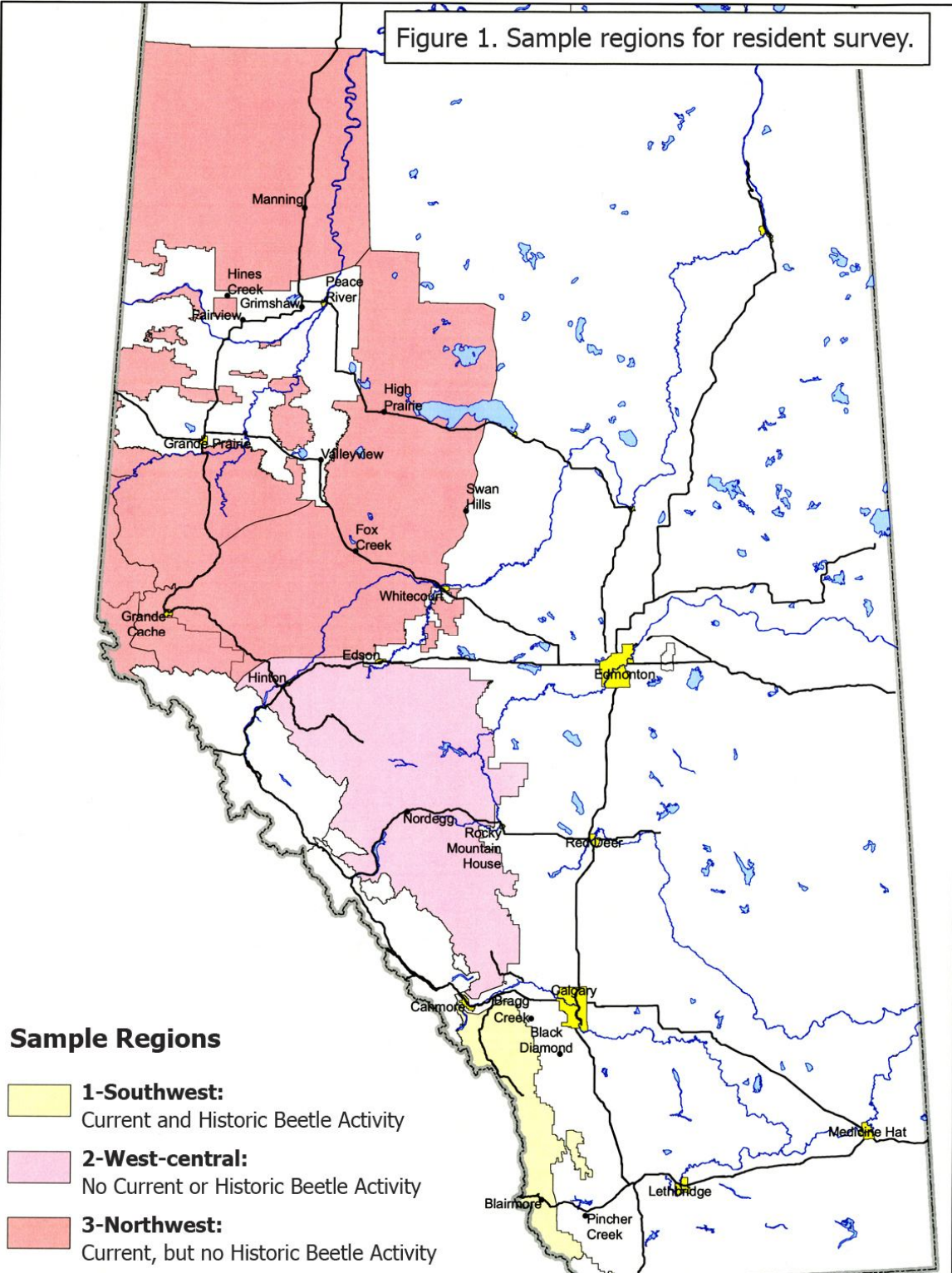
Statistical analyses were performed using SAS® (version 9.1.3). Differences among group means were analyzed using analysis of variance (ANOVA) and the Tukey-Kramer multiple comparison test. We used  $p \leq 0.05$  as the significance level in the statistical tests. A “no opinion” option was provided for all of the questions, and these responses were coded as missing values in the analysis of means.

Four hundred and eight (31%) of the public respondents provided comments on the survey. The comments were imported into NVivo (version 8.0) software for qualitative data analysis. Comments were coded based on themes identified by the researchers. Some examples of the themes are prescribed burning, trust in industry, information needs, and dissatisfaction. The comments are not necessarily representative




of all respondents. People who were concerned or dissatisfied with MPB management in Alberta tended to comment more frequently. The comments are, however, useful in providing insights into the quantitative responses and public concerns. The comments cited in this report are transcribed verbatim from the survey booklets, with no editing of grammar or spelling.

We compared demographic characteristics of the public respondents to data from the 2006 Canada Census (Statistics Canada, 2008) to gauge the representativeness of the sample to the population. We used census subdivision (CSD) data and selected CSDs that best corresponded with the sample region boundaries, although the correspondence between our region boundaries and CSD boundaries was not exact. Therefore, the census data represent estimates of the characteristics of interest.

Figure 1. Sample regions for resident survey.



**Sample Regions**

-  **1-Southwest:**  
Current and Historic Beetle Activity
-  **2-West-central:**  
No Current or Historic Beetle Activity
-  **3-Northwest:**  
Current, but no Historic Beetle Activity

## 3.0 Results

### 3.1 Demographic Characteristics

Although the telephone recruitment of the public sample resulted in nearly an even gender mix, there were slightly more male than female respondents to the mail survey (Table 3). This suggests that women might feel less informed about MPB or have less interest in MPB than men; as a result, they either did not complete the survey or gave it to a male household occupant to complete. Compared to the 2006 census information, women are slightly under-represented in the southwest and west-central survey respondents (Statistics Canada, 2008). The managers consisted mainly of men.

Table 3. Gender Distribution (%)

Region	Male	Female	Female in region, according to census data <sup>1</sup>
Southwest	54.7	45.3	50.0
West-central	53.8	46.3	48.5
Northwest	51.9	48.1	48.5
Combined	53.5	46.5	n/a
Managers	87.5	12.5	n/a

<sup>1</sup> Statistics Canada (2008)

Public respondents represent a wide age distribution (Table 4a). The northwest region had a higher representation of younger respondents. There are more northwest respondents in the 25-to-34-year age category and fewer in the 55-to-64 age category compared with the other regions. In contrast, the managers were primarily between 35 and 54 years old.

A comparison of the public respondents to the 2006 Canada Census (Statistics Canada, 2008) (Table 4b) shows that the age distribution of respondents is skewed toward the 45-to-74 year categories (i.e., survey respondents are older than the general population). There are a number of reasons that may explain the age difference, including the increasing exclusive use of mobile phones by young people, the likelihood of answering a land line,<sup>1</sup> and perhaps a greater interest in MPB among the older respondents.

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<sup>1</sup> Our sample selection was restricted to respondents 18 or over and did not include mobile phones. The Canada Census has age groupings of 15 to 19 and 20 to 24, so for comparison to our age group of 18 to 24, two-fifths of the census 15-to-19 group was added to the 20-to-24 group. This calculation assumes an equal distribution among all ages in the 15-to-18 group, which may introduce a small error to the resulting 18-to-25 group for Census information.

Table 4a. Age Distribution (%)

Region	18 to 25	25 to 34	35 to 44	45 to 54	55 to 64	65 to 74	75 or older
Southwest	6.1	6.6	17.3	27.3	27.7	12.1	3.0
West-central	7.6	10.4	15.1	24.5	27.6	11.1	3.8
Northwest	6.9	16.5	15.0	27.6	20.7	9.4	3.9
Combined	6.8	10.9	15.9	26.5	25.5	10.9	3.5
Managers	16.3	9.3	25.6	32.6	16.3	0.0	0.0

Table 4b. 2006 Census<sup>1</sup> Age Distribution (%)

Region	18 to 25	25 to 34	35 to 44	45 to 54	55 to 64	65 to 74	75 or older
Southwest	12.2	18.2	20.1	21.2	13.8	7.5	6.7
West-central	12.7	15.6	21.2	22.8	14.8	8.1	4.7
Northwest	15.4	20.7	20.9	19.6	11.9	6.7	4.7
Combined	14.3	18.8	20.9	20.8	13.0	7.2	4.9

<sup>1</sup> Statistics Canada (2008)

The southwest region had fewer respondents with a household member dependent on any of the forest industry, the oil and gas sector, or mining sector but had substantially more who were dependent on the tourism sector for their economic livelihood (Table 5). The northwest region had the highest percentage (31%) of respondents dependent on agriculture.

Table 5. Household Dependence on Resource Sectors (%)

Sector	Southwest	West-central	Northwest	Combined
Forest industry	10.2	23.6	25.6	19.4
Tourism industry	26.3	7.4	7.9	14.3
Agriculture	4.9	22.4	30.9	18.8
Oil and gas or mining industries	22.1	53.8	50.1	41.3
Natural resource agency (provincial or federal government department)	6.5	3.9	7.1	5.8
Nobody in the household depends on above industries	48.4	25.8	28.4	34.7

The southwest respondents had a higher level of educational attainment, with substantially more having a Bachelor's degree or higher (49%) than in the other regions (Table 6a). The land managers, however, had the highest levels of education, with about 73% having a Bachelor's degree or higher. Compared with the 2006 census data, the public survey respondents had substantially higher educational attainment than the general population (Table 6b). For example, the rate of Bachelor's degree attainment for survey respondents is about double that of the regional populations.

Table 6a. Level of Education of Respondents (%)

Educational level	Southwest	West-central	Northwest	Combined	Managers
Some high school or less	4.1	10.4	12.6	8.7	0.0
High school graduate	12.0	28.6	23.5	20.8	2.5
Technical school or community college	23.0	35.6	38.5	31.9	22.5
Some university	11.3	5.6	7.8	8.4	2.5
University degree (Bachelor's)	28.8	13.2	14.2	19.3	45.0
Some graduate studies	4.3	2.8	1.1	2.8	5.0
Graduate university degree (Masters, PhD, medical degree)	16.5	3.9	2.2	8.0	22.5

Table 6b. Level of Education in Census 2006<sup>1</sup> (%)

Educational level	Southwest	West-central	Northwest	Combined
Some high school or less	18.5	25.6	29.5	24.8
High school graduate	21.9	25.8	24.5	22.5
Technical school or community college	31.4	35.9	34.0	31.4
Some university	25.7	12.0	11.6	11.7
University degree (Bachelor's)	16.0	7.0	6.9	7.0
Some graduate studies	2.0	0.7	0.6	0.7
Graduate university degree (Masters, PhD, medical degree)	6.0	1.9	1.7	1.9

<sup>1</sup> Statistics Canada (2008)

To examine whether the differences in age, sex, and education distributions between survey respondents and the 2006 census might bias the survey results, we tested correlations and conducted *t*-tests with perceived impacts, overall satisfaction with the



MPB response, acceptance of management options, and trust statements. We found no association ( $p \leq 0.05$ ) between the demographic variables and overall satisfaction and only small correlations between demographic variables and a few of the perceived risks, management options, and trust statements. Age was correlated (Pearson correlation coefficient,  $r$ ), with 2 management options ( $r \leq 0.14$ ) and with 7 trust statements ( $r \leq 0.11$ ), and was not correlated ( $p \leq 0.05$ ) with perceived impacts. Sex was correlated (Spearman correlation coefficient,  $r_s$ ) with 5 perceived impacts ( $r_s \leq 0.22$ ) and 2 trust statements ( $r_s \leq 0.11$ ). Education was correlated with 3 trust statements ( $r < 0.20$ ), 1 perceived impact ( $r_s = 0.16$ ), and 5 management options ( $r_s < 0.10$ ).  $T$ -tests also showed the differences between men and women and between respondents with and without a university degree to be modest. Based on these results, we concluded that the discrepancy between the demographic composition of the survey respondents and the general population would have little effect on the generalization of the survey results.

### 3.2 Perceptions of MPB

#### 3.2.1 Importance

Issue salience is a prerequisite to people’s engagement in a natural resource management issue. We found that the MPB was of high personal importance to respondents in all regions. More than 80% of respondents rated the MPB as being somewhat or very important to them personally, with nearly 50% rating it as very important (Table 7a). Only about 5% rated the MPB as not important to them personally. A comparison of mean scores showed no significant differences among the regions (Table 7b). This question was not asked of the land managers.

Table 7a. Personal Importance of MPB (%)

Region	Not important at all	Somewhat not important	Neutral	Somewhat important	Very important	No opinion
Southwest	2.1	3.4	10.7	34.8	49.0	0.0
West-central	3.8	1.9	7.4	39.9	46.4	0.5
Northwest	3.2	2.2	9.4	38.2	44.2	2.7
Combined	3.0	2.6	9.2	37.5	46.7	1.0

Table 7b. Mean<sup>1,2</sup> (and Standard Deviation) of Personal Importance of MPB

South-west	West-central	North-west	Combined
4.2 <sub>a</sub> (0.9)	4.2 <sub>a</sub> (1.0)	4.2 <sub>a</sub> (0.9)	4.2 (0.9)

<sup>1</sup> Rated on a scale from 1 = “not important at all” to 5 = “very important.”

<sup>2</sup> Any two means in a row that do not share a letter are significantly different at  $p < 0.05$  according to the Tukey-Kramer test.

### 3.2.2 Perceptions of Impacts

To examine how the MPB might affect Alberta residents, we asked a series of questions on perceptions of potential impacts of MPB. First, respondents were asked to rate impacts on the forests in their region, on their community, and on them personally (Table 8a). Land managers were not asked this question. The highest rating for negative impact of MPB was for forests, with a large percentage of respondents in the three regions rating the impacts on forests as very negative (31%) or somewhat negative (51%). Impacts on communities were also rated as negative, but, compared with impacts on forests, fewer respondents rated community impacts as very negative (13%). Respondents tended to view the MPB as having either no impact or a somewhat negative impact on them personally. Only about 10% of respondents viewed the MPB as having a positive impact on forests, communities, or themselves.

A comparison of the mean responses shows that respondents from the northwest had a slightly more negative assessment of the impacts on forests in their region (Table 8b) than respondents from other regions. Respondents from the west-central region had a slightly less negative assessment of impacts on their community compared with those in the southwest and northwest regions. They also had a slightly less negative assessment of personal impacts compared to the southwest.

Table 8a. Perceptions of MPB Impacts (%)

Impact	Region	Very negative	Somewhat negative	No impact	Somewhat positive	Very positive	No opinion
The forest in "your region of" Alberta	Southwest	30.0	54.3	4.7	5.0	3.7	2.4
	West-central	21.5	56.9	8.7	5.5	4.3	3.1
	Northwest	40.8	40.3	4.5	4.0	7.3	3.3
	Combined	30.6	50.7	5.9	4.9	5.0	2.9
Your community	Southwest	9.9	63.5	18.0	4.9	2.4	1.3
	West-central	9.3	47.2	31.6	7.5	2.0	2.4
	Northwest	20.2	51.9	14.5	5.7	5.7	2.0
	Combined	12.9	54.6	21.3	6.0	3.3	1.9
You personally	Southwest	11.6	42.7	37.6	4.1	3.0	1.1
	West-central	10.7	28.0	53.0	3.7	3.2	1.5
	Northwest	14.5	31.3	42.3	5.8	4.8	1.5
	Combined	12.2	34.4	44.0	4.5	3.6	1.3

Table 8b. Mean<sup>1, 2</sup> (and Standard Deviation) of Perceptions of MPB Impacts

	Southwest	West-central	Northwest	Combined
The forest in “ <i>your region of</i> ” Alberta	2.0 <sub>a b</sub> (0.9)	2.1 <sub>a</sub> (1.0)	1.9 <sub>b</sub> (1.1)	2.0 (1.0)
Your community	2.3 <sub>a</sub> (0.8)	2.4 <sub>b</sub> (0.8)	2.2 <sub>a</sub> (1.0)	2.3 (0.9)
You personally	2.4 <sub>a</sub> (0.9)	2.6 <sub>b</sub> (0.9)	2.5 <sub>a b</sub> (1.0)	2.5 (0.9)

<sup>1</sup> Rated on a scale from 1 = “very negative” to 5 = “very positive”.

<sup>2</sup> Any two means in a row that do not share a letter are significantly different at  $p < 0.05$  according to the Tukey-Kramer test.

Several potential impacts associated with MPB outbreaks have been incorporated into management strategies and control options. Next, we asked respondents their level of concern with some of these impacts (Table 9a). Overall, a majority of respondents in all regions (> 65%) rated all of the impacts as of moderate or great concern. Loss of scenic quality was a great concern for about 62% of respondents. This was followed by loss of the forest as an economic resource (58%) and changes to wildlife habitat (56%). Although about one-third of respondents had a great concern regarding falling trees and loss of community identity, these were of least concern in comparison with the other impacts.

There were some regional differences in concerns. Based on the ranking of responses, scenic quality, risk of forest fires, and changes to wildlife habitat were of greatest concern for residents in the southwest region. Scenic quality, loss of the economic resource, and changes to habitat were of greatest concern for residents in the west-central region. The residents in the northwest region rated loss of the economic resource as their greatest concern, followed by scenic quality and loss of habitat.

The respondents in the southwest region seem to be slightly less concerned about impacts. Fewer of these respondents indicated a great concern over the impacts, and they had significantly lower mean concern ratings than the respondents in the west-central region on changes to wildlife habitat, loss of scenic quality, and changes to forest recreation (Table 9b). They also had significantly lower ratings on loss of forest as an economic resource than respondents in both the west-central and northwest regions.

In contrast to residents, land managers’ greatest concerns were loss of the forest as an economic resource and increased risk of forest fires. Nearly 75% of the land managers rated economic impact as a great concern, and nearly 50% rated increased risk of forest fires as a great concern (Table 9a). Differences in mean concern ratings show that land managers were substantively less concerned about wildlife habitat, loss of scenic quality, and falling trees than residents in the three regions and were more concerned about economic impacts than residents in the southwest (Table 9b). Land managers did not differ from the residents in concerns about increased risk of forest fires, increased runoff and higher water tables, changes to forest recreation, and loss of community identity.

Table 9a. Level of Concern About MPB Impacts (%)

Concern	Region	No concern	Slight concern	Moderate concern	Great concern	No opinion
Increased risk of forest fires	Southwest	5.1	17.5	28.6	48.4	0.4
	West-central	2.9	14.9	30.5	51.3	0.5
	Northwest	4.0	13.5	28.5	53.5	0.5
	Combined	4.0	15.4	29.2	50.9	0.5
	Managers	4.6	14.0	32.6	48.8	0.0
Loss of scenic quality	Southwest	4.3	9.8	27.1	58.2	0.6
	West-central	1.4	9.3	22.9	66.4	0.0
	Northwest	3.8	10.3	24.5	61.0	0.5
	Combined	3.2	9.8	24.9	61.7	0.4
	Managers	18.6	16.3	39.5	25.6	0.0
Increased runoff and higher water tables	Southwest	5.2	13.4	34.3	44.2	3.0
	West-central	5.3	12.3	31.6	49.4	1.5
	Northwest	7.0	20.0	32.8	37.0	3.3
	Combined	5.8	15.1	32.9	43.6	2.6
	Managers	2.3	16.3	39.5	37.2	4.6
Falling trees	Southwest	11.8	23.7	34.2	29.3	1.1
	West-central	10.6	22.8	33.2	32.9	0.5
	Northwest	12.8	22.5	32.5	31.0	1.3
	Combined	11.7	23.1	33.3	31.0	0.9
	Managers	16.3	39.5	32.6	11.6	0.0
Changes to wildlife habitat	Southwest	6.2	12.2	32.6	48.2	0.9
	West-central	2.9	11.0	22.0	63.4	0.7
	Northwest	4.3	12.3	25.8	56.6	1.0
	Combined	4.5	11.8	27.1	55.8	0.9
	Managers	7.0	16.3	60.4	14.0	2.3
Loss of the forest as an economic resource (e.g., forestry, tourism)	Southwest	8.1	17.0	29.8	44.0	1.1
	West-central	2.9	8.4	23.0	64.1	1.7
	Northwest	2.5	6.3	23.3	66.7	1.3
	Combined	4.7	10.9	25.6	57.6	1.3
	Managers	2.3	0.0	20.9	65.1	11.6
Changes to the forest for recreation	Southwest	6.6	18.8	28.3	46.0	0.2
	West-central	4.3	12.5	32.0	51.0	0.2
	Northwest	6.3	15.5	28.0	48.5	1.8
	Combined	5.8	15.7	29.4	48.4	0.7
	Managers	2.3	20.9	48.8	27.9	0.0
Loss of community identity tied to the forest	Southwest	12.7	17.4	34.1	33.7	2.2
	West-central	7.2	20.4	32.6	37.7	2.2
	Northwest	9.7	19.2	35.9	30.4	4.7
	Combined	10.0	18.9	34.2	34.0	3.0
	Managers	9.3	23.3	39.5	23.3	0.0

Table 9b. Mean<sup>1,2</sup> (and Standard Deviation) of Concern about MPB Impacts

	South-west	West-central	North-west	Combined	Managers
Increased risk of forest fires	3.2 <sub>a</sub> (0.9)	3.3 <sub>a</sub> (0.8)	3.3 <sub>a</sub> (0.9)	3.3 (0.9)	3.3 <sub>a</sub> (0.9)
Loss of scenic quality	3.4 <sub>a</sub> (0.8)	3.5 <sub>b</sub> (0.7)	3.4 <sub>a,b</sub> (0.8)	3.5 (0.8)	2.7 <sub>c</sub> (1.1)
Increased runoff and higher water tables	3.2 <sub>a</sub> (0.9)	3.3 <sub>a</sub> (0.9)	3.0 <sub>b</sub> (0.9)	3.2 (0.9)	3.1 <sub>a,b</sub> (0.8)
Falling trees	2.8 <sub>a</sub> (1.0)	2.9 <sub>a</sub> (1.0)	2.8 <sub>a</sub> (1.0)	2.8 (1.0)	2.4 <sub>b</sub> (0.9)
Changes to wildlife habitat	3.2 <sub>a</sub> (0.9)	3.5 <sub>b</sub> (0.8)	3.4 <sub>a,b</sub> (0.9)	3.4 (0.9)	2.8 <sub>c</sub> (0.8)
Loss of the forest as an economic resource (e.g., forestry, tourism)	3.1 <sub>a</sub> (1.0)	3.5 <sub>b</sub> (0.8)	3.6 <sub>b</sub> (0.7)	3.4 (0.9)	3.7 <sub>b</sub> (0.6)
Changes to the forest for recreation	3.1 <sub>a</sub> (0.9)	3.3 <sub>b</sub> (0.8)	3.2 <sub>a,b</sub> (0.9)	3.2 (0.9)	3.0 <sub>a,b</sub> (0.8)
Loss of community identity tied to the forest	2.9 <sub>a</sub> (1.0)	3.0 <sub>a</sub> (0.9)	2.9 <sub>a</sub> (1.0)	2.9 (1.0)	2.8 <sub>a</sub> (0.9)

<sup>1</sup> Rated on a scale from 1 = “no concern” to 4 = “great concern.”

<sup>2</sup> Any two means in a row that do not share a letter are significantly different at  $p < 0.05$  according to the Tukey-Kramer test.

### 3.3 Attitude Toward MPB

We assessed attitudes toward the MPB using a series of statements reflecting positive and negative evaluations. This attitude scale has been used in previous studies of residents and visitors to national parks in Canada (McFarlane et al., 2006) and Germany (Müller and Job, 2009).

Overall, residents had a negative assessment of the MPB (Table 10a). A majority agreed that it is a threat to biodiversity (70%), it results in substantial economic losses (85%), and it is an ecological disaster (66%). A majority disagreed that the beetle helps ensure that forests are healthy (70%), that it is important in rejuvenating forests (62%), and that it is more beneficial than harmful (79%).

There is some regional variation in the public responses. Although residents in the southwest had a negative assessment of the MPB, these residents were less negative in their views than residents in the other regions. For example, about 31% strongly agreed that the beetle is a threat to biodiversity compared with about 40% of residents in the other regions; only 40% of residents in the southwest strongly agreed that the MPB results in substantial economic losses compared with about 60% in the other regions. Similarly, respondents in the southwest had significantly lower mean ratings on the negative statements and higher ratings on the positive statements compared with those in the other regions (Table 10b).

Land managers also had a negative assessment of the MPB. About 51% of managers agreed that it is a threat to biodiversity or an ecological disaster, and 56% disagreed that the MPB helps ensure that forests are healthy or that it is important in

rejuvenating forests (Table 10a). About 76% of managers strongly agreed that the MPB results in substantial economic losses. A comparison of the mean responses shows that land managers' attitudes are similar to those of respondents in the southwest region but differ from those of respondents in the west-central and northwest regions (Table 10b). For example, both respondents in the southwest and land managers had significantly lower mean scores on statements that the MPB is a threat to biodiversity and an ecological disaster and higher scores on the statement that the MPB helps ensure that forests are healthy. Land managers' responses, however, are similar to those of respondents in the west-central and northwest regions in their view that the MPB results in substantial economic losses.

Table 10a. Attitude Toward MPB (%)

Statement	Region	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree	No opinion
<b>Positive statements</b>							
The mountain pine beetle helps ensure that forests are healthy	Southwest	34.8	23.9	11.8	18.5	6.7	4.3
	West-central	49.9	25.8	11.1	9.9	1.9	1.5
	Northwest	51.0	25.1	7.8	10.1	3.3	2.8
	Combined	44.8	24.9	10.3	13.1	4.1	2.9
	Managers	29.3	26.8	2.4	31.7	9.8	0.0
The mountain pine beetle is important in rejuvenating the forest	Southwest	27.6	26.3	15.0	19.3	6.2	5.6
	West-central	40.5	26.5	12.3	15.7	4.1	1.0
	Northwest	41.7	24.8	11.6	13.9	2.8	5.3
	Combined	36.2	25.9	13.1	16.4	4.5	4.0
	Managers	31.7	24.4	0.0	36.6	7.3	0.0
Overall, the mountain pine beetle is more beneficial than harmful	Southwest	45.3	28.4	13.9	5.3	4.5	2.6
	West-central	58.5	23.7	10.6	2.9	3.1	1.2
	Northwest	60.3	21.3	9.5	2.5	3.5	3.0
	Combined	54.2	24.7	11.4	3.7	3.7	2.3
	Managers	47.5	27.5	20.0	5.0	0.0	0.0
<b>Negative statements</b>							
The mountain pine beetle is a threat to biodiversity	Southwest	6.1	12.0	14.2	31.4	31.2	5.2
	West-central	3.7	8.6	10.3	31.6	41.7	4.2
	Northwest	3.1	5.9	10.0	33.5	40.2	7.4
	Combined	4.4	9.0	11.6	32.1	37.4	5.6
	Managers	7.3	21.9	19.5	24.4	26.8	0.0
The mountain pine beetle results in substantial economic losses	Southwest	2.6	4.5	11.3	39.2	40.2	2.3
	West-central	4.3	3.4	4.8	26.1	60.4	1.0
	Northwest	2.5	3.8	3.5	26.2	62.7	1.3
	Combined	3.1	3.9	6.8	30.9	53.7	1.6
	Managers	2.4	4.9	2.4	12.2	75.6	2.4
Mountain pine beetle outbreaks are an ecological disaster	Southwest	8.3	20.5	11.3	30.6	26.9	2.4
	West-central	6.7	12.3	11.1	28.9	39.9	1.2
	Northwest	5.3	9.3	11.6	29.0	42.6	2.3
	Combined	6.9	14.4	11.3	29.5	36.0	2.0
	Managers	17.1	24.4	7.3	19.5	31.7	0.0

Table 10b. Mean<sup>1,2</sup> (and Standard Deviation) Attitude Toward MPB

	Southwest	West-central	Northwest	Combined	Managers
Positive statements:					
The mountain pine beetle helps ensure that forests are healthy	2.4 <sub>a</sub> (1.3)	1.9 <sub>b</sub> (1.1)	1.9 <sub>b</sub> (1.1)	2.0 (1.2)	2.7 <sub>a</sub> (1.4)
The mountain pine beetle is important in rejuvenating the forest	2.5 <sub>a</sub> (1.3)	2.2 <sub>b,c</sub> (1.2)	2.1 <sub>b</sub> (1.2)	2.2 (1.2)	2.6 <sub>a,c</sub> (1.4)
Overall, the mountain pine beetle is more beneficial than harmful	1.9 <sub>a</sub> (1.1)	1.7 <sub>b</sub> (1.0)	1.6 <sub>b</sub> (1.0)	1.8 (1.1)	1.8 <sub>a,b</sub> (0.9)
Negative statements:					
The mountain pine beetle is a threat to biodiversity	3.7 <sub>a</sub> (1.2)	4.0 <sub>b</sub> (1.1)	4.1 <sub>b</sub> (1.0)	3.9 (1.1)	3.4 <sub>a</sub> (1.3)
The mountain pine beetle results in substantial economic losses	4.1 <sub>a</sub> (1.0)	4.4 <sub>b</sub> (1.0)	4.4 <sub>b</sub> (0.9)	4.3 (1.0)	4.6 <sub>b</sub> (1.0)
Mountain pine beetle outbreaks are an ecological disaster	3.5 <sub>a</sub> (1.3)	3.8 <sub>b</sub> (1.3)	4.0 <sub>b</sub> (1.2)	3.7 (1.3)	3.2 <sub>a</sub> (1.5)

<sup>1</sup> Rated on a scale from 1 = "Strongly disagree" to 5 = "Strongly agree."

<sup>2</sup> Any two means in a row that do not share a letter are significantly different at  $p < 0.05$  according to the Tukey-Kramer test.

### 3.4 Perceptions of MPB Management

We used several questions to examine perceptions of MPB management on Crown land used by the forest industry as well as in parks and protected areas. We assessed the preferred approach by examining the extent to which respondents think the MPB should be managed. Respondents chose from a series of options ranging from letting the MPB infestation run its course to doing all that can be done to stop the MPB. We also examined the acceptance and effectiveness of specific management options, including harvesting options, prescribed burning, and chemical use in controlling the MPB.

#### 3.4.1 Preferred Approach

Regarding the approach that should be taken to manage the MPB on Crown land used by the forest industry (Table 11) and in provincial parks and protected areas (Table 12), a majority of residents in the west-central and northwest selected the option to do all that can be done to control the MPB in their regions. The next favoured option was to intervene in susceptible areas before the MPB attacks, followed by intervening only in areas affected by the MPB. Allowing the MPB to run its course without intervention was selected by less than 10% of respondents. Residents in the southwest showed a wider distribution of responses than residents in the other regions. Fewer respondents in the

southwest chose “do all that can be done,” and more chose “intervene in susceptible areas” and “allow the beetle to run its course.” For all regions, there were no significant differences between the approaches to managing Crown land versus protected areas.

Allowing the MPB to run its course on Crown land used by the forest industry was not acceptable to any of the land managers, but some managers (7%) were more tolerant of letting the MPB run its course in parks and protected areas. Compared with the public, more managers (70%) selected “do all that can be done to stop the beetle.”

Table 11. Views on the Best Approach to Manage MPB on Crown Land (%)

Approach	Southwest	West-central	Northwest	Combined	Managers
Allow the beetle to run its course without intervention	7.6	2.7	4.4	5.1	0.0
Intervene only in areas that beetles have already attacked	20.3	18.2	15.1	18.0	7.5
Intervene in areas that are susceptible to the beetle before the beetle attacks	26.4	21.9	21.0	23.3	22.5
Do all that can be done to control the beetle	45.6	57.3	59.6	53.7	70.0

Table 12. Views on the Best Approach to Manage MPB in Protected Areas (%)

Approach	Southwest	West-central	Northwest	Combined	Managers
Allow the beetle to run its course without intervention	7.8	4.6	4.3	5.7	7.3
Intervene only in areas that beetles have already attacked	22.0	18.8	17.9	19.7	9.8
Intervene in areas that are susceptible to the beetle before the beetle attacks	25.9	21.0	19.4	22.3	24.4
Do all that can be done to control the beetle	44.3	55.5	58.3	52.3	58.5

### 3.4.2 Acceptability of Management Options

To examine acceptance of specific management options for MPB, we presented a description of a number of options (see Appendix A). Respondents rated the acceptability of these on Crown lands used by the forest industry as well as in parks and protected areas in their respective regions.

Overall, with the exception of prescribed burning of areas not yet attacked, a majority of respondents rated the options as somewhat or very acceptable for the management of Crown lands used by the forest industry (Table 13a). The options with the highest-percentage ratings as very acceptable were forest harvesting activities: salvage



logging (73%), harvesting infested areas (57%), and adjusting harvest plans (50%). Prescribed burning received lower levels of acceptability than harvesting activities. The least acceptable option was prescribed burning of uninfested areas. There was a wide distribution of responses to this option, with about 48% rating it as very or somewhat unacceptable. There was greater acceptability, however, of prescribed burning of infested areas: about 80% rated this as somewhat or very acceptable. Thinning healthy trees before they are attacked (70%), cutting infested trees and burning them on-site (75%), and chemical control with carbaryl (56%) were rated as somewhat or very acceptable by a majority of residents.

There were differences among the regions in acceptability of some options. The respondents in the northwest differed from those in the other regions; they had lower mean acceptability ratings for prescribed burning of either infested or uninfested areas and higher acceptability ratings than respondents in the southwest for harvesting activities (salvage logging and harvesting) (Table 11b). Respondents in the southwest had lower mean ratings than those in the other two regions of the use of chemical control and adjusting harvest plans. Respondents in the southwest rated chemical control as slightly unacceptable, whereas those in the other regions rated it as acceptable.

Land managers showed strong support for all of the management options. There were few differences between responses from the public and from land managers. Land managers also favoured harvesting activities (Table 13a). A high percentage of the managers rated harvesting infested trees (83%), adjusting harvest plans (83%), and salvage logging (71%) as very acceptable. However, the land managers had substantively higher mean acceptability ratings than public respondents in all three regions for prescribed burning of uninfested areas. (Land managers rated it as acceptable whereas the public rated it as unacceptable.) (Table 13b) They had higher ratings than respondents in the southwest and west-central regions for forest companies adjusting their harvest plans to log healthy but susceptible areas, and they rated the acceptability of pheromones and harvesting infested trees higher than the respondents in the southwest.

Residents rated management activities in parks and protected areas similar to activities on Crown lands used by the forest industry. Although there was less support for harvesting activities in parks and protected areas, salvage logging (56%), adjusting harvest plans (37%), and harvesting infested areas (43%) were rated as very acceptable by a substantial percentage of respondents (Table 14a).

A comparison of the mean scores shows that the respondents in the southwest region were less accepting of harvesting, adjusting harvest plans, and chemical control and more accepting of cut and burn in protected areas than respondents in the other regions (Table 14b). The respondents in the northwest were substantively less accepting of prescribed burning of uninfested areas in parks and protected areas.

A majority of land managers supported all of the management activities, with the exception of salvage logging, in parks and protected areas (Table 14a). Managers were substantively less accepting than the public of salvage logging and were more accepting than the public of prescribed burning of uninfested areas in parks and protected areas (Table 14b).

Table 13a. Acceptability of Management Options on Crown Land Used by the Forest Industry (%)

Management option	Region	Very unacceptable	Somewhat unacceptable	Neutral	Somewhat acceptable	Very acceptable	No opinion
Prescribe burn areas attacked by the beetle	Southwest	6.1	8.2	2.4	32.8	49.7	0.9
	West-central	4.5	8.6	3.3	38.0	45.1	0.5
	Northwest	6.5	12.8	4.8	37.6	37.1	1.3
	Combined	5.7	9.8	3.4	36.0	44.3	0.9
	Managers	9.8	4.9	2.4	21.9	61.0	0.0
Prescribe burn areas that are not yet attacked	Southwest	20.0	23.0	13.0	26.7	16.3	0.9
	West-central	22.6	25.7	11.1	23.1	16.8	0.7
	Northwest	33.3	21.1	12.0	20.1	10.7	2.8
	Combined	25.0	23.3	12.1	23.5	14.7	1.4
	Managers	19.5	9.8	0.0	19.5	51.2	0.0
Use of pheromones	Southwest	6.3	6.9	11.0	24.2	46.7	5.0
	West-central	3.4	6.8	12.1	26.7	49.0	1.9
	Northwest	4.4	4.6	14.1	30.0	42.8	4.1
	Combined	4.7	6.2	12.3	26.8	46.3	3.7
	Managers	0.0	2.5	7.5	25.0	65.0	0.0
Thinning the forest	Southwest	7.4	10.2	10.4	31.8	38.5	1.7
	West-central	6.3	12.1	9.9	33.3	37.9	0.5
	Northwest	5.3	12.7	11.4	36.3	30.7	3.6
	Combined	6.4	11.6	10.6	33.7	35.9	1.9
	Managers	0.0	20.0	12.5	17.5	47.5	2.5
Cut and burn on site	Southwest	5.0	8.0	7.1	35.2	43.6	1.1
	West-central	5.3	13.4	9.3	31.8	39.2	1.0
	Northwest	6.8	11.1	7.3	32.2	41.3	1.3
	Combined	5.6	10.7	7.9	33.2	41.5	1.1
	Managers	7.5	10.0	5.0	15.0	62.5	0.0
Harvesting	Southwest	5.6	4.8	6.7	29.3	52.5	1.1
	West-central	4.3	3.1	5.0	29.2	57.9	0.5
	Northwest	3.0	2.0	4.3	28.0	61.7	1.0
	Combined	4.4	3.4	5.4	28.8	57.1	0.9
	Managers	2.5	0.0	0.0	15.0	82.5	0.0
Adjusting harvest plans	Southwest	8.7	9.6	11.3	29.1	39.4	2.0
	West-central	3.6	6.9	7.7	26.3	54.8	0.7
	Northwest	3.5	4.0	8.1	25.4	57.4	1.5
	Combined	5.4	7.0	9.1	27.1	50.0	1.4
	Managers	2.4	0.0	0.0	14.6	82.9	0.0
Chemical control on small areas	Southwest	21.3	21.3	10.6	28.4	16.5	2.0
	West-central	15.5	14.8	8.8	33.1	27.1	0.7
	Northwest	14.2	11.2	10.0	33.9	28.7	2.0
	Combined	17.2	16.0	9.8	31.7	23.8	1.6
	Managers	7.3	21.9	19.5	17.1	34.1	0.0
Salvage logging	Southwest	5.2	3.3	3.9	17.4	69.3	0.9
	West-central	3.1	3.1	3.1	17.8	72.5	0.5
	Northwest	2.5	0.8	3.0	14.0	77.9	1.8
	Combined	3.7	2.4	3.4	16.5	73.0	1.0
	Managers	0.0	4.9	2.4	21.9	70.7	0.0

Table 13b. Mean<sup>1,2</sup> (and Standard Deviation) Acceptability of Management Options on Crown Land Used by the Forest Industry

	Southwest	West-central	Northwest	Combined	Managers
Prescribe burn areas attacked by the beetle	4.1 <sub>a</sub> (1.2)	4.1 <sub>a</sub> (1.1)	3.9 <sub>b</sub> (1.2)	4.0 (1.2)	4.2 <sub>ab</sub> (1.3)
Prescribe burn areas that are not yet attacked	3.0 <sub>a</sub> (1.4)	2.9 <sub>a</sub> (1.4)	2.5 <sub>b</sub> (1.4)	2.8 (1.4)	3.7 <sub>c</sub> (1.6)
Use of pheromones	4.0 <sub>a</sub> (1.2)	4.1 <sub>ab</sub> (1.1)	4.1 <sub>ab</sub> (1.1)	4.1 (1.1)	4.5 <sub>b</sub> (0.8)
Thinning the forest	3.9 <sub>a</sub> (1.3)	3.8 <sub>a</sub> (1.2)	3.8 <sub>a</sub> (1.2)	3.8 (1.2)	3.9 <sub>a</sub> (1.2)
Cut and burn on site	4.1 <sub>a</sub> (1.1)	3.9 <sub>a</sub> (1.2)	3.9 <sub>a</sub> (1.3)	4.0 (1.2)	4.2 <sub>a</sub> (1.3)
Harvesting	4.2 <sub>a</sub> (1.1)	4.3 <sub>ab</sub> (1.0)	4.4 <sub>b</sub> (0.9)	4.3 (1.0)	4.8 <sub>b</sub> (0.7)
Adjusting harvest plans	3.8 <sub>a</sub> (1.3)	4.2 <sub>b</sub> (1.1)	4.3 <sub>bc</sub> (1.0)	4.1 (1.2)	4.8 <sub>c</sub> (0.6)
Chemical control on small areas	3.0 <sub>a</sub> (1.4)	3.4 <sub>b</sub> (1.4)	3.5 <sub>b</sub> (1.4)	3.3 (1.4)	3.5 <sub>ab</sub> (1.4)
Salvage logging	4.4 <sub>a</sub> (1.1)	4.5 <sub>ab</sub> (0.9)	4.7 <sub>b</sub> (0.8)	4.5 (1.0)	4.6 <sub>ab</sub> (0.8)

<sup>1</sup> Rated on a scale from 1 = "Very unacceptable" to 5 = "Very acceptable."

<sup>2</sup> Any two means in a row that do not share a letter are significantly different at  $p < 0.05$  according to the Tukey-Kramer test.

Table 14a. Acceptability of Management Options in Provincial Parks and Protected Areas (%)

Management option	Region	Very unacceptable	Somewhat unacceptable	Neutral	Somewhat acceptable	Very acceptable	No opinion
Prescribe burn areas attacked by the beetle	Southwest	6.5	9.1	3.9	32.1	47.3	1.1
	West-central	8.7	9.6	5.1	35.6	40.6	0.5
	Northwest	8.8	11.3	7.3	38.3	33.0	1.3
	Combined	7.9	10.0	5.3	35.2	40.7	0.9
	Managers	2.4	7.3	0.0	17.1	73.2	0.0
Prescribe burn areas that are not yet attacked	Southwest	22.1	22.1	12.7	25.6	16.8	0.9
	West-central	26.6	23.5	12.6	22.0	14.5	0.7
	Northwest	36.3	20.3	11.7	20.1	9.1	2.5
	Combined	28.0	22.0	12.3	22.7	13.7	1.3
	Managers	9.8	9.8	4.9	21.9	53.7	0.0
Use of pheromones	Southwest	6.8	8.7	10.9	25.9	44.2	3.5
	West-central	4.8	7.5	11.1	27.1	48.3	1.2
	Northwest	6.8	4.8	10.1	29.1	45.1	4.1
	Combined	6.2	7.1	10.7	27.3	45.8	2.9
	Managers	2.4	7.3	2.4	19.5	65.9	2.4
Thinning the forest	Southwest	8.8	12.3	10.9	30.4	36.1	1.5
	West-central	10.6	12.1	11.1	35.8	30.0	0.5
	Northwest	9.6	14.4	10.4	32.6	29.8	3.3
	Combined	9.6	12.9	10.8	32.8	32.1	1.7
	Managers	12.5	10.0	12.5	20.0	42.5	2.5
Cut and burn on site	Southwest	5.9	10.4	6.7	34.5	41.2	1.3
	West-central	9.4	13.7	7.7	34.0	34.9	0.2
	Northwest	9.4	13.4	8.4	31.1	36.5	1.3
	Combined	8.1	12.4	7.6	33.3	37.7	0.9
	Managers	9.8	0.0	2.4	21.9	65.9	0.0
Harvesting	Southwest	11.4	9.6	7.9	25.8	43.2	2.2
	West-central	9.3	6.9	6.9	34.8	41.5	0.5
	Northwest	7.6	8.3	7.1	30.6	44.2	2.3
	Combined	9.5	8.3	7.3	30.2	43.0	1.7
	Managers	24.4	12.2	4.8	19.5	39.0	0.0
Adjusting harvest plans	Southwest	15.9	13.0	10.6	26.2	32.2	2.2
	West-central	10.6	9.7	9.7	29.2	38.4	2.4
	Northwest	8.4	10.7	11.2	27.3	40.1	2.3
	Combined	11.8	11.2	10.5	27.5	36.7	2.3
	Managers	17.1	9.8	9.8	14.6	41.5	7.3
Chemical control on small areas	Southwest	24.6	21.8	12.1	21.6	18.1	1.9
	West-central	21.5	12.9	9.1	27.8	28.2	0.5
	Northwest	16.7	13.7	7.6	34.4	25.8	1.8
	Combined	21.1	16.4	9.7	27.6	23.8	1.4
	Managers	12.2	19.5	14.6	19.5	34.1	0.0
Salvage logging	Southwest	9.9	7.6	5.2	20.1	56.6	0.7
	West-central	8.4	5.3	3.6	25.8	56.5	0.5
	Northwest	6.5	5.8	5.5	20.1	60.8	1.3
	Combined	8.4	6.3	4.8	22.0	57.9	0.8
	Managers	31.7	17.1	7.3	9.8	34.1	0.0

Table 14b. Mean<sup>1,2</sup> (and Standard Deviation) Acceptability of Management Options in Provincial Parks and Protected Areas

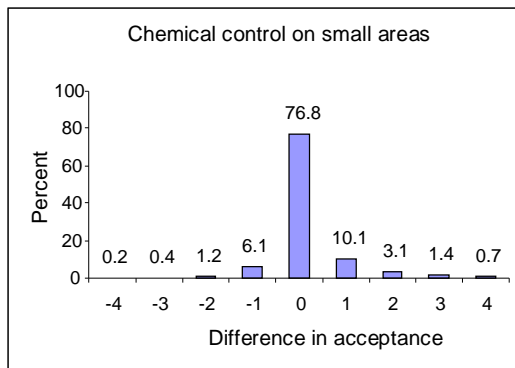
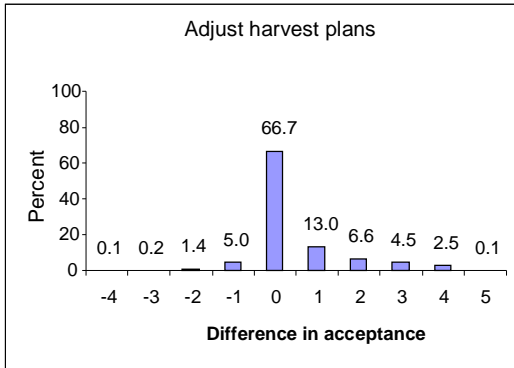
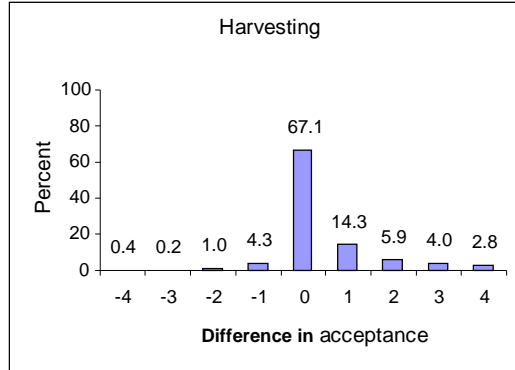
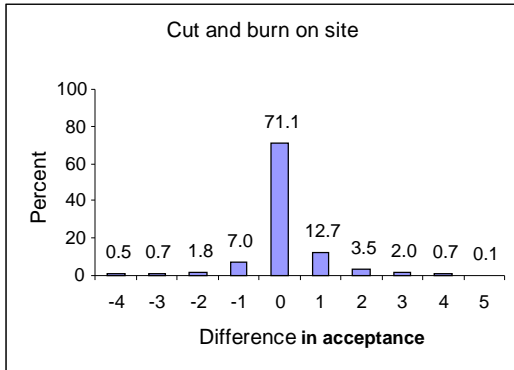
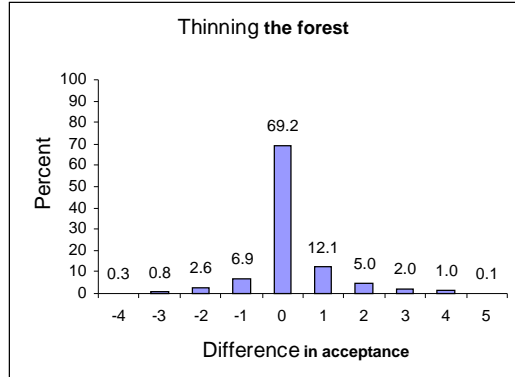
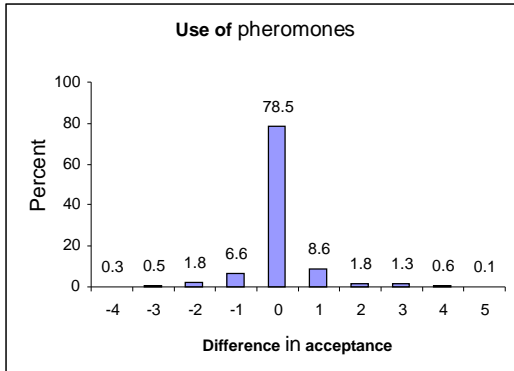
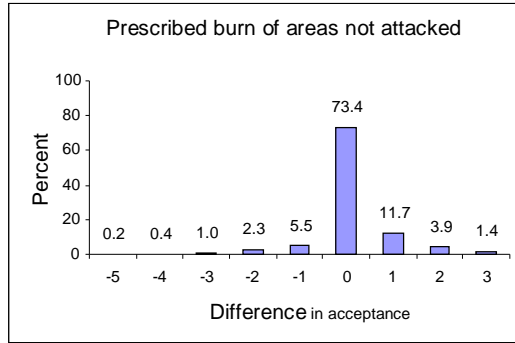
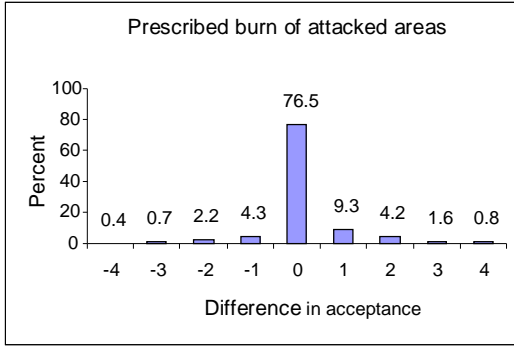
	Southwest	West-central	Northwest	Combined	Managers
Prescribe burn areas attacked by the beetle	4.1 <sub>a</sub> (1.2)	3.9 <sub>a,b</sub> (1.3)	3.8 <sub>b</sub> (1.3)	3.9 (1.3)	4.5 <sub>a</sub> (1.0)
Prescribe burn areas that are not yet attacked	2.9 <sub>a</sub> (1.4)	2.7 <sub>a</sub> (1.4)	2.4 <sub>b</sub> (1.4)	2.7 (1.4)	4.0 <sub>c</sub> (1.4)
Use of pheromones	4.0 <sub>a</sub> (1.3)	4.1 <sub>a</sub> (1.2)	4.1 <sub>a</sub> (1.2)	4.0 (1.2)	4.4 <sub>a</sub> (1.0)
Thinning the forest	3.7 <sub>a</sub> (1.3)	3.6 <sub>a</sub> (1.3)	3.6 <sub>a</sub> (1.3)	3.7 (1.3)	3.7 <sub>a</sub> (1.5)
Cut and burn on site	4.0 <sub>a</sub> (1.2)	3.7 <sub>b</sub> (1.3)	3.7 <sub>b</sub> (1.3)	3.8 (1.3)	4.3 <sub>a</sub> (1.2)
Harvesting	3.8 <sub>a</sub> (1.4)	3.9 <sub>b</sub> (1.3)	4.0 <sub>b</sub> (1.3)	3.9 (1.3)	3.4 <sub>a</sub> (1.7)
Adjusting harvest plans	3.5 <sub>a</sub> (1.5)	3.8 <sub>b</sub> (1.3)	3.8 <sub>b</sub> (1.3)	3.7 (1.4)	3.6 <sub>a,b</sub> (1.6)
Chemical control on small areas	2.9 <sub>a</sub> (1.5)	3.3 <sub>b</sub> (1.5)	3.4 <sub>b</sub> (1.4)	3.2 (1.5)	3.4 <sub>a,b</sub> (1.4)
Salvage logging	4.1 <sub>a</sub> (1.4)	4.2 <sub>a</sub> (1.2)	4.2 <sub>a</sub> (1.2)	4.2 (1.3)	3.0 <sub>b</sub> (1.7)

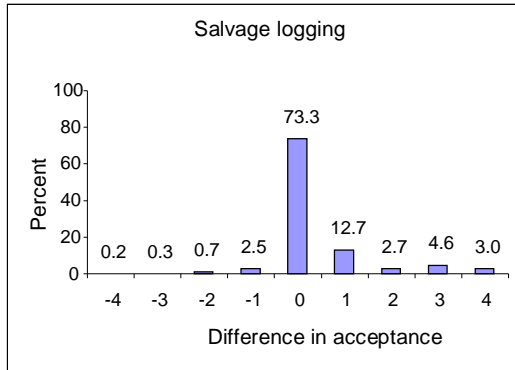
<sup>1</sup> Rated on a scale from 1 = "Very unacceptable" to 5 = "Very acceptable."

<sup>2</sup> Any two means in a row that do not share a letter are significantly different at  $p < 0.05$  according to the Tukey-Kramer test.

To examine further the similarity in responses for acceptability of management options on Crown land and protected areas, we subtracted each individual's response for management in protected areas from his/her response for management on Crown land used by the forest industry. For example, if an option for Crown land was rated 4 (somewhat acceptable) but 3 (neutral) for protected areas, the result is +1. A positive value indicates the respondent viewed the option as more acceptable on Crown lands. A zero indicates the respondent rated the acceptability the same for both Crown lands and protected areas. A negative value indicates the option was rated as less acceptable for Crown lands. Graphs for each option are shown below.

The graphs demonstrate that most respondents made no distinction between Crown land used by the forest industry, on the one hand, and parks and protected areas, on the other hand, in terms acceptability of the options (i.e., the majority of response comparisons equal zero). The management options where the difference is greatest are harvesting activities, such as harvesting and salvage logging. Actions most likely to be preferred in protected areas versus Crown land are the use of pheromones and prescribed burns of areas already attacked, although here also almost 90% of respondents show no difference in acceptability.





We examined respondents’ comments to provide insight into the reasons for the lack of support for prescribed burns. The primary concern was the effect of smoke on people’s health. There were also concerns about the potential for burns to get out of control, waste of timber resources, and impacts on tourism. The following quotes provide examples of these themes.

People in the southwest cited their personal experiences with impacts on their health and tourism:

*“Smoke from prescribed burns has strongly affected my health and my enjoyment of outdoor activities. For that reason I am against prescribed burns.”*

*“The most recent prescribed burn (Nestor?) had a dreadful impact on people living within the immediate Bow Valley and Calgary area. It is appreciated that much effort is required to complete a prescribed burn, but the breathing and health quality of the air for 2 weeks was unacceptable.”*

*“We have a very short summer in the mountains and without exception Parks start burns on beautiful long weekends. Town and the Park tourism suffers.”*

*“Tourists don't want to see dead forests. Tourists will leave if it's too smoky. Fire should be used sparingly. 2003 was a miserable here due to fires. We need to be able to make a livelihood to live here.”*

Respondents in the west-central and northwest regions expressed concern over prescribed fires burning out of control:

*“I very much distrust the practice of prescribed burning as it often seems to get out of control (e.g., east side of highway in Jasper National Park).” [Northwest]*

*“As far as I've see, most times control burns are used they become uncontrolled burns and do as much or more damage.” [West-central]*

*“The forestry goes into an area to (so called) do control burning for whatever reason (Pine beetles) etc. and invariably the fire gets away and makes a larger disaster than pine beetle does.” [West-central]*

One northwest respondent viewed prescribed burning as a waste:

*“As with any natural resource I dislike the thought of wasting it through burns.”*

### **3.4.3 Effectiveness of Management Options**

Prescribed burning infested areas had the highest effectiveness rating. About 77% of the public respondents viewed prescribed burning infested areas as somewhat or very effective in controlling MPB (Table 15a). This was followed by cutting and burning infested trees on-site, with 71% of public respondents rating this option as somewhat or very effective. Prescribed burning of uninfested areas was viewed as the least effective option, with 44% rating it as somewhat or very effective.

Management options with the highest percentage of residents rating them as very effective were harvesting infested trees (33%), adjusting harvest plans to harvest healthy but susceptible areas (32%), cutting and burning infested trees on-site (28%), and prescribed burning of infested areas (27%). Only 12% and 15% rated prescribed burning of uninfested areas and adjusting harvest plans as very effective, respectively.

There were few differences among the regions in perceived effectiveness of management options. The respondents in the southwest viewed adjusting harvest plans as less effective than those in the other regions, whereas the respondents in the northwest viewed prescribed burning of uninfested areas as less effective than those in the other regions (Table 15b).

The land managers rated most of the management actions as somewhat or very effective in controlling the beetle. However, thinning healthy trees before they are attacked and using chemicals on small areas were rated as effective by a minority of managers (Table 15a). Managers and the public were similar in their views of effectiveness of most options. Managers, however, rated prescribed burning of infested areas and thinning healthy trees as significantly and substantively less effective than did public respondents (Table 15b).

Respondents' comments provide some insight into the reasons that MPB controls might be viewed as ineffective. One theme that we identified was related to the MPB being part of nature; as such, only natural controls were viewed as effective.



*“I think it’s a losing battle. We can contain its spread and slow the spread, but not stop it. The original spread was due to climate change, and only climate change will totally end it. I believe the climate will cause more changes to our natural environment in the near future. Maybe it’s time to give up the beetle fight and start spending on post-beetle plan (replacing our forests with trees resistant to beetle attacks).” [Southwest]*

*“The spread of the beetle will be rapid and likely all our attempts at halting its advance will be futile. Until we can get a prolonged cold spell to naturally halt them I think we're out of luck.” [Northwest]*

Another theme related to the continuing spread of the beetle as evidence that controls were not effective.

*“Regardless of measures taken, the beetle infestation is still spreading, which leads me to believe that not enough is being done to prevent it, or the particular measures are ineffective. I think a lot more needs to be done to prevent and control the beetle.” [West-central]*

*“From what I've seen, my sense is that the attempt at controlling the pine beetle, while commendable, is doomed to failure. The infestation this year is worse than the previous 2, at least at my place.” [Northwest]*

The beetle destruction in BC was also cited as evidence of the ineffectiveness of controls.

*“I personally think that we really are at the mercy of Mother Nature - if there were viable means of ‘eradicating’ the pine beetle then surely a province like BC would have done so before their forests were decimated.” [West-central]*

*“I think control (by agencies, etc.) of Mountain Pine Beetle will be largely ineffective except in select ‘high-value’ areas. My impression is that, in BC, control has not been very effective and they have moved on to salvage the remaining economic value and clean up.” [Southwest]*

Table 15a. Views on the Effectiveness of Management Options in the Region (%)

Management option	Region	Very ineffective	Somewhat ineffective	Neutral	Somewhat effective	Very effective	No opinion
Prescribe burn areas attacked by the beetle	Southwest	5.9	7.8	5.0	48.2	28.8	4.4
	West-central	5.4	9.5	5.6	50.5	27.1	2.0
	Northwest	6.6	10.1	4.5	50.6	24.7	3.5
	Combined	5.9	9.1	5.1	49.7	26.9	3.3
	Managers	14.6	26.8	2.4	39.1	17.1	0.0
Prescribe burn areas that are not yet attacked	Southwest	15.3	17.1	14.2	32.8	13.1	7.4
	West-central	14.5	18.7	17.0	33.4	13.5	3.0
	Northwest	19.5	20.6	18.5	28.7	8.4	4.3
	Combined	16.4	18.7	16.5	31.7	11.8	5.0
	Managers	19.5	14.6	2.4	48.8	14.6	0.0
Use of pheromones	Southwest	4.4	7.6	14.6	42.6	18.8	12.0
	West-central	3.4	8.1	17.8	44.4	22.7	3.7
	Northwest	3.6	6.4	15.8	49.5	17.9	6.9
	Combined	3.8	7.4	16.0	45.3	19.8	7.7
	Managers	10.0	12.5	15.0	52.5	10.0	0.0
Thinning the forest	Southwest	7.2	18.4	13.1	40.7	15.1	5.5
	West-central	8.8	13.4	14.6	44.9	16.6	1.7
	Northwest	7.4	16.0	13.0	43.5	16.3	3.8
	Combined	7.8	16.0	13.6	42.9	16.0	3.7
	Managers	19.5	24.4	21.9	29.3	2.4	2.4
Cut and burn on site	Southwest	5.0	8.7	9.4	43.8	28.8	4.4
	West-central	8.1	9.6	12.6	41.4	26.9	1.5
	Northwest	4.8	9.8	9.6	45.8	27.7	2.3
	Combined	5.9	9.4	10.5	43.7	27.8	2.8
	Managers	7.3	17.1	4.9	43.9	26.8	0.0
Harvesting	Southwest	6.4	9.0	11.7	39.9	27.5	5.5
	West-central	5.1	6.9	8.1	44.5	33.7	1.7
	Northwest	2.8	6.6	6.4	44.2	37.6	2.5
	Combined	4.9	7.6	8.8	42.7	32.7	3.3
	Managers	4.9	7.3	4.9	36.6	46.3	0.0
Adjusting harvest plans	Southwest	7.7	10.7	13.8	37.2	23.9	6.8
	West-central	4.7	6.9	10.0	40.8	35.0	2.7
	Northwest	3.3	5.8	10.9	39.5	37.0	3.5
	Combined	5.3	7.9	11.7	39.1	31.6	4.4
	Managers	5.0	10.0	0.0	42.5	42.5	0.0
Chemical control on small areas	Southwest	14.4	12.5	16.2	33.3	14.4	9.2
	West-central	12.9	11.4	13.4	38.0	20.7	3.7
	Northwest	11.3	9.1	12.6	41.1	21.9	4.0
	Combined	13.0	11.1	14.2	37.2	18.8	5.8
	Managers	21.9	17.1	21.9	24.4	12.2	2.4

Table 15b. Means<sup>1, 2</sup> (and Standard Deviation) of the Effectiveness of Management Options in the Region

	Southwest	West-central	Northwest	Combined	Managers
Prescribe burn areas attacked by the beetle	3.9 <sub>a</sub> (1.1)	3.9 <sub>a</sub> (1.1)	3.8 <sub>a</sub> (1.1)	3.9 (1.1)	3.2 <sub>b</sub> (1.4)
Prescribe burn areas that are not yet attacked	3.1 <sub>a</sub> (1.3)	3.1 <sub>a</sub> (1.3)	2.9 <sub>b</sub> (1.3)	3.0 (1.3)	3.2 <sub>a,b</sub> (1.4)
Use of pheromones	3.7 <sub>a</sub> (1.0)	3.8 <sub>a</sub> (1.0)	3.8 <sub>a</sub> (1.0)	3.8 (1.0)	3.4 <sub>a</sub> (1.2)
Thinning the forest	3.4 <sub>a</sub> (1.2)	3.5 <sub>a</sub> (1.2)	3.5 <sub>a</sub> (1.2)	3.4 (1.2)	2.7 <sub>b</sub> (1.2)
Cut and burn on site	3.9 <sub>a</sub> (1.1)	3.7 <sub>a</sub> (1.2)	3.8 <sub>a</sub> (1.1)	3.8 (1.1)	3.7 <sub>a</sub> (1.3)
Harvesting	3.8 <sub>a</sub> (1.2)	4.0 <sub>a,b</sub> (1.1)	4.1 <sub>b</sub> (1.0)	3.9 (1.1)	4.1 <sub>a,b</sub> (1.1)
Adjusting harvest plans	3.6 <sub>a</sub> (1.2)	4.0 <sub>b</sub> (1.1)	4.0 <sub>b</sub> (1.0)	3.9 (1.1)	4.1 <sub>a,b</sub> (1.1)
Chemical control on small areas	3.2 <sub>a</sub> (1.3)	3.4 <sub>a,b</sub> (1.3)	3.6 <sub>b</sub> (1.3)	3.4 (1.3)	2.9 <sub>a</sub> (1.4)

<sup>1</sup> Rated on a scale from 1 = "Very ineffective" to 5 = "Very effective."

<sup>2</sup> Any two means in a row that do not share a letter are significantly different at  $p < 0.05$  according to the Tukey-Kramer test.

In addition to the effectiveness of specific management options, we also asked respondents their views on controlling the MPB infestation in Alberta. Only about 31% of the public respondents thought that it was likely or very likely that current management actions in Alberta will stop the spread of the MPB within the next 5 years (Table 16a). There appears to be considerable uncertainty among the public, with about 19% selecting the "not sure" response.

The land managers were not as optimistic about controlling the MPB, with about 69% indicating it was unlikely (37%) or very unlikely (32%) that the MPB would be controlled in the next 5 years. The mean responses show that managers view short-term control of the MPB as significantly less likely than does the public (Table 16b).

Similarly, about 50% of public respondents and 60% of the land managers either somewhat or strongly agreed that natural processes (such as weather) are the only effective means in controlling the MPB (Table 17a). More than 60% of residents in all regions agreed that climate change will be a major contributor to MPB outbreaks in the future (Table 18a). Similarly, about 61% of managers agreed that climate change will contribute to future outbreaks.

There was little variation in these views among the regions (Table 17b and 18b). Based on mean ratings, there were no significant differences among respondents in the regions in views that current management action will stop the spread of MPB in 5 years.

Respondents in the southwest indicated slightly stronger agreement than those in the northwest that natural processes are the only effective means of control and also indicated slightly stronger agreement than the other regions that climate change will be a major contributor to MPB outbreaks.

Table 16a. Likelihood That Management Action Will Stop Spread of MPB Within 5 Years (%)

Region	Very unlikely	Unlikely	Likely	Very likely	Not sure
Southwest	15.2	38.5	20.3	7.5	18.6
West-central	11.2	35.2	24.6	8.4	20.6
Northwest	14.4	34.8	24.1	8.7	17.9
Combined	13.7	36.3	22.9	8.2	19.0
Managers	31.7	36.6	21.9	7.3	2.4

Table 16b. Mean<sup>1,2</sup> (and Standard Deviation) Likelihood That Management Action Will Stop Spread of MPB Within 5 Years

Southwest	West-central	Northwest	Combined	Managers
2.8 <sub>a</sub>	2.9 <sub>a</sub>	2.8 <sub>a</sub>	2.8	2.1 <sub>b</sub>
(1.3)	(1.3)	(1.3)	(1.3)	(1.0)

<sup>1</sup> Rated on a scale from 1 = "Very unlikely" to 5 = "Very likely."

<sup>2</sup> Any two means in a row that do not share a letter are significantly different at  $p < 0.05$  according to the Tukey-Kramer test.

Table 17a. Natural Processes Are the Only Effective Means in Controlling MBP (%)

Region	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree	No opinion
Southwest	13.6	22.3	7.8	38.9	16.2	1.3
West-central	14.9	26.0	10.8	32.5	14.9	1.0
Northwest	17.1	27.7	8.9	30.7	13.9	1.7
Combined	15.1	25.2	9.1	34.2	15.0	1.3
Managers	5.0	27.5	7.5	40.0	20.0	0.0

Table 17b. Mean<sup>1,2</sup> (and Standard Deviation) Natural Processes Are the Only Effective Means in Controlling MBP

Southwest	West-central	Northwest	Combined	Managers
3.2 <sub>a</sub>	3.1 <sub>ab</sub>	3.0 <sub>b</sub>	3.1	3.4 <sub>ab</sub>
(1.3)	(1.3)	(1.4)	(1.3)	(1.2)

<sup>1</sup> Rated on a scale from 1 = "Strongly disagree" to 5 = "Strongly agree."

<sup>2</sup> Any two means in a row that do not share a letter are significantly different at  $p < 0.05$  according to the Tukey-Kramer test.

Table 18a. Climate Change Will Be a Major Contributor to Future MPB Outbreaks (%)

Region	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree	No opinion
Southwest	6.0	6.4	11.2	39.9	31.6	4.9
West-central	6.5	11.5	13.7	36.9	27.1	4.3
Northwest	7.0	11.4	13.9	39.3	22.9	5.5
Combined	6.5	9.7	12.8	38.8	27.4	4.9
Managers	9.8	12.2	17.1	19.5	41.5	0.0

Table 18b. Mean<sup>1,2</sup> (and Standard Deviation) Climate Change Will Be a Major Contributor to Future MPB Outbreaks

Southwest	West-central	Northwest	Combined	Managers
3.9 <sub>a</sub> (1.1)	3.7 <sub>b</sub> (1.2)	3.6 <sub>b</sub> (1.2)	3.7 (1.2)	3.7 <sub>ab</sub> (1.4)

<sup>1</sup> Rated on a scale from 1 = “Strongly disagree” to 5 = “Strongly agree.”

<sup>2</sup> Any two means in a row that do not share a letter are significantly different at  $p < 0.05$  according to the Tukey-Kramer test.

### 3.4.4 Satisfaction with the Response

To assess satisfaction with the response to MPB in the regions, we asked respondents their satisfaction with the overall response and with the response of specific management agents. A slight majority of respondents were satisfied with the overall response to MPB in their region (Table 19a). About 53% indicated they were somewhat or very satisfied with the response. The most common response (44%) was somewhat satisfied; less than 10% indicated they were very dissatisfied. Managers expressed a higher level of satisfaction, with 24% indicating they were very satisfied. A comparison of mean ratings, however, showed no significant differences among regions or between regions and land managers on overall satisfaction (Table 19b).

Table 19a. Overall Satisfaction With Response to MPB (%)

Region	Very dissatisfied	Somewhat dissatisfied	Neutral	Somewhat satisfied	Very satisfied	No opinion
Southwest	6.0	15.2	16.0	47.2	8.1	7.5
West-central	5.8	18.6	13.7	45.1	8.9	8.0
Northwest	7.0	19.8	15.0	40.5	7.8	10.0
Combined	6.2	17.7	15.0	44.4	8.3	8.4
Managers	2.4	19.5	12.2	41.5	24.4	0.0

Table 19b. Mean <sup>1,2</sup> (and Standard Deviation) of Overall Satisfaction With Response to MPB

Southwest	West-central	Northwest	Combined	Managers
3.4 <sub>a</sub> (1.1)	3.4 <sub>a</sub> (1.1)	3.2 <sub>a</sub> (1.1)	3.3 (1.1)	3.6 <sub>a</sub> (1.1)

<sup>1</sup> Rated on a scale from 1 = "Very dissatisfied" to 5 = "Very satisfied."

<sup>2</sup> Any two means in a row that do not share a letter are significantly different at  $p < 0.05$  according to the Tukey-Kramer test.

Public respondents, however, appear to be less satisfied with responses of individual agents (Table 20a). The provincial government had the highest satisfaction rating, with 46% of public respondents indicating they were somewhat or very satisfied, followed by the forest industry (40%), national parks (38%), municipal government (35%), and private landowners (16%). In rating their satisfaction with the individual agents, a large percentage of respondents chose the no opinion and neutral responses, suggesting that they do not have a good understanding of what each agent is doing in response to the MPB outbreak.

There was some variation among the regions in satisfaction with agents. The respondents in the southwest were more satisfied with the national park response than those in the other regions. The respondents in the southwest were also less satisfied with the forest industry response than those in the northwest region and more satisfied with municipal government response than those in the west-central region.

Managers expressed satisfaction with the response of provincial government agencies and the forest industry: 63% and 73% were somewhat or very satisfied with provincial government agencies and the forest industry, respectively. Only 42% and 32% were somewhat or very satisfied with the response of municipal governments and national parks, respectively. Land managers were significantly and substantively more satisfied with the forest industry than respondents in all regions (Table 20b).

Potential reasons for dissatisfaction with the response to the MPB infestation were revealed in respondents' comments. We identified four themes that might be contributing to dissatisfaction. One theme related to the timeliness of the response.

*"I believe that Alberta was/is too slow to respond to the environmental and economical issues related to the very obvious and releveltness, fast-moving pine beetle."* [Southwest]

*"By the time the forestry department even realized that we had a problem and then watched it develop and then tried to come up with some prevention or management with this problem - it was too late as usual."* [Northwest]

*"Too little, too late. The government got caught with their pants down. We witnessed the beetle in BC many years ago, before it came to Alberta. I believe the government... let it get so out of hand that they cannot control it any longer. The control measures attempted in our community were ineffective and only half heartedly attempted."* [Northwest]

Another theme related to the level of effort.

*“Some parts of Northern Alberta have been neglected by Provincial Government priorities. Now these neglected areas are heavily infested, and funding is being cutback. The government needs to become more aggressive in Northern Alberta to prevent further outbreak.” [Northwest]*

Some commented that funds would be better spent on other issues.

*“Money should be used elsewhere to help fund education and the needy with social programs.” [Southwest]*

The lack of response by private landowners was also identified as a concern.

*“I am dismayed to see that private land owners have not even bothered to destroy their badly infected windbreaks.” [Northwest]*

*“Why don’t the municipal governments insist land owners destroy infected trees prior to the beetles flying in July? It appears everyone just puts up with it and is willing to lose trees.” [Northwest]*

There were also words of encouragement for and appreciation of the MPB response. Respondents in the west-central region wrote:

*“SRD is doing a great job in controlling the pine beetle in Alberta. Don't give up.”*

*“Thank you SRD for their continued efforts to monitor and educate the public. Help keep us green.”*

And respondents in the southwest commented:

*“Ongoing efforts to control the mountain pine beetle are vitally essential. Appreciate all that is being done.”*

*“Appreciate all efforts and resources currently in place to manage the pine beetle problem. Thanks!”*

Table 20a. Satisfaction With Regional Response to MPB (%)

Agent	Region	Very dissatisfied	Somewhat dissatisfied	Neutral	Somewhat satisfied	Very satisfied	No opinion
Provincial government agencies	Southwest	6.5	11.3	18.2	40.9	9.1	14.1
	West-central	6.3	15.6	17.5	36.7	10.0	13.9
	Northwest	6.5	13.3	22.3	33.5	5.5	19.0
	Combined	6.4	13.3	19.3	37.2	8.3	15.6
	Managers	9.8	14.6	12.2	26.8	36.6	0.0
National parks	Southwest	5.4	9.5	18.6	38.0	10.4	18.1
	West-central	9.3	15.9	20.3	30.1	7.6	16.9
	Northwest	5.1	11.7	25.7	21.1	4.6	31.8
	Combined	6.6	12.3	21.3	30.2	7.7	22.0
	Managers	22.0	24.4	9.8	19.5	12.2	12.2
Your municipal government	Southwest	7.1	14.7	23.3	27.2	11.6	16.2
	West-central	7.6	16.9	29.1	23.5	3.9	19.1
	Northwest	8.3	16.6	19.9	30.5	8.1	16.6
	Combined	7.6	16.0	24.1	27.0	8.0	17.2
	Managers	9.8	17.1	19.5	29.3	12.2	12.2
Forest industry	Southwest	10.2	13.8	18.6	23.1	7.1	27.2
	West-central	7.8	16.8	15.6	38.5	8.5	12.7
	Northwest	7.6	13.9	19.7	35.8	9.6	13.6
	Combined	8.6	14.8	18.0	32.1	8.4	18.3
	Managers	0.0	7.3	17.1	36.6	36.6	2.4
Private landowners	Southwest	3.9	11.0	35.9	8.4	2.2	38.5
	West-central	5.6	13.1	39.4	12.7	1.7	27.5
	Northwest	8.6	15.7	29.1	19.5	5.1	22.0
	Combined	5.9	13.2	34.9	13.3	2.9	29.8
	Managers	4.9	12.2	36.6	14.4	9.8	22.0

Table 20b. Mean<sup>1,2</sup> (and Standard Deviation) Satisfaction With Regional Response to MPB

	Southwest	West-central	Northwest	Combined	Managers
Provincial government (provincial parks, provincial forestry)	3.4 <sub>a</sub> (1.1)	3.3 <sub>a</sub> (1.1)	3.2 <sub>a</sub> (1.1)	3.3 (1.1)	3.7 <sub>a</sub> (1.4)
Regional National Park	3.5 <sub>a</sub> (1.1)	3.1 <sub>b</sub> (1.2)	3.1 <sub>b</sub> (1.0)	3.3 (1.1)	2.7 <sub>b</sub> (1.4)
Your municipal government	3.3 <sub>a</sub> (1.2)	3.0 <sub>b</sub> (1.0)	3.2 <sub>a,b</sub> (1.2)	3.1 (1.1)	3.2 <sub>a,b</sub> (1.2)
Forest industry	3.0 <sub>a</sub> (1.2)	3.3 <sub>a,b</sub> (1.1)	3.3 <sub>b</sub> (1.1)	3.2 (1.2)	4.1 <sub>c</sub> (0.9)
Private landowners	2.9 <sub>a</sub> (0.8)	2.9 <sub>a</sub> (0.9)	3.0 <sub>a</sub> (1.1)	2.9 (0.9)	3.2 <sub>a</sub> (1.1)

<sup>1</sup> Rated on a scale from 1 = "Very dissatisfied" to 5 = "Very satisfied."

<sup>2</sup> Any two means in a row that do not share a letter are significantly different at  $p < 0.05$  according to the Tukey-Kramer test.



### 3.5 Trust in Management

To examine trust in management, we first presented general statements of trust in the provincial government and the forest industry. About 45% of public respondents either somewhat or strongly agreed that the provincial government does a good job of providing information about MPB management activities, and about 48% trusted the provincial government to implement a responsible and effective MPB program (Table 21a). About 37%, however, disagreed that the provincial government does a good job of providing information, and 33% did not trust the provincial government to implement a responsible and effective MPB program. Similarly, about 35% agreed that the forest industry is doing a good job of managing the forest to prevent the spread of MPB, and 45% trusted the industry to adjust its practices to minimize the impacts of MPB. About 33% of respondents neither trusted the industry to adjust its practices nor agreed that the industry is doing a good job of managing the forest for MPB.

Respondents in the southwest differed from those in the other regions in giving lower mean ratings on trust statements related to the forest industry (i.e., they were less trusting of the forest industry) (Table 21b).

Managers showed a high level of trust in both the provincial government and forest industry. More than 60% either somewhat or strongly agreed that the provincial government does a good job of providing information, that they trust the provincial government to implement a responsible and effective beetle program, that the forest industry is doing a good job of managing the forest to prevent the spread of MPB, and that they trust the industry to adjust its practices to minimize beetle impacts. Land managers differed from respondents in the regions in having significantly higher mean trust ratings for both the provincial government and the forest industry (Table 21b).

Some of the public respondents' comments reflected their trust in land managers:

*"It is my opinion that this is a serious threat to our forests and than any and all measures need to be taken to ensure the future of our forests. I have confidence in the professionals to control this issue and hope that they do anything necessary to stop its growth and population here in Alberta."* [West-central]

*"I don't know much about the pine beetle and I entrust our provincial government to enable resources and expertise to manage elimination of the BEETLE."* [West-central]

Respondents' comments also provide insight into why they did not trust the forest industry. Concerns with the industry included impacts of logging, past forest industry activity, and more extensive logging being rationalized for MPB control. The following quotes represent examples of these concerns.

A resident in the northwest region noted:

*“What I disagree with is letting CANFOR and Weyerhaeuser increase their cuts to get ahead of the beetle. I work in the forest every day, and most of the folks I talk to believe the forest companies are taking advantage of this situation for profit. ... we believe the FMA agreements give the Forest companies too much power and the provincial government has no control on them!”*

A similar view was expressed by a resident in the southwest:

*“I believe in general, the forest industry utilizes the mountain pine beetle excuse as justification to harvest a greater amount of healthy trees; all for the mighty dollar.”*

Another resident in the northwest region noted the waste and impact on non-timber values associated with logging in the area:

*“The forest industry is taking advantage of the pine beetle to log big patches of timber in our area and they leave the poplar either laying on the ground to rot or they pile them and burn them. They are totally destroying any trails in the area and making it impossible to travel on any logged out area - by walking - or quadding. ... There is no reason to take down the poplar trees. ... It is a total disaster what they are doing in the name of the pine beetle. They are also cutting unaffected trees and leaving a lot of dead (Pine beetle) trees standing which will fall down. You don't see hardly any animals in the area anymore.”*

Several respondents in the west-central region cited past logging activities as a reason for not trusting the industry to manage the MPB:

*“I lived in the Bow Crow Forest west of Sundre, and watched the logging companies rape the forests for years. They took more than they were supposed to, logged right down across creeks, mainly had their own way. They were told they could not go back to some areas for 10 or 20 years. The logging companies are now using the excuse of the pine beetle to go into those areas and take what little they left the first time around, including a huge amount of spruce. The government needs stop listening to the forest industry and put some knowledgeable people in charge. I believe that the forest industry has very little knowledge of the pine beetle.”*

Table 21a. Trust in the Provincial Government and Forest Industry (%)

Statements	Region	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree	No opinion
The provincial government does a good job of providing information about its mountain pine beetle management activities	Southwest	10.5	25.2	16.5	37.8	7.7	2.4
	West-central	9.6	31.3	13.5	34.0	8.2	3.4
	Northwest	9.3	25.3	12.8	40.1	7.0	5.5
	Combined	9.8	27.2	14.4	37.3	7.6	3.7
	Managers	2.4	19.5	2.4	36.6	39.0	0.0
I trust the provincial government to implement a responsible and effective mountain pine beetle management program	Southwest	10.9	22.1	15.6	38.1	10.7	2.6
	West-central	10.1	23.6	16.4	34.9	12.7	2.4
	Northwest	10.8	21.8	16.3	38.0	10.3	3.0
	Combined	10.6	22.5	16.1	37.0	11.2	2.7
	Managers	4.9	19.5	12.2	34.2	29.3	0.0
The forest industry is doing a good job of managing the forest to prevent the spread of the beetle	Southwest	12.2	22.8	24.0	20.0	4.1	17.0
	West-central	8.9	19.2	22.8	32.2	10.8	6.0
	Northwest	9.0	21.5	21.3	32.5	7.0	8.8
	Combined	10.1	21.2	22.8	27.9	7.2	10.8
	Managers	2.4	12.2	19.5	41.5	21.9	2.2
I trust the forest industry to adjust its practices to minimize the impacts from the beetle	Southwest	18.8	23.3	17.3	26.5	7.5	6.6
	West-central	11.0	20.4	13.9	35.5	16.1	3.1
	Northwest	8.8	20.3	17.0	38.6	11.0	4.3
	Combined	13.2	21.4	16.1	33.2	11.4	4.8
	Managers	2.4	19.5	14.6	34.1	26.8	2.4

Table 21b. Mean <sup>1,2</sup> (and Standard Deviation) of Trust in the Provincial Government and Forest Industry

	Southwest	West-central	Northwest	Combined	Managers
The provincial government does a good job of providing information about its mountain pine beetle management activities	3.1 <sub>a</sub> (1.2)	3.0 <sub>a</sub> (1.2)	3.1 <sub>a</sub> (1.2)	3.1 (1.2)	3.9 <sub>b</sub> (1.2)
I trust the provincial government to implement a responsible and effective mountain pine beetle management program	3.2 <sub>a</sub> (1.2)	3.2 <sub>a</sub> (1.2)	3.2 <sub>a</sub> (1.2)	3.2 (1.2)	3.6 <sub>a</sub> (1.2)
The forest industry is doing a good job of managing the forest to prevent the spread of the beetle	2.8 <sub>a</sub> (1.1)	3.2 <sub>b</sub> (1.2)	3.1 <sub>b</sub> (1.1)	3.0 (1.2)	3.7 <sub>c</sub> (1.0)
I trust the forest industry to adjust its practices to minimize the impacts from the beetle	2.8 <sub>a</sub> (1.3)	3.3 <sub>b</sub> (1.3)	3.2 <sub>b</sub> (1.2)	3.1 (1.3)	3.7 <sub>b</sub> (1.2)

<sup>1</sup> Rated on a scale from 1 = "Strongly disagree" to 5 = "Strongly agree."

<sup>2</sup> Any two means in a row that do not share a letter are significantly different at  $p < 0.05$  according to the Tukey-Kramer test.

There are several dimensions of trust that can influence social acceptance in natural resource management. To examine which dimensions might be relevant to MPB management, we used a series of statements related to openness and fairness, competency and commitment, faith in management, and personal interaction to assess the trust in the provincial government, the agency responsible for the management of MPB in Alberta.

There was a mixed response on openness and fairness statements (Table 22a). A minority of public respondents either somewhat or strongly agreed that all relevant points of view are considered (34%) and that there is openness to new ideas and alternative points of view (38%). A minority, however, also somewhat or strongly agreed that information is biased and one-sided (25%) and that the government is too influenced by the forest industry (37%). There was a high percentage of no opinion and neutral responses among the public with nearly 50% of residents choosing these responses on some of the openness and fairness statements. This suggests that the public is not familiar with information provided by the provincial government or public involvement in MPB decision making.

The highest agreement was on the competency and commitment of the provincial government. About 50% of the public either somewhat or strongly agreed that the provincial government has the necessary expertise to manage the MPB, and 67% either somewhat or strongly agreed that the provincial government is committed to reducing impacts from the MPB.

There was also agreement that MPB control is in the best interest of Albertans (84% either somewhat or strongly agreed). A majority of public respondents also agreed that they have opportunities to learn the reasons for management actions and they understand why specific actions have been taken. However, a minority (39%) felt that the response to MPB reflects their values and opinions.

Respondents from different regions differed on only one statement. Those in the southwest indicated significantly higher agreement than those in other regions that the provincial government is too influenced by the forest industry (Table 22b).

Land managers exhibited a high level of trust in the provincial government. Most managers rated the provincial government as open and fair. Only 15% and 20% respectively, agreed or somewhat agreed that information is biased and one-sided and that the government is too influenced by the forest industry, respectively. In contrast, most agreed or somewhat agreed that all relevant points of view are considered (63%) and that there is openness to new ideas and alternative points of view (73%). Land managers also had a high level of agreement on competency and commitment: 70% either somewhat or strongly agreed that the government has the expertise, and 83% either somewhat or strongly agreed that it is committed to reducing impacts. About 70% of land managers either somewhat or strongly agreed that the response to MPB reflected their values.

A comparison of the mean ratings shows that land managers are significantly more trusting of the provincial government than are the public respondents (Table 22b). For example, land managers consistently viewed the provincial government as more open and fair and had more confidence in government expertise. Regarding personal interaction with government, the managers indicated a more positive experience, had higher agreement that the response to the MPB reflects their values, and greater opportunity to learn the reasons for management decisions.

Table 22a. Dimensions of Trust Related to MPB Management (%)

Statements	Region	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree	No opinion
Openness and fairness:							
Provincial government information about the mountain pine beetle tends to be biased and one-sided	Southwest	6.9	20.7	30.6	19.2	6.0	16.6
	West-central	7.3	17.7	35.8	20.1	5.3	13.8
	Northwest	6.5	20.9	34.4	19.1	5.5	13.6
	Combined	6.9	19.8	33.5	19.5	5.7	14.8
	Managers	25.0	42.5	17.5	7.5	7.5	0.0
In managing the mountain pine beetle, the provincial government considers all relevant points of view	Southwest	6.0	20.0	24.1	28.0	4.3	17.5
	West-central	4.8	22.5	24.5	32.2	5.1	10.9
	Northwest	4.5	21.7	27.5	27.0	5.5	13.9
	Combined	5.2	21.4	25.3	29.0	5.0	14.2
	Managers	7.5	12.5	12.5	45.0	17.5	5.0
The provincial government is open to new ideas and alternative points of view on beetle management	Southwest	4.9	12.5	27.3	25.8	6.9	22.8
	West-central	3.9	11.5	26.1	32.7	10.2	15.6
	Northwest	4.5	11.3	28.9	30.4	9.1	15.8
	Combined	4.5	11.8	27.4	29.4	8.6	18.3
	Managers	5.0	10.0	12.5	52.5	20.0	0.0
The provincial government is too influenced by the forest industry regarding mountain pine beetle management	Southwest	4.7	15.0	23.4	26.8	14.2	15.9
	West-central	9.9	18.9	26.2	25.4	10.9	8.7
	Northwest	7.6	19.4	26.5	23.9	9.1	13.6
	Combined	7.3	17.6	25.2	25.5	11.5	12.9
	Managers	30.0	37.5	12.5	12.5	7.5	0.0
Competency and commitment:							
The provincial government has the necessary expertise to manage the beetle effectively	Southwest	9.4	23.1	13.3	39.2	7.5	7.5
	West-central	5.1	24.2	14.7	38.4	10.9	6.8
	Northwest	6.3	23.3	14.8	40.9	10.3	4.5
	Combined	7.0	23.5	14.2	39.5	9.5	6.3
	Managers	2.5	17.5	10.0	30.0	40.0	0.0
The provincial government is committed to reducing the impacts of mountain pine beetle on Alberta	Southwest	3.0	7.5	12.6	45.3	22.9	8.8
	West-central	1.5	10.2	12.6	45.0	23.5	7.3
	Northwest	3.8	10.3	15.8	45.6	19.1	5.5
	Combined	2.7	9.2	13.6	45.3	21.9	7.3
	Managers	5.0	5.0	7.5	47.5	35.0	0.0

Table 22a. Dimensions of Trust Related to MPB Management (%)

Statements	Region	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree	No opinion
Faith in management:							
Mountain pine beetle control is in the best interest of Albertans	Southwest	4.1	5.2	7.7	31.8	49.9	1.3
	West-central	1.2	4.3	5.8	26.2	60.6	1.9
	Northwest	2.0	5.8	5.0	26.1	57.3	3.8
	Combined	2.5	5.1	6.3	28.2	55.7	2.3
	Managers	5.0	5.0	2.5	20.0	67.5	0.0
There is no other option but to accept the provincial government's plans for mountain pine beetle	Southwest	14.2	26.6	20.2	23.6	6.0	9.4
	West-central	13.6	31.3	19.9	21.4	7.3	6.6
	Northwest	10.9	32.3	19.6	20.6	8.1	8.4
	Combined	13.0	29.9	19.9	22.0	7.1	8.2
	Managers	10.0	22.5	12.5	32.5	20.0	2.5
Personal interaction:							
I have the opportunity to learn about the reasons for mountain pine beetle management decisions	Southwest	4.5	15.3	18.8	32.5	18.5	10.3
	West-central	4.1	13.8	17.7	39.6	16.5	8.3
	Northwest	4.3	12.5	22.1	35.9	14.0	11.2
	Combined	4.3	14.0	19.5	35.9	16.5	9.9
	Managers	2.5	5.0	12.5	30.0	50.0	0.0
I understand why specific management actions have been taken	Southwest	3.0	8.4	14.3	46.7	19.7	8.0
	West-central	2.7	6.3	18.0	45.5	20.0	7.5
	Northwest	1.8	7.3	18.8	40.5	19.9	11.8
	Combined	2.5	7.4	16.9	44.3	19.8	9.0
	Managers	0.0	7.5	12.5	32.5	47.5	0.0
My past experience with forest management issues was positive	Southwest	6.9	14.4	22.8	26.7	7.8	21.3
	West-central	4.9	20.0	23.6	25.1	10.0	16.6
	Northwest	4.0	14.6	22.4	30.5	8.1	20.4
	Combined	5.4	16.3	23.0	27.4	8.6	19.5
	Managers	2.5	7.5	7.5	45.0	30.0	7.5
I feel the response to the mountain pine beetle reflects my values and opinions	Southwest	7.6	14.9	25.5	31.1	8.9	12.1
	West-central	5.6	14.6	30.6	29.9	10.9	8.5
	Northwest	5.6	13.5	30.1	28.3	8.9	13.5
	Combined	6.3	14.4	28.6	29.8	9.6	11.4
	Managers	5.0	15.0	7.5	52.5	17.5	2.5

Table 22b. Mean <sup>1,2</sup> (and Standard Deviation) of Dimensions of Trust Related to MPB Management

	Southwest	West-central	Northwest	Combined	Managers
Openness and fairness:					
Provincial government information about the mountain pine beetle tends to be biased and one-sided	3.0 <sub>a</sub> (1.0)	3.0 <sub>a</sub> (1.0)	3.0 <sub>a</sub> (1.0)	3.0 (1.0)	2.3 <sub>b</sub> (1.2)
In managing the mountain pine beetle, the provincial government considers all relevant points of view	3.1 <sub>a</sub> (1.0)	3.1 <sub>a,b</sub> (1.0)	3.1 <sub>a</sub> (1.0)	3.1 (1.0)	3.6 <sub>b</sub> (1.2)
The provincial government is open to new ideas and alternative points of view on beetle management	3.2 <sub>a</sub> (1.0)	3.4 <sub>a,b</sub> (1.0)	3.3 <sub>a,b</sub> (1.0)	3.3 (1.0)	3.7 <sub>b</sub> (1.1)
The provincial government is too influenced by the forest industry regarding mountain pine beetle management	3.4 <sub>a</sub> (1.1)	3.1 <sub>b</sub> (1.2)	3.1 <sub>b</sub> (1.1)	3.2 (1.2)	2.3 <sub>c</sub> (1.2)
Competency and commitment:					
The provincial government has the necessary expertise to manage the beetle effectively	3.1 <sub>a</sub> (1.2)	3.3 <sub>a</sub> (1.1)	3.3 <sub>a</sub> (1.1)	3.2 (1.2)	3.9 <sub>b</sub> (1.2)
The provincial government is committed to reducing the impacts of mountain pine beetle on Alberta	3.9 <sub>a</sub> (1.0)	3.9 <sub>a</sub> (1.0)	3.7 <sub>a</sub> (1.0)	3.8 (1.0)	4.0 <sub>a</sub> (1.0)
Faith in management:					
Mountain pine beetle control is in the best interest of Albertans	4.2 <sub>a</sub> (1.1)	4.4 <sub>b</sub> (0.9)	4.4 <sub>a,b</sub> (1.0)	4.3 (1.0)	4.4 <sub>a,b</sub> (1.1)
There is no other option but to accept the provincial government's plans for mountain pine beetle	2.8 <sub>a</sub> (1.2)	2.8 <sub>a</sub> (1.2)	2.8 <sub>a,b</sub> (1.2)	2.8 (1.2)	3.3 <sub>b</sub> (1.3)



Table 22b. Mean <sup>1,2</sup> (and Standard Deviation) of Dimensions of Trust Related to MPB Management

	Southwest	West-central	Northwest	Combined	Managers
Personal interaction:					
I have the opportunity to learn about the reasons for mountain pine beetle management decisions	3.5 <sub>a</sub> (1.1)	3.6 <sub>a</sub> (1.1)	3.5 <sub>a</sub> (1.1)	3.5 (1.1)	4.2 <sub>b</sub> (1.0)
I understand why specific management actions have been taken	3.8 <sub>a</sub> (1.0)	3.8 <sub>a</sub> (1.0)	3.8 <sub>a,b</sub> (1.0)	3.8 (1.0)	4.2 <sub>b</sub> (0.9)
My past experience with forest management issues was positive	3.2 <sub>a</sub> (1.1)	3.2 <sub>a</sub> (1.1)	3.3 <sub>a</sub> (1.0)	3.2 (1.1)	4.0 <sub>b</sub> (1.0)
I feel the response to the mountain pine beetle reflects my values and opinions	3.2 <sub>a</sub> (1.1)	3.3 <sub>a</sub> (1.1)	3.2 <sub>a</sub> (1.0)	3.2 (1.1)	3.6 <sub>a</sub> (1.1)

<sup>1</sup> Rated on a scale from 1 = “Strongly disagree” to 5 = “Strongly agree.”

<sup>2</sup> Any two means in a row that do not share a letter are significantly different at  $p < 0.05$  according to the Tukey-Kramer test.

### 3.6 Information on Mountain Pine Beetle

We used a series of questions about information sources to examine sources used and trusted by the public. First, we provided a list of possible sources and asked respondents to indicate the sources they used. Next, we asked them to indicate the sources they trusted the most and the least to provide accurate and reliable information on MPB.

The most popular sources of information on MPB for the public were media (87%), the provincial government (54%), the federal government (37%), and the forest industry (34%). More respondents in the southwest used the federal government (50%), non-government environmental organizations (33%), and universities (17%), whereas fewer used the forest industry (20%), as sources of information (Table 23).

Although the media was the most popular information source, it was chosen as the most trusted source by only 11% of public respondents, and it was the least trusted source for 27% of respondents. The provincial government had the largest percentage of respondents who indicated it was their most trusted source (27%). About 13% chose the federal government, and an equal percentage chose the forest industry, as their most trusted source. About 25% chose the forest industry and 23% chose non-government environmental organizations as the least trusted source for MPB information.

The respondents in the southwest seemed to differ from those in the other regions on sources they trusted to provide reliable information. A larger percentage of respondents in the southwest chose the federal government, universities, and non-government environmental organizations as most trusted sources, and 37% chose the forest industry as the least trusted source.

An analysis of respondents' comments suggest that distrust of the media may arise from the media sensationalizing the issue and reporting inaccurately.

A respondent in the southwest wrote:

*“Unfortunately, I don't access the government agencies for updates on MPB actions and control measures. All info is through the media, and frankly it's biased and sensational at best.”*

And a resident in the northwest noted:

*“Media reports in the past have been very misleading. Federal Scientists quoting high mortality rates when locally we are well aware this is not true.”*

Table 23. Sources of Information on MPB (%)

Source	Region	Use as source	Most trusted source	Least trusted source
The media (newspapers, radio, television)	Southwest	88.9	8.2	26.3
	West-central	87.8	8.9	28.4
	Northwest	89.2	15.5	24.9
	Combined	86.6	10.6	26.6
The provincial government (forestry and parks departments)	Southwest	51.9	22.5	7.2
	West-central	54.3	31.0	11.3
	Northwest	55.8	26.6	11
	Combined	53.9	26.5	9.7
Your municipal government	Southwest	35.0	4.1	6.0
	West-central	12.4	0.8	9.4
	Northwest	32.7	6.3	10.7
	Combined	26.9	3.7	8.5
The federal government (Parks Canada, Canadian Forest Service)	Southwest	49.8	18.2	5.2
	West-central	31.3	9.4	7.2
	Northwest	28.4	9.0	6.5
	Combined	37.1	12.6	6.2
Forest industry	Southwest	20.3	4.1	37.0
	West-central	45.2	17.3	18.2
	Northwest	37.2	18.8	17.5
	Combined	33.6	12.8	25.1
Non-government environmental organizations	Southwest	32.9	13.9	12.7
	West-central	23.7	8.6	18.8
	Northwest	18.6	6.6	22.6
	Combined	25.5	10.0	17.6
Think-tanks such as the Pembina or Fraser Institutes	Southwest	16.7	7.9	4.7
	West-central	14.6	9.2	4.4
	Northwest	8.5	5.1	5.8
	Combined	13.5	7.5	4.9
Universities	Southwest	16.7	14.9	0.7
	West-central	10.3	9.2	1.4
	Northwest	11.1	8.7	0.6
	Combined	12.8	11.1	0.9
Other (please specify):	Southwest	15.0	6.2	0.0
	West-central	15.8	5.7	0.6
	Northwest	13.3	3.3	0.3
	Combined	14.7	5.2	0.3
I do not use any of these	Southwest	1.5	0.0	0.2
	West-central	2.6	0.0	0.3
	Northwest	2.8	0.3	0.0
	Combined	2.3	0.1	0.2

Land managers were also provided with a list of possible information sources and asked to indicate the top 3 they rely on in making MPB management decisions. Scientific information was the most popular source, followed by the MPB experience in BC (Table 24). Industry stakeholders and municipal governments were sources for few of the land managers. Public opinion was used the least.

Table 24. Managers' Top 3 Sources of Information About MPB (%)

	First	Second	Third
Consensus of my Alberta colleagues	20.9	9.3	39.5
My personal experience	11.6	11.6	11.6
The mountain pine beetle experience in BC	25.6	34.9	23.3
Scientific information	44.2	32.6	11.6
Industry stakeholders	2.3	9.3	7.0
Municipal governments	0.0	2.3	2.3
Public opinion	0.0	0.0	4.7

### 3.7 Experience and Familiarity With the Mountain Pine Beetle

To assess the extent to which residents have experience with the MPB we asked about a range of experiences, from indirect (media coverage) to the direct, personal experience (having beetles on their property) (Table 25). Nearly all respondents (> 90%) had been exposed to media coverage of the MPB, and many reported having seen forests affected by MPB. A majority reported having seen small patches of trees (78%) or large areas of forest (70%) affected by the MPB or having driven through areas in BC affected by the MPB (79%). Very few reported that the MPB had attacked trees on their property. Reports of infestation on personal property were highest in the northwest region, where nearly 20% of respondents reported MPB on their property. West-central residents seem to have less experience with the MPB than residents in the other regions. Fewer west-central residents reported seeing small patches or large areas affected by the MPB or having the MPB on their property.

Table 25. Personal Experience With MPB (%)

Experience	Region	Yes
Heard about the mountain pine beetle in the media (newspapers, radio, TV)	Southwest	92.1
	West-central	90.5
	Northwest	93.3
	Combined	91.7
Seen small patches of trees affected by the beetle	Southwest	83.8
	West-central	68.3
	Northwest	82.4
	Combined	78.3
Seen large areas of forests (such as entire hillsides) affected by the beetle	Southwest	77.5
	West-central	63.3
	Northwest	68.6
	Combined	70.1
The beetle has attacked trees on my property	Southwest	11.5
	West-central	5.5
	Northwest	19.3
	Combined	12.0
Driven through or visited areas in BC affected by the beetle	Southwest	85.3
	West-central	79.0
	Northwest	73.0
	Combined	79.4

We assessed the public’s familiarity with MPB and its management using both a self-rated level of awareness of management and an assessment of MPB knowledge. Respondents rated their level of awareness of MPB management in their region by indicating if they were not aware, had little or moderate knowledge or were well informed. To assess how well informed the public is about basic information on the MPB in Alberta, we presented a series of true-or-false statements based on information that had appeared in Alberta newspapers or was readily available on the Internet. We created a knowledge score for each respondent by summing the number of correct responses.

Most respondents (52%) rated themselves as having moderate knowledge of MPB management in their region (Table 26). About 41% rated themselves as having little knowledge. Very few respondents said they were not aware or well informed.

From responses on the true-or-false statements, it appears that the public is not very well informed about basic MPB facts. The only statement that nearly all respondents (91%) answered correctly was that mild winters have contributed to the MPB outbreak (Table 27). A majority also knew that MPB is not spread by birds (73%) and that it is a naturally occurring insect in parts of western Alberta (53%). A minority knew that the MPB infests mainly old pine trees (41%), that fire suppression has contributed to the outbreak (46%), that a single beetle cannot kill a young pine (41%), that the beetle was not imported from Europe (26%), and that the beetle is not found across Canada (38%). Although 53% knew the beetle is naturally occurring, about 67% indicated they were “not sure” whether the beetle had been imported from Europe.

There was considerable variation among the regions in respondents' familiarity with the MPB. Respondents from the southwest appeared to be the best informed. For example, fewer respondents in the northwest knew that the beetle is naturally occurring (44%) than respondents the southwest (62%); that the beetle was not imported from Europe (20% northwest, 32% southwest); and that fire suppression is a contributing factor in the outbreak (39% northwest, 53% southwest). Respondents in the southwest also had a significantly higher mean knowledge score (4.5 out of a possible 8) than respondents from the west-central (4.1) and northwest (3.8) regions (Table 28).

Table 26. Self-rated Knowledge of MPB Management (%)

Level of awareness	Southwest	West-central	Northwest	Combined
Not aware of it	0.9	1.7	3.3	1.9
Little knowledge	39.0	40.6	42.2	40.5
Moderate knowledge	54.9	50.9	49.3	51.8
Well informed	5.2	6.8	5.3	5.8

Table 27. Distribution (%) of Responses to True-or-False Statements

Statements	Region	Mostly true	Mostly false	Not sure
The mountain pine beetle is a naturally occurring insect in parts of western Alberta	Southwest	62.2	26.3	11.5
	West-central	51.2	30.1	18.7
	Northwest	44.1	35.3	20.6
	Combined	53.0	30.4	16.7
A single mountain pine beetle can kill a young tree	Southwest	26.6	44.1	29.3
	West-central	28.9	40.8	30.3
	Northwest	31.0	38.8	30.2
	Combined	28.7	41.4	29.9
The mountain pine beetle is spread mainly by birds carrying it from one tree to another	Southwest	3.7	79.1	17.2
	West-central	2.7	69.8	27.5
	Northwest	6.6	73.0	20.5
	Combined	4.3	74.2	21.6
The mountain pine beetle infests mostly old pine trees	Southwest	43.5	40.9	15.7
	West-central	41.3	43.0	15.8
	Northwest	37.9	46.5	15.6
	Combined	41.0	43.3	15.7
Mild winters have contributed to the current mountain pine beetle outbreak	Southwest	93.9	1.7	4.3
	West-central	91.5	2.9	5.6
	Northwest	88.3	3.7	8.0
	Combined	91.4	2.8	5.9
The mountain pine beetle was imported to Canada from Europe	Southwest	7.0	31.5	61.5
	West-central	8.6	24.8	66.6
	Northwest	13.0	20.3	66.8
	Combined	9.4	25.8	64.8
The suppression or prevention of forest fires has contributed to the current mountain pine beetle outbreak	Southwest	52.5	20.8	26.7
	West-central	47.2	24.2	28.6
	Northwest	38.7	27.7	33.7
	Combined	46.4	24.1	29.5
The mountain pine beetle is found in forests across Canada, from Newfoundland to Vancouver Island	Southwest	23.0	39.6	37.4
	West-central	23.8	39.1	37.1
	Northwest	24.1	36.4	39.5
	Combined	23.6	38.4	38.0

Table 28. Mean<sup>1</sup> (and Standard Deviation) Knowledge Score

Southwest	West-central	Northwest	Combined
4.5 <sub>a</sub>	4.1 <sub>b</sub>	3.8 <sub>b</sub>	4.1
(1.9)	(2.0)	(1.9)	(1.9)

<sup>1</sup> Any two means that do not share a letter are significantly different at  $p < 0.05$  according to the Tukey-Kramer test.

In respondents' comments, many acknowledged that they did not know much about MPB other than what they have seen in BC and locally. Based on these comments, we identified two themes pertaining to the type of information that people would like to receive. The following quotes provide examples of the themes.

The first theme was requests for information on how to identify and control MPB on respondents' property.

*"We have been made aware through media, municipality, etc of when they came, the level of infestation and partly why (winds, mild winter etc) ... but very little on what we and others can do in backyard of all our affected trees." [Northwest]*

*"I have PineTrees on my property. I feel there has not been any good information about how to protect our trees if it is possible." [Northwest]*

*"I think more information regarding the pine beetle, specifically how to determine if trees are infested should have been distributed to all property owners." [Southwest]*

*"I have not yet seen evidence of mountain pine beetle in my trees - but I am uncertain as to what to look for. ... I would be interested in knowing if I can do anything about the pine beetle on my property if it is affected." [Southwest]*

The second theme pertained to requests for updates on the Alberta situation. Many respondents felt uninformed about the MPB in the province.

*"Maybe more local information in paper on what's happening, where prevention is at. How prevention methods used have worked or not." [Southwest]*

*"More education is needed to familiarize people with the causes, outcome and control methods of Mountain Pine Beetle infestations. I have not seen any promotional or educational campaigns by the province or forestry industry." [Southwest]*

*"I don't really know which measures or to what degree the government or Parks or forestry or whoever are actually taking to control the beetle infestation and spread. More literature and news needs to be accessible to keep the public better informed." [West-central]*

*"I also believe that there should be far more literature about the beetle and the proposed action plans, available to the public. Generally I hear very little about the beetle." [Northwest]*



### **3.8 Land Managers' Views of Science, Media, and the Public**

Land managers were asked additional questions to examine their views of MPB science, of the media's role in communicating MPB information to the public, and of the public's opinions about MPB.

Land managers had a very favourable view of MPB science (Table 29). They use and trust science in MPB management decision-making. Nearly all land managers agreed that they used science in management decisions (92%), that science is useful in management decision-making (96%), and that they keep up to date on MPB science (90%). A majority disagreed with statements that the science is too complex (67%) and there is too much uncertainty in MPB science (65%), and agreed that the science is timely (61%). Land managers were supportive of investing money in science. Most disagreed (77%) that both government and industry should invest less money in MPB science. About 89% of land managers trusted the science produced by government agencies; a reduced majority (76%) trusted the science produced by universities.

Regarding the media, few land managers agreed that the media does a good job of representing MPB science to the public (20%) and that the media can be trusted to portray the MPB in a responsible manner (14%). Clearly, land managers do not have a favourable view of the media in reporting MPB information to the public.

Although few land managers (14%) thought that public opinion on MPB is informed by scientific information, a majority (63%) thought that local values and opinions should be included in MPB management.

Table 29. Land Managers' Views on MPB Science (%)

Statement	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree	No opinion
I keep myself up to date on MPB science	0.0	2.0	8.2	32.7	57.1	0.0
MPB science is timely in management decision-making	0.0	16.3	20.4	28.6	32.7	2.0
MPB science is useful in management decision-making	0.0	0.0	4.1	36.7	59.2	0.0
I utilize MPB science in management decisions	0.0	0.0	6.1	30.6	61.2	2.0
There is too much complexity within MPB science to use it effectively in management decisions	18.4	49.0	10.2	16.3	6.1	0.0
There is too much uncertainty within MPB science to use it effectively in management decisions	20.4	44.9	14.3	16.3	4.1	0.0
I trust the MPB science that is produced by government agencies	2.1	6.3	12.5	35.4	43.8	0.0
I trust the MPB science that is produced by universities	0.0	4.1	20.4	30.6	44.9	0.0
Governments need to invest less money in the science of MPB	22.9	54.2	14.6	8.3	0.0	0.0
Industry needs to invest less money in the science of MPB	22.9	54.2	14.6	6.3	2.1	0.0
The media does a good job at representing MPB science to the public	18.4	38.8	22.5	18.4	2.0	0.0
The media can be trusted to portray the MPB in a responsible manner	22.5	38.8	24.5	14.3	0.0	0.0
The public's opinions on MPB are informed by good scientific information	22.5	36.7	26.5	10.2	4.1	0.0
Local public values and opinions ought to be included in MPB management	5.0	12.5	20.0	47.5	15.0	0.0

## **4.0 Discussion**

Public acceptance is essential for effective natural resource management decision-making. Adverse public judgments can result in postponement, modification, or even cancellation of any management strategy, regardless of its economic feasibility or the rigour of the underlying science (Shindler et al., 2002). Thus, understanding public perceptions and addressing public concerns, especially in areas directly affected by the MPB, should be an integral component of MPB management strategies. This study provides some insights into public perceptions of MPB and its management in areas of Alberta most affected by the MPB, and its findings have implications for addressing public concerns in the management response.

### **4.1 Support for Management**

This study showed that MPB is an important issue for residents in forested regions of western Alberta. They perceive the MPB as having negative impacts on forests and communities. Most of these residents believe MPB is affecting biodiversity and is an ecological disaster; as well, they do not view it as having benefits to forests. They are primarily concerned about the potential impacts on the economy, scenic quality, and wildlife habitat. This study showed strong public support for intervention to stop the spread of MPB: letting the infestation run its course was not an acceptable option. The public is supportive of early intervention; a “wait and see” approach is unacceptable to most residents. Many respondents commended the provincial government’s fast response and cited BC as an example of government waiting too long to respond and allowing MPB to get out of control. Some respondents, however, viewed the beetle as a natural phenomenon and controls as futile or viewed past forest management practices such as clear-cut logging and fire suppression, which have created an even-aged monoculture pine forest, as the basis of the current infestation.

Regarding specific control options, prescribed burning of uninfested areas was the least acceptable option for the management of both Crown lands used by the forest industry and protected areas. Respondents’ comments suggest that lack of support for prescribed burning is grounded in concerns about health effects from smoke, the risk of a prescribed burn escaping its planned boundaries, and the burning of valuable timber. Harvesting activities (salvage logging, harvesting infested areas, and adjusting harvest plans) received the strongest support. There were few differences in the acceptance of control options for Crown lands used by the forest industry and control options for parks and protected areas. Although there was slightly less support for harvesting activities in protected areas, they were still rated very acceptable by a substantial percentage of respondents.

The strong support for control, however, did not translate into the belief that the MPB will be controlled in the short term. Most of the respondents and land managers did not think that management actions will stop the spread of MPB within the next 5 years. This view is consistent with the Alberta Sustainable Resource Development (ASRD) strategy, which includes a 20-year plan of continued MPB management. ASRD also suggests that land managers and the public should expect the MBP infestation to continue and expect control to be a long-term process.

Although there is strong public support for managing the MPB, most respondents believe that natural processes are the only effective means of controlling it and that

climate change will be a major contributor to future outbreaks. In other words, this suggests that the public wants management agencies to try to stop the spread of MPB, and the public supports most of the control options being used but is sceptical that these will be successful. This could be because they view control as largely dependent on climate (i.e., cold winters).

Respondents were satisfied (albeit at a low level of satisfaction) with the overall response to MPB in Alberta. Residents seem less satisfied with the response of specific management agencies. However, a high number of no opinion and neutral responses on satisfaction with specific agencies suggest that residents are unfamiliar with the response of individual agencies and industry in their regions. The lack of knowledge of MPB management efforts is further evident from the number of respondents who indicated low levels of awareness of MPB management in their region.

## **4.2 Regional Variation**

In bark beetle infestations, public perceptions and judgments of risks and acceptance of management strategies have been found to be influenced by the unique context of each situation: the interplay between biophysical (or ecosystem) and social environments (Flint, 2006). In this study, we examined public perceptions of MPB and its management in 3 regions of Alberta with varied contexts; specifically, differing MPB histories, current infestation status, and socioeconomic characteristics. There were some notable differences in responses among the study regions, suggesting context influences public perceptions in Alberta. Respondents in the northwest region — the most forest-sector dependent region in the study, where the beetle has invaded from BC only recently — viewed impacts on forests and communities more negatively than respondents in the other regions. They also rated loss of the forest as an economic resource of greater concern, whereas respondents in other regions had greater concern over loss of scenic quality.

The respondents in the southwest differed from the respondents in the other regions in several respects. This region was the least forest-sector dependent and was the only region with historical MPB outbreaks. Although southwest respondents had a negative view of the MPB, their views were less negative than those of respondents in other regions. Residents in the southwest had greater knowledge of MPB than residents in the other regions. They were less accepting of harvesting activities to control the beetle and also viewed harvesting activities as less effective in controlling the MPB than respondents in the other regions. More respondents in the southwest thought it unlikely that current controls will stop the spread of MPB, viewed natural processes as the only effective means of controlling the MPB, and believed that climate change will be a major contributor to future MPB outbreaks. Respondents in the southwest also have a more negative view of the forest industry. More respondents from this region disagreed that the industry is doing a good job of managing forests to prevent the spread of MPB or that the industry can be trusted to adjust practices to minimize impacts from the MPB. The lack of trust in the forest industry was also evident in the number of respondents who indicated the forest industry was their least trusted source of MPB information. Written comments provided some insights into the source of distrust of the forest industry. Several respondents indicated dissatisfaction with clearcutting in the southwest,

suggesting that distrust of the forest industry is not specific to MPB management but stems from a history of distrust of the industry operating in the region.

The regional differences shown in this study suggest context can influence public perceptions and judgments. The context for forest insect disturbance is constantly changing, as insects move through their lifecycles and as their biophysical and socioeconomic impacts change over decades. Like the infestation itself, public perceptions and willingness to accept particular control measures are likely to be dynamic, changing as the infestation goes through its cycle and the many impacts manifest themselves (Flint, 2006). Therefore, as the MPB infestation continues in Alberta, land managers will have to contend not only with MPB dynamics but also with changing public perceptions of MPB and its management. Monitoring and incorporating public concerns and effectively communicating management strategies will be integral to continued public acceptance. Public education and management response should be tailored to local concerns and contexts. For example, for the respondents in the southwest, the primary concern is scenic quality; these respondents are not as supportive of logging activities to control MPB. In contrast, for the respondents in the northwest, the primary concern is economic impacts; they are supportive of management strategies that address support for the forest industry (i.e., logging activities). Tailoring responses that address regional concerns (developing management strategies that explicitly address scenic quality in the southwest and economic impacts in the northwest) are likely to be more acceptable in the long term than a uniform response across the province.

### **4.3 Trust in Agencies**

Trust in management agencies has been shown to be an important factor in influencing public perceptions of risks and acceptance of natural resource management strategies. For example, agencies that are viewed as open to public input, competent, and good decision-makers tend to foster public acceptance of fuels management such as prescribed burning and forest thinning (Olsen and Shindler, 2010; Shindler and Toman, 2003; Winter, Vogt, and McCaffrey, 2004). Regarding bark beetle infestations, confidence in land managers has been shown to lower the perception of threats to ecological and community well-being in areas with infestations (Flint, 2007).

We used several indicators to examine trust in management agencies and the forest industry. The public viewed the provincial government as being competent and committed to managing MPB; the public also agreed that MPB management is in the best interest of Albertans. Although most respondents felt that they had opportunities to learn about MPB management and understood why actions were taken, fewer viewed the government as open and fair. The public displayed a high degree of uncertainty (as evidenced by a high number of no opinion and neutral responses) regarding openness and fairness of the provincial government in MPB management, suggesting that they might be unfamiliar with how stakeholders are involved or how decisions are made. Of those who expressed an opinion, however, most were divided on the assessment that the government considers all points of view and is open to new ideas, and that information is biased. These findings suggest there are opportunities for communicating and engaging the public in the MPB response.

The need to formulate a rapid response to the MPB and the considerable time involved in negotiating a management strategy with local stakeholders (Flint et al., 2009)

present challenges for fostering public participation and building trust between management agencies and the public (MacKenzie and Larson, 2010). Unlike conventional forest management plans, response to insect disturbances can leave little time to develop trust relationships, seek consensus, or incorporate local concerns into a management response. The sense of urgency for a response to the MPB appears to be shared by the public and is probably an important influence on the current acceptance of management strategies. As the sense of urgency diminishes, however, openness and trust relationships are likely to become integral to continued support of MPB management.

#### **4.4 Land Managers and the Public**

This study also compared land managers' and residents' perceptions. Land managers and residents were similar in several respects. They both had a negative view of the MPB, with a majority, for example, viewing it as a threat to biodiversity and an ecological disaster. A majority of both land managers and residents supported harvesting activities (thinning uninfested areas, harvesting infested areas, adjusting harvest plans, and salvage logging) to control the MPB in Crown lands used by the forest industry and in parks and protected areas, and a majority rated these controls as effective in controlling the MPB. Both residents and land managers also thought it unlikely that management actions will stop the spread of the beetle within the next 5 years and viewed natural processes (such as weather) as the most effective means to control the beetle. However, letting the MPB run its course was not acceptable to the vast majority of residents and land managers.

There were also some notable differences between the land managers and residents that could have implications for public education and MPB management. Managers were less concerned about non-timber impacts (scenery, wildlife, and recreation) of MPB on forests; their concerns were primarily economic impacts and fire risk. Although economic impacts were also a concern of residents, residents were concerned about a broader array of impacts, including scenic quality and changes to wildlife habitat. Land managers were more supportive than residents of harvesting activities in controlling MPB on Crown lands used by the forest industry but were less supportive than residents of the harvesting activities in parks and protected areas. The public was more optimistic than land managers that MPB will be controlled within 5 years, suggesting the public might have higher expectations of MPB management outcomes than the land managers. Land managers, who consist of provincial government and forest industry employees, expressed a higher level of satisfaction with the overall response than the public and were more satisfied with provincial government and forest industry responses. Land managers also expressed higher levels of trust in the provincial government and forest industry.

Differences in public and expert judgments of risk and risk management options are often attributed to a poorly informed, irrational public (Slovic, 1999; Sjöberg, 1999). Knowledge, however, is seldom a good predictor of perceived risk or public response. Even when the public is informed of the risk, the public reaction typically incorporates many subjective and contextual factors. Therefore, it is important for land managers to understand that the public is experiencing the infestation in specific social and environmental contexts rather than dismissing uninformed public views as invalid. In this study, although land managers viewed public opinion as uninformed by science, they did

not dismiss a role for the public in MPB management. Most felt that local values and opinions should be included in MPB management.

Providing information is essential, and the public seems to want more information. However, information is unlikely to be sufficient on its own in gaining and retaining public trust and acceptance of beetle management. The public filters information through social and environmental contexts. Therefore, it is essential to understand the variation in public response and judgments in different contexts, and to tailor management and communication to address local concerns. Land managers should also be cognizant of how their judgments of MPB differ from the public's. Land managers are focused on traditional forest management concerns (economic impacts and fire risk), and these will inevitably influence communications and management strategies. Although the public may agree with the traditional forest management outcomes, the public has additional concerns that, if not given adequate attention, could serve as a source of dissatisfaction with the response to MPB.

#### **4.5 Public Awareness**

A study of MPB coverage in Alberta newspapers from 2000 to 2008 concluded that residents in our study regions had been exposed to many messages and issues related to the MPB's presence, potential impacts, and management strategies (Romanowski, 2009). The study also showed that the newspapers reported primarily factual information from management agencies such as ASRD and Parks Canada, and there were few challenges to this information from reporters or the public. Our study results, however, show that many residents and land managers do not trust the media in reporting on the MPB.

Our study also shows that the public uses the media as the primary source of information, and the public is poorly informed of basic MPB information and of MPB management in their region. The provincial government was the most trusted source of information for many respondents. The public's trust in the provincial government and lack of trust in the media suggests that there is an opportunity for government to communicate directly with residents. In addition, some respondents commented that the only information they received was through the media, although they preferred to hear from ASRD. Respondents' comments also provided an indication of the types of information that people wanted. Some residents, particularly in the northwest, requested help in identifying MPB-infested trees on their property and in controlling MPB on their own land. There was also a desire for more information on the MPB situation, MPB control measures, and the progress of MPB control.

The finding that both residents and land managers do not trust the media suggests some options to create opportunities for direct communication and build trust relationships between managers and the public. These include hosting community events such as workshops on MPB identification and management on private property, and tours of treated areas. Demonstrating how non-timber considerations (especially scenic quality and wildlife habitat) are incorporated into management strategies, discussing benefits of management options, and acknowledging uncertainties are potential means to improve communications and continue building trust. Including forest health officers, scientists, wildlife biologists, and other experts in public events provides the public with an

opportunity to hear the latest information and have their questions answered by those most knowledgeable.

This study has provided insights into the views of residents in the most affected areas of Alberta. If the spread of the MPB threatens Canada's boreal forest and forest-dependent communities, it will be vital to understand public perceptions and acceptance of management options across a wide geographic area as well as discrepancies between public and expert judgments. This will enable authorities to develop communication strategies, management plans, and options sensitive to local needs, as well as to adapt management strategies to the dynamics of both the infestation and the public response.



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## APPENDIX A

### Options for Managing the Mountain Pine Beetle

There are a number of options that can be used to prevent or slow the beetle's spread. Some, but not all, of these are being used on provincial Crown land. We would like to know if these are acceptable to you and whether you believe they will be effective in controlling the beetle in northwest Alberta.

**Here is some information to assist you in answering the next question.**

**Prescribed burning** is the deliberate burning of forested areas under controlled conditions that allow the fire to be confined to a predetermined area. Fire can be effective in killing the beetles and in preventing their spread by reducing suitable habitat for the beetle.

**Pheromones** are chemicals produced by the beetles to communicate with each other. One type of pheromone is used by forest managers to attract the beetles to an area. This concentrates the beetles in small areas in preparation for application of other control measures. Another type of pheromone acts as a repellent, keeping the beetles away from an area. Pheromones are used to treat small areas.

**Thinning the forest** is the harvesting of healthy trees before they are attacked by the beetle. It involves removing only selected trees from an area to reduce the susceptibility of the remaining trees to attack. This increases tree vigor and decreases suitable habitat for the beetle.

**Cut and burn** involves cutting infested trees and burning them on site or moving the trees to a central place and burning them in a large pile. This is effective when there are only a few affected trees.

**Harvesting** involves cutting and removing infested trees from an area and milling and processing the trees to kill the beetles. This is effective when there are large blocks of affected trees and in areas where timber companies are operating.

**Adjusting harvest plans** involves logging healthy but susceptible areas before they are attacked. Forestry companies change their harvest plans to log areas that are most vulnerable to the beetle and reduce beetle habitat.

**Chemical control** is the application of the insecticide carbaryl (Sevin). It is used primarily on high value trees in campgrounds or other landscaped sites and in seed orchard plantations.

**Salvage logging** is not used to control the beetle. Rather, it involves harvesting forests killed by the beetle before the trees lose their economic value. Removing the dead trees also reduces the threat of forest fires and speeds up the regeneration of a new forest.