

How Serious is the Mountain Pine Beetle Problem? From a Timber Supply Perspective

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Abstract

Timber supply analyses were undertaken to assess the potential mid-term timber supply impacts of the ongoing mountain pine beetle infestation in British Columbia. Twelve management units in central British Columbia comprising 43% (9.9 million ha) of the provincial timber harvesting land base were assessed. The 12-unit analysis projected a significant decline in timber supply 15 years from now, when killed trees might deteriorate beyond a merchantable condition. The projected reduction in mid-term timber supply was 19% relative to the pre-uplift annual allowable cut (AAC) (23.2 million m³). A timber supply impact assessment was completed separately for the Quesnel timber supply area (TSA). The impact for this very infested area could be up to 29% compared to the pre-uplift level (2.248 million m³). Similar to the aggregated 12-unit analysis, the decline is forecast to coincide with the deterioration of killed timber, or in about 15 years from now. Solutions are presented which could mitigate the mid-term reduction in timber supply.

Introduction

The mountain pine beetle infestation affecting the central interior of British Columbia (BC) has been ongoing since 1994. In the past two years, the rate of spread and attack intensity have increased dramatically. As of this year (2003), 4.2 million ha of red attack were recorded through aerial overview surveys in the province (BC Ministry of Forests 2004). This represents an increase of 100% since 2002. Given the intensity of this epidemic, efficient management strategies have been developed to help reduce the spread of the infestation and limit the amount of beetle-killed timber in affected zones. However, in some areas with extremely high beetle populations, not all the beetle-killed timber will likely be harvested.

To further develop effective management responses, it is necessary to understand the potential timber supply impacts, and which of the factors associated with the infestation may be subject to management intervention. The review and analysis discussed in this talk examines the possible timber supply impacts in seven timber supply areas (TSAs) and five tree farm licences (TFLs) in BC. An in-depth review of the Quesnel TSA is performed.

Mountain Pine Beetle Symposium: Challenges and Solutions. October 30-31, 2003, Kelowna, British Columbia.
T.L. Shore, J.E. Brooks, and J.E. Stone (editors). Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Information Report BC-X-399, Victoria, BC. 298 p.

Description of the Mountain Pine Beetle Infestation

There are two key factors which have contributed to the expanding mountain pine beetle epidemic:

- The number of ha of mature, susceptible lodgepole pine (>80 years old) in BC has increased by about three times since 1910 (Taylor and Carroll 2004); and
- Warmer climate conditions have expanded the beetle's range into previously unsuitable areas, such as northern areas and higher elevations (Carroll et al. 2004).

Fire control measures, which have been effective since the mid-1900s, have increased the protection of forest resources. This has led to an accumulation of old pine forest above historical levels. At present, lodgepole pine of all ages covers 14.9 million ha in the province. Of this, over 8 million ha are stocked with mature, susceptible pine. In terms of merchantable volume, this represents one billion m³ (British Columbia Ministry of Forests 2003).

The second factor has been hot, dry summers and mild winters in central BC that have allowed the mountain pine beetle population to reach epidemic levels in mature pine forests. Average minimum temperatures during the winter have increased by +2.2°C to +2.6°C over the last 100 years (British Columbia Ministry of Water, Land and Air Protection 2002). Favourable conditions have been created, allowing the beetle to spread into previously unsuitable regions. As well, drought stress due to higher summer temperatures has increased the susceptibility of older pine stands to beetle attack. Climate models project that this warming trend will continue.

Based on a summary of British Columbia Ministry of Forests aerial surveys for 1999-2003 (British Columbia Ministry of Forests 2004), the estimated infested area has increased from 165,000 ha in 1999 to 4.2 million ha in 2003 (Fig. 1). These areas describe the annual "red attack" or trees killed by the beetle in the previous year. This area does not include green attack (recently attacked) trees, which will die in the following year.

The aerial surveys include an estimate of the attack severity within stands, based on the percentage of mortality. The severity categories are light (1-10% of trees recently killed); moderate (11-29% of trees recently killed); and severe (over 30% of trees recently killed in an area). Figure 2 describes the aerial surveys between 1999-2003. Since that time, beetle infestations have continued to spread over a significant portion of the south and central interior. At present, 64% of the infestations are described as light, 18% as moderate and 18% as severe. As of 2002, the Mountain Pine Beetle Emergency Task Force had estimated that approximately 108 million m³ of wood had been infested in BC.

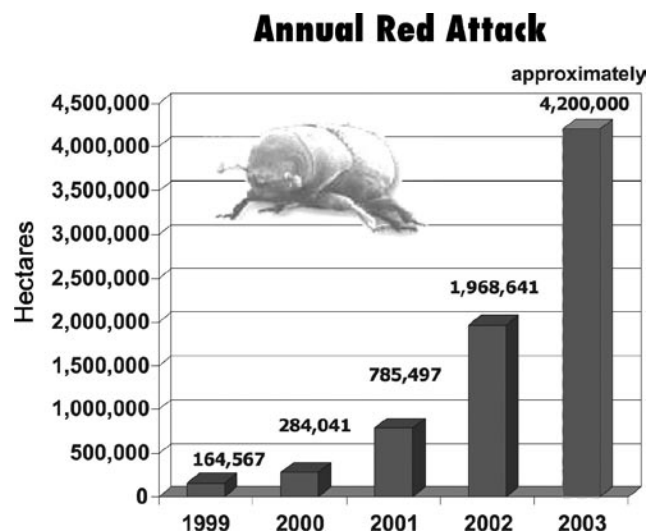


Figure 1. Summary of mountain pine beetle red attack from aerial overview surveys in BC, 1999-2003.

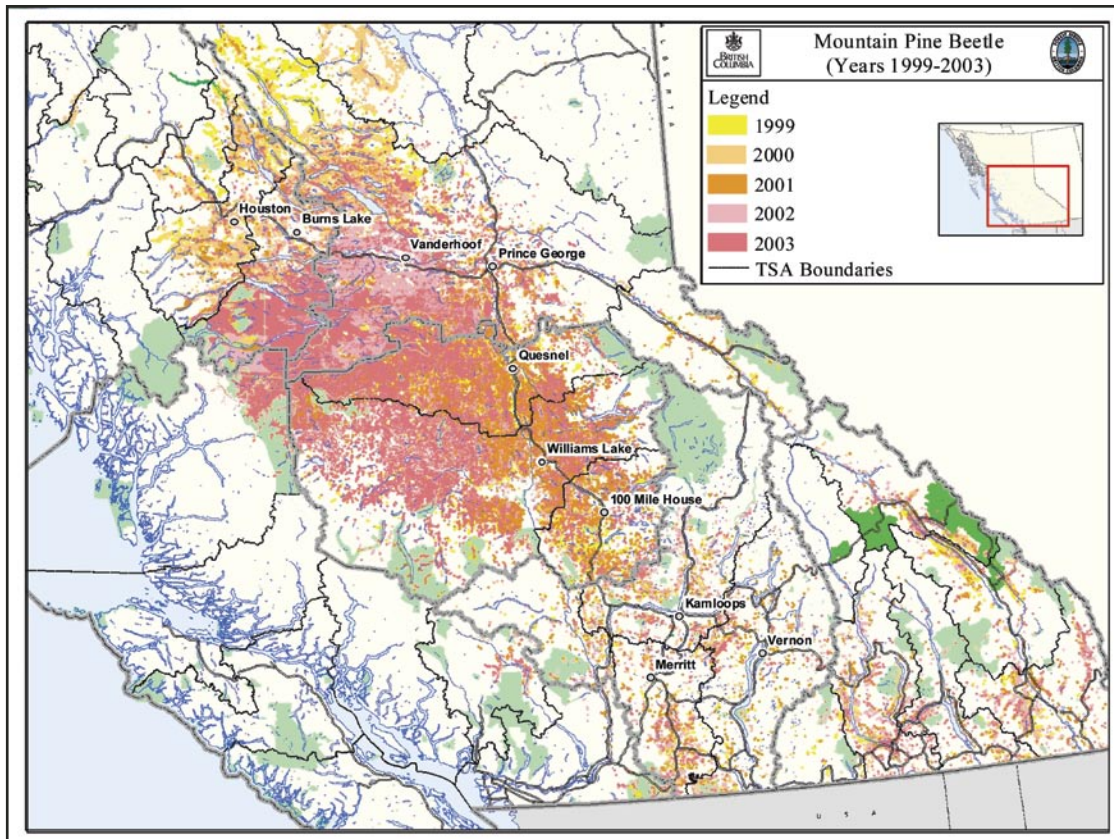


Figure 2. Provincial map of area infested by mountain pine beetle between 1999-2003.

Mountain Pine Beetle Analysis Area (12 units)

Timber Supply Impact Study

To examine the potential impact of the mountain pine beetle on timber supply, the British Columbia Ministry of Forests examined seven TSAs and five TFLs, referred to as management units, represented by the more severely infested areas in central BC, stretching from Houston to Kamloops (Fig. 3).

BC's total interior timber harvesting land base comprises 20 million ha. Of these, the 12 management units occupy 9.9 million ha. Most at risk from the infestation are 3.3 million ha, which contain mature pine-leading stands (forests with >50% pine older than 80 years). Another 1.4 million ha are comprised of stands with 10-50% susceptible pine. This component of the land base may not be as affected by the mountain pine beetle because other tree species exist in the stands (Fig. 4).

The current total allowable annual cut (AAC) for the analysis area (12 management units) is about 30 million m³. Of this, 6.8 million m³ is attributable to harvest level increases (uplifts) due to the mountain pine beetle infestation in seven of the 12 affected units (Table 1).

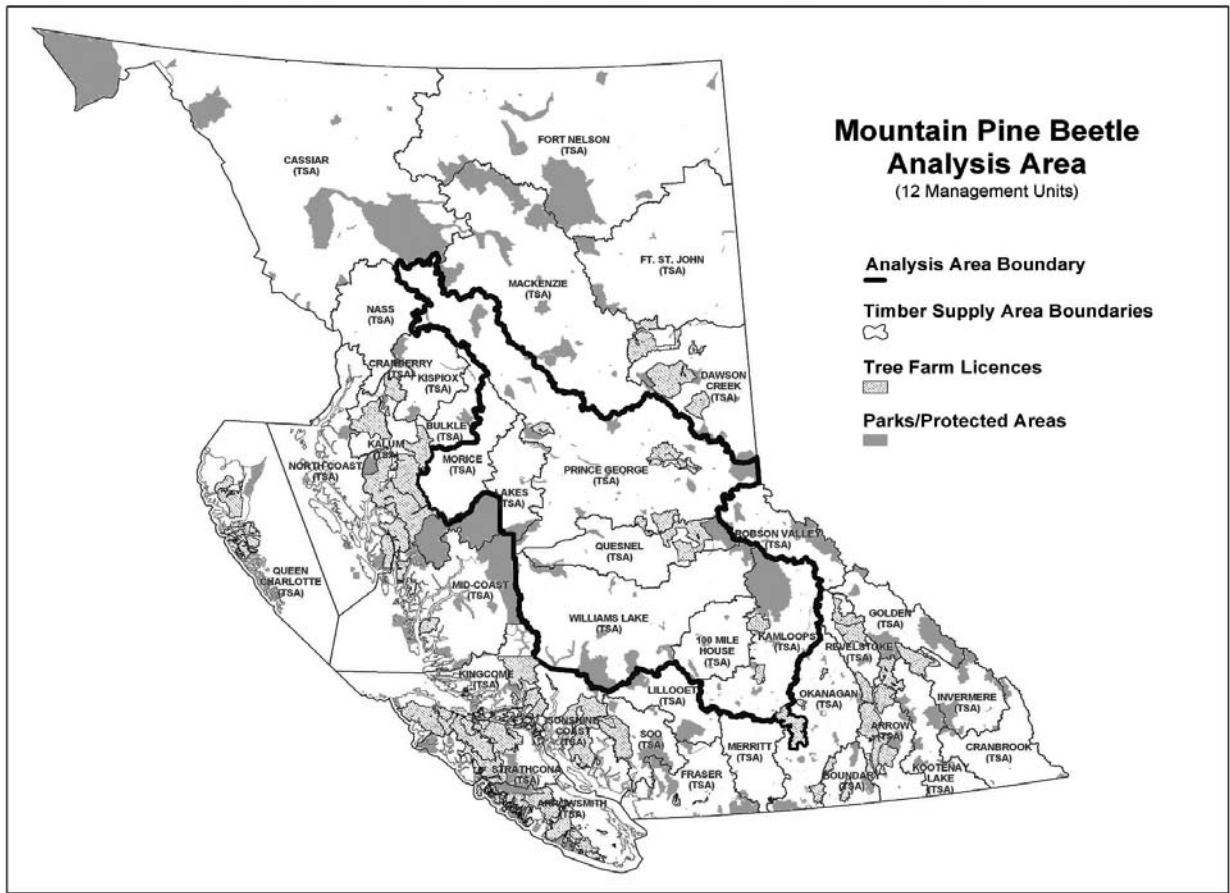


Figure 3. Mountain pine beetle analysis area (12 management units) in central BC.

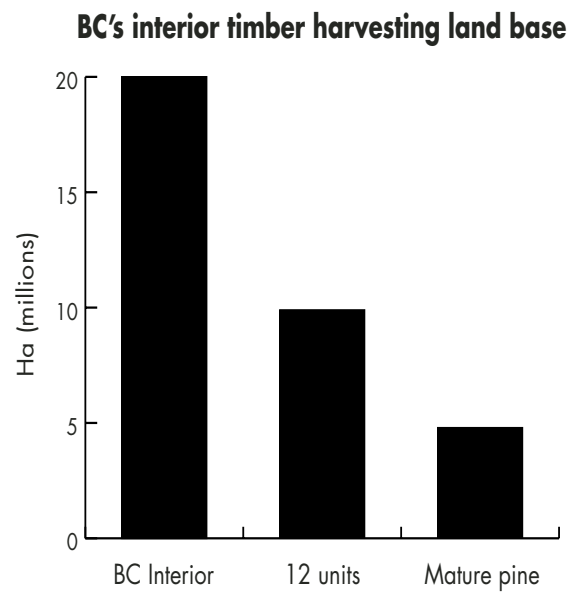


Figure 4. BC's interior timber harvesting land base.

Table 1. Current AAC totals and uplifts attributable to the mountain pine beetle in seven management units in the analysis area.

Management Units	AAC (m ³ / year)	Uplifts (m ³ / year)
Lakes	2,962,000	1,500,000
Prince George	12,244,000	3,000,000
Quesnel	3,248,000	1,000,000
Williams Lake (since 1980s)	3,768,000	850,000
TFL 42 (Fort St. James)	160,000	40,000
TFL 5 (near Quesnel)	300,000	177,200
TFL 53 (near Quesnel)	500,000	261,000

Assumptions for Assessing the Timber Supply Impact in the 12 Management Units

The analysis examined only the impacts of the current beetle infestation and an estimate of the extent to which it might spread. No attempt was made to forecast beetle infestations that may occur in future decades, or future changes to forest management practices such as reforestation and fire management. The following key assumptions reflect the best estimate of the possible dynamics of the infestation averaged over the 12 units:

- Initial harvest rate was set at 30 million m³/year;
- Half of the high risk pine (>80 years old and >50% pine) equalling 1.6 million ha was assumed to be fully attacked by 2002;
- Attacked and killed trees would take 15 years to deteriorate to an unmerchantable condition; and
- Over the first 15 years, harvesting consists of 60% pine and 40% other species.

Projected impacts and key observations

Figure 5 shows the projection of timber available for harvest, based on the assumptions described. The timber supply is projected to decline significantly in 15 years after the attacked and killed trees have deteriorated, and are no longer considered merchantable. The following projections illustrate possibilities that could reduce the impact on future timber supply:

- If harvest levels are higher than 30 million m³/year, then unsalvaged losses could be less than the projected 200 million m³;
- If more pine is harvested rather than the current profile of 60% pine and 40% other species, then there will be fewer unsalvaged losses; and
- If stands with the highest amount of mortality are harvested within the first 15 years, the timber supply impacts will be reduced.

Other projections showed that where infestation and mortality exceeded 50%, there would be proportionately more severe impacts on the mid-term timber supply. Several TSAs exist with a large component of mature lodgepole pine, such as the Quesnel TSA, where the level of mortality could be higher than 50%. An in-depth analysis for the Quesnel TSA was performed.

Projected Impacts

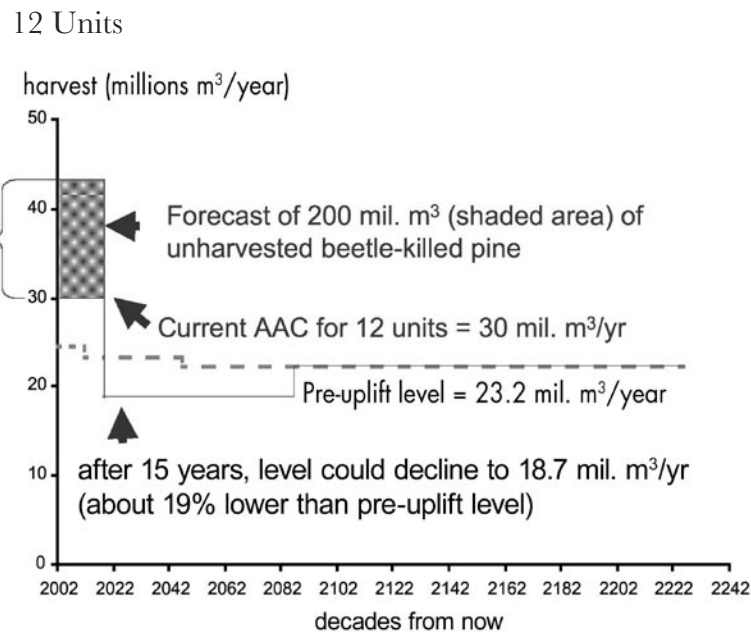


Figure 5. Projected impacts of mountain pine beetle on future timber supply.

Quesnel TSA

A more detailed analysis was undertaken for the Quesnel TSA. In this analysis, as in the assessment of the 12 management units, only the current infestation was examined. The Quesnel TSA landbase is approximately 1.6 million ha. The area considered available for timber harvesting is about one million ha. Susceptible pine stands comprise 590,000 ha, while an additional 150,000 ha are considered somewhat susceptible (25-50% pine). The age of susceptibility was estimated to be 60 years in the Quesnel TSA rather than 80 years estimated for the 12 units, due to observed high levels of attack in younger pine forests (personal observation, BC Ministry of Forests staff).

Key assumptions for Quesnel

For the Quesnel analysis, the following key assumptions reflect an estimate of the possible growth and intensity of the infestation:

- The cumulative infested area in 2002 was 215,300 ha (by severity class 45% high, 22% severe, 16% very severe, and 17% over-run);
- The rate of spread was projected to be 40% per year, until all 590,000 ha of pine-leading stands were infested (Fig. 6);
- The initial harvesting rate was 3.2 million m^3/year ; and
- The average shelf life of pine was estimated to be 13 years for the Quesnel TSA.

40% expansion rate
 Attack level (percent of attacked trees)

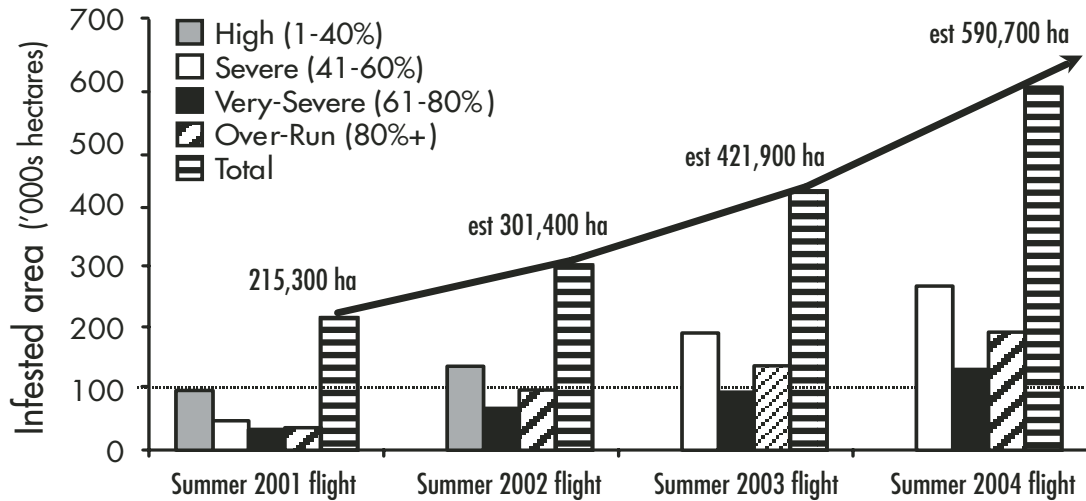


Figure 6. Expansion rate of mountain pine beetle in the Quesnel TSA analysis.

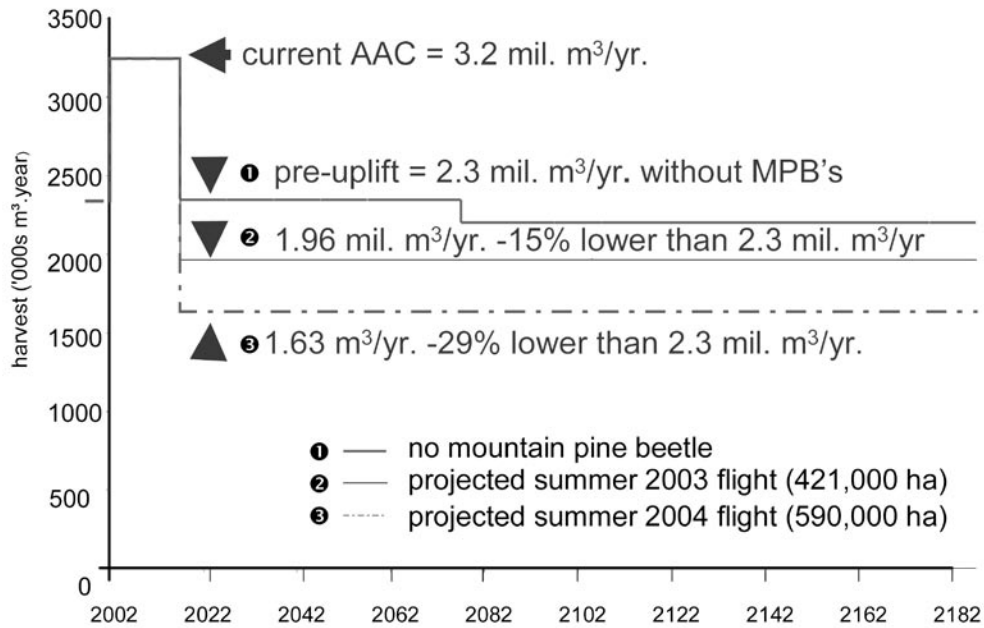


Figure 7. Projected impacts of mountain pine beetle on future timber supply in the Quesnel TSA. (MPB = mountain pine beetle)

Projected impacts and key observations for the Quesnel TSA

Figure 7 shows the timber supply projections for three scenarios:

- If there were no mountain pine beetle infestation;
- If the infestation stopped at the projected summer 2003 level (421,900 ha); and
- If the infestation stopped at the projected summer 2004 level (all 590,000 ha of pine-leading stands are attacked by varying severity classes, but not over-run).

The projection for no beetle infestation follows the base case forecast in the most recent Timber Supply Review analysis (British Columbia Ministry of Forests 2001). The level of 2.3 million m³/year was the AAC for the Quesnel TSA prior to 2001 (British Columbia Ministry of Forests 2001). Then the AAC was increased to 3.248 million m³ to address the mountain pine beetle infestation.

If the infestation stopped at the projected summer 2003 level, i.e., with a very cold 2003/2004 winter and no further spread of the infestation, the timber supply would decline from its current AAC level (3.248 million m³/year) to 1.96 million m³. This is approximately 15% lower than pre-uplift levels (Fig. 7).

The lowest forecast levels in Figure 7 show the potential effect if the beetle continues to spread by 40% during the summer of 2004, until all available pine has been infested. Given that the rate of spread in this area is closer to 200%, it is likely that the infestation has already reached the level projected for 2004. After 15 years, the projected analysis shows a timber supply of 1.63 million m³/year, a 29% decrease of the mid-term harvest. If the infestation continues beyond next summer, future timber supply will decline still further. However, it is unlikely that 100% of the pine will be killed. In the past, large-scale outbreaks have collapsed due to localized depletion of suitable host trees, in combination with adverse weather effects (Safranyik 1978).

It has been determined that harvesting at the current AAC of 3.248 million m³ will likely not keep up with the infestation. If the current AAC is maintained for 15 years, 42 million m³ could be harvested, leaving about 34 million m³ unsalvaged. With higher harvest levels, timber losses could be reduced, although the decline of the mid-term timber supply level would still occur. If next winter is sufficiently cold, or if pine retains its merchantability for longer, the projected declines may not be as great.

Summary of Timber Supply Analyses and Challenges Ahead

The 2003 data and analysis results for the 12 management units in central BC show the seriousness of the problem. However, impacts could be reduced if:

- harvesting is directed to the more severely infested stands and at reducing the spread of the infestation;
- harvesting focuses more on pine than on other species; or
- the infested forests are regenerated more quickly.

The extent of the infestation is uncertain and the deterioration rate of killed trees is beyond management intervention. However, timber supply declines might be lessened if harvests were focused in areas where deterioration rates were more rapid. If warm weather trends continue for the next one to three years, then it is likely that the mountain pine beetle infestation will have a significant impact on the available timber supply over the mid-term. To minimize this impact, continued aggressive action toward harvesting beetle-killed timber, the development of local economic, social and environmental strategies, and the collaboration between interested communities toward the completion of a responsive provincial strategy, will help to mitigate the severe impacts of the mountain pine beetle on the people and forests of central BC.

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