Discussion Paper

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An assessment of critical assumptions supporting the timber supply modelling for mountain-pine-beetle-induced allowable annual cut uplift in the Prince George Timber Supply Area

John Pousette[1] and Chris Hawkins[2]

Abstract

To address the mountain pine beetle epidemic, the allowable annual cut (AAC) for the Prince George Timber Supply Area (TSA) has been increased by 5.7 million m^3 to 14.944 million m^3. Timber supply model forecasts supporting AAC uplift decisions show a significant mid-term timber supply falldown. Timber supply modelling undertaken for the Prince George TSA in support of the recent AAC decision has not incorporated mortality in stands less than 60 years old, has generally considered the shelf life of beetle-killed wood to be 5 years for use as dimension lumber and 5 additional years for use as products of reduced fibre quality, and has assumed that pine timber makes up at least 78% of the total harvest in the short term. Current research suggests that certain of these assumptions may be optimistic. Refinements to these important timber supply analysis assumptions may result in a mid-term timber supply falldown that is deeper and longer than originally forecast. If the current outbreak continues unabated, stands in which lodgepole pine represents over 70% of the volume will provide enough mature growth to satisfy the new AAC for a further 14 years. It may be that the current increased AAC will not be realized for this period of time because of economic and environmental reasons. Greater value may be gained by not harvesting pine-dominated stands that contain significant stand structure or advance regeneration. Retention of these stands could mitigate the negative effects to the environment, hydrology, and wildlife while increasing the volume available in the latter part of the mid-term. Barriers to forest licensees focussing harvest in these stands include current mill requirements, existing traditional operating areas, previously approved cutting permits, stumpage appraisal, accessibility, and other economic considerations.

KEYWORDS: *allowable annual cut, immature pine mortality, mountain pine beetle, timber shelf life, timber supply analysis, timber supply modelling.*

Contact Information

1 MSc Candidate, Natural Resources and Environmental Studies, University of Northern British Columbia, 2000 South Ospika Boulevard, Prince George, BC V2N 4W5. Email: John.G.Pousette@gov.bc.ca

2 Mixedwood Ecology Program Chair, University of Northern British Columbia, 3333 University Way, Prince George, BC V2N 4Z9. Email: hawkinsc@unbc.ca

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Introduction

The timber supply analyses undertaken by both government and industry for various forest management units predict a significant mid-term falldown as a result of the current mountain pine beetle epidemic (Pedersen 2004a; Canadian Forest Products 2005; Nussbaum 2006). At a provincial level, this falldown in future harvest is likely to begin in approximately 10 years and last for a further 50 years. The extent (depth and length) of the falldown will depend on the following factors.

- The extent of mortality in immature lodgepole pine trees.
- The extent to which harvesting follows the expected focus on dead and dying pine as modelled in the timber supply analysis supporting the Chief Forester's allowable annual cut (AAC) determination.
- The extent of mortality in mature trees.
- The shelf life of attacked mature trees.

No new timber supply analysis was undertaken in support of this paper. Instead, we examine trends in these four factors for the Prince George Timber Supply Area (TSA) in the context of timber supply analysis principles. We also explore how these trends may affect the forecasted mid-term AAC falldown.

The timber supply analyses undertaken by both government and industry predict a significant mid-term falldown as a result of the current mountain pine beetle epidemic.

Background

Provincial-level Increases in the Allowable Annual Cut

In response to the mountain pine beetle (MPB) infestation, the Chief Forester increased AACs in British Columbia by over 15 million m^3 (B.C. Ministry of Forests and Range 2006), or by approximately 21%. In forest management units in which the MPB infestation has peaked (e.g., the Vanderhoof Forest District; the Lakes and Quesnel TSAs; and Tree Farm Licence (TFL) 53 [Dunkley Lumber Ltd.]), these increases in AAC are intended to permit the salvage of attacked timber. The focus in these units is to salvage as much as reasonably possible before the timber loses its economic value while considering all other forest values. In management units in which the MPB infestation is at an earlier stage (e.g., the Merritt, Okanagan, and Invermere TSAs), AAC increases are intended to reduce the spread of beetles by removing infested trees before the beetles reproduce. Table 1 provides a summary of increases in the AAC related to MPB by forest management unit. Further AAC uplifts may be established as the infestation moves out of the central interior into the northern and southern portions of the province.

Timber Supply Analysis of Forest Management Units Infested by Mountain Pine Beetle

Under Section 8 of the British Columbia's *Forest Act*,[1] the Chief Forester must consider several factors when determining an AAC. To explore these factors, timber supply analysis is done using computer models. These analyses predict future harvest forecasts using forest inventory files, stand growth and yield models, and forest management assumptions. As part of the timber supply analysis, a "base case" harvest forecast is established that reflects the currently observed forest management assumptions. Where uncertainty exists in the input data, a sensitivity analysis is also conducted to examine the possible range of outcomes. Many of the timber supply analyses supporting MPB AAC uplifts also considered the MPB spread predictions given in the *British Columbia Provincial Scale Mountain Pine Beetle Model* (Eng *et al.* 2005). Although principles of timber supply review are based on "current practice" and the "base case," these predictions allowed the Chief Forester to examine "what if" scenarios in which the MPB infestation spreads unabated through the next two decades.

Prince George Timber Supply Area

The Prince George TSA (Figure 1), which is made up of the Prince George, Vanderhoof, and Fort St. James forest districts, has had two MPB-related AAC increases since 2002. The first increase (3.0 million m^3, effective June 1, 2002) was directed toward stands in which the harvest would reduce the spread of beetles.

[1] Revised Statutes of British Columbia. 1996. Chapter 157. Forest Act. Part 2, Section 8. URL: *http://www.for.gov.bc.ca/tasb/legsregs/forest/foract/part2.htm#section8*

TABLE 1. Provincial allowable annual cut uplifts to address the mountain pine beetle infestation (to January 30th 2006) (B.C. Ministry of Forests and Range 2006)

Management unit	Current AAC (m^3)	MPB uplift (m^3)
Kamloops TSA	4 352 770	1 000 000
Lakes TSA	3 162 000	1 662 000
Merritt TSA	2 814 171	1 000 000
Okanagan TSA	3 375 000	700 000
Prince George TSA	14 944 000	5 700 000
Quesnel TSA	5 280 000	2 940 000
Williams Lake TSA	3 768 400	850 000
Tree Farm Licence (TFL) No. 5	300 000	177 000
TFL 18	290 000	112 000
TFL 42	160 000	40 000
TFL 49	580 000	200 000
TFL 53	880 000	641 000
Total	**39 906 341**	**15 022 000**

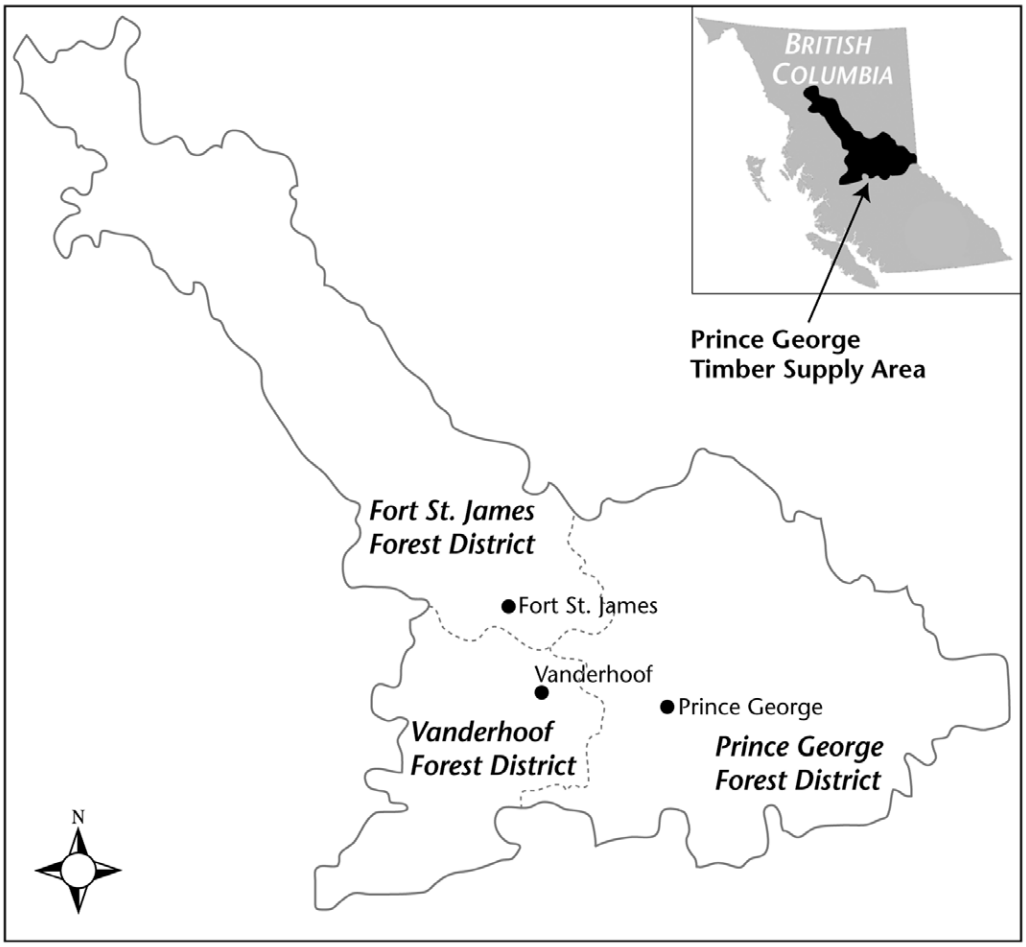

FIGURE 1. Forest districts within the Prince George TSA (B.C. Ministry of Forests and Range 2006).

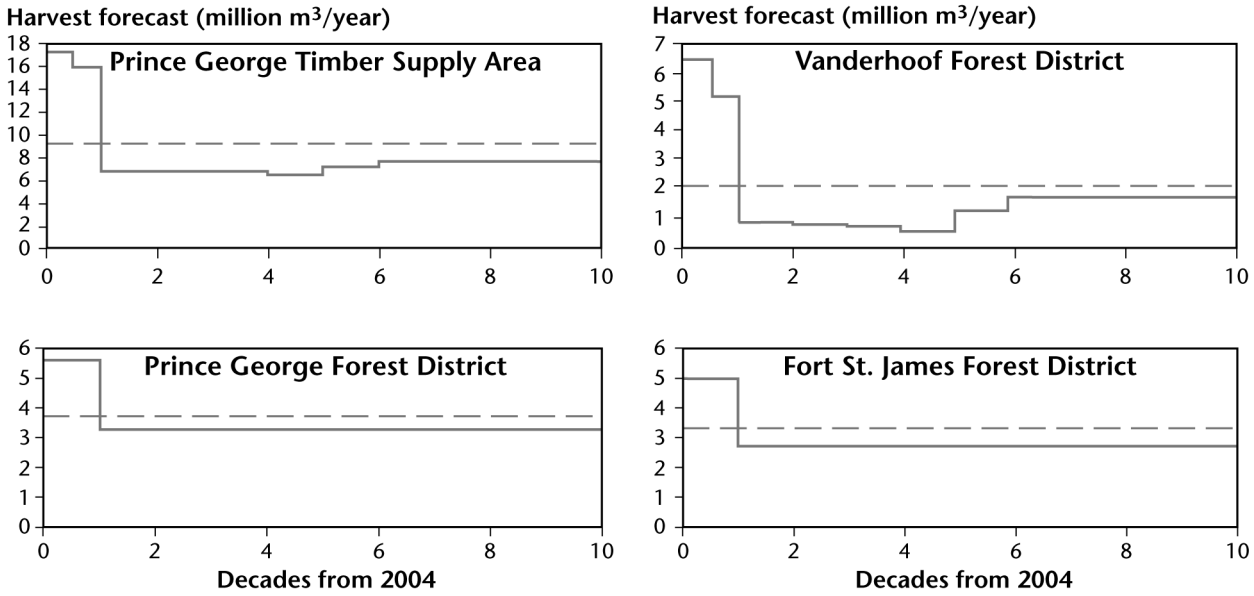

FIGURE 2. Harvest forecasts based on projected mortality to 2009, by forest district in the Prince George TSA and for the TSA as a whole (Pedersen 2004b). Dashed line represents pre-MPB steady state harvest forecasts.

The most recent increase of an additional 2.7 million m^3 (effective October 1, 2004) refocussed the AAC on salvage. The analysis supporting the most recent AAC uplift examined two scenarios relating to the spread of beetles (Pedersen 2004b). The base case used the current MPB-related pine mortality to 2004 and a sensitivity analysis examined the harvest forecast predictions in which the MPB epidemic continues unabated through to 2009 (Eng *et al.* 2005) (Figure 2). Although the harvest forecast produced by the timber supply model shows an initial 5-year level of 17.1 million m^3, the Chief Forester established an AAC of 14.944 million m^3 because of uncertainty surrounding the persistence of the infestation and inventory volumes, and increased stand- and landscape-level retention for biodiversity (Pedersen 2004b).

Factors Affecting the Extent of the Timber Supply Falldown

Immature Mortality and Timber Supply Forecasts

The harvest forecasts shown in Figure 2 do not account for any mortality in pine stands less than 60 years old. Ongoing research regarding mortality in natural and planted immature stands by Hawkins (2006) and Maclauchlan (2006) indicates significant levels of attack. For biogeoclimatic subzones such as the Sub-Boreal Spruce (i.e., SBSdw2, dw3, and mc2) where the MPB infestation has peaked or is on the decline, Hawkins (2006) reported landscape-level mortality of 12% in age class one (1–20 years old), 29% in age class two (21–40 years old), and 26% in age class three (41–60 years old). Results from Hawkins' study indicate that current attack rates for immature pine may increase further as beetles run short of suitable larger-diameter host trees, and confirm that greater attack rates occur in stands with larger stem diameters. Hawkins also reported that stands thinned and pruned under various silviculture programs (e.g., the joint provincial/federal Forest Resource Development Agreement [FRDA] program) generally experience higher rates of attack. Conversely, Maclaughlin (2006) found in a provincial-level study that spaced stands did not experience significantly higher levels of attack compared with unspaced stands.

Immature mortality caused by the MPB will result in an extension, and possibly a deepening, of the mid-term falldown period beyond that which has been forecast in any provincial timber supply analysis to date. In addition, to ensure that stands are not at an increased risk of further epidemic levels of attack, caution must be exercised

Current attack rates for immature pine may increase further as beetles run short of suitable larger-diameter host trees.

TABLE 2. Percentage of pine and approximate harvest level assumed in the first 10 years of the Prince George TSA timber supply forecasts supporting the 2004 AAC decision (calculated and actual; A. Nussbaum, Senior TSA Analyst, Forest Analysis and Inventory Branch, B.C. Ministry of Forests and Range, pers. comm., 2005)

	Pre-uplift (2002) AAC			Uplift AAC			Current AAC			Assumed	
Forest district	Harvest (million m^3)	% pine	% other	Allocation (million m^3)	% pine	% other	Allocation (million m^3)	% pine[a]	% other[a]	% pine	% other
Prince George	4.2	60	40	1.3	100	0	5.5	69	31	67	33
Vanderhoof	2.0	80	20	3.9	100	0	5.9	93	7	92	8
Fort St. James	3.0	70	30	0.5	100	0	3.5	74	26	70	30
Prince George TSA	9.2			5.7			14.9			78	22

[a] Calculated

when proposing silviculture treatments under the current *Forests for Tomorrow* program (S. Hoyles, Silviculture/ Forest Health Team Leader, B.C. Ministry of Forests and Range, pers. comm., 2006).

Assumptions About the Proportion of Lodgepole Pine Expected to be Harvested

Traditionally, lumber mills in the Prince George TSA had specific requirements regarding log size, species, and lumber grades to satisfy long-established customer relationships. In establishing the AAC for the Prince George TSA, licensee requirements for certain lumber-mill profiles by species were considered. Table 2 outlines the assumptions regarding species percentages used in the 2004 timber supply analysis. To maintain AAC uplifts without unduly affecting the mid-term timber supply, the timber supply analysis assumed that harvested pine should constitute at least 92% in the Vanderhoof Forest District, 67% in the Prince George Forest District, and 70% in the Fort St. James Forest District. For the TSA as a whole, pine is expected to constitute 78% of the harvest volume. Harvesting pine at even higher percentages than assumed in the analysis may help alleviate the mid-term timber supply falldown. Unharvested stands would then contain mostly non-pine species. After the MPB epidemic, these stands should have a high enough residual volume to be successfully harvested in 10–50 years. The response to the release associated with the death of pine is the subject of ongoing research into both immature understorey regeneration (pine and other species) and mature non-pine secondary species.

Harvest of Lodgepole Pine

Figure 3 shows the percentage of pine volume harvested from Crown land since 1998 in each of the three Prince George TSA forest districts. The MPB epidemic is most advanced in the Vanderhoof Forest District, with pine representing over 75% of the mature timber inventory. In this district, the proportion of pine harvested on Crown land has increased from 69% in 1998 to 85% in 2005. The harvest of pine on Crown land in the Prince George Forest District has increased from 31% to 66% during the same time period; in the Fort St. James Forest District, pine harvest increased from 50% to 63%. In 2005, pine harvest represented 71% of the harvest volume for the Prince George TSA as a whole. Although the forest industry has significantly increased its focus on pine harvest, the forest districts in this TSA have yet to achieve the amount modelled in the analysis supporting the most recent AAC uplift. One reason for this might relate to the previous Forest Practices Code. Under the Code, major licensees generally had a large timber inventory approved as "category A" cutblocks. For some licensees, this standing timber inventory represented as much as 3-years' harvest. The current *Forest Act* (Section 58 [1] and [2]) requires that logging under approved cutting permits occurs by a certain date, otherwise licensees must pay for the timber even if it is not harvested. This is referred to as "take or pay" legislation. As this approved standing timber inventory is harvested, licensees will be able to focus more of their AAC on salvage of MPB-attacked pine. Under new scaling grade changes that took effect April 1, 2006 (see "Shelf Life as Reflected in Scaled Log Grades" below), licensees were given an opportunity to surrender cutting permits without penalty. This window of opportunity existed until June 2006 and allowed licensees to surrender approved, but unharvested, cutting permits that did not focus on attacked pine.

Another reason that harvest billings show licensees have yet to achieve the level of pine harvest modelled in

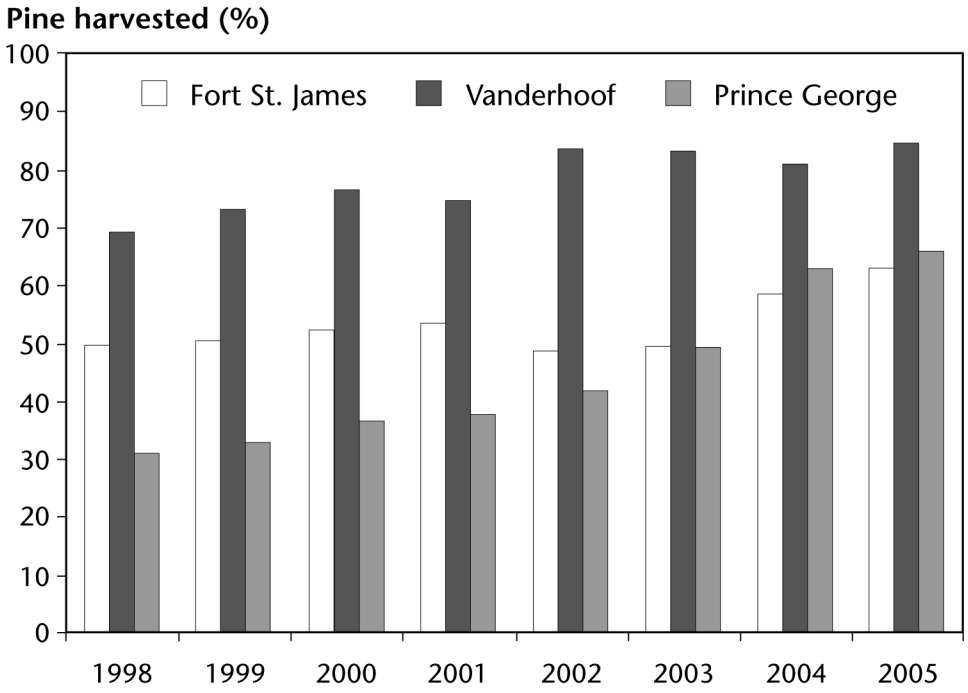

FIGURE 3. The percent of pine volume harvested from Crown land in each of the three forest districts in the Prince George TSA since 1998 (B.C. Ministry of Forests and Range 2005a).

the timber supply analysis relates to the underestimation of non-pine species in pine-leading stands in the forest inventory. Forest inventory techniques in British Columbia include the stratification of aerial photographs for timber types followed by a very limited field-check of these forest inventory polygons using ground plots. Inventories based on aerial photographs provide an accurate accounting of the dominant and co-dominant tree species, but not of the intermediate or suppressed trees lower in the canopy.

Equating forest inventory to harvest billing is not a true and fair comparison, but it does indicate major trends. Forest inventory is designed to be accurate at a TSA level to within ± 10% (D. Nakatsu, Resource Information Growth and Yield Specialist, Forest Analysis Branch, B.C. Ministry of Forests and Range, pers. comm., 2006). Harvest billing is based on scale returns and waste assessments, and is designed to be accurate at a forest-management-unit level to within ± 1% (L. Husband, Interior Scaling Supervisor, Prince George Forest District, B.C. Ministry of Forests and Range, pers. comm., 2006).

Until April 1, 2006, the harvest of MPB-attacked pine had been encouraged by Crown stumpage rates of $0.25 per cubic metre for dead and dry logs (see "Shelf Life as Reflected in Scaled Log Grades" below). The B.C. Ministry of Forests and Range's recently announced changes to log grading alter this incentive by proposing to drop the categories of dead and dry sawlogs. It is unknown how these changes will affect the focus on dead and dying pine.

Projected Dead Lodgepole Pine Volume over the Next 10 years

If the AAC uplift for the Prince George TSA was to continue for 10 years, the total amount of pine targeted for harvest (based on timber supply modelling expectations) would be approximately 115 000 000 m^3. The amount targeted for other species (e.g., spruce, balsam fir, Douglas-fir, and deciduous species) would be about 35 000 000 m^3. Assuming that the current MPB epidemic continues at the rate predicted for the Prince George TSA (Eng *et al.* 2005), attacked pine volume on the timber harvesting land base over the same 10-year period would be approximately 225 000 000 m^3. This prediction includes volume from stands in which pine is the primary species as well as from stands in which pine makes up a minor component. Under the current AAC uplift, this estimate represents about twice the volume of pine mortality that is expected to be harvested over the same time period. Clearly, more than enough dead

lodgepole pine timber will be available to satisfy current forest licence commitments and targets for stand- and landscape-level retention for biodiversity and other integrated resource management objectives. With such an excess of unharvested dead timber, stands should be categorized for retention based on:

1. ability to contribute to mid-term timber supply (post-epidemic);
2. suitability for stand- and landscape-level biodiversity contribution; and
3. capacity to contribute to other high-value forest resources (e.g., caribou habitat).

Priorities exist for stands in the last two categories, but a discussion of these is beyond the scope of this paper.

Priorities for stands in the first category might be derived from:

- the quantity of other species (non-pine) in the mature stand (mixedwood);
- the quantity and vigour of surviving pine trees;
- the amount of suitable understorey in the form of seedlings and saplings (vigour of regeneration);
- the susceptibility of the surviving trees to blowdown; and
- access and economic issues.

Current Lodgepole Pine Mortality

Table 3 shows MPB-caused lodgepole pine mortality (after 2005 beetle flight) for the three forest districts in the Prince George TSA. The attack data presented in this table was obtained by the Council of Forest Industries (COFI)/B.C. Ministry of Forests and Range MPB Task Force for 2005 and is compared to the MPB mortality predicted for 2006 (Eng *et al.* 2005).

Because of the methodologies used, the COFI data must be compared with the following year's BCMPB prediction (D. Routledge, COFI Mountain Pine Beetle Task Force, pers. comm., 2006). The COFI data is collected in October each year through a survey of forest licensees and is a measure of grey-, red-, and green-attack trees infested by MPB. Green-attack trees are those that were infested during the summer beetle flight. These show up as red-attack trees in late spring and summer of the following year. For a given year, the BCMPB v2 model (Eng *et al.* 2005) only predicts mortality up until the summer flight because it is based on spring and summer aerial surveys of red MPB-killed pine. Green-attack trees are not tallied and red-attack trees are those infested during the previous summer's flight. The model predictions are based on B.C. Ministry of Forests and Range aerial surveys done since 1999 (Westfall 2004).

Table 3 indicates that MPB-caused lodgepole pine mortality in the Prince George TSA to the fall of 2005 (grey-, red-, and green-attack) is between 110 and 140 million m^3. For the 2005 post-flight attack, an 18% difference is evident between that reported by the COFI/B.C. Ministry of Forests and Range MPB Task Force and the BCMPB v2 prediction. Considering the errors inherent in the data collection, these figures are considered to be the best available estimate of the range of current mortality in the Prince George TSA.

Lodgepole Pine as a Proportion of the Current Standing Mature Inventory

Figure 4 shows the current (2004) mature forest inventory for the Prince George TSA by species and the percentage of lodgepole pine in forest inventory polygons for each of the forest districts. Forest inventory

TABLE 3. Cumulative MPB-caused lodgepole pine mortality (post-2005 beetle flight) for the three forest districts in the Prince George TSA

	Cumulative pine mortality (million m^3)	
Management unit	**Reported[a]**	**Predicted[b]**
Prince George Forest District	26.5	31.5
Vanderhoof Forest District	89.5	55.4
Fort St. James Forest District	19.7	24.5
Prince George TSA	135.7	111.4

[a] Doug Routledge, Vice President, Northern Operations, Council Of Forest Industries (COFI) and COFI/B.C. Ministry of Forests and Range Mountain Pine Beetle Task Force, pers. comm., 2006.

[b] British Columbia provincial-scale mountain pine beetle model (BCMPB v2, Eng *et al.* 2005).

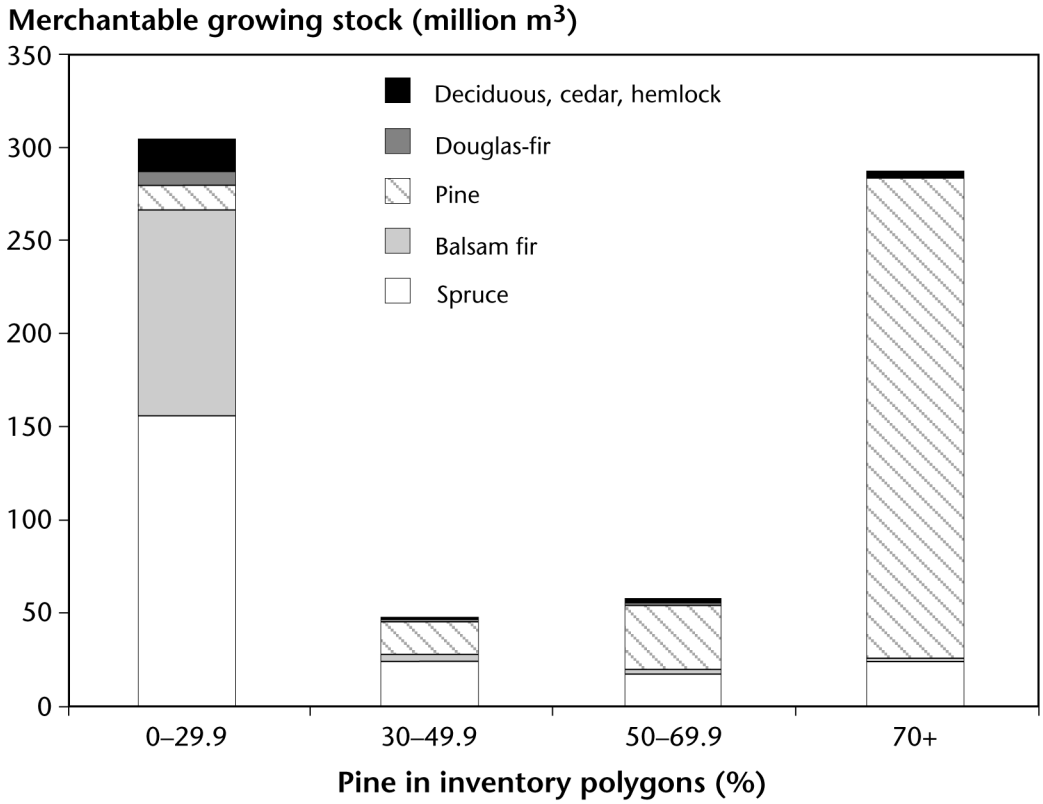

FIGURE 4. Merchantable growing stock (standing timber greater than 61 years old) summarized by the percentage of pine in inventory strata for the Prince George TSA.

polygons in the timber harvesting land base are grouped into one of four strata based on their pine content: 0–29.9%, 30–49.9%, 50–69.9%, and 70–100% pine by volume (cubic metres). These strata are entirely arbitrary and serve only to illustrate four simple categories that may fit a MPB harvest management strategy.

For the Prince George TSA, the 2004 forest inventory indicates that over 280 million m^3 of mature volume exists in stands in which pine makes up greater than 70% of the timber. Stands in which pine represents 70% or more of inventory polygons generally occur in the Vanderhoof Forest District, the western portion of the Prince George Forest District, and the southern and central portion of the Fort St. James Forest District (Figure 5). In these stands, pine constitutes approximately 90% (over 250 million m^3) of this volume. In addition, 30 million m^3 of incidental spruce, balsam fir, and Douglas-fir occur in these stands. Assuming 80% mortality (Eng *et al.* 2005), at the end of the epidemic approximately 200 million m^3 of dead lodgepole pine will exist in the Prince George TSA. Not all of this is harvestable as the Chief Forester also allowed for an additional 12% retention for biodiversity in his AAC uplift decision. In 2004, enough volume existed in this stratum alone to satisfy up to 16 years of harvest at the current accelerated rate ([280 million $m^3 \times 0.88$] ÷ 14.944 million m^3/year). This assumes (possibly erroneously) that the shelf life for attacked pine is not limiting. Harvest activities that have occurred since 2004 have reduced this a further 2 years to 14 years of potential supply in stands in which pine makes up over 70% of the timber volume. If stands in which pine represents 50–69.9% of the species are added, a further 3 years of harvest at the current accelerated AAC could occur. At this time, no clearcut-type harvest is necessary in stands in which pine represents less than 50% of the standing volume. The latter stands represent potential mid-term timber supply. The current AAC uplift is unlikely to be realized for the 14 years, as calculated, because it does not recognize that greater value may be gained by not harvesting pine-dominated stands, which contain significant stand structure or advance regeneration. Retention of these stands could mitigate the negative effects to the environment, hydrology, and wildlife while increasing the volume available in the latter part of the mid-term.

If the MPB epidemic continues, other species may be available for harvest in the mid-term (see Figures 4 and 5). For those stands in which pine represents less than 50% of the standing volume, balsam fir makes up

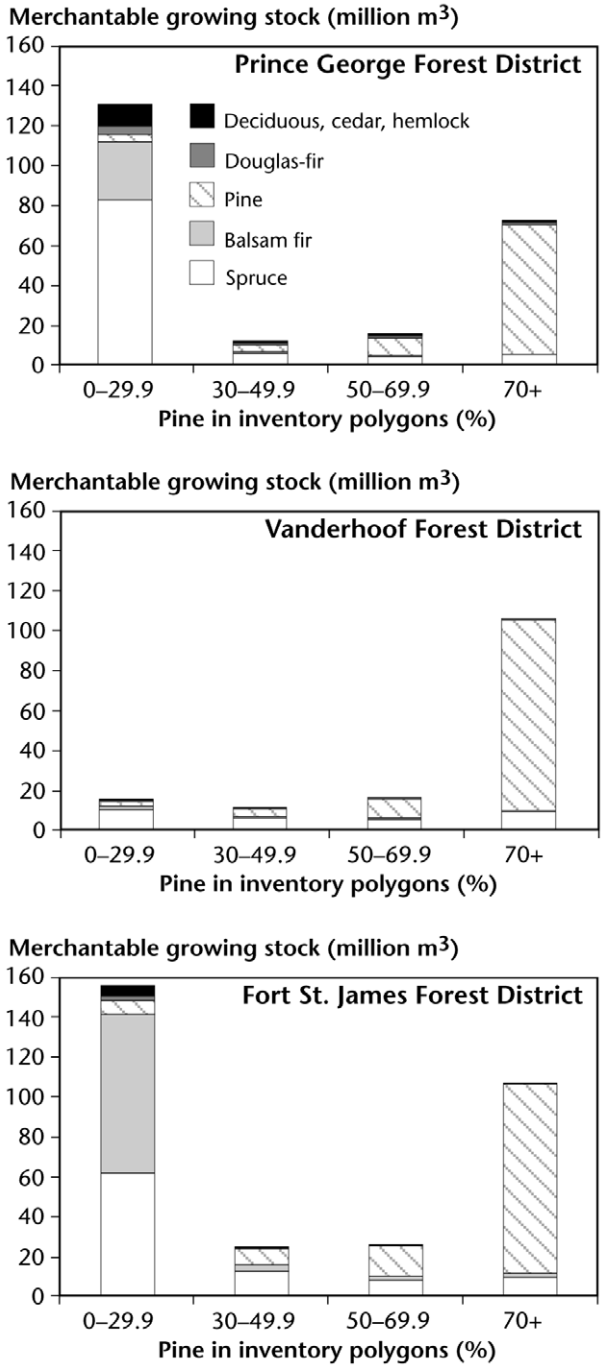

FIGURE 5. Merchantable growing stock (standing timber greater than 61 years old) summarized by the percentage of pine in inventory strata for each of the forest districts in the Prince George TSA.

115 million m^3 of the 350 million m^3 of mature timber. This less desirable species occurs on the steeper slopes and higher elevations of the Fort St. James Forest District in stands that have been under attack by the balsam bark beetle since 2002 (A. Tait, Zone Forester, Stewardship, B.C. Ministry of Forests and Range, Fort St. James Forest District, pers. comm., 2006).

For those stands in which pine constitutes less than half of the volume, spruce accounts for approximately 180 million m^3, Douglas-fir for 8 million m^3, and other species (e.g., cedar, hemlock, and deciduous species) for 17 million m^3 of the volume. In these non-pine-leading stands, pine accounts for 30 million m^3 of the volume, but it is not known how much will be attacked by the MPB.

Barriers exist to focussing future harvests on the stands in which pine represents 70% or more of the inventory. For instance, certain considerations govern where licensees can, and will, harvest, including traditional licensee operating areas and mill requirements, outstanding approved cutting permits, stumpage appraisal considerations, location, access, timber quality, and economics.

Shelf Life as Reflected in Scaled Log Grades

Shelf life of beetle-killed wood is defined as: "the length of time after death that a tree will be usable for a given product" (Eng *et al*. 2005). In the central interior, Pedersen (2004a) reported that beetle-killed timber is typically usable for dimension lumber for up to 3–5 years after attack. The log grades used for stumpage appraisal purposes before April 2006 reflect the condition of the logs brought into mills. For example, before the 2006 changes were implemented, log-scaling rules for lodgepole pine separated dead-dry from live-green (Table 4). A grade-3 log is dead and dry and typically exhibits loose bark and no indication of a live phloem layer (Figure 6); however, grade-3 logs have not deteriorated to the extent that they are less desirable for lumber. Grade-3 pine logs deteriorate into grade-5 logs when the extent of checking

TABLE 4. Log grades for pine used in the British Columbia interior before April 2006

	Log grades	
Expected recovery	**Live (green)**	**Dead (dry)**
Greater than 50%	"sawlog" (blank grade)	3
Less than 50%	4	5

FIGURE 6. A typical log classified as "grade-3" according to provincial scaling regulations that existed before April 2006. Photo taken in Canadian Forest Product's Plateau Division log yard in August 2004.

increases and less than 50% is useable to process into dimension lumber. Logs with multiple checks are difficult to process into quality lumber and are reported to "explode" in the milling process (S. Sheldon, Woodlands Manager, Dunkley Lumber Ltd., pers. comm., 2006). Grade-5 logs are often referred to as pulpwood. Before the 2006 grade changes, grade-5 logs were not charged to the AAC.

As the MPB epidemic has grown, the volume of grade-3 timber harvested from Crown land in the Prince George Forest District has also increased significantly (Figure 7). Over 63% of the lodgepole pine harvested in 2005 was grade 3 or grade 5, and over 10% of all pine harvested was grade 5.

Shelf life plays a major role in the expected timber supply. During the current epidemic, the mountain pine beetle has generally attacked the largest host trees in a

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stand first and in subsequent years of repeated attack moves down to smaller-diameter trees until a minimum threshold diameter of about 10 cm (diameter measured at 1.3 m height) is reached (Hawkins 2006; Maclauchlan 2006). For a given stand, this often results in a range of time since mortality and a range of conditions with respect to suitability for processing and shelf life. For the harvest forecasts shown in Figure 2, shelf life was assumed to be 10 years—5 years for sawlogs and a further 5 years for other products (Pedersen 2004b). This assumption may or may not be optimistic for the Prince George Forest District and other management units in which attacked lodgepole pine appears to be degrading at a faster rate than expected (i.e., an increasing amount of the harvest is scaled as pulpwood, or grade 5, timber). Current improvements in sawmilling technology and the innovative use of pulp-quality timber for other fibre-based products may offset the rapid deterioration of timber. If not, shelf-life assumptions used in analyses to date are optimistic and the negative effects on timber supply may be experienced in both the short and mid-term.

Conclusions

For the Prince George TSA, important timber supply analysis assumptions regarding immature mortality, the proportion of attacked lodgepole pine harvested, and the shelf life of beetle-killed timber will likely result in a mid-term timber supply falldown that is deeper and longer than originally forecast. If the current outbreak continues unabated, the forest inventory in the Prince George TSA contains enough mature volume in pine-leading stands (i.e., stands in which lodgepole pine represents 70% or more of volume) to satisfy the AAC for a further 14 years. This estimate also accounts for other values such as enhanced biodiversity. However, forest licensees face barriers to focussing future harvests on this profile, including mill requirements, existing traditional operating areas, previously approved cutting permits, stumpage appraisal considerations, accessibility, and economic considerations.

Assuming that the mid-term timber supply will mostly depend on other species, licensees will also have

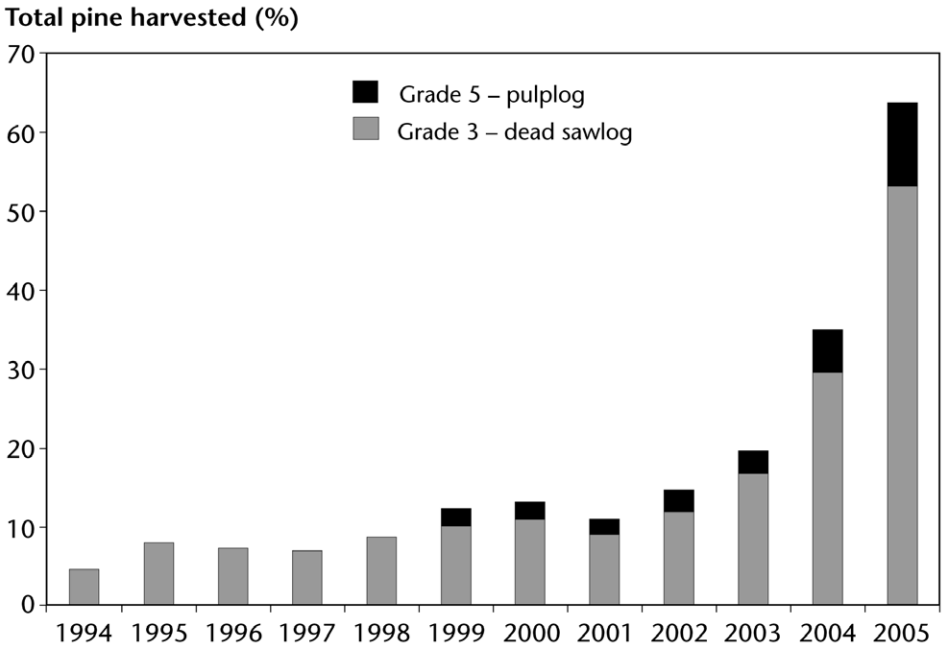

FIGURE 7. Grade-3 logs (dead sawlogs) and grade-5 logs (pulplogs) as a percentage of the total pine harvested from Crown land in the Prince George Forest District (B.C. Ministry of Forests and Range 2005a).

to contend with higher delivered wood costs, lower revenues (for *Abies* sp.), and reduced logging season (i.e., increased wet ground will restrict access to the winter months only).

Government and the forest industry must consider the development of a co-ordinated strategy to help mitigate these impacts in central interior timber supply areas such as Prince George, where the mountain pine beetle will likely significantly reduce the mid- and long-term timber supply. The following immediate actions may be considered:

- Defer harvest in mature stands in which pine does not represent the major component; the remaining species may make up an economically harvestable stand in the future.
- Defer harvest in MPB-attacked mature pine stands in which significant levels of suitable advance regeneration occurs in the form of understorey poles, seedlings, and saplings.
- Shift harvest in traditional licensee operating areas from stands with few attacked pine to stands in which attacked pine makes up a significant component (e.g., as in the Bowron Valley in the 1980s during the spruce bark beetle infestation).
- Examine, and modify if required, legislative and operational impediments to strategies (such as those suggested above) that may help alleviate future falldown in timber supplies.

To ensure that implementation is appropriate for a given forest management unit, timber supply analysis and growth and yield modelling must explore the potential effects of these forest management actions. Where results show significant mitigation of mid-term timber supply, appropriate actions should be considered.

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Test Your Knowledge . . .

An assessment of critical assumptions supporting the timber supply modelling for mountain-pine-beetle-induced allowable annual cut uplift in the Prince George Timber Supply Area

How well can you recall some of the main messages in the preceding discussion paper? Test your knowledge by answering the following questions. Answers are at the bottom of the page.

1. To address the mountain pine beetle epidemic, the allowable annual cut in British Columbia was raised to approximately 86 million m^3, as of January 2006. What is the magnitude of the increase (rounded to the nearest million)?
   A) 30 million m^3
   B) 20 million m^3
   C) 15 million m^3
   D) 10 million m^3
   E) 5 million m^3

2. A critical assumption used in the timber supply analysis supporting the Chief Forester's 2004 AAC uplift decision for the Prince George Timber Supply Area was that a certain proportion of the harvest was to be MPB-susceptible lodgepole pine. How much of the harvest in the TSA is expected to be pine?
   A) 45%
   B) 56%
   C) 67%
   D) 78%
   E) 89%

3. What may be hindering certain forest licensees from focussing future harvests on pine?
   A) Maintaining the integrity of traditional licensee operating (chart) areas.
   B) Mill configuration requirements.
   C) Customer requirements.
   D) Economics possibly tied to stumpage appraisal considerations.
   E) Accessibility (existing road networks).
   F) All of the above.

ANSWERS

1. C 2. D 3. F