Guidance on Landscape- and Stand-level Structural Retention in Large-Scale Mountain Pine Beetle Salvage Operations

December 2005

Introduction

The purpose of this document is to share my thoughts with other forest professionals on the retention of forest structure in large-scale salvage operations of mountain pine beetle killed-timber. It is my hope that this paper will provide useful information; however, I would like to stress at the outset that this is not to be interpreted as direction. This paper is intended as guidance only and is not legally binding.

While it is important to recover as much economic value as possible from our stands of dead pine before they deteriorate, it is also critical to ensure our planning and practices associated with protecting biodiversity values are in step with the increased rate of salvage harvesting.

In the fall of 2004, in response to the potential loss of timber volume due to mountain pine beetle infestation, Larry Pedersen, the previous Chief Forester of British Columbia, increased the allowable annual cut (AAC) in the Lakes, Prince George and Quesnel TSAs. The extent of the beetle infestation in these three TSAs means that the control strategy previously in effect was no longer effective, and the decision was made to move to a salvage strategy. The 2004 AAC increases are intended to facilitate harvesting of pine stands that have already been damaged by beetle infestation. As a result, forest harvesting will occur at a much faster rate than was contemplated when the AAC was set at levels designed to harvest the “healthy” forest.

Since taking over as Chief Forester, I have also had to consider timber supply implications in management units affected by the mountain pine beetle epidemic. I anticipate more such reviews will be completed in the years to come. I believe it is incumbent on me to inform forest professionals regarding the ecological principles that the previous Chief Forester and I have taken into consideration during the course of making AAC determinations in management units affected by the mountain pine beetle.

In this paper, I will discuss the issues and ecological principles considered by the previous Chief Forester and the reasoning behind his AAC determinations. In addition, I will provide my thoughts on the determination decisions and present information for consideration by resource professionals as they implement the large-scale salvage program.

Background and Issue

British Columbia is currently in the midst of the largest recorded mountain pine beetle outbreak in North America (B.C. Min. of For. 2004).

As part of the timber supply review process for the Lakes, Prince George and Quesnel TSAs, the previous Chief Forester asked for an Interpretation Paper to be written outlining the current understanding of the Ministry of Forests and Range about the implications of large-scale salvage operations (Eng 2004). The Interpretation Paper raised significant concerns about the environmental impacts of the rapid increase in the rate of harvesting associated with salvage. In order to manage the risks, the Interpretation Paper made a number of stewardship recommendations. A key recommendation was to increase the amount of retention in proportion to the size of salvage openings (up to 25% in the case of openings larger than 1000 hectares).

Based on this information, the previous Chief Forester assumed an additional 12% stand-level retention within forests that were classified as moderately or severely beetle attacked (i.e., greater than 31% of the stand is dead pine). This level of retention is over and above:

- standard stand-level retention (wildlife tree retention, and lakeshore, wetland and stream riparian retention); and
- standard old-growth retention.

The previous Chief Forester was well aware that his decision to rely on a timber supply analysis that assumed increased retention was an unusual situation within the timber supply world. Normally, a timber supply analysis is an extrapolation of current practices. Indeed, this is one of the previous Chief Forester's "guiding principles" for AAC determinations. However, in the Lakes, Prince George and Quesnel TSAs, the previous Chief Forester believed there were compelling reasons to allow for higher retention levels when salvaging beetle-killed wood.

When discussing the rationale for this aspect of his AAC determinations, the previous Chief Forester stated:

> "For the purpose of this decision, I have decided to reflect the stewardship recommendations [in the Interpretation Paper] as modelled in the base case. While I acknowledge that they are not mandatory, I feel it is appropriate to consider their implications in the decision in order to ensure that adequate opportunity is given to other government decision makers to consider how to respond to this new information. This seems more reasonable in the short term rather than precluding its consideration by implementing an uplift that would compromise their possible attainment."[1]

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[1] Quesnel Timber Supply Area: Rationale for Allowable Annual Cut Determination. http://www.for.gov.bc.ca/hts/tsa/tsa26/tsr3/rationale.pdf. Note that this quotation is repeated in the rationales for the 2004 allowable annual cut determinations for the Prince George and Lakes TSAs.

In November 2004, I took over as Chief Forester. I have since reviewed the circumstances surrounding the previous Chief Forester's AAC determinations for the Lakes, Prince George and Quesnel TSAs. I concur with the previous Chief Forester's assessment of the key recommendation in the Interpretation Paper.

Admittedly, "For operations of the scale anticipated in BC, there is no literature documenting effects of [large-scale] salvage." (Bunnell et al. 2004). On a small-scale, there is a large and growing body of literature that documents the benefits to non-timber values of retaining structure (in the form of live trees and standing and fallen dead trees) on harvested cutblocks.[2] The question is whether retaining additional structure will be equally effective in dealing with the risks associated with large-scale salvage. For the reasons set out below, I believe the answer is "Yes."

The 4.9 million cubic metres of total AAC uplift for the three TSAs represents a 27% increase in harvest levels over previous existing AACs. When this is combined with the previous AAC uplifts for controlling the beetle infestation, the harvest level is about 80% higher than it would have been if a healthy forest management scenario had prevailed. On the plus side, along with the rapid harvesting comes rapid reforestation, bringing about a certain amount of hydrologic recovery as the new seedlings grow and transpire. However, it is important to note that hydrologic recovery is not expected until the new trees are about 9 metres tall (B.C. Min. of For. 2001). Until then, there is a significant risk of hydrological problems.

Rapid harvesting also means that large percentages of watersheds will be harvested over a short period. This represents a departure from what is normally considered acceptable in watersheds, thus increasing the risk of stream instability, sedimentation and loss of biodiversity. I believe increased retention is likely the best option for minimizing these risks, particularly until these watersheds have reached hydrologic recovery. Retention may be particularly effective around sensitive areas (e.g., areas with high water tables) – maintaining an undisturbed forest floor with large amounts of dead wood and, where possible, live trees.

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[2] For an introduction to the subject, I suggest:

- Franklin, J.F., D.B. Lindenmayer, J.A. MacMahon, A. McKee, J. Magnsun, D.A. Perry, R. Waide, and D. Foster. 2000. Threads of Continuity. Cons. Biol. in Practice Volume 1, No. 1, pp. 8-16.
- Special Issue of Forest Ecology and Management. 2002. Volume 155, Issues 1-3, pp. 315-423.
- Coates, K.D. and P.J. Burton. 1997. A gap-based approach for development of silvicultural systems to address ecosystem management objectives. For. Ecol. Manage. 99:337-354.
- Seymour, R.S. and M.L. Hunter Jr. 1999. Principles of Ecological Forestry. In: Managing Biodiversity in Forest Ecosystems. M.L. Hunter Jr., editor. Cambridge University Press. pp. 22-61.

In reaching this conclusion, I am mindful of the following:

- Both harvesting and beetle infestation may result in increased peak flows and water yields, leading to elevated risks for streambank instability and sedimentation (Cheng 1989).
- Increased water yields are less likely to produce adverse effects if roads and other ground disturbance are absent (e.g., areas retained from harvesting) (Hetherington 1987).
- Hydrologic recovery is sped up by leaving live species to transpire water (e.g., understory shrubs, advanced regeneration or non-pine mature trees) (B.C. Min. of For. 2001).
- Regarding the wildlife species present in the three uplift TSAs, keeping non-pine tree species within salvage blocks will help retain about 60% of the terrestrial vertebrate species, bryophytes, lichens and non-pest invertebrates (Bunnell et al. 2004).
- Retained standing dead pine has been shown to remain standing for upwards of 10 years. During this time, it can help to sustain cavity nesting species and provide shade, thus slowing down spring snowmelt. Once the dead pine falls, it becomes coarse woody debris to provide habitat and shade for other species (Bunnell et al. 2004) (Hewlet 1982).
- Retained live pine is at high risk of becoming infested; however, until then, it will provide transpiration benefits and likely remain standing longer than pine that is already dead.

In summary, there is significant uncertainty about the effects of the 80% increase in harvesting in the Lakes, Prince George and Quesnel TSAs, particularly with regard to non-timber values such as biological diversity and hydrologic function. Accordingly, I believe caution is warranted.

Even in the absence of research specifically addressing the impact of large-scale salvage, I believe there is sufficient evidence to suggest that the risk to non-timber values decreases as the amount of retention increases at either the stand or landscape level (or in some cases both). The remainder of this paper sets out some options forest professionals may wish to consider when providing advice to licensees on the appropriate level of retention for large-scale salvage operations.

I will begin by looking at options at the landscape level. In particular, I believe that collaborative, multi-stakeholder, long-term landscape-level planning is the best option for managing increased retention that is balanced between the landscape and the stand.

I will then discuss options that can be used at the stand level. Stand-by-stand decisions on retention levels can be done without landscape-level planning, although for reasons I will address below, perhaps not as effectively.

Landscape-level Planning

The key to good planning for beetle salvage is to plan out many years for both the retention and harvest areas.[3] A potential benefit of this planning is a reduction in the amount of stand-level retention. For example, watersheds containing significant landscape-level retention (or inoperable areas that will not be harvested) may need less stand-level retention.

Such long-term landscape-level planning could potentially be undertaken within the implementation frameworks of the Vanderhoof, Lakes, and Prince George LRMPs, the Cariboo Chilcotin Land Use Plan, and the collaborative planning being done to meet the *Order Establishing Landscape Biodiversity Objectives for the Prince George Timber Supply Area*, October 20, 2004. Alternatively, licensee groups might wish to undertake such planning as part of their Sustainable Forest Management Plan (SFMP) work.

The primary issue is the placement of increased amounts of retention across management units, considering both stand-level retention (e.g., riparian areas and wildlife trees) and landscape-level retention (e.g., old growth, ungulate winter ranges, and wildlife habitat areas). Accordingly, I would recommend that forest professionals consider the following strategies.

Guidance for Landscape-level Planning and Operations

1. Plan out as many years as possible for both the retention and harvest areas.
2. Plans should be spatially explicit for landscape-level retention, considering the full range of values for conservation – visuals, ungulate winter ranges, wilderness tourism, etc.
3. Recognize that retention levels may vary by landscape unit in the plan in order to retain areas of non-pine species for mid-term harvest.
4. Develop the plan cooperatively so it is known and honoured by all operators harvesting in the management unit.
5. Complete salvage operations in the area as quickly as possible.

Stand-level Retention

In the Lakes, Prince George and Quesnel TSAs, we are contemplating salvage operations of an unprecedented spatial and temporal scale. However, I believe good stand-level planning can help reduce the potential negative effects on a variety of values (Lindenmayer et al. 2004). Ideally, retention will be spatially well-distributed within all harvested openings to provide vertical structure, a variety of wildlife habitats, and coarse woody debris over the long term.

Obviously, determining the amount and placement of retention within a particular cutblock will be based on a consideration of both the timber and non-timber

[3] For ease of analysis, the modelling of increased retention for timber supply was done on a block-by-block basis.

values found within the block and the sensitivity of these values to disturbance. Even so, I believe there are some principles that are generally applicable to all blocks. Accordingly, I would recommend that forest professionals consider the following strategies.

Guidance for Stand-level Planning and Operations

1. Retain areas with live trees as a first priority in order to maximize the potential to move water from the soil through evapotranspiration. For example, areas with advanced regeneration or areas with lower pine to non-pine ratios of mature stems. Cutblocks of particularly high mortality will rely on the maintenance of dead pine where insufficient live trees exist.
2. Maintain stand-level retention for the rotation. These retention areas are providing an important source of dead wood, standing and down structure, and intact forest floor, which assists with hydrologic stability and provides biodiversity and habitat value throughout the stand rotation – potentially "lifeboating" species until the newly regenerated stand matures sufficiently and provides higher levels of biological diversity. Having said this, I do note the possibility that a portion of the retained areas, particularly those chosen with advanced regeneration and a mixture of tree species, may achieve an operable status 30 or 40 years sooner than the salvaged component of the stands. This may provide a late mid-term harvest opportunity and have a relatively low impact on stand ecology since the regenerated stands will have attained hydrologic recovery.
3. Operable areas of non-pine species should be kept available to provide mid-term harvest opportunities. These areas should not be locked up as stand-level retention. It is important to balance the need for ecological conservation with the need to protect timber values.
4. Vary the amount of stand-level retention with the size of the cutblock based on opening size. To that end, I draw licensees' attention to Table 1 from the Interpretation Paper, which is reproduced here.

Table 1. Recommended proportion of stand-level retention based on opening size.

Opening Size	Percent of Opening Un-harvested/retained
<50 ha	10%
50 – 250 ha	10 – 15 %
250 – 1000 ha	15 – 25 %
> 1000 ha	> 25 %

5. With respect to Table 1, it will be a challenge to define the opening size if it "grows" over time. There are, therefore, two ways to assess the amount of stand-level retention. First, wildlife tree retention is assessed as defined by the requirements of FRPA. However, when considering this guidance document, retention levels should be assessed in a second way – for "functional" openings. Functional openings can be defined as contiguous areas harvested or disturbed within the last 30 years (or a similar time frame), plus the retention areas within and adjacent to the opening.
6. The retention levels outlined in Table 1 are only an average suggested for blocks of a similar size within an operating area. Retention levels should not be applied arbitrarily to any one size of opening since no two openings are the same. The amount of retention and its spatial distribution will be different as a result of differences in stand characteristics such as topography, LRMP direction, and environmental sensitivity. Accordingly, there is a range of targets for stand-level retention around the generally desired percentage for a given opening size.

Conclusion

In closing, the challenge of managing the impact of the beetle infestation will continue for several more decades. Though this guidance is not legally binding, it is important for me, as British Columbia's Chief Forester, to share my thoughts on this important resource management issue with other forest professionals.

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