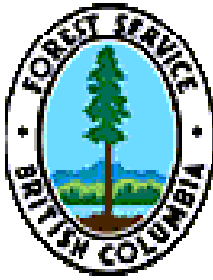


Kamloops TSA Forest Health Strategy



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Prepared for:

Kamloops and Headwaters Forest Districts

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TABLE OF CONTENTS

1.0: INTRODUCTION	5
1.1 STRATEGY AREA OF INFLUENCE	5
1.2 BACKGROUND – FOREST HEALTH MANAGEMENT IN THE TSA	5
1.3 LINKS TO OTHER PLANS	5
1.4 FOREST HEALTH MANAGEMENT OBJECTIVES.....	6
1.5 DETERMINATION OF PRIORITY FOREST HEALTH FACTORS WITHIN THE TSA	6
2.0: BARK BEETLE STRATEGY	7
2.1 GUIDING PRINCIPLES.....	7
2.2 BARK BEETLE OBJECTIVES.....	7
2.3 BARK BEETLE PRIORITIES AND STRATEGIES	7
2.4 MOUNTAIN PINE BEETLE STRATEGIES	12
2.5 SPRUCE AND DOUGLAS-FIR BEETLE STRATEGIES.....	16
2.6 BLOWDOWN	20
2.7 WESTERN BALSAM BARK BEETLE	20
3.0: DEFOLIATORS	20
3.1 WESTERN SPRUCE BUDWORM	20
3.2 TWO-YEAR CYCLE SPRUCE BUDWORM.....	21
3.3 WESTERN HEMLOCK LOOPER (IDL).....	22
4.0: DECIDUOUS DEFOLIATORS AND LEAF MINERS.....	22
5.0: ROOT DISEASES	22
5.1 INTRODUCTION.....	22
5.2 LAMINATED ROOT DISEASE	23
5.3 TOMENTOSUS ROOT DISEASE	23
5.4 MANAGEMENT STRATEGIES AND TACTICS (ALL ROOT DISEASES)	23
6.0: PESTS OF YOUNG STANDS.....	23
6.1 INTRODUCTION.....	23
6.2 WARREN’S ROOT COLLAR WEEVIL	24
6.3 DWARF MISTLETOES	24
6.4 SPRUCE / WHITE PINE WEEVIL (IWS)	26
6.5 WHITE PINE BLISTER RUST	26
6.6 ROOT DISEASES	26
6.7 ANIMAL DAMAGE - DEER.....	27
6.8 ANIMAL DAMAGE - CATTLE.....	27
6.9 HARD PINE STEM RUSTS.....	27
7.0: RESEARCH REQUIREMENTS	28
8.0: REFERENCES	29
8.1 GENERAL FOREST HEALTH REFERENCES	29
8.2 BARK BEETLE REFERENCES	30
8.3 SUMMARY OF INTERNET INFORMATION SOURCES (IN ORDER FIRST REFERENCED)	31

APPENDICIES

APPENDIX 1: 2007 UPDATE OF THE KAMLOOPS TSA MOUNTAIN PINE BEETLE STRATEGY	33
1.0 INTRODUCTION.....	33
1.1 THE KAMLOOPS TSA MPB STRATEGY – MARCH 2006	33
1.2 2007 UPDATE OF “THE KAMLOOPS TSA MPB STRATEGY – MARCH 2006”	34
2.0 NATURAL RESOURCE VALUES – ISSUES AND GUIDANCE FOR SALVAGE PLANNING.....	36
3.0 PRIORITIES FOR SALVAGE OPERATIONS.....	36
3.1 ISSUES	36
3.2 SALVAGE PRIORITIES	36
3.3 FACTORING VOLUME ESTIMATES FOR SUSCEPTIBLE STANDS	37
4.0 SALVAGE CAPACITY AND ALLOCATION OF RESOURCES	38
4.1 ISSUES	38
4.2 INTRODUCTION.....	38
4.3 TSA STRATEGY TO ADDRESS HIGHEST PRIORITY FOR SALVAGE (HPS) STANDS.....	38
4.4 PRINCIPLES FOR ALLOCATION OF RESOURCES TO ADDRESS MPB PRIORITIES	40
5.0 BUSINESS AND ADMINISTRATIVE ISSUES	40
6.0 DATA SUPPORTING THE 2007 UPDATE OF THE 06 MPBS.....	41
APPENDIX 2: DOUGLAS-FIR BARK BEETLE STATISTICS AND STRATEGIES	45
APPENDIX 3: SPRUCE BARK BEETLE STATISTICS AND STRATEGIES	50
APPENDIX 4: COMMITMENT SPREAD SHEET.....	55

LIST OF TABLES

<i>Table 1: Priority and ranking of Forest Health Factors in the Kamloops TSA</i>	<i>6</i>
<i>Table 2: Bark Beetle Strategy Definitions</i>	<i>9</i>
<i>Table 3 Bark Beetle Management Tactics as they apply to specific BMU strategies.....</i>	<i>11</i>
<i>Table 4: Roles and responsibilities for implementation of the Kamloops TSA FH Strategy.....</i>	<i>12</i>
<i>Table 5: Kamloops TSA THLB 2006 Aerial Survey Results</i>	<i>35</i>
<i>Table 6 TSA Salvage Priorities – Stand Characteristics.....</i>	<i>36</i>
<i>Table 7: TSA 2006 Salvage Priorities -- MPB Attack Levels</i>	<i>37</i>
<i>Table 8: Major Licensee Pcell Strategy for Salvaging “Highest Priority for Salvage” Stands.....</i>	<i>39</i>
<i>Table 9: TSA Aerial Overview Flight Information – 2005 and 2006 -- THLB.....</i>	<i>41</i>
<i>Table 10: TSA MPB Salvage Priorities – 06 MPBS and 2007 Update -- THLB</i>	<i>43</i>
<i>Table 11: Mountain pine beetle BMU strategies and statistics.....</i>	<i>44</i>
<i>Table 12: Douglas-fir bark beetle BMU strategies and statistics</i>	<i>46</i>
<i>Table 13: Susceptible age stands with a Douglas-fir component by BMU.</i>	<i>47</i>
<i>Table 14: Summary of Douglas-fir bark beetle occurrence in the Kamloops TSA</i>	<i>48</i>
<i>Table 15: Spruce bark beetle BMU strategies and statistics</i>	<i>51</i>
<i>Table 16: Susceptible Age stands with a spruce component by BMU</i>	<i>52</i>
<i>Table 17: Summary of the 2006 spruce beetle in the Kamloops TSA.....</i>	<i>53</i>

LIST OF FIGURES

<i>Figure 1: Kamloops TSA Mountain Pine Beetle Strategies -- Feb 2007.....</i>	<i>16</i>
<i>Figure 2: Kamloops TSA Douglas-fir Bark Beetle BMU Strategies – Feb 2007.....</i>	<i>18</i>
<i>Figure 3: Kamloops TSA Spruce Bark Beetle BMU Strategies – Feb 2007.....</i>	<i>19</i>

1.0 Introduction

1.1 Strategy Area of Influence

The Kamloops Timber Supply Area (TSA) is located in the south central interior of B.C. and includes the Kamloops Forest District and the Clearwater portion of the Headwaters District. It covers approximately 2.7 million hectares (including Wells Gray Provincial Park and excluding Tree Farm Licences 35 and 18). In the area available for timber harvesting, the greater part of the forest is dominated by lodgepole pine, Douglas-fir, spruce, and balsam. Smaller areas are dominated by cedar, hemlock and deciduous species. Lodgepole pine, Douglas-fir, and spruce are the tree species most commonly utilized by the local forest industry. The following forest health strategy covers this area.

1.2 Background – Forest Health Management in the TSA

By definition, Integrated Forest Health Management (IFHM) is a system that applies all suitable techniques and methods to maintain pest populations at levels below those causing unacceptable damage or mitigates such damage. A complete IFHM program includes both proactive and reactive measures. Proactive forest health measures help regulate extremes in pest cycles, reduce future pest risks, and ensure the sustainability of forest resources. Reactive forest health measures consist of suppressing existing pest outbreaks using short-term direct control methods with the intent of lowering pest populations and preserving resource values. Reactive measures will always be part of a forest health program due to the cyclical or unpredictable nature of forest damaging agents. Stakeholders within the Kamloops TSA support this integrated management approach.

This document does not contain a conclusive list of all pests, but rather those that may have significant impacts or those that frequently occur within the TSA. Licensees were asked to comment on the relative priority or ranking of forest health factors (FHF).

Management strategies and tactics used in the Kamloops TSA are generally consistent with those outlined in relevant Forest Practices Code Guidebooks. Bark beetle management strategies were updated in early 2007 by District staff working with TSA forest licensees. Key tactics and actions are provided based on current and historical beetle incidence, overall stand hazard, beetle pressure, accessibility; and available forest licensee and forest district resources.

1.3 Links to Other Plans

Forest health management should strive to enhance “ecosystem health” thereby improving resiliency and sustainability. This approach complements the Vision Statement of the “Sustainable Forest Management Plan (SFM) for the Kamloops Timber Supply Area” (Anon, 2003):

“The Sustainable Forest Management Plan will foster forest management practices – based on a balance of science, professional judgment and local and First Nations input – that sustain the long-term health and productivity of forest ecosystems while contributing to a strong economy and thriving communities throughout the Timber Supply Area”.

It is worth noting that the Headwaters Forest District covers two timber supply areas. The

Headwaters Forest District Forest Health Strategy for the Robson Valley Timber Supply Area (Pathfinder Forestry Consultants, March, 2006) is the sister document for the northern portion of the Headwaters District.

1.4 Forest Health Management Objectives

1. Increase the success of regeneration practices
2. Increase the productivity of immature stands and minimize timber losses in order to stabilize the timber supply in the TSA.

The loss of future fiber supply presents a considerable challenge for stakeholders within the TSA and management of any significant forest health agent that may potentially affect this remaining supply will be critical. In addition, ecologically appropriate forest health practices may decrease impact on non-timber resource values, reduce the risk of wildfire associated with widespread timber mortality and improve public safety in multiple use areas. The bark beetle portion of this strategy outlines specific bark beetle management objectives.

TSA forest health management objectives are achieved by:

1. Maintaining a scheduled detection program for bark beetle Suppression BMUs and ongoing detection, identification and documentation of all other major forest health factors during silvicultural/stand management operations;
2. Assessing and updating stand and landscape level hazard and risk using the “best available information”;
3. Implementing appropriate, biologically-based management strategies and tactics;
4. Evaluating silvicultural and stand management practices for the purposes of proactive management; and
5. Quantifying the impact of forest health factors for incorporation into Timber Supply Reviews.

1.5 Determination of Priority Forest Health Factors within the TSA

A list of forest health factors (FHF) impacting forests of the Kamloops TSA was compiled in the winter of 2003 and was based mostly on forest licensee input. Rankings were adjusted in 2007 based on Forest District and licensee perspectives and professional opinion.

*Table 1: Priority and ranking of Forest Health Factors in the Kamloops TSA
(number in brackets denotes ranking)*

High	Moderate	Low
Armillaria root disease (1)	Western gall rust	Windthrow
Laminated root disease (2)	Warren's root collar weevil	Spruce gall adelgids
Spruce weevil (3)	Western hemlock looper	Moose
Two-year cycle spruce budworm	Lodgepole pine dwarf mistletoe	Western pine beetle
Tomentosus root disease (5)	Western balsam bark beetle	Exploding canker of fir
Mountain pine beetle (2)	Deer	Stalactiform blister rust
Spruce beetle (1)	Douglas-fir tussock moth	Comandra blister rust
Douglas-fir beetle (1)	Cattle (DHW)	Blackstain root disease
Western spruce budworm		Porcupine
White pine blister rust (4)		Spruce broom rust
Cattle (DKA)		Pine needle disease
		Forest tent caterpillar

2.0 Bark Beetle Strategy

2.1 GUIDING PRINCIPLES

1. Be consistent with current legislation. Augment, rather than reiterate policy and legislation.
2. Follow provincial guidance provided in “British Columbia’s Mountain Pine Beetle Action Plan 2006-2011”¹, in the forthcoming “Provincial Forest Health Strategy” with companion “Technical Implementation Guidelines”, and by the Provincial Bark Beetle Coordinator.
3. Align with the March 2006 “Kamloops TSA Mountain Pine Beetle Strategy” (updated Sections 1, 3 and 4 (2007) are included as Appendix 1 of the FHP).
4. Licensees and BC Timber Sales (BCTS) are encouraged to build upon the strategies and tactics contained herein in order to maximize the available harvesting capacity.

2.2 BARK BEETLE OBJECTIVES

The objective is an effective, coordinated, operational approach to beetle management; minimizing damage and maximizing economic recovery. Specifically:

1. Identify and prioritize bark beetle occurrences for suppression and salvage activities.
2. Provide updated strategic guidance for ongoing bark beetle management in the KTSA.
3. Facilitate co-operative planning between agencies and licensees.
4. Facilitate the development of scientifically, and ecologically sound operational strategies, plans and practices that result in a consistent coordinated approach.
5. Provide useful guidance to operational planners, reviewing agencies and approval authorities that facilitates forest health planning (FSPs, SPs and CPs) and operations.
6. Assign responsibility for beetle management to the various major licensees, BCTS, and Ministry of Forests (MOFR), and identify where there may be opportunities for small tenure holders, including small-scale salvage operators, to assist in salvage/suppression efforts.
7. Enable operational planners to focus on economically viable priorities to get maximum value from the infested trees (timely information, operational focus, easy to use, coordinated actions).

2.3 Bark Beetle Priorities and Strategies

Due to the diversity of forest types, all four major tree-killing bark beetle species pose a threat to the forests in the TSA. These beetles are the mountain pine beetle *Dendroctonus ponderosae*, Douglas-fir beetle *Dendroctonus pseudotsugae*, spruce beetle *Dendroctonus rufipennis* and western balsam bark beetle *Dryocoetes confusus*. The western balsam bark beetle is ubiquitous within most of the subalpine stands in the TSA. Infestations are detected and recorded by the Southern Interior Region aerial overview.

Priority and strategy assignment occurs on two levels: broad provincial zonations and landscape level beetle management units (BMUs). Information that is used to determine the status of forest health agents is provided by the MOFR via the annual aerial overview survey

¹ http://www.for.gov.bc.ca/hfp/mountain_pine_beetle/

and by reports from licensees, regional, district and branch forest health specialists and stewardship staff.

2.3.1 Bark Beetle Management Zones

The province is broken down into broad management zones within a defined Emergency Bark Beetle Management Area (EBBMA). Provincial bark beetle management zones allow rational allocation of resources to support aggressive actions in areas where management will have the greatest impact. The Province's beetle infested areas are divided into three broad "provincial bark beetle management zones" based on several parameters (i.e., level of attack, distribution of attack, susceptible stands remaining, age of outbreak, etc.) that relate to the likelihood of successful management. The three zones are:

- A. Aggressive Management – beetle populations are managed down to endemic levels;
- B. Containment – populations are held static; and
- C. Salvage/Limited Activity – minimal active management of beetle populations.

Tactics:

1. Aggressive and Containment Emergency Management Unit: all forest health treatments, including harvesting, may be used to control the infestation.
2. Sanitation Emergency Management Unit: harvesting is the primary forest health treatment used against the infestation.

Emergency Bark Beetle Management Areas

The Provincial Bark Beetle Coordinator updated the provincial zonation for Mountain Pine, Douglas-fir and Spruce Bark Beetles in January 2007. The designation followed examination of 2006 aerial overview information as well as consideration of management objectives reasonably expected to occur. For maps and designation letters refer to the Emergency Bark Beetle web site². Zonation is summarized by BMU in Tables 11 (Appendix 1), 12 (Appendix 2) and 15 (Appendix 3).

2.3.2 Beetle Management Units (BMU)

Within each broad Bark beetle Management Zone are individual Beetle Management Units (BMUs). BMUs are planning and reporting units for operational beetle management. The Kamloops TSA is divided into 29 BMUs. For each bark beetle, the BMUs have been assigned one of four specific strategies. These strategies are:

1. Suppression (also includes Prevention)
2. Holding Action (also included Maintain Low)
3. Salvage
4. Monitor (formerly Abandon)

Strategies are selected biannually based on the level of outbreak in an area, stand hazard rating, accessibility, beetle pressure from surrounding areas and the estimated effectiveness of management actions in achieving the strategy objective and performance measure. Potential constraints to meeting objectives are considered when assigning strategies within the TSA. Common constraints in the Kamloops TSA include conflicting resource values, First Nations

² http://www.for.gov.bc.ca/hfp/mountain_pine_beetle/maps/ebbma/

interests, operability, economic feasibility and harvest and treatment capacity. The implementation of a particular strategy in a BMU represents a commitment on the part of forest licencees and forest districts to work towards a measurable goal or performance measure prior to the next beetle flight.

2.3.3 General TSA Strategies

1. Strategy definitions and objectives are provided in Table 2.
2. BMU strategies for Lodgepole pine, Douglas-fir and spruce were updated in February 2007. The designations are shown in Figures 1 to 3 and summarized in Tables 11 (Appendix 1), 12 (Appendix 2) and 15 (Appendix 3).
3. Suppression activities for spruce and Douglas-fir bark beetles are prioritized ahead of salvage of mountain pine beetle. Spruce beetle suppression is the highest priority (due to its potential for rapid spread and high attack ratios plus recent blowdown events) followed by Douglas-fir beetle suppression and then mountain pine beetle salvage.
4. Explore opportunities for expediting harvest authority approvals consistent with “suppression” objectives.
5. Identify opportunities for smaller operators (small-scale salvage) to assist in carrying out the suppression activities.

Table 2: Bark Beetle Strategy Definitions

Strategy	Where Strategy Applicable	Strategic Objective and Performance Measure
Prevention	Large areas of uninfested or lightly infested timber with a moderate to high hazard rating.	Reduce the susceptibility/attractiveness of a stand to bark beetles.
Suppression	Area with low level of infestation or incipient populations where levels are building and where resources are available for aggressive management actions	Maintain area in a relatively uninfested state. Treat > 80% of polygons within 1 year.
Holding Action	Infestations in areas where resources or access are unavailable now, but are expected in the future.	Maintain an existing outbreak at a relatively static level over the short term. Treat 50-79% of polygons within 1 year.
Salvage	Areas where management efforts cannot reduce the beetle population, harvesting capacity and/or access is unavailable.	Delineate affected areas and salvage log stands to recover losses and rehabilitate. Other management objectives take precedent. Treat <50% of polygons within 1 year.
Monitor	Inaccessible areas or where management activities are restricted.	Satisfy other resource objectives or access concerns, some timber loss accepted.

2.3.4 Bark Beetle Management Tactics

A variety of treatment options are presently available. Most are used in combinations or in phases lasting up to several years. Wherever possible the utilization of tree fibre in conjunction with beetle population reduction is the preferred treatment. More expensive and labour

intensive options are generally chosen only to augment other treatments. The following list identifies the common tactics in the Kamloops TSA. Other options may be considered. *The Bark Beetle Management Guidebook* contains a more comprehensive list of possible tactics and treatments. Detailed discussion of management tactics for mountain pine beetle may be found in the publication “Strategies and Tactics for Managing the Mountain Pine Beetle, *Dendroctonus ponderosae*” (Maclauchlan and Brooks, 2001).

- **Detection:** Infestation presence and intensity may be assessed by overview flights, detailed flight surveys and ground detection (walkthrough recces and detailed probes).
- **Prediction/Monitoring:** Hazard and risk rating, over wintering mortality studies and green to red ratio calculations may be used to predict the size and potential location of future populations. Baited Lindgren funnel traps may be used as a flight monitoring tool for mountain pine beetle.
- **Harvesting:** Harvesting may be divided into 3 categories: sanitation, salvage, and high hazard host removal. This includes small patch and single tree selection in Suppression or Prevention BMUs and the direction of small scale salvage and NRFL priorities into Suppression BMUs.
- **Single Tree Treatment:** Fall and burn or fall and peel are included in this category. MSMA will no longer be used as a bark beetle management tool by the Ministry of Forests and Range.
- **Baiting and trap trees:** Aggregation semiochemicals or the intentional creation of patches of preferred host may be used to contain and concentrate beetle populations in an area where harvesting or other treatments are planned and access is available.
- **Hauling Restrictions and Logyard Management:** These restrictions are generally not required if trucks do not stop between the logging site and the destination and infested logs are “watered”, debarked or processed promptly. Restrictions may be implemented during beetle flight if points of destination are located within uninfested, high hazard drainages. Due to the level and distribution of the mountain pine beetle, hauling restrictions are not in place in the TSA. The goal of yard management is prompt manufacturing of delivered logs during beetle flight. Pheromone traps (to monitor flight or mass trap) and watering of decks may also be employed.
- **Access Development:** Access planning and development is important for short and long term management of the mountain pine beetle and other bark beetles in high value and high hazard stands.
- **Beetle Proofing:** Through stand manipulation, this *may* reduce the attractiveness of a stand to the mountain pine beetle. Suitable stands must be chosen and host removal uses all-aged selection or even-aged partial cutting.

Verbenone is a major ingredient of the antiaggregation pheromone of the mountain pine beetle. Although not practical for large-scale application, verbenone may be used as part of an integrated pest management program in specific situations such as on private property or high value recreation sites where attacks by the beetle are likely.

- **Reduction of Stand Susceptibility/Prevention:** Silvicultural treatments such as species and age class manipulation on a landscape level with the reduction of large, continuous areas of mature and over-mature forest types (that have been the result of activities such as fire suppression), in order to reduce the level of future damage to the forest. Requires a

long-term focus and is arguably the most effective long-term proactive prevention tactic. Management tactics used within the TSA are appropriate for the strategy identified for a particular BMU (Table 3).

Table 3 Bark Beetle Management Tactics as they apply to specific BMU strategies

Activity	Prevention	Suppression	Holding	Salvage	Monitor
Aerial Overview Survey	Yes	Yes	Yes	Yes	Yes
Detailed Aerial Survey	Yes	Yes	No – detail not required to direct harvest	No – detail not required to direct harvest	No – no action will be taken
Harvesting	High hazard host removal	Sanitation and high hazard host removal	Sanitation and high hazard host removal	Focus no longer on beetle removal but salvage of merchantable timber	Other resource objectives take precedence over harvest.
Single tree Treatments	Where conventional harvest not possible and treatment success is expected	Where conventional harvest not possible and treatment success is expected	Very minimal use when combined with harvest in adjacent areas	No – infestations too widespread to expect success.	Other resource objectives take precedence.
Access Development	Yes, into high hazard stands	Yes, into infested high hazard stands	Yes, into infested high hazard stands	Yes, into infested high hazard stands	Other resource objectives take precedence.

2.3.5 Guidance for salvage harvesting

Section 2 of the Kamloops TSA MPB Strategy - March 2006³ provides information to consider when planning salvage of mountain pine beetle attacked stands. This information may also be applicable when planning Douglas-fir and spruce salvage activities.

2.3.6 Bark Beetle Roles and Responsibilities

Licensee and BCTS planners and government agency reviewers collaboratively undertake implementation of this strategy.

1. Meetings are held on an as-needed basis to discuss the implementation and effectiveness of this strategy.
2. MOFR completes aerial overview surveys in the late summer and provides the resulting information to the licensees. The 2006 results are at regional⁴ and provincial web sites⁵.
3. Detailed aerial surveys and ground surveys are the responsibility of MOFR and licensees as

³ <http://www.for.gov.bc.ca/dka/KamloopsTSAMPBStrategy2006.pdf>

⁴ http://www.for.gov.bc.ca/rsi/ForestHealth/Aerial_index.htm

⁵ <http://www.for.gov.bc.ca/hfp/health/overview/overview.htm>

decided through the collaborative effort and as per available funding. Aerial survey results are available on the DKA Forest Health FTP site.⁶

4. Single tree removal/disposal, trap tree placement/removal and larger scale treatments are the responsibility of MOFR and licensees as decided through the collaborative effort.
5. The MOFR will pursue additional funding opportunities to undertake trap-tree programs, ground surveys, and small-site treatments in areas designated as “suppression” for Douglas-fir and spruce beetle.
6. Specific roles for monitoring, reporting and consolidation of information are determined via the meetings mentioned above.
7. Assessment of hazard and risk information is carried out by the MOFR and provided to licensees and other agencies as requested⁷.

Table 4: Roles and responsibilities for implementation of the Kamloops TSA FH Strategy

Action	Completion Date	Responsibility		
		Region	District	Licensee
Preparation of TSA Strategy Document	March		X	
Aerial Overview Survey	August	X		
Detailed Aerial Surveys	September		X	X - TFL
Single Tree Treatment/Bait and Trap Tree Program	Following year's plan: Dec		X	X
Monitoring, Reporting, and Consolidation of information	Ongoing	X	X	X
One on one communication	Ongoing		X	X
Complete Commitment Spreadsheet For Spruce and Douglas-fir treatments	October		X	X
Complete MPB pcell report and plan update	October		X	X
Aerial Spray Program	May-June	X		
Hazard and Risk Rating	Maps available on request.	X		
Final Report	February of following year		X	

2.4 Mountain Pine Beetle Strategies

Mountain Pine Beetle (*Dendroctonus ponderosae*)

2006 area impacted: 394,075 ha (17% increase over the 336,705 ha affected in 2005). Refer to

⁶ <http://www.for.gov.bc.ca/ftp/dka/external/!publish/Forest%20Health/>

⁷ http://www.for.gov.bc.ca/rsi/ForestHealth/hazard_rating.htm

Appendix 1 and the DKA forest health FTP site⁸ for information, mapping and data summaries. Mountain pine beetle has been reduced in priority from “high (1)” to “high (2)” due to the impracticality of continuing suppression activities in the midst of an epidemic situation. The species is still of high concern due to the accelerated spread and high attack levels not only in older age classes and at lower elevations, but also in stands that were expected to replace the mature growing stock.

The general strategy in the “salvage” zone is to harvest affected stands before their economic value is degraded while managing current and future forest values in context of sustainability.

2.4.1 Executive summary:

- **Kamloops Timber Supply Area (TSA) Mountain Pine Beetle Strategy (MPBS) – March 2006 (06 MPBS)**
- **2007 Update of the 06 MPBS**

Introduction

The Kamloops TSA MPB strategy identifies the issues created by the MPB infestation and provides information and strategies to address them.

The 2006 Kamloops TSA MPB Strategy has the following objectives:

1. Determine the extent of current and future infestations
2. Develop guidance to facilitate salvage planning.
3. Develop a TSA strategy that prioritizes stands/areas for salvage operations considering stand susceptibility, short and long term timber supply and other resource values
4. Develop a strategy to allocate resources to the highest priorities using summarized stand volumes/areas by priority.
5. Provide information to support TSR AAC recommendations (maintain, extend, or increase current AAC uplift)

The 2007 update of the 06 MPBS addressed objectives 1, 3 and 4. The 2006 Kamloops TSA MPB Strategy is a stand alone document. The 2007 update of the 06 MPBS is an integral part of the Kamloops TSA Forest health Plan and is included as Appendix 1. The 2007 update, using current data and refined strategies maintains a focus on maximizing the salvage harvest of the highest priority stands. Following is a brief description of 2007 results. Included are some key concepts and recommendations from the 06 MPBS that were not reviewed as part of the 2007 update.

Objective 1: Determine the extent of current and future infestations

1. The extent of the susceptible stands and the severity of the attack has significant implications, particularly for natural resource values, short and long term forest industry operations and investment risks, and physical and administrative capacity to address the situation.
2. High beetle population levels can be found in some stands in all parts of the KFD and the south-west part of the Headwaters Forest District (HFD)⁹ (Tables 5 and 11).

⁸ <http://www.for.gov.bc.ca/ftp/dka/external/!publish/Forest%20Health/>

⁹ Reference to the HFD in this strategy refers only to those portions of the district within the Kamloops TSA.

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3. The 2006 aerial survey results show fifty-four percent of PI stands (PI > 40%) older than 60 years with some level of attack.
 4. There is almost 60,000,000 m³ in these PI stands susceptible to MPB attack.
 5. Regional estimates based on Provincial history to date are eighty percent of the susceptible PI stands in the TSA will be attacked to some significant level.
 6. MPB attack intensity in the KFD will likely peak in 2008 (2007 MPB flight).

Objective 2: Develop guidance to facilitate salvage planning. (not updated)

1. Focus is managing for forest values, meeting public expectations and expediting salvage planning and operations. (06 MPBS)
2. Watershed/landscape level strategic and operational planning is emphasized. (06 MPBS)
3. Biodiversity and ecosystem functioning, and “hydrology – water – riparian” are the primary areas where guidance is provided. (06 MPBS)

Objective 3: Develop a TSA strategy that prioritizes stands/areas for salvage operations

Salvage priorities described in the 06 MPBS considered stand level characteristics, other resource values, Beetle Management Unit (BMU) strategies in place, and current attack severity.

1. Resource values (not updated -- Sections 2 and 3 of the 06 MPBS).
2. Stands with MPB in holding BMUs are a high priority for action. Where harvesting resources are limited they should be directed to holding BMUs before salvage BMUs.
3. Stand characteristics used to define TSA salvage priority are stand age, stem size (SI), level of occurrence of PI in stands, and site productivity (SI). The 2007 update adjusts the ranking of stand level characteristics (site index) and aligns with the February 2007 BMU strategies.
4. Priority stands have been grouped into three salvage priority classes; Low, Medium and High. Priority classes reflect the influence of stand characteristics on the susceptibility to MPB attack and short and long term timber supply. (Table 6)
5. Stand priorities have been combined with attack severity to identify the stands of Highest Priority for Salvage (HPS). HPS stands are those in medium and high priority for salvage that have a red attack level of moderate or higher (shaded area in Table 7).
6. The need for field review on a stand by stand basis to make a harvesting decision has been identified. It is recognized that care needs to be taken when deciding which volumes or areas are to be written off. The question is not the level or severity of the attack. The question is “can you recover enough timber of sufficient quality to provide an economic return?” (06 MPBS)
7. Shelf life is an important consideration when determining salvage priorities. Unfortunately, insufficient information is available to guide priority setting. The consensus is there is a very short window of opportunity; at most two years from attack. (06 MPBS)
8. 25,000,000 m³ in Low Salvage Priority stands are not initially included in salvage harvesting strategies. These stands require assessment for opportunities (salvage, capital investment, environmental benefit).
9. Stands with a PI component of less than 40 percent are not included in the salvage priorities or the salvage harvesting strategies.

-
10. To account for factors that reduce volume availability for salvage harvest, and to ensure estimates are conservative, a Salvage Factor of 50% is used when estimating the amount of susceptible and/or attacked volume that is commercially available for salvage (Table 8).

Objective 4: Develop a strategy to allocate resources to the highest priorities

A strategy to allocate harvesting resources to the highest priorities has been developed using summarized stand volumes and areas by priority. Licensees and BCTS worked collaboratively with Forest District staff to map which priority areas for harvest they will address and which are available for NRFLs or other uplift tenures.

1. This strategy is short term, extending from November 2006 to December 2008.
2. Volume estimates and pcell plans indicate there is sufficient HPS volume to meet available salvage AAC including uplift.
3. Annual review and updating of the strategy is required. It is designed as a rolling two year plan.
4. There may be an opportunity to focus the SSSP on Pcells with less than 25,000 m³. Such a focus might reduce overlap areas and issues with Major Licensees or BCTS and provide for more comprehensive planning for the SSSP.
5. Shifting of traditional operating areas, even temporarily, is very disruptive to the planning and operating practices of Major Licensees/BCTS. Operating principles to minimize issues was provided in Section 5 of the 06 MPBS.
6. Strategies described in Sec 5 of the 06 MPBS also address two primary areas of concern regarding overlapping and multiple tenures:
 - Watershed level assessments and planning -- coordinating planning with multiple licensees.
 - Operational challenges with overlapping tenures.

Objective 5: Provide information to support TSR AAC recommendations (not updated)

Next Steps

1. Address the 25,000,000 m³ in priority stands not included in salvage harvesting strategies as HPS.
2. Annual review of the area specific (pcell) allocation strategy (sec 4.3).
3. The 2006 Kamloops TSA Strategy and 2007 update serves as an umbrella document supporting coordination and integration of new information and more detailed approaches to specific aspects of MPB management and salvage. Integrate new information and more detailed approaches as they are developed.
4. Develop watershed assessment systems that will be effective in the current situation, and prioritize watersheds for assessment - ongoing
5. Monitoring of strategy implementation
6. Share information – awareness of impacts, strategies and results

Cooperation

From the outset there was recognition it was in the best interest of the TSA to address the MPB epidemic cooperatively. Licensees, BCTS and MOFR district staff have developed and implemented this strategy on that basis. (06 MPBS)

2.4.2 KTSA Tactics

1. Extent of the mountain pine beetle infestation, priorities for salvage and allocation of resources among tenure holders are provided in the 2007 update (Appendix 1) of the 2006 Kamloops TSA Mountain Pine Beetle Strategy.
2. Guidance for planning the salvage harvest of mountain pine beetle is included in Section 2 of the 2006 Kamloops TSA Mountain Pine Beetle Strategy.
3. BMU strategies for mountain pine beetle were reviewed and redesignated in February 2007. The majority of the KTSA has been identified as “salvage” for the purposes of the provincially established Emergency Bark Beetle Management Area. Since there are no longer opportunities to effectively control the spread of the mountain pine beetle, emphasis (priority) for management has been shifted to spruce beetle and Douglas-fir beetle where suppression activities may still be effective in controlling the spread, and impact of the insect.
4. Salvage harvesting of mountain pine beetle affected/susceptible stands is now a major focus in the TSA. Stands harboring beetle populations in Containment/Holding BMUs are a high priority for action. Where harvesting resources are limited they are directed to Holding BMUs before Salvage BMUs.
5. Single tree treatments are restricted to Suppression and Prevention BMUs within the TSA. None of the 29 BMUs in the TSA currently have this strategy for managing mountain pine beetle.

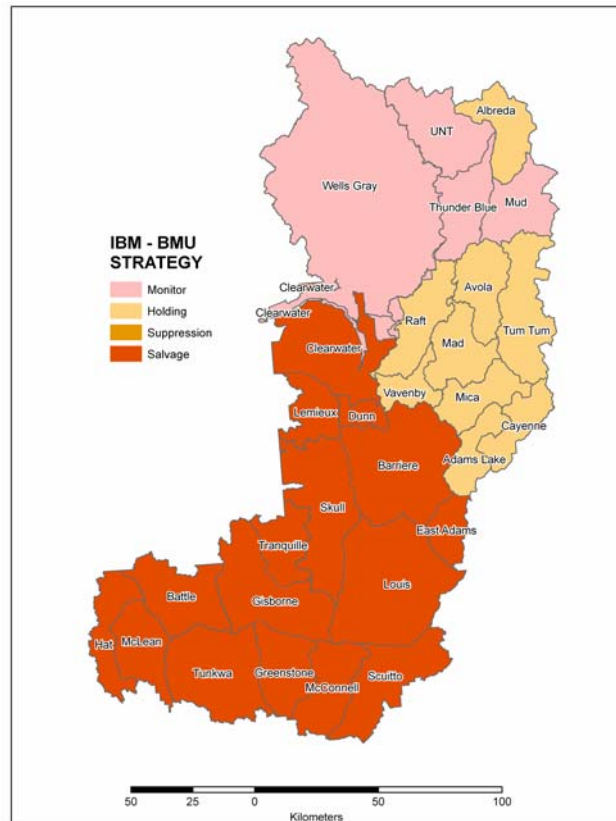


Figure 1: Kamloops TSA Mountain Pine Beetle Strategies -- Feb 2007

2.5 Spruce and Douglas-fir Beetle Strategies.

1. Both spruce and Douglas-fir beetle infestations have been increasing in the KTSA, but are still considered manageable at this time. Aggressive suppression of active infestations, in concert with an expedited program of trap trees has the potential to be effective in reducing these populations and the overall area of infestation.
2. Detailed aerial surveys are conducted to identify all Spruce and Douglas-fir stands with beetle infestations of three trees or more. Suppression activities are planned for that winter with the goal of treating at least 80% of all identified sites in the suppression zones. All

sites should be evaluated and the planned action (including no treatment) determined and recorded in the commitment spreadsheet¹⁰ (Appendix 4 and web site DKA FH FTP site).

3. Single tree treatments are restricted to Suppression and Prevention BMUs within the TSA. Single tree treatment tactics for Douglas-fir beetle and spruce beetle will be focused in areas where harvest access is restricted or not available before the next beetle flight and beetles pose a significant risk to neighbouring susceptible stands and where reduction of the majority of current beetle-infested trees is achievable and a substantial impact on infestation size and spread is expected. Typically these tactics are combined with harvesting in adjacent areas.
4. Directed sanitation harvesting of active Douglas-fir and spruce beetle infestations in Suppression, Holding and Prevention BMUs is considered to be the most effective means of managing current beetle populations to minimize infestation size and spread within the Kamloops TSA.
5. Expedited trap-tree programs throughout the Douglas-fir and spruce suppression zones to capture beetles and concentrate them where there is existing access.
6. The highest priority for treatment is the unconstrained landbase where “suppression” actions are being undertaken. Suppression of infested areas inside constrained areas (OGMA, MDWR, Riparian, etc.) are considered secondary to the above.

Detailed description of activities and treatments for “Suppression” of Spruce and Douglas-fir beetle:

1. Identify areas with beetle activity from overview flight provided by MOFR.
2. Confirm existing overview sites and identify new sites utilizing detailed aerial and ground surveys.
3. Prescribe treatments for all identified sites based on beetle activity level (no treatment, monitor, trap tree, fall and burn and harvest) anticipating that control activities may have to continue for more than one year. Where direct treatment is not possible (due to operability, economics, constraints on the landbase, etc.) prioritize actions based on the most effective use of the forest management capacity while protecting all forest resources.
4. Limit trap tree program to areas with low to moderate infestations (fall trees by the end of March in the KFD and the end of April in the HFD).
5. Focus harvesting activity in unconstrained or modified harvest areas.
6. Propose harvest areas (trap trees and blocks) within constrained areas (OGMAs, RRZs etc.) only if the site is within a low to moderately infested area and treatment of the site is critical to ensure effective beetle control in the area.
7. Complete the commitment spreadsheet that lists the sites, locations, and prescribed and completed treatments (Appendix 4 and web site noted below). Provide completed spreadsheet to the Forest Districts by October.
8. Summarize effectiveness of the previous years treatments by site or area.
9. Recommend treatments for the coming year by site or area.

¹⁰ <http://www.for.gov.bc.ca/ftp/dka/external/!publish/Forest%20Health/FdSxsusceptible/>

2.5.1 Douglas-fir Beetle (*Dendroctonus pseudotsugae*)

Refer to Appendix 2 for 2006 statistics and strategies by BMU and to the DKA Forest health FTP site for locations and other detail.

Douglas-fir BMU Strategies

The TSA is within the provincial EBBMA identified for Douglas-fir beetle. All TSA BMUs are “undesigned” provincially (Jan. 2007). Operationally, twenty-three BMUs (in the lower two thirds of the TSA) have either Suppression or Holding strategies for Douglas-fir beetle (Figure 2). These strategies were deemed appropriate based on:

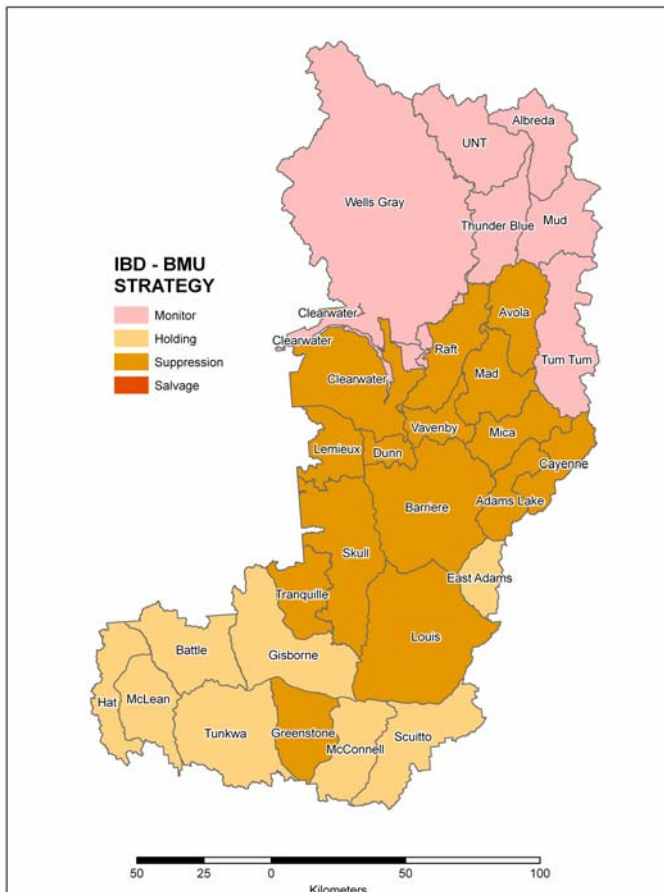


Figure 2: Kamloops TSA Douglas-fir Bark Beetle BMU Strategies – Feb 2007

- The perceived rise in beetle activity in many areas despite the lack of detection on the aerial overview survey
- A belief that attention must focus on mitigating potential losses in mature fir and spruce stands that will represent a greater proportion of the future timber supply in the TSA.

The remaining 6 BMUs are designated as Monitor. Douglas-fir beetle is limited both by host and climate in the northern third of the TSA; infestations do occur, but are generally short-lived. As well, Douglas-fir is typically reduced to a minor stand component in these BMUs, except for clusters located in the valley bottoms.

Other management priorities typically take precedence over beetle management in provincial parks such as Wells Gray, although active management has occurred in this park in recent years. Douglas-fir beetle populations in Wells Gray Provincial Park have now declined.

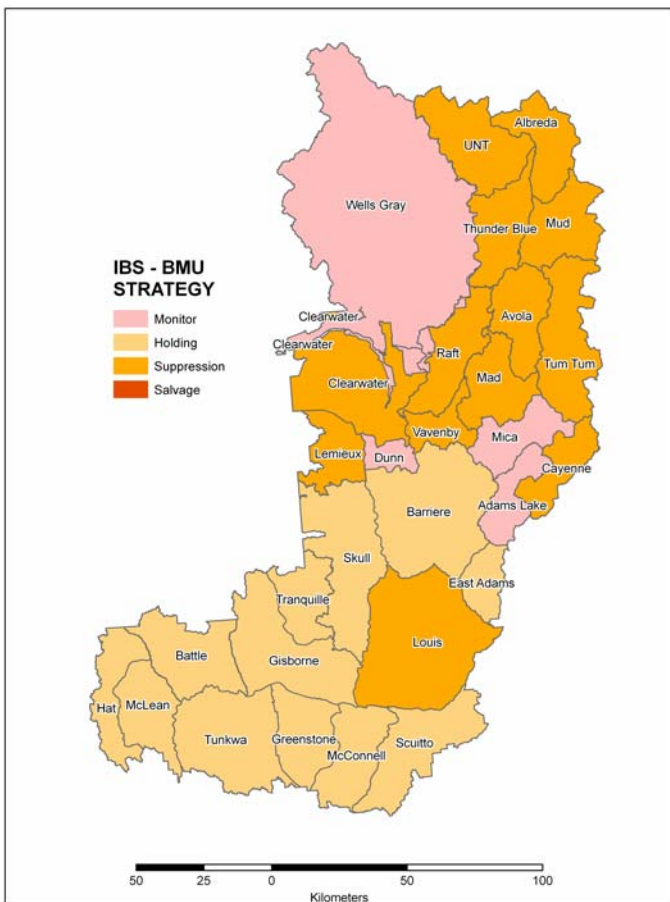
KTSA Tactics: “Suppression” action

Fire-Affected Stands–Specific Management Tactics:

1. Historically, build-up of populations of this beetle has occurred in areas affected by large-scale forest fires where significant numbers of live, fire-scarred fir remain and endemic levels of beetle existed before the fire. Landscape level forest fires affected four BMUs in the TSA in 2003. As well, there were a number of smaller wildfires in the Clearwater area. These fires typically occurred in lower elevation stands containing a preponderance of

Douglas-fir, ponderosa pine, lodgepole pine mixed with some spruce and other species.

2. The possibility of Douglas-fir beetle build-up will be considered when developing plans for managing these burnt areas (refer to “Biological issues surrounding burnt and fire-charred wood”, Maclauchlan, 2003). The potential for Douglas-fir beetle build-up post-fire depends on several things including local populations pre-fire; amount of susceptible host; local weather conditions and pre-emptive management actions deployed.
3. Pre-emptive management actions may include
 - Mapping and photographing areas in order to delineate the degree or intensity of the burn, by forest cover type (species and age) in order to identify stands most at risk; and
 - Salvaging in a manner that incorporates the threat of build-up.
4. Several other management tactics have also proved effective in dealing with active infestations, particularly when used in combination with harvesting and trap trees. These include the removal of fire-damaged, susceptible host material; mass trapping using semiochemicals; and the application of anti-aggregation pheromone, MCH.
 - Recent operational trials with MCH have been encouraging. The use of this product is still restricted to “operational trials”, although product registration is being considered.



2.5.2 Spruce Beetle (*Dendroctonus rufipennis*) Strategies

Refer to Appendix 3 for 2006 statistics and strategies by BMU and to the DKA Forest health FTP site for locations and other detail.

Beetle Management Unit Strategies

The TSA is within the provincial EBBMA identified for spruce bark beetle. The Provincial zonation shows two BMUs designated as containment (Lemieux and Louis), the rest are undesignated. Operationally, three smaller BMUs in the central part of the TSA, together with Wells Gray Park, are designated “monitor”. The balance of the TSA’s BMUs are either holding or suppression. Other resource values, mixed stands, poor access and low beetle occurrence are factors in the monitoring designations.

Figure 3: Kamloops TSA Spruce Bark Beetle BMU Strategies – Feb 2007

KTSA Tactics: “Suppression” action

Spruce beetle is currently the species of greatest concern due to rapid spread and high attack ratios and shortest “shelf-life” due to ecotypes where beetle is located.

2.6 Blowdown

Concentrated and scattered windthrow in Douglas-fir, spruce and balsam stands during wind events has the potential to trigger substantial increases in infestations of bark beetle. Windthrow patches should be addressed promptly to minimize the expansion of beetle populations, especially in the vicinity of MDWRs and OGMAs. It may be appropriate in some areas to leave blown-down trees on the ground until after the beetle flight and utilize them as trap trees. Windthrown trees should be removed prior to the beetle flight of the following year so that attacked blowdown does not contribute to increases in beetle attack.

KTSA Tactics: Harvest Douglas-fir and spruce blowdown within one year of windthrow event to reduce opportunities for bark beetle build-up.

2.7 Western Balsam Bark Beetle

The western balsam bark beetle (*Dryocoetes confusus Swaine*) is ubiquitous within most of the subalpine stands in the TSA. The KTSA is designated as “monitor” for the purposes of treating beetle infested stands.

KTSA Tactics:

1. Infestations are detected and recorded by the Southern Interior Region aerial overview
2. Harvesting operations managed to avoid creation of favorable breeding situations:
 - Debris management and disposal
 - Beetle-infested trees or windthrown will be salvage logged when feasible
3. Aggregative pheromones can help concentrate beetles into stands scheduled for harvest

3.0 Defoliators**3.1 Western Spruce Budworm**

71,000 hectares of spruce budworm were recorded in the 2006 overview flight. Most of the attack is light or moderate in 2006.

Stand density, stand structure, species composition, tree vigor, host tree age, elevation and aspect are all factors which contribute to stand susceptibility. Fire suppression and selective harvesting activities within the last 100 years have led to a succession of predominantly Douglas-fir stands; some of which have dense understories. In some cases the vertical structure of these stands combined with species composition and poor vigor has resulted in high hazard spruce budworm stands that are also vulnerable to high intensity fires.

Based on historical defoliation, Douglas-fir stands within the IDFxw, xh and mw, and the ICH mk and ICHmw have experienced widespread defoliation events. Forests of the IDF tend to sustain longer outbreaks, hence more damage than those of the ICH. The quality of foliage on drier sites (Brookes *et al.* 1995) and the multi-storied nature of stands contribute to increased

susceptibility.

Reduced growth, top dieback, stem deformities or mortality may occur depending upon the duration and severity of defoliation. Suppressed understory or intermediate trees usually suffer the most damage. Research indicates that harvest volumes may be reduced by 8-25% over a 10-year period based on a 7-year infestation simulation (Alfaro 1992). Tree mortality can also occur as a result of a number of years of successive moderate or severe defoliation, or by secondary causal agents, i.e. Douglas-fir beetle, and root diseases.

3.1.1 Management Strategies and Tactics

Detection, prediction and direct suppression (i.e. by means of chemical and biological control) of defoliator pests remains the responsibility of the Southern Interior Region, MOFR. District staff will gather information about high risk areas such as woodlots to aid regional staff in deciding which stands are priorities to treat.

Some forestry practices in the interior Douglas-fir forests of the TSA have exacerbated landscape susceptibility and therefore impact of this insect. In many areas, selective harvesting has removed much of the ponderosa pine component, leaving a predominantly Douglas-fir forest. In addition, pine regeneration has been excluded on many sites due to the regenerative features of Douglas-fir. Fire suppression has resulted in dense regeneration of Douglas-fir in some stands, particularly in the suppressed and intermediate layers. Historically, frequent ground fires in these ecosystems would kill much of this regeneration; promoting a higher proportion of ponderosa pine. Preventative strategies and tactics are available to work towards a reduction of landscape level susceptibility within the TSA.

The Kamloops TSA management practices for defoliators are consistent with the Defoliator Management Guidebook (1995) which can be viewed at the following website:

<http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/defoliat/defoltoc.htm>

3.2 Two-Year Cycle Spruce Budworm

In general, populations of Two-year cycle budworm have been decreasing over the last several years. A formal hazard rating system has not been developed for two-year cycle spruce budworm. A coarse scale study in the Central Interior found that stands which were more frequently defoliated occurred in the wet, cool Sub-Boreal Spruce and moist, very cold Engelmann Spruce-Subalpine Fir biogeoclimatic classifications (Shand *et al*, 2001). Based strictly on historical defoliation extent susceptible stands in the wet cool and cold ESSF (wc and wk) and ICH very wet, cool (vk) are more likely to be defoliated in the TSA.

3.2.1 Management Strategies and Tactics

Detection, prediction and direct suppression (i.e. by means of chemical and biological control) of defoliator pests remain the responsibility of the Southern Interior Region, MOFR.

Two-year cycle spruce budworm is not covered within the FPC Defoliator Management Guidebook. As with most defoliators however, reduction of susceptible material through species manipulation will reduce hazard.

3.3 Western Hemlock Looper (IDL)

3.3.1 History

It has historical presence in the Kamloops TSA with the most recent epidemic occurring between 1989 to 1994. The western hemlock looper is a destructive insect that has periodic outbreaks, every 11 and 20 plus years respectively, in the interior. The preferred host of the looper is the western hemlock, although during outbreaks the looper feeds on almost any foliage, including broad leaved forest trees and shrubs. Western hemlock looper populations, in general, have been decreasing over the last several years with no defoliation showing in the Kamloops TSA in 2006.

3.3.2 Hazard

For hazard and risk assessment information, refer to this website:

<http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/defoliat/defoltoc.htm>

3.3.3 Management Strategies and Tactics

Detection, prediction and direct suppression (i.e. by means of chemical and biological control) of defoliator pests remain the responsibility of the Southern Interior Region, MOFR.

Well-spaced, even-aged, thrifty stands should be less susceptible and suffer fewer impacts from western hemlock looper defoliation. Promoting mixed species stands composed of less than 50% western hemlock, avoiding cedar-hemlock mixes, and preferring non-host species will also lessen susceptibility in high hazard ecosystems of the TSA. Stand tending treatments such as spacing and fertilization will help maintain a healthy stand that is likely more resilient to western hemlock looper defoliation.

4.0 Deciduous Defoliators and Leaf Miners

These defoliators are not actively managed, as they do not impact significant commercial tree species in the TSA.

5.0 Root Diseases

5.1 Introduction

5.1.1 History

Kamloops and Headwaters Forest districts have a history of root diseases due to the wide range of ecosystems that support root disease pathogens as a function of the forest.

5.1.2 Hazard

Stand susceptibility or hazard is based upon species composition and biogeoclimatic zone. There is little difference in susceptibility to Armillaria among conifers less than 15 years old. Selective loggings, pre-commercial thinning, spacing and or brushing are disturbance events that increase the risk within stands for root disease. Recent researches, as well as ongoing studies, are trying to establish relationships between plant groupings or habitat type and root disease incidences.

The known extent of root diseases is based upon hazard and risk criteria developed for the Forest Practices Code Root Disease Management Guidebook (Anon 1995), which can be found at this website:

<http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/root/roottoc.htm>

5.2 Laminated Root Disease

5.2.1 Hazard

Laminated root disease hazard at a landscape level, 54% of the ICH stands are considered high hazard and 58% of the IDF.

5.3 Tomentosus Root Disease

5.3.1 Hazard

A general rule of thumb for Tomentosus root disease is if there is/was spruce within the stand then this root disease will be present (*pers comm.* D. Morrison 2003). Canadian Forest Products Ltd.(Vavenby Division) considers this root disease as a major concern in spruce stands within their operating area.

5.4 Management Strategies and Tactics (all root diseases)

Management strategies and tactics are described in the Forest Practices Root Disease Management Guidebook (Anon 1995)

<http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/root/roottoc.htm>

The Kamloops and Headwaters District will be hosting training sessions in detection and management strategies in the early summer of 2007. These sessions will be lead by the regional pathologist as a follow up to a survey that was sent out to determine clients training needs for forest health issues.

6.0 Pests of Young Stands

6.1 Introduction

A variety of insects and disease are found within young stands, many of which act as natural thinning agents or gap creators. Weevils, stem rusts, lodgepole pine dwarf mistletoe, foliar diseases and mammals are among some of these pests. While they may have historically acted as natural thinning agents and provided for patch and landscape level diversity, their response to current management regimes and subsequent impacts may not be compatible with timber objectives. Their relative incidence (hazard and risk) and impact vary widely dependent on geographic location, ecosystem and management regime.

The following reviews relative hazards of some of the major pests of young stands. These hazards are based upon a combination of the following: FPC guidebooks, a five-year overview of pests of young stands surveys conducted by the Forest Insect and Disease Survey Unit of Forestry Canada (Nevill *et al* 1996), surveys conducted in young lodgepole pine in the Clearwater Forest District (Maclauchlan and Buxton 2001) and an assessment of pest impact in spaced and pruned stands in the Kamloops Forest Region (Maclauchlan and Brooks 1998). The

following summary pertains to those biogeoclimatic subzones, which had high incidences/intensities (high hazard), therefore exclusion from the text does not translate to non-occurrence in a non-referenced biogeoclimatic zone. For this reason a tabular summary has not been provided since gaps exist in the data.

6.2 Warren's Root Collar Weevil

Warren's root collar weevil was found in 35% of the lodgepole pine stands examined in the ICHmw3 and 17% of the ICHwk1 (Maclauchlan and Buxton 2001). Nevill et al (1996) reported 23% of the stands surveyed in the ICHwk1 were infested, 33% of the MSxk and at lower levels in the IDFdk1 (5%). This pest of young lodgepole pine prefers deep duff layers, which are more frequently found in the wetter ecosystems. Populations in B.C and Alberta occur below altitudes of 1585m. Lodgepole pine first becomes susceptible to attack at about 6 to 8 years age and 1.5 to 2 m height, and may continue to sustain injury through to maturity. Dominant and codominant trees are often preferred, as are trees growing on somewhat moist, productive sites with coarse-textured soils and deep duff layers and a rich component of ground flora. In west-central Alberta density also appeared to have a significant relationship with weevil numbers although this has not been investigated in B.C. Movement of flightless adults searching for new host trees is usually no more than 10 to 13 meters in a year.

6.2.1 Management Strategies and Tactics

The use of mixed species in planting will reduce the damage from this insect. Weevil attack in young stands may develop from populations in adjacent unlogged areas, residual uncut trees or infested stumps within the clearcut. Infested cut stumps left behind after logging allow established populations to continue development and the new regeneration provides a continuity of habitat for the weevil. Pre-commercial thinning or spacing in infected stands may result in lower than anticipated final densities if the prescription did not allow for mortality in high incidence areas.

6.3 Dwarf Mistletoes

As a result of fire exclusion, lodgepole pine dwarf mistletoe has responded by increasing in severity and incidence across the landscape. Salvage activities for mountain pine beetle may allow development of some layered canopies following outbreaks. In instances where lodgepole pine is able to regenerate, these layered stands facilitate rapid spread of mistletoe to new regeneration. Nevill *et al* (1996) found greater than 20% incidence in 22%, 17% and 5% respectively of the IDFdk1, MSxk and MSdml.

6.3.1 Management Strategies and Tactics

Larger clearcuts typically reduce dwarf mistletoe spread into the regenerating stand because the edge to interior ratio is high. The trend toward reduced cut block sizes and partial cutting systems may result in infection of the regenerating conifers by seed dispersal from infected adjacent and overstory trees. Also, spread may be accelerated when dense infected residual stands are partially disturbed by cutting or wildfire. Less intense managed wildfires leave infected, live overstory trees, allowing dwarf mistletoe to rapidly establish and intensify in the understory stand. Both pre-commercial and commercial thinning increase the light available in stands and, therefore, can increase the activity of latent dwarf mistletoe infections. However, in

commercial thinning, trees are of merchantable size and the time to final harvest usually does not allow substantial further impact.

Dwarf mistletoes significantly affect the health of forests and the success of silvicultural systems and treatments. Dwarf mistletoe information is required at the landscape level, including occurrence and general levels of incidence. In stands infected by dwarf mistletoe, a risk assessment and appropriate treatments must be documented in any silvicultural or stand management type prescription. The presence of any dwarf mistletoe should be noted by host species.

Where a seed tree silviculture system is being considered, it is recommended that the percentage of potential seed trees infected and the severity of infection be recorded.

For the purpose of designing cutblocks that will reduce infection of regeneration, note distribution of infected trees and any natural barriers to spread such as rock outcrops, roads, patches of non-host tree species, and any other similar features that might be incorporated into the prescription.

Where dwarf mistletoe has been noted or found during a stand management assessment, or where there is a high probability of occurrence, record the following information:

- Percentage of trees infected and severity of infection (see method in section on “Dwarf mistletoe infection rating”) in the current stand; or
- Incidence and severity of infection on proposed residual crop trees (after treatment); and
- Proportion of any non-host tree species.
- Infection rating of potential residual crop trees is highly recommended.

Carefully consider the free growing criteria for dwarf mistletoes before making recommendations for stand management activities.

Management of dwarf mistletoe is relatively simple where susceptible tree species grow in even-aged stands, and an even-aged stand is desired. Although control might be less certain or even problematic in other situations, some management or treatment options are available to reduce dwarf mistletoe impacts under almost any silviculture system.

All cutblocks should be designed to minimize spread of dwarf mistletoe into the young stand by leaving residual non-host species as border trees, and incorporating natural barriers wherever possible. Non-host tree species should be planted or used for natural regeneration as much as possible.

Shelterwood and selection systems are not recommended in stands where susceptible tree species comprise more than 50% of the total stems, and more than 20% of the susceptible overstory trees are visibly infected.

In certain instances, management of infected stands might be desirable to fulfill resource management objectives other than timber production. Infected trees with large witches brooms and some infected stands appear to be preferentially used by some animals and birds for nesting, cover and other habitat purposes. However, any prescriptions made where these other resource management objectives are paramount should explicitly consider expected impacts of dwarf mistletoes. Any strata managed under such regimes should be assessed, and expectations for growth and yield adjusted accordingly.

In recreation sites or other areas, dwarf mistletoe infested stands can be maintained or managed for certain features, such as wildlife habitat. However, hazards associated with infected trees should be considered. Dwarf mistletoe brooms can act as fuel ladders, increasing the fire hazard, and large brooms are prone to breakage. Pruning can be used to remove large brooms and maintain tree vigour.

6.4 Spruce / White Pine Weevil (IWS)

6.4.1 Hazard

The impact of spruce weevil on young plantations (pre and post free growing) within the Kamloops TSA varies by hazard zone

6.4.2 Management Strategies and Tactics

The following website gives information for strategies and tactics to manage spruce weevil and are consistent with management practices in the Kamloops TSA.

<http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/weevil/we-toc.htm>

A spruce weevil study undertaken in the wetter subzones of the ICH indicated that provenance/seedlot seemed to play an important role in susceptibility and/or impact, i.e. ability to recover (Brooks 1994). The study determined that local provenances were less susceptible and recovered better, provided they were planted within their elevational range.

6.5 White Pine Blister Rust

6.5.1 Hazard

White pine blister rust is considered high hazard in all ecosystems of British Columbia, even outside the natural range of white pine. White pine blister rust greatly reduces the probability of white pine reaching maturity throughout the range of the species. Landscape level hazard and risk rating for white pine blister rust is simple, if white pine is present, it is at high risk from blister rust.

6.5.2 Management Strategies and Tactics

The following website gives information for management strategies and tactics if the decision is made to manage white pine as a commercial species.

<http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/PINESTEM/PINE-TOC.HTM>

6.6 Root Diseases

6.6.1 Hazard

Root diseases are causing significant volume losses in young stands. The highest hazard/risk stands to Armillaria appear to be in the ICHmw3 and IDFxh2 where Nevill et al. (1996) reported that 48% and 50%, respectively had infections ranging from 1-5%. Similarly, Maclauchlan and Brooks (1998), found the ICH was the most severely impacted by Armillaria root disease. Laminated root disease was reported less frequently by Nevill et al (1996); in 4% of the stands examined in the ICHmw3. These figures are based on a random sample of mostly managed stands; therefore all ecosystems were not sampled proportionately. This explains the lack of more widespread incidences of laminated root disease; particularly in the IDF. Tomentosus root disease was also found in 4% and 11% respectively of the ICHmw3 and

ICHmk3 stands.

6.6.2 Management Strategies and Tactics (all root diseases)

See previous root disease section.

6.7 Animal Damage - Deer

Ungulates damage trees in two main ways: by browsing seedlings, suckers, saplings, and foliage; and by rubbing antlers on saplings and larger trees. Browsing normally occurs in late summer and autumn, and in winter where deer or elk concentrate. Occasionally, seedlings are killed when pulled from the ground. More commonly, browsing on terminal and lateral shoots causes growth loss and deformation in seedlings and saplings. Repeated browsing results in severe height suppression over extensive portions of affected plantations. Most damage occurs in the spring during bud flush. Effects on young trees include decreased growth, stem deformation, and multiple stems. Open wounds provide entry sites for decay. Regenerating areas, widely-spaced plantations, and areas of high ungulate populations, risk permanent damage.

6.8 Animal Damage - Cattle

Within the Kamloops TSA the impacts of cattle damage on young plantations (pre-free growing) is ranked as high priority for the Kamloops District and moderate for the Headwaters District. This damage includes trampling wounds resulting in various degrees of girdling, scarring and breakage which may cause reduced growth rates, deformities, mortality and/or predispose young crop trees to pathogens. Other contributing factors to cattle damage can be placement of salt licks, location of water sources, herd management and some site preparation techniques.

6.8.1 Management and Tactics:

For strategies to mitigate damage to plantation trees and regenerating sites refer to the Range Management Guidebook June 1995. Attention should be given to the level of use, timing, and salt placement.

6.9 Hard Pine Stem Rusts

6.9.1 Hazard

The IDFdk1, IDFdk2, MSdm2, MSxk, and ESSFdc2 are considered high hazard biogeoclimatic subzones for the hard pine stem rusts, the majority of which are found in the Kamloops Forest District. Anecdotal evidence suggests that juvenile spacing activities in young lodgepole pine stands may be increasing the hazard and impact of pine stem rusts. Nevill *et al* (1996) reported that 4% of the young stands examined in the ICHmw3 had greater than 10% incidence of either stalactiform or comandra stem rust. Similarly western gall rust had the highest impacts in the ICHmw3 and the SBSmm respectively, where 4% and 33% of the stands examined had infections exceeding 10%. Maclauchlan and Buxton (2001) reported that 60% and 50% of the stands examined in the ICHmw3 and ICHwk1 were infected with western gall rust.

6.9.2 Management Strategies and Tactics

The strategies and tactics for pine rusts are found in the Pine Stem Rust Management

Guidebook (1996) at the following website and are consistent with management practices in the Kamloops TSA.

<http://www.for.gov.bc.ca/tasb/legregs/fpc/fpcguide/PINESTEM/PINE-TOC.HTM>

7.0 Research Requirements

Research is required to improve strategies and tactics to minimize the longer-term impact of bark beetle attack on forest values and the TSA annual allowable cut. Current research is found on the following web sites.

1. Ministry of Forests and Range:

- Southern Interior Forest Region:

<http://www.for.gov.bc.ca/rsi/ForestHealth/entomology/Research.html>

- Forest Practices Branch – Forest health

http://www.for.gov.bc.ca/hfp/mountain_pine_beetle/#research

2. Canadian Forest Service Research and Development:

http://mpb.cfs.nrcan.gc.ca/research/index_e.html

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8.3 Summary of Internet Information Sources (in order first referenced)

- 1 British Columbia's Mountain Pine Beetle Action Plan 2006-2011"
http://www.for.gov.bc.ca/hfp/mountain_pine_beetle/
- 2 Emergency Bark Beetle web site
http://www.for.gov.bc.ca/hfp/mountain_pine_beetle/maps/ebbma/
- 3, 11 Kamloops TSA MPB Strategy - March 2006
<http://www.for.gov.bc.ca/dka/KamloopsTSAMPBStrategy2006.pdf>
- 4 & 5 MOFR aerial overview survey results are at regional and provincial web sites.
http://www.for.gov.bc.ca/rsi/ForestHealth/Aerial_index.htm
<http://www.for.gov.bc.ca/hfp/health/overview/overview.htm>
- 6, 8 DKA Forest Health FTP site.
<http://www.for.gov.bc.ca/ftp/dka/external!/publish/Forest%20Health/>
- 7 MOFR Bark Beetle Hazard and risk information
http://www.for.gov.bc.ca/rsi/ForestHealth/hazard_rating.htm
- 10 Douglas-fir and spruce bark beetle commitment spreadsheet
[http://www.for.gov.bc.ca/ftp/dka/external!/publish/Forest%20Health/FdSxsusceptible/Defoliator Management Guidebook](http://www.for.gov.bc.ca/ftp/dka/external!/publish/Forest%20Health/FdSxsusceptible/Defoliator%20Management%20Guidebook)
<http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/defoliat/defoltoc.htm>
- Western Hemlock Looper hazard and risk assessment information
<http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/defoliat/defoltoc.htm>
- Forest Practices Code Root Disease Management Guidebook (Anon 1995)
 - known extent of root diseases is based upon hazard and risk criteria
 - Management strategies and tactics<http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/root/roottoc.htm>

Strategies and tactics to manage spruce weevil

<http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/weevil/we-toc.htm>

Strategies and tactics for pine rusts, and for managing white pine as a commercial species.

<http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/PINESTEM/PINE-TOC.HTM>

Research

1. Ministry of Forests and Range:

• Southern Interior Forest Region:

<http://www.for.gov.bc.ca/rsi/ForestHealth/entomology/Research.html>

• Forest Practices Branch – Forest health

http://www.for.gov.bc.ca/hfp/mountain_pine_beetle/#research

2. Canadian Forest Service Research and Development:

http://mpb.cfs.nrcan.gc.ca/research/index_e.html

12 2005/06 MPB Mapping and Data

<http://www.for.gov.bc.ca/ftp/dka/external!/publish/Forest%20Health/MPB%20stats%202005/>

13 2006/07 MPB Mapping and Data

<http://www.for.gov.bc.ca/ftp/dka/external!/publish/Forest%20Health/MPB%20stats%202006/>

18, 24, 30 Lodgepole pine, Douglas-fir and Spruce bark beetle hazard mapping

http://www.for.gov.bc.ca/rsi/ForestHealth/hazard_rating.htm

SIFR Pest Overview Reports: <http://www.for.gov.bc.ca/rsi/ForestHealth/Overview.html>

Appendix 1: 2007 Update of the Kamloops TSA Mountain Pine Beetle (MPB) Strategy

1.0 Introduction

1.1 The Kamloops TSA MPB Strategy – March 2006

The current Mountain Pine Beetle (*Dendroctonus ponderosae*, MPB) epidemic is having a significant impact on communities and forest values. The 2006 Kamloops TSA MPB Strategy (06 MPBS) was developed to provide guidance for harvesting of lodgepole pine (PI) stands susceptible to MPB attack. The strategy was designed to focus resources in response to the epidemic levels of attack by identifying the significant issues created by the MPB infestation and providing information and guidance to address them.

The 06 MPBS had the following objectives:

1. Determine the extent of current and future infestations
2. Develop guidance to facilitate salvage planning.
3. Develop a TSA strategy that prioritizes stands/areas for salvage operations considering stand susceptibility, short and long term timber supply and other resource values
4. Develop a strategy to allocate resources to the highest priorities using summarized stand volumes/areas by priority.
5. Provide information to support TSR AAC recommendations (maintain, extend, or increase current AAC uplift)

The 06 MPBS is intended to expedite the response to the epidemic levels of attack by assessing the current extent of the attack and forecasting future attack volumes, prioritizing the attacked volumes for salvage, identifying and allocating salvage harvesting resources, and providing a set of principles for implementing MPB salvage.

The strategy is applicable to the Timber Harvesting Land Base (THLB). It is aligned with Objectives 3 to 7 of British Columbia's Mountain Pine Beetle Action Plans (2005 – 2010 and 2006 -- 2011). The strategy incorporates many of the activities identified for each of these objectives. The 06 MPBS is intended to provide short term direction (< five years) to address an epidemic infestation. The strategy is not a broad MPB management plan, nor does it address non salvage aspects of MPB management.

It was recognized the Kamloops TSA MPB strategy would be a living document that would require regular reviews and updating. The 06 MPBS is available on the MOFR, Kamloops Forest District (KFD) website¹¹. Mapping and data can be located on the district' FTP site under the Forest Health tab¹².

¹¹ www.for.gov.bc.ca/dka/MPBStrategyKamloopsTSA

¹² <http://www.for.gov.bc.ca/ftp/dka/external/!publish/Forest%20Health/>

1.2 2007 Update of “The Kamloops TSA MPB Strategy – March 2006”

The 2006-07 update of the 06 MPBS focuses on original objectives 1, 3 and 4 (Sections 1, 3, and 4 of the 06 MPBS). This update, using current data and refined strategies maintains a focus on maximizing the salvage harvest of the highest priority stands. Assumptions and considerations used to build the original strategy, if unchanged, are referred to rather than repeated.

1.2.1 Updated Information

To determine the extent of current and future infestations 2005-06 data and mapping has been updated:

1. Susceptible stands have been identified
2. The 2006 MOFR overview flight has been used to map MPB attacked stands
3. Data summaries and mapping are similar to those used for the 06 MPBS and can be found on the Kamloops Forest District ftp site under the forest health tab¹³.
 - Major Licensee and BC Timber Sales (BCTS) operating area boundaries are used as the primary analysis units.
 - The data summarizes area and volume for the THLB based on age, site index and percent of pine.
 - A pivot table is available to assist additional data base querying.
 - Information to support strategy development is available down to the planning cell (Pcell¹⁴) level.

Of note, MPB mapping provides the percent of red attack compared to the total of red attack and green stems. There is no mapping or notation for grey attack.

1.2.3 Susceptible Stands

Information regarding stands susceptible to MPB attack, and current levels of attack, is summarized in Table 5 on the following page. The strategy’s focus is on stands where PI is at least 40% of the stand volume, and stand age is 60 years or more (“focus PI stands”).

1.2.4 MPB Occurrence – Current and projections

1.2.4.1 Current Situation

High beetle population levels can be found in some stands in all parts of the KFD and the south-west part of the HFD. The majority of the stands susceptible to attack are located within the KFD and the area immediately to the north in the HFD. The MPB management strategy for the KFD portion of the TSA is salvage. No specific ecosystems or areas of the KFD can be considered a refuge from the beetle. In the HFD holding, monitoring and salvage strategies apply to specific Beetle Management Units (BMUs).

Information regarding the extent of the current MPB attack was provided primarily by the MOFR via the 2006 aerial overview survey.

¹³ <http://www.for.gov.bc.ca/ftp/dka/external/!publish/Forest%20Health/>

¹⁴ Refer to Section 4.4 for a description

There is almost 60,000,000 m³ in PI leading stands susceptible to MPB attack. This represents approximately 29 percent of the total volume in the Kamloops TSA THLB. Of significant

Table 5: Kamloops TSA THLB 2006 Aerial Survey Results

MPB Attack Severity ¹⁵	Non PL Leading	PL<60 years	PL > 60 years	THLB Total	Non PL Leading	PL<60 years	PL > 60 years	THLB Total
	Volume*				Area			
Nil	113,234	265	27,690	141,190	640,078	66,638	109,566	816,283
Trace	1,255	1	1,767	3,023	4,846	296	7,153	12,295
Low	6,639	22	8,005	14,666	32,665	2,698	31,826	67,189
Moderate	5,269	35	9,366	14,670	27,221	3,766	38,366	69,353
Severe	1,804	14	6,221	8,039	9,139	2,100	25,105	36,344
Very Severe	1,389	15	6,505	7,910	6,648	2,778	26,816	36,242
Grand Total	129,591	352	59,554	189,497	720,598	78,276	238,832	1,037,706

*All tables in this strategy provide volumes in 1'000s of cubic meters.

concern, fifty-four percent of the focus PI stands have some level of attack that was visible during the 2005 aerial survey. Impact of the 2006 green attack is not included in the data.

Comparing the 2005-06 with the 2006-07 information

1. Total area attacked in the focus PI stands increased by 5,000 ha (4%)
2. Area of severe and very severe attack increased significantly (204%)
3. Offsetting this was the decrease in Nil and trace attack area (60%)

Table 9 in Section 7 provides a more detailed comparison of the two years statistics.

1.2.4.2 Forecasting the future

Regional estimates, based on Provincial history to date, indicate that eighty percent of the susceptible PI stands in the TSA will be attacked to some significant level. The KFD MPB infestation will likely peak in 2008 (2007 MPB flight). In addition to “in-stand” population build-up, MPB is spreading through intense flights. It is expected that the epidemic will end by 2013 due to lack of host stands. Following is a forecast of annual volumes attacked based on these estimates.

Assumptions:	Low Priority Stands	Med & High Priority Stands	Total	Comments
Total Volume	25,673	33,881	59,554	
80% attacked	20,538	27,105	47,643	
Per year over 6 years	3,423	4,517	7,941	Assumes equal attack. Attack likely to be higher at front end and diminish
X 50% Factor	1,712	2,259	3,970	Volume per year: Appears sufficient volume for continued uplift

¹⁵ Nil: no observed attack; Trace - < 1%; Light - 1 to 10%; Moderate - 11 to 30%; Severe - 30 to 50%; Very severe - > 50%

2.0 Natural Resource Values – Issues and Guidance For Salvage Planning

This section of the 06 MPBS has not been updated

3.0 Priorities for Salvage Operations

3.1 Issues

1. Susceptible PI stands impacted by MPB are in excess of AAC/harvest capacity
2. Salvage harvesting priorities affects other resource values.
3. Salvage harvesting priorities also influences short and long term timber supply.
4. A limited shelf life for conventional products requires continuing focus on the highest priority stands and sites.

3.2 Salvage Priorities

3.2.1 2007 Adjustment

Short term TSA harvest priorities have been developed to provide proactive and timely direction for an emergency situation (06 MPBS - Sec 3.3). This strategy considered stand level characteristics, other resource values, Beetle Management Unit (BMU) strategies in place, and current attack severity. Risk of attack and shelf life were also considered.

One change to salvage priorities related to stand level characteristics has been incorporated in the 2007 update. Previously, too much lower site was included in higher salvage priorities. The result was a reduced focus on salvaging and reforesting the best TSA sites.

The updated combinations of stand characteristics used to define TSA salvage priority are described in Table 6. Each combination has been rated for priority with “Stand 1” the

Table 6 TSA Salvage Priorities – Stand Characteristics

Salvage Priority	Stand Characteristics	Stand Age	PI Component of Stand (%)	Site Index
Low	Stand 1	PL>60yrs	40-59	<16
	Stand 2	PL>60yrs	60-79	<16
	Stand 3	PL>60yrs	80-100	<16
	Stand 4	PL>60yrs	40-59	16-17,
Medium	Stand 5	PL>60yrs	60-79	16-17
	Stand 6	PL>60yrs	40-59	>17
High	Stand 7	PL>60yrs	80-100	16-17
	Stand 8	PL>60yrs	60-79	>17
	Stand 9	PL>60yrs	100	>17

lowest priority for salvage harvesting and “Stand 9” the highest priority. These stands have been grouped into three salvage priority classes; Low, Medium and High.

The 9 Stands in Table 6 account for all of the focus PI stands identified in Table 5. Not included are 80,000 ha of non PI stands with some level of MPB attack. These stands include

substantial volume of other species (> 60%) and are not a priority for salvage harvesting.

Comparison of 06 MPBS statistics with those in this update must consider the effect of the revised definitions used to determine salvage priority.

3.2.2 BMU Strategies

BMU strategies for MPB were updated in February 2007. Monitoring, holding and salvage strategies apply to BMUs in the HFD. Stands harboring beetle populations in holding BMUs are a high priority for action. The objective is to limit populations to the current level. Where suitable (terrain, volume, economics) salvage logging is one tool available to achieve the objective. Where harvesting resources are limited they should be directed to holding BMUs before salvage BMUs.

A salvage strategy applies to all of the BMUs in the KFD. These KFD BMUs are a priority for salvage after required resources have been applied to salvage harvest identified areas in the holding BMUs.

TSA priorities and strategies for Douglas-fir and spruce bark beetle generally take precedence over those for mountain pine beetle. The MPB BMU strategies, together with additional BMU information, can be found in Section 6 of this 2007 update.

3.2.3 Summary of Salvage Priorities:

Table 7: TSA 2006 Salvage Priorities
-- MPB Attack Levels

MPB Severity (Red attack)	Low Salvage Priority¹	Medium Salvage Priority	High Salvage Priority	Total
Nil	10,023	4,758	12,909	27,690
Trace	1,185	158	424	1,767
Low	3,646	1,184	3,175	8,005
Moderate	4,575	999	3,792	9,366
Severe	2,837	584	2,800	6,221
Very Severe	3,407	354	2,744	6,505
Grand Total	25,673	8,038	25,843	59,554

*Volume expressed in 1000's.

More detailed results are available in area and volume summaries on the web site. Comparisons with the 06 MPBS can be found in section 6 of this update.

3.3 Factoring Volume Estimates for Susceptible Stands

To minimize short and long term timber supply impacts, as much salvage harvesting as possible needs to be carried out as soon as possible. At the same time, the 06 KTSA MPS (Sec 3.4) took a conservative approach in determining available salvage volumes. To account for factors that reduce volume availability, and to ensure estimates are conservative, a Salvage Factor of 50% is used when estimating the amount of susceptible and/or attacked volume that is commercially available for salvage.

Salvage priorities for the TSA have been developed considering stand level characteristics, other resource values, Beetle Management Unit (BMU) strategies in place, and current attack severity. The objective is to salvage stands with significant MPB populations and maximize both volume recovered and long term timber supply. Table 7 summarizes TSA volumes by salvage priority based on 2006 aerial mapping. Stands having a Medium or High Salvage Priority and an MPB attack severity of moderate or higher are the Highest Priority for Salvage (HPS).

4.0 Salvage Capacity and Allocation of Resources

4.1 Issues

1. There is a shortfall of AAC capacity to salvage stand volume affected by MPB attack.
2. At the current rate of harvest additional volume is going to lose commercial value for solid wood products.

4.2 Introduction

A strategy to allocate resources to the highest priorities was developed using prioritized stand volumes identified as part of Objectives 1 and 3.

Licensees worked collaboratively with the MOFR to confirm which priority areas for harvest they will address and which are available for NRFLs or other uplift tenures.

4.3 TSA Strategy to Address Highest Priority for Salvage (HPS) Stands (November 2006 to December 2008)

Following is an update of the short term area specific allocation strategy (Table 8).

1. The purpose of the short term strategy is to allocate available resources against current HPS volumes. The strategy identifies HPS areas and volumes:
 - To be addressed by Major Licensees or BCTS
 - Available for other licensees.
2. Approach Taken
 - Development of a resource allocation strategy required mapping and analysis at the planning cell level. Planning cells are previously identified administrative units within the TSA. They are sub-landscape unit in scope, and follow readily identifiable terrain/topography.
3. Term and Volume
 - The detail involved in developing these strategies at the Pcell level, and the uncertainty associated with projected attack intensities and volumes, did not warrant extending the strategy beyond the end of 2008.
 - The volume projected to be in the HPS category after the 2006 beetle flight (2007 aerial mapping) was used for the allocation strategy. This volume is the equivalent of the sum of each planning cell's low, moderate, severe and very severe volumes in the moderate and high priority for salvage classes (columns) shown for 2006 in Table 7. It is projected the current 2006 low attack intensity stands will be rated moderate during 2007 aerial mapping.

Table 8: Major Licensee Pcell Strategy for Salvaging “Highest Priority for Salvage” Stands
 Period; November 2006 to December 2008

PI Harvest Forecast (Volumes in 1,000's of m ³)										
ID	Category	Major Licensees (ML)								TSA Total
		BCTS	BP	Canfor	GS	Interfor	Tolko	WF	WY	
A	Total HPS to Dec 2008	3,788	81	1,019	127	634	1,688	1,025	7,271	15,633
B	HPS net of Salvage Factor (50% X A)	1,894	41	510	64	317	844	513	3,636	7,817
C	Net HPS addressed by ML/BCTS	1,478	0	463	17	79	133	111	1,229	3,510
D	Net HPS addressed by other licences	35	0	0		0	513	95	879	1,522
E	Net HPS in Pcells with < 25,000 m ³	170	24	47	19	112	92	88	325	877
F	Questionable	13	17		27	126	106	149	705	1,143
G	Net HPS Available (B - C to F)	198	-1	-1	1	0	0	70	498	765

Licensee capacity compared to commitment										
PL AAC available	775	0	200	8	150	100	130	631	1,994	
PL AAC available Nov 2006 to Dec 2008	1,705	0	440	18	330	220	286	1,388	4,387	
HPS addressed by ML/BCTS	1,478	0	463	17	79	133	111	1,229	3,510	
HPS addressed compared to PI AAC available (%)	87	100	105	97	24	60	39	89	80	

Notes:

1. Weyerhaeuser & West Fraser had a factored volume of 263,000 m³ not included in the logging history update (included in Questionable – line F)
2. Questionable: If not high priority stand types (not PI leading etc) or a questionable economic chance (steep, inaccessible, PI size)
3. Apportionment to major licensees 1,570,637. Major licensee MPB AAC available is 1,219,000 (78% of total AAC)
4. Other AAC available: NRFLs 700,000 and SSSP 100,000

4. Priority

A The priority for harvesting from November 2006 to December 2007 is economical stands in order from very severe, severe, to moderate as classified in the 2006 aerial flight. Moderate is assumed to be severe when adding 2006 green attack.

B The next step is to plan for 2008 harvesting. The priorities are any remaining stands from (A) and stands which are currently classified in the 2006 aerial flight as low attack intensity. Stands mapped as low attack intensity are anticipated to actually be at moderate attack intensity when green attack is included, and are projected to be at severe attack intensity after the 2007 green attack is added.

5. Ability to address/harvest

- The volume included in foregoing priorities (A) and (B) reflects anticipated attack levels following the 2007 MPB flight. The licensee Pcell strategy is based on just over two years of harvesting (November 2006 to December 2008). Each licensee identified

Pcells they would partially or fully address using available AAC.

6. Results and Conclusions

- A short term allocation strategy has been developed (November 2006 to December 2008).
- The short term strategy indicates there is sufficient HPS volume to meet available salvage AAC including uplift (Lines C, D & E). This area specific allocation strategy will require annual review and updating; a rolling two year plan.
- Unaddressed and partially addressed pcells have been identified. These areas are available for major licensees, NRFLs and other tenures with insufficient HPS volume in their own operating areas.
- If all available salvage volumes identified become committed through extended or increased uplifts, the areas shown as questionable or addressed would be revisited to ensure there are no additional salvage opportunities.
- There may be an opportunity to focus the SSSP on Pcells with less than 25,000 m³ (Table 8, row E). Such a focus might reduce overlap areas and issues with Major Licensees or BCTS and provide for more comprehensive planning for the SSSP.
- 25,000,000 m³ in Low Salvage Priority stands are not initially included in salvage harvesting strategies. These stands require assessment for opportunities (salvage, capital investment, environmental benefit).

4.4 Principles For Allocation Of Resources To Address MPB Priorities

Major Licensees (ML)/BCTS operating areas are gentlemen's agreement only. Where a ML or BCTS requires help to address salvage volumes, the preferred strategy may be for a ML, BCTS or a temporary licence holder to enter the operating area of the ML/BCTS to provide assistance. Shifting of traditional operating areas between ML/BCTS, even temporarily, is very disruptive to the planning and operating practices of ML/BCTS. The location of additional temporary licences on top of traditional operating areas compounds the difficulties. In an effort to minimize issues principles have been developed and are presented in Section 5.0 of the 06 MPBS.

5.0 Business and Administrative Issues

This Section of the 06 MPBS has not been updated

6.0 Data Supporting the 2007 Update of the 06 MPBS

Table 9: TSA Aerial Overview Flight Information – 2005 and 2006 -- THLB

2005 Overview Flight Information used to support March 2006 Kamloops TSA MPB Strategy

MPB Attack Severity	Non PL Leading	PL<60 years	PL > 60 years	THLB Total	Non PL Leading	PL<60 years	PL > 60 years	THLB Total
	Volume ('000s)				Area			
Nil	122,273	427	25,684	148,383	662,013	67,386	96,663	826,062
Trace	2,720	45	4,487	7,253	11,902	1,684	16,757	30,343
Low	8,569	47	12,569	21,185	40,614	4,043	47,642	92,298
Moderate	5,264	43	9,045	14,353	25,444	2,994	34,111	62,548
Severe	1,495	9	3,439	4,943	7,077	994	12,961	21,032
Very Severe	893	14	3,326	4,234	4,991	873	12,433	18,296
Grand Total	141,215	585	58,550	200,351	752,039	77,974	220,566	1,050,579

MPB Attacked	18,941	158	32,866	51,968	90,028	10,588	123,904	224,517
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2006 Overview Flight Information used to support 2007 update of the 06 MPBS

MPB Attack Severity	Non PL Leading	PL<60 years	PL > 60 years	THLB Total	Non PL Leading	PL<60 years	PL > 60 years	THLB Total
	Volume ('000s)				Area			
Nil	113,234	265	27,690	141,190	640,078	66,638	109,566	816,283
Trace	1,255	1	1,767	3,023	4,846	296	7,153	12,295
Low	6,639	22	8,005	14,666	32,665	2,698	31,826	67,189
Moderate	5,269	35	9,366	14,670	27,221	3,766	38,366	69,353
Severe	1,804	14	6,221	8,039	9,139	2,100	25,105	36,344
Very Severe	1,389	15	6,505	7,910	6,648	2,778	26,816	36,242
Grand Total	129,591	352	59,554	189,497	720,598	78,276	238,832	1,037,706

MPB Attacked	16,357	87	31,864	48,308	80,519	11,638	129,266	221,423
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Table 9: TSA Aerial Overview Flight Information – 2005 and 2006 -- THLB Continued:

Change: 2005 to 2006 Overview Flight Information

MPB Attack Severity	Non PL Leading	PL<60 years	PL > 60 years	THLB Total	Non PL Leading	PL<60 years	PL > 60 years	THLB Total
	Volume ('000s)				Area			
Nil	-9,039	-162	2,006	-7,193	-21,935	-748	12,903	-9,779
Trace	-1,465	-44	-2,720	-4,230	-7,056	-1,388	-9,604	-18,048
Low	-1,930	-25	-4,564	-6,519	-7,949	-1,345	-15,816	-25,109
Moderate	5	-8	321	317	1,777	772	4,255	6,805
Severe	309	5	2,782	3,096	2,062	1,106	12,144	15,312
Very Severe	496	1	3,179	3,676	1,657	1,905	14,383	17,946
Grand Total	-11,624	-233	1,004	-10,854	-31,441	302	18,266	-12,873

MPB Attacked	-2,584	-71	-1,002	-3,660	-9,509	1,050	5,362	-3,094
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Table 10: TSA MPB Salvage Priorities – 06 MPBS and 2007 Update -- THLB

2006/07 HPS highlighted using 2005 overview flight information (06 MPBS)

MPB Attack Severity	Low Salvage Priority	Med Salvage Priority	High Salvage Priority	THLB Total	Low Salvage Priority	Med Salvage Priority	High Salvage Priority	THLB Total
	Volume ('000s)				Area			
Nil	5,319	4,793	15,572	25,684	27,656	17,514	51,493	96,663
Trace	1,281	744	2,462	4,487	6,235	2,496	8,026	16,757
Low ¹⁶	3,326	1,702	7,541	12,569	17,017	5,899	24,726	47,642
Moderate	2,105	1,522	5,419	9,045	10,885	5,367	17,859	34,111
Severe	687	534	2,218	3,439	3,699	1,875	7,387	12,961
Very Severe	540	405	2,381	3,326	2,804	1,544	8,085	12,433
Total	13,258	9,700	35,592	58,550	68,295	34,695	117,576	220,566

HPS M3	HPS Ha
21,721	72,742

2007/08 HPS highlighted using 2006 overview flight information (2007 Update)

MPB Attack Severity	Low Salvage Priority	Med Salvage Priority	High Salvage Priority	THLB Total	Low Salvage Priority	Med Salvage Priority	High Salvage Priority	THLB Total
	Volume ('000s)				Area			
Nil	10,023	4,758	12,909	27,690	49,338	17,232	42,996	109,566
Trace	1,185	158	424	1,767	5,229	556	1,368	7,153
Low	3,646	1,184	3,175	8,005	17,194	4,103	10,528	31,826
Moderate	4,575	999	3,792	9,366	22,476	3,463	12,427	38,366
Severe	2,837	584	2,800	6,221	13,981	1,994	9,130	25,105
Very Severe	3,407	354	2,744	6,505	16,565	1,212	9,039	26,816
Total	25,673	8,038	25,843	59,554	124,784	28,560	85,488	238,832

HPS M3	HPS Ha
15,632	51,897

Change from 2006 to 2007 overview flight information (and redefinition of priority stands)

MPB Attack Severity	Low Salvage Priority	Med Salvage Priority	High Salvage Priority	THLB Total	Low Salvage Priority	Med Salvage Priority	High Salvage Priority	THLB Total
	Volume ('000s)				Area			
Nil	4,704	-35	-2,663	2,007	21,683	-282	-8,497	12,903
Trace	-96	-586	-2,038	-2,720	-1,006	-1,940	-6,658	-9,604
Low	320	-518	-4,366	-4,564	177	-1,795	-14,198	-15,816
Moderate	2,470	-523	-1,627	321	11,591	-1,904	-5,432	4,255
Severe	2,150	50	582	2,782	10,282	119	1,744	12,144
Very Severe	2,867	-51	363	3,179	13,761	-332	954	14,383
Total	12,415	-1,662	-9,749	1,004	56,488	-6,135	-32,088	18,266

HPS M3	HPS Ha
-6,089	-20,845

¹⁶ Yellow shading highlights 2 years of HPS for 2006/07 and 2007/2008. Current low attack intensity is assumed to be moderate in the second year of the strategy to allocate harvesting resources.

Table 11: Mountain pine beetle BMU strategies and statistics¹⁷

District	BMU	Strategy (Feb 2007)	Provincial Zonation (Jan., 2007)	Gross Area	Susceptible Area (Ha) (> 60yrs)	MPB Area (Ha) Mapped 2006
Kamloops	Barriere	Salvage	Salvage	170,970	48,208	17,170
	Battle	Salvage	Salvage	84,812	43,086	29,145
	East Adams	Salvage	Salvage	34,779	8,881	3,333
	Gisborne	Salvage	Salvage	123,921	46,887	19,277
	Greenstone	Salvage	Salvage	65,855	30,070	23,513
	Hat	Salvage	Salvage	55,534	31,467	14,462
	Lemieux	Salvage	Salvage	47,780	25,467	18,217
	Louis	Salvage	Salvage	195,227	52,607	23,162
	McConnell	Salvage	Salvage	69,666	19,297	12,366
	McLean	Salvage	Salvage	63,080	16,718	10,211
	Scuitto	Salvage	Salvage	95,357	39,283	21,717
	Skull	Salvage	Salvage	128,716	39,040	36,918
	Tranquille	Salvage	Salvage	52,523	28,639	36,510
	Tunkwa	Salvage	Salvage	125,489	62,883	54,702
Kamloops District Total				1,313,709	492,532	320,703
Headwaters	Adams Lake	Holding	Containment	43,811	11,186	2,999
	Albreda	Holding	Containment	61,971	2,610	109
	Avola	Holding	Containment	63,488	14,236	536
	Cayenne	Holding	Containment	46,239	11,947	2,190
	Clearwater	Salvage	Salvage	143,416	31,333	33,059
	Dunn	Salvage	Salvage	19,844	3,072	1,671
	Mad	Holding	Containment	63,978	22,560	3,063
	Mica	Holding	Containment	54,225	21,650	2,768
	Mud	Monitor	Undesignated	69,617	1,119	96
	Raft	Holding	Containment	76,942	18,702	3,415
	Thunder Blue	Monitor	Undesignated	67,909	3,850	580
	Tum Tum	Holding	Containment	99,254	9,920	215
	Upper North Thompson	Monitor	Undesignated	93,380	4,960	208
	Vavenby	Holding	Containment	33,046	7,679	2,230
Wells Gray	Monitor	Undesignated	536,453	0	21,464	
Headwaters District Total				1,473,573	164,824	74,605
TSA Total				2,787,282	657,356	395,309

Hazard mapping is available on the SIFR web site¹⁸. Assumptions used to develop the mapping are also provided.

¹⁷ Gross TSA area, area mapped is from the 2006 overview flight

¹⁸ http://www.for.gov.bc.ca/rsi/ForestHealth/hazard_rating.htm

Appendix 2

Douglas-fir Bark Beetle Statistics and Strategies

The following table summarizes Douglas-fir beetle management strategies and statistics in the Kamloops TSA¹⁹.

Table 12: Douglas-fir bark beetle BMU strategies and statistics

District	BMU	Strategy (Feb 2007)	Provincial Zonation (Jan., 2007)	Gross Area	Susceptible Area (Ha) ²⁰ Fd >121 years	IBD Area (Ha) Mapped 2006
Kamloops	Barriere	Suppression	Undesignated	170,970	35,161	16.3
	Battle	Holding	Undesignated	84,812	33,666	
	East Adams	Holding	Undesignated	34,779	4,286	
	Gisborne	Holding	Undesignated	123,921	39,081	
	Greenstone	Suppression	Undesignated	65,855	17,721	
	Hat	Holding	Undesignated	55,534	22,486	
	Lemieux	Suppression	Undesignated	47,780	10,674	15.0
	Louis	Suppression	Undesignated	195,227	40,251	78.3
	McConnell	Holding	Undesignated	69,666	9,721	
	McLean	Holding	Undesignated	63,080	18,590	
	Scuitto	Holding	Undesignated	95,357	23,025	
	Skull	Suppression	Undesignated	128,716	12,661	30.3
	Tranquille	Suppression	Undesignated	52,523	1,602	
	Tunkwa	Holding	Undesignated	125,489	33,584	
Kamloops District Total				1,313,709	302,508	139.8
Headwaters	Adams Lake	Suppression	Undesignated	43,811	8,914	23.0
	Albreda	Monitor	Undesignated	61,971	1,668	
	Avola	Suppression	Undesignated	63,488	5,193	5.8
	Cayenne	Suppression	Undesignated	46,239	3,817	23.3
	Clearwater	Suppression	Undesignated	143,416	10,414	29.0
	Dunn	Suppression	Undesignated	19,844	1,059	13.3
	Mad	Suppression	Undesignated	63,978	4,983	15.3
	Mica	Suppression	Undesignated	54,225	4,629	17.8
	Mud	Monitor	Undesignated	69,617	2,619	
	Raft	Suppression	Undesignated	76,942	3,845	13.8
	Thunder Blue	Monitor	Undesignated	67,909	5,262	
	Tum Tum	Monitor	Undesignated	99,254	1,013	
	Upper North Thompson	Monitor	Undesignated	93,380	1,028	
	Vavenby	Suppression	Undesignated	33,046	3,466	32.5
	Wells Gray	Monitor	Undesignated	536,453	0	0.5
Headwaters District Total				1,473,573	57,909	174.0
TSA Total				2,787,282	360,417	313.8

¹⁹ Gross TSA area, attack area mapped is from the 2006 detailed flight

²⁰ Forest cover types (>121 yrs) with a Douglas-fir component

Forest cover types (>121 yrs) with a Douglas-fir component are found throughout the southern two thirds of the TSA. Sixteen percent of the total TSA area (excluding Wells Gray BMU) is covered by susceptible age stands with a Douglas-fir component. Seven BMUs have greater than 25% of their area in these types of stands. Wells Gray BMU, which encompasses Wells Gray Provincial Park also has a large area of susceptible forest cover type although data is not available.

Table 13: Susceptible age stands with a Douglas-fir component by BMU²¹.

District	BMU	Gross Area Occupied by Age (Ha)			Total Area ≥121 years (Ha)	% BMU Area >121 years
		121-140	141-250	>250		
Kamloops	Barriere	14923	19038	1199	35,161	21
	Battle	9328	21238	3100	33,666	40
	East Adams	1006	3232	47	4,286	12
	Gisborne	14045	23573	1463	39,081	32
	Greenstone	8535	8627	558	17,721	27
	Hat	5439	16234	813	22,486	40
	Lemieux	8897	1777	0	10,674	22
	Louis	18798	20453	1000	40,251	21
	McConnell	5634	4028	60	9,721	14
	McLean	5306	12367	917	18,590	29
	Scuitto	12625	9658	742	23,025	24
	Skull	8805	3782	74	12,661	10
	Tranquille	847	716	39	1,602	3
	Tunkwa	11359	21186	1039	33,584	27
Kamloops District Total		125549	165909	11051	302,508	23
Headwaters	Adams Lake	2180	6250	483	8,914	20
	Albreda	151	788	730	1,668	3
	Avola	281	3356	1556	5,193	8
	Cayenne	328	2975	514	3,817	8
	Clearwater	5777	4233	403	10,414	7
	Dunn	879	180	0	1,059	5
	Mad	1419	2813	751	4,983	8
	Mica	1941	2253	434	4,629	9
	Mud	105	1600	914	2,619	4
	Raft	1332	1452	1061	3,845	5
	Thunder Blue	158	2708	2396	5,262	8
	Tum Tum	28	370	615	1,013	1
	Upper North Thompson	22	489	517	1,028	1
	Vavenby	2005	1136	325	3,466	10
Headwaters District Total		16607	30603	10698	57,909	6
TSA Total		142156	196512	21749	360,417	16

²¹ Gross TSA area, excludes Wells Gray BMU

The following table summarizes 2006 Douglas-fir beetle affected area by spots and patches for each BMU in the Kamloops TSA²².

Table 14: Summary of Douglas-fir bark beetle occurrence in the Kamloops TSA

District	BMU	Spot ²³ Area Attacked			Patch Area Attacked		Total Area Attacked (Ha)
		Spots	Trees	Area (Ha)	Patches	Area (Ha)	
Kamloops	Barriere	65	698	16.3			16.3
	Battle						
	East Adams						
	Gisborne						
	Greenstone						
	Hat						
	Lemieux	58	386	15.0			15.0
	Louis	244	3,359	66.0	1	12.3	78.3
	McConnell						
	McLean						
	Scuitto						
	Skull	114	1,334	30.3			30.3
	Tranquille						
	Tunkwa						
Kamloops District Total		481	5,777	127.5	1	12.3	139.8
Headwaters	Adams Lake	89	891	23.0			23.0
	Albreda						
	Avola	23	156	5.8			5.8
	Cayenne	81	1,206	23.3			23.3
	Clearwater	115	867	29.0			29.0
	Dunn	53	372	13.3			13.3
	Mad	59	512	15.3			15.3
	Mica	67	815	17.8			17.8
	Mud						
	Raft	55	412	13.8			13.8
	Thunder Blue						
	Tum Tum	2	15	0.1			0.1
	Upper North Thompson						
	Vavenby	123	1,067	32.5			32.5
Wells Gray	2	10	0.5			0.5	
Headwaters District Total		669	6,323	174.1	0	0.0	174.1
TSA Total		1,150	12,100	301.6	1	12.30	313.9

²² Gross TSA area, area mapped is from the 2006 detailed flight

²³ Small infestations of up to 50 trees may be identified as a spot infestation; all spots (point sources) are classified as severe. For GIS input the following scale is applied to area estimates: 2 - 30 trees = 0.25 ha; 31 - 50 trees = 0.50 ha.

Douglas-fir Bark Beetle Hazard Mapping

Hazard mapping is available on the SIFR web site²⁴. Assumptions to develop the mapping are also provided.

In general, hazard is highest in steep, moderately dense, south-facing stands of slow-growing Douglas-fir in the IDF where the mean diameter is >45cm dbh and stand age greater than 140 years. At low or endemic levels, Douglas-fir beetles normally infest felled trees, over-mature and damaged trees, logging debris, blowdown and trees stressed by drought, disease or fire. Fire scarred trees are particularly susceptible

Root disease may be an important component of Douglas-fir population dynamics in the TSA and may make trees more vulnerable to both primary and secondary beetle attack and increase the potential for a successful attack. For this reason, high hazard root disease ecosystems are carefully monitored, particularly following abiotic events, such as drought, fire and windthrow. Recently there is a concern that Douglas-fir beetle (and western pine beetle) populations may increase in some drought-affected areas, especially where high numbers of mature trees have been killed.

²⁴ http://www.for.gov.bc.ca/rsi/ForestHealth/hazard_rating.htm

Appendix 3

Spruce Bark Beetle Statistics and Strategies

The following table summarizes spruce bark beetle management strategies and statistics in the Kamloops TSA²⁵.

Table 15: Spruce bark beetle BMU strategies and statistics

District	BMU	Strategy (Feb 2007)	Provincial Zonation (Jan., 2007)	Gross Area	Susceptible Area (Ha), Sx >121 years	IBS Area (Ha) Mapped 2006
Kamloops	Barriere	Holding	Undesignated	170,970	45,193	
	Battle	Holding	Undesignated	84,812	7,218	
	East Adams	Holding	Undesignated	34,779	7,273	
	Gisborne	Holding	Undesignated	123,921	14,584	
	Greenstone	Holding	Undesignated	65,855	16,271	
	Hat	Holding	Undesignated	55,534	13,151	
	Lemieux	Suppression	Containment	47,780	13,380	0.3
	Louis	Suppression	Containment	195,227	27,856	638.7
	McConnell	Holding	Undesignated	69,666	6,311	
	McLean	Holding	Undesignated	63,080	7,456	
	Scuitto	Holding	Undesignated	95,357	14,909	
	Skull	Holding	Undesignated	128,716	20,382	
	Tranquille	Holding	Undesignated	52,523	14,627	
	Tunkwa	Holding	Undesignated	125,489	22,116	
Kamloops District Total				1,313,709	230,727	639.0
Headwaters	Adams Lake	Monitor	Undesignated	43,811	12,199	1.3
	Albreda	Suppression	Undesignated	61,971	18,513	
	Avola	Suppression	Undesignated	63,488	24,020	0.5
	Cayenne	Suppression	Undesignated	46,239	15,663	1.0
	Clearwater	Suppression	Undesignated	143,416	12,081	1.8
	Dunn	Monitor	Undesignated	19,844	1,304	
	Mad	Suppression	Undesignated	63,978	15,416	0.5
	Mica	Monitor	Undesignated	54,225	15,185	2.5
	Mud	Suppression	Undesignated	69,617	17,218	1.3
	Raft	Suppression	Undesignated	76,942	22,966	0.8
	Thunder Blue	Suppression	Undesignated	67,909	25,523	
	Tum Tum	Suppression	Undesignated	99,254	24,868	
	Upper North Thompson	Suppression	Undesignated	93,380	31,110	1.0
	Vavenby	Suppression	Undesignated	33,046	6,161	
Wells Gray	Monitor	Undesignated	536,453	0		
Headwaters District Total				1,473,573	242,227	10.5
TSA Total				2,787,282	472,954	649.5

²⁵ Gross TSA area, attack area mapped is from the 2006 detailed flight

Forest cover types (>121 yrs) with a spruce component are located throughout the TSA (Table 16). Spruce is the most significant species by volume in the Headwaters District portion of the TSA. Twenty-one percent of the total TSA area (excluding Wells Gray BMU where there is no data) is covered by age-susceptible stands that have a spruce component. 6 BMUs have 30% or more of their area in this forest cover type.

Table 16: Susceptible Age stands with a spruce component by BMU²⁶

District	BMU	Gross Area Occupied by Age (Ha)			Total Area ≥121 years (Ha) ²⁷	% BMU Area >121 years
		121-140	141-250	>250		
Kamloops	Barriere	9441	28171	7581	45,193	26
	Battle	2810	4384	25	7,218	9
	East Adams	493	6226	553	7,273	21
	Gisborne	7890	6589	106	14,584	12
	Greenstone	8928	7070	273	16,271	25
	Hat	3157	9561	433	13,151	24
	Lemieux	11352	2028	0	13,380	28
	Louis	10467	15290	2099	27,856	14
	McConnell	3807	2502	2	6,311	9
	McLean	2412	4911	133	7,456	12
	Scuitto	9138	5379	392	14,909	16
	Skull	14130	5938	315	20,382	16
	Tranquille	7883	6626	118	14,627	28
	Tunkwa	10308	11472	336	22,116	18
Kamloops District Total		102214	116148	12365	230,727	18
Headwaters	Adams Lake	966	8584	2649	12,199	28
	Albreda	1550	9557	7405	18,513	30
	Avola	665	13746	9609	24,020	38
	Cayenne	477	10012	5175	15,663	34
	Clearwater	4289	6161	1632	12,081	8
	Dunn	610	594	100	1,304	7
	Mad	833	8614	5969	15,416	24
	Mica	1478	10161	3546	15,185	28
	Mud	183	7130	9905	17,218	25
	Raft	1575	8109	13282	22,966	30
	Thunder Blue	586	13482	11455	25,523	38
	Tum Tum	194	14017	10657	24,868	25
	Upper N. Thompson	299	18159	12652	31,110	33
	Vavenby	1188	3365	1609	6,161	19
Headwaters District Total		14894	131690	95644	242,228	26
TSA Total		117108	247838	108009	472,955	21

²⁶ Gross TSA area, excludes Wells Gray BMU

²⁷ Forest cover types (>121 yrs) with a spruce component

The following table summarizes 2006 spruce bark beetle affected area by spots and patches for each BMU in the Kamloops TSA.

Table 17: Summary of the 2006 spruce beetle in the Kamloops TSA²⁸

District	BMU	Spot ²⁹ Area Attacked			Patch Area Attacked		Total Area Attacked (Ha)
		Spots	Trees	Areas	Trees	Area	
Kamloops	Barriere						
	Battle						
	East Adams						
	Gisborne						
	Greenstone						
	Hat						
	Lemieux	1	3	0.3			0.3
	Louis	24	1,078	9.8	1	629.0	638.7
	McConnell						
	McLean						
	Scuitto						
	Skull						
	Tranquille						
	Tunkwa						
Kamloops District Total		25	1,081	10.0	1	629.0	639.0
Headwaters	Adams Lake	4	95	1.3			1.3
	Albreda						
	Avola	2	40	0.5			0.5
	Cayenne	4	45	1.0			1.0
	Clearwater	7	130	1.8			1.8
	Dunn						
	Mad	2	30	0.5			0.5
	Mica	8	190	2.5			2.5
	Mud	4	79	1.3			1.3
	Raft	3	16	0.8			0.8
	Thunder Blue						
	Tum Tum						
	Upper North Thompson	2	10	1.0			1.0
	Vavenby						
Wells Gray							
Headwaters District Total		36	635	10.5	0	0.0	10.5
TSA Total		61	1,716	20.5	1	629.0	649.5

²⁸ Includes all land tenures and ownership types, source: Kamloops Aerial Overview Survey

²⁹ Small infestations of up to 50 trees may be identified as a spot infestation; all spots (point sources) are classified as severe. For GIS input the following scale is applied to area estimates: 2 - 30 trees = 0.25 ha; 31 - 50 trees = 0.50 ha.

Spruce Bark Beetle Hazard Mapping

Hazard mapping is available on the SIFR web site³⁰. Assumptions to develop the mapping are also provided.

In general, the order of hazard (high to low) for spruce stands is: stands in creek bottoms; better stands of spruce on benches, slopes, and high ridges; poorer stands on benches, slopes, and high ridges; mixtures of spruce and lodgepole pine and stands containing all immature spruce.

Spruce beetles normally infest downed trees or logging debris, but, when beetle populations are large, they attack and kill living trees causing widespread damage. The amount and proximity of preferred host material such as infested blowdown, breakage and logging debris is incorporated into risk evaluation. Any susceptible stand within 2 km of a spruce beetle infestation is considered to be at high risk.

³⁰ http://www.for.gov.bc.ca/rsi/ForestHealth/hazard_rating.htm

Appendix 4 Commitment Spread Sheet

Point Number	Mapsheet	BMU	Licensee Operating Area	Species	Beetle Infested Y/N	Number Red Trees	Number Green Attacks	Volume	Area	Other Forest Health Issue	Action Recommended ¹	Who to complete action	Action Due Date	Action Complete (harvested)	Access	Notes

¹Action codes:

- M** monitor
- TS** treat; SSS or ML salvage (i.e. 499 permits)
- TT** trap trees
- AP** occurrence is included in blocks, cutting permits or other approved harvest plan