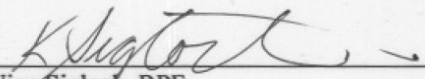


Kamloops TSA - Forest Health Strategy




March 2009

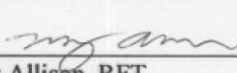
Kamloops and Headwaters Forest Districts

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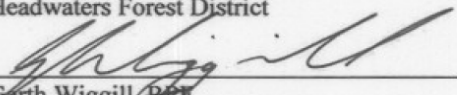
Date: 4 May 2009

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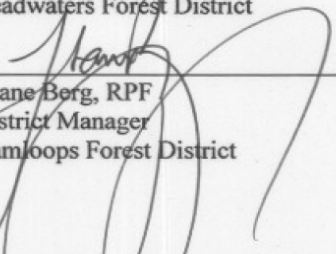
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1.0 Introduction

This Forest Health Strategy (the Strategy) covers the Kamloops Timber Supply Area (TSA) including the Kamloops Forest District (DKA) and the Clearwater portion of the Headwaters Forest District (DHW). It covers approximately 2.8 million hectares (including Wells Gray Provincial Park and excluding tree farm licences). The TSA Timber Harvesting Landbase (THLB) is dominated by lodgepole pine, Douglas-fir, spruce, and balsam. Smaller areas are dominated by cedar, hemlock and deciduous species. The northern portion of DHW is covered in the Forest Health Strategy for the Robson Valley Timber Supply Area¹ by Pathfinder Forestry Consultants, completed in March 2009.

The Strategy is guided by, and aligned with, the Provincial Forest Health Strategy, the Forest Health Program and the Forest Health Implementation Strategy.² The intent of the Strategy is to provide Forest Professionals³ with guidance on, and information about forest health agents in the TSA. The objective is to enhance ecosystem health thereby improving forest resiliency and sustainability. This is consistent with the vision statement of the Kamloops Sustainable Forest Management Plan and the Kamloops Land Resource Management Plan.⁴

This document does not contain a conclusive list of all pests. The pests that have been included may have significant impacts or frequently occur within the TSA.

Understanding the implications of climate change for forest health is a major focus of the Ministry of Forests and Range (MFR). Climate change strategies for forest pests can be found in *Forest Health and Climate Change*.⁵

¹ <http://www.for.gov.bc.ca/ftp/DHW/external/!publish/>

² Link to the Provincial Forest Health Strategy, the Forest Health Program and the Forest Health Implementation Strategy: <http://www.for.gov.bc.ca/hfp/health/>

³ <http://www.abcfp.ca/>

⁴ <http://www.ilmb.gov.bc.ca/slrp/lrmp/index.html>

⁵ <http://www.for.gov.bc.ca/rsi/ForestHealth/index.htm>

2.0 Guiding Principles

1. Follow applicable legislation. Augment or identify, rather than reiterate policy and legislation, e.g., FRPA bulletins provide additional guidance.⁶
2. Remain consistent with and follow guidance provided by regional forest health experts. The Southern Interior Forest Region (RSI) forest health web site contains links to research, contacts, overview data and other forest health information.⁷
3. Follow provincial guidance provided by the;
 - Forest Practices Branch⁸ (e.g., Provincial Forest Health Strategy, Research, etc.)
 - British Columbia's Mountain Pine Beetle Action Plan 2006-2011⁹
 - Provincial Forest Health Implementation Strategy
 - Regional Forest Health Strategy¹⁰
 - Chief Forester Guidance (e.g., December 2005 Guidance on Landscape and Stand Level Structural Retention in Large Scale MPB Operations)
4. Enable operational planners to focus on economically viable priorities to get maximum value from the affected trees.

⁶ http://www.for.gov.bc.ca/hth/timten/FRPA_implementation%20sept11/Bulletins.htm

⁷ <http://www.for.gov.bc.ca/rsi/ForestHealth/index.htm>

⁸ <http://icw.for.gov.bc.ca/hfp/foresthealth.htm>

⁹ http://www.for.gov.bc.ca/hfp/mountain_pine_beetle/

¹⁰ <http://www.for.gov.bc.ca/rsi/ForestHealth/index.htm>

3.0 Roles and Responsibilities

Forest Professionals (licensee and BCTS planners, government agencies and others) collaboratively undertake implementation of the Strategy. A summary of roles and responsibilities is in Table 1.

Proposed budget for treatments in the TSA is in Appendix 1.

1. Meet on an as-needed basis to discuss the implementation and effectiveness of this strategy and to identify specific roles for monitoring, reporting and consolidation of information.
2. Licensees and BCTS are encouraged to build upon the strategies and tactics referenced in this document in order to maximize the available harvesting capacity.
3. MFR completes aerial overview surveys and provides the resulting information to the licensees. The latest results can found on the regional and provincial forest health web sites.¹¹
4. Detailed aerial surveys and ground surveys are conducted on a priority based system subject to funding, and are the responsibility of MFR and licensees as decided through a collaborative effort. Aerial survey results are available annually on the FTP site.¹²
5. Single tree removal/disposal, trap tree placement/removal and larger scale bark beetle treatments are the responsibility of MFR and licensees as decided through a collaborative effort. Guidance on small scale salvage is provided by TSA salvage documents on the FTP site.¹³
6. The MFR and licensees will pursue all funding opportunities to conduct priority treatment options to mitigate impacts from bark beetles in areas designated as suppression. (E.g., trap-tree programs, ground surveys, and small-site treatments.)
7. Assessment of hazard and risk information is done on a five year rotation by MFR subject to funding, and will be provided to licensees and other agencies as requested.¹⁴

¹¹ <http://www.for.gov.bc.ca/hfp/health/overview/overview.htm>

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

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

¹⁴ http://www.for.gov.bc.ca/rsi/ForestHealth/hazard_rating.htm

Table 1: Roles and responsibilities for implementation of the Kamloops TSA FH Strategy

Action	Completion Dates	Responsibility		
		Region	District	Licensee
Preparation of TSA Strategy Document	March		X	
Aerial Overview Surveys	August	X		
Detailed Aerial Surveys	September		X	X - TFL
Single Tree Treatment/Bait and Trap Tree Program	Falling by end of March in DKA and April in DHW		X	X
Monitoring, Reporting, and Consolidation of information	Ongoing	X	X	X
One on one communication	Ongoing		X	X
Provide and coordinate commitment spreadsheet for spruce and Douglas-fir treatments	As information becomes available		X	
Complete commitment spreadsheet for spruce and Douglas-fir treatments	As information becomes available			X
Aerial Spray Program	May-June	X		

4.0 Priority Forest Health Factors within the TSA

A list of forest health factors impacting the Kamloops TSA was compiled in the winter of 2003 and was based mostly on forest licensee input. Rankings were adjusted in February 2009 to downgrade IBM, from high to moderate, to reflect salvage status of IBM (see Section 6.1 Beetle Management Units). IBM remains moderate due to the susceptibility of young pine stands and the aggressive salvage efforts to recover value from affected mature pine stands. Douglas-fir tussock moth (IDT) has been moved to high priority based on current outbreak levels of tussock moth and public health concerns. Table 2 lists the forest health factors in the TSA and their relative priority.

Table 2: Priority and ranking of Forest Health Factors in the Kamloops TSA (numbers 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
Cattle (DKA)	Deer	Stalactiform blister rust
spruce beetle (1)	Cattle (DHW)	Comandra blister rust
Douglas-fir beetle (1)	Mountain pine beetle (was high)	Blackstain root disease
western spruce budworm		Porcupine
White pine blister rust (4)		spruce broom rust
Douglas-fir tussock moth (was moderate)		pine needle disease
		Forest tent caterpillar

Deciduous pests are noted in *Section 8.0 Deciduous Pests* and the *Overview of Forest Health in the Southern Interior Region*

Detection and monitoring strategies, occurrence, and population trends of priority health factors are described in the annual *Overview of Forest Health in the Southern Interior Forest Region*.¹⁵

¹⁵ <http://www.for.gov.bc.ca/rsi/ForestHealth/overview.html>

5.0 Non-Recovered Losses (NRLs)

The Timber Supply Review (TSR) recognizes non-recovered losses (NRLs) in harvestable timber volume due to damage caused by fire, wind, insects, diseases and other pests. NRLs in the TSAs leading lodgepole pine (pine) stands is almost exclusively from IBM. With TSA wide aggressive approaches to pine utilization losses are expected to be reduced significantly. Non-leading pine stands are assumed to suffer a range of volume losses depending on the severity of attack. Estimates of annual unsalvaged losses are summarized in Table 3 (from Section 8(8)e Factor #57 of Kamloops TSA TSR 4.¹⁶) Provincially, the methodology for NRL calculation is being revisited to establish a consistent approach.

Table 3: Non-Recovered (recoverable) Losses NRLs

Cause of Loss	Annual Non-Recovered Losses (m ³ /year)
Douglas-Fir beetle	6 000
spruce beetle	74 560
western hemlock looper	8 295
wildfire	30 857*
wind damage	18 196
root disease in managed stands	1 494
	139 402

1. “*Methods to Estimate Unsalvaged Losses for Timber Supply Review*” developed by the Ministry of Forests, Forest Practices Branch, provided the methodology to estimate NRLs.
2. Information to determine unsalvaged losses for bark beetles and western hemlock looper was collected from “*Methodology of Kamloops NRL Calculations – Kamloops TSA October 2007*”. This report was prepared by Timberline Natural Resource Group.
3. There is uncertainty regarding the spruce bark beetle unsalvaged losses. The potential exists for misidentification of tree species and/or beetle infestation type which is a common error during forest health aerial overview flights (25% error, Dr. Lorraine MacLauchlan, RSI Entomologist). Indications are that spruce bark beetle populations are on the rise.
4. Even though it is accepted that balsam bark beetle is accounted for in the Variable Density Yield Prediction (VDYP) we can expect, in the future, an increase in losses over and above what has been accounted for. These increased losses are a projection based on an increase in harvesting these timber types and future climate regimes, i.e., drought and stress.

¹⁶ “Timber Supply Analysis Information Package – Kamloops TSA TSR 4” (available from DKA - John McQueen John.McQueen@gov.bc.ca)

5. Wildfire unsalvaged losses were calculated using 16 years of data. *A 12 210 m³ loss was used for 2003. This is an average loss per year calculated from 10 years of data. 374 380 m³ was salvaged from the 2003 wildfires. The total NRL for the 2003 fire season NRL are 4 986 261 m³. This figure was not included as it was considered to be an anomaly in the dataset.
6. Wind damage was calculated for blowdown events within unharvested stands greater than 200 m³ in the last 10 years. A 96.0 hectare catastrophic wind event on Gollen Plateau in 2004 is included in the calculation.
7. Root disease in managed stands is not accounted for in the Operational Adjustment Factors (OAFs) of the Topsy curves. In TSR2, the estimated volume was determined by using an OAF of 0.5% to estimate the annual losses in the Kamloops TSA (Regional Pathologist). New research shows that this OAF is underestimated and should be 1%. (Dr. Michelle Cleary, RSI Pathologist)
In the near future, the Canadian Forest Service (CFS) will be refining the OAFs and this information will likely be available before TSR 5. (Dr Michelle Cleary, RSI Pathologist)

PUBLIC INPUT

None

CONCLUSION

1. The base case underestimates NRLs.
2. Trends for future impacts to the TSR are greater NRL due to increased populations of spruce and balsam bark beetle and increased losses in managed stands due to root disease.

IMPACT ON TSR

Impact of NRLs to TSR is a downward pressure of 76 812 m³/year - which is approximately 45% more than estimated in the basecase.

6.0 Bark Beetles

Beetle infestations are detected and recorded by RSI aerial overview surveys and DKA and DHW detailed surveys (subject to funding). 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 (IBM) *Dendroctonus ponderosae*, Douglas-fir beetle (IBD) *Dendroctonus pseudotsugae*, spruce beetle (IBS) *Dendroctonus rufipennis* and western balsam bark beetle (IBB) *Dryocoetes confusus*. Severity of attack for the four main bark beetles is available in table format by Forest District in the annual *Overview of Forest Health in the Southern Interior Forest Region*.¹⁷

The objective of beetle management is an effective, coordinated, operational approach that minimizes damage and maximizes economic recovery. Currently, spruce and Douglas-fir beetle salvage are the highest priority in the TSA due to the potential for rapid spread and high attack ratios. Mountain pine beetle salvage is also still a priority in localised areas within the TSA. Small scale salvage is being used extensively in the Kamloops TSA for management of spruce and Douglas-fir beetle, including salvage of windthrown areas. The western balsam bark beetle is ubiquitous within most of the subalpine fir stands in the TSA. Mortality caused by IBB appears to have been increasing in certain locations over the past few years.

A comprehensive list of possible tactics and treatments for bark beetles can be found in The Bark Beetle Management Guidebook¹⁸ and on the provincial and regional websites. Detailed discussion of management tactics for mountain pine beetle may be found in; “Strategies and Tactics for Managing the Mountain Pine Beetle, *Dendroctonus ponderosae*” (Maclauchlan and Brooks, 2001).

¹⁷ <http://www.for.gov.bc.ca/rsi/ForestHealth/overview.html>

¹⁸ <http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/beetle/betletoc.htm>

6.1 Bark Beetle Management Units

Priority and strategy assignment occurs on two levels for bark beetles. Broad provincial zonations, Emergency Bark Beetle Management Areas (EBBMAs), which identify landscape level beetle management areas with similar bark beetle management strategies.¹⁹ Beetle Management Units (BMUs) identify priority geographic landscape level areas in a TSA that guide management and funding of specific bark beetles. BMU designations are reviewed annually and updated as necessary.

The provincial EBBMA zonation for pine (IBM), Douglas-fir (IBD) and spruce (IBS) bark beetles were updated in February 2009 by the provincial bark beetle coordinator. Maps and designation letters are on the Emergency Bark Beetle web site.²⁰ The TSA level BMU strategies are described in Table 5.

Appendix 2, 3 and 4 contain BMU designations, statistics and maps for IBM (2), IBD (3) and IBS (4).

The broad provincial EBBMA zone categories are:

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

Table 4: TSA level bark beetle BMU 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.

¹⁹ <http://www.for.gov.bc.ca/hfp/health/fhdata/bmucriteria.htm>

²⁰ http://www.for.gov.bc.ca/hfp/mountain_pine_beetle/maps/ebbma/

6.1 Mountain Pine Beetle (IBM)

The 2009 strategy for IBM maintains a focus on maximizing the salvage harvest of the highest priority stands²¹. 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 the context of sustainability.

Mountain pine beetle has been reduced in priority from “high (1)” to “medium” (Table 2), due to salvage status in the majority of TSA BMUs. IBM is still of concern due to the attack in young stands, which are expected to provide future timber/fibre supply. More information on attack in young stands is in the 2008 Regional Forest Health Overview report.²²

In Appendix 2, mountain pine beetle BMUs are mapped and summarized by priority to assist planning and salvage activities.

6.2 Douglas-fir Beetle (IBD) and Spruce Beetle (IBS)

Spruce and Douglas-fir beetle infestations have been increasing in the TSA and are still considered manageable at this time. 2008 aerial overviews have underestimated actual infestation levels, detailed surveys and ground reconnaissance have indicated increases and decreases depending on the site.

Aggressive suppression of active IBD infestations, with an expedited program of trap trees has been effective in reducing many of these populations. IBS infestations have been underestimated and detailed surveys and ground reconnaissance should be conducted in 2009.

In Appendix 3 and 4 - Douglas-fir (3) and spruce (4) beetle, BMUs are mapped and summarized by priority to assist planning and salvage activities.

The updated commitment spreadsheets identifying the location of beetle populations have been provided to licensees and are available on the FTP site.²³

Other references and resources available for consideration during planning of salvage harvesting include:

- MFR beetle web site²⁴
- Small Scale Salvage Guidance documents for DKA and DHW are on the ftp sites²⁵
- Section 2 of the Kamloops TSA Mountain Pine Beetle Strategy - March 2006²⁶

²¹ http://www.for.gov.bc.ca/dka/Forest_Health/Doc/KamloopsTSAMPBStrategy2006.pdf

²² <http://www.for.gov.bc.ca/hfp/health/overview/overview.htm>

²³ DKA <http://www.for.gov.bc.ca/ftp/DKA/external!/publish/Forest%20Health/> and DHW http://www.for.gov.bc.ca/ftp/DHW/external!/publish/Small_Scale_Salvage_Headwaters/

²⁴ http://www.for.gov.bc.ca/hfp/mountain_pine_beetle/stewardship/

²⁵ <http://www.for.gov.bc.ca/ftp/DKA/external!/publish/Forest%20Health/>

²⁶ http://www.for.gov.bc.ca/dka/Forest_Health/Doc/KamloopsTSAMPBStrategy2006.pdf

6.3 Western Balsam Bark Beetle (IBB)

The IBB is ubiquitous within most of the subalpine fir stands in the TSA. The TSA is monitoring IBB infestations, but not currently managing for IBB. Infestations are detected and monitored as part of the RSI aerial overview flights and long-term research installations.

6.4 Blowdown

Concentrated and scattered windthrow in Douglas-fir, spruce and subalpine fir stands have the potential to trigger increases in bark beetle infestations. Windthrow should be addressed promptly, to minimize the expansion of beetle populations (E.g., in the vicinity of Mule deer winter range and Old Growth Management Areas.) Windthrown trees should be removed prior to the beetle emergence from affected trees.

7.0 Defoliators

Detection, prediction and treatment of defoliators remain the responsibility of the MFR RSI. MFR district staff will gather information for high risk areas (E.g., woodlots) to aid regional staff in deciding which stands are priorities to treat.

Two defoliators of concern in the Kamloops TSA are western spruce budworm and Douglas-fir tussock moth.

More specific information on the defoliator program can be found on the RSI Forest Health website²⁷, in the Regional Forest Health Strategy and in the Defoliator Management Guidebook (1995)²⁸.

7.1 Western Spruce Budworm (IDW)

The population of IDW is expected to remain static or increase throughout the TSA in 2009. Approximately 126,000 hectares of Douglas-fir is currently affected by IDW.

7.2 Douglas-fir Tussock Moth (IDT)

Priority areas of infestation are treated as necessary as part of the RSI spray program. Due to the potential to cause allergic reactions in people and tree mortality, this insect is a priority for treatment.

7.3 Two-Year Cycle Spruce Budworm (IDB)

In general, populations of two-year cycle budworm have been decreasing over the last several years. Currently IDB is not being managed in the TSA. Research on impacts and management are ongoing.

²⁷ http://www.for.gov.bc.ca/rsi/ForestHealth/Defoliator_Program.htm

²⁸ <http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/defoliat/defoltoc.htm>

7.4 Western Hemlock Looper (IDL)

IDL populations are low, with an outbreak expected in the next two years.

8.0 Deciduous Pests

Considering the increasing management and use of deciduous species, as well as climate change implications, deciduous pests have been incorporated in the Strategy.

Since 2003, paper birch (*Betula papyrifera*) has been experiencing mortality referred to as birch decline or dieback. Although this decline has not been quantified or mapped, the magnitude is significant. Because birch is well-distributed in the valleys, the mortality is easily noticed. The public, especially landowners, are concerned about the losses in tree cover.

On birch, both *Armillaria* root disease and bronze birch borer are commonly found. These agents are endemic and not known to cause widespread epidemics. Their association with the upsurge of mortality is unclear. It is likely that one or more broad underlying causes such as climate-induced stress is predisposing trees to attacks. At this time, the decline seems to have tapered off.

9.0 Root Diseases

Stand susceptibility or hazard for root diseases is based on species composition and biogeoclimatic zone. Selective logging, pre-commercial thinning, spacing and/or brushing are practices that increase the risk within stands for root disease.

The known extent of root diseases is based upon hazard and risk criteria developed for the Forest Practices Code Root Disease Management Guidebook (1995).²⁹

Armillaria and *Phellinus* root diseases are present in the TSA. Other lesser known pathogens are present in localised areas, e.g., Tomentosis is present in the northern portion of the TSA.

9.1 *Armillaria* Root Disease (DRA)

Armillaria is a significant forest health concern throughout the southern interior region. It affects conifers starting as early as ages 4 or 5 and peaks around ages 12 to 15. Since the disease is not fully expressed at the time most free growing declarations are made, large openings and understocked-stands can be expected post-free growing.

²⁹ <http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/root/roottoc.htm>

A stand establishment decision aid, or decision key, has been developed to support decision making for management of *Armillaria* root disease in regenerating stands³⁰. It provides a revised table of host susceptibility ratings for species as well as a decision key to help natural resource managers choose from among several different treatments. (SIFR (RSI) Forest Health Overview, 2007)

9.2 Phellinus (Laminated) Root Disease (DRL)

In the Kamloops TSA, the objective is to compile *Phellinus* data from growth and yield permanent sample plots, and to establish a root disease inventory of occurrence and incidence (SIFR (RSI) Forest Health Overview, 2007). The work is ongoing to add the data to the existing incidence database. It will be used to determine future stand level losses and operational adjustment factors (OAF) for *Phellinus* in the TSR.

10.0 Pests of Young Stands

A variety of insects and disease are found within young stands but, 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. Weevils, stem rusts, lodgepole pine dwarf mistletoe, foliar diseases and mammals are among some of these pests. Management strategies for these pests are consistent with the Forest Practices Code Guidebooks.³¹

Over the last four years, young pine mortality has been separated from mature pine³². RSI contains the majority of the attack, and both DKA and DHW are affected.

The main damaging agents in young stands are;

Warren's Root Collar Weevil

Warren's root collar weevil has been recorded as migrating into immature pine stands, from pine beetle attacked mature stands. Attack in young stands may develop from populations in adjacent unlogged areas, residual uncut trees or infested stumps within the clearcut. Further research is underway.

Dwarf Mistletoes

In stands infected by dwarf mistletoe, a risk assessment, appropriate treatments and free growing criteria should be considered before making recommendations for stand management activities.

³⁰ http://www.forrex.org/jem/ISS48/vol9_no2_art7.pdf

³¹ <http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/>

³² <http://www.for.gov.bc.ca/rsi/ForestHealth/Overview.htm>

White Pine Blister Rust

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. A white pine blister rust stand establishment decision aid has been developed by Stefan Zeglen, Richard Hunt, and Michelle Cleary, and has been published as an extension note in Volume 10 - Issue 1 of The BC Journal of Ecosystems and Management.³³

Dothistroma

A Dothistroma stand establishment decision aid has been developed by Larry McCulloch and Alex Woods and has been published as an extension note in Volume 10 - Issue 1 of The BC Journal of Ecosystems and Management (use previous footnote link.) Although Dothistroma may not be an issue in the TSA, there is evidence of it in stands in DHW.

Root Diseases (Young Stands)

Root diseases cause significant volume losses in young stands. See Section 9.0 Root Diseases.

Animal Damage

Animal damage is primarily caused by ungulates in the Kamloops TSA. Animal damage is often underestimated in aerial overview assessments as it is masked by IBM and other damaging agents.

Animal Damage - Livestock

Within the Kamloops TSA, the impact of cattle damage on young plantations is ranked as high priority for DKA and moderate for DHW. Other contributing factors to cattle damage can be placement of salt licks, location of water sources, herd management and some site preparation techniques.

Hard Pine Stem Rusts

Evidence suggests that juvenile spacing activities in young lodgepole pine stands may be increasing the hazard and impact of pine stem rusts. Pine stem rusts in the TSA include western gall rust, commandra and stalactiform blister rusts.

³³ <http://www.forrex.org/publications/jem/jem.asp>

11.0 Further Links and References

11.1 General Forest Health Information Sources

- Alfaro, R.I., S. Taylor, G. Brown and E. Wegwitz. 1999. Tree mortality caused by the western hemlock looper in landscapes of central British Columbia. *For. Ecol. and Mgmt.* 124:285-291.
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11.3 Internet Information Sources

Provincial Forest Health Strategy

<http://www.for.gov.bc.ca/hfp/health/Strategy/FH%20Strategy.pdf>

Forest Health Program <http://www.for.gov.bc.ca/hfp/health/Strategy/FH%20Program.pdf>

Forest Health Implementation Strategy

<http://www.for.gov.bc.ca/hfp/health/Strategy/FH%20Impl.%20Strategy.pdf>

Southern Interior Forest Region Forest Health Home Page

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

“2007 Overview of Forest Health in the Southern Interior Forest Region

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

British Columbia’s Mountain Pine Beetle Action Plan 2006-2011”

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

Emergency Bark Beetle web site

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

Kamloops TSA MPB Strategy - March 2006

http://www.for.gov.bc.ca/dka/Forest_Health/Doc/KamloopsTSAMPBStrategy2006.pdf

Kamloops TSA MPB Strategy - March 2006

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

MFR 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>

DKA Forest Health FTP site.

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

MFR Bark Beetle Hazard and risk information

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

Timber Supply Review Public Discussion Paper (October 2007)

<http://www.for.gov.bc.ca/hts/tsa/tsa11/tsr3/11ts07pdp.pdf>

Defoliator Management Guidebook

- western spruce budworm management practices
- western hemlock looper hazard and risk assessment information
- Douglas-fir tussock moth strategies

<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 dwarf mistletoe

<http://www.for.gov.bc.ca/tasb/legsregs/fpc/fpcguide/dwarf/dwarftoc.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>

11.4 Research Information Sources

1. Ministry of Forests and Range:

RSI - Southern Interior Forest Region:

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

HFP - Forest Practices Branch – Forest health

<http://www.for.gov.bc.ca/mof/reports.htm>

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

Provincial MPB model <http://www.for.gov.bc.ca/hre/bcmpb/>

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

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

APPENDIX 1: 2009 Proposed Budget

District	Bark Btl Sp.	Surveys		Treatments				Total Cost (\$)		
		Detailed Air		Ground		Other			Baits	
		ha	\$	ha	\$	trees	\$	#	\$	
DKA	IBD	1,321,587	\$113,946	1,177	\$41,204					\$155,149
	IBS	1,015,381	\$71,077	3,292	\$115,203					\$186,279
DHW	ALL					Overview /Detailed	\$16,000			\$16,000
	IBD					125	\$3,600	15	\$7,000	\$10,600
	ALL					Heli Access & Other	\$9,000			\$9,000
TSA Totals			\$185,022		\$156,406		\$28,600		\$7,000	\$377,028

DKA notes:

- Funding is not requested for activities in parks. Parks are included in the gross BMU areas and are flown during the detailed overview flights. Overview information is provided to parks.
- Detailed flight costs were calculated at \$0.14/ha using the gross BMU ha since the cost of flying just the susceptible areas is unknown and inefficient. Where Fdi and Sx are both in suppression, the cost was divided between them equally.
- Ground survey costs were estimated using the hectares detected in the 2007 detailed aerial overview flights and calculated at a cost of \$35.00/ha.
- Treatment costs have not been added due to the current preferred treatment of using trap trees through the SSS program. Provided market conditions make this economical, this will be the method utilised.

DHW notes:

- In the Vavenby BMU the IBD is on the increase in several of the sites probed. Proposal for baits to be used.
- Possibility for a competitive FLTC for IBD in the Vavenby BMU.

APPENDIX 2: 2008 BMU Map and Summary Tables for Mountain Pine Beetle

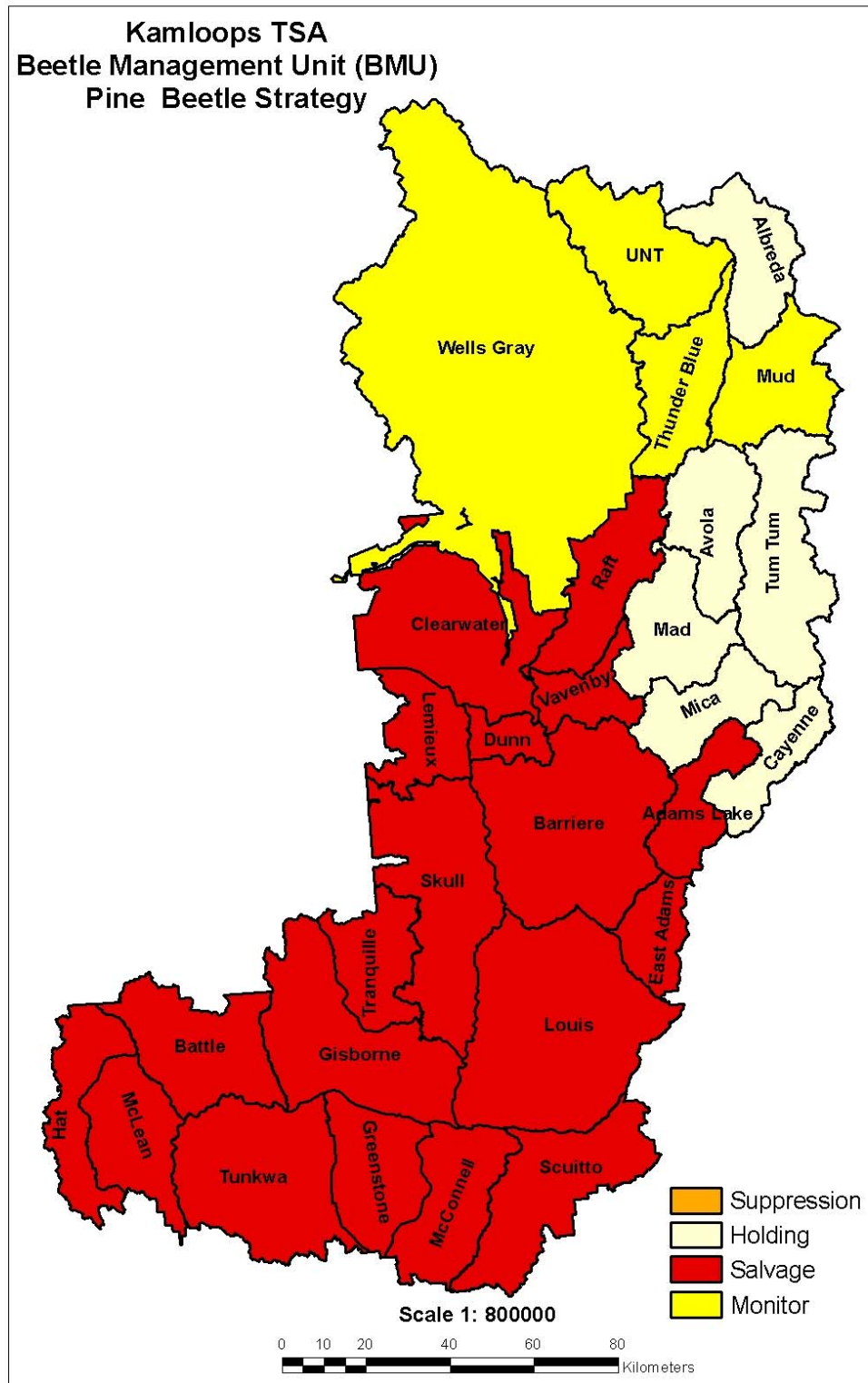


Table 5: Mountain pine beetle BMU strategies and statistics³⁴

District	BMU	BMU Zonation (2008)	Provincial EBBMA	Gross Area	Susceptible Area (Ha) (> 60yrs)	MPB Area (Ha) Mapped 2008
DKA	Barriere	Salvage	Salvage	170,970	40,728	6985
	Battle	Salvage	Salvage	91,007	32,376	21228
	East Adams	Salvage	Salvage	34,779	8,514	3100
	Gisborne	Salvage	Salvage	123,921	33,061	13415
	Greenstone	Salvage	Salvage	65,901	21,269	13785
	Hat	Salvage	Salvage	56,762	26,473	15528
	Lemieux	Salvage	Salvage	47,842	26,582	13265
	Louis	Salvage	Salvage	195,237	40,572	11870
	McConnell	Salvage	Salvage	69,666	13,710	14351
	McLean	Salvage	Salvage	63,080	12,243	8501
	Scuitto	Salvage	Salvage	95,357	25,277	11906
	Skull	Salvage	Salvage	128,716	36,045	27382
	Tranquille	Salvage	Salvage	52,524	34,542	28292
	Tunkwa	Salvage	Salvage	125,825	56,855	42638
DKA Total				1,321,586	408,249	232,247
DHW	Adams Lake	Salvage	Salvage	43,811	7,981	1711
	Albreda	Holding	Containment	61,971	1,250	1087
	Avola	Holding	Containment	63,488	8,991	3531
	Cayenne	Holding	Containment	46,239	10,194	4639
	Clearwater	Salvage	Salvage	131,403	28,430	25413
	Dunn	Salvage	Salvage	19,832	5,594	116
	Mad	Holding	Containment	63,978	16,834	8504
	Mica	Holding	Containment	54,247	14,450	4431
	Mud	Monitor	Undesignated	69,616	274	213
	Raft	Salvage	Salvage	69,647	15,701	8724
	Thunder Blue	Monitor	Undesignated	67,499	1,092	513
	Tum Tum	Holding	Containment	99,267	3,529	1361
	Upper North Thompson	Monitor	Undesignated	93,272	1,948	1410
	Vavenby	Salvage	Salvage	33,046	5,012	585
	Wells Gray	Monitor	Undesignated	539,026		16123
DHW Total				1,456,343	121,279	78,359

³⁴ Gross TSA area -- includes all land tenures and ownership types. All stands > 60 years old with Pli identified in the inventory layer are included as susceptible. Area mapped is from the 2008 overview flight. 24% of the total TSA area (excluding Wells Gray BMU - no data) is covered by age-susceptible stands that have a lodgepole pine component.

APPENDIX 3: 2008 BMU Map and Summary Tables for Douglas-fir Beetle

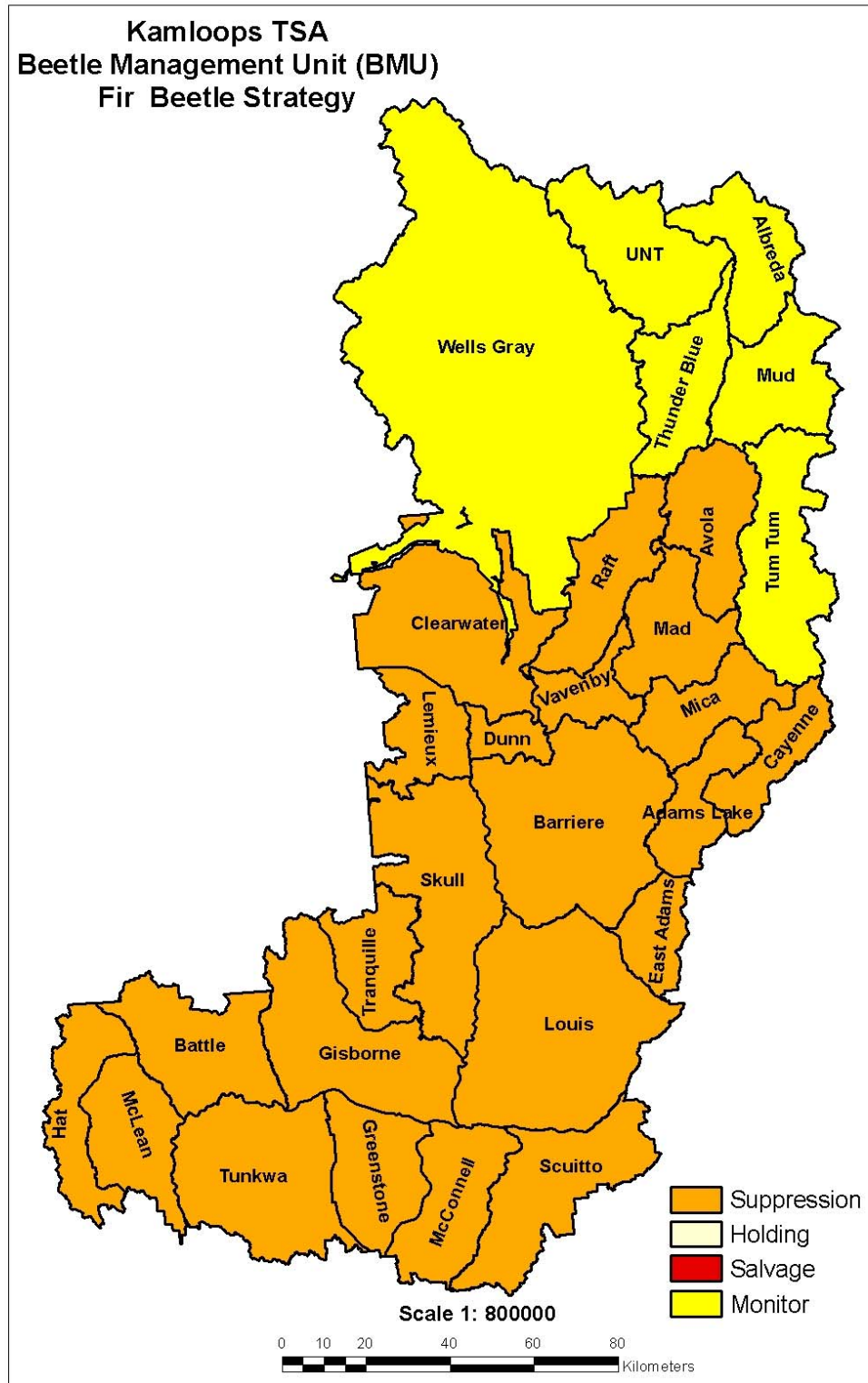


Table 6: Douglas-fir bark beetle BMU strategies and statistics in the TSA³⁵

District	BMU	BMU Zonation (2008)	Provincial EBBMA	District Ha	Susceptible Area ³⁶ (Fir > 121 years)				IBD Area Mapped 2008	
					All stands with Fd occurrence		Area where Fd ≥40% of stand		Detailed Flight	Overview Flight
					Ha	% of BMU	Ha	% of BMU	Ha	Ha
DKA	Barriere	Suppression	Aggressive	170,970	34,349	20	26,209	15	102	20
	Battle	Suppression	Aggressive	91,007	41,280	45	31,104	34	5	16
	East Adams	Suppression	Aggressive	34,779	4,374	13	3,888	11	4	1.5
	Gisborne	Suppression	Aggressive	123,921	48,183	39	41,684	34	115	284
	Greenstone	Suppression	Aggressive	65,901	19,462	30	12,226	19	14	0.75
	Hat	Suppression	Aggressive	56,762	25,209	44	19,194	34		0.5
	Lemieux	Suppression	Aggressive	47,842	11,662	24	5,318	11	230	32
	Louis	Suppression	Aggressive	195,237	54,038	28	39,329	20	585	563
	McConnell	Suppression	Aggressive	69,666	10,392	15	8,373	12	0	0.25
	McLean	Suppression	Aggressive	63,080	25,987	41	22,559	36	15	5
	Scuitto	Suppression	Aggressive	95,357	23,645	25	16,942	18	43	
	Skull	Suppression	Aggressive	128,716	14,690	11	9,869	8	47	15
	Tranquille	Suppression	Aggressive	52,524	1,499	3	346	1	1	0.25
	Tunkwa	Suppression	Aggressive	125,825	41,703	33	29,052	23	17	1
DKA Total				1,321,586	356,472	27	266,092	20	1177	939.5

³⁵ Gross TSA area -- includes all land tenures and ownership types, attack area mapped is from the 2006 DHW and DKA detailed flights, 2007 DKA detailed flight and 2007 TSA overview flight

³⁶ Forest cover types (>121 yrs) with a Douglas-fir component

Table 6: Douglas-fir bark beetle BMU strategies and statistics con't

District	BMU	BMU Zonation (2008)	Provincial EBBMA	Gross BMU Area	Susceptible Area ³⁷ (Fir > 121 years)				IBD Area Mapped	
					All stands with Fd occurrence		Stands where Fd ≥40%		Detailed Flight	Overview Flight
					Ha	% of BMU	Ha	% of BMU	Ha	Ha
DHW	Adams Lake	Suppression	Aggressive	43,811	6,795	16	4,279	10	3	
	Albreda	Monitor	Undesignated	61,971	1,484	2	164	0		
	Avola	Suppression	Aggressive	63,488	4,500	7	1,190	2	2	
	Cayenne	Suppression	Aggressive	46,239	4,208	9	1,810	4	6	
	Clearwater	Suppression	Aggressive	131,403	9,034	7	4,943	4	23	0.25
	Dunn	Suppression	Aggressive	19,832	2,852	14	2,220	11		1
	Mad	Suppression	Aggressive	63,978	3,862	6	2,318	4	3	
	Mica	Suppression	Aggressive	54,247	4,236	8	2,213	4	3	
	Mud	Monitor	Undesignated	69,616	2,230	3	1,168	2		
	Raft	Suppression	Aggressive	69,647	3,009	4	2,048	3	10	
	Thunder Blue	Monitor	Undesignated	67,499	4,706	7	711	1		
	Tum Tum	Monitor	Undesignated	99,267	842	1	272	0		
	Upper North Thompson	Monitor	Undesignated	93,272	949	1	153	0		
	Vavenby	Suppression	Aggressive	33,046	2,787	8	2,471	7	21	10
	Wells Gray	Monitor	Undesignated	539,026					3	
DHW Total				1,456,343	51,493	6	25,958	3	73	11.3
TSA Total				2,777,929	407,965	18	292,050	13	1250	950.8

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

³⁷ Forest cover types (>121 yrs) with a Douglas-fir component

Table 7: Susceptible age stands (≥ 121 years) with a Douglas-fir component by BMU³⁸.

(Taken from 2008 FH Strategy – changes are not significant)

District	BMU	Gross Area Occupied by Age (Ha)							
		All stands with Fd occurrence				Stands where Fd $\geq 40\%$			
		121-140	141-250	>250	Total Area	121-140	141-250	>250	Total Area
DKA	Barriere	13,594	19,292	1,464	34,349	10,695	15,168	345	26,209
	Battle	11,590	26,309	3,381	41,280	6,311	21,604	3,189	31,104
	East Adams	1,130	3,196	48	4,374	943	2,915	29	3,888
	Gisborne	15,896	30,206	2,081	48,183	12,450	27,189	2,045	41,684
	Greenstone	7,603	11,246	612	19,462	4,278	7,502	446	12,226
	Hat	6,559	17,669	981	25,209	3,866	14,437	891	19,194
	Lemieux	9,379	2,282	0	11,662	3,702	1,616	0	5,318
	Louis	23,658	29,125	1,255	54,038	18,778	19,752	799	39,329
	McConnell	6,084	4,254	54	10,392	4,612	3,707	54	8,373
	McLean	8,241	16,443	1,303	25,987	7,072	14,241	1,245	22,559
	Scuitto	11,532	11,393	720	23,645	7,460	8,933	548	16,942
	Skull	9,578	4,934	178	14,690	5,613	4,149	107	9,869
	Tranquille	792	667	39	1,499	64	243	39	346
	Tunkwa	15,631	24,008	2,064	41,703	9,546	17,484	2,022	29,052
	DKA Total		141,268	201,023	14,180	356,472	95,392	158,942	11,758

³⁸ Gross TSA area, excludes Wells Gray BMU

Table 7: Susceptible age stands (≥ 121 years) with a Douglas-fir component by BMU³⁹ con't

District	BMU	Gross Area Occupied by Age (Ha)							
		All stands with Fd occurrence				Stands where Fd $\geq 40\%$			
		121-140	141-250	>250	Total Area	121-140	141-250	>250	Total Area
DHW	Adams Lake	2,175	4,054	566	6,795	1,395	2,568	316	4,279
	Albreda	148	670	665	1,484	2	79	82	164
	Avola	298	2,792	1,410	4,500	40	762	387	1,190
	Cayenne	1,103	2,605	499	4,208	469	1,233	109	1,810
	Clearwater	4,860	3,786	387	9,034	2,778	2,104	61	4,943
	Dunn	2,327	524	0	2,852	1,714	506	0	2,220
	Mad	959	2,197	707	3,862	723	1,376	218	2,318
	Mica	1,704	2,114	418	4,236	1,209	992	12	2,213
	Mud	94	1,511	625	2,230	10	897	260	1,168
	Raft	908	1,192	909	3,009	692	939	417	2,048
	Thunder Blue	141	2,360	2,205	4,706	66	223	423	711
	Tum Tum	28	338	476	842	11	140	122	272
	Upper North Thompson	23	447	480	949	0	48	105	153
	Vavenby	1,498	996	293	2,787	1,396	900	175	2,471
DHW Total		16,267	25,586	9,640	51,493	10,507	12,765	2,686	25,958
TSA Total		157,536	226,609	23,820	407,965	105,900	171,707	14,444	292,050

³⁹ Gross TSA area, excludes Wells Gray BMU

Table 8: BMU summary of Douglas-fir bark beetle occurrence (spots and patches) in the Kamloops TSA⁴⁰.

District	BMU	2008 Detailed Flight						2008 Overview Flight					
		Spot Area Attacked ⁴¹			Patch Area Attacked		Total Area Attacked	Spot Area Attacked			Patch Area Attacked		Total Area Attacked
		Spots	Trees	Area (Ha)	Patches	Area (Ha)	Ha	Spots	Trees	Area (Ha)	Patches	Area (Ha)	Ha
DKA	Barriere	229	2043	58.5	2	43	101.5	10	120	2.5	6	17	20
	Battle East Adams	18	184	4.5			4.5	11	135	2.75	1	13	16
	Gisborne	13	144	3.5			3.5	6	75	1.5			2
	Greenstone	396	3817	100.	1	15	115	80	955	20	25	264	284
	Hat	54	500	13.5			13.5	3	35	0.75			1
	Lemieux							2	15	0.5			1
	Louis	136	1303	35	4	195	230	8	125	2	8	30	32
	McConnell	478	4894	124	16	461	585	52	580	13	45	550	563
	McLean	1	3	0.25			0.25	1	5	0.25			0
	Scuitto	60	567	15.25			15.25	19	240	4.75			5
	Skull	33	439	8	1	34	42	6	65	1.5			2
	Tranquille	183	1378	47			47	19	170	4.75	2	10	15
	Tunkwa	5	52	1.25			1.25	1	15	0.25			0
	DKA Total	68	513	17			17	4	40	1			1
	DKA Total	1674	15837	428	24	748	1176	222	2575	56	87	884	942

⁴⁰ Gross TSA area

⁴¹ 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.

Table 8: Summary of Douglas-fir bark beetle occurrence in the Kamloops TSA con't

District	BMU	2008 Detailed Flight						2008 Overview Flight						
		Spot Area Attacked ⁴²			Patch Area Attacked		Total Area Attacked	Spot Area Attacked			Patch Area Attacked		Total Area Attacked	
		Spots	Trees	Area (Ha)	Patches	Area (Ha)	Ha	Spots	Trees	Area (Ha)	Patches	Area (Ha)	Ha	
DHW	Adams Lake	12	160	3.25			3.25							
	Albreda													
	Avola	9	75	2.25			2.25							
	Cayenne	24	177	6			6							
	Clearwater	93	577	23.25			23.25	1	5	0.25				0.25
	Dunn							4	30	1				1
	Mad	11	104	2.75			2.75							
	Mica	12	114	3			3							
	Mud													
	Raft	38	241	9.5			9.5							
	Thunder Blue													
	Tum Tum													
	Upper North Thompson													
	Vavenby	81	623	20.6			20.6	2	30	0.5	4	9		9.5
Wells Gray	11	54	2.75			2.75	1	5	0.25				0.25	
DHW Total		291	2125	73.35	0	0	73.35							11
TSA Total		1965	17962	501	24	748	1249	230	2645	58	91	893		953

⁴² 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.

APPENDIX 4: 2008 BMU Map and Summary Tables for Spruce Beetle

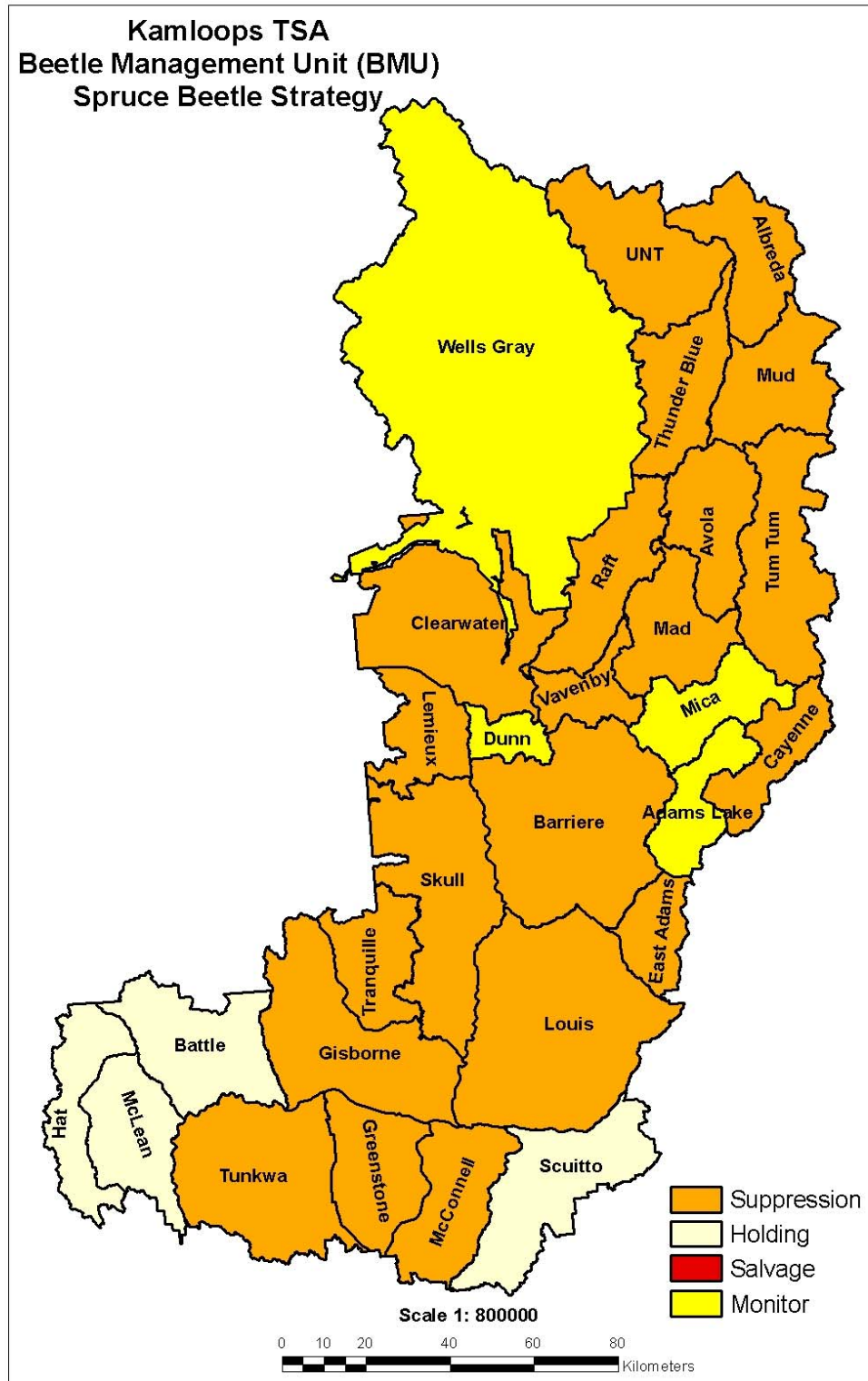


Table 9: Kamloops TSA spruce bark beetle BMU strategies and statistics⁴³

District	BMU	BMU Zonation (2008)	Provincial EBBMA	Gross BMU Area Ha	Susceptible Area ⁴⁴ (Spruce > 121 years)				IBS Area Mapped	
					All stands with Sx occurrence		Area where Sx ≥40% of stand		Detailed Flight	Overview Flight
					Ha	% of BMU	Ha	% of BMU	Ha	Ha
DKA	Barriere	Suppression	Aggressive	170,970	49,425	29	26,802	16		
	Battle	Holding	Containment	91,007	9,375	10	1,086	1		
	East Adams	Suppression	Aggressive	34,779	7,033	20	3,457	10		
	Gisborne	Suppression	Aggressive	123,921	12,819	10	1,645	1	0.5	
	Greenstone	Suppression	Aggressive	65,901	13,989	21	3,687	6	0.25	
	Hat	Holding	Containment	56,762	14,392	25	4,476	8		174
	Lemieux	Suppression	Aggressive	47,842	15,226	32	5,864	12	0.25	
	Louis	Suppression	Aggressive	195,237	26,559	14	9,494	5	3290	722
	McConnell	Suppression	Aggressive	69,666	5,334	8	1,267	2		
	McLean	Holding	Containment	63,080	8,102	13	2,101	3		
	Scuitto	Holding	Containment	95,357	11,606	12	1,881	2		
	Skull	Suppression	Aggressive	128,716	21,608	17	8,212	6	0.5	7
	Tranquille	Suppression	Aggressive	52,524	20,590	39	8,502	16		192
	Tunkwa	Suppression	Aggressive	125,825	22,722	18	3,613	3	1.25	
DKA District Total				1,321,586	238,782	18	82,085	6	3293	1095

⁴³ Gross TSA area -- includes all land tenures and ownership types, attack area mapped is from the 2006 DHW and DKA detailed flights, 2007 DKA detailed flight and 2007 TSA overview flight

⁴⁴ Forest cover types (>121 yrs) with a spruce component

Table 9: Spruce bark beetle BMU strategies and statistics con't

District	BMU	BMU Zonation (2008)	Provincial EBBMA	Gross BMU Area	Susceptible Area ⁴⁵ (Spruce > 121 years)				IBS Area Mapped	
					All stands with Sx occurrence		Stands where Sx ≥40%		Detailed Flight	Overview Flight
					Ha	% of BMU	Ha	% of BMU	Ha	Ha
DHW	Adams Lake	Monitor	Undesignated	43,811	8,591	20	4,738	11		
	Albreda	Suppression	Aggressive	61,971	16,581	27	8,404	14		
	Avola	Suppression	Aggressive	63,488	21,466	34	12,513	20		
	Cayenne	Suppression	Aggressive	46,239	14,524	31	8,351	18		28
	Clearwater	Suppression	Aggressive	131,403	10,788	8	3,421	3	1	
	Dunn	Monitor	Undesignated	19,832	5,489	28	3,712	19		
	Mad	Suppression	Aggressive	63,978	13,602	21	7,131	11		
	Mica	Monitor	Undesignated	54,247	13,564	25	6,862	13	51	217
	Mud	Suppression	Aggressive	69,616	15,688	23	8,247	12		
	Raft	Suppression	Aggressive	69,647	19,972	29	14,338	21	62	
	Thunder Blue	Suppression	Aggressive	67,499	21,706	32	11,021	16		
	Tum Tum	Suppression	Aggressive	99,267	23,584	24	10,464	11		
	Upper North Thompson	Suppression	Aggressive	93,272	29,478	32	18,186	19		
	Vavenby	Suppression	Aggressive	33,046	4,683	14	2,768	8		
	Wells Gray	Monitor	Undesignated	539,026					41	328
DHW Total				1,456,343	219,717	24	120,155	13	154	573
TSA Total				2,777,929	458,499	20	202,240	9	3447	1668

Forest cover types (>121 yrs) with a spruce component are located throughout the TSA. Spruce is the most significant species by volume in the Headwaters portion of the TSA. Twenty-four percent of the total TSA area (excluding Wells Gray BMU) is covered by age-susceptible stands that have a spruce component.

⁴⁵ Forest cover types (>121 yrs) with a spruce component

Table 10: Susceptible Age stands with a spruce component by BMU⁴⁶

(Taken from 2008 FH Strategy – changes are not significant)

District	BMU	Gross Area Occupied by Age (Ha)							
		All stands with Sx occurrence				Stands where Sx ≥40%			
		121-140	141-250	>250	Total Area ⁴⁷	121-140	141-250	>250	Total Area
DKA	Barriere	8,306	31,797	9,322	49,425	2,710	17,005	7,088	26,802
	Battle	2,944	6,398	33	9,375	75	997	13	1,086
	East Adams	497	5,975	561	7,033	66	2,870	521	3,457
	Gisborne	7,030	5,683	106	12,819	712	920	12	1,645
	Greenstone	7,464	6,259	265	13,989	1,455	2,058	174	3,687
	Hat	3,564	10,378	450	14,392	568	3,588	320	4,476
	Lemieux	12,746	2,480	0	15,226	4,607	1,257	0	5,864
	Louis	9,670	14,566	2,323	26,559	1,468	6,119	1,907	9,494
	McConnell	3,116	2,216	2	5,334	666	601	0	1,267
	McLean	2,412	5,516	174	8,102	462	1,639	0	2,101
	Scuitto	6,552	4,701	353	11,606	771	990	121	1,881
	Skull	13,508	7,725	376	21,608	3,491	4,368	353	8,212
	Tranquille	11,171	9,301	119	20,590	2,786	5,597	119	8,502
	Tunkwa	10,873	11,209	640	22,722	1,615	1,949	49	3,613
	DKA Total	99,852	124,205	14,725	238,782	21,450	49,958	10,677	82,085

⁴⁶ Gross TSA area, excludes Wells Gray BMU

⁴⁷ Forest cover types (>121 yrs) with a spruce component

Table 10: Susceptible Age stands with a spruce component by BMU⁴⁸ con't

(Taken from 2008 FH Strategy – changes are not significant)

District	BMU	Gross Area Occupied by Age (Ha)							
		All stands with Sx occurrence				Stands where Sx ≥40%			
		121-140	141-250	>250	Total Area	121-140	141-250	>250	Total Area
DHW	Adams Lake	1,020	5,770	1,801	8,591	303	3,238	1,197	4,738
	Albreda	1,455	9,014	6,112	16,581	783	3,446	4,175	8,404
	Avola	647	12,252	8,567	21,466	300	6,018	6,195	12,513
	Cayenne	1,424	8,583	4,517	14,524	832	4,163	3,355	8,351
	Clearwater	3,716	5,513	1,560	10,788	514	1,654	1,254	3,421
	Dunn	1,344	3,102	1,044	5,489	395	2,370	947	3,712
	Mad	597	7,422	5,582	13,602	225	3,381	3,525	7,131
	Mica	1,330	9,258	2,976	13,564	387	4,651	1,823	6,862
	Mud	190	7,020	8,479	15,688	31	2,549	5,667	8,247
	Raft	1,308	7,086	11,579	19,972	672	4,020	9,646	14,338
	Thunder Blue	525	11,829	9,352	21,706	208	3,871	6,942	11,021
	Tum Tum	191	13,789	9,604	23,584	83	5,261	5,120	10,464
	Upper North Thompson	317	17,736	11,426	29,478	41	8,928	9,217	18,186
	Vavenby	870	2,507	1,306	4,683	241	1,453	1,074	2,768
	DHW Total	14,932	120,879	83,906	219,717	5,015	55,004	60,137	120,155
	TSA Total	114,784	245,084	98,631	458,499	26,465	104,961	70,813	202,240

⁴⁸ Gross TSA area, excludes Wells Gray BMU

Table 11: BMU Summary of spruce beetle occurrence (spots and patches) in the TSA⁴⁹

District	BMU	2008 Detailed Flight						2008 Overview Flight										
		Spot Area Attacked ⁵⁰			Patch Area Attacked		Total Area Attacked	Spot Area Attacked			Patch Area Attacked		Total Area Attacked					
		Spots	Trees	Area (Ha)	Patches	Area (Ha)	Ha	Spots	Trees	Area (Ha)	Patches	Area (Ha)	Ha					
DKA	Barriere																	
	Battle																	
	East Adams																	
	Gisborne	2	9	0.5			0.5											
	Greenstone	1	13	0.25			0.25											
	Hat									5	174			174				
	Lemieux	1	3	0.25			0.25											
	Louis	1	6	0.25	4	3290	3290			47	722			722				
	McConnell																	
	McLean																	
	Scuitto																	
	Skull	2	9	0.5			0.5			3	7			7				
	Tranquille									19	192			192				
	Tunkwa	5	29	1.25			1.25											
DKA Total							12	69	3	4	3290	3293	0	0	0	74	1095	1095

⁵⁰ 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.

