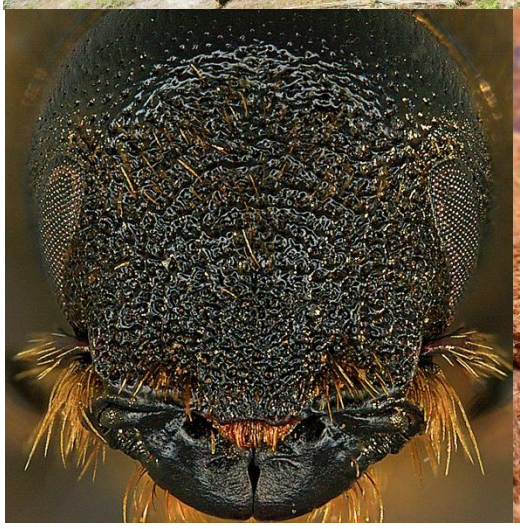
Kamloops TSA – Forest Health Strategy 2023



Thompson Rivers Natural Resource District

2023

Updated by: _____ Date: August 31, 2023

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Executive Summary

The Kamloops TSA Forest Health Strategy has been updated for 2023 with the most current information available. There have been several edits, as well as some additions. It is expected that over the next few years, there will be more information added with respect to stocking standards related to forest health factors and climate change adaptation strategies.

Items to note for 2023:

- **A Beetle Management Unit (BMU) Overview Flight table** has been updated with the 2022 flight data for Douglas-fir (IBD), Spruce (IBS), Mountain Pine Beetle (IBM), and Balsam Bark (IBB) beetles. A BMU Map for Douglas-fir Beetle has also been updated and to include the 2022 flight data.

- **New Regional Forest Pathologist:** Calvin Jensen is the new pathologist for the Thompson Okanagan Region. He started work in November 2021. Calvin has been working on becoming acquainted with forest pathology in British Columbia and the Thompson/Okanagan Region. He has been going through the records of past trials and experiments in the region to better understand the research that has been conducted. As well Calvin is writing a report about the current state of forest pathology knowledge in the southern interior. He is hoping to conduct fieldwork in the summer to study these historic operational trials, begin new projects, and settle more into his role as Regional Pathologist.

- The non-recoverable losses for the Kamloops TSA will not be updated in this strategy due to the Forest Analysis & Inventory Branch's old growth analysis priorities.

- Relatively minor areas of foliage damage due to drought and wind throw were mapped in 2022. Drought damage is occurring more frequently and can affect all species and ages of forests.

- Lorraine MacLauchlan - *Pest incidence in mid-rotation lodgepole pine stands in the Thompson Okanagan Region*; can be found in the ***2022 Thompson Okanagan Region Conditions Report***. Results from these surveys reveal that the presence of insects and disease are an ongoing issue. Further investigation into regeneration schemes, stand tending practices, and harvesting systems could lead to healthier and more resilient future stands. This should shed light on the impact of changing climate conditions and build upon the Ministry's growing database of pests affecting young stands and their development following the free growing assessment date.

- Lorraine MacLauchlan - *Spruce weevil attack on lodgepole pine in the Kamloops TSA*; can be found in the ***2022 Thompson Okanagan Region Conditions Report***. Survey results suggest that spruce weevil attack on lodgepole pine may be more common than

previously thought. The attacks seemed to occur during or after particularly warm and dry growing seasons. Spruce weevil attack was high in these stands and given the longer developmental time available, there is a possibility for spruce weevil populations to increase rapidly. Because these stands are predominantly lodgepole pine, emerging weevils may attack lodgepole pine more frequently. More surveys should be conducted to determine the extent and frequency of this phenomenon.

Update on Bark Beetles in Kamloops TSA:

- **Western balsam bark beetle** increased slightly from 20,482 hectares in 2021 to 27,936 ha in 2022. The more concentrated populations were in the Trophy and Table Mountain areas, Chu Chua Creek, Granite Mountain, and Dunn Peak, with scattered populations in the North Thompson River area north to Allan Creek and Adolph Creek.

- **Spruce beetle** declined again in 2022 to just 464 hectares mapped compared to 3,832 ha in 2021. Small pockets of infestation were recorded in Wells Gray Park.

- **Douglas fir beetle** was mapped at 4,867 hectares, down from 5,055 hectares in 2021. In the west portion of the TSA, populations were mapped in Hat Creek to Cornwall Hills and Allen Creek. Populations were still active north of Kamloops Lake along the Tranquille River to Black Pines. Pockets of Douglas-fir beetle continued along the west side of the North Thompson River from Darfield to Little Fort and Latremouille Creek. On the east side of the Thompson River, Douglas-fir beetle was mapped along Louis Creek, Cahilty Creek, and north to Blucher Hall and Garrison Mountain. There are active populations of Douglas-fir beetle and wood borer in the 2021 fires in the Kamloops TSA, which are expected to attack green, live Douglas-fir in 2023 either within or outside the fire perimeter.

- **Mountain Pine beetle** – during the 2022 overview flight there was only one hectare of mountain pine beetle observed.

Update on Defoliators:

- **Two-year Cycle Spruce Budworm** was mapped at 11,786 ha, an increase of 10,265 ha from 2021. The majority of defoliation was observed north from Emar Lakes Park to Taweel Park in the Grizzly Lakes and Swayback Ridge area, and around Italia and Corsica Lakes. There were no recorded infestations in the southern portion of the Kamloops TSA.

- **Western Spruce Budworm** remained very low in the Kamloops TSA affecting 426 hectares in 2022.

- **Western hemlock looper** increased slightly in 2022 to 171 hectares affected, mostly within Wells Gray Park near Flourmill and Donald Creeks and at the southwest end of Hobson Lake.

- **Aspen Serpentine Leaf miner** activity declined by 73% in the Kamloops TSA, recorded on 6,975 ha in 2022 compared to 25,190 ha in 2021. Some of this decline could have been caused by larval mortality during the 2021 heat dome. The most notable defoliation was mapped north of Thuja Lakes, between Allan Lake and Powder Lake, with scattered spots of defoliation around Bonaparte Lake.

- **Minor Defoliator's** - small areas of damage caused by Satin Moth (2 ha)

No foliar pathogens were detected in the 2022 aerial overview flights in the Kamloops TSA.

Review the *2022 Thompson Okanagan Region Conditions Report* at Aerial overview survey summary reports - Province of British Columbia (gov.bc.ca) for more information on pests and diseases in the Kamloops TSA.

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1.0 Introduction

This Forest Health Strategy covers the Kamloops Timber Supply Area (TSA), also known as the Thompson Rivers Natural Resource District. It covers approximately 2.8 million hectares (including Wells Gray Provincial Park and excluding tree farm licenses). The TSA Timber Harvesting Landbase (THLB) is dominated by lodgepole pine, Douglas-fir, spruce, and sub-alpine fir. Smaller areas are dominated by cedar, hemlock, and deciduous species.

The Strategy is guided by, and aligned with, the Ministry of Forests (MOF) Provincial Forest Health Program.[1] The intent of the Strategy is to provide Forest Professionals[2] 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.

This document does not contain a conclusive list of all pests. The pests that have been included are considered to have the potential for significant impacts and/or frequently occur within the TSA.

Understanding the implications of climate change for forest health is a focus of the MOF. Climate change strategies for forest pests can be found in *Forest Health and Climate Change*.[3]

[1] Link to the Provincial Forest Health Program, Provincial Forest Health Strategy, and the Forest Health Strategy Implementation: Forest health - Province of British Columbia (gov.bc.ca)

[2] Forest Professionals BC - FPBC

[3] Forest health - Province of British Columbia (gov.bc.ca)

2.0 Guiding Principles

1. Follow applicable legislation. Augment or identify, rather than reiterate policy and legislation, e.g. FRPA bulletins provide additional guidance.[4]
2. Remain consistent with and follow guidance provided by regional forest health experts. [5]
3. Follow-guidance provided by the:
   - Forest Practices Branch[6] (e.g., Provincial Forest Health Strategy, Research, etc.)
   - Provincial Forest Health Implementation Strategy
   - Chief Forester Guidance
4. It is recommended that Forest Professionals use the new root disease guidance document when dealing with root disease within the Kamloops TSA. Or - Forest Professionals should use the new root disease guidance document when dealing with root disease within the Kamloops TSA. Management of root diseases - Province of British Columbia (gov.bc.ca)
5. Enable operational planners to focus on economically viable priorities to get maximum value from the affected trees.

[4] Managing resource values under the Forest and Range Practices Act - Province of British Columbia (gov.bc.ca)

[5] Ministry of Forests Region & District Contacts - Province of British Columbia (gov.bc.ca)

[6] Forest health - Province of British Columbia (gov.bc.ca)

3.0 Roles and Responsibilities

Forest Professionals collaboratively undertake implementation of the Strategy. Table 1 shows a summary of roles & responsibilities and their respective timelines.

1. Meet as needed 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. MOF completes aerial overview surveys and provides the resulting information to the licensees. The latest results can be found on the regional and provincial forest health web sites.[7]

4. Detailed aerial and ground surveys are conducted on a priority-based system subject to funding and are the responsibility of MOF and licensees as decided through a collaborative effort. Most recent aerial survey results are available at the following site.[8]

5. Single tree removal/disposal, trap tree placement/removal and larger scale bark beetle treatments are the responsibility of MOF and licensees as decided through a collaborative effort. Guidance on small-scale salvage can be obtained by contacting the district.

6. The MOF 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). Funding sources are Land Based Investment (LBI), Forest Enhancement Society (FES) and Forest Carbon Initiative (FCI).

7. Assessment of hazard and risk information is done on a five-year rotation by MOF subject to funding and will be provided to licensees and other agencies as requested.

8. Regional specialists will attend the TSA meetings twice a year early spring and late fall.

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[7] Forest health - Province of British Columbia (gov.bc.ca)

[8] Aerial overview survey summary reports - Province of British Columbia (gov.bc.ca)

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 south and April in north portions of the TSA		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
Targeted pest specific detailed surveys	May - September	X	X	
TSR focused surveys/research	May - September	X	X	
Drought	As information becomes available	X	X	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 this year have been adjusted to accommodate recommendations from the Regional Entomologist Lorriane MacLauchlan. Douglas fir beetle is ranked high priority due to the 2017 wildfire in Elephant Hill where beetle populations are increasing, as predicted, within the 5 km perimeter of the fire. The Sparks Lake and Tremont Fires burned in 2021 where there was significant beetle activity mapped in 2020. These fires have many trees and stands that will be highly susceptible to Douglas-fir beetle attack in 2022, therefore, detection and mitigation should be targeted in and near these burnt stands where hazard and risk are high.

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

High	Moderate	Low	Potential High
Douglas-fir beetle Western balsam bark beetle Spruce beetle Western spruce budworm Two-year cycle budworm Armillaria root disease Laminated root disease Spruce weevil Western gall rust Drought	Western hemlock looper Warren's root collar weevil White pine blister rust Lodgepole pine dwarf mistletoe Deer Mountain pine beetle Tomentosus (SBS) Douglas-fir tussock moth Stalactiform blister rust Comandra blister rust	Windthrow Moose Western pine beetle Blackstain root disease Porcupine Dothostromia Lophodermella Forest tent caterpillar Hare (south) Cattle (south portion TSA) Deer * (north portion of TSA)	

Deciduous pests are noted in *Section 8.0 Deciduous Pests* and the *2022 Thompson Okanagan Region Conditions Report.*[9]

* Deer put into high priority for the south slopes in the IDF biogeoclimatic zone from Clearwater to north of Vavenby. Detection and monitoring strategies, occurrence, and population trends of priority health factors are described in the annual Overview of Forest Health in Southern British Columbia.
**Drought has exacerbated pre-existing damaging agents within stands and will aggravate future damage from secondary bark beetles. Lorraine MacLauchlan Regional Entomologist 2019

5.0 Non-Recovered Losses (NRLs) (non-recoverable losses were not calculated for 2022)

Non-recoverable losses (NRL) are timber volumes destroyed or damaged on the timber harvesting land base (THLB) by natural causes such as fire, wind, insects, and disease that are not recovered through salvage operations and remain unutilized. In timber supply analysis these losses are accounted for by estimating an average annual unsalvaged loss and deducting this amount from the harvest projection throughout the planning period of the Timber Supply Review (TSR).

Endemic pest losses are considered natural processes within stands and are accounted for within the growth and yield models.

Wildfire NRLs Wildfire losses since 2003 have not been used to ensure enough time has passed during which salvaging could occur. If not salvaged after 10 years, the merchantable volume remaining will be considered as an NRL (TSR5 Factor 52).

[9] Aerial Overview Surveys - Province of British Columbia (gov.bc.ca)

Insect and abiotic forest health factors present in the Kamloops TSA are described below with the associated NRL for the identified forest health factor. The NRL, unless otherwise stated, were derived by Adrian Walton (MOF) as part of a provincial estimate of NRLs in each TSA.

Table 3: Non-Recovered (recoverable) Losses NRLs 2019

Cause of Loss	**Annual Non-Recovered Losses (m^3/year)**
Douglas-Fir beetle Spruce beetle Balsam Bark Beetle/ 2-year cycle budworm Wildfire Tussock Moth Spruce Budworm Mountain Pine Beetle Drought	

1. Table 3 presents the estimated forest volume killed in the Timber Harvesting Land Base by selected Aerial Overview Forest Health Factors, as well as the amount of that killed volume that has not been harvested as of the year 2019.
2. Source Data:
   a) Circa 2001 forest inventory derived from the circa 2001 Vegetation Inventory (VRI) and circa 2001 State of the Forest.
   b) 1999 through 2019 Aerial Overview Surveys of Forest Health.
   c) Logging history derived from the VRI and Results databases.
   d) Provincial Mountain Pine Beetle Spread Model (www.for.gov.bc.ca/hre/bcmpb)
3. Author: Adrian Walton, Ministry of Forests, Lands, Natural Resource Operations and Rural Development
4. Production Date: April 2019

6.0 Bark Beetles – Blowdown - Drought

Beetle infestations are detected and recorded by TOR aerial overview surveys and Thompson Rivers Natural Resource District 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. Beetle species of note include Douglas-fir beetle (IBD) *Dendroctonus pseudotsugae*, spruce beetle (IBS) *Dendroctonus rufipennis,* western balsam bark beetle (IBB) *Dryocoetes confususa,* and to a lesser degree, mountain pine beetle (IBM) *Dendroctonus ponderosae* (following the outbreak). Severity of attack for the four main bark beetles is available in table format by Forest District in the *2022 Thompson Okanagan Region Conditions Report.*[10]

[10] Aerial Overview Surveys - Province of British Columbia (gov.bc.ca)

The objective of beetle management is an effective, coordinated, operational approach that minimizes damage and maximizes economic recovery. Currently, Douglas-fir beetle sanitation is still the highest priority in the TSA due to the potential for rapid spread and high attack ratios. Large areas along the margins of the 2017 Elephant Hill fir experienced variable burn severity and low-intensity ground fires, which have led to increased populations within the 5 km perimeter of the fire as mapped in the overview survey flight in 2021. The wildfires of 2021 have the potential to increase Douglas-fir beetle infestations in fire-scarred live and healthy green trees. Other than in the Clearwater area, small-scale salvage is no longer being used as a tool in the Kamloops TSA for management of Douglas-fir beetle, including salvage of windthrown areas. Some licensees have taken on the management of Douglas-fir beetle using trap trees in their development areas.

Mountain pine beetle salvage of dead stands is still being carried out in localized areas within the TSA.

The Western balsam bark beetle is ubiquitous within most of the subalpine fir stands in the TSA. Mortality caused by IBB has been increasing in certain locations over the past few years. Many of these areas experienced concurrent two-year cycle budworm defoliation, which may have masked some of the more scattered attacks.

A comprehensive list of possible tactics and treatments for bark beetles can be found in The Bark Beetle Management Guidebook[11] and best practices on the provincial and regional websites.

6.1 Bark Beetle Management Units

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 – updated for 2022.

The provincial Emergency Bark Beetle Management Area (EBBMA) zonations have been replaced and returned to the policy regime that was in place before the mountain pine beetle epidemic. Blanket salvage permits will still be available with approval based on the TSA Forest Health strategy. The guidance on the use of blanket salvage permits and comparative cruising will be available in the updated Interior Appraisal manual and the Cutting Permit and Road Tenures Administration manual.

[11] Province of BC Bark Beetle Management Guidebook

Appendix 1 contains a BMU map for IBD; Appendix 2 contains a BMU Summary Table for Bark Beetles (IBB, IBD, IBM, IBS).

Table 4: TSA level bark beetle BMU strategy definitions

Strategy	Where Strategy Applicable	Strategic Objective and Performance Measure
Prevention	Large areas of un-infested 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.

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

Spruce beetle declined again in 2022 with small pockets of infestation recorded in Wells Gray Park. Douglas-fir beetle was down slightly from 2021. There are active populations of Douglas-fir beetle and wood borer in the 2021 fires in the Kamloops TSA, which are expected to attack green, live Douglas-fir in 2023 either within or outside the fire perimeter. Aggressive suppression of active IBD infestations, with an expedited program of trap trees could be effective in reducing many of these populations.

To assist with identification of risk factors and best management practices to mitigate post wildfire fir beetle impacts, Lorraine Maclauchlan, the Southern Interior Regional Entomologist, has written a document to assist with

planning and prioritizing mitigation operations. This document, *Efficacy of Three Treatments in Post-Wildfire Management of Douglas-fir Beetle,* starts on page 58 of the *2018 Overview of Forest Health Conditions in Southern British Columbia*.

Aerial overview survey summary reports - Province of British Columbia (gov.bc.ca)

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

- MOF beetle web site[12]
- Small-Scale Salvage Guidance documents for Thompson Rivers District can be obtained from the District office for the Clearwater area.

6.3 Mountain Pine Beetle (IBM)

There was only one hectare of mountain pine beetle observed during the 2022 overview flight. Mountain pine beetle has been reduced in priority from "high (1)" to "medium" (Table 2), due to salvage status in the majority of the TSA BMUs.

6.4 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 TOR aerial overview flights and long-term research installations. Lorraine MacLauchlan has recently written the following research article, *Quantification of Dryocoetes confusus-caused mortality in subalpine fir forests of Southern British Columbia*.

[12] Bark beetles - Province of British Columbia (gov.bc.ca)

6.5 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.

6.6 Drought

Relatively minor areas of drought damage were recorded in 2022. Drought damage is occurring more frequently and can affect all species and ages of forests. Lorraine Maclauchlan has written a paper on *Effects of the 2017 Drought on Young Pine Stands in the Southern Interior* starting on page 46 of the *2018 Overview of Forest Health Conditions in Southern British Columbia.*
Aerial overview survey summary reports - Province of British Columbia (gov.bc.ca)

7.0 Defoliators

Detection, prediction, and treatment of defoliators remain the responsibility of the Thompson Okanagan region. MOF district staff assist in gathering information for high-risk areas (e.g., woodlots) to aid regional staff in deciding which stands are priorities to treat.

More specific information on the defoliator program can be found on the Provincial Forest Health website[13], and in the Provincial Forest Health Strategy.

7.1 Western Spruce Budworm (IDW)

Western spruce budworm remained very low in the Kamloops TSA affecting only 426 Ha in 2022.

[13] Forest insects and pathogens - Province of British Columbia (gov.bc.ca)

7.2 Douglas-fir Tussock Moth (IDT)

Priority areas of infestation are treated as necessary as part of the Thompson Okanagan spray program. Due to the potential to cause allergic reactions in people and tree mortality, this insect is a priority for treatment. During the 2022 overview flight, there was no tussock moth observed in the TSA, most likely due to virus infection and adverse climate conditions, such as the 2021 heat dome.

7.3 Two-Year Cycle Spruce Budworm (IDB)

Two-year cycle spruce budworm was in its "up" year of its cycle and was mapped at 11,786 ha, an increase of 10,265 ha from 2021. The majority of defoliation was observed north from Emar Lakes Park to Taweel Park in the Grizzly Lakes and Swayback Ridge area, and around Italia and Corsica Lakes. There were no recorded infestations in the southern portion of the Kamloops TSA.

7.4 Western Hemlock Looper (IDL)

Western hemlock looper and associated defoliators are monitored annually at 16 permanent sampling sites in the Thompson Okanagan Region with moth trapping done on all 16 sites. Western hemlock looper increased slightly in 2022 to 171 hectares affected, mostly within Wells Gray Park near Flourmill and Donald Creeks and at the southwest end of Hobson Lake.

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 broadly underlying causes such as climate-induced stress is pre- disposing trees to attacks.

Aspen Serpentine Leaf miner activity declined by 73% in the Kamloops TSA, recorded on only 6,975 ha in 2022 compared to 25,190 ha in 2021. Some of this decline could have been caused by larval mortality during the 2021 heat dome. The most notable defoliation was mapped north of Thuja Lakes, between Allan Lake and Powder Lake, with scattered spots of defoliation around Bonaparte Lake.

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.

Operational management procedures and the known extent of root diseases can be found in the new guidebook *Managing Root Disease in British Columbia* 2018 publication.[14]

This guidebook is intended for forest professionals and practitioners to use the science-based survey and treatment options that are outlined in the guidebook to guide them in preparing the best management practices when operating in root disease areas. This document replaces the Root Disease Stand Establishment Decision Aid (SEDA).

Armillaria and Phellinus root diseases are present in the TSA. Other lesser-known pathogens are present in localized 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. 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.

9.2 Phellinus (Laminated) Root Disease (DRL)

As stated above for Armillaria, the new guidebook for root disease called *Managing Root Disease in British Columbia* has been published as of April 2018 and should be used for managing Laminated root disease.

[14] Province of BC - Managing Root Disease in BC Guidebook

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.

MOF has established a protocol for assessing the health of young stands, 5+years post-Free Growing Declaration, which provides a retrospective look at silvicultural practices. The Stand Development Monitoring (SDM) protocol is under the Forest and Range Effectiveness Evaluation Program (FREP). Information on the FREP SDM Protocol can be found on the FREP website[15].

Damaging agents in young stands of note:

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.

White Pine Blister Rust

White pine blister rust is considered a 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.

[15] Stand Development Monitoring Protocol 2.0 - Province of British Columbia (gov.bc.ca)

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.[16]

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 across the TSA, there is evidence of its presence in stands in the northern portion of the TSA.

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 other damaging agents.

Animal Damage - Livestock

Within the Kamloops TSA, the impact of cattle damage on young plantations is ranked as a high priority for the Kamloops area. Other contributing factors to cattle damage can be placement of salt licks, location of water sources, herd management, removal of or damage to natural or man-made range barriers 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, as well as Atropellis canker.

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11.0 Further Links and References

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11.3 Internet Information Sources

Provincial Forest Health Strategy

Forest Health Program - Province of British Columbia (gov.bc.ca)

Forest insects and pathogens - Province of British Columbia (gov.bc.ca)

Province of BC's Mountain Pine Beetle Action Plan 2006-2011

Aerial overview survey summary reports - Province of British Columbia (gov.bc.ca)

MOF Bark Beetle Hazard and Risk Information and Susceptibility Mapping

Province of BC - Managing Root Disease in BC Guidebook

Strategies and Tactics to Manage Dwarf Mistletoe - Province of British Columbia (gov.bc.ca)

Strategies and Tactics to Manage Spruce Weevil - Province of British Columbia (gov.bc.ca)

Strategies and Tactics for Pine Rusts, and for Managing White Pine as a Commercial Species - Province of British Columbia (gov.bc.ca)

11.4 Research Information Sources

1. Ministry of Forests and Range:

   HFP - Forest Practices Branch – Forest health

   Forest health - Province of British Columbia (gov.bc.ca)

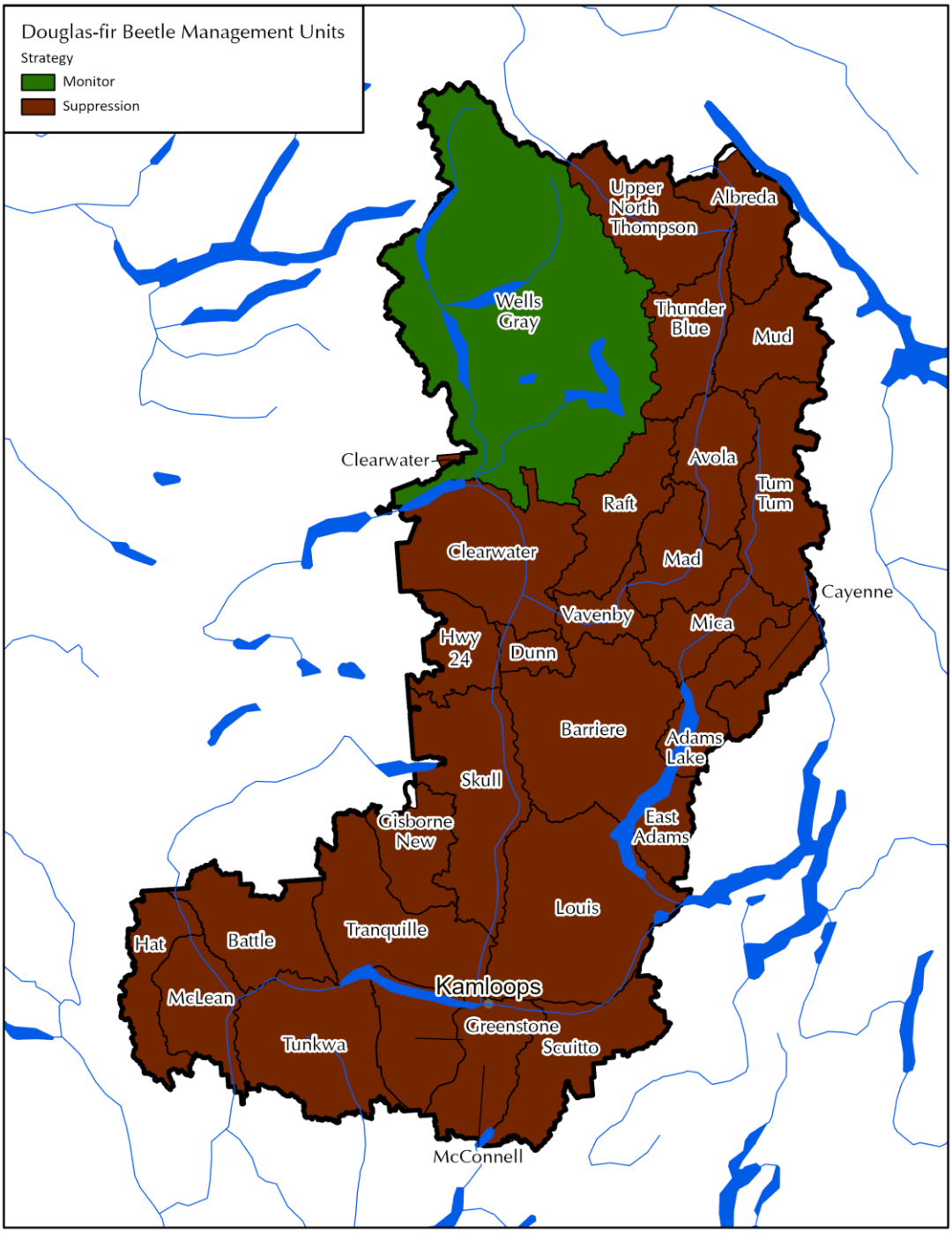
   Bark beetles - Province of British Columbia (gov.bc.ca)

2. Canadian Forest Service Research and Development:

   Forests and forestry (canada.ca)

Lodgepole pine, Douglas-fir and Spruce bark beetle hazard mapping
MOF Bark Beetle Hazard and Risk Information and Susceptibility Mapping

APPENDIX 1: 2022 BMU Map for Douglas-fir Beetle



APPENDIX 2: 2022 BMU Summary Table for Bark Beetles

			Bark Beetle Type						
District Name	TSA Name	BMU Name	Western Balsam Bark Beetle occurrence (Ha)	Douglas-fir Beetle occurrence (Ha)	Mountain Pine Beetle occurrence (Ha)	Spruce Beetle occurrence (Ha)	% of BMU Affected	Unaffected (Ha)	Grand Total (Ha)
Thompson Rivers Natural Resource District	Kamloops Timber Supply Area	Adams Lake	32.81	4.00			< 0.1	43,779.81	43,816.62
		Albreda	2,311.59			0.25	3.7	59,665.78	61,977.62
		Avola	172.48	2.75	0.50		0.3	63,323.47	63,499.19
		Barriere	3,850.48	435.55			2.5	166,716.60	171,002.64
		Battle		94.18			0.1	84,731.18	84,825.36
		Cayenne	466.64	18.08			1.0	45,760.26	46,244.98
		Clearwater	2,729.87	5.75			1.9	140,674.35	143,409.97
		Dunn	785.84	67.19			4.3	19,000.18	19,853.21
		East Adams	732.57	120.96			2.5	33,931.05	34,784.59
		Gisborne New	107.32	0.25			0.2	52,405.66	52,513.23
		Greenstone	1,522.03	3.50			2.3	64,334.52	65,860.06
		Hat	48.65	565.52		5.18	1.1	54,929.59	55,548.95
		Hwy 24	337.77	178.41			1.1	47,230.65	47,746.83
		Louis	574.54	1,291.42			1.0	193,467.53	195,333.48
		Mad	437.18	2.50			0.7	63,546.63	63,986.31
		McConnell	77.84	5.25			0.1	69,586.23	69,669.32
		McLean		814.79			1.3	62,289.89	63,104.68
		Mica	353.35	5.00			0.7	53,877.92	54,236.27
		Mud	1,613.61				2.3	68,005.86	69,619.46
		Raft	2,050.94	1.25			2.7	74,905.39	76,957.58
		Scuitto	258.28	5.75			0.3	95,097.52	95,361.56
		Skull	58.91	822.03			0.7	127,879.78	128,760.72
		Thunder Blue	553.58				0.8	67,364.42	67,918.00
		Tranquille	112.63	304.10			0.3	123,532.16	123,948.89
		Tum Tum	611.95	1.00			0.6	98,650.41	99,263.36
		Tunkwa	0.75	69.58			< 0.1	125,437.10	125,507.43
		Upper North Thompson	2,258.17				2.4	91,130.02	93,388.19
		Vavenby	612.78	41.43			2.0	32,398.60	33,052.81
		Wells Gray	5,263.46	6.25	0.25	458.34	1.1	513,421.66	519,149.96
	Kamloops Timber Supply Area Total (Ha)		27,936.03	4,866.50	0.75	463.77	1.2	2,737,074.23	2,770,341.28
Thompson Rivers Natural Resource District Area Total (Ha)			**27,936.03**	**4,866.50**	**0.75**	**463.77**	1.2	**2,737,074.23**	**2,770,341.28**