Williams Lake Timber Supply Area
Forest Health Strategy
2019/2020

BRITISH COLUMBIA | Ministry of Forests, Lands, Natural Resource Operations and Rural Development

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Forward

The purpose of the Williams Lake TSA Forest Health Strategy 2019/2020 is to inform operational planners, reviewing agencies and approval authorities of forest health risks, issues and best management practices.

Updates of Note 2019/20:

- New Interim Modification to Regional Biodiversity Conservation Strategy Update Note 7B
- Beetle Management Unit Maps with Corresponding Strategies.
- Priority and ranking of *Forest Health Factors in the Williams Lake TSA (Table 2)*.
- The district will be following the Interim Modifications to Biodiversity Update 7B guidelines for 2019/2020 seasons

Forest Health Factors to note for the coming field season are:

- The 2017 wildfires had a heavy impact on the WLTSA. There have been guidance documents and exemptions letters to facilitate and direct forest operations in these areas.
- Douglas-fir bark beetle – There are concerns about the continuing impact of the 2017 (and 2018) wildfires on the already high Douglas-fir beetle population.
- Drought – Due to two back-to-back drought years, drought stress and mortality in 2019 may still be evident. As with any stressor, there is potential for bark beetles and secondary insects to be attracted to stressed trees and cause further mortality.
- Western spruce budworm –There will be a spray program in 2019 to maintain low population numbers, focused mainly on areas near the Fraser River and Chimney Lake. An expanded spray program in 2020 is highly likely.
- Douglas-fir Tussock Moth - An outbreak of has been discovered along the Fraser River corridor in the south of the district. A spray program in 2020 is highly likely.

For more information on pests and diseases in the Williams Lake TSA review the *2018 Overview of Forest Health Conditions in Southern British Columbia*

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1. Introduction

This strategy recommends actions to address forest health issues in the Williams Lake Timber Supply Area (WLTSA) also known as the Cariboo-Chilcotin Natural Resource District. It is one of the largest Timber Supply Areas (TSAs) in the province, covering approximately 4.93 million hectares. There are three general landscape types: the Chilcotin Plateau, the central portion of the TSA and the eastern portion of the TSA. The Chilcotin Plateau, located west of the Fraser River, is characterized by a drier climate with extensive lodgepole pine forests and some Douglas-fir. The central portion of the TSA, located both east and west of the Fraser River, has mixed-species forests primarily Douglas-fir and lodgepole pine as well as a large portion of drybelt Douglas-fir stands. The eastern portion of the TSA increases in elevation and moisture to forests of spruce, pine, western redcedar, western hemlock and subalpine fir.

The intent of this document is to provide guidance and information to operational planners, reviewing agencies and approval authorities on forest health risks, issues and best management practices. It outlines the current status of forest health factors and key strategies and actions to minimize losses from damaging agents. The objective is to enhance ecosystem health by improving forest resiliency and sustainability. By providing acceptable approaches to forest health management this document attempts to simplify the planning and approval process for forest health treatments.

2. Guiding Principles

The WLTSA strategy and Forest Professionals[1] are to be consistent with all relevant legislation and planning guidance including:

- Chief Forester guidance in the Williams Lake TSA Rational for Allowable Annual Cut (AAC) Determination (February 25, 2015);
- Chief Forester Post –Natural Disturbance Forest Retention Guidance (2017 Wildfires)
- Regional Manager Post-Wildfire Salvage guidance to Licensees
- Cariboo Region Delegated Decision Makers Post-Wildfire Salvage Expectations for Land Use Designations in Cariboo Region
- Chief Forester Guidance on Landscape- and Stand-level Structural Retention in Large-Scale Mountain Pine Beetle Salvage Operations (December 2005); and
- Cariboo-Chilcotin Land Use Plan (CCLUP), Government Actions Regulation (GAR) Orders pertaining to Ungulate Winter Range (#U-5-001, U-5-002 and U-5-003),

[1] Forest Professionals are Registered Professional Foresters, Registered Forest Technologists, Special Permit and Limited License Holders, Accredited Timber Cruisers, Accredited Timber Evaluators and Silvicultural Accredited Surveyors. Forest professionals ensure that the forests are managed sustainably. (http://abcfp.ca/)

and associated strategies;
Order for Shallow/Moderate Snowpack MDWRs
Order for Transition/Deep Snowpack MDWRs

- Mule Deer Winter Range exemptions for wildfire impacted stands
- CCLUP Regional Biodiversity Conservation Strategy and Updates;
- FRPA bulletins.

3. Forest Health Objectives

- Identify beetle management strategies (Suppression, Salvage and Monitor) for each Beetle Management Unit (BMU). The 2019 BMU strategy maps are located in Appendix 2.
- Provide updated strategic guidance for the ongoing forest health management in the WLTSA.
- Identify treatment strategies for forest health management.
- Facilitate co-operative planning between agencies and licensees.
- Establish short- and long-term harvest guidelines to best address opportunities, given the current pest incidences and infestation levels.
- Facilitate the development of scientifically and ecologically sound operational plans and practices.
- In conjunction with the various licensees and MFLNRORD identify areas of responsibility for beetle management. This includes where there may be opportunities for small tenure holders to assist in salvage/suppression efforts.

4. Roles and Responsibilities

- Licensees and FLNRORD will collaboratively undertake implementation of this strategy primarily through the WLTSA Forest Health Committee.
- Meetings of this committee will be held on an as-needed basis to discuss the implementation and effectiveness of this strategy. An outline of meeting topics, dates and actions are shown in Table 1.
- Bark beetle treatment planning (detailed aerial surveys, probing, pheromone placement, single tree removal/disposal, trap tree placement/removal and larger scale treatments such as sanitation harvesting) is an iterative process involving the collaborative effort of licensees and FLNRORD in WLTSA Forest Health Committee.

Table 1: Implementation schedule for Forest Health meetings

Topic	Meeting Dates	Actions
Planning	June - October	• Aerial overview and detailed flight information • Updated BMU strategies and boundaries • Identify areas of responsibility and planned activities based on infestation levels and capability • FLNRORD report on IBD treatments and monitoring evaluations
Implementation	August - March	• Discussion of planned and implemented beetle treatments • Update on spruce budworm treatments of the previous year (if applicable), and egg mass sampling and treatment strategy • WLTSA Forest Health Strategy in draft
Monitoring & Evaluation	January – June	• Licensee summary submission of Douglas-fir beetle treatment type and location • Evaluation of treatments and monitoring results with recommendations for future planning • Overwinter mortality sampling results for Douglas-fir bark beetle • Update on western spruce budworm treatment plans and target areas • Final version of WLTSA Forest Health Strategy endorsed and released

5. Priority Forest Health Factors in the WLTSA

The priority status of forest health agents is derived from the FLNRORD annual aerial overview survey, from regional forest health specialists, district and branch forest health staff, and reports from licensees.

Within the WLTSA pest species are ranked according to:

- distribution of pest and current incidence levels,
- available susceptible host species,
- landscape level hazard and risk information,

- known or suspected impacts on forest resource values,
- availability of operational detection and treatment methods, and
- costs and benefits of applying detailed detection and treatment activities.

Table 2: Priority of the Forest Health Factors within the WLTSA

High	Moderate	Low
Wildfire	Armillaria Root Disease	Mountain Pine Beetle
Douglas-fir Beetle	Tomentosus Root Disease	Western Balsam Bark Beetle
Western Spruce Budworm	Laminated Root Disease	Douglas-fir Tussock Moth
Drought Damage	Western Gall Rust	Forest Tent Caterpillar
Spruce Beetle	Commandra Rust	Aspen Serpentine Leaf Miner
Gypsy Moth	Lodgepole Pine Dwarf Mistletoe	Black Army Cutworm
	Post-wildfire Damage	Lodgepole Pine Terminal Weevil
	Elytroderma Needle Cast	Warren Root Collar Weevil
	White Pine Weevil	Stalactiform Rust
	Two Year Cycle Budworm	Atropellis Canker
	Western Hemlock Looper	Lophodermella Needle Cast
		Windthrow
		Pine Needle Sheathminer
		Flood Damage
		Bear Damage
		Winter Desiccation
		Balsam Woolly Adelgid

6. Forest Health Factors and Management Directions

Definitions

The following definitions, from the *Provincial Bark Beetle Management Technical Implementation Guidelines, Spring 2003*, are used for the purposes of this document regardless of any changes that may be made to the provincial definitions.

Beetle Management Unit (BMU): is a planning and reporting unit for operational beetle management. Its purpose is to facilitate the implementation of beetle management activities.

The following are strategies that may be employed within BMUs. An assigned strategy is based on the level of outbreak in an area and the estimated effectiveness of selected treatments in achieving stated objectives.

Suppression: This is the most aggressive Strategy. It is selected when the infestation status is such that aggressive direct control actions are expected to keep an area at endemic population levels. Areas are lightly infested, and resources for direct control or harvesting and milling capacities equal or exceed the amount of the infestation. The intent of the strategy is to reduce or keep the outbreak to a size and distribution that can be handled within "normal resource capability".

Objective: To reduce populations and maintain them at a relatively low level. Target is to treat 80 to 100% of the known infestation sites. All harvest and treatment is directed at currently attacked trees. The intent is to "control" outbreak in that area and stop spread.

Holding: The intent of this strategy is to maintain an existing outbreak at a relatively static level. It is a delaying strategy until adequate resources are available, or access is created to allow for a more aggressive approach, or to reduce overall loss while waiting for a killing climatic event. This is appropriate in areas with chronic beetle infestations that are too large to deal with using single tree treatments or where access is poorly developed for directed harvesting.

Objective: To maintain the infestation to a relatively static level by treating ~50 – 70% of the known infestation sites. The level of harvest and/or treatment is equal to the rate of infestation expansion. Harvesting should be concentrated in green attacked trees.

Monitor: This strategy is applied to areas where there are low population levels, where management efforts would be ineffective in substantially reducing the beetle population and subsequent levels of damage, or where there is no short term (less than 5 years) possibility of salvaging dead timber. This may be due to management constraints such as wilderness area, Parks or ecological reserve, or because access cannot be put in place before substantial merchantable degradation of the dead material occurs.

Objective: To record the change in attack level with no action required beyond monitoring and recording. This objective is appropriate in parks, ecological reserves and inoperable areas where the outbreak has peaked, salvage is not possible, and there is no current opportunity for any mitigation of further loss.

Salvage: This strategy is applied to areas where management efforts would be ineffective in substantially reducing beetle populations and subsequent levels of damage. Such areas have extensive outbreaks covering a large proportion of susceptible stands. The objective in this case is to salvage affected stands and minimize value loss.

Objective: To salvage timber previously attacked to minimize value loss. Indications are that holding the infestation static will fail due to influx of populations from heavily infested BMUs in proximity. Emphasis is more to retrieve values at risk and maximize Crown revenues by directing harvest towards killed stands prior to significant

degradation. Treat <50% of the currently infested sites. This objective is appropriate in areas where suppression and holding actions are no longer appropriate or feasible.

Bark Beetles

The goal of bark beetle management is to minimize the spread of bark beetles and the loss of crown timber and to protect non-timber resource values. The bark beetle hazard maps were updated in 2015 for the WLTSA.

Douglas-fir Beetle (IBD) (*Dendroctonus pseudotsugae* (Hopk.))
Priority = High, area impacted increased to 50,254 ha in the 2018 AOS.

Douglas-fir beetle is causing significant damage to forests in the WLTSA and is currently at outbreak levels. During outbreaks Douglas-fir beetle can kill large numbers of healthy trees over extensive areas. Outbreaks can have extremely negative impacts on ungulate winter range (MDWR), preservation of Old Growth Management Areas (OGMAs), watershed management and recreation and aesthetic values. Hot beds for beetle activity include along the Fraser River and near Williams Lake, with increases seen in Soda Creek, Mackin Creek, and Chimney Lake.

Detailed helicopter-GPS surveys have been conducted annually for heavily impacted areas of the WLTSA that are good candidates for operational treatments. This detailed survey provides accurate GPS coordinates of infestation centres and when infestations are continuous using polygons. The 2019 detailed flight identified 3278 infestation spots and 3 polygon infestations.

Stand management for Douglas-fir beetle:

- Follow Best Practices for Managing Douglas-fir Beetle:
  - Introduction and Biology
  - Management Strategies and Tactics
  - Landscape and Stand Level Planning
  - Douglas-fir Beetle and Wildfire
- Sanitation harvest activities within constrained areas (OGMAs, RRZs, etc…) must be consistent with the CCLUP and applicable Update Notes. These are ecologically sensitive areas and it is imperative that any activity in these areas is consistent with current biodiversity guidance and special care and attention is given to harvesting practices.
- There are currently Interim Modifications to Biodiversity Update #7b in effect

WLTSA Strategy: "Suppression" for some Douglas-fir dominated areas (see Appendix 2 for specifics).

Spruce Beetle (IBS) (*Dendroctonus rufipennis* (Kirby))
Priority = High, area impacted decreased to 2,787 ha.

Spruce stands are generally located in moist to wet ecosystems which result in faster decay and a short "shelf-life" of one to three years. Many spruce-leading stands have a high site index and if these stands are not harvested and re-forested promptly it could result in significant long-term losses in productivity. High site index stands should be prioritized for salvage of dead trees and suppression of infestation centres with an aim to balance forest health and mid-term timber supply. Wind felled spruce is an excellent habitat to spruce beetles and blowdown centres should be carefully monitored to ensure populations are dealt with before they start increasing and attacking standing healthy spruce.

Spruce beetle is difficult to detect in overview surveys but is useful in identifying general trends in beetle levels. Attack declined in 2018, with most areas classified as trace or light. The areas to watch are Quesnel Lake and Horsefly Lake in the east and Big Creek and Churn Creek in the south.
Although infestations appear to be declining, spruce beetle continues to be a species of great concern due to rapid spread, high attack ratios, and short "shelf-life" due to ecotypes where the beetle is located. The main treatments for spruce beetle are trap tree deployment and salvage harvest. Poor access, steep ground and other economic challenges have led to very little harvesting of infested spruce.

WLTSA Strategy: "Monitor" for the majority of the WLTSA and "Suppression" for some areas (see Appendix 2 for specifics).

Mountain Pine Beetle (IBM) (*Dendroctonus ponderosae* Hopkins)
Priority = Low, area impacted increased to 14,775 ha.

In the AAC Rationale for Williams Lake TSA the Chief Forester directs licensees "to continue to focus harvesting as much as possible on mountain pine beetle-impacted pine-leading stands in the Williams Lake TSA; and to harvest no more than their share of the AAC partition attributable to live tree volume." This strategy should be followed while managing current and future forest values in context of sustainability.

Overall Objective: Salvage affected pine stands in a manner that will:

- maximize the economic value obtained from the killed trees,
- extend the salvage term (i.e. harvest those stands with the most dead wood), and
- expedite the restoration of impacted stands to the harvesting land base.

High Priority for Salvage (Unconstrained Landbase)

- Stands with at least 70 percent pine with high percentages of beetle-infested or killed stems

- Stands located west of the Fraser River
- Low volume stands (<100 cubic metres/ha)
- Pure pine stands with little or no advanced regeneration (especially high site index) to expedite stand recovery. (i.e. Ideal candidate areas for stand rehabilitation)
- Areas where shelf-life is considered short (i.e. wetter BEC zones)

Moderate Priority Salvage (Unconstrained Landbase):

- Areas where shelf-life is considered short
- >50% Pine by Volume
- >30% beetle attack (Red green and grey combined)
- High/Moderate Susceptibility

Low Priority Salvage (Unconstrained and constrained areas)

- Mixed Stands (< 50% pine)
- Maximize harvest of infested pine through selective harvest.
- Prescriptions should target pine removal rather than clearcut, where residual stands can be maintained in a wind firm condition to target the maximum volume of infested pine and to encourage natural regeneration of non-pine (climax) species especially where advanced regen exists in understory. Where more than one beetle species has infested mixed stand, then the rational should be explicit.
- OGMA's, MDWR's, Riparian and other constrained areas in accordance with higher level plan guidelines, Land Use Orders and GAR orders.
- High amount of advanced regeneration
- Stands with suitable secondary structure (see Appendix 4 for definition)

The following table provides guidance to the placement of salvage areas on the landbase. It serves as guidance for salvage planning, but other values as listed above, should also be considered and rationalized in harvesting proposals.

Table 3: Priority for pine salvage based on stand characteristics and level of beetle kill (Modified from McLennan 2003) (Eng 2004).

	Percentage of pine killed (Green, Red and Grey attack)				
Percentage of stand volume that is pine	<30%	30-50%	51-70%	>70% West of the Fraser River	>70% East of the Fraser River
<30%	No	No	No	No	No
30-50%	No	No	No	Low	Low
51-70%	Low	Low	Low	High	Moderate
>70%	Low	Moderate	Moderate	High	Moderate

WLTSA Strategy: All BMUs within the WLTSA have been identified as "salvage" strategy (Appendix 2) for Mountain Pine Beetle.

Western Balsam Bark Beetle (IBB) (*Dryocetes confusus* Sw.)
Priority = Low, area impacted increased to 66,287 ha with most infestations rating trace or light.
Stand management for Western Balsam Bark Beetle:

- To prevent high in-stand losses from IBB, manage to younger ages (i.e. harvest at 80 yrs) once >100 yrs very susceptible to attack.
- To some degree, stand edges promote more blowdown of Bl than is typical in stands so after harvesting Bl-leading stands monitor blowdown and any beetle build-up.
- Trap trees can be used for IBB (much the same as for spruce beetle, fir beetle) – although the timing is not as well know (fall vs. spring felling).
- Stands can be baited prior to harvest to contain as many beetles in the proposed block as possible.
- Stands should be hazard rated and managed (planned for harvest & regeneration) based upon:
    - species (>50% Bl)
    - age (older stands higher risk)
    - BEC – ESSF highest hazard in that most Bl is found in this ecosystem but Bl in the MS & SBS is very susceptible to attack because it is drought stressed more frequently and thus becomes easier to attack.
    - The ESSFdv and ESSFxc are highest hazard, followed by ESSFwc, mw, cv and dc.
    - elevation
    - current and past beetle attack

WLTSA Strategy: "Monitor" with no treatments planned.

Defoliators

Defoliators, such as the western spruce budworm and 2-year cycle budworm, impact all age classes of their preferred hosts and can substantially impact growth and productivity and wood quality. Severe defoliation by these insects can result in mortality, especially in younger age classes, and have negative impacts on other stewardship values on the land base (e.g., ungulate ranges).

Western spruce budworm (IDW) (*Choristoneura freemani* Razowski)
Priority = High, area impacted increased to 11,294 ha.

Severe defoliation of mature stands does not typically result in mortality but stresses the trees reducing wood quality and quantity, and predisposes Douglas-fir to attack by Douglas-fir bark beetle. When a mature stand is infested, understory mortality can be

very significant. As a result of this understory mortality and Douglas-fir bark beetle mortality NSR stands are created.

FLNRO has been conducting aerial treatments of moderate to severe western spruce budworm populations using *Bacillus thuringiensis* var. *kurstaki* (B.t.k.) annually to protect the most valuable stands at risk. Detailed monitoring is conducted each year to determine population dynamics. Egg mass sampling occurs September to October to determine if threshold is met to initiate a spray program. Bud mining surveys are then conducted the following spring to estimate population levels and timing of spray applications. There will be a small scale spray program in 2019, focused around Chimney Lake, Till Lake, Meldrum Creek and Canoe Creek.

This pest is of high significance as it not only has the potential to cause mortality and growth loss in the current growing stock, but also stresses the trees, increasing future vulnerability to bark beetle attack and furthering potential losses to mid-term timber supply.

Silviculture strategies:

- Plant higher densities to increase resilience in stands decreasing the overall susceptibility to sever and sustained Western Spruce Budworm defoliation events.

WLTSA Strategy: "Monitor" in conjunction with an aerial spray program. Detailed monitoring at the "moderate" egg mass sites in order to track larval development and populations levels and tree defoliation will be conducted.

Gypsy moth (IDM) (*Lymantria dispar* (Hulst))
Priority = High

Gypsy moth is an invasive non-native species which has not become established in the WLTSA. This insect defoliates deciduous trees and has over 300 known hosts. Introduction to an area could occur from recreational and other vehicles traveling in or from infested areas carrying pupae or eggs.

WLTSA Strategy: "Monitor" through the use of a trapping program in conjunction with District and Regional staff and the Canadian Forest Service. Early detection of this defoliator is critical for eradication treatments.

Douglas-fir Tussock Moth (IDT) (*Orgyia pseudotsugata* (McD.))
Priority = High

Douglas-fir Tussock Moth has the potential to cause significant mortality due to defoliation, although, top-kill, growth reduction, and secondary insects and fungi attacks

may also occur. All ages of Douglas-fir are susceptible. Outbreaks typically occur every 10- 12 years and last around 4 years.

The outbreak in 2019 is significant as it is the furthest north that IDT has ever been recorded. This outbreak is centered in the Fraser River Valley, near the community of Dog Creek.

WLTSA Strategy: "Monitor" in conjunction with an aerial spray program. Detailed monitoring at the identified sites in order to track larval development and populations levels and tree defoliation will be conducted.

Two Year Cycle Budworm (IDB) (*Choristoneura biennis* Freeman)
Priority = Moderate, area impacted increased to 23,400 ha of mostly light defoliation.

In the interior wet belt two year budworm defoliates true firs and spruce species during "on" years (in the WL TSA this occurs during even years). This pest has the potential to create significant damage in the eastern portion of the WLTSA, with infestations covering over a million hectares recorded for the Cariboo during previous outbreaks. Potentially, plantations could suffer significant damage from this insect, and severe defoliation may predispose trees to attack by western balsam bark beetle or spruce beetle.

WLTSA Strategy: "Monitor" with no treatments planned.

Western Hemlock Looper (IDL) (*Lambdina fiscellaria lugubrosa* (Hulst))
Priority = Moderate, area impacted was not recorded in 2017.

The western hemlock looper is a very destructive insect that defoliates western hemlock, western red cedar, Douglas-fir and spruce species. Untreated, it can lead to high levels of mortality during its two to four year outbreaks. In severe cases, previously damaged stands may require stand rehabilitation. Generally this insect has an eight year cycle between high population levels. Historically outbreaks have been restricted to around Quesnel Lake. The last time populations were high in this TSA was 2012, so would not expect populations to increase again until 2020.

WLTSA Strategy: "Monitor" with no treatments planned.

Forest tent caterpillar (IDF) (*Malacosoma disstria* Hubner)
Priority = Low, area impacted was not recorded in 2017.

One or more years of severe defoliation may result in top-kill, branch mortality, reduced radial growth and if the infestation persists, occasional mortality. Many of the infested stands were also infested with aspen serpentine leaf miner.

WLTSA Strategy: “Monitor” with no treatments planned.

Aspen Serpentine Leaf Miner (ID6) *(Phyllocnistis populiella* Chambers)
Priority = Low, area impacted has increased to 61,294 ha.

Leaf miners tunnel between the epidermal layer of the leaf, reducing the leaf’s photosynthetic capacity. Outbreaks of this pest are fairly common in western North America. Short (1 or 2 year) outbreaks do not normally have major long-term impacts on tree growth; however, this insect has been active for several years in areas around the Williams Lake TSA. The majority of sites affected in 2018 were classified as moderate to severe.

WLTSA Strategy: “Monitor” with no treatments planned.

Black Army Cutworm (IDA) (*Actebia fennica* (Tausch.))
Priority = Low, area impacted was not recorded in 2017.

In the absence of herbaceous plants and shrubs Black Army Cutworm (IDA) will defoliate coniferous seedlings. Monitoring of IDA took place in 2018 due to the large area affected by wildfires in 2017. Populations were found to be low, but planting sites that are devoid of all vegetation should be avoided for 1-2 years after the wildfire.
BAC Management:

- Identify high risk sites
    - Burned openings south or west facing slopes are preferred for egg laying
    - Severe burns decreases natural vegetation which leads to higher risk of plantation defoliation
    - ESSF, MS, SBS, ICH, and IDF
    - Drought-prone sites
- Delay planting for 1 – 2 years
- Avoid spring planting
- Survey for BAC damage on natural vegetation in the spring
- Pheromone monitoring

WLTSA Strategy: “Monitor” with no treatments planned.

Pine Needle Sheathminer (IDI) *(Zelleria haimbachi* (Busck))
Priority = Low, area impacted has decreased to 1,677 ha.

The Pine needle sheathminer generally attacks juvenile to immature pine stands. Up to 100% of the new growth may be destroyed resulting in growth reduction.

WLTSA Strategy: “Monitor” with no treatments planned.

Balsam Woolly Adelgid (IAB) (*Adelges piceae* (Ratz.))
Priority = Low, no aerial detection in BC for AOS

Balsam Woolly Adelgid generally attacks all true firs, with amabilis and grand firs attacked most frequently and subalpine fir most easily damaged. Damage includes swelling and distortion at buds and leader resulting in stunted growth, poor timber quality and tree death.
During a survey conducted in 2017 to determine the spread of BWA northward in BC, light infestation of BWA was found along the Horsefly River.
There is no large scale treatment that can feasibly be employed for mature stands.

WLTSA Strategy: "Monitor" with no treatments planned.

Weevils

White Pine Weevil (IWS) (*Pissodes Strobi)*: Priority = Moderate
Lodgepole Pine terminal Weevil (IWP) (Pissodes terminalis): Priority = Low
Warren's Root Collar Weevil (IWW) (*Hylobius warren)*: Priority =Low

White pine weevil and lodgepole pine terminal weevil can cause significant forking damage in young stands. Most of the mortality occurs in the first 10 years. The ICH and parts of the SBSdw1 are at high risk for white pine weevil. Warren Root Collar weevil can cause scattered mortality in young stands.

Silviculture strategies:

- Plant alternate species or species mixes.
- Leave non-target species; for example do not brush aspen.
- Plant higher densities.
- Plant genetically resistant stock for terminal weevil.

WLTSA Strategy: "Monitor" individual affected stands.

Diseases

Root Diseases

The old FPC Root Disease Guidebook (1996) has been updated to a new guidance document called "Managing Root Disease in British Columbia". The updated and revised root disease website is also now available.

Armillaria Root Disease (DRA) (*Armillaria ostoyae* (Romagnesi) Herink)
Priority = Moderate
Armillaria root disease causes mortality in a wide range of conifers and deciduous trees and may increase the susceptibility of infected trees to bark beetles and other pests.

Douglas-fir, true firs, and spruce are highly susceptible to Armillaria root disease, western hemlock exhibits medium to high susceptibility, pines are moderately susceptible, and western red cedar and deciduous species have a lower susceptibility. Western larch also appears to be less susceptible to Armillaria after age twenty to forty.

Tomentosus Root Disease (DRT) (*Inonotus tomentosus* (Fr.))
Priority = Moderate
Spruce is the primary host for Tomentosus root disease, with lodgepole pine and Douglas-fir exhibiting medium susceptibility. Infection can occur via spores, or from root to root contact between trees or trees and stumps. Tomentosus root disease often goes undetected and can cause considerable growth loss in mature spruce stands.

Laminated Root Rot (DRL) (*Inonotus sulphurascens* (Murrill) Gilb.)
Priority = Moderate
Laminated root rot is primarily a disease of Douglas-fir. It is most prevalent on warm south facing slopes in the ICH and SBSdw1. It forms discrete root rot centres or openings with associated windthrown and dead standing trees. Windthrown trees generally have characteristic root balls with decay along the annual rings and typically fall in all directions.

WLTSA Strategy: "Monitor" and follow the updated guidance document Managing Root Disease in British Columbia.

Root Rot silviculture Strategy:

- Free growing assessments should be conducted after age 12 in high hazard root rot BEC zones. Root diseases are often not detectable before age 12.
- Plant tolerant or resistant species
- Root Rot centres are more easily identified and mapped before harvest

Stem Rusts of Pine

Comandra blister rust (DSC) (*Cronartium comandrae* Peck),
Stalactiform blister rust (DSS) (*Cronartium coleosporioides* Arthur)
Western gall rust (DSG) (*Endocronartium harknessii* (J.P. Moore))
Priority = Moderate

DSS, DSC, and DSG all occur within the WLTSA. These pests are particularly important in young pine stands (<25 years of age). Comandra and stalactiform rust can only infect lodgepole pine from spores produced on the alternate host plant. These spores are typically only transmitted over short distances. The frequency of alternate plant hosts present on a site is likely an important risk factor for the Cronartium stem rusts. Western gall rust is the most common forest health factor affecting young lodgepole pine stands and does not require and alternate host.

WLTSA Strategy: "Monitor" young stands (esp. pure pine stands).
Silviculture strategy:

- Where pine is a preferred species, minimum stocking should be increased to 2000sph to offset mortality due to rust.
- Plant alternate species where possible to minimize the risk of losses.
- Before considering spacing it is important to conduct pest surveys and to consider the impact of forest pests on final stocking levels. In some instances it may be wise to delay spacing until the final impact of forest pests can be more accurately assessed.

Dwarf Mistletoe

Lodgepole Pine Dwarf Mistletoe (DMP) (*Arceuthobium americanum* Nutt. Ex Engelm.)
Priority = Moderate
There are high incidences of lodgepole pine dwarf mistletoe in the SBPSxc where lodgepole pine is the only preferred species. The disease is caused by a parasitic plant and spread occurs from infected residual trees. Preliminary results of a study in the Chilcotin indicate that dwarf mistletoe severity will likely increase in the SBPSxc as a result of scattered small diameter residual pine (<20cm dbh) which survived the Mountain Pine Beetle outbreak. Dwarf Mistletoe sanitation treatments are one of the best ways of controlling the spread of the disease.

WLTSA Strategy: "Monitor" young pine stands.
Harvest systems:

- Design large cut blocks with smooth edges.
- Maintain dwarf mistletoe free boundaries and natural barriers whenever possible (e.g. roads, non lodgepole pine timber type, water bodies, etc.).
- Avoid leaving wildlife tree patches and leave strips infected with dwarf mistletoe within or adjacent to the block whenever possible especially along road right of ways.
- Stands or portions of stands which are infested should be treated following harvest by removal of all residual lodgepole pine over 0.5m in height. Residuals will generally have dwarf mistletoe plants unless they were shaded prior to harvesting. On average it takes four years between infection and the first appearance of plants. A trial is being set up to measure the effectiveness of sanitation treatments using heights of 0.3m, 1.0m, 3.0m and no treatment.

Needle Casts

Elytroderma Needle Cast (DFE) (*Elytroderma deformans* (Weir) Darker)
Priority = Moderate
Elytroderma needle cast is easily recognized and well documented on Ponderosa pine but often goes misdiagnosed on Lodgepole pine. It is unique from other foliage disease in its ability to infect and persist in shoots where it can cause severe stunting and brooming. Elytroderma displays similar symptoms to Lophodermella but it can be distinguished by the fruiting bodies and stunting that it causes. Elytroderma is widespread in the IDF and SBPS, withwet low lying areas adjacent to swamps generally having a higher incidence. Severe stunting has been observed in some stands but information is lacking on the extent and impact of this disease within the Williams Lake TSA.

WLTSA Strategy: "Monitor" and document the extent of damage through stand density monitoring surveys. Increase general awareness of the disease in young pine stands. Retain Douglas-fir in pine salvage blocks. The residual Douglas-fir will act as seed trees that will increase diversity in the stand to mitigate the impact of climate change.

Silviculture Strategy:

- Increase regeneration densities to 2000sph offset potential losses and damage from Elytroderma.
- Plant alternate species where appropriate for the site.
- Dwarf mistletoe sanitation treatments can effectively remove infected advanced regen.

Lophodermella Needle Cast (DFL) (*Lophodrmella concolor* (Dearn.) Darker)
Priority = Low
When conditions are optimal (wet springs and summers), needle cast can infect large tracts of pine forest, particularly plantations. The long-term impact of this foliar disease is not completely understood, although permanent sample plots in affected plantations show significant growth reduction and mortality. This agent should be closely monitored, mapped, and the impact on plantations carefully recorded (esp. in the IDF & SBPS). Condition were optimal in 2018 for high intensity infections in 2020.

WLTSA Strategy: "Monitor"

Dothistroma Needle Blight (DFS) (Dothistroma *septosporum* (Dorogin) M. Morelet)
Priority = Low, area impacted is 19,115ha
Conditions were optimal (wet, cool spring and summer) in 2019 and could potentially create widespread, high intensity infections in 2020. This agent can spread rapidly and defoliate trees in weeks causing significant damage. Tree mortality can occur with

repeated infections. Dothistroma occurs on all ages of lodgepole, ponderosa and other pine species.

WLTSA Strategy: "Monitor"

Abiotic Injuries

Wildfire Damage and Post-Wildfire Mortality

Wildfire damage: Priority = High, area impacted has decreased to 12,486 ha.
Post-Wildfire mortality: Priority = High, area impacted has increase to 2,228

The 2017 wildfires were the most extensive on record in BC's history with the Cariboo Region being the most severely impacted. These large wildfire affected areas impact social, economic and environmental factors which all must be considered when determining a treatment for an area.
Post-wildfire mortality as a result of the 2017 wildfires should have peaked in 2018.

WLTSA Strategy: Follow

- Chief Forester Post –Natural Disturbance Forest Retention Guidance (2017 Wildfires)
- Regional Manager Post-Wildfire Salvage guidance to Licensees
- Cariboo Region Delegated Decision Makers Post-Wildfire Salvage Expectations for Land Use Designations in Cariboo Region
- Best Practices for Managing Douglas-fir Beetle - Douglas-fir Beetle and Wildfire
- Mule Deer Winter Range exemptions for wildfire impacted stands

Drought Damage

Priority = Moderate, area impacted increased to 735 ha.

2017 and 2018 were some of the driest summers on record in the District. It is anticipated that more drought stress and mortality will become evident throughout 2019. There is also a potential for secondary insects to be attracted to these stressed trees and cause further mortality.
Sites mapped for drought should be monitored closely when they are detected because the trees become stressed making them more susceptible to bark beetle infestations causing further mortality. Areas of drought should therefore be subject to ground checks if they are located in suppression zones.

WLTSA Strategy: "Monitor" with no treatments planned. If damage occurs in susceptible Douglas-fir stands then stressed trees should be protected with MCH, other appropriate strategies include trap trees or fall and burn.

Windthrow
Priority = Low, area impacted has increased to 35 ha.

The area of windthrow recorded during the overview survey was 35 ha. The occurrence of windthrow can contribute to the maintenance and build-up of local spruce and Douglas-fir bark beetle populations.

Windthrow patches of Douglas-fir and spruce should be addressed promptly to minimize the expansion of beetle populations. 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.

WLTSA Strategy: Allow windthrow to act as trap trees through summer and harvest before April 1st to prevent bark beetle population build-up. Alternative strategies are to use MCH, trap trees and/or fall and burn.

Flooding Damage
Priority = Low, area impacted has increased to 6.36 ha.

Sites mapped for flooding should be monitored closely when they are detected because the trees become stressed making them more susceptible to bark beetle infestations. Areas of flooding should therefore be subject to ground checks if they are located in suppression zones.

WLTSA Strategy: "Monitor" with no treatments planned. Strategies are to use MCH, trap trees or fall and burn.

Bear Damage
Priority = Low, area impacted has increased to 976 ha causing trace to light levels of mortality.

This damage has been occurring in lodgepole pine plantations in the eastern Cariboo and has been ongoing for several years.

WLTSA Strategy: "Monitor" with no treatments planned.

7. Bark Beetle Management

The Aerial Overview Survey (AOS) is conducted annually over 80-90% of the province provides a way to track changes in various visible forest health agents. The graphs in

Appendix 1 are based on AOS data from 1999-2015 showing the total area impacted by each bark beetle.

Follow guidance provided by Best Practices for Managing Douglas-fir Beetle:

- Introduction and Biology
- Management Strategies and Tactics
- Landscape and Stand Level Planning
- Douglas-fir Beetle and Wildfire

Bark beetle hazard maps identify stands that are highly susceptible to bark beetle because of their stand characteristics.
Detailed and overview aerial survey data for 2018 is the most up to date information for infestation location.

Mule Deer Winter Range (MDWR) and Bark Beetles
Follow Government Actions Regulation (GAR) orders pertaining to ungulate winter range (#U-5-001, U-5-002, and U-5003):

- Ungulate Winter Ranges Cariboo Chilcotin Land Use Plan, Shallow and Moderate Snowpack
- Ungulate Winter Ranges Cariboo Chilcotin Land Use Plan, Transition and Deep Snowpack

  - Use existing access only.
  - Trees selected for trap trees should be ones that would be harvested in a regular MDWR entry
  - Trap trees should not be located on ridge lines or topographic breaks.
  - Trap trees should be marked to cut and fallers should be instructed clearly as to what the goals are and should be supervised appropriately.
  - Trap tree sites must be accurately mapped with trees removed prior to next beetle flight without damage to the surrounding stand.
  - Trap tree sites in MDWRs would be followed up with a second treatment (eg., trap trees, anti-aggregation pheromone baiting (MCH))
  - All infested Douglas-fir trees, stumps, and debris associated with sanitation harvest must be treated and/or removed from the site prior to beetle flight.

Old Growth Management Areas (OGMAs) and Bark Beetles
In many areas, OGMAs contain the only representation of old forests in a given landscape/BEC zone. The qualities present in the OGMAs (large old trees) are also attractive for bark beetle. To minimize the impact on OGMAs the following precautions will be taken:

- Be consistent with the Land Use Objectives for the Cariboo-Chilcotin Land Use Plan and Biodiversity Updates.
- Identify OGMAs of major concern for annual bark beetle monitoring
- Susceptible stands outside OGMAs will aid in prioritizing OGMA treatments

- Where infestations occur inside OGMAs, if appropriate, locate an intensive trap tree program outside the boundary to draw beetles out of the OGMA
- Consider using MCH on Douglas-fir where it could be of benefit to protect healthy stands inside OGMAs which may be provided and/or placed by FLNRORD
- All infested Douglas-fir trees, stumps, and debris associated with sanitation harvest must be treated and/or removed from the site prior to beetle flight.

8. Non-Recoverable Losses

Non-recoverable losses account for the average volume lost each year due to natural causes, such as pests, fire and wind, that are not recovered or salvaged. The WLTSA Rationale for AAC Determination assumed a total of 149,553 cubic metres per year. Since this time a new tool for estimating NRL has been developed using the provincial aerial overview survey data. The salvage areas are netted out of the mapped mortality resulting in a rough estimate of unsalvaged volumes. This spreadsheet is posted on the FTP site at https://www.for.gov.bc.ca/ftp/HFP/external/!publish/Forest_Health/NRLs/ The most recent NRL estimates for the WLTSA are provided in Table 4.

Table 4: Summary of estimated non-recoverable losses (unsalvaged) by damaging agent 2008-2018

Year	Douglas-fir beetle (m3/yr)	Drought (m3/yr)	Fire (m3/yr)	Flood (m3/yr)	Mountain Pine Beetle (m3/yr)	Spruce beetle (m3/yr)	Western Balsam Bark Beetle (m3/yr)	Total (m3/yr)
2008	73,510	0	238	0	3,497,652	16,015	1,440	3,588,855
2009	60,160	0	514,717	0	1,506,064	87,598	208	2,168,747
2010	4,416	0	557,308	124	135,053	122,556	9,74	819,540
2011	5,799	0	944	297	35,835	10,933	2,299	56,107
2012	25,238	0	6,888	6,136	30,346	85,204	9,813	163,625
2013	2,602	0	1,283	4,593	8,368	17,536	2,116	36,498
2014	34,531	36	7,266	6,812	5,746	1,950	3,426	59,768
2015	36,200	21,123	39,082	1,490	7,462	4,274	615	110,246
2016	121,996	7,915	1,332	1,821	20,615	18,884	5,647	178,210
2017	169,823	0	2,866,697	388	18,761	36,488	2,609	3,094,766
2018	91,476	1,076	173,832	3,698	19,483	1,447	8,151	299,163

9. Reducing the Impacts of Climate Change

There is a growing body of evidence that global climate change has contributed to increased incidence and severity of a number of forest health factors (Woods et al., 2010). Therefore, adapting natural resource management to climate change is necessary to ensure forests are productive and ecosystems are resilient.

The Cariboo Region Extension Note on Adapting Natural Resource Management to Climate Change includes climate change projections; projected impacts of climate change to ecosystems; and adaptation strategies for natural resource management.

Website for Climate Change and Adaptation in B.C. Forests:
https://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/natural-resources-climate-change
The choice of silviculture strategies and/or harvesting systems can be an important consideration in establishing a healthy future stand. These strategies need to be considered in the context of integrated resource management.

Some silvicultural strategies and harvesting systems are listed below to help minimize the impact from forest pests and mitigate the risks associated with climate change:

- Treat the site prior to planting. For obligate parasites that have short distance spread (dwarf mistletoes) or site specific pests (some root rots), site treatment such as sanitation spacing or stumping can be an effective method of reducing losses from disease.
- Planting within two years of slash burning may increase the risk of black army cut worm or Rhizina root disease in certain areas.
- Before considering spacing it is important to conduct pest surveys and to consider the impact of forest pests on final stocking levels. In some instances it is preferable to delay spacing until the final impact of forest pests can be more accurately assessed.
- The Ministry of Forests Lands, Natural Resource Operations and Rural Development has modified their seed transfer standards to climate based seed transfer to mitigate the impacts of climate change.
- Partial harvest systems are generally not recommended in stands with root disease or dwarf mistletoe but may be beneficial for regenerating well stocked stands with greater structural and species diversity and may provide some mitigation against growing season frosts and other weather events.

10. Key TSR Issues

In February 2015 a new Annual Allowable Cut Determination for the WLTSA was published. In this document FLNRO staff, other agencies and licensees (as appropriate) are directed by the Chief Forester to undertake or support specific tasks and studies. The key tasks and studies that relate to this strategy are noted below. These projects are important to help reduce the risk and uncertainty associated with factors that affect the timber supply in the Williams Lake TSA.

Short-term considerations:

1. Licensees are to continue to focus harvesting as much as possible on mountain pine beetle-impacted pine-leading stands in the Williams Lake TSA; and to harvest no more than their share of the AAC partition attributable to live tree volume.
2. District staff are to monitor the following and report semi-annually to the chief forester:
    a. harvest performance within MPB-killed pine-leading stands and the volume attributable to live trees within those stands; and
    b. harvest contribution from non-pine leading stands.

Mid-term timber supply considerations:

1. *Low productivity sites*: Staff are to explore opportunities (eg., rehabilitation and bioenergy) for the use of some of the low productivity sites before the next determination
2. *Mule deer winter range*: Staff are to address MDWR issues including meeting minimum basal area targets relative to current or projected stand conditions; incentives for non-clearcut harvesting approaches given higher administrative and planning costs; and addressing poor forest health conditions that may be exacerbated by lack of management before the next determination so that this factor can be better considered. There is also a need for a standard Cariboo region-wide approach to modelling winter range requirements stemming from an order under the Government Actions Regulation.
3. *Douglas-fir stands*: Staff are to explore innovative ways (such as use of LiDAR) to improve the inventory, including growth and yield, of Interior Douglas-fir stands given their contribution to mid-term timber supply.

Other considerations:

1. *Climate change*: Staff are to try and understand projected climate change impacts in the TSA so that this important consideration can be factored into the next determination.

11. Web Links for Resources

Cariboo Region Forest Health Strategies and Data

Guide to identifying Douglas-fir beetle attack from ground assessments
https://www.for.gov.bc.ca/ftp/RSI/external/!publish/Forest%20Health/Forest%20Health%20Presentations/Douglas-fir_beetle_signs.pdf

2015 updated Seral Analysis. This analysis is based on the 2015 VRI data.
Report:
ftp://ftp.geobc.gov.bc.ca/publish/Regional/WilliamsLake/forest/seral/seral_2015/report/
Maps:
ftp://ftp.geobc.gov.bc.ca/publish/Regional/WilliamsLake/forest/seral/seral_2015/maps/

Root Rot shape files
https://www.for.gov.bc.ca/ftp/RSI/external/!publish/Forest%20Health/Root%20Rot%20Shapefiles/

Biodiversity Committee Updates

Cariboo-Chilcotin Land Use Plan. 2006. An Integrated Strategy for Management of Biodiversity and Bark Beetles in Douglas-fir and Spruce Stands. Update Note #7b.
https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/cariboo-region/cariboochilcotin-rlup/update_note_7b.pdf

Land Use Order
Objectives for wildlife tree retention, OGMAs, Critical Fish Habitat, Lakes, Riparian Reserve Zones, Grasslands, High Value Moose Wetlands, and Grizzly Bear.
ftp://ftp.geobc.gov.bc.ca/publish/Regional/WilliamsLake/Cariboo-Chilcotin_LUOR_Order/legal_order_document/CaribooChilcotinLUO_May2011.pdf

MDWR Management Strategies
Management Strategy for Mule Deer Winter Ranges in the Cariboo-Chilcotin Part 1a:
Management Plan for Shallow and Moderate Snowpack Zones. 2007. R.J. Dawson, H.M. Armleder, B. Bings, and D. Peel.

Management Strategy for Mule Deer Winter Ranges in the Cariboo-Chilcotin Part 1b: Management Plan for Transition and Deep Snowpack Zones. 2006. R.J. Dawson, H.M. Armleder, B. Bings, and D. Peel.

General Wildlife Measures

Order for Shallow/Moderate Snowpack MDWRs:
http://www.env.gov.bc.ca/wld/documents/wha/Amendment_ShallowModerate_Feb07_Ord.pdf

Order for Transition/Deep Snowpack MDWRs:
http://www.env.gov.bc.ca/wld/documents/wha/Amendment_TransDeep_Feb07_ord.pdf

Individual MDWR Long-term Objectives Maps, Overview TSA MDWR maps, Snowpack Zones map:
http://www.env.gov.bc.ca/esd/distdata/ecosystems/mdwr/

Information Notes:

Mule Deer Winter Range Strategy Committee. 2014. Regional mule deer winter range strategy. Information Note #1. Guidance for fire damaged stands.

https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/cariboo-region/cariboochilcotin-rlup/fire_damaged_stands.pdf

Mule Deer Winter Range Strategy Committee. 2014. Regional mule deer winter range strategy. Information Note #2. Guidance for MDWR General Wildlife Measure Exemption Requests for Salvage of Insect-killed Douglas-fir.

https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/cariboo-region/cariboochilcotin-rlup/mule_deer_winter_range_wildfire_exemption_request.pdf

Frost Hazard Guide and Extension Note

Steen, O.A.S., R. Stathers, and R. Coupé. 1990. Identification and management of summer frost prone sites in the Cariboo Forest Region. For. Can. and B.C. Min. For., Victoria, B.C. FRDA Rep. 157. 23 pp.
http://www.for.gov.bc.ca/hfd/pubs/Docs/Frr/Frr157.htm
https://www.for.gov.bc.ca/rsi/research/cextnotes/extnot05.pdf

Ecora Resource Group Ltd. 2012. Drought risk and frost hazard mapping for the Williams Lake TSA. And Frost Hazard Workbook (Excel). (maps available upon request).

https://www.for.gov.bc.ca/ftp/DCC/external/!publish/Frost%20Hazard/Report%20and%20tools/

General Forest Health Information

Provincial Aerial Overview Survey
https://www.for.gov.bc.ca/ftp/HFP/external/!publish/Aerial_Overview/

RESULTS Incidence Maps
https://www.for.gov.bc.ca/ftp/HFP/external/!publish/Forest_Health/RESULTS%20incidence%20maps/

12. References

Eng, M. 2004 Forest Stewardship in the Context of Large-scale Salvage Operations: An Interpretation Paper, B.C. Ministry of Forests Forest Science Program Technical Report 019

Heineman, J.L. et al. 2010 Investigating the influence of climate, site, location, and treatment factors on damage to young lodgepole pine in southern British Columbia. Can J. For. Res. 40: 1109-1127

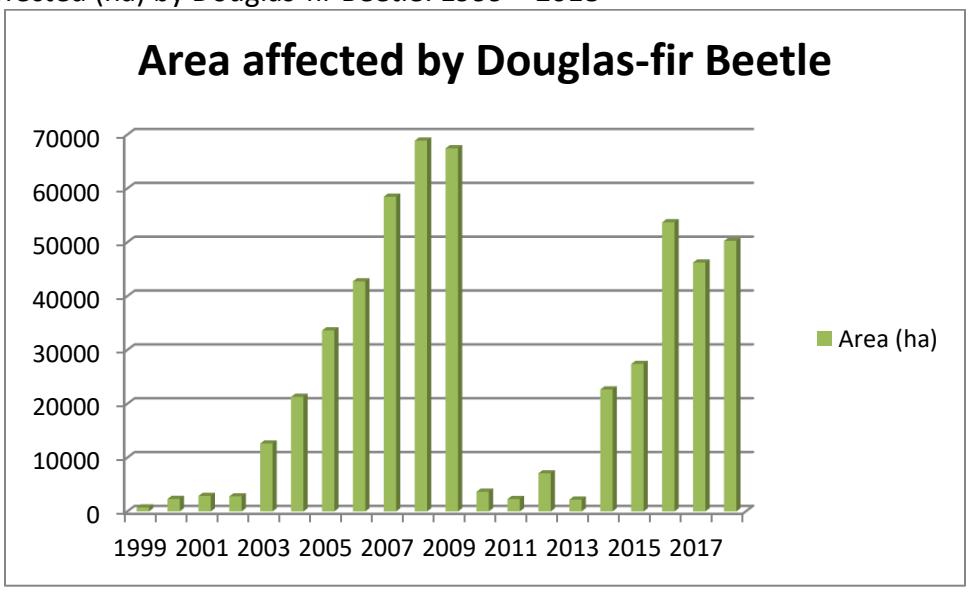
McLennan, D. 2003. Ecosystem restoration recommendations in areas affected by major salvage harvesting. British Columbia Ministry of Water, Land and Air Protection. Terrestrial Ecosystem Restoration Program, Victoria, B.C. Review draft.

Westfall J. & Brooks, J. 2001 Cariboo Forest Region Pests of Young Pine Stands: Incidence and Impact 1996-1999. B.C. Min. of For.

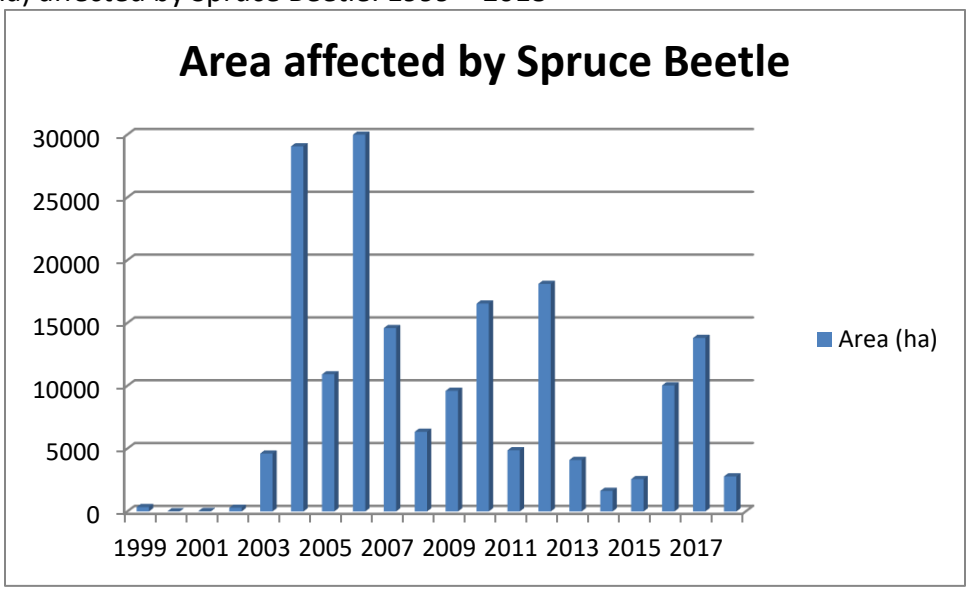
Woods, A.J. et al. 2010. Forest health and climate change: a British Columbia perspective. Forestry Chronicle 86(4): 412-417.

Appendix 1: Bark Beetle Population Trends 1999-2018

Area affected (ha) by Douglas-fir Beetle: 1999 – 2018

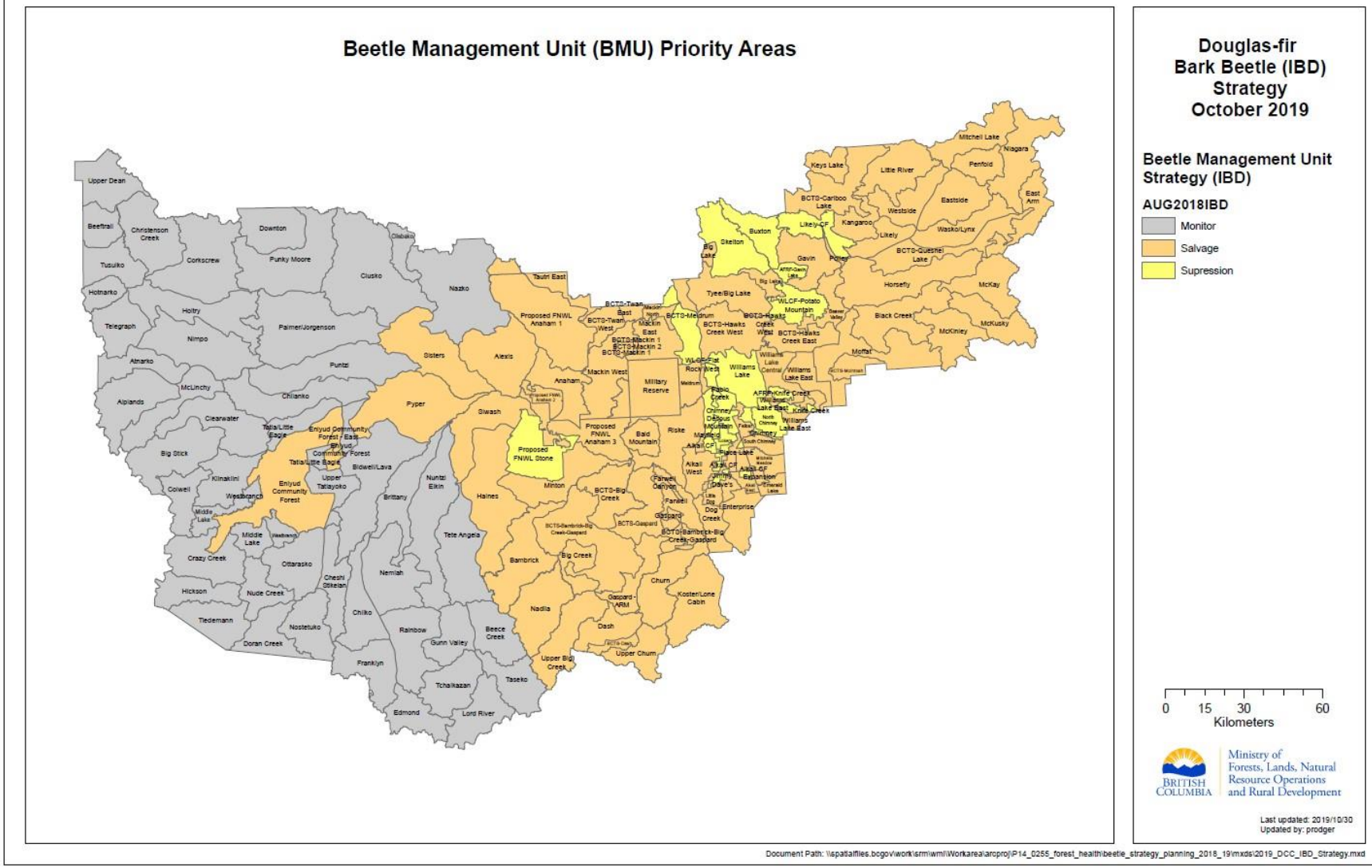


Area (ha) affected by Spruce Beetle: 1999 – 2018



Appendix 2:

Beetle Management Units and WLTSA Strategies


Beetle Management Unit (BMU) Priority Areas
Douglas-fir
Bark Beetle (IBD)
Strategy
October 2019
Beetle Management Unit
Strategy (IBD)
AUG2018IBD
Monitor
Salvage
Supression
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Kilometers
BRITISH COLUMBIA
Ministry of
Forests, Lands, Natural
Resource Operations
and Rural Development
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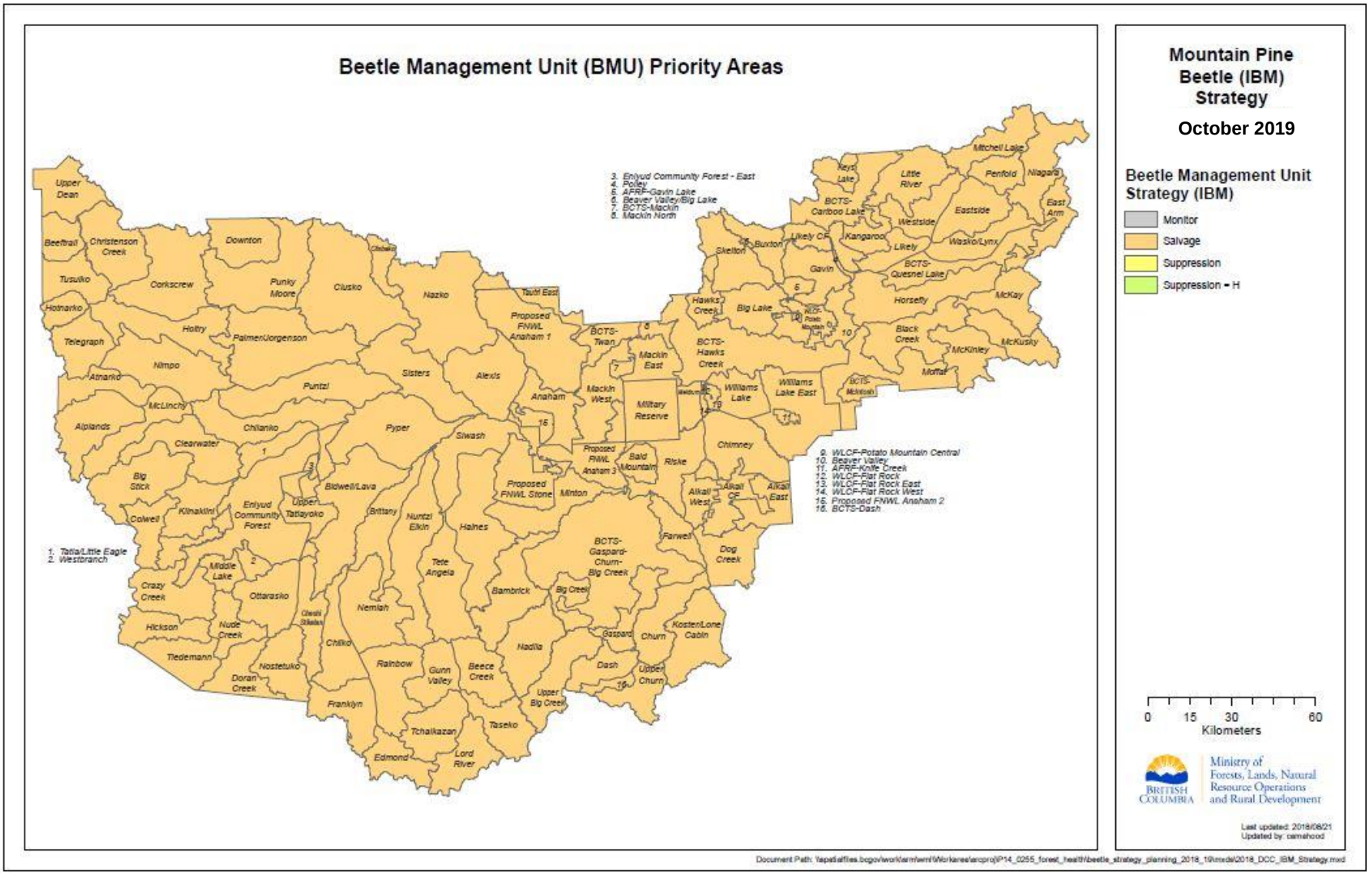
Beetle Management Unit (BMU) Priority Areas
Mountain Pine Beetle (IBM) Strategy
October 2019
Beetle Management Unit Strategy (IBM)
Monitor
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3. Eniyud Community Forest - East
4. Polley
5. AFRF-Gavin Lake
6. Beaver Valley/Big Lake
7. BCTS-Mackin
8. Mackin North
9. WLCF-Potato Mountain Central
10. Beaver Valley
11. AFRF-Knife Creek
12. WLCF-Flat Rock
13. WLCF-Flat Rock East
14. WLCF-Flat Rock West
15. Proposed FNWL Anaham 2
16. BCTS-Dash
1. Tatla/Little Eagle
2. Westbranch
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Kilometers
Ministry of Forests, Lands, Natural Resource Operations and Rural Development
BRITISH COLUMBIA
Last updated: 2018/08/21
Updated by: camehood
Upper Dean
Beeftrail
Christenson Creek
Tusulko
Hotnarko
Telegraph
Atnarko
Alplands
Big Stick
Colwell
Crazy Creek
Hickson
Tiedemann
Doran Creek
Nostetuko
Nude Creek
Middle Lake
Ottarasko
Kilnaklini
Clearwater
McLinchy
Nimpo
Holtry
Corkscrew
Downton
Punky Moore
Palmer/Jorgenson
Puntzi
Chilanko
Upper Tatlayoko
Eniyud Community Forest
Bidwell/Lava
Brittany
Nuntzi Elkin
Chilko
Nemiah
Franklyn
Rainbow
Gunn Valley
Tchaikazan
Edmond
Lord River
Taseko
Beece Creek
Nadila
Upper Big Creek
Tete Angela
Haines
Bambrick
Big Creek
Gaspard
Churn
Dash
Upper Churn
Kosten/Lone Cabin
Dog Creek
Farwell
Alkali West
Alkali CF
Alkali East
Chimney
Riske
Bald Mountain
Proposed FNWL Anaham 3
Proposed FNWL Stone
Minton
Siwash
Pyper
Sisters
Alexis
Nazko
Clusko
Anaham
Mackin West
Military Reserve
Mackin East
BCTS-Twan
Proposed FNWL Anaham 1
Tautri East
Hawks Creek
Big Lake
BCTS-Hawks Creek
Williams Lake
Williams Lake East
Skelton
Buxton
Likely CF
Kangaroo
Gavin
Likely
Westside
Eastside
Wasko/Lynx
BCTS-Quesnel Lake
Horsefly
Black Creek
McKinley
McKusky
Moffat
McKay
Penfold
Niagara
East Arm
Mitchell Lake
Little River
Keys Lake
BCTS-Cariboo Lake
BCTS-Mcintosh
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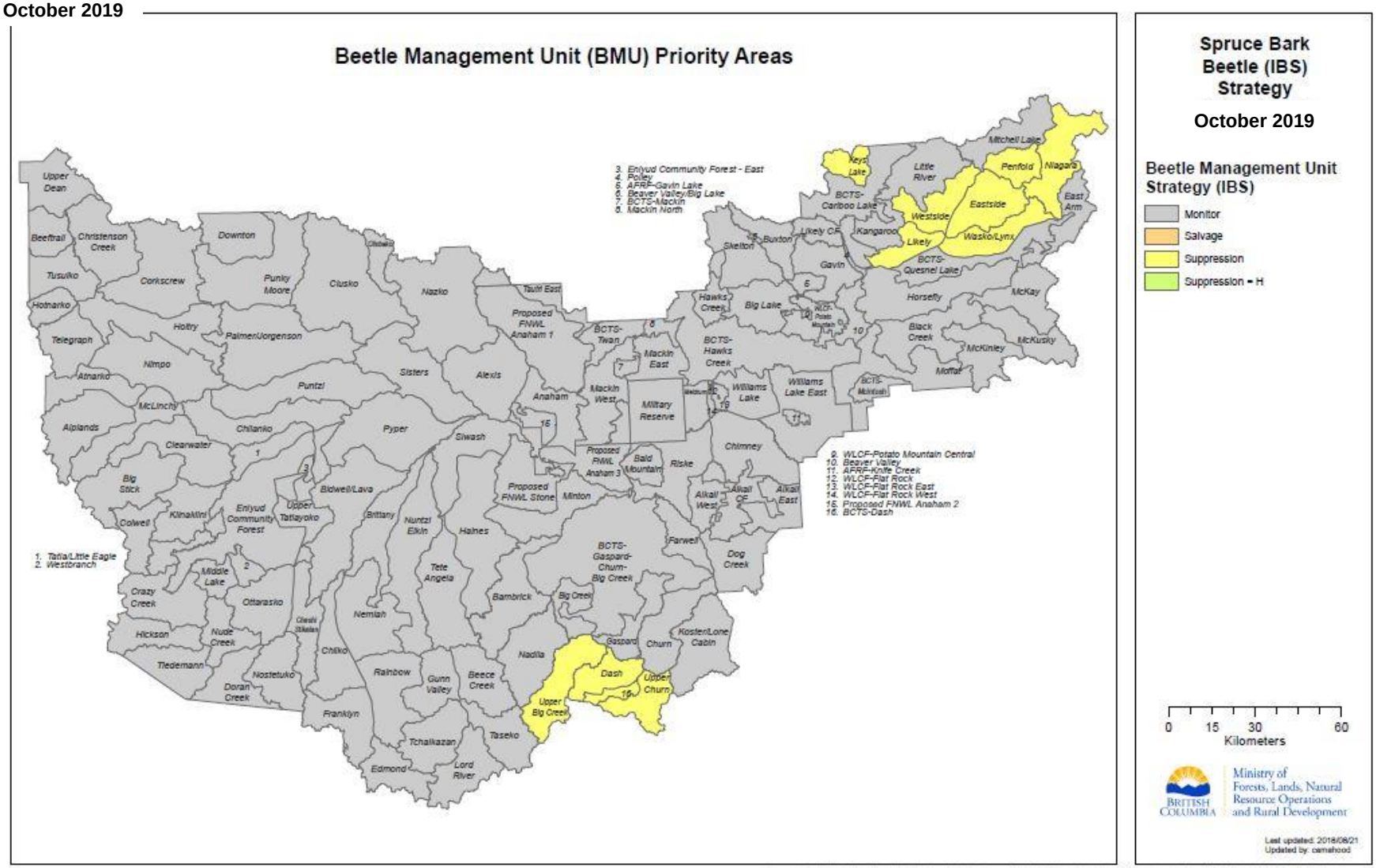

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