OMINECA REGION

GUIDELINES FOR ESTABLISHING CONVENTIONAL TRAP TREES

1 Background

Conventional trap trees are an effective and efficient method for the control of spruce beetle (*Dendroctonus rufipennis*) infestations. The spruce beetle itself, during endemic situations, prefers downed and dying, large diameter, spruce timber. Though they can be found in standing live mature spruce, the normal abundance of fresh blowdown timber is usually sufficient to maintain a static, endemic population. It is this situation that conventional trap trees attempt to emulate. In an epidemic situation, the task is much more difficult trying to attract the emerging beetles to a location where the timber can be removed and transported to a facility where the beetles are destroyed in the milling process.

2 Characteristics

The characteristics of trees that can be utilized for trap trees varies by location, but the same general rules apply. The spruce beetle is attracted to freshly downed, large diameter, spruce timber. They prefer the shadiest and coolest of locations on the tree itself, with room to expand their population. Trees that are branchy (open grown) provide the most suitable habitat since the branches themselves provide shade to the felled tree. Efforts must be made to keep as much branching remaining on the felled tree as possible. The advanced regeneration in the area should also be left intact along with other mature tree species. Preferably the first felled tree receives shade from the crown of the second felled tree lying on its bole and so on.

Individual trees must be felled in the direction where they will receive the greatest amount of shade for the longest period of time. Trees should not be resting on the ground but be close allowing attack to occur on the underside of the bole of the tree. The trap trees should be felled in small patches of 15 to 25 trees (truckload) spaced roughly 400 m along a roadway, on alternating sides of the road, if possible, close to known beetle infestations (~800 m, preferably less). This level of distribution should be sufficient for light to moderate populations. For heavier populations, spacing of a higher frequency is required such as every 200 m on alternating sides of the road. Freshly blown down spruce in a given area must be worked into the trap configuration as these provide the most ideal habitat, and may already have populations building in them.

3 Location

Conventional trap trees must be felled in close proximity to a known population that is confirmed to be emerging in the upcoming spring. This information is provided from a formal beetle survey, but can be determined by other means such as during block layout by experienced personnel. Trap tree patches must be located along a road or in an area easily accessible for transport, such as a cutblock edge near a road system.

Individual locations of patches must be GPS'ed and accurately mapped, with the number of trees felled at each patch recorded. Painted numbers on each tree to be removed is a good practice also, to ensure all intended traps are removed. Follow up monitoring will be required for these sites. This data should be entered into a tracking spreadsheet.

The spruce beetle has been known to infest debris piles, (stumps, tops etc.) and these sites must be included, utilized and addressed in a good trap tree program. These sites could be monitored similar to the trap tree sites and added to the tracking spreadsheet as they get burned or controlled in some other manner.

4 Timing

Conventional trap trees should be felled prior and as close to the beetle flight in the spring as possible. The beetle flight begins when temperatures in the canopy reach 16°C. This can occur as early as the first part of May. Monitoring is absolutely necessary to determine when the flight will occur. Snow levels, access and labour will have an impact on the timing. Trees can be felled as early as February, but their efficacy is very weather dependent, having the trees felled close to the flight ensures the best possible circumstance for control. The release of attracting pheromones from the felled tree dissipates as the weather warms and the tree decomposes. For an effective trap tree program, annual programs will need to be established in areas of known beetle activity.

5 Extraction and Disposal

All trap trees felled must be left in place until after August of the same year and then disposed of prior to the next year's flight. There remains a potential for a growing population to emerge from that tree prior to this time. Beetles remaining in the trap tree after August are likely committed to that host eliminating any chance of emergence. The trap tree patches should be skidded and hauled before snow levels preclude the absolute efficient cleanup of the site. Tops and branches and all other slash left after extraction must be piled and burned or effectively destroyed by some other means.

During extraction it is important to fell and remove any standing infested tree in amongst the trap trees.

6 Monitoring

Monitoring of the beetle populations in the surrounding timber as well as in the trap trees is essential to a good trap tree control program. Bark samples at various locations on the bole of the tree, throughout the summer, to capture life cycle data is considered good practice. To aid in determining the timing of the flight from the infested area to felled trees, pheromone traps could be used. Pheromone traps are very good at monitoring flights and not so much at control of a situation (details on data collection can be found within the *Omineca Region Guidelines for Spruce Beetle Haul and Mill Strategies*). Data collected from the sites must be recorded.

7 Precautions

- Care must be taken not to create an opening where the shade is reduced and barriers to beetle flight are decreased.
- Trap trees must be healthy and large in diameter.
- Do not limb or buck the trap trees.
- Where possible and in compliance with WCB regulation, avoid brushing regeneration around trap trees
- Trap trees felled must be treated by whatever means possible. Trap trees left untreated only exacerbate the problem.
- During sanitation harvesting and trap tree establishment, trees must be cut as close to the ground as possible since emerging beetles come from the very lowest part of the tree and stump.

8 Restrictions

- Do not fall trap trees in or into a riparian area, if there is a chance they may not get removed.
- Do not fall the trap trees too early in the winter where they may become covered in snow, or access may not be sufficient at time of extraction or disposal.

9 Other Similar Tactics

9.1 Log Decks

Winter felled wood can be left at roadside or landings through the spring flight. These decks can attract beetle, in spite of the fact they will not likely be in the shade. The outer logs will provide shade to the inner logs creating habitat for the flying beetles.

9.2 Trap Tree Trails

Where there may not be opportunity for the number of trap trees desired on a particular road system, narrow and long trails can be established into a stand where known infestations are occurring. Trails should be oriented to minimize the amount of sunshine the trees and the trail could receive throughout the day.

9.3 Pre-development

Pre development of blocks and road systems can be effective at controlling impending beetle flights. This option requires another level of planning and relies on several uncontrollable factors such as weather and lumber markets.

10 Consider

In known spruce beetle areas that are being harvested to control the beetle population, the brood emerging the spring after the winter harvest will be emerging from the stumps and slash in that cutblock. It is an acceptable practice to leave log decks on site (or trap trees) to attract as many of the flying beetles as possible before removing that wood for transport.

11 Expectations

- A trap tree plan in place for pre and post-harvest operations in spruce stands
- All trap trees felled will be removed or disposed of, ensuring no beetles emerging from intentionally downed timber.
- All trap trees felled will be marked in the field.
- Accurate locations of trap trees will be collected with the use of GPS
- Accurate reporting as to the location and numbers of trees felled and removed will be submitted through ESF, including all information included on the attached data dictionary, which can also be found at *\DMK\external\publish\SpruceBeetle*

REFERENCE:
Use of trap tree for Spruce Beetle Management in BC 1979-1984

For additional information on spruce beetle suppression, please contact your local FLNR office.

BRITISH COLUMBIA

OMINECA REGION

GUIDELINES FOR EXPEDITED AUTHORIZATION SUBMISSIONS

Authorization submissions for beetle suppression (trap trees, harvest, blanket salvage permits, forestry licences to cut, roads, etc.) will be expedited by Ministry staff. The onus is on the applicant to clearly articulate the situation that requires immediate attention. Should an area require timely harvesting or tree falling and removal, FLNR requires specific information to fulfill our requirements for First Nations Consultation and other planning processes.

Aerial Overview surveys (AOS) and government funded initial walkthrough surveys are preliminary spruce beetle detection surveys which are used to help us prioritize where to focus our efforts for spruce beetle information gathering and management.

The following points are to be considered.

1. Information provided

- government funded survey information
- AOS results
- susceptibility mapping

2. Survey specifics

- Size(ha), boundary, and pattern (spatial distribution) of the infestation
- Incidence and severity of the infestation measured by:
    - the % of spruce attacked in the last 3 years (i.e. 2015, 2014 & 2013)
    - life cycles present
    - attack densities and success of the attacking beetles and the vigour of the new broods as measured by a series of phloem samples
- The risk of beetle spread within (and adjacent) the stand based on stand susceptibility and beetle pressure
- Access, operability, and integrated resource management issues
- The *sanitation* and *salvage harvesting priority rating*
- The *necessity* for beetle management action within the stand

3. Additional information

- What information was required to properly plan this area? (First Nations concerns, stand maturity, OGMA's, etc.)
- Are the beetles scattered throughout the area or are they contained within a defined area, or have they spread out side of this area?
- What additional information did you collect? (on site data, stand data)
- Is there information missing?

Submissions for expedited authorizations must reasonably address, but should not be limited to:

- A defined extent of beetle found and the harvest boundary
- A description of spruce beetle lifecycles found
- A depiction of the location of the beetles and the severity/ attack intensity
- The sanitation and salvage harvesting priority rating for the area
- A summary of adjacent risks
- A description of access and barriers to access

For additional information on spruce beetle suppression, please contact your local FLNR office.

BRITISH COLUMBIA

BRITISH COLUMBIA

OMINECA REGION

GUIDELINES FOR SPRUCE BEETLE HAUL AND MILL STRATEGIES

1 Purpose

To establish uniform procedures for minimizing the potential escape of spruce beetle adults from infested spruce logs during storage, hauling and milling operations in **suppression beetle management units** in the Omineca Region.

2 Background

The success of sanitation harvesting is contingent upon expeditious extraction, transportation and processing of beetle-infested logs before newly developed adult beetles can emerge in the forest, escape from logs on landings/roadsides, from loads in transit, or from decks in mill yards. This 3-step process is only as effective as its weakest component. If substantial beetles escape from logs during their transportation or, especially, mill yard storage, the objective of expeditious sanitation harvesting has been largely wasted. **This is only relevant in suppression beetle management units**. Guidance is provided for licensees contemplating hauling and milling of beetle-infested wood during the beetle flight.

Lengthy restrictions may not be necessary or practical for a variety of reasons and this document outlines options for increasing flexibility in hauling and milling of infested trees under certain situations. This flexibility starts with the licensee monitoring the beetle development using a relatively simple methodology in order to further reduce the "no haul window" to an approximate 6 week period. This restricted period can be further reduced to approximately 3 weeks if short-term forecasted day time temperatures are monitored.

Plans to haul and mill infested wood during the traditional "no haul" window should be formulated at least 8 weeks prior to the planned hauling. If hauling and milling activities are to be conducted in more than one district, proponent licensees need to liaise with adjacent districts. Plans should consider, as a minimum, the information outlined in sections 6 to11. Particular attention should be paid to obtaining accurate and complete information to facilitate a risk assessment.

3 Assessing and Managing Risk

The potential benefits from hauling and milling beetle-infested wood during the flight must clearly outweigh the likelihood and magnitude of beetles escaping from logs around temporary storage areas, in transit, or especially around mills. The assessment of risk should consider an analysis of the environmental, economic and social risk of this activity. Where the risk is high, serious consideration should be given to not hauling and milling through the normal "no haul" window.

4 Potential Benefits

The reasons and benefits for hauling and milling beetle infested wood during the flight might be:

- a newly detected infestation in a previously uninfested area cannot be hauled and processed before the flight period starts. This area must have a high potential for spread wherein trap trees might not sufficiently contain emerging beetles;
- there has been an extended spring break-up and the licensee needs wood in the mill to keep it operating;
- hauling and milling during the flight leads to a net benefit in beetle management. The strategy could increase the capacity of licensees to utilize more beetle infested wood by harvesting in the season best suited for the site. Therefore, a better balance in harvesting infested summer and winter blocks is possible resulting in a net gain in beetle management;

5 Potential Risks

The likelihood and magnitude of risks should be considered for:

- economic impacts on the licensee or community, e.g., increased operating costs and increased deterioration of log and lumber quality through delays in manufacturing if the plan is not implemented;
- any operational barriers, e.g., a mill unable to process wood greater than a certain diameter that may impede the success of the operation;
- community concerns regarding past milling practices during significant infestations;
- any past beetle escape along haul routes or around mill yards. The potential spread of beetles in these areas should be heeded with consideration of the current attack status and the susceptibility of the surrounding forest;
- areas of high beetle susceptibility in sensitive land ownership categories (e.g., private land, parks, etc.) should be identified and considered, and
- how infested wood hauled out of the district will be handled.

6 Risk Assessment

An example of risk analysis is provided in Table 1.

Table 1. Example of Assessment of Risks of Hauling & Milling During Beetle Flight

Risks	Likelihood of Event	Magnitude of Consequences	Total Risks
Potential spread along:			
- haul route	Low	High	Moderate
- mill yard or temporary storage area	Moderate	Moderate	Moderate
Community Concerns:			
- problems with historic milling practices	High	Low	Moderate
- affect of proposal on private land	Moderate	Moderate	Moderate
- loss of public trust	Low	Low	Low
Licensee Concerns:			
- reduced revenue	Low	Low	Low

The above risks should be compared to the potential benefits of implementing the proposal:

- reduced licensee costs through increased access to summer wood;
- reduced beetle spread through improved sorting of infested wood; and
- improved licensee contingency plans to assess the risk around mill yards.

A plan to haul and mill infested wood during the flight could be made under certain conditions in order to reduce the potential moderate risks while realizing the positive benefits.

7 Contingencies and methods

- Infested logs can be marked and sorted prior to loading. Beetle-infested loads can be hauled to the mill without delay and processed expeditiously.
- No infested wood should be delivered to a mill when rapid processing cannot occur, e.g., excessive infested inventory may remain unprocessed because of a holiday.
- Harvesting, hauling and milling staff should be trained and delegated with the responsibility for ensuring the success of the plan. Clear instructions should be provided to all relevant personnel regarding the strategy.
- Scaling of infested wood should be managed in order to avoid unnecessary milling delays.

- A contingency plan should be developed as part of the risk assessment strategy to detect and treat spillover attacks within 3 km of mill yards and within 400 m (or other reasonable distance) of transportation corridors.
- If air temperature is monitored at the mill site, hauling can be suspended if flight threshold temperatures are reached (see Sect. 9).
- The licensee should track the processing times for infested timber, record the strategy's successes and failures and recommend solutions.

8 Monitoring beetle development and flight

The methods listed here should be used to monitor spruce beetle development and emergence in order to determine when the beetle flight period will occur. The companion monitoring system included in the following points is important to help distinguish the beetle flight period.

The following method describes the use of spruce beetle infested trees and Lindgren funnel traps for flight monitoring.

a) Select an area of spruce trees that contain active spruce beetle brood ready to emerge from successful attack the previous year or two years previous in your operating area. For licensees that have large operating areas, monitor as close to the harvesting area as possible. Selected trees should be representative of the typical beetle attack. More than one clump of 3 trees may be necessary for larger infestations or for infestations influenced by varying elevations, aspects, or proximity to waterbodies.

b) In late April, place 3 Lindgren funnel traps near the above attacked trees in order to attract the escaping beetles. All attacked trees should be harvested or treated after the monitoring period.

c) Start examining the Lindgren funnel traps when canopy temperatures are nearing the flight threshold of 16^{o}C. The hauling or storage of infested wood should be controlled when canopy temperatures near the flight threshold of 16^{o}C and spruce beetles are identified in the Lindgren traps.

d) Continue to graph the presence of adult beetles in the Lindgren funnel traps twice per week. The restrictions on hauling and milling of infested wood can stop two weeks after the beetle flight period has ended i.e. less than 30 beetles found in the traps.

9 Monitoring temperature

Determining the period of high beetle flight (in Sect. 8) will normally minimize the "no-haul" window. This period can be further reduced if hauling is regulated using the "**monitored temperature approach**" as per Table 2. This approach is based on the knowledge that temperatures can be accurately predicted up to 48 hours in advance by qualified weather technicians, and that spruce beetle have a flight threshold of 16°C.

Table 2. Temperature restrictions for hauling & storage of spruce beetle-infested wood

Daily maximum predicted temperature	Action
< 16° C	Store
16° - 25° C	Hauling only between 2300 - 0800 hrs.
25° C +*	No hauling

If the temperature is predicted to be less than 16°C on a particular day, then hauling infested wood can occur unimpeded through that day. If the temperature is predicted to range from 18° - 25° C, then hauling should only occur between 2300 and 0800 hours, and no infested wood should be stored after this period. If the temperature is predicted to exceed 25° C, then no hauling of infested wood should occur on that day

because 18° C can be exceeded during the night. It is important that if actual temperatures exceed predictions, particularly in the mill yard, then operations should be aligned with the actions outlined in Table 2. If the proponent uses the monitored temperature approach then air temperature needs to be monitored at the mill yard.

10 A method for licensees to monitor and track infested wood during the flight period

Licensees should consider the following information:

a) The volumes by cutting permit and forest licence that will be hauled and milled during the flight.
b) Document the benefits that may be derived and remember that these should clearly outweigh the risks.
c) Consider the following factors and decide how they will be managed during the period:
    - On-block sorting and harvest management of infested wood.
    - Forest susceptibility and attack status along the haul route(s) and around the mill yard.
    - Pre-existing inventories of infested wood in the mill yard and how hauling additional infested wood will affect milling.
    - Costs to the licensee of the traditional hauling and milling calendar date restrictions.
    - Scaling of infested wood.
    - Any other relevant factors that may affect the decision.

d) Consider how the above or any other factors combine to increase the risk of future spruce beetle spread.
e) Clearly describe the detection and treatment measures that your company will implement within a reasonable distance of the haul route and/or around the mill yard. These measures could include procedures for truck breakdowns while hauling infested wood.
f) Outline operational procedures and constraints that you will adopt to guide hauling and milling activities to minimize the risk throughout the flight period. Specify the methodology for monitoring the flight and explain whether or not the “monitored temperature approach” will be adopted.

11 Mitigation measures

To reduce the risk and liability of hauling and milling beetle infested wood at a processing plant during the beetle flight, the licensee may consider any of the following contingencies or combinations of them depending on the level of risk associated with the operation.

- If beetle infested wood is hauled during the beetle flight, logging truck drivers should be instructed to ensure uninterrupted transportation from the block to the mill site.
- If an interruption occurs due to a truck breakdown or for any other reason, the mill owner should be notified and treatment plans can be formulated to address the additional risk associated with the incident.
- If beetle infested wood is transported outside the forest district boundary, the forest districts enroute to, and the receiving forest district, must be consulted prior to commencement of transport to ensure relevant concerns are addressed.
- During winter operations, beetle infested wood can be sorted. Non-infested volumes can be separated for transport during the beetle flight.
- Infested wood should not be stored at storage sites or in the mill yard during the beetle flight, but should be hot-milled immediately**.**
- All beetle infested wood brought to mill yards should be processed prior to the beetle flight unless mitigation measures are employed.
- Any infested wood hauled during the flight should be done via the "monitored temperature approach."
- During the spruce beetle flight period, non-infested and/or non-host species should be transported and milled.

- Placing infested logs at the bottom of decks and packing them with snow can retard beetle development and "buy time" if there are excessive inventories requiring priority milling.
- Stakeholders living in proximity to mill yards and hauling corridors should be advised of the risk and probable consequences of beetle escape.
- A plan should be developed as part of the risk assessment strategy to detect and treat any spill-over attacks within 3 km of each mill yard or storage area.

The licensee should consider the varying levels of risk associated with each mill site or storage area. Use of the monitored temperature approach and an appropriate array of mitigative measures should lessen the risk of beetle escape.

For additional information on spruce beetle suppression, please contact your local FLNR office.

OMINECA REGION

SPRUCE BEETLE BENEFICIAL MANAGEMENT PRACTICES

1 Introduction

The purpose of this document is to outline beneficial management practices (BMPs) to mitigate the impact of spruce beetle on the midterm timber supply and to maintain ecosystem functions.

Spruce is an integral part of forested ecosystems throughout Omineca Region's parks, protected areas and special management areas including, but not limited, to wildlife habitat areas, caribou habitat, old growth management areas and wildlife tree retention areas. Given the importance of spruce to the region's forests and to the Omineca mid-term timber supply, any threat is of substantial concern.

Spruce beetle BMPs are determined to be effective means of preventing or reducing spruce beetle population growth. Beneficial management practices outlined in this document are comprised of particulars from the *Bark Beetle Management Guidebook (1995),* guidance from FLNR wildlife and ecosystem specialists, and are reflective of ongoing discussions with Spruce Beetle Working Groups in Prince George and Mackenzie.

Beneficial management practices are a key piece of the Ministry's ongoing strategy for mitigating impacts of the current spruce beetle outbreak.

2 Background & biology

- The spruce beetle (*Dendroctonus rufipennis*) is native to British Columbia and is regularly seen in forested areas, but higher-than-normal populations of spruce beetles have been detected in the Omineca region.
- FLNR has been actively identifying tree stands that demonstrate an expansion of spruce beetle populations.
- More than 156,000 hectares of forest in the Omineca region are currently infested by spruce beetles, primarily in the southern areas of the Mackenzie Timber Supply Area and the northern portion of the Prince George Natural Resource District, in the Prince George Timber Supply Area.
- The ministry will continue to work with forest licensees and other stakeholders to identify affected areas, evaluate population control methods and determine the most effective ways to limit the current outbreak.
- The B.C. government is closely monitoring the situation to minimize any impacts on ecosystem health, timber supply, the forest industry, and forestry jobs.

3 Detection

Aerial detection of trees affected by spruce beetles can be challenging. An infested host tree does not immediately display crown signs of stress or impending death until 13-15 months after being successfully attacked. Trees can go from healthy green crowns to fallen needles within a few months.

3.1 Spruce beetle susceptibility mapping

Susceptibility maps, generated by FLNR, display stand susceptibility to spruce beetle attack and not current beetle populations. These maps are to focus surveys and subsequent treatment in areas with higher likelihood of epidemic populations. They do not validate immediate harvest.

The hazard rating process can indicate where substantial losses can be expected to occur if spruce beetle populations rise to epidemic levels. This valuable planning tool identifies those stands that are highly susceptible to attack. Hazard rating considers stand age, basal area, stand density, and elevation.

High hazard stands have:

- an average spruce dbh greater than or equal to 41 cm
- a spruce volume exceeding 300 m³/ha
- more than 65% spruce content in well-drained creek bottoms

In general, the hazard hierarchy for spruce stands are:

1. stands in creek bottoms
2. better stands of spruce on benches, slopes, and high ridges
3. poorer stands on benches, slopes, and high ridges
4. mixtures of spruce and lodgepole pine
5. stands containing all immature spruce

Detailed information on the new system for calculating beetle susceptibility can be found in Appendix C.

3.2 Aerial detection

Spruce beetle incidences are identified by FLNR as part of yearly provincial, high level, fixed wing aerial forest health surveys known as aerial overview surveys (AOS). These flights occur at a time that is optimal to examine a number of forest health indicators.

However, the typically late summer fall timing of these flights limits the ability to effectively mobilize ground surveys prior to snowfall. Therefore detailed FLNR heli-GPS aerial surveys, by helicopter, should be conducted during the prime detection window (after the needles change colour from previous year's infestation) to gather the most accurate and timely information.

FLNR combines knowledge from these flights with susceptibility mapping to generate maps. These maps are used to identify where ground surveys are required not to validate the presence of grey trees (where beetle have come and gone) but more importantly the full extent of currently infested trees.

3.3 Ground detection

3.3.1 Walkthroughs are non-systematic preliminary ground reconnaissance. They determine:

- the size and spatial distribution of the infestation
- access, operability, and integrated resource management issues
- the necessity to obtain further information through probes

3.3.2 Probes are systematic and detailed secondary ground reconnaissance surveys that provide precise estimates of extent and concentration of the spruce beetle attack in currently attacked trees, as well as sufficient information to stratify an area for various management actions. Ground data can also be used to determine if the population is on a one-year or two-year life cycle which will impact the timing of treatments.

Licensees or FLNR contractors perform walkthroughs and/or full scale probes in areas identified as priorities using methods outlined in the *Spruce Beetle Ground Survey Guidelines* established for the Omineca Region.

Data gathered from probes may be necessary to clarify management alternatives and provide sufficient information to stratify the area for various treatment actions. A treatment decision, as part of total chance planning for the area, is then developed based on the nature and intensity of the infestation and pertinent stand factors, such as spruce component, susceptibility and operability context.

3.3.3 Cruising is conducted to assess the merchantability and value prior to harvesting. Although spruce beetle presence can be determined from a cruise the latter cannot replace walkthroughs and/or full scale probes as they are 1) not detailed enough, 2) not designed to record beetle severity and multiple-year attacks, and 3) are seldom conducted by sufficiently experienced beetle classifiers. Therefore, probing should not be conducted in conjunction with cruising, nor should cruising precede a walkthrough or probe.

4 Beetle management units

A beetle management unit (BMU) is a planning and reporting unit for operational beetle management to facilitate the implementation of beetle management activities. BMU boundaries are customarily congruent with the boundaries of Landscape Units. Resource management objectives should be consistent throughout the unit.

Suppression: Objective is to reduce populations and maintain them at a relatively low level. Target is to treat >80% of known infestation centers in the first and subsequent years. All harvest and treatment is directed at spruce beetle infested trees (sanitation)

Holding: Objective is to maintain the infestation to a relatively static level by treating ~50-79% of known infestations in each year. That is, the level of harvest and/or treatment is equal to the rate of infestation expansion. Harvesting should be concentrated in infested trees with live spruce beetle.

Salvage: Objective is to salvage for value recovery as the highest priority. Holding the infestation static may 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 dead stands prior to significant degrade.

Monitoring: Objective is to only record the change in attack level with no beetle management being attempted. Periodic field checks should be completed to determine if beetle attack has occurred, or if a known endemic population is growing.

5 Spruce beetle suppression options

Various control strategies are used in concert to suppress spruce beetle populations. These strategies focus on sanitation versus salvage. Choice of management strategies for spruce beetle depends upon:

- the size and pattern of the infestation
- severity of attack in each of the last three year
- vigour and survival of the new broods
- the stand hazard
- integrated resource management issues/constraints
- existing and future access
- harvesting operability
- resources available for detection and treatment

5.1 Trap trees

Trap trees can be ten times more effective than standing healthy unbaited spruce at attracting spruce beetle.

5.1a Conventional trap trees are deployed to:

- contain emerging beetles in cutblocks prior to sanitation logging
- protect adjacent healthy timber or reserves
- "mop-up" beetles emerging from adjacent lightly infested stands or stumps and slash following sanitation logging

Conventional trap trees should be routinely felled every year in areas identified primarily as spruce beetle harvesting in order to continually reduce the spruce beetle population. Trap trees can be deployed as patches, decks, strips and or pre-felled landings and rights-of way. Once the traps become infested, they must be removed or otherwise treated before the brood matures to attack new hosts. Refer to *Use of trap trees for spruce beetle management in BC 1979-1984, Pest Management Report #5* and Section 41 of *FRPA Forest Planning and Practices Regulation* for more information.

5.1b Lethal trap trees are not available at this time and unlikely to be available prior to 2017 or 2018. Two research trials are ongoing to identify and test suitable lethal trap tree agents.

5.2 Sanitation harvest

Sanitation harvesting for spruce beetle suppression maximizes the extraction of infested spruce stands with adult and young beetles in order to reduce the existing population and to prevent their spread. The highest priority should be given to stands with high levels of new attack, high hazard, and a high risk of spread. Smaller infestations can be addressed using a Blanket Salvage Permit. Recent guidance from Tim Sheldon, Deputy Minister, was provided to inform licensees and districts of the recommended application of this tenure tool.

Trees infested the previous year by beetles on a 2-year life cycle can be pre-felled the following summer to significantly reduce beetle emergence for hibernation (when the beetles travel to the root collar for winter) prior to winter logging.

5.3 Pheromones

Synthetic pheromones mimic the chemical signals beetles emanate when initially attacking a susceptible spruce tree. Pheromones can be effective at drawing in large number of beetles; this is beneficial to suppression efforts only when the attracted populations are subsequently exterminated as noted in Section 41 of *FRPA Forest Planning and Practices Regulation.* It should be noted that pheromone suppliers do not keep large quantities on hand because of shelf life. As such they require sufficient notification to manufacture the products.

The use of semiochemical tree baits in 50 m x 50 m grid patterns in spruce beetle infested stands is a temporary holding tactic until sanitation harvesting is completed. Grid baiting should be installed by no later than mid-May before the beetle flight (May) on cutting permits scheduled for harvesting in the following fall/winter. The recommended density of baiting is four baits per hectare.

Baiting costs are recognized as a "Forest Management Administration" cost to the Interior Appraisal Manual.

When to consider using pheromones:

- pheromone-baited Lindgren traps adjacent to log sort yards and mill sites to see if any new adults are escaping from infested logs in the yard
- smaller, distinct blocks having a light scattered attack with no heavily infested patches
- stands where sanitation harvest is clearly scheduled to occur at the soonest opportunity after the beetle flights and before emergence for hibernation

5.4 Fall and burn/ fall and peel

Handfalling, bucking, or debarking and burning of actively infested spruce trees are valid and effective control strategies for small inoperable or isolated infestations. Although this option is the only one currently available for treating infestations in inoperable areas, it is unlikely to be implemented frequently due to the expense, and worker safety concerns.

5.5 Salvage harvest

Salvage harvesting is primarily conducted to recover damaged timber before it loses wood product value ("shelf life"). These trees no longer have any living broods and therefore, this tactic does not reduce spruce beetle populations. It is, however, the first step in returning the site to increased forest production and recovering spruce trees killed by spruce beetle before the wood becomes unsuitable for primary manufacturing as timber. Salvage is not the foremost priority in Omineca at this time. The shelf life of dead spruce for sawlogs is less than lodgepole pine, estimated to be approximately 5 years.

6 Prevention

Preventing the increase of spruce beetle numbers before they become epidemic. Prompt salvage of spruce blowdown must be an ongoing practice in highly susceptible spruce ecosystems.

6.1 Scaling

Log scalers and weighpersons play a key role in identifying infestations in load deliveries and sample loads as well as identifying and determining beetle infested storage and inventory capacity.

6.2 Hauling and milling restrictions

Spruce originating from the Omineca should be treated as infested unless otherwise verified.

Restrictions on hauling and milling of spruce beetle infested logs are occasionally necessary. If hauling occurs at the beginning and end of the spruce beetle flight, night hauling may need to be utilized, and logs milled within before daytime temperatures reach 16°C. Restrictions, if required, would apply during the beetle flight period from Mid-May to Mid-August.

6.3 Utilization

In spruce beetle sanitation-logged areas long butts, tops greater than 10 cm in diameter, decked logs, and stumps may contain spruce beetle. Maturing beetles will emerge to attack new hosts unless the infested material is burned, removed and milled, or otherwise treated.

- stumps should be cut as low as possible
- a 10 cm diameter top utilization should be used and all tops be scattered on the block or piled and burned on landings
- long butts (if permitted) should be piled and burned on suitable landings or elsewhere
- all recently killed host material such as larger broken tops, spilled logging loads, and recent edge blowdown should be removed before they are attacked

6.4 Reduce windthrow events

Windthrown spruce during endemic and epidemic spruce beetle populations should be managed to prevent beetle population growth.

Given spruce's susceptibility to windthrow (in large part due to its relatively shallow rooting and large sail-like crown), care must be taken to mitigate the risk of future windthrow from spruce beetle infested stem removal from an area. Use small patch (<1 hectare) removal wherever possible. For active infestations larger than 1 hectare, ensure prevailing wind direction, topographic features and edge feathering are considered and incorporated into block design and layout.

7 Spruce beetle management options in special management areas

Suppression options vary considerably between these constrained areas given their unique nature, designation, composition and function. Any cutting or harvesting in constrained areas should be considered as part of a total chance plan for the area. Spruce beetle suppression strategies utilized in a particular special management area must meet the objectives of the order in place for that specific unit.

7.1 Operational options in special management areas

Special management areas include: Old Growth Management Areas, Landscape Biodiversity Areas, Critical Fish Areas, Fisheries Sensitive Watersheds, Wildlife Habitat Areas, and Ungulate Winter Range.

Beetle management in areas spatially identified to manage for 'other forest values', or classified as a special management zone, is designed to balance the needs to suppress beetle populations that pose a significant risk with the need to maintain the special values. These BMPs address suppression treatments in "no-harvest" areas as well as areas that permit harvesting with restrictions, such as Fisheries Sensitive Watersheds. These BMPs do not supersede existing guidance as per Government Action Regulations (GARs) and associated General Wildlife Measures (GWMs) and Objectives, or FPPR Section 7 Notices for species at risk or ungulates.

In this section, "No-harvest" suppression methods refer to beetle control methods where no trees are removed from the stand. In comparison with sanitation harvesting, bark beetle suppression using trap trees has less ecological impact on old forest values and reduces collateral loss of green and dead trees.

7.2 Trap trees in special management areas

- Place trap tree sites outside of special management areas.
- Place trap tree sites along existing roads or skid trails.
- Avoid falling trap trees within riparian areas.
- Non-target volume removal of trees greater than 27.5 cm dbh for access and damage must be limited to 10% or less of the trap tree volume felled within a special management area.
- Use small, well distributed trap tree sites wherever possible. It is usually preferable to use more small well distributed sites than fewer large sites.
- Select, fall and remove trap trees carefully to minimize damage to residual trees.

8 Setting priorities

Timelines and resources compel the need to prioritise efforts in terms of probability and impact. Each incidence of spruce beetle attack needs to be assessed in terms of extent, intensity and vigour, and therefore the risk that it presents. Variables to be considered in determining risk include:

- current size of the population
- population trend – is it increasing, decreasing or stagnant?
- is attack of new hosts successful or not? (trees 'pitching out' the new adults?)
- spruce component in the stand and its susceptibility (as % of basal area)
- spruce component in adjacent stand(s) – potential for spread.

A recommended hazard/risk assessment procedure can be found in Appendix C.

The Sanitation and Salvage Harvesting Priority Rating, as determined using the tool developed by FLNR Regional Forest Entomologist, in concert with the spruce beetle probe card (FS 1111) or the compass and traverse sheet (FS 375) will be highly useful for this application.

For additional information on spruce beetle suppression, please contact your local FLNR office.

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APPENDIX A: TIMELINES

This table provides a time horizon by which to plan beneficial management practices.

- Beetle flight begins when beetles have matured and canopy temperatures reach 16^{o} C or higher.
- Trap trees are most effective when felled as close as possible to the begining of the flight window.
- All harvested/felled wood with active beetle, including infested trap trees, are moved to a mill yard, processed and/or disposed of prior to the next flight to minimize the spread of the beetle.

Stage/Month	S	O	N	D	J	F	M	A	M	J	J	A
Detection flights												
Ground walk through and probing												
Trap tree removal or burning												
Log deck removal												
Possible beetle flight window												
Trap tree falling												
Hauling restrictions												

APPENDIX B: SPRUCE BEETLE HARVEST INDEX

Sanitation harvest index = (A + B + C) x D
A = % most recent attack in stand
B = % 1-year-old attack in stand/1.5
C = % 2-year-old attack in stand/2.0
D = total % of healthy and attacked spruce in stand

Sanitation harvest index	Recommendation
0-599	Leave (monitor, trap trees, baits, etc.)
600-999	Probe to obtain more precise information
1000+	Operational cruise prior to sanitation harvest

APPENDIX C: SPRUCE BEETLE HAZARD AND RISK RATING

Hazard rating of stand susceptibility considers factors of: site quality, stand age, proportion of susceptible basal area, and stand location, density, and growth rate.

To determine stand hazard, the following formula is applied:

$10 \times (Q \times A \times P \times L \times S_2) \times 0.5$

Where the formula factors are:

Q = Site quality (good = 1.14; medium = 0.60; poor = 0.27)

A = Age (> 120 = 1.21; 100-120 = 0.74, <100 = 0.07)

P = Proportion of susceptible basal area

= (basal area of spruce $\geq$ 17.5 cm)/(basal area of all species $\geq$ 12.5 cm) x 100

L = Location

= (24.4 x absolute longitude) - (121.9 x latitude) - (elevation (m)) + 4408.1)

S_2 = Stand density and growth rate (see the following link to calculate):

Hazard ratings can be used to set priorities for surveys and treatments and may be used during the preparation of site plans as a tool in preventative management. Stands with high hazard and risk values have a high priority for management.

https://www.for.gov.bc.ca/ftp/hfp/external/!publish/barkbeetles/New%20Susceptibility%20Ratings/Documentation/SB_Hazard_Rating_Documentation_version1.2.doc

Task	Update	Progress
Coordinated plan for spruce beetle in Omineca	**Upon request from FLNR: Forestry Licensees presented 20 recommendations to FLNR to address issues that might impede success** • FLNR will be drafting a government response to the recommendations to provide answers, information on ongoing efforts, and indicate where additional discussion between government and licensees is required (end of May)	On track
Spruce beetle project manager, $1 million for detection and research 2016/17, public advisory committee	**Public advisory committee list has been finalized** • Candidates to be contacted this week • Committee will review and advise on the 20 recommendations and government response **Research trials on the efficacy of traps will begin this spring**	Was waiting for industry response. Full speed ahead now.
Suppression efforts	**Nearly 5,300 ha are being treated with trap trees this spring** • This represents excellent coordination between FLNR and industry as well as significant effort on behalf of licensees **Blocks to harvest spruce with live beetle are planned for next harvest cycle**	On track
Optimal knowledge management	**Omineca is on the leading edge of this outbreak. We are sharing methodologies and protocols with other BC regions and other provinces.** • New Brunswick contacted us this past week as they have an increasing population **Planning a "Spruce Beetle Summit" (Summer of 2016)** • Bring together experts from Canada and the US for knowledge exchange and insight into ongoing research • BC to provide training opportunities to provinces in need	On track

Spruce Beetle Update
April 18, 2016

Spruce Beetle Outbreak -Update

May 2016

Outbreak confirmed

A spruce beetle outbreak was confirmed in Omineca Region in October of 2015.
Elements of an outbreak:

- Significant # of hectares impacted; 156,000 ha for Omineca
- Beetle present in both one and two year life cycles
- Beetle successful in attacking large and small diameter spruce
- Populations are increasingly severe

Responsibilities during a spruce beetle outbreak

FLNR: Detection through annual aerial overview surveys, helicopter surveys, and ground surveys.

Licensees: Treatment through conventional trap trees, targeted harvest. Planned hauling and milling of infested timber to reduce spread.

FLNRO Detection (2015-2016 fiscal)

- $250,000 aerial surveys
- $500,000 ground surveys

TSA Working Groups (operations)

Working groups were established for both the Mackenzie and Prince George TSAs in 2015 with the primary focus of using the detection information from FLNR to prioritize treatment. Working groups bring licensees and FLNR to the same table for collaborative planning.

- 5,300 ha was treated in the spring of 2016 with trap trees
- 4,680 ha harvested removing 226,000m^3 of spruce trees with live beetle during the 2016 fiscal year

Omineca Working Group (strategic)

Licensees impacted by the outbreak reviewed the direction from government (BMPs, expectations, guidelines) and developed recommendations to government to support suppression.

- Licensees will share operating areas where necessary
- FLNRO will provide a formal response document that will outline ongoing efforts, options/decisions/choices/results/findings

Public Advisory Committee

The first meeting of the Omineca Spruce Beetle Public Advisory Committee will occur June 15th. This group will review direction from government and recommendations from licensees and provide advice on forestry and non-forestry values of importance to the citizens of British Columbia.

- Academia
- FN
- Community Forests
- Local governments
- NGOs
- Commercial recreation users (guide outfitters)
- Non-commercial recreation users (hunters)

FLNRO Removing Barriers

- Tenures, Competitiveness & Innovation investigating tenures and pricing options
- Newly developed survey methodologies will eliminate redundancy and costs to licensees to capture data necessary for expedient treatment
- Will conduct extensive heli surveys with licensees to identify areas for suppression harvest
- Engineering branch analysing infrastructure needs to access impacted timber
- Working with BC Parks to establish trap trees within parks and safeguard values with adjacent harvest opportunities
- Expedition of authorizations, extension with FN for trap trees
- Field trials on new pheromone attractants and experimental horizontal traps

> Chief Forester, Diane Nicholls - *BC has not seen a spruce beetle outbreak of this magnitude in decades. Government has provided direction to forest licensees to target spruce beetle suppression while respecting mid- term timber supply needs and non-timber values. This will result in harvest of spruce with ground confirmed living populations of beetles and the use of trap trees on the landscape. It is my expectation that FLNRO will continue to build strong connections with industry and the public to mitigate impacts from this outbreak and work as a team together for best results. It is important to maintain integrity, consistency and science in our collective approach on sanitation harvests.*

Knowledge Management

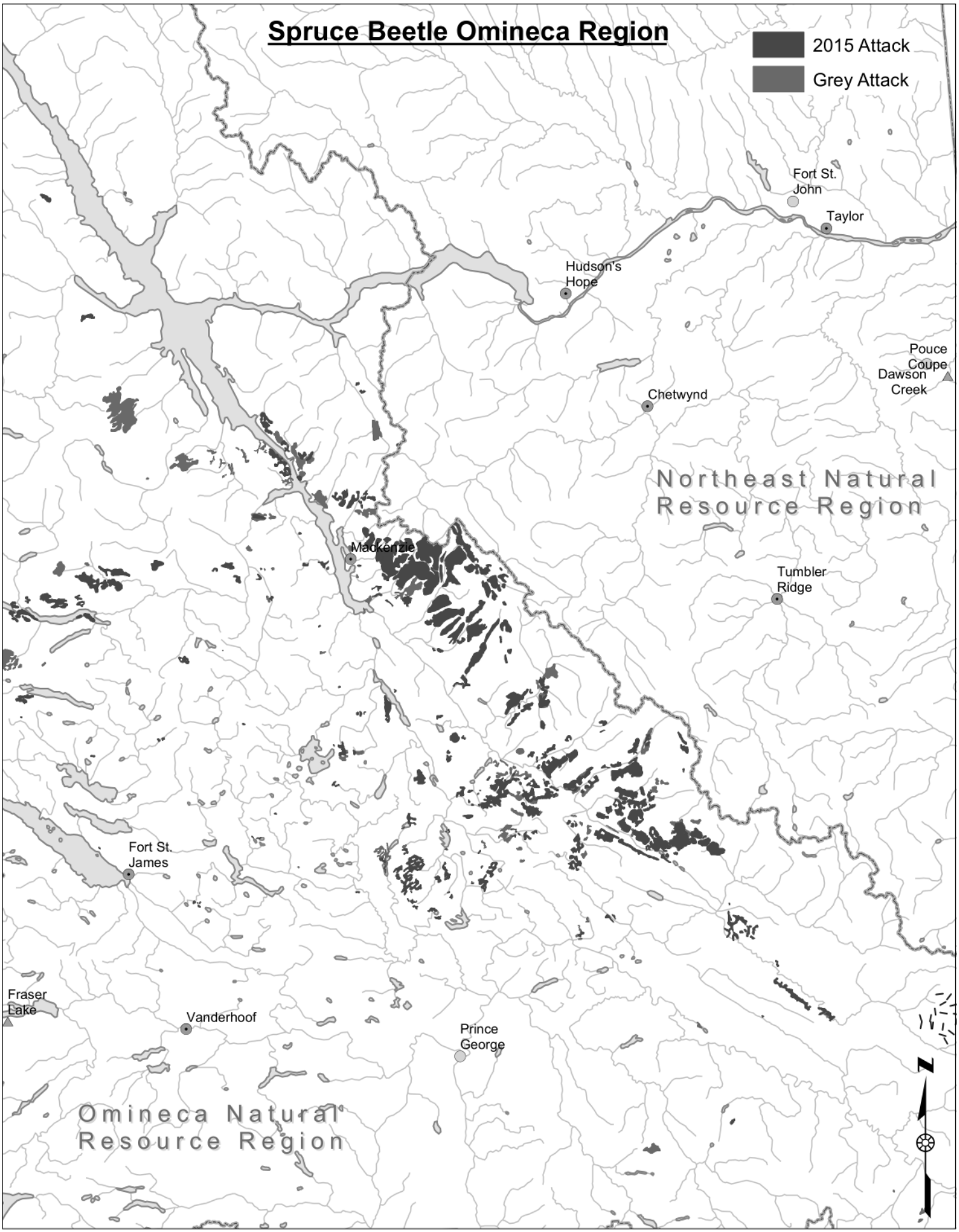
Spruce beetle outbreaks usually last 7 years; we are in year 3 in Omineca. There is a small window to mitigate impact by thoroughly and judiciously applying tactics at population epicentres. Industry, stakeholders, and government need to capture, develop, share, and effectively use knowledge for success.

- Recalling retired FLNRO staff (contract/emeritus) & connecting with Beetle Bosses from MPB outbreak to learn from the past
- Hosting a summit in 2016 to bring together North American experts for BC to gather information on new research or successful operational techniques and for BC to provide training to other provinces experiencing spruce beetle population growth
- Durable products and processes developed for Omineca are provincially relevant therefore shelf-ready for other regions
- Reaching out to all NRS staff to increase knowledge of the outbreak to better integrate with their clients and communities

Attachments:

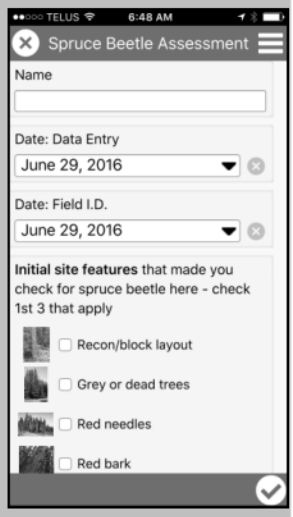
i. *Omineca Region BMPs for Spruce Beetle (FLNRO)*
ii. *Recommendations from Impacted Licensees and BCTS to Government for the Management of Spruce Beetle in the Omineca Region*

Spruce Beetle Omineca Region



Spruce Beetle Outbreak
June 2016 Update

Engagement Success



Crowd Sourcing App in alpha test version FN and the public were asking for a way to report spruce beetle sightings. Megan Fong and Andy Muma (Smithers FLNRO) are developing an app for users to report and see their report incorporated, in real time, to a provincial map tracking the outbreak.

Community Learning Series is ongoing Darin Hancock (Mackenzie FLNRO) is offering 1/2 day workshops for local government, FN, and FLNRO offices that take participants through the factors of this outbreak and into the field to see the infestation in standing and trap trees.

Omineca Public Advisory Committee had their inaugural meeting in June. The group will review existing planning documents from FLNRO and Industry. In the fall the committee plans to host a meeting with FLNRO and Licensees to discuss advice to be heeded as the outbreak continues.

Knowledge Growth and Management

Field trials are ongoing in Omineca to investigate shelf life of impacted spruce, efficacy of conventional trap trees, and trials of new pheromones.

Spruce Beetle Summit planned for fall to bring together North American spruce beetle specialists to Prince George to appraise lessons learned or unfamiliar approaches from historic outbreaks and for FLNRO experts to share the progressive strategies/planning/detection/research developments being applied in B.C.. *FLNRO is recognized as a leader in detection, treatment, and collaboration. Government reps from Nova Scotia and Alberta plan to attend for face to face advice and training.*

New ground survey techniques are being developed cooperatively for the PG and Mackenzie TSAs. These new techniques, to be employed in Omineca this fall, will reduce existing time delays from detection to treatment. The days or weeks gained will improve treatment success considerably.