# SPRUCE BEETLE DOCUMENT SERIES

## OMINECA REGION

***VERSION 3: JUNE 2017***

This compendium is a complete set* of existing documents provided to Mackenzie and Prince George TSA spruce beetle working group members during the period of May 2015 to May 2017.

Additional information and maps on the Omineca outbreak can be accessed through the government website. TSA specific survey results, BMU information, meeting minutes, and research findings can be accessed through local FTP sites.

** fact sheets, government strategy, expectations, beneficial management practices, guidelines*

# SECTION ONE

# PUBLIC INFORMATION

# NEWS RELEASE

For Immediate Release
2016FLNR0030-000371
March 11, 2016

Ministry of Forests, Lands and Natural Resource Operations

**British Columbia government acting on spruce beetle**

PRINCE GEORGE – In response to recent increases in the spruce beetle population, the Ministry of Forests, Lands and Natural Resource Operations is committing $1 million and has designated a spruce beetle manager to work with First Nations, local communities and stakeholders to develop a regional spruce beetle management plan.

The spruce beetle (Dendroctonus rufipennis) is a common forest pest that normally feeds on the inner bark of weakened or fallen spruce trees, but is capable of killing healthy trees if the infestation is sufficiently serious and prolonged. Spruce beetle outbreaks occur regularly in British Columbia and have historically lasted up to seven or eight years.

The current infestation has affected 156,000 hectares of forest in the Omineca region, specifically the eastern valleys of the Mackenzie timber supply area and northern portions of the Prince George timber supply area. This is a significant increase from the 7,653 hectares affected in 2013 and is the largest spruce beetle outbreak since the 1980s.

Recent weather patterns, including warm springs, dry summers, warm winters and windstorms (resulting in more tree blowdowns), have contributed to the increase in spruce beetle populations in the region. The Chief Forester is monitoring the situation to help ensure a balance between maintaining the mid-term timber supply, requirements of other resource values, such as wildlife habitat and the need for sanitation control of the spruce beetle.

The insects are native to British Columbia, so it's not unusual to see them in the province's forested areas. The Omineca region contains 9,018,763 hectares of forest, with 4,728,782 hectares available for logging.

The funding of $1 million for 2016-17 is in addition to the $850,000 the ministry spent on spruce beetle detection activities in 2015-16. Aggressive control activities include a focus on sanitation logging on the timber-harvesting land base and use of "trap" trees in areas outside the timber-harvesting land base, such as wildlife habitat areas, or areas that are uneconomic to harvest.

Heather Wiebe, resource manager in the Mackenzie Natural Resource District, has been designated as the Omineca spruce beetle project manager. She will be forming a public advisory committee that will work with stakeholders, communities and First Nations to represent the environmental and social values the forests of Omineca provide. This will complement forest licensees' suppression plans.

**Quotes:**

**Forests, Lands and Natural Resource Operations Minister Steve Thomson –**

"The ministry has a robust forest health program and is committed to controlling the spruce beetle outbreak in the Omineca. We recognize the importance of forestry in the north as a regional economic driver."

**Prince George-Mackenzie MLA Mike Morris –**

"We need to take aggressive action to control this current spruce beetle outbreak. I'm confident that with all groups working together, we will be able to do so."

**Quick Facts:**

- The Mackenzie Timber Supply Area and the Prince George Timber Supply Area were both assessed during the ministry's "aerial overview survey" in the summer and fall of 2015.
- Aerial assessments and ground surveys are both being used to identify affected stands of spruce trees.
- Ministry staff are also investigating how remote sensing technology could be used to detect and map affected areas.

**Learn more:**

Factsheet about spruce beetles: https://news.gov.bc.ca/files/SpruceBeetles_factsheet.pdf

Spruce beetles: www.gov.bc.ca/ominecasprucebeetle

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BRITISH COLUMBIA

Ministry of
Forests, Lands and
Natural Resource Operations



# Spruce Beetles in British Columbia

## WHAT IS A SPRUCE BEETLE?

- The spruce beetle (*Dendroctonus rufipennis*) is a forest pest that is native to spruce forests of western North America. In British Columbia, the spruce beetle typically has a two-year life cycle. Beetles exhibiting a one-year life cycle can also be found after early, warm spring weather.
- The adult beetle is about six millimetres long and has a black, segmented body and red-brown wing covers. The colour of an immature adult ranges from pale yellow to brown.
- Spruce beetle larvae are cylindrical, legless and white or tan in colour, measuring six or seven millimetres long.
- Between cyclical outbreaks, spruce beetle populations are usually held in check through climatic conditions, predation and a lack of susceptible hosts.



*Above: adult spruce beetle*

## EFFECTS ON SPRUCE TREES

- The beetle attacks the inner bark of spruce trees. The adult female bores through the tree's bark and creates an egg gallery in the sapwood where she lays her fertilized eggs.
- When the larvae hatch, they feed on the inner bark and continue to burrow laterally in the tree. The insect's extended larval galleries and associated blue stain fungi eventually kill the tree.
- Recent weather patterns, including warm springs, dry summers, warm winters and windstorms (resulting in more tree blowdowns) have contributed to the current increase in spruce beetle populations in this region.
- When populations exceed naturally occurring levels, the beetles are better positioned to attack and kill standing spruce trees that are otherwise healthy. A spruce beetle outbreak has the potential to seriously harm or kill spruce trees over large areas wherever mature spruce stands grow.

## DETECTION

- Identifying trees affected by spruce beetles can be a challenge. An infested host tree does not immediately display signs of stress or impending death until 13 to 15 months after being successfully attacked.
- This is different than what's seen during a mountain pine beetle infestation, where the colour of the needles change from green to chlorotic (pale green or yellow) in early spring of the following year. The pine tree then turns red and is grey by the end of the second summer after it is attacked.

## CURRENT INFESTATION IN THE OMINECA REGION

- Spruce beetle outbreaks occur regularly in B.C. and historically have lasted up to seven or eight years.
- As of January 2016, the most serious spruce beetle infestation in British Columbia is occurring in the eastern valleys of the Mackenzie Timber Supply Area and in the northern portions of the Prince George Timber Supply Area.
- More than 156,000 hectares of spruce forests in the Omineca region are currently infested by spruce beetles. Only 7,653 hectares of damaged forests were seen in 2013, so the current infestation in parts of the Omineca region represents the biggest spruce beetle outbreak since the 1980s.
- The Omineca region contains 9,018,763 hectares of forest, with 4,728,782 hectares considered to be part of the Timber Harvesting Land Base.

## WHAT IS THE B.C. GOVERNMENT DOING ABOUT THE CURRENT OUTBREAK?

- Ministry of Forests, Lands and Natural Resource Operations staff have been actively identifying tree stands in the Omineca region where adult beetles and their young are present, as well as reviewing which population control methods would be most effective in those areas.
- Higher-than-normal populations of spruce beetles in the Omineca region are being carefully monitored and reviewed by the Ministry of Forests, Lands and Natural Resource Operations, due to the potential impact on the area's timber supply, ecosystems, First Nations traditional territories and local communities.
- In 2015-16, the ministry spent $850,000 in the Omineca to: detect timber containing active beetle infestations; plan and implement control methods; and direct the harvesting of standing trees that had been killed by spruce beetles. The ministry has committed another $1 million for this work in 2016-17.
- A public advisory committee will be formed with representatives, communities, First Nations and key stakeholders to provide input into a regional spruce beetle plan.

## FOR MORE INFORMATION:

Call FrontCounterBC at 1 877 855-3222 to be connected to a local spruce beetle expert.



*Above: spruce beetle larvae*





# Working Together

## British Columbia's Spruce Beetle Mitigation Strategy

December 2016







BRITISH COLUMBIA

Ministry of
Forests, Lands and
Natural Resource Operations

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# INTRODUCTION

In 2014, the Ministry of Forests, Lands and Natural Resource Operations detected a new outbreak of spruce beetles in the Omineca Region and began developing a mitigation plan to improve its understanding of the infestation. The ministry also increased staff activity on the ground to reduce the outbreak's spread and minimize its impact on forest resources.





*The spruce beetle (Dendroctonus rufipennis) is a forest pest that is native to spruce forests of western North America and attacks the inner bark of these trees. The adult is about six millimetres long.*

Over the past year, the outbreak has continued to grow and the ministry has stepped up its efforts and focused its attention on managing the infestation. This document outlines the history of the Omineca outbreak, the actions taken to date to mitigate the beetle's negative effects, and the actions that the ministry intends to take in the coming years.

The spruce beetle (*Dendroctonus rufipennis*) is a forest pest that is native to spruce forests of western North America and attacks the inner bark of these trees. When spruce beetle populations are higher than normal, they are better positioned to attack and kill standing spruce trees that are otherwise healthy. A spruce beetle outbreak has the potential to seriously harm or kill trees over large areas, wherever stands of mature spruce trees grow.

Spruce beetle populations are on the rise throughout British Columbia. The province's largest spruce beetle outbreak in decades began in 2014 in the eastern valleys of the Mackenzie Timber Supply Area and the northern portions of the Prince George Timber Supply Area.

The current infestation in the Omineca region is significant. According to the ministry's 2016 aerial overview survey, about 210,000 hectares of forest in the Omineca region are currently impacted by spruce beetle, compared to about 156,000 hectares in October 2015. Only 7,653 hectares of damaged forests were identified in 2013.

The Omineca region contains 9,018,763 hectares of forest, with 4,728,782 hectares considered to be part of the timber harvesting land base. Of the forests that support timber harvesting in the Omineca region, 1,159,191 hectares are comprised of stands dominated by spruce trees.

The current spruce beetle outbreak differs in numerous ways from the mountain pine beetle infestation in recent years. The spruce beetle outbreak has occurred in mixed stands (where more than one tree species exist), it has



*Trees killed by spruce beetles don't show visible foliage discolouration for at least 12 months, but subsequent colour changes occur rapidly. The photo on the right was taken about two months after the photo on the left.*

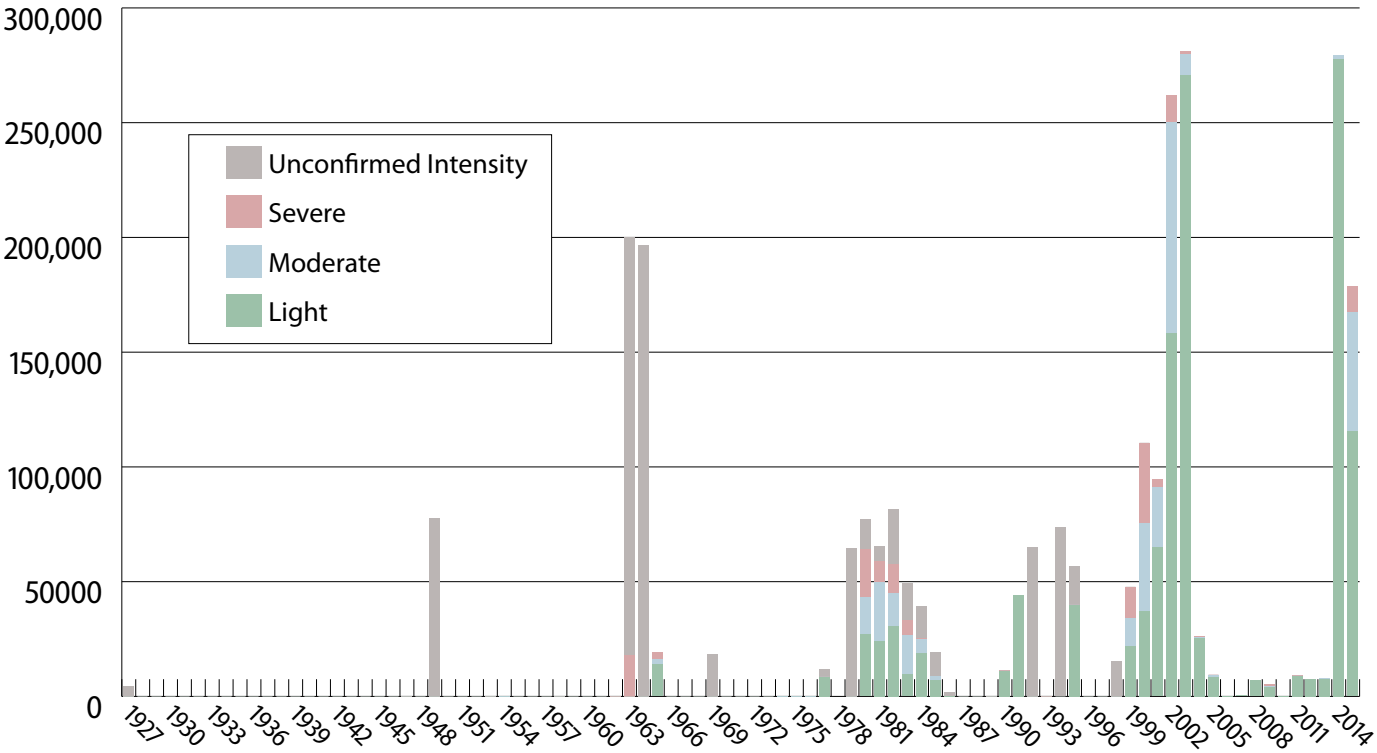


exhibited a slower rate of spread, and the beetles often don't kill the entire spruce tree stand that they have attacked.

However, the potential impact of this spruce beetle outbreak on the mid-term timber supply and local ecosystems could still be significant, since its effects would compound the damage already done by mountain pine beetles in British Columbia's forests.

Identifying trees that have been attacked by spruce beetles can be a challenge. An infested host tree viewed from the air does not immediately display signs of stress or impending death until 13 to 15 months after being successfully attacked.

This is different than what's seen during a mountain pine beetle infestation, where the colour of the needles change from green to chlorotic (pale green or yellow) in the early spring of the following year. The pine tree then turns red and is typically grey by the end of the second summer after the initial attack.




*Spruce beetle outbreaks occur periodically in British Columbia and have historically lasted up to seven or eight years.*

*Working Together: British Columbia's Spruce Beetle Mitigation Strategy* outlines the B.C. government's response to this forest health issue. It also builds on the tactical plans that have been implemented by the ministry and by forest licensees (including BC Timber Sales), focusing on: reducing spruce beetle populations by treating infested trees; safeguarding other values (such as wildlife habitat) on the landscape; and reducing losses of marketable timber from beetle-killed trees.

Significant bark beetle outbreaks (including the spruce beetle and other types of bark beetles) are occurring more frequently as North America's climate gradually changes. As stated in the Mountain Pine Beetle Action Plan

2006-2011, forest professionals will continue to be called upon to "address the outbreaks in a manner that captures the best economic value of beetle-killed forests while respecting the other values and resource objectives."

Although the current spruce beetle outbreak in the Omineca region is a concern, the potential damage to B.C.'s forests is not on the same scale as the mountain pine beetle outbreak that has had a major impact on the timber supply in the Interior. The 1999-2015 mountain pine beetle epidemic was the largest in North America's recorded history and has so far attacked over 16 million hectares of forests in B.C.'s Interior.

The Ministry of Forests, Lands and Natural Resource Operations is committed to working collaboratively with forest licensees, stakeholders, First Nations and local governments to deal effectively with the current outbreak in B.C. and potential impacts on the region's timber supply, ecosystems and communities.

To foster this close collaboration, the ministry established the Omineca Spruce Beetle Public Advisory Committee in July 2016. The committee's members include academics, representatives of non-governmental organizations (NGOs), communities, First Nations, forest professionals, wildlife practitioners and forest licensees.

This committee will provide insights into the current outbreak and other potentially affected values, draw on lessons learned from the mountain pine beetle epidemic, identify areas of future research and conduct an annual review of how successful the treatments of affected areas have been.

## SPRUCE BEETLE BIOLOGY

Spruce beetle outbreaks occur periodically in British Columbia and have historically lasted up to seven or eight years. Between these cyclical outbreaks, spruce beetle populations are usually held in check by climatic conditions, predation (by woodpeckers, flies and other beetle species) and a lack of susceptible host trees.

In British Columbia, the spruce beetle typically has a two-year life cycle. During an outbreak such as this one, however, beetles behave differently and exhibit a one-year life cycle in response to warm spring weather that arrives earlier than normal.

The adult beetle is about six millimetres long (about the size of a grain of rice) and has a black, segmented body and red-brown wing covers. The colour of an immature adult ranges from pale yellow to brown. Spruce beetle larvae are cylindrical, legless, white or tan in colour and are also about six millimetres long.

The female adult beetle bores through the spruce tree's bark and creates an egg gallery in the inner bark, where she lays her fertilized eggs. When the larvae hatch, they feed on the inner bark and continue to burrow around the tree. The insect's extended larval galleries and associated blue stain fungi will eventually kill the tree.





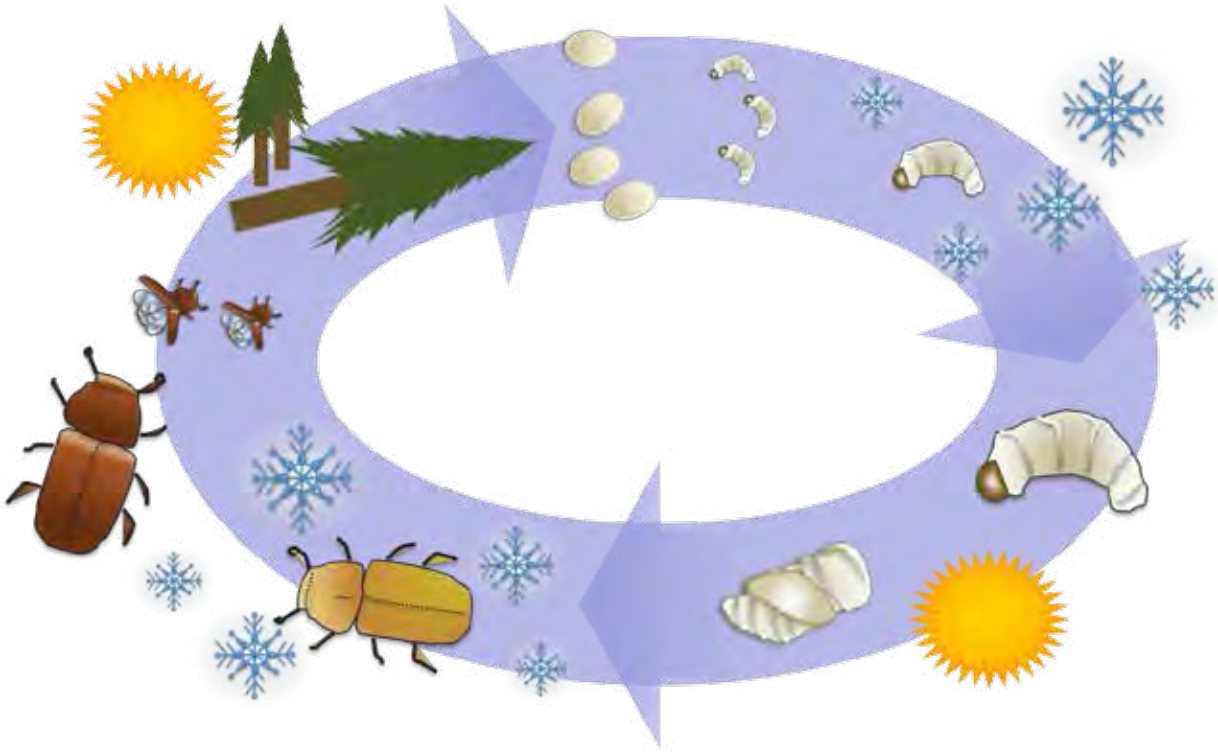


*Adult spruce beetles and their larvae are about six millimetres long -- roughly the size of a grain of rice.*

The spruce beetle's appearance is similar to that of the mountain pine beetle and both of these pests are able to "turn on" genes to guard against freezing within a few hours of temperatures dipping to the freezing point. Once this "antifreeze" physiology has been triggered, cold weather won't harm them much.

The weather conditions required to dramatically reduce spruce beetle populations occur less frequently these days, given B.C.'s changing climate. A cold snap with temperatures below -33 C is needed to kill off substantial numbers of spruce beetles.

Recent weather patterns in B.C., including warm springs, dry summers, warm winters and windstorms (resulting in more trees being blown down) have contributed to the increase in spruce beetle populations in the Omineca region.



*This diagram illustrates the typical two-year life cycle of the spruce beetle. The female beetle lays her eggs in early summer and they hatch into larvae that overwinter in the first year. During the second summer, the larvae develop into immature adults that can survive the second winter. The following spring, the adult beetles emerge and fly to new host trees to attack them. During a significant outbreak, the spruce beetle is capable of completing its life cycle within a single year — not two — so the entire process is compressed. Its development to the immature adult stage occurs before the first winter and the resulting adult beetles attack new host trees during the first spring.*



*Representatives from the forest industry, First Nations and government are sharing resources to combat the current spruce beetle outbreak.*

# OVERALL PRIORITIES OF THE STRATEGY

The ministry's priorities for mitigating the impacts of the spruce beetle outbreak are to:

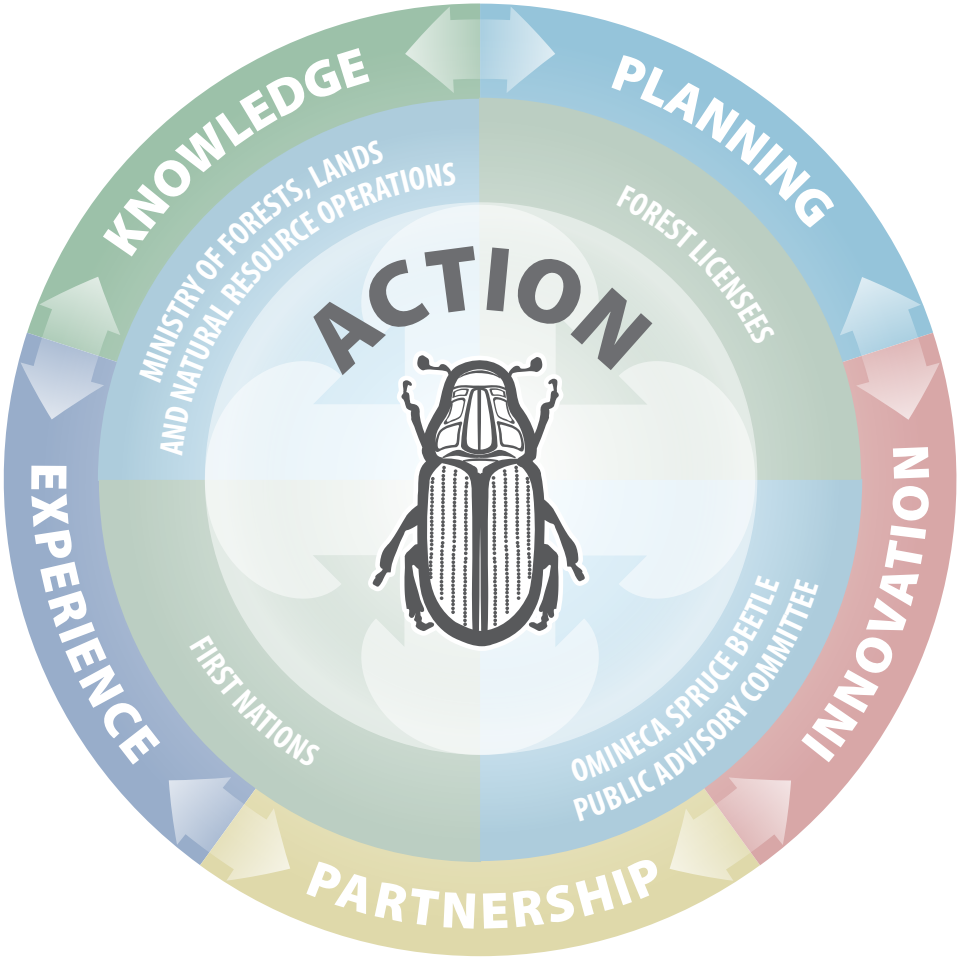
- co-ordinate effective planning and implementation of mitigation measures
- safeguard non-timber values
- prevent or reduce damage to ecosystems in areas that are susceptible to (but not yet experiencing) spruce beetle outbreaks
- recover the greatest value from dead spruce timber before it decays or is damaged by wildfires
- restore forest resources in areas affected by spruce beetle outbreaks



## *Co-ordinate effective planning and implementation of mitigation measures*

- A crucial lesson learned from the mountain pine beetle epidemic is the importance of governments, organizations and stakeholders working collaboratively from the outset.
- In order to deal with the Omineca spruce beetle outbreak, representatives from the forest industry, First Nations and government have made a concerted effort to pool resources, synchronize spruce beetle treatments and prioritize areas where they can make the greatest impact by working together.
- During the current spruce beetle outbreak, the B.C. government has:

- *streamlined processes to quickly share information about where spruce beetle populations have been detected;*
- *provided guidelines, beneficial practices and expectations related to forest management to forest licensees;*
- *enhanced survey techniques to obtain the most accurate scientific data possible to determine the most appropriate treatments; and*
- *worked with the forest industry to streamline spruce beetle mitigation activities.*




*The B.C. government is working closely with the forest industry and other stakeholders to monitor and mitigate the current spruce beetle outbreak.*

## *Safeguard non-timber values*

- Bark beetles of various types play an important role in the creation and maintenance of North American spruce forest ecosystems. Therefore, consideration of non-timber forest values such as wildlife habitat is also critical when assessing the need to undertake spruce beetle management activities.
- Spruce beetle treatments in special management areas must balance the need to suppress beetle populations with the need to maintain important wildlife habitat and areas containing sensitive or otherwise significant values.
- This balance can be achieved using two main approaches:
  - *prevent infestations from taking hold (see section below)*
  - *limit the treatment of infested trees in some cases, so that dead timber, spruce trees that have not been attacked yet, non-host trees, and the intact forest understory continue to benefit wildlife, help retain water within the ecosystem, maintain wilderness areas (and related visual qualities), or provide other ecological or historical benefits.*
- To obtain this balance the ministry has developed guidelines for making harvesting treatment decisions in special management areas such as old growth management areas, landscape biodiversity areas, critical fish areas, fisheries-sensitive watersheds, wildlife habitat areas and ungulate winter range.





## *Prevent or reduce damage to ecosystems in areas that are susceptible to (but not yet experiencing) spruce beetle outbreaks*

- When spruce beetle populations are at normal levels, the preferred hosts for the beetles are mature spruce trees that have been blown down by wind.
- To reduce the number of these "blowdown" trees, forest professionals take preventive steps to make trees stands more resilient to strong winds (such as thinning trees at the edges of the stand, so the wind's initial force is spread out as is passes through the remaining trees).
- During an outbreak, spruce beetles target mature, large-diameter standing trees that are typically over 120 years old.
- Forest professionals establish conventional "trap trees" to mimic blowdown spruce trees and successfully reduce beetle populations. Healthy, large-diameter trees are cut down and left on the ground in a shaded area to attract spruce beetles during their flight period (May to August).
- These trap trees are 10 times more successful attracting migrating adult spruce beetles than standing spruce trees. Every trap tree can protect eight to 10 nearby healthy trees.



*In this photo, a ring of blue fungal stain extends several centimetres toward the centre of a cut spruce tree. This tell-tale staining is caused by fungi that are typically associated with spruce beetles, which "hitch a ride" with the adult spruce beetles when they attack new host trees. These fungi, combined with the damage done by the spruce beetles and their larvae, eventually kill the tree. The permanent blemishes impair the value and marketability of the affected tree.*

- Once adult beetles and their larvae are established within a trap tree, the log is taken to a mill prior to the next flight period. The beetles and larvae are killed during the milling process.
- Harvesting is also an effective way to reduce spruce beetle populations. By harvesting standing trees infested with spruce beetles, it's possible to remove current beetle populations and help prevent infestations in neighbouring stands of healthy spruce trees.

## *Recover the greatest value from dead spruce timber before it decays or is damaged by wildfire*

- Because spruce trees tend to grow in moist soils, dead trees topple quickly. This means that the "shelf life" of an infested spruce tree is only about seven years. Shelf life is determined not only the decay rate of a tree, but also the diminishing economic value of the wood products as the quality of the tree deteriorates.
- By way of comparison, pine trees from drier sites have an average shelf life of 15 years after being killed by a mountain pine beetle attack.
- Forest companies have shown considerable ingenuity in making the best use of timber from trees that have been killed by bark beetles. However, it is important to prioritize where to harvest these trees first to maximize their economic value, while also preserving non-timber values.

## *Restore forest resources in areas affected by spruce beetle outbreaks*

- The widespread nature of this particular spruce beetle outbreak could impact entire forest ecosystems.
- Timber growth, wildlife habitat, soil productivity, water quality, water runoff patterns, recreational uses and other forest values will be affected by the death of spruce trees.
- A key challenge in some landscape units in the Omineca region is that large volumes of dead spruce timber would result in a "gap" in the supply of mature timber 20 to 60 years from now.
- Although this gap cannot be completely avoided, steps can be taken to reduce its negative impacts. As salvage harvesting occurs, reforestation and ecosystem restoration activities can follow.



# WHAT'S BEEN DONE SO FAR…

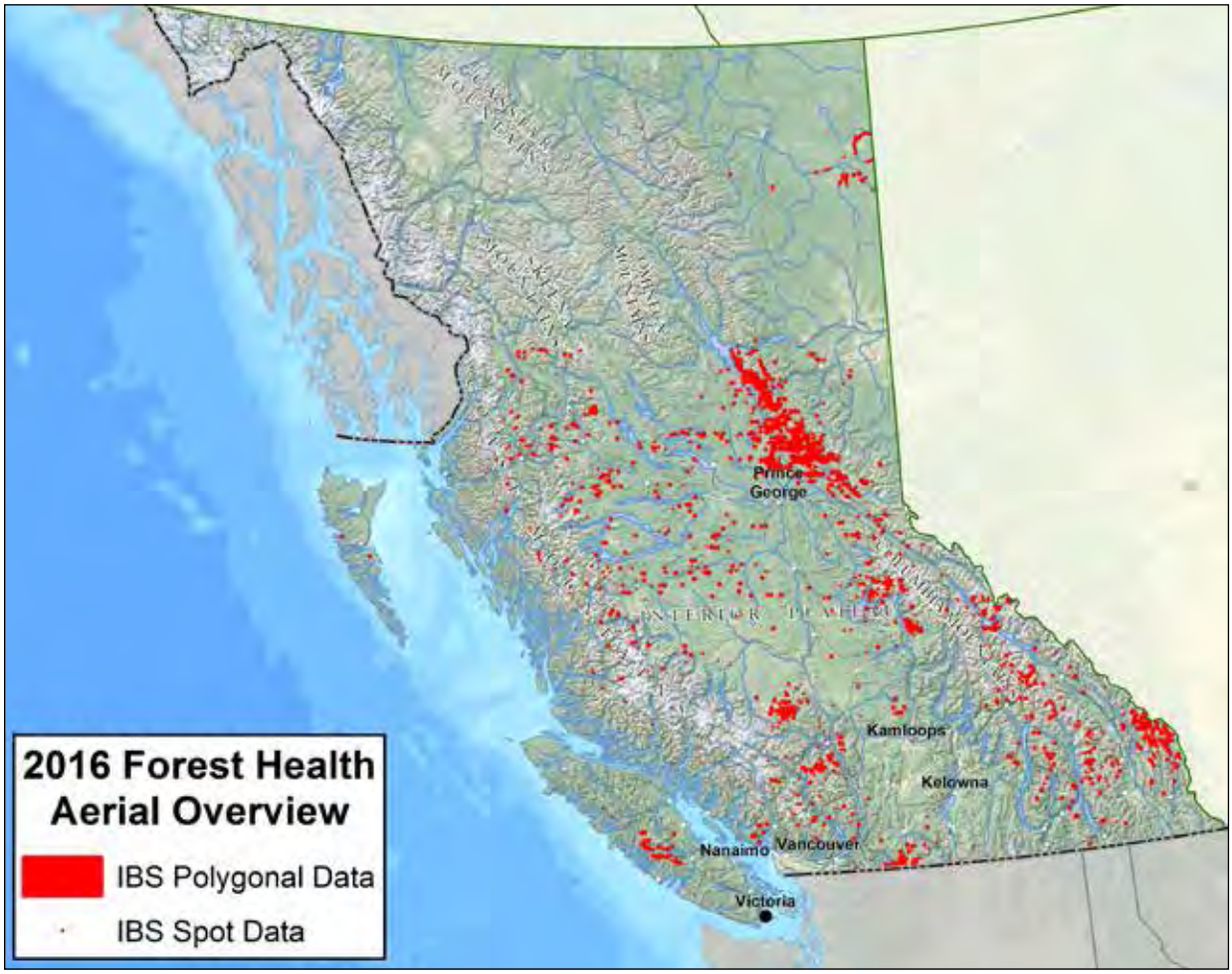
The B.C. government is working closely with the forest industry and other stakeholders to monitor and mitigate the current spruce beetle outbreak, take preventive steps to make stands of trees more resilient to strong winds, and implement remediation measures such as trap trees.



Ministry of Forests, Lands and Natural Resource Operations staff have been actively identifying areas in the Omineca region where adult beetles and their young are present. The ministry is reviewing which population control methods would be most effective in those areas.

The ministry has also been providing current infestation data to licensees as they focus on logging infested spruce trees and use of "trap trees" on the timber-harvesting land base to control the beetle's spread in areas outside of the timber-harvesting land base.

The Ministry of Forests, Lands and Natural Resource Operations has provided classroom and field training to consultants, licensees, consultants, First Nations and ministry staff to increase their knowledge of spruce beetle and treatment options.




*This map indicates areas where spruce beetle attacks have been record throughout the province. The current outbreak in the Omineca region is indicated by the concentration of red dots north of Prince George.*

Other key steps include the following:





## *Government funding*

- In 2015-16, the ministry spent $850,000 in the Omineca region to detect trees that contained active spruce beetle infestations. The resulting information was used to implement mitigation methods using trap trees and selective harvesting of infested standing trees.
- The ministry also allocated $1 million for spruce beetle detection, mapping and research in 2016-17.
- In summer 2016, the Ministry of Forests, Lands and Natural Resource Operations committed another $100,000 for spruce beetle detection in B.C.

## *Spruce beetle summit in Prince George (Oct. 19-20, 2016)*

- About 115 forestry personnel, spruce beetle experts, and others gathered in Prince George in October 2016 to share the latest research on spruce beetle management and discuss best practices. This included presentations of current data from entomologists, economists, ecologists, climatologists, hydrologists and biologists.
- B.C.'s chief forester opened the summit. Other speakers and attendees included researchers, academics, government staff, local stakeholders, representatives from the forest industry and non-governmental organizations.
- The summit was convened to ensure that forest professionals in B.C. have the best available scientific research and information about how to mitigate the impact of spruce beetles on the mid-term timber supply and on ecosystem health.
- One of the most important goals of the summit was to support a growing community of individuals and organizations involved in the current spruce beetle outbreak in B.C. The participants now have a clear picture of the current situation and know whom to contact if they have questions or ideas related to future research or treatments.

## *Licensee involvement*

- Each timber supply area affected by the spruce beetle outbreak has a spruce beetle working group in place to slow the beetle's spread. These working groups are composed of licensees and government representatives.
- The ministry is leading the spruce beetle detection effort and the resulting data is shared with licensees through these working groups.
- Similarly, licensees share the commitments they've made to treat affected forests with trap trees and harvesting.
- The licensees and the ministry also work together in forums such as timber supply area steering committee meetings and ministry-licensee operational issues forums.

- The Province of B.C.'s chief forester is actively monitoring the current spruce beetle situation, encouraging collaboration between all stakeholders and directing the ministry's response to the current outbreak.
- Licensees strive to achieve a workable balance between maintaining the mid-term timber supply and considering potential implications for other resource values such as wildlife habitat and protected areas.
- The ministry has also outlined its expectations of licensees, including beneficial management practices and operational guidelines related to special management areas, log hauling, milling and the use of trap trees.
- Licensees have also provided recommendations to the government to support their efforts to mitigate the outbreak.

## *Technical considerations*

- The Ministry of Forests, Lands and Natural Resource Operations is responsible for the detection of spruce beetle outbreaks, funded through the ministry's Land Based Investment Strategy. Detection methods include the following:
  - ***Annual aerial overview survey:*** *Forest health specialists fly over the entire province every year in fixed-wing aircraft, looking for a myriad of forest health issues, including the presence of spruce beetles.*
  - ***Helicopter GPS verification:*** *Helicopters and a global positioning system (GPS) are used to verify the course findings of the annual aerial overview survey and to look more closely at highly susceptible stands not initially identified in the overview survey. A helicopter can fly at lower altitudes and speeds than a fixed-wing aircraft, so the data it collects is generally more accurate.*
  - ***Ground survey:*** *A ground survey is the only way to detect a current "green" spruce beetle attack (the trees appear to be healthy and still have green needles, but have live beetles living within them) and confirm the location of active beetle populations. The annual aerial overview survey and helicopter GPS verification flights can only identify where the beetles have already been active. During a ground survey, forestry professionals and contract surveyors walk through tree stands and determine the year of the attack, its extent and severity, and the risk of a beetle infestation spreading.*
- Once licensees receive the ministry's detection data, they can make their harvesting and treatment plans.
  - *The use of conventional trap trees is effective in areas where spruce beetle populations are emerging and starting to grow.*
  - *Sanitation harvesting targets currently infested trees and can be useful in areas with growing populations.*
  - *Salvage harvesting removes dead but marketable standing trees that spruce beetles have already abandoned.*
- Licensees will carefully adapt tactics and treatments for each area, depending on ecosystem needs and constraints.







*As new questions arise about insect ecology and management, scientific experts help guide the direction of new operational research. This work provides indispensable tools to improve our knowledge of the spruce beetle's behaviour and help develop management practices based on the best available science.*

# NEXT STEPS

The next steps in this ongoing effort include:

- increased monitoring of the current outbreak
- suppression tactics aimed at further slowing the growth of spruce beetle populations
- regular interactions with forestry personnel and spruce beetle experts to exchange forest health information; share operational techniques; and reinforce best practices for mitigating the harmful effects of spruce beetles
- taking the impact of the spruce beetle outbreaks into account during future timber supply reviews
- further research (to be conducted by the ministry in collaboration with licensees and the federal government) into the "shelf life" of timber killed by spruce beetles

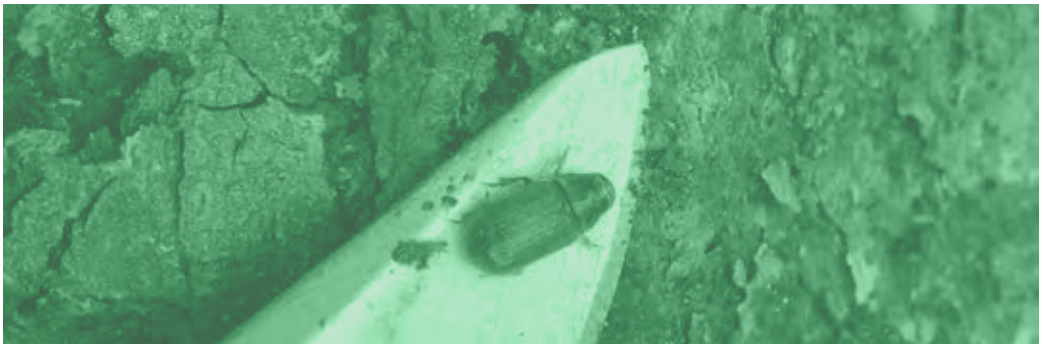
The Ministry of Forests, Lands and Natural Resource Operations will continue to collaborate with licensees, communities and stakeholders to achieve a workable balance between safeguarding the mid-term timber supply, protecting non-timber values and reducing losses of marketable timber due to spruce beetle damage.

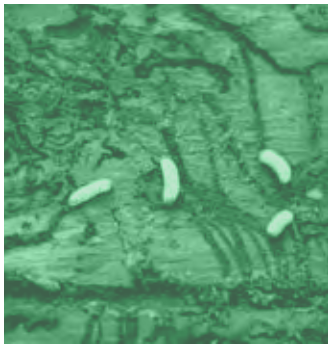
British Columbia's forest industry remains strong, resilient and focused on the future.

The approach that the government has taken to deal quickly with the Omineca outbreak demonstrates the benefits of sharing information and resources, and of working collaboratively with its industry partners.

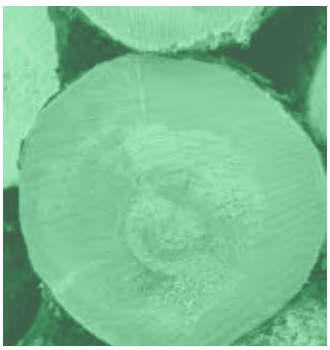
More information about spruce beetles in the Omineca Region is available online at: *www.gov.bc.ca/ominecasprucebeetle*








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COLUMBIA
www.gov.bc.ca/ominecasprucebeetle









# SECTION TWO

# DISTRICT MANAGER EXPECTATIONS

# MACKENZIE NATURAL RESOURCE DISTRICT

# SPRUCE BEETLE MANAGEMENT

## DISTRICT DIRECTION

Bark beetles are a part of the natural ecosystem. However, when conditions are right, populations quickly proliferate from endemic to epidemic levels. Epidemic populations are detrimental as they attack and kill large diameter, mature and over mature trees. Pockets of epidemic populations of Spruce Beetle *Dendroctonus rufipennis* (IBS) were recorded in Mackenzie Natural Resource District (MNRD) in 2015 and further growth of these populations will become a threat to the midterm timber supply. As such, actively managing this forest health concern in a consistent manner utilizing recognized best management practices will produce long lasting results. The newly formed Mackenzie "Spruce Beetle Working Group" is tasked with identifying issues relating to harvesting, planning and policy in dealing with spruce beetle management.

The MNRD is providing information and guidance in consideration of getting prompt and effective actions to help manage (and reduce) a growing spruce beetle population.

## IBS DETECTION

Initial spruce beetle infestations are identified through high level fixed wing aerial surveys. Low level aerial surveys are recorded through sketch mapping and are verified by ground sampling. The first ground survey, the walkthrough, is a "coarse filter" that quickly determines the extent of the infestation and the treatment options available based on the sanitation harvest index thresholds. Probes are used to gather more precise information to clarify management alternatives. A treatment decision is then developed for the stand based on the intensity of infestation, the beetle life cycle, and other management considerations. This can occur after the walkthrough or the probe.

## SUSCEPTIBILITY MAPS

These maps state susceptibility to IBS attack and not current beetle populations. The maps are a tool to help focus surveys and subsequent treatment in areas with higher likelihood of IBS epidemics. High susceptibility does not validate immediate harvest in these areas, rather, the need to institute proactive measures to mitigate impact of potential IBS populations.

MNRD susceptibility maps are available:
https://www.for.gov.bc.ca/ftp/DMK/external/!publish/SpruceBeetle/Beetle_Hazard_Rating_Data_TSA_16_MacKenzie/Beetle_Hazard_Rating_TSA_16.gdb/ .

### ADDITIONAL REPORTS OF IBS AREAS

To supplement data collected through regional fixed wing aerial survey flights, all Ministry of Forests, Lands and Natural Resource Operations (FLNR) staff and licensees should provide the MNRD representative with information collected through field work or aerial surveys regarding IBS attacked trees and the associated attack codes noted in the manuals. This information will be reviewed and help determine the flight paths and high priority locations of the MNRD led low level helicopter aerial surveys.

Information is to be provided to the MNRD representative as soon as possible. This information is crucial for how the Spruce Beetle Working Group manages these sites.

> **Expectation:** That all FLNR staff and licensees report any suspect beetle areas to MNRD appointed staff with the following information: 1.GPS location 2. Beetle life cycle stage 3. Beetle attack code and 3. Number of trees affected.

### AERIAL FLIGHTS AND SUBSEQUENT SKETCH MAPPING

Ministry of Forests, Lands and Natural Resource Operations (FLNR) regional staff will conduct the initial fixed wing aerial survey flights of the district and forward results to MNRD representative. MNRD staff will review and identify areas of high spruce bark beetle susceptibility and conduct subsequent low level helicopter flights while recording findings through sketch mapping (identification of specific beetle/forest health management areas). "Omineca Region Forest Health Strategy"

> **Expectation:** FLNR/MNRD staff will, via annual maps, identify IBS polygons with a hazard rating, and propose treatments/management options based on these aerial flights and sketch mapping.

### WALKTHROUGHS AND OR PROBES

Walkthroughs are non-systematic preliminary ground reconnaissance survey that is done after flight /anecdotal information is received but before beetle probes. This is done to determine the extent and concentration of the IBS attack and prior to recommendations for probing or other treatment decisions. Surveyors are to conduct their walkthrough and then attempt to select a representative portion of the area to collect 50-200m of probe data.

Probes are systematic and detailed secondary ground reconnaissance surveys. Probing will determine detailed, more precise estimates of the same information gathered from walkthroughs, and will provide sufficient information to stratify the area for various treatment actions.

**Expectation:** Licensees perform walkthroughs and full scale probes (if required) in areas identified as priorities using methodologies outlined in the "Spruce Beetle Ground Survey Guidelines" established for the Omineca Region. This should be done prior to performing or requesting a treatment option

## IBS TREATMENT OPTIONS

Treatments for IBS are limited to four general options:

1) Monitor site
   a) Field checks of a susceptible spruce beetle timber type to determine if beetle attack has occurred or if a known endemic population is growing. Information obtained to assist in decision to move to other treatment options.
2) **Trap trees** (conventional and lethal)
   a) Conventional trap trees are deployed to:
      i) contain emerging beetles in cutblocks prior to sanitation logging
      ii) protect adjacent healthy timber or reserves
      iii) "mop-up" beetles emerging from stumps and slash following sanitation logging.
      iv) conventional trap trees **must be subsequently removed or treated** to kill trapped beetles prior to emergence.
      v) Please refer to "Use_of_trap_trees_for_spruce_beetle_management_in_bc_RH_1991" for more information.
   b) Lethal Trap trees are not available at this time (Research trials currently being planned)
3) **Harvesting**
   a) Sanitation harvesting is the extraction of currently infested spruce stands to help reduce the existing spruce beetle population and help prevent their spread (trap tree programs can be run in conjunction with this). Priority is given to stands with high levels of new attack, high hazard, and a high risk of spread. All harvesting methods can be used.
   b) Salvage harvesting is primarily conducted to recover damaged timber before it loses its value for potential wood products. Such trees no longer have any living broods. This tactic does not reduce spruce beetle populations, but is the first step in returning the site to forest production.
4) **Prevention** (including hauling restrictions)
   a) Hauling and milling restrictions may be required: i.e. all wood to be milled prior to next beetle flight.
   b) Prudent utilization during and after harvesting may be required i.e. 10cm tops, stumps to be cut as low as possible, long butts to be burned along with other larger tops or material that the bugs can breed in.

**Baiting (associated with harvesting) –** The use of semiochemical tree baits in grid patterns in spruce beetle infested stands is a temporary holding tactic until the stand can be sanitation logged.

## BLOCK HARVEST PLANNING

Harvest planning along with operational planning will have to be adjusted to accommodate trap trees felled in advance of the normal felling schedule (i.e. fall trap trees in March –April; summer harvest may be delayed until September). Some blocks may have small portions of spruce left and felled at the end of the winter harvest season as trap trees to draw in any residual bugs flying from stumps and then removed the following fall.

> **Expectation:** Harvest plans are made using information gathered from walk through or probe information and in accordance to IBS treatment options appropriate for the hazard rating attributed to the harvest or adjacent polygon(s).
>
> **Expectation:** Conventional trap trees should be routinely felled every year in spruce harvesting areas to continually reduce the IBS 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.
>
> **Expectation:** Licensee's will be aggressive in their planning for sanitation harvesting and trap tree use by providing FLNR with necessary walkthrough and beetle probe information to assist in quick and timely decisions /permits.

## ADDITIONAL INFORMATION

Hazard rating

Hazard rating identifies those stands where substantial losses can be expected to occur if an outbreak of spruce beetle occurs. This valuable planning tool identifies those stands that are highly susceptible to attack. Hazard rating considers stand age, host basal area, stand density, and elevation. (Bark Beetle Management Guidebook, 1995)

High hazard stands have:

- an average spruce dbh greater than or equal to 41 cm
- a spruce volume exceeding 300 $m^3$ /ha
- more than 65% spruce content in well-drained creek bottoms.

In general, the order of hazard for spruce stands is:

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.

**References:**

Use_of_trap_trees_for_spruce_beetle_management_in_BC_RH_1991

SBGroundSurveyGuidelineAug62014

Bark Beetle Management Guidebook 1995

Spruce beetle life cycle document

# PRINCE GEORGE NATURAL RESOURCE DISTRICT

# SPRUCE BEETLE MANAGEMENT DIRECTION

## DISTRICT DIRECTION

Bark beetles are a part of the natural ecosystem. However, when conditions are right, populations quickly proliferate from endemic to epidemic levels. Epidemic populations are detrimental as they attack and kill large diameter, mature and over mature trees. Pockets of epidemic populations of Spruce Beetle *Dendroctonus rufipennis* (IBS) were recorded in Prince George Natural Resource District (PGNRD) in 2015 and further growth of these populations will become a threat to the midterm timber supply. As such, actively managing this forest health concern in a consistent manner utilizing recognized beneficial management practices will produce long lasting results. The district Spruce Beetle Working Group is tasked with identifying issues relating to harvesting, planning, and policy in dealing with spruce beetle management.

The PGNRD is providing information and guidance in consideration of getting prompt and effective actions to help manage (and reduce) a growing spruce beetle population.

## IBS DETECTION

Initial spruce beetle infestations are identified through high level fixed wing aerial surveys. Low level aerial surveys are recorded through sketch mapping and are verified by ground sampling. The first ground survey, the walkthrough, is a "coarse filter" that quickly determines the extent of the infestation and the treatment options available based on the sanitation harvest index thresholds. Probes are used to gather more precise information to clarify management alternatives. A treatment decision is then developed for the stand based on the intensity of infestation, the beetle life cycle, and other management considerations. This can occur after the walkthrough or the probe.

## SUSCEPTIBILITY MAPS

These maps state susceptibility to IBS attack and not current beetle populations. The maps are a tool to help focus surveys and subsequent treatment in areas with higher likelihood of IBS epidemics. High susceptibility does not validate immediate harvest in these areas, rather, the need to institute proactive measures to mitigate impact of potential IBS populations.

PGNRD susceptibility maps are available at:
ftp://ftp.for.gov.bc.ca/DPG/external/!publish/Spruce%20Beetle/

### ADDITIONAL REPORTS OF IBS AREAS

To supplement data collected through regional fixed wing aerial survey flights, all Ministry of Forests, Lands and Natural Resource Operations (FLNR) staff and licensees should provide the PGNRD representative with information collected through field work or aerial surveys regarding IBS attacked trees and the associated attack codes noted in the manuals. This information will be reviewed and help determine the flight paths and high priority locations of the PGNRD led low level helicopter aerial surveys.

Information is to be provided to the PGNRD representative as soon as possible. All documented spruce beetle infestation areas including AOS polygons, helicopter and ground survey polygons are available in the spatial file format at the following location:

ftp://ftp.for.gov.bc.ca/DPG/external/!publish/Spruce%20Beetle/

This information is crucial for how the Spruce Beetle Working Group manages these sites.

> **Expectation:** That all FLNR staff and licensees report any suspect beetle areas to PGNRD appointed staff with the following information: 1. GPS location, 2. Beetle life cycle stage, 3. Beetle attack code and 4. Number of trees affected.

### AERIAL FLIGHTS AND SUBSEQUENT SKETCH MAPPING

FLNR regional staff will conduct the initial fixed wing aerial survey flights of the district and forward results to PGNRD representative. PGNRD staff will review and identify areas of high spruce bark beetle susceptibility and conduct subsequent low level helicopter flights while recording findings through sketch mapping (identification of specific beetle/forest health management areas). "Omineca Region Forest Health Strategy"

> **Expectation:** FLNR/PGNRD staff will, via annual maps, identify IBS polygons with a hazard rating, and propose treatments/management options based on these aerial flights and sketch mapping.

### WALKTHROUGHS AND OR PROBES

Walkthroughs are non-systematic preliminary ground reconnaissance survey that is done after flight /anecdotal information are received but before beetle probes. This is done to determine the extent and concentration of the IBS attack and prior to recommendations for probing or other treatment decisions. Surveyors are to conduct their walkthrough and then attempt to select a representative portion of the area to collect 50-200m of probe data.

Probes are systematic and detailed secondary ground reconnaissance surveys. Probing will determine detailed, more precise estimates of the same information gathered from walkthroughs, and will provide sufficient information to stratify the area for various treatment actions.

> **Expectation:** Licensees perform walkthroughs and full scale probes (if required) in areas identified as priorities using methodologies outlined in the "Spruce Beetle Ground Survey

Guidelines" established for the Omineca Region. This should be done prior to performing or requesting a treatment option

**Expectation:** Licensees that have been provided with data from PGNRD staff are to use that date to plan and forecast their activities. This should be completed as part of their planning each year.

## IBS TREATMENT OPTIONS

Treatments for IBS are limited to four general options:

1) **Monitor site**
   a) Field checks of a susceptible spruce beetle timber type to determine if beetle attack has occurred or if a known endemic population is growing. Information obtained to assist in decision to move to other treatment options.
2) **Trap trees** (conventional and lethal)
   a) Conventional trap trees are deployed to:
      i) contain emerging beetles in cutblocks prior to sanitation logging
      ii) protect adjacent healthy timber or reserves
      iii) "mop-up" beetles emerging from stumps and slash following sanitation logging.
      iv) conventional trap trees **must be subsequently removed or treated** to kill trapped beetles prior to emergence.
      v) Please refer to "Use_of_trap_trees_for_spruce_beetle_management_in_bc_RH_1991" for more information.
   b) Lethal trap trees are not available at this time (Research trials currently being planned)
3) **Harvesting**
   a) Sanitation harvesting is the extraction of currently infested spruce stands to help reduce the existing spruce beetle population and help prevent their spread (trap tree programs can be run in conjunction with this). Priority is given to stands with high levels of new attack, high hazard, and a high risk of spread. All harvesting methods can be used.
   b) Salvage harvesting is primarily conducted to recover damaged timber before it loses its value for potential wood products. Such trees no longer have any living broods. This tactic does not reduce spruce beetle populations, but is the first step in returning the site to forest production.
4) **Prevention** (including hauling restrictions)
   a) Hauling and milling restrictions may be required: i.e. all wood to be milled prior to next beetle flight.
   b) Prudent utilization during and after harvesting may be required i.e. 10cm tops, stumps to be cut as low as possible, long butts to be burned along with other larger tops or material that the bugs can breed in.

**Baiting (associated with harvesting) –** The use of semiochemical tree baits in grid patterns in spruce beetle infested stands is a temporary holding tactic until the stand can be sanitation logged.

## BLOCK HARVEST PLANNING

Harvest planning along with operational planning will have to be adjusted to accommodate trap trees felled in advance of the normal felling schedule (i.e. fall trap trees in March –April; summer harvest may

be delayed until September). Some blocks may have small portions of spruce left and felled at the end of the winter harvest season as trap trees to draw in any residual bugs flying from stumps and then removed the following fall.

> **Expectation:** Harvest plans are made using information gathered from walk through or probe information and in accordance to IBS treatment options appropriate for the hazard rating attributed to the harvest or adjacent polygon(s).
>
> **Expectation:** Conventional trap trees should be routinely felled every year in spruce harvesting areas to continually reduce the IBS 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.
>
> **Expectation:** Licensee's will be aggressive in their planning for sanitation harvesting and trap tree use by providing FLNR with necessary walkthrough and beetle probe information to assist in quick and timely decisions /permits.

## ADDITIONAL INFORMATION

"Hazard rating identifies those stands where substantial losses can be expected to occur if an outbreak of spruce beetle occurs. This valuable planning tool identifies those stands that are highly susceptible to attack. Hazard rating considers stand age, host basal area, stand density, and elevation." (Bark Beetle Management Guidebook 1995)

High hazard stands have:

- an average spruce dbh greater than or equal to 41 cm
- a spruce volume exceeding 300 $m^3$ /ha
- more than 65% spruce content in well-drained creek bottoms.

In general, the order of hazard for spruce stands is:

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

## REFERENCES

Use_of_trap_trees_for_spruce_beetle_management_in_BC_RH_1991

SBGroundSurveyGuidelineAug62014

Bark Beetle Management Guidebook 1995

Spruce beetle life cycle document

# SECTION THREE

# BEST MANAGEMENT PRACTICES & GUIDELINES

# 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 $m^3$/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 <u>not</u> 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$^{o}$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.*

**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

# 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$^{o}$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 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

# GUIDELINES FOR BLANKET SALVAGE PERMITS

# (FOR SPRUCE BEETLE SANITATION)

## 1. Purpose

The purpose of these guidelines is to provide licensees and district staff with an efficient means to determine if a proposed salvage opportunity under a Blanket Salvage Permit (BSP) is a priority for the district and to provide consistent administration while recognizing different priorities between districts.

The responsibility for updating the guidelines and ensuring they are readily available to the public is with the Resource District.

## 2. General Information

The purposes of harvesting under a BSP are to:

- Harvest and utilize small, isolated areas of timber that have been killed or damaged by wind throw, insects, fire or disease.
- Expedite the harvest authorization processes to capture the value of dead or damaged timber before the quality deteriorates,
- Expedite the harvest authorization process to manage and control insect infestations (sanitation timber salvage).

For the purposes of BSPs the following definitions are established for Crown timber:

**2.1. Damaged Timber** is:

a. Trees that are dead or damaged as a result of wind, fire, snow press, drought, landslide, flooding; or

b. Trees as a result of the effects of forest pests or disease that are dead; or

c. Trees that require management and control of insect infestation or will die within one year (sanitation timber salvage), as determined by the district manager.

**2.2. Sanitation Timber Salvage** is the harvesting of timber either standing or felled, for the purposes of managing and controlling insect infestations and includes trap trees or overflow trees.

**2.3. Isolated Timber** is defined as timber that cannot be logically added to an approved or potentially planned harvest opportunity unless required for sanitation timber salvage purposes.

**2.4. Minimizing the amount of undamaged timber** is a site specific forest stewardship requirement that recognizes that undamaged timber may need to be harvested: for access purposes, worker and public safety purposes, and for overall stand management reasons.

## 3. Requirements for Blanket Salvage Permits

BSP must meet the following criteria:

1. Maximum volume per block is 5,000 $m^3$.
2. Maximum block size of 15 hectares unless the silviculture system used on the cut block is other than clear cutting, and at the completion of harvest the trees retained on the harvested area conform to the stocking standards specified in an approved Forest Stewardship Plan.
3. The area of timber to be salvaged must be isolated.
4. For sanitation timber salvage, the request to amend the Cutting Permit must include supporting documentation that justifies the harvest for insect control. Examples of documentation would be surveys, probe information, use of trap trees, etc.
5. The amount of undamaged timber must be minimized.
6. Harvesting must be scale-based.

It is the responsibility of both licensees and district staff to ensure that cut blocks proposed for harvest under a BSP do not overlap with other existing tenures and authorizations. It is expected that when a licensee is requesting an amendment to add a block outside of the licensee's chart area that a referral to the chart holder be completed.

Refer to the *Interior Appraisal Manual's Blanket Salvage Cutting Authorities* for the requirements.

## 4. Specific District Priorities

In addition to the criteria listed above, the following is a list of the district priorities in regard to harvesting under BSP:

**At this time BSP's will be considered <u>only</u> for sanitation harvest of spruce beetle infested stands to:**

1. Control spruce beetle populations in beetle management units with suppression/prevention and holding objectives.
2. Establish trap tree sites and/or remove timber from trap tree sites and overflow associated with trap trees.
3. Be used when sanitation harvest priority rating exceeds 1000 from spruce beetle probes.

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

# 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.*

# OMINECA REGION

# GUIDELINES FOR SPRUCE BEETLE TREATMENT IN SPECIAL MANAGEMENT AREAS

## 1 Background

Special management areas serve a role in conserving important wildlife habitat and areas with sensitive or significant values. Bark beetles play an important role in the creation and maintenance of many forest ecosystems. As such, consideration of non-timber forest values is critical when assessing the need to undertake management activities. Treatment for spruce beetle in these areas must balance the needs to suppress beetle populations with the need to maintain the other identified values.

These guidelines apply to special management areas, specifically: Old Growth Management Areas, Landscape Biodiversity Areas, Critical Fish Areas, Fisheries Sensitive Watersheds, Wildlife Habitat Areas and Ungulate Winter Range.

This document does not supersede the need to comply with:

- Land Use Objectives (https://www.for.gov.bc.ca/tasb/SLRP/legal-direction/)
- Government Action Regulations: http://www.bclaws.ca/civix/document/id/complete/statreg/582_2004
- Approved Ungulate Winter Range: http://www.env.gov.bc.ca/wld/frpa/uwr/approved_uwr.html
- Approved Wildlife Habitat Areas: http://www.env.gov.bc.ca/cgi-bin/apps/faw/wharesult.cgi?search=show_approved
- Approved Fisheries Sensitive Watersheds: http://www.elp.gov.bc.ca/wld/frpa/fsw/approved.html
- Section 7 Notices for Species At Risk: http://www.env.gov.bc.ca/wld/frpa/notices/sar.html
- Section 7 Notices for Ungulate Winter Survival: http://www.env.gov.bc.ca/wld/frpa/notices/uwr.html

## 2 Guidelines

Beetle Management Units (BMUs) are established province-wide as a basis for developing strategies for the management of major bark beetles, including spruce beetles. Each unit identifies an area where defined forest health strategies can be applied (for definition, see the Omineca Forest Health Strategy 2016, available at https://www.for.gov.bc.ca/hfp/health/TSA_strategies.htm ). Therefore, the treatment options for special management areas are dependent on the objectives for that BMU. Generally, the use of conventional trap trees or no-harvest treatments, are preferred options to address spruce beetle in special management areas.

### 2.1 Prerequisites to Treatment

Before any treatments (trap trees or harvest) are implemented in special management areas, a rationale must be provided to the FLNRO District Manager in your jurisdiction that demonstrates:

- 80-100% of the known beetle infestations on crown provincial forest land within the BMU have been addressed ('addressed' equates to use of conventional trap trees or sanitation harvest); *and*
- all known infestations on crown provincial forest lands within 500 m of the infested other forest value area have been addressed ('addressed' equates to use of conventional trap trees or sanitation harvest).

### 2.2 Government Action Regulation Orders

2.2.1 In areas covered by an order under the Government Action Regulation (GAR), which prohibits or restricts the construction of roads or harvesting, a rationale needs to be provided. The rationale must demonstrate the impact of spruce beetle mortality on the given value is greater than the impact of harvesting. If timber harvesting and road construction are deemed necessary, they must be conducted in accordance with the General Wildlife Measures (GWM). Where adherence to the order is not practicable, an exemption to the GWM must be obtained through the Landbase Stewardship Division of FLNRO and may be signed off by the Regional Executive Director. Exemptions will require that material adverse impacts on Caribou within in each Ungulate Winter Range do not occur.

2.2.2 Where impacts of spruce beetle are not demonstrated to be greater than the impact of harvesting, yet the infestation is demonstrated to pose a significant risk to the adjacent working forest then harvesting should proceed as indicated in Section 3 (Treatment Options).

### 2.3 Draft or Proposed Government Action Regulation Orders

In areas covered by draft or proposed orders it is recommended that the proposed GWM's or objectives are followed. Where adhering to the GWM or objective is not practicable, licensees are to work with Landbase Stewardship Division of FLNRO to meet objectives.

### 2.4 Old Growth Management Areas and Landscape Biodiversity Areas

In Old Growth Management Areas (OGMAs) an assessment of timber and biodiversity values must be done regarding the impact of harvesting or not harvesting the particular OGMA or portion of the OGMA. Where an OGMA, or portion of the OGMA, is proposed to be harvested, a replacement area must be identified and endorsed by FLNRO District Stewardship staff or the Regional Old Growth Specialist, prior to harvesting.

In Landscape Biodiversity Areas (LBAs) there may be slight changes (<5% of the polygon) to the boundaries of the polygon area to incorporate operational issues. If polygons are impacted (area reductions), replacement areas of equal or better value will be identified. These changes will be tracked and the information provided to the Government Landscape Objective Working Group or a government designate by August 31 of each year, for the period ending March 31 of that same year. If more than 5% of a LBA polygon are impacted by harvesting, an assessment of timber and biodiversity values must be done regarding the impact of harvesting or not harvesting the particular portion of the LBA. Where greater than 5% of the LBA is proposed to be harvested, a replacement area must be identified and endorsed by FLNRO District Stewardship staff or the Regional Old Growth Specialist, prior to harvesting.

## 3 Treatment Options

### 3.1 Conventional Trap Trees

Trap tree sites can be utilized within special management areas providing that the objectives or GWM's are met. If used, trap tree sites should be located on the periphery of special management areas. It is the discretion of the District Manager to approve the use of trap trees within special management areas as per *Omineca Region Guidelines for Establishing Conventional Trap Trees (March 2015)*.

### 3.2 Sanitation Harvest

Sanitation harvest for spruce beetles should only be considered where significant areas of susceptible stands are located within 800 m (the average maximum flight distance of spruce beetles) of the infestation edge, in the special management area.

### 3.3 Windthow/ Blow Down

Windthrow patches within special management areas of greater than five spruce trees should be treated as trap tree sites if they are a threat to surrounding forests, and removal meets the objectives and GWM in place. Windthrown trees infested with beetles should be removed and processed prior to the next beetle flight.

## 4 Monitoring of Bark Beetle Suppression Activities

FLNRO will be responsible for monitoring treatment commitments, effectiveness of beetle suppression, stand level prescriptions and treatment, and post-harvest blow down. Monitoring efforts will be used to assess:

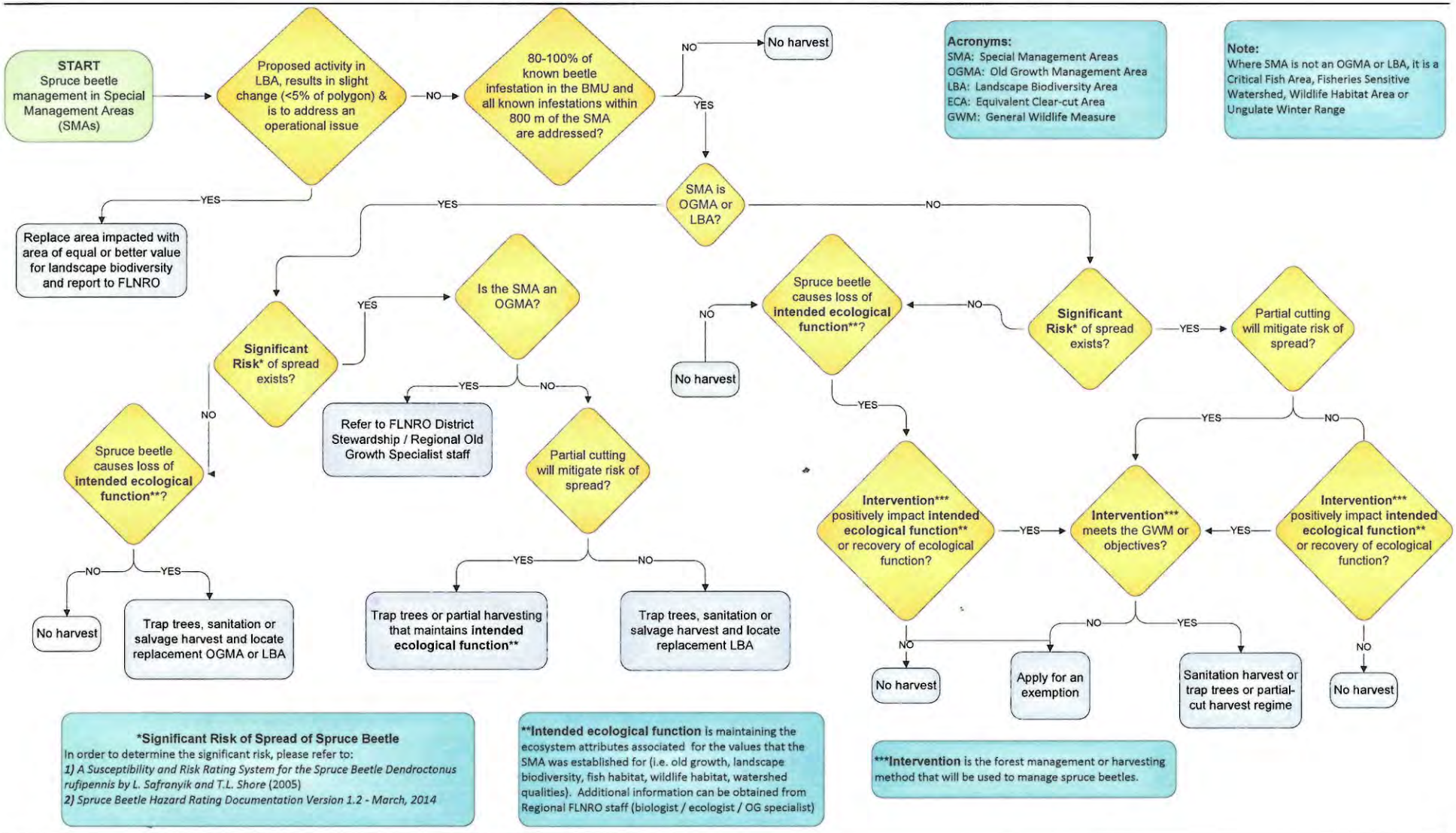
- implementation success of treatment commitments;
- implementation of recommendations in this guideline;
- the effectiveness of treatments on spruce beetle populations; and,
- the impact of harvest treatments on non-timber values within special management areas.

## 5 Deciding on the Appropriate Treatment Option

Treatment decisions in special management areas are complex. The following decision trees were developed to identify appropriate treatment options.

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

# Decision Tree: Spruce Beetle Management within Special Management Areas



# OMINECA REGION

# GUIDELINES FOR WATERSHED PLANNING

## 1 Purpose

To provide hydrological considerations when planning salvage harvest/logging to address the current spruce beetle outbreak. Proper management of watershed resources will minimize the risk of:

- channel destabilization,
- loss of fish habitat,
- increased channel sedimentation,
- increased landslide activity,
- elevated water tables,
- potential damage to forest road surfaces, cuts and fills, and drainage structures,
- loss of soil and site productivity, and
- loss of water quality.

## 2 Background

The hydrologic response of forested watersheds to disturbance is influenced by the scale and intensity of the disturbance, the weather, the geophysical setting, as well as conditions of the forest cover and understory. As this current outbreak progresses so will discussion about the need to "salvage harvest" marketable standing dead trees killed by spruce beetle. Harvest, of any kind, must balance optimizing market value in the timber, protect green spruce for midterm timber supply, and safeguarding non-timber values including aquatic ecosystems and watershed hydrology. In light of this, the following hydrology-related changes and management options are presented for consideration as a component of FLNRO's document series for the spruce beetle outbreak in the Omineca Region. Although the extent of spruce mortality and potential salvage logging may be significant in many watersheds it is important to balance the management response to ensure non-timber values are maintained. Salvage harvest and road construction can exacerbate any potential hydrological response to the beetle outbreak.

## 3 Hydrologic Change Associated with Stand Mortality and Salvage Logging

A reduction in forest canopy can result in:

- increased water reaching, stored in, and flowing from hillslopes,
- earlier onset of spring snowmelt,
- increased spring and total annual streamflow volumes,
- earlier onset of summer low flows due to early snowmelt,
- more rapid streamflow response to storms,
- increased surface erosion.

The magnitude of hydrologic change will depend on:

- the severity and time since attack,
- presence, density and extent of secondary structure,
- the extent of salvage logging within stands and across a watershed,
- the occurrence of fire,
- the physical characteristics of the watershed,
- the amount of impervious surfaces such as roads and associated ditch lines, and
- the weather.

If attacked stands are left to deteriorate naturally, any hydrologic change that occurs will be gradual as trees turn from green to yellow and red, drop their needles, lose fine branches, and eventually fall to the ground. At the same time, remaining over story will function normally or thrive and understory will release due to increased light levels and reduced competition for nutrients, both of which can lead to increased evapotranspiration rates. In contrast, logging (of any kind) can result in an immediate change to a hydrologic system. For example, logging will physically remove the dead standing spruce, and therefore eliminate any role they might provide through shade or canopy interception of precipitation. In addition, logging activities can affect the hydrologic system through:

- removal of non-spruce species and understory coniferous regeneration,
- changing the amount and distribution of fine and coarse woody debris,
- site preparation with resulting disruption of soil hydrology and potential for erosion, and
- the conversion of subsurface to surface runoff along roads and skid trails.

The duration of hydrologic change associated with the IBS outbreak will depend on:

- whether the entire over story has died or been logged,
- the amount of ground disturbance,
- the presence, age, and density of advance regeneration, and
- the regeneration delay.

## 4 Watershed Planning Expectations

To mitigate the effects of the IBS outbreak on water and watersheds, the following recommendations should be considered by forest resource planners where practicable:

- conduct salvage harvesting and road construction occur in watersheds where ground surveys have identified that understory regen is below current stocking standards and over story is composed of 80+% spruce.
- salvage log in stages by using a variety of cutting intensities and retention strategies, distributed over the landscape, to desynchronize runoff,
- avoid sensitive terrain and soil types and develop erosion control plans,
- minimize harvesting within riparian areas,
- maintain a diversity of cover types and minimize post-harvest reforestation delays through single tree or patch retention to protect advanced regeneration as well as non-coniferous forest vegetation,
- leave fine and coarse woody debris in openings where possible to trap snow and also delay surface runoff,
- develop watershed management strategies that will maintain other forest resource values,
- construct, inspect, maintain and deactivate roads to ensure natural surface and shallow subsurface drainage remain intact,
- upgrade drainage networks on permanent roads prior to salvage logging as necessary to accommodate expected increases in peak flows,
- monitor for road erosion and remediate,
- minimize road construction and site disturbance,
- consider available regional watershed evaluation findings which include watershed-based hazard indices for riparian, sediment and peak flow,

- follow harvesting recommendations on alluvial fans where they are encountered (*Land Management Handbook 57*),
- identify and consider fisheries sensitive and temperature sensitive watersheds harvest level and riparian requirements,
- increase collaboration with resource management agencies to communicate and discuss issues, hazards, and risks in watersheds affected by IBS beginning with the identification of watersheds where downstream risks to public safety and infrastructure could be increased along with risk to aquatic life and community values.

*For additional information on spruce beetle management, please contact your local FLNRO office.*

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# SECTION FOUR

# SURVEY METHODOLOGY

# Spruce Beetle Ground Survey Guidelines
# Omineca & Northeast Regions
# B.C. Ministry of Forests, Lands and Natural Resource Operations

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## Purpose:

To establish uniform procedures for ground detection and assessment of damage by spruce beetle, *Dendroctonus rufipennis,* in the Prince George, Mackenzie, and Dawson Cr. Timber Supply Areas. These procedures will enable surveyors to determine: 1) the location (area, boundary, and pattern) of spruce beetle attack, 2) the percent and intensity of beetle attack in the past 3 years, and 3) the stand structure and potential for management options. Walkthroughs, probes, and a hybrid of both as described herein are the recommended ground survey procedures for determining spruce beetle attack locations and severities. **These procedures should not to be conducted in conjunction with timber cruises nor should timber cruising precede at least a walkthrough.** Timber cruisers may not be sufficiently experienced in spruce beetle ground detection, and beetle attack data from cruising is not detailed enough for proper beetle management planning.

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## Definitions:

**Strip Line/Sampling Strip** - a 10 m wide x 100 m long (1000 $m^2$) ground survey unit usually extended to the nearest 50 -100 m past the last recorded beetle-attacked spruce. Strip lines are run with all types of ground surveys but the data collected within will vary by the survey method.

**Pixel** - a 100 m wide x 100 m (10,000 $m^2$ or 1 ha) long ground survey unit in which a **strip line** traverses. The strip line is a 10% sample of the pixel and during probes determines if the entire pixel is classified as infested or not infested and to what extent.

**Mini-pixel** - a 10 m x 10 m (100 $m^2$) ground survey unit that is installed during **hybrid method** ground surveying. This 100 $m^2$ sampling unit can represent 10% of a 1000 $m^2$ area or 5% of a 2000 $m^2$ area.

**Walkthrough** - a non-systematic preliminary ground reconnaissance conducted by an experienced individual (recommend 2-person crew for safety) in order to determine **rough estimates** of the extent and intensity of beetle attack prior to the recommendation of any possible probing or other management decision. The configuration and extent of walkthroughs are often site-specific decisions made by the surveyor. It may be specified that a minimum length of probing, e.g., 50 - 100 m, be included from a representative area within the walkthrough boundary.

**Probe** - a systematic and detailed secondary ground reconnaissance conducted by at least a two-person experienced crew. Probing will indicate the extent, intensity, vigour, and year(s) of beetle attack. It will also provide additional information on stand species composition, diameter, and general susceptibility. Probe lines are spaced no further than 100 m apart (see

pg. 4). Probing is the recommended method in all moderately-attacked areas and locations which may have sensitive values such as wildlife habitat, First Nations issues, high visual quality objectives, or other values/constraints requiring more detailed and systematic survey information before a management decision can be made.

**Hybrid Method** - a systematic and partially detailed ground reconnaissance conducted by at least a two-person experienced crew where walkthrough lines are run on a more systematic or grid-like basis but spaced wider than 100 m apart. Where beetle-attacked trees are encountered, the surveyor has the option of establishing a 10 m x 10 m "mini-pixel" in this infested location if it is representative of the stand(s) before moving on and continuing the walkthrough line. The continuing walkthrough can revert to a probe line if required and then revert back to a walkthrough line when suitable.

**Salvage Harvesting** - harvesting operations primarily designed to recover timber damaged or degraded by fire, **an old insect attack**, wind, or disease before the wood becomes unmerchantable. Control of forest health factors such as bark beetles is incidental and is not the primary objective of salvage logging.

**Sanitation Harvesting** - logging operations specifically designed to maximize the extraction of **currently infested** or infected stands in order to reduce the damage caused by forest pests and to prevent their spread. Currently infested spruce are those which have been attacked by spruce beetle in 2016 on a 1- or 2-year cycle or those attacked in 2015 on a 2-year cycle.

**Phloem Samples** - To determine relative beetle attack densities and brood densities between areas surveyed via any of the 3 survey methods, a total of 20 *most-recently* attacked spruce (i.e., 2016-attacks based on the current date) must be sampled per area/stand. On each selected tree, two 15 cm x 15 cm (225 $cm^2$) bark samples are removed at dbh; one from the north side and one from the south and the appropriate information tallied as per the method on pg. 11.

**Initial Detection (Sketchmapping)**

All susceptible spruce stands are normally aerially sketchmapped before any walkthroughs are undertaken. Since foliage of attacked spruce can often take 13-15 months to fade and become noticeable from the air, sketchmapping merely maps previously killed trees and is a starting point from which walkthroughs are planned. Susceptible spruce stands usually have an average d.b.h. of 41 cm or more with 65% or more of spruce in a well-drained creek bottoms or on low benches. Sketchmapping will provide preliminary information contained in Table 1.

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Table 1. Preliminary Information from Sketchmapping

| Sketchmapping Classification | Percent "Discoloured" Trees* | Suggested Priorities for Walkthroughs** |
|---|---|---|
| Light | 0 - 5 | 2nd or 3rd |
| Moderate | 6 - 15 | 1st |
| Heavy | 16+ | 2nd or 3rd |

* based on total stems
** at each District's discretion

**Walkthroughs** will determine "**rough**" **estimates** of:

1) the **size** (ha), **boundary**, and **pattern** (spatial distribution) of the infestation;
2) the **incidence and severity** of the infestation as measured by:
   -the percentage of spruce attacked in the last 3 years, i.e., 2016, 2015, and 2014 (or previous); and
   -the attack densities and success of the attacking beetles and the vigour of the new broods as measured by a few random phloem samples;
3) **the risk of beetle spread** within (and to outside) the stand based on stand susceptibility and beetle pressure;
4) **access, operability**, and **integrated resource management issues**;
5) a **sanitation and salvage harvesting priority rating** (Table 5, pg. 10); and
6) the **necessity to obtain further information or take other action** as detailed below.

Based on walkthroughs or the hybrid method, the surveyor will classify the area/stand and recommend one of the 3 broad options in column 3 of Table 2

Table 2. Spruce Beetle Management Options After Walkthroughs

| Walkthrough Classification | Sanit./Salv. Harvest Rating* | Beetle Management Recommendations** |
|---|---|---|
| Light | 0 - 599 | **Leave** (monitor, trap trees, baits, etc..) |
| Moderate | 600 - 999 | **Hybrid Method** or **Probe** (to obtain further information) |
| Heavy | 1000+ | **Recommend Layout for Cruising and** expeditious sanitation logging)*** |

* see formula in Table 5 which mainly weights 2016- and 2015-attacks (2014- or older attacks are a minor consideration).

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** all recommendations must consider access and integrated resource management issues. The precise thresholds for management action may vary by District, TSA, or by operating areas within a District (see *Bark Beetle Management Guidebook* for further information).

*** assuming road access exists or could be in the near future.

**Probing** will determine "**detailed**" **estimates** of:

1) the **size** (ha), **boundary**, and **pattern** (spatial distribution) of the infestation;
2) the **incidence and severity** of the infestation as measured by:
   -the percentage of spruce attacked in the last 3 years, i.e., 2016, 2015, and 2014 (or previous); and
   -the attack densities and success of the attacking beetles and the vigour of the new broods as measured by a series of phloem samples;
3) **the risk of beetle spread** within (and to outside) the stand based on stand susceptibility and beetle pressure;
4) **access, operability**, and **integrated resource management issues**; and
5) a **sanitation and salvage harvesting priority rating** (see Table 5, pg. 10); and
6) the necessity for possible **beetle management action** within the stand

A **Hybrid Method** survey will determine information more detailed than a walkthrough but less detailed than a probe but will still provide the following information:

1) the **size** (ha), **boundary**, and **pattern** (spatial distribution) of the infestation;
2) the **incidence and severity** of the infestation as measured by:
   -the percentage of spruce attacked in the last 3 years, i.e., 2016, 2015, and 2014 (or previous); and
   -the attack densities and success of the attacking beetles and the vigour of the new broods as measured by a series of phloem samples;
3) **the risk of beetle spread** within (and to outside) the stand based on stand susceptibility and beetle pressure;
4) **access, operability**, and **integrated resource management issues**; and
5) a **sanitation and salvage harvesting priority rating** (see Table 5, pg. 10); and
6) the necessity for possible **beetle management action** within the stand

The intention of the hybrid method is to increase sampling from perhaps 5% coverage obtained from an average walkthrough (depends on size of the stand, number of lines and their spacing) to 10% (equal to a probe) if the 10 m x 10 m "mini-pixel" is an appropriately representative 10% sample of 1000 $m^2$. Instead of tallying every tree >17.5 cm dbh in a 10 m x 100 m pixel to help determine stand composition and beetle attack, a surveyor may want to install a mini-pixel to determine the species composition and percent attack by dbh class and then, as the walkthrough continues, simply GPS and record the code of every attacked spruce. In any given stand, surveyors might begin with a walkthrough, revert to a hybrid method and install a mini-pixel, and/or even revert to a probe on a portion(s) of their survey area - all in the same entry without having to return to the site later. Alternatively, surveyors could run all their walkthroughs first as a coarse filter and then only return to those few sites that require the hybrid method or probing.

Figure 1. Layout of Spruce Beetle Ground Survey Lines (Strip Lines and Pixels)

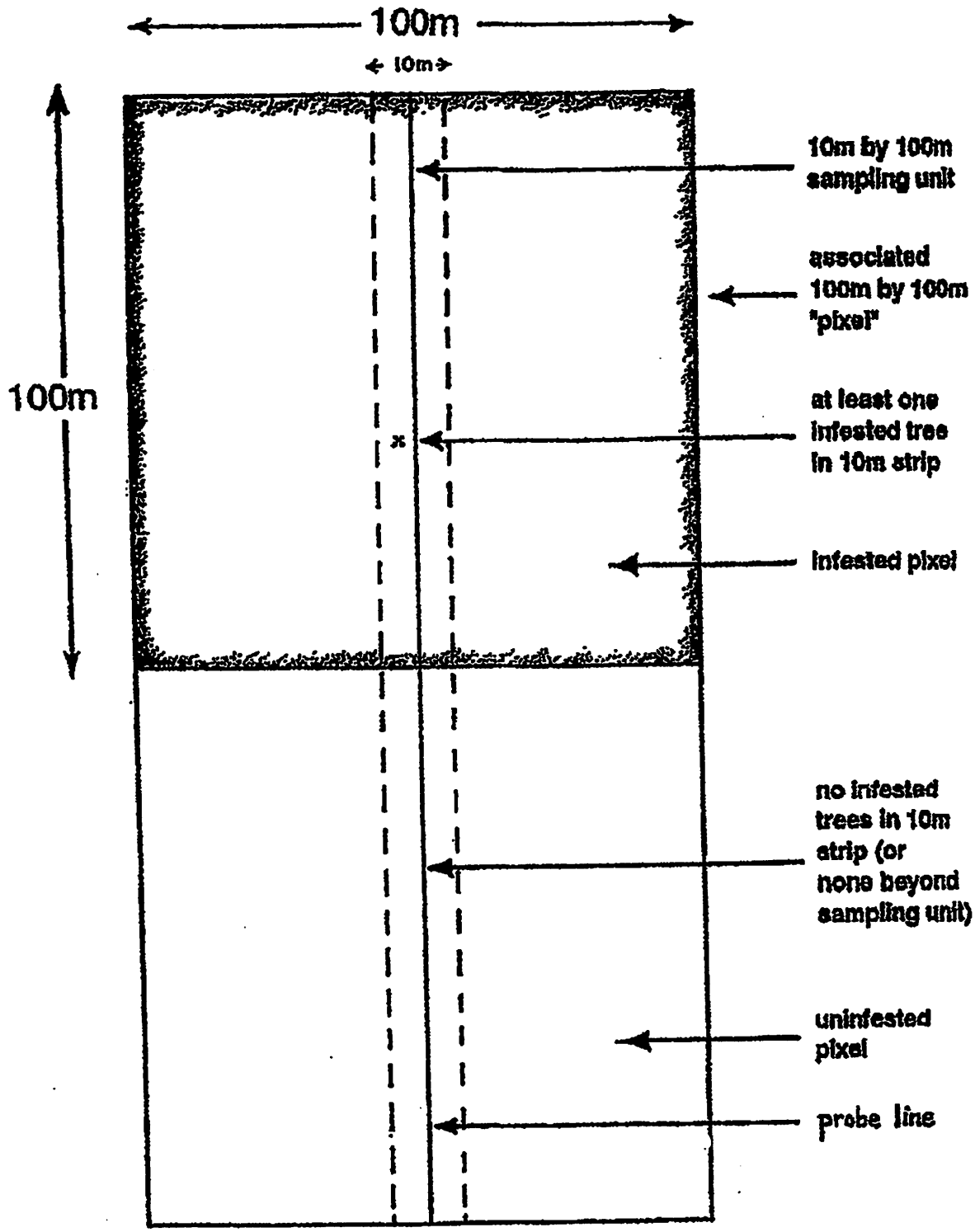


Figure 2. Spruce Beetle Probe (Ground Survey) Card (FS 1111) with filled in example.

BRITISH COLUMBIA

**SPRUCE BEETLE PROBE CARD**

| | | |
|---|---|---|
| LOCATION<br>Hook Lake | 10 U 599584 E<br>6075671 N | PAGE 1 OF 3 |
| BEARING<br>245° SL-1 | DISTANCE<br>0-100 m | STRIP WIDTH<br>10 m |

| DIAMETER CLASS | SURFACE AREA FACTOR | NUMBER OF HEALTHY HOSTS | BARK BEETLE CODE BY YEAR OF ATTACK | | | | | | OTHER TREE SPECIES | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | B | Pl |
| 17.5 - 25.0 | 3.3 | | | | | | | | | |
| 25.1 - 30.0 | 5.3 | | | | | | | | | |
| 30.1 - 35.0 | 7.1 | | | | | | | | | |
| 35.1 - 40.0 | 9.4 | | | | | | | | | |
| 40.1 - 45.0 | 11.6 | | | | | | | | | |
| 45.1 - 50.0 | 13.8 | | | | | | | | | |
| 50.1 - 55.0 | 16.2 | | | | | | | | | |
| 55.1 - 60.0 | 18.7 | | | | | | | | | |
| 60.1 + | 25.3 | | | | | | | | | |
| TOTALS | | 40 | 8 | 3 | 8 | 2 | 5 | | 44 | 8 |

| BARK SAMPLES 15cm x 15cm | NO. ENTRANCE HOLES | NO. PARENT ADULTS | NO. LARVAE | NO. PUPAE | NO. CALLOW ADULTS | FRESH (GREEN) BLOWDOWN | |
|---|---|---|---|---|---|---|---|
| | | | | | | Attacked | Unattacked |
| 1a | | | | | | | |
| 1b | | | | | | | |

COMMENTS
- 90% on a 2-year cycle
- a few pitchouts on smaller diam. stems
- ⊡ also code 2

| CREW NAMES | DATE Y | M | D |
|---|---|---|---|
| John Smith + Bill Jones | 15 | 11 | 20 |

FS 1111 RPG 2000/01 7530881048 (100/bd)

As an example, if three separate but adjacent stands are initially surveyed by walkthroughs, the surveyor might return to a portion of one of the strip lines that is representative of the area covered and install a mini-pixel before leaving the area. With proper planning, walkthroughs usually reveal sufficient information to make a management decision on 80% of infested sites.[1]

If probing is recommended after walkthroughs or a hybrid method (from Table 2), then delineated stands should be grid-probed via systematic parallel probe lines consisting of 10 m-wide strips (5 m on each side of centre line) and spaced 100 m apart (Fig. 1). All trees greater than 17.5 cm dbh within the 10 m-wide strip will be recorded within one of the existing diameter classes on the *Spruce Beetle Probe Card* (FS 1111) (Fig. 2 - example) or *Beetle Probe Card* (FS 1111A). As information will be summarized by 100 m long strips, all probe lines should be run to the nearest 100 m.

All spruce beetle-attacked trees will be recorded as codes 1-6 as per the *Regional Bark Beetle Codes* summarized in Table 3 and recorded on the *F.S. 1111* in numerical form (Fig. 2). Probers must remove at least a small portion of phloem from every infested tree within their 10 m strip to ensure coding accuracy. All attacked trees will also be mapped on the *Compass and Traverse Sheet* (*F.S. 375*) or similar (Fig. 3 - example) which will accompany the completed *FS 1111.*

Table 3. Bark Beetle Codes for Spruce Beetle*

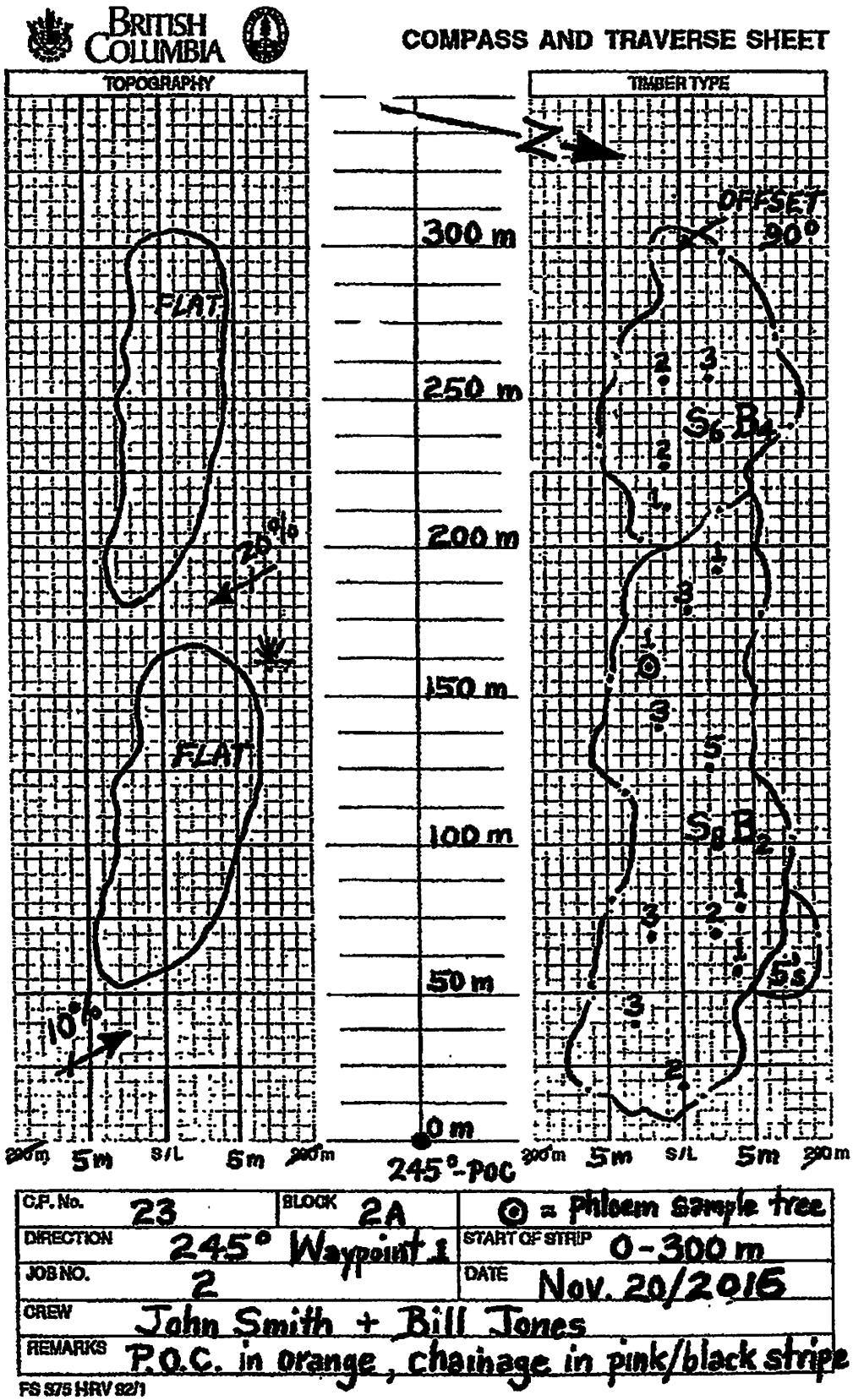
| Code no. | Year of attack | Year** and type of attack |
|---|---|---|
| 1 | Most recent | 2016 - Full |
| 2 | Most recent | 2016 - Strip |
| 3 | Second recent | 2015 - Full |
| 4 | Second recent | 2015 - Strip |
| 5 | Third recent | 2014 - Full |
| 6 | Third recent | 2014 - Strip |

* a complete summary of the signs and symptoms of attack for each code is available from the *Spruce Beetle Coding Sheet.*

** fill in the appropriate years of attack in the blank lines as illustrated. They will always be in pairs for the past 3 years of attack.

[1] Beetle ground surveys funded by the provincial *Landbased Investment Strategy Account* cannot be used to lay out boundaries for cutting permit applications. Block layout costs are recoverable by licensees as an appraisal cost claim.

Fig. 3. The Compass and Traverse Sheet (F.S. 375) with filled in example.



To determine relative beetle attack densities and brood densities between areas during the hybrid method or probing, a total of 20 *most-recently* attacked spruce (i.e., 2016-attacks based on the current date) must be sampled per area/stand. Ideally, one tree should be sampled approximately every 200 m along the line. At each sample tree, two 15 cm x 15 cm (225 $cm^2$) bark samples are removed at dbh with a hatchet; one from the north side and one from the south and the appropriate information tallied as depicted in the lower portion of the *FS 1111* (Fig. 2). Such sample trees must also be clearly delineated (e.g., by a circle or GPS reference) on the F.S. 375 (Fig. 3). While some of these samples will undoubtedly be "clumped" (e.g., 5 trees within 300 m), the overall objective is to obtain a relative comparison of beetle attack densities and brood densities between areas/stands surveyed. It is recommended that a few such samples be taken during walkthroughs. Bark sample data also provides a key bark beetle coding check for survey supervisors and Ministry and licensee field monitors. Table 4 can be used to rate the mean beetle attack densities and larval densities between areas surveyed in order to further rank sanitation logging priorities.

Table 4. Spruce Beetle Attack Density and Larval Density Rating

| Mean no. entrance holes per 225 $cm^2$ phloem sample | Mean attack density | Mean no. living larvae per 225 $cm^2$ phloem sample* | Mean larval density |
|---|---|---|---|
| < 1 | low | < 4.9 | low |
| 1.0 - 1.9 | moderate | 5.0 - 14.9 | moderate |
| 2.0 - 3.9 | high | 15.0 - 24.9 | high |
| > 3.9 | severe | > 24.9 | severe |

* Assumes samples taken from July 15 - March 31 from a population in the first year of a 2-year cycle

**Survey Line Delineation**

Even though computer tablets with mapping software are gaining in popularity for survey navigation and data entry, the initiation and termination of all beetle survey lines should be clearly marked with highly visible flagging tape which indicates:

1) the geographic location, waypoint reference, and survey line number, e.g., *Windfall Cr., GPS pt. D, Probe A, SL #5;*
2) the "point-of-commencement" (*P.O.C*) or "point of termination" (*P.O.T.*) and bearing, e.g., *P.O.C. - 270°*; and
3) the crew number/name and date, e.g., *Crew #2, Oct. 28/16*

Along the length of the survey line, flagging tape should be hung at appropriate intervals (approximately every 30-50 m) indicating the general direction of the line so that anyone standing anywhere on the line at a later date (e.g., a field auditor) can follow it without solely relying on GPS and/or a mapping software file. Every 100 m interval along the line should be marked with different or longer flagging tape, e.g., *0 + 100 m*. Wherever the crew changes direction, the GPS location and offset bearings and distances must also be clearly indicated by flagging tape, e.g., GPS pt. E, *offset 90° + 100 m.*

**Probe Data Calculations and Summarization**

Beetle code data collected on the *F.S. 1111* must be multiplied by the corresponding *mean surface area (of bark) per m²* (*S.A.* factor ) (*Fig. 2*, column 2) (for strip attacks, i.e., codes 2, 4 & 6, use 0.5) and the products transposed to the *Spruce Beetle Infestation Summary Sheet* (Table 5 - example). Summarized data will then provide:

1) the proportion of the block infested (based on the number of infested 100 m x 100 m pixels);
2) the percent attack in the past 3 years.

If road access exits into the surveyed area/stand or a road could be constructed soon, the District should calculate the *Sanitation and Salvage Harvest Priority* value (Table 5 - bottom formula). If *salvage* wood cannot be utilized for particular products such as veneer, the third component in the formula can be omitted. Complete details on the rationale for the formula are provided in the *Bark Beetle Management Guidebook.*

On the completion of a survey, data from *F.S. 1111's* and *F.S. 375's* should be summarized by area, stand, or other unit into an appropriate spreadsheet or table to indicate the following minimum information;

1) Contract number (if relevant);
2) Geographic reference, e.g., "*Parsnip R. south*";
3) Opening number (if available), mapsheet, unit, and block numbers, e.g., *93-0-11-e, Unit 2e, Block 1*; GPS commencement waypoint;
4) Names of surveyors;
5) Date of the survey;
6) Total m surveyed;
7) Total ha surveyed;
8) Total no. of healthy spruce tallied;
9) Total no. of attacked spruce by beetle codes 1 - 6;
10) Total no. of all spruce tallied;
11) Percent attack for each beetle code 1 - 6;
12) Percent attack in each of the last 3 years, i.e., for 2016, 2015, and 2014 (from Table 5);
13) Proportion of the block infested (from Table 5);
14) Mean attack density and mean larval density (from Table 4);
15) Percent spruce in the stand; and
16) Percent other conifers by species.

## Table 5. Spruce Beetle Infestation Summary Sheet

| DBH Class | Healthy Hosts | 2016 | | 2015 | | 2014 | | Other Species |
|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | |
| 17.5 - 25.0 | *3.3* | | | | | | | *3.3* |
| 25.1 - 30.0 | *10.6* | | | | | | | *31.8* |
| 30.1 - 35.0 | *21.3* | *7.1* | | | | | | *35.5* |
| 35.1 - 40.0 | *47.0* | *9.4* | *4.7* | *18.8* | *4.7* | | | *103.4* |
| 40.1 - 45.0 | *81.2* | *23.2* | *5.8* | *34.8* | *5.8* | *11.6* | | *139.2* |
| 45.1 - 50.0 | *151.8* | *27.6* | *6.9* | *27.6* | | *13.8* | | *193.2* |
| 50.1 - 55.0 | *113.4* | *16.2* | | *16.2* | | *48.6* | | *32.4* |
| 55.1 - 60.0 | *56.1* | *18.7* | | | | | | *18.7* |
| 60.1 + | *25.3* | | | | | | | |
| Totals | *510* | *102.2* | *17.4* | *97.4* | *10.5* | *74.0* | 0 | 557.5 |

STEPS

1. Proportion of Block Infested = $\frac{\text{No. of Infested Pixels}}{\text{Total No. of Pixels in Survey}}$

2. Percent attack within infested portion (assumes 85% + beetles are on a 2-year life cycle).

- The results from all attacked pixels should be used.
- The number of trees on the SB Probe Card should be multiplied by the SAF* with products calculated separately for each row and column individually in the above table.

- % 2016 Attack = $\frac{102.2 + 17.4}{811.5}$ x 100 = *14.7%*
- % 2015 Attack = $\frac{97.4 + 10.5}{811.5}$ x 100 = *13.3%*
- % 2014 Attack = $\frac{74 + 0}{811.5}$ x 100 = *9.1%*
- % Host in Stand = $\frac{811.5}{1369}$ x 100 = *59.3%*

Sanitation & Salvage Harvesting Priority Rating (calculate if required by the District)

(% 2016 + $\frac{\%\ 2015}{1.5}$ + $\frac{\%\ 2014}{4}$) x % Host = _____

( 14.7 + $\frac{13.3}{1.5}$ + $\frac{9.1}{4}$ x 59.3 = 1539.5

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* Surface area factor (mean area per diameter class)

**Mapping**
An appropriate 1:10,000 scale summary forest cover map for each surveyed area/stand must also be included (paper or digital file) which contains:

1) a 10,000 map scale and north arrow;
2) an opening number or unit and mapsheet number which matches the spreadsheet data;
3) clearly plotted survey lines with GPS coordinates tied into a physical feature(s) indicating *P.O.C.'s, P.O.T.'s*, strip line numbers, bearings, and distances;
4) a colour stratification of infested areas into 3 categories of combined 2016 + 2015 attacks:
   - light - 0 - 5%
   - moderate - 6 - 9%
   - heavy - 10% +
5) a 4-character label must be added to the attacked map polygon indicating the percent attack in the past three years and the percent spruce (healthy plus attacked) in the stand, i.e., *5,8,6,70* which equates to a 5% attack in 2016, 8% in 2015, 6% in 2014 (or previous), and 70% spruce; and
6) as a contract option, all adjacent trap tree patches and recent blowdown can also be included on the map as per the Ministry's cartographic standards.

**Additional Survey Information**
Further information can also be specified depending on District/licensee requirements and the experience of the ground survey crew and their consulting company, and can include:

1) topography and operability for winter or summer logging;
2) integrated resource management concerns such as riparian zones, wildlife habitat, landscape values, etc . .
3) vigour of the beetle population considering it's:
   - possible origin and attack history in the stand;
   - Potential for spread considering the next major flight and the percent 1- and 2-year cycle beetles; and
   - Impacts of woodpecker activity, host resistance, and other population limiting Factors.
4) Site specific recommendations for spruce beetle management such as:
   - Sanitation logging (clear-cut, patch removal, single tree "snip and skid" or combination thereof);
   - trap trees;
   - Pheromone grid-baiting of standing trees;
   - Utilization and remedial actions required for hazard reduction (e.g., slash management, low stumps and blowdown extraction); and
   - further recommended detection via more ground surveys and/or heli-GPS)

## PURPOSE

Spruce Beetle (SBB) ground based surveys are conducted to gather and report information which will assist forest managers in planning and treatment decisions related to the SBB activity in the area and to aid in the overall management of SBB activity in the Region.

Ground detection and assessment of damage by Spruce Beetle could will utilize a STAR PROBE ground survey procedure for sites with identified points of less than 10 infested trees, (as determined from aerial surveys). Surveys will be focused on identified GPS locations. In general, ground surveys collect the following information: (a) Verify presence and severity of Spruce Beetle infestations, (b) Determine the boundaries and size (ha) of infestations, (c) Assess basic stand characteristics to estimate merchantability, susceptibility and risk of the remaining stand, (d) Assess access, operability and integrated resource management issues, (e) Assess the necessity to obtain further information or take other action, (f) Provide treatment recommendations, which incorporate all the above issues.

## SPRUCE BEETLE STAR PROBE GROUND SURVEY PROCEDURES

### GENERAL

(a) The Contractor shall perform surveys for each area listed in the Schedule B only during those periods where field conditions are suitable for the type of survey work.

(b) The Contractor must submit a Work Plan Schedule, which outlines how the specific areas listed in the contract will be completed within the term of the contract. The Company will provide the initial outline for the contractors Work Plan Schedule and reserves the right to request changes to this Work Plan Schedule. Once the contract has been initiated, the Company will co-ordinate a continued work schedule. The Work Plan Schedule must incorporate planned submission of completed work in "batches" to allow for Quality Assurance assessment to be conducted in a timely manner.

## SAMPLING SPECIFICATIONS FOR STAR PROBE GROUND SURVEYS

### GENERAL

(a) Digital information identifying the location of GPS points identified from the detailed aerial survey will be provided. A GPS point is associated with a "fading" and/or a red tree.

(b) The probe line shall run from a known point (POC) to the GPS infestation. Any new infestations containing current attack trees found along the line shall be documented as a new infestation on separate field cards, mapped and added to the database. New Infestations: all contract requirements apply to the new infests including GPS coordinates, mapping, and database updates

(c) Once the GPS survey point is located, establish a plot centre at the epicentre of the infested area (wherever possible). Select an uninfested tree as the plot centre. Record the GPS location of the plot centre as well as the positional accuracy. A minimum of four lines in the cardinal directions (N, S, E, W) will be established. Beginning at plot centre a recce line straight out to the N from plot centre for a distance of 100m will be established. All infested trees within sight will be assessed and marked

digitally on a handheld GPS or tablet. Potentially infested trees within sight must be assessed by a qualified spruce beetle surveyor. If no live attack (codes 1-4) are detected, the line terminates at 100m and a new line beginning at plot centre, in one of the remaining cardinal directions is established. If there is no live attack detected after completion of the four lines, the surveyors move to another point and establish a new star probe. If there is live attack, the line continues 100m past the last live attack tree. (i.e. if the last live attack was found at the 77m mark, the total line length is 177m) the maximum line length will be 200m. Any live attack noticed during the survey past this point is noted. In addition, lines in the inter-cardinal directions within that and the adjacent quadrant are established utilizing the same convention as mentioned above. Should a star probe exceed 25 infested (live) trees, either on the walk to or within the probe itself the surveyors will begin a new survey utilizing the hybrid method.

All infested trees discovered during the probe, must be marked with paint or ribbon, up to the maximum of 25 trees.

(d) All new infestations containing current attack trees found along the access line shall be GPS'd, documented separately, mapped, and added to the infestation summary and database.

# SECTION FIVE

# LINDGREN FUNNEL TRAPS & USE OF FIRE

# LINDGREN FUNNEL TRAPS

This document provides specific information on the use of Lindgren funnel traps to monitor beetle development and flight, as described in section 8 of *Omineca Region Guidelines for Spruce Beetle Haul and Mill Strategies* (March 2016).

## 1 Background

Lindgren funnel traps (invented by Dr. B. Staffan Lindgren, professor emeritus UNBC) are primarily used for monitoring and sampling insect populations; they can also be used to mop up infestations or to suppress small localized insect populations. If used for monitoring bark beetle flights, traps must be established before the beetle flight period (often early May through July for major bark beetles). Funnel traps may be quickly overwhelmed with insects during large outbreaks, so if suppression of bark beetle populations is the goal, baited trees slated for harvest or conventional trap trees may be better options. In addition, for some bark beetles, anti-aggregation pheromones are commercially available and are useful for repelling attacking insects from high value trees or stands.

## 2 Set Up

Funnel trap assembly is illustrated in the Figure 1. Funnel traps can be suspended from a rope tied between two trees or from stand-alone metal hangers. Lures (containing pheromone components that act as attractants to target insects) are suspended in the centre of the trap using plastic extensions. Vendors sell both baits and lures (see Table 2). Baits are designed to attach to trees (standing or cut) in order to concentrate beetles in an area that will be harvested and processed. Lures are used in funnel traps.

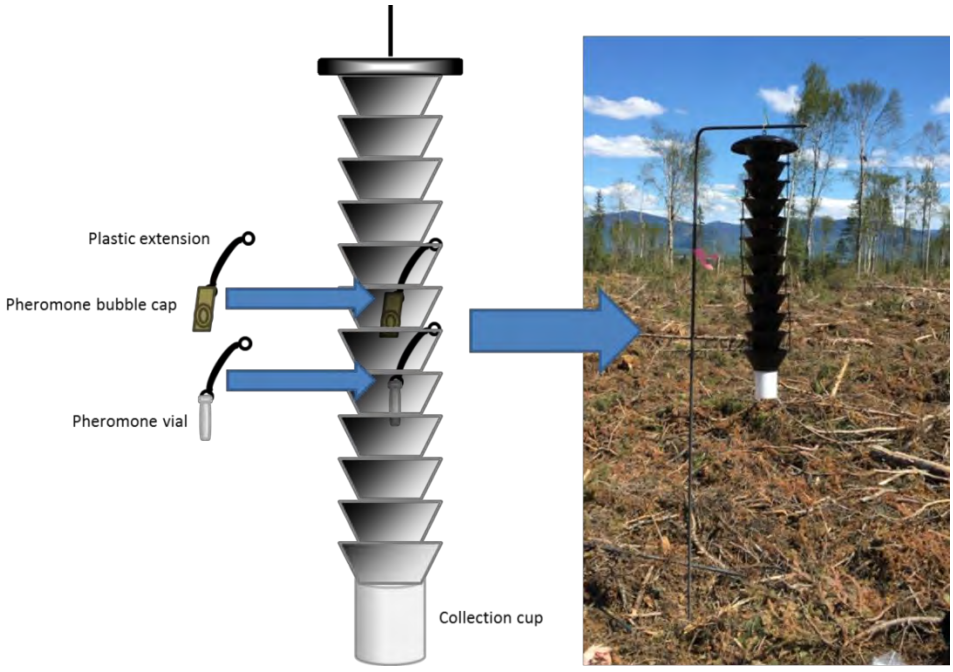



**Figure 1 – Funnel trap assembly. Lures, such as pheromone bubble caps or vials, are attached to the black plastic extensions and placed in the centre of the trap. The right photo shows the final trap setup suspended from a rebar hanger.**

Hangers can be made from rebar, aluminum conduit, or any other sturdy material. If using rebar or aluminum, dimensions should be approximately 3 metres in length with a 0.6 metre bend at the top and at least a 0.6 metre section that is inserted into the ground. Welded cross bars at the base of the stand are recommended for both stand stability and as a method for placing the hanger in the ground.
Ideally, traps should be placed well away from susceptible host trees (usually between 40 and 100 metres away). ***Because funnel traps are attracting forest pests using lures, there is always a risk of 'spillover' attacks on healthy trees in the area, especially if insect populations are high.***

Trap layout can vary, depending on the objectives of the trapping exercise. Single traps can be used to effectively monitor flight times and populations, especially if checked frequently and populations are low enough not to quickly fill the trap. For monitoring or suppressing very high populations of insects during outbreaks, a more intense trap layout may be useful. For example, groups of three traps may be placed in a grid or line with 30 to 100 metre intervals in between.

## 3 Trapping Cups

The white cup on the bottom of the trap can be either a 'wet cup' or a 'dry cup'.

A wet cup is designed to hold a liquid that both kills and preserves trapped insects. Normally, wet cups are filled with propylene glycol – camper antifreeze – that is nontoxic (Figure 2). This can be diluted up to 50% with water.




**Figure 2 – An example of propylene glycol or camper and marine antifreeze.**

Dry cups are designed to be used with volatile insecticides (such as Vaportape insecticidal strips manufactured by Hercon Environmental, see vendors below). ***Insecticidal strips are not currently approved for use in funnel traps in Canada***, but the BC government is working to obtain approval. If dry cups are used without insecticidal strips, insect numbers may not be accurate as trapped insects attract other predatory insects that will munch on your catch, or target insects may simply just fly away! These factors decrease the accuracy of target insect counts. If you have dry cups, the drainage holes can be plugged for a quick conversion to wet cups, if required, or you can purchase wet cups that will attach to existing funnel traps.

## 4 Data Collection

Lindgren funnel traps are used for a number of purposes. Data collected may include:

- monitoring date
- location
- collector's name
- treatment / lure type
- local environmental data (e.g., elevation, aspect, features such as log yards that may influence or explain trap catches)
- number, weight or volume, and species of collected insects
- notes

If possible, please send any relevant trapping data to regional provincial entomologist (for the Omineca Region, please send to Jeanne.Robert@gov.bc.ca). The data is very useful in confirming and tracking insect occurrences in multiple locations, especially for information such as bark beetle flight times and numbers.

## 5 Checking the Traps

The frequency of checks depends on weather, but most traps should be checked weekly. Heavy rain or wind, or damage by bears, may necessitate more frequent checks to prevent loss of data. During each check, remove the insects from the cup. Use paint filters (Figure 2) within funnels to separate insect samples from the used antifreeze, and collect the used antifreeze in a container for disposal. Pour fresh antifreeze into cups.

Count, weigh, or estimate the volume of the insect samples on site, or preserve samples in jars, containers, or plastic bags that contain 70-90% ethanol or isopropyl alcohol. This will preserve specimens for counting or identifying later. If you want to preserve specimens for more than a few days, storing them in the fridge or freezer is recommended. Samples should contain clear labels written on paper in pencil (pens or felts will dissolve in alcohol!) – the paper labels can be stored in the jar, submerged in the ethanol with the insect samples.

## 6 List of field equipment needed for collection

- fresh anti-freeze for filling or re-filling cups
- empty container to collect and dispose of used antifreeze
- filters and funnel to separate insects from antifreeze
- squeeze bottle for rinsing insects in the filter
- 70-90% ethanol or isopropyl alcohol if you want to preserve specimens (for later identification or experiments)
- data labels written on paper with pencil
- leak proof containers for storing collected insects




**Figure 2 – examples of paint filters that will work for mass trapping efforts**

## 7 Vendors for Equipment and Supplies

Hardware stores and paint supply shops are best bets for purchasing funnels, filters, and general storage containers. Dollar stores can also be a good source for inexpensive storage containers. Information on vendors can be found in Tables 1 and 2.

**Table 1: Entomological equipment and scientific supplies**

| Vendor | Items available | Website |
|---|---|---|
| Bioquip | • insect collecting supplies (e.g., forceps)<br>• squeeze bottles<br>• ethanol<br>• high quality storage jars and vials | https://www.bioquip.com/ |

**Table 2: Traps and lures**

| Vendor | Items available | Website |
|---|---|---|
| Synergy semiochemicals | • lures and baits for bark beetles and other insect pests<br>• anti-aggregation pheromones<br>• funnel traps | http://www.semiochemical.com/ |
| Westgreen global technologies | • lures and baits<br>• vaportape insecticidal strips<br>• funnel traps | http://www.westgreenglobaltechnologies.com/ |

*For additional information on spruce beetle suppression, please contact your region or district FLNRO office.*

# THE USE OF PRESCRIBED FIRE FOR SPRUCE BEETLE SUPPRESSION
## PROS AND CONS

*Prescribed fire is the knowledgeable and controlled application of fire to a specific land area to accomplish planned resource management objectives.*

**Pros**

1. Prescribed fire may affect beetle or brood established in stumps below the duff line when fuel moisture codes (Duff Moisture Code, Drought Code) are high enough to ensure a persistent fire resulting in duff consumption greater than 60%.
2. Prescribed fire will also affect brood established in downed material that was not harvested and or timber that has been left for other purposes (habitat, riparian etc.) if such material is burned. Effectiveness for this type of fire is generally good.
3. Prescribed fire will reduce the preferred habitat so the risk of infestation of stumps and downed material is significantly lower than unburned areas.
4. Prescribed fire will also reduce the risk of wildfire (unplanned events) which given the size and nature of control efforts, the probability of a wildfire impacting harvested areas is close to 100%.
5. Prescribed fire will reduce reforestation costs and improve seedling growth while controlling brush and the need for herbicide or other such treatments.

**Cons**

1. Cut block perimeters will have to be designed for using prescribed fire in a safe and effective manner.
2. Fringe damage may increase suitable host material if trees are killed without commensurate bark damage
3. The size of the control efforts (i.e. harvesting) could affect how many blocks could be treated during the burning season.
4. Burning windows are limited and smoke impacts may be elevated, however, bear in mind that resource management open fire is exempt from smoke control regulations.
5. Manpower and equipment availability may limit the number of blocks that could be burned. This along with provincial wildfire load may impact burning schedules and the crowns ability to accept additional risk.
6. There are a limited number of persons with experience in prescribed fire thus a steep learning curve may affect licensee`s abilities and comfort levels.

It is my opinion that the benefits of prescribed fire outweigh the risks and operational restrictions than no fire use at all. Past beetle control efforts have been affected by fire, (wildfire) where if a prescribed burning program had been incorporated into the control program, there would have been significantly smaller fires and reduced damage and costs. One way or another, fire will impact harvesting, regeneration and timber values whether we like it or not. Best practices should include the use of prescribed fire as part of the arsenal of control methods.

Brent Bye
Senior Protection Officer
Fire Management
Prince George Fire Centre
Phone: (250) 565-6716

RESOURCE MANAGEMENT OPEN FIRE
See: Section 23 of the *Wildfire Regulation*

**Liability -** The Liability of persons carrying out resource management open fire is defined in the burn plan where manpower and equipment required for control and suppression of the burn are enumerated. The burn plan will also indicate the amount of time any burn is expected to be active and the registration number issued for the burn will indicate the date when the burn should be extinguished. This puts both a time and resource limitation on the person carrying out the burn.

**Wildfire caused by an escape –** If a resource management fire escapes the intended area to be burned, it must be reported and the person conducting the burn must take suppression action using the defined manpower and equipment outlined in the burn plan. Suppression action will continue unless no longer practicable or the person is relieved in writing by an official. If the government takes action on the wildfire (escape) the government may seek administrative penalties, damages and government's control costs. However, there are caveats to penalties, damage and cost recovery. Penalties may be considered if a person carrying out the burn caused the escape through a willful act, costs may be recovered unless the person carrying out the burn contributes to the "Annual Rent Regulation – Fire Preparedness Levy" and damages may be recovered but would be assessed on an individual basis.

Things to consider in the Burn Plan – There are several ways to reduce error or confusion in the plan being:

1. Define the area to be burned realistically. If internal block values (e.g. riparian, wildlife trees etc.) are likely to be damaged by the burn, include those values as part of the burn area. If block configuration is such that fringe damage is likely, include the expected area affected within the area to be burned. This will reduce the number of times a burn will have been deemed to have escaped and thus becomes a reportable wildfire.
2. Be realistic in the manpower and equipment being assigned to the burn. Consider access, ground conditions and other limitations that may affect suppression or mop up efforts.
3. Ensure that fuel breaks are mapped and constructed where required.
4. Develop plan with enough time for review and editing. Sooner is better than later.
5. Use the template provided on the public web site, however not all fields will have to be filled in for all burn plans.
6. Determine how you will develop accurate fuel moisture calculations for the area to be burned. This is of the most critical types of information where accuracy and on site adjustment will ensure the success of the burn. Weather forecasting is also available including ventilation indices.