



Working Together

British Columbia's Spruce Beetle Mitigation Strategy

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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.

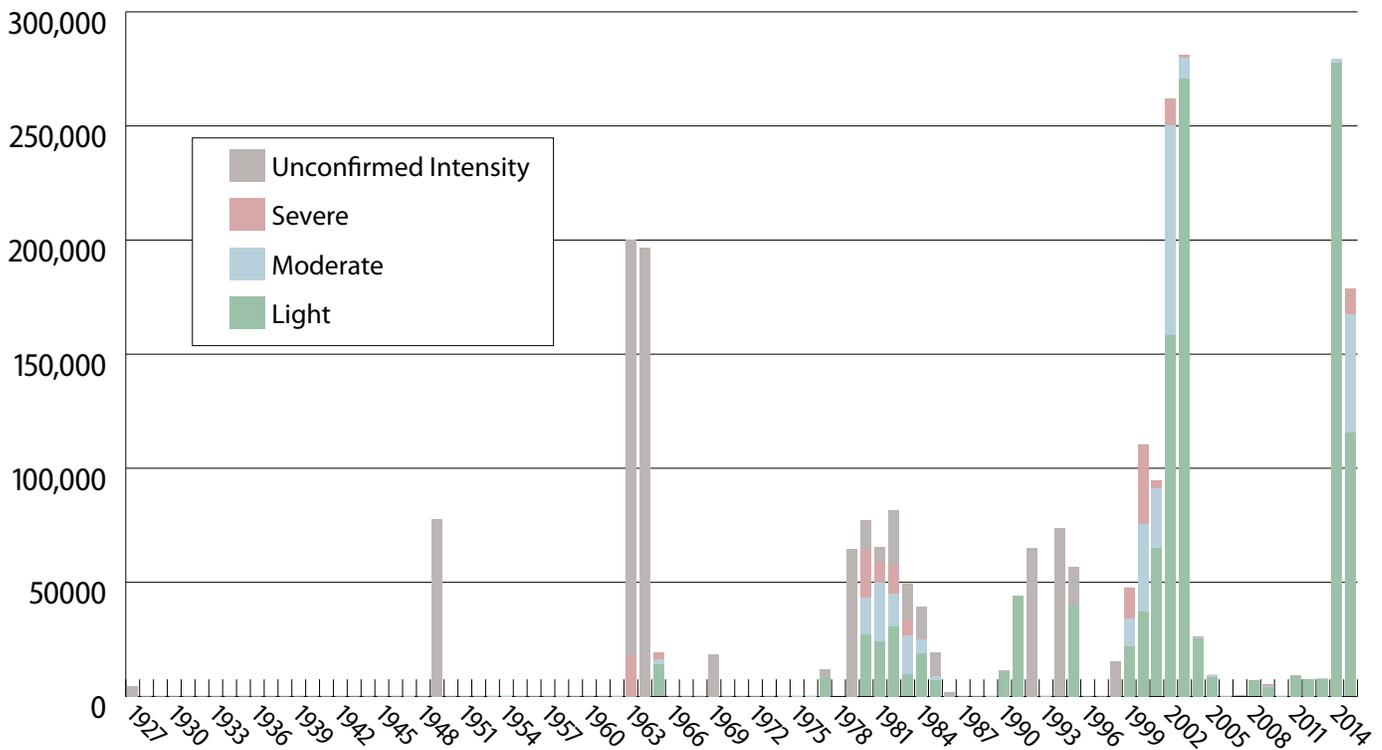


exhibited a slower rate of spread, and the beetles often don't kill the entire spruce tree stand that they have attacked.

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.

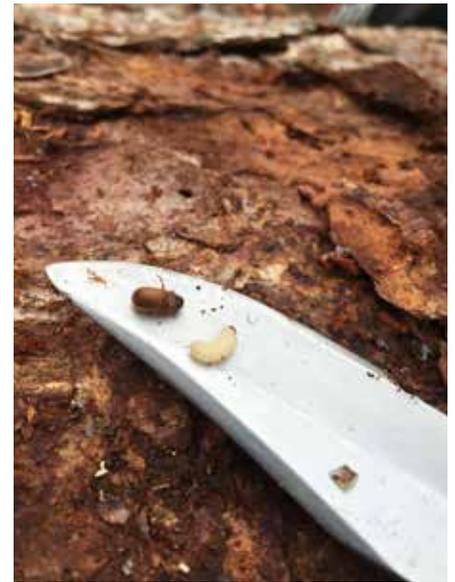
SPRUCE BEETLE BIOLOGY

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.

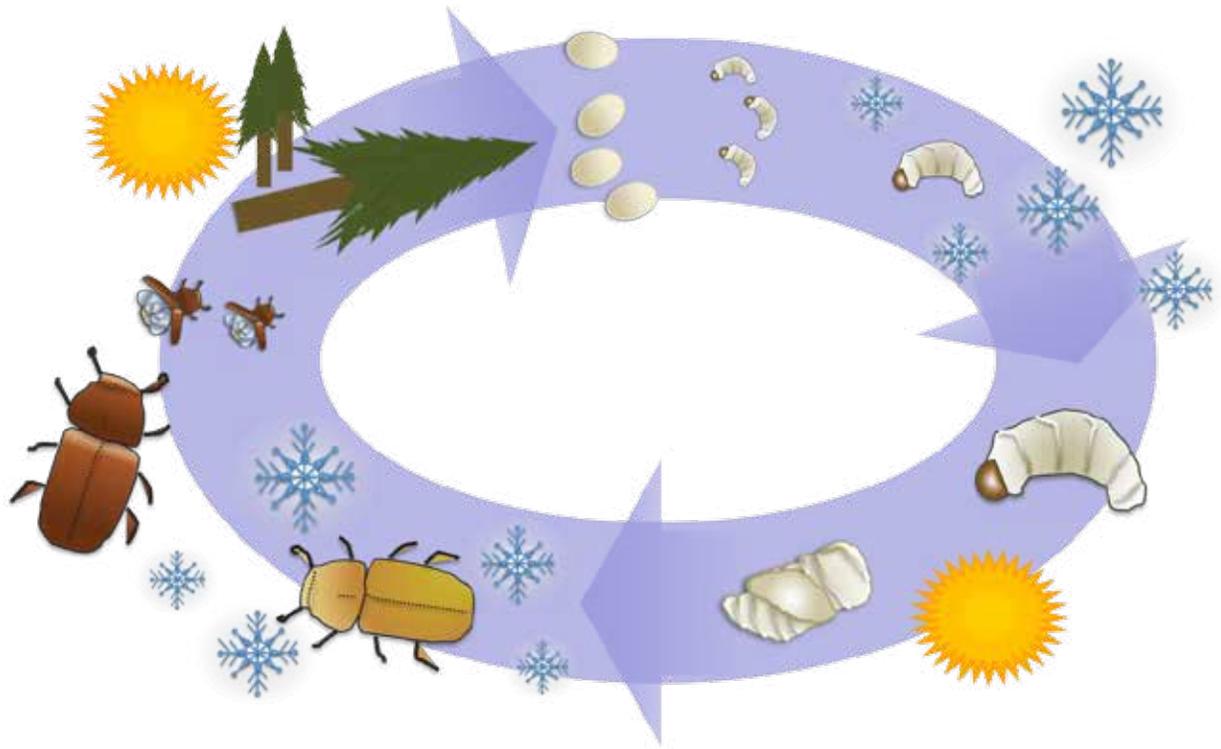


Adult spruce beetles and their larvae are about six millimetres long -- roughly the size of a grain of rice.

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:

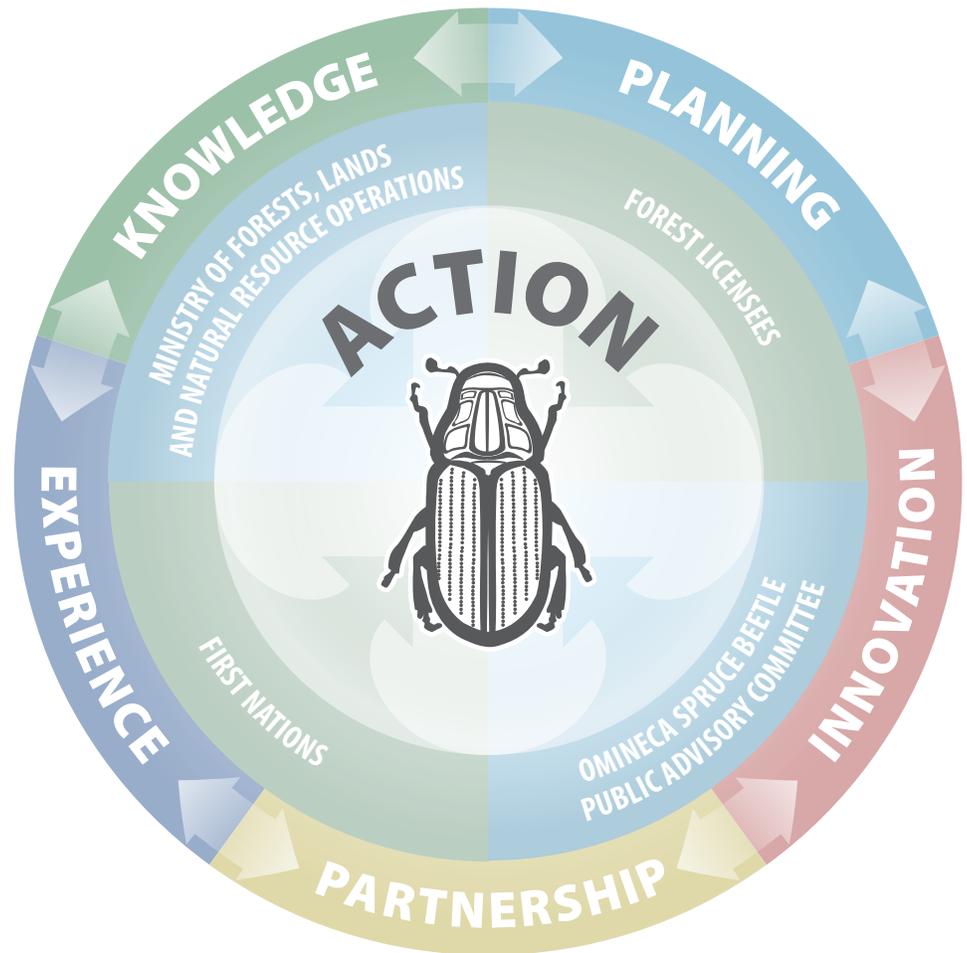
- co-ordinate effective planning and implementation of mitigation measures
- safeguard non-timber values
- prevent or reduce damage to ecosystems in areas that are susceptible to (but not yet experiencing) spruce beetle outbreaks
- recover the greatest value from dead spruce timber before it decays or 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 tree 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 it 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 blow-down 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 at 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.



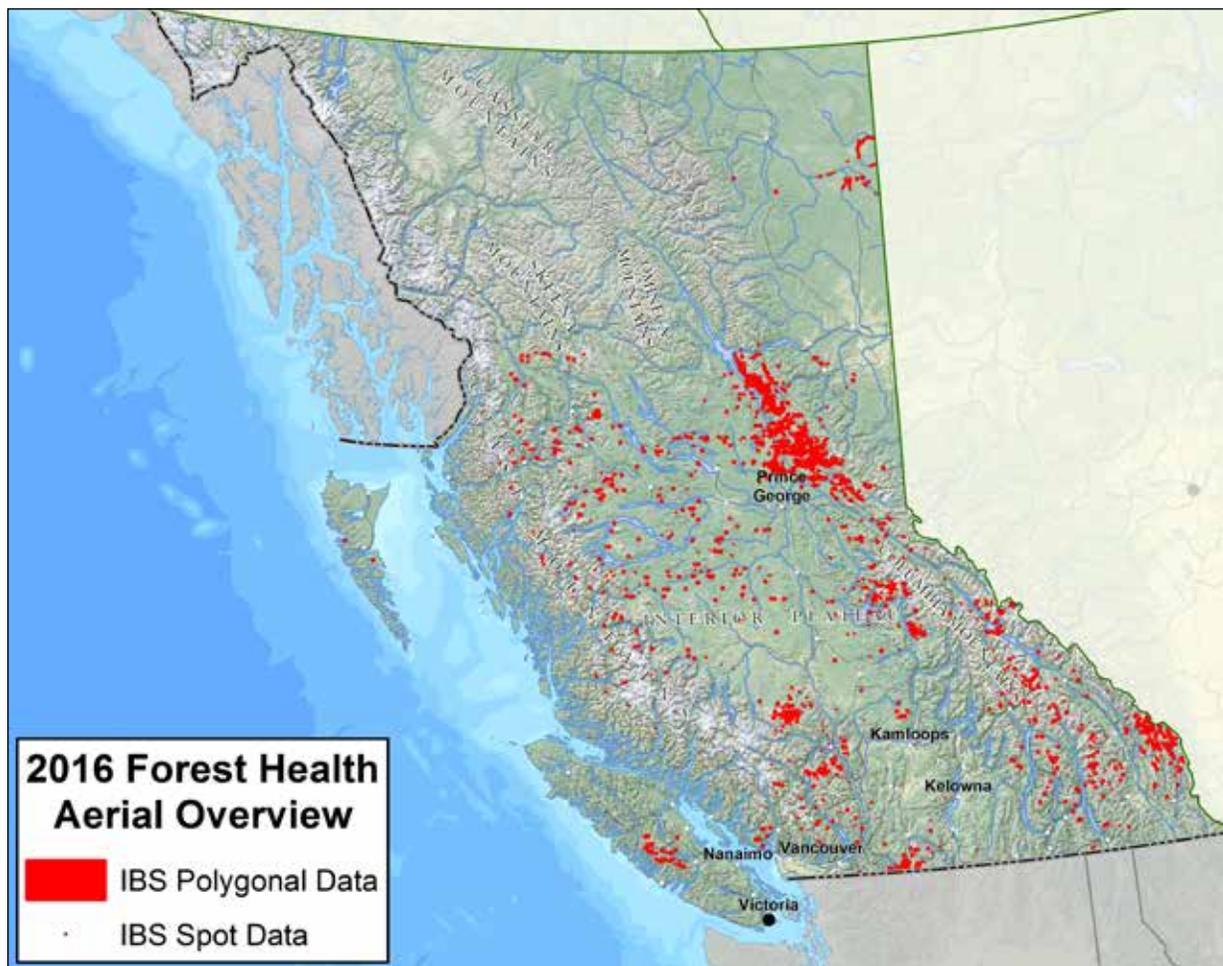
WHAT'S BEEN DONE SO FAR...

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



