



Guide to Bark Beetles Affecting Ponderosa Pine Trees – Detection and Management

Bark beetles kill more trees in B.C. than any other insect group. There are 2 main species of bark beetles that may cause tree mortality on live, green ponderosa pine trees in the District of Lake Country - mountain pine beetle (MPB) and the western pine beetle (WPB). The red turpentine and the pine engraver beetles are not aggressive tree killers but may attack trees of reduced vigor or those infested with other bark beetles.

Bark Beetle Biology

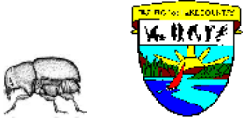
Bark beetles are small, dark, cylindrical hard-bodied insects. These beetles are able to overcome a tree's defense system by mass-attacking. This mass attack is coordinated by pheromones (chemical messengers) the beetles release. The lifecycles of the various bark beetle species follow a similar pattern. Adult bark beetles bore under the bark of trees and the females lay their eggs. When the larvae hatch, they feed on the tree tissues directly under the bark. Adults also introduce fungi, which kill cells responsible for water transport in the tree. Attacked trees die as a result of being girdled by the fungi-killed cells and feeding larvae. The beetles typically overwinter under the bark of infested trees as adults, or larvae in various stages of development. The year following attack young adults complete their maturation and leave their original host to find another, where the lifecycle begins again.



Attack Signs and Symptoms – Detecting infested trees

Needles of attacked trees will pale and then fade to yellow, to reddish-brown, and finally to red in the months following bark beetle attack (2). Reddish-brown boring dust will be present on the base of attacked trees (3). Reddish-brown pitch tubes can sometimes be seen on the outside of the bark (4). There may be evidence of woodpecker feeding on the trunks of attacked trees; patches of bark are removed and bark flakes lie on the ground or snow below the tree (5). Grayish blue sapwood caused by blue-stain fungi carried by the beetles may be visible if infested trees are cut. Attack by bark beetles typically results in tree death the first year of attack. Strip attacks (attack focussed on one side of the tree only) may occur at low population levels but often these trees are the first to be reattacked the following year.





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Beetle Damage

These particular bark beetles are native insects and they play a role in forest succession and renewal. Beetle populations are affected by environmental factors such as unseasonable cold snaps or extended periods of cold winter weather. Woodpeckers, parasitic and predatory insects help maintain a balance in population dynamics in non-outbreak situations.

Bark beetles become pests when they impact resources humans find valuable. Outbreaks have the potential to change the structure, species composition and appearance of forested landscapes. Damaging effects associated with bark beetle outbreaks in urban areas include the lowering of property values, degradation of various activities (including recreation) and loss of aesthetic or scenic beauty of landscapes. Increased fuel loads that accompany most outbreaks increase risk of damage or loss due to wildfires if not managed. Many of the trees that die within an urban area are destined to become safety or structural hazards and will eventually have to be removed. Beetle management and tree removal can be costly.

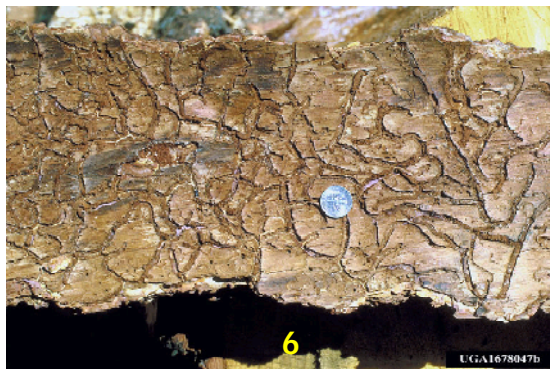
Determining the Beetle Species

It is important to determine which bark beetle species (WPB or MPB) is attacking in order to make appropriate choices with respect to management tactics and treatment timing. The host trees these beetles attack and colonize as well as their gallery shape help distinguish between beetle species.

Often the western pine beetle is associated with a variety of beetles that infest ponderosa pine. Pine engraver beetles may infest the tree's crown; mountain pine beetles, may co-attack the main bole; and red turpentine beetles, may colonize the butt and root collar area of the tree. There is cross-attraction between western pine beetle and mountain pine beetle, with mountain pine beetle often filling in the lower bole portion of trees attacked by western pine beetle.

Many species of wood-boring beetles feed on old or weakened or fire-scarred live trees or those killed by bark beetles or other forest health agents. These larvae may produce piles of wood-colored (white) sawdust; the color of this sawdust may distinguish boring of these beetles from bark beetles (that produce fine orange-brown sawdust). This sawdust may be relatively fine or coarse and fibrous. These borers also are responsible for the wide zig-zag or meandering tunnels seen beneath the bark and deep in the wood.

WPB



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MPB





| <i>DISTINGUISHING FEATURE</i> | WPB | MPB |
|--------------------------------------|--|--|
| Preferred Host Tree | Mature to old ponderosa pine trees. Usually, the WPB breeds in scattered, old, slow-growing, or diseased trees; and trees weakened by stand stagnation, lightning, fire, or mechanical injury. This beetle, however, will also attack and kill healthy young trees during an epidemic, although trees under 15 cm in diameter are seldom attacked. | MPB prefers large diameter, mature and over-mature lodgepole pine. Western white and ponderosa pine may also be attacked. Outbreaks initially occur in less healthy, over-mature stands, but, as more trees become infested, the beetle population increases and spreads to healthy and progressively smaller trees. |
| Adult Flight Time | Mid-late April through August | Early July through September |
| Gallery Shape | Beetles and brood construct long, meandering, dust-packed galleries under the bark (6). | Adults construct vertical egg galleries under the bark (7). |
| Generations/year | 1-2 | 1 typically |

Bark Beetle Management Tactics

A thorough understanding of the biology and ecology of the insect will greatly facilitate management decisions. There are a number of treatment options available to urban land managers and property owners. Often managers incorporate the use of a combination of tactics into an integrated pest management plan.

1. Prevention

The most effective longterm strategy for managing native trees and their bark beetle associates is the preventative approach. Prevention is a pro-active approach designed to change conditions that are conducive to successful bark beetle attacks and development. Prevention is best accomplished by reducing available food sources and modifying the stand environment. This may include the maintenance of thrifty, vigorous trees; density and age class manipulation to reduce the level of potential future damage by these beetles; and continued annual monitoring and treatment. Overstocking creates inter-tree competition for water, light and nutrients, and may reduce a tree's ability to resist attack by bark beetles. Environmental stresses are not controllable, but many stress factors are human-induced and therefore can be changed. Finally, when replacing trees killed by bark beetles, plant a mixture of suitable tree species.



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2. Sanitation Harvesting

Sanitation harvesting may be defined as the removal of stems containing live brood prior to beetle flight in order to prevent spread to adjacent susceptible trees. This may include the harvesting of single stems or small patches where appropriate. Non conventional methods such as horse logging may be utilized if appropriate.

3. Falling and Burning or Falling and Peeling

Falling and burning or falling and peeling are common and effective single tree treatments. Infested trees with red or green crowns that contain live beetle broods are felled. The infested portions of the trees are then bucked, piled and burned, ensuring that all infested bark area is consumed. *Please Note:* During the normal burning season a regular fire permit can be obtained from the Fire Department or from Customer Service Centre at the District Office. If you wish to burn trees due to beetle kill outside of the regular burning season you can obtain a special permit by applying through the Development Services Department at the District Office. For any enquiries please call the Customer Service Centre at 766-5650.

As an alternative to fall and burn, infested trees may be felled and debarked (peeled). The wood may then be used for other purposes (i.e. firewood, construction material). This is not applicable once the beetle brood has passed the pupal stage. By this time, bark must be burnt, buried or chipped as adult beetles are not as susceptible to desiccation or exposure.

Single tree treatments such as these may be effective in removing beetle populations in infested trees up until the next beetle flight. Therefore, the treatment cutoff for mountain pine beetle would be approximately early July and for western pine beetle approximately mid April. If in doubt, trees should be checked to see if there are still beetles under the bark.

4. Pre-emergence Insecticide Treatment

This treatment is intended to kill beetles as they emerge from infested trees so as to prevent spread. However, single tree removal may be a more practical alternative as dead standing trees may pose safety concern or become a fire hazard in the future. The insecticides most often used are Sevin® (active ingredient carbaryl) and Dursban® (active ingredient chlorpyrifos). It is strongly recommended that interested parties consult a certified pesticide applicator. These registered products must be purchased and applied by a commercial applicator only in accordance with the directions on the label. It is an offence under the Pest Control Products Act to use a controlled product under unsafe conditions.

5. Protective Insecticide Treatment

This is a preventive treatment intended to protect high value trees from attack. This type of treatment is often expensive and may require annual applications until the risk is reduced. The insecticide most often used is Sevin® (active ingredient carbaryl). It is strongly recommended that interested parties consult a certified pesticide applicator. These registered products must be purchased and applied by a commercial applicator only in accordance with the directions on the label. It is an offence under the Pest Control Products Act to use a controlled product under unsafe conditions.

6. Mass-trapping

Mass trapping using pheromone-baited traps has been used successfully in specific situations. Their use is typically restricted to areas where other options are limited and brood removal via harvest/single tree treatments is not possible. MPB may be mass-trapped at log storage



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facilities in order to minimize outflight to adjacent areas. This tactic requires the expertise of an entomologist specializing in pheromone management.

7. Reppellents

Verbenone pouches can be used to prevent MPB mass attack by signaling to incoming beetles that potential host trees are too crowded. Verbenone has been shown to be extremely effective as part of an Integrated Pest Management program when properly installed in areas where attacks by MPB are likely. It is most effective when all known currently infested trees are removed. Verbenone is designed for late spring (June) installation to deter July-September attacks. Suppliers recommend a grid placement for small areas; pouches (placed on the north side of the tree at 2-3 m height) deployed at 10-15 m centers.

Reppellent compounds for WPB are still in the research phase. The antiaggregation pheromone verbenone alone has only limited effect at repelling the western pine beetle.

8. Tactics generally considered unsuitable for urban use

Aggregating semiochemical (pheromone) tree baits have been used extensively in large-scale forestry operations where beetle control activities via harvesting or single tree treatment cannot be implemented until after the next beetle flight and in mop-up operations around harvested and treated infestations. The use of baits must be regarded as a temporary holding technique that can contain and concentrate a local beetle population in the general area where baits are placed. The use of tree baits must always be followed by actions to remove or eradicate the concentrated beetle populations. It is strongly recommended not to place any baits in inaccessible areas, where beetle populations are negligible or on small land parcels (ie <10-15 hectares). Baits will intensify bark beetle populations and losses will increase, in addition overflow attack on unbaited trees is common and losses on adjacent properties would be expected.

MSMA (monosodium methane arsenate) is an organic arsenical herbicide that has been used in similar circumstances as the fall and burn tactic for mountain pine beetle in remote, inaccessible areas. It is not appropriate or registered for use within a populated area.



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Treatment Timing

The following are recommended dates for bark beetle detection and treatment activities:

| MANAGEMENT TACTICS | CRITICAL DATES | |
|-----------------------------------|---|---------------------|
| | WPB | MPB |
| ATTACK DETECTION | Sept 15 on | Sept 30 on |
| | <i>Do majority of detection work once beetle flight is finished for the year, some attack may be noticed before these dates</i> | |
| SANITATION HARVESTING | Sept 15 - April 15 | Sept 30 - June 15 |
| SINGLE TREE TREATMENTS | | |
| Single Tree Selection | Sept 15 - April 15 | Sept 30 - June 15 |
| Fall and Burn/Peel | Sept 15 - April 15* | Sept 30 - June 15** |
| | <i>Burn in accordance with fire regulations</i> | |
| Insecticide Application*** | Prior to April 15 | Prior to June 15 |

* After the end of March bark should be burnt, buried or chipped as well.

** After the end of May bark should be burnt, buried or chipped as well.

*** To be used in accordance with the label instructions