The benefits of tree baits

Synergy Semiochemicals tree baits are designed to contain and concentrate mass attacks of destructive bark beetles.

Endemic bark beetles are important components of our forest ecosystems but may become problematic when they transition into an epidemic (Figure 1). This outburst of uncontrolled populations are caused by a combination of ambient, mechanical and nutritional stress suffered by the host trees, where mature stands tend to be the most susceptible. In addition, a lack of sufficiently long cold winter temperatures due to the rise of global temperatures, has resulted in an increase in beetle overwintering survival.

Bark Beetle outbreaks cause measurable ecosystem disturbance in forest tree stands leading to widespread tree mortality and declining timber production.

These outbreaks are orchestrated by a concert of chemical signals exchanged between specific bark beetle species and the trees they colonize. Synergy Semiochemical's tree baits are precisely engineered to provide the necessary pheromones used by specific bark beetles as well as the kairomones emitted by specific host trees to control beetle outbreaks.

Tree baits are designed to initiate an early attack. Baits are used to contain and concentrate mass attacks of bark beetles and limit their dispersal, which allows for the effective removal of contained beetles through conventional harvesting methods.

The ecology of each beetle should be carefully considered when deploying tree baits and to maximize the effectiveness of tree baits as part of an Integrated Pest Management Plan (IPM).

Synergy Semiochemicals Corp.

Phone: 604-454-1122
Email: synergy@semiochemical.com
www.semiochemical.com

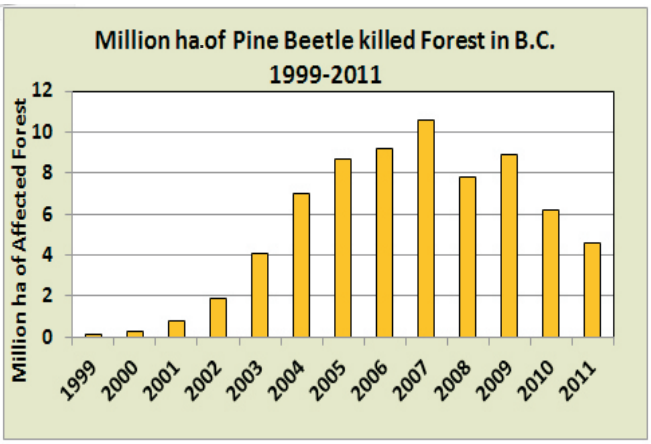


Figure 1. The effects of a pine beetle epidemic on the forests of British, Columbia Canada

Synergy tree bait stapled to a tree

Synergy tree bait

Bark beetle ecology and detection

Douglas fir beetle - *Dendroctonus pseudotsugae*

Douglas fir beetles have one generation per year. **Spring emergence varies with location and weather but usually occurs between mid April to early June**. This species prefers large logging debris , or otherwise stressed trees over standing, green Douglas Fir or Spruce trees. Douglas Fir beetle attack can be recognized by carefully examining trees for orange-brown boring dust found in bark crevices on the lower portion of the tree's bole or on the ground as well as resin streams which can be visible high off the ground. Certainty of diagnosis of attack, however, can only come from removing sections of bark to reveal egg galleries, eggs or developing brood. These galleries can be identified by vertical egg galleries parallel to the wood grain and larval galleries in alternate groupings perpendicular to the wood grain.

Spruce beetle - *Dendroctonus rufipenis*

The Spruce beetle has a life cycle that ranges from 1-3 years, depending on temperature and climatic conditions. **This species begin flying from late May to early July**. Like most bark beetles, the Spruce beetle relies on stressed trees and windthrow to attack and overwhelm trees. Their hosts range from Engelmann spruce, White spruce, Sitka spruce and occasionally Black spruce.

At first sight, infested trees will have light brown to red brown boring dust present in bark crevices and around the base of the tree. Pitch tubes may also be indicative of beetle attack if present in the bark. The egg galleries are formed parallel to the wood grain while the larvae galleries form a fan shape that extends perpendicularly from the wood gain.

Mountain Pine beetle -

Dendroctonus ponderosae

Mountain pine beetle normally have one generation per year. Like other bark beetles **time of emergence, dispersal and attack varies with temperature, however, they most likely occur during late June to mid August.**

All pine trees native to North America are susceptible to attack, in particular lodge pole pine *Pinus contorta*.

Infested trees will show the following external symptoms: pitch tubes of cream to pinkish color surrounding beetle entry holes; boring dust in bark crevices, particularly around the root collar of the tree; small round emergence holes of about 2.5 mm in diameter.

Precise diagnosis of beetle attack can be seen underneath the bark were Mountain Pine beetles form vertical galleries parallel to the wood grain in early summer and later larvae excavate galleries outward perpendicular to the vertical parental gallery.

Western Pine beetle -

Dendroctonus brevicomis

The Western pine beetle has 1 to 3 generations per year depending on elevation. Ponderosa Coulter pine are usually the most susceptible host trees to this beetle.

The beetles tend to **fly twice a year; the first in late April/early May and the second in August. The flights and attacks will vary with temperature.**

When trees are infested they will show very small pitch tubes, however, removing the bark will actually determine if an infestation is present. The galleries formed by this bark beetles have a distinctive winding, crisscrossing pattern.

Note on additional beetles species:

We are able to provide baits for additional beetles species including **Ips beetles** and other bark boring species.

If you are unsure of what baiting strategy to use, give us a call and we can guide you towards a successful management strategy.

Integrated Pest Management (IPM)

Tree baits work best within an Integrated Pest Management Plan (IPM) incorporating the following steps:

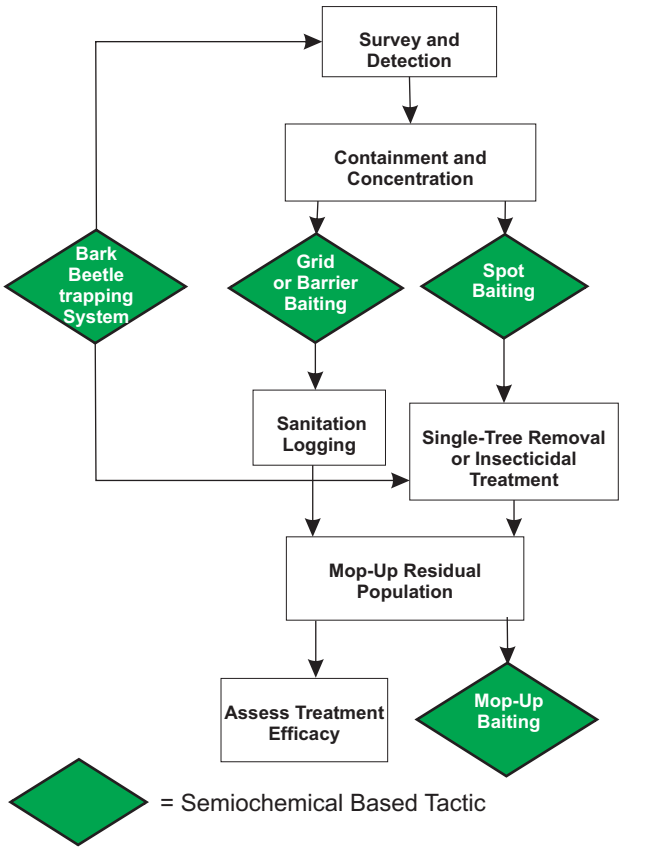
1. Clearly identify the pest. Is it the Bark beetle species that you are targeting or another pest insect (eg. Ips species)? Has the bark beetle capitalized on a tree health problem (eg. soil disturbance, dwarf mistletoe etc..)?

2. If the key damaging agent is a bark beetle take extra steps to better understand the beetle and its biology.

3. In British Columbia, consult the Forest Practices Code "Bark Beetle Management Guidebook" for valuable guidance on management strategies.

4. Be aware of all potential control options (thinning, prescribed burn, pesticides, etc.) and determine the mix that is best for your situation.

5. Assess the effectiveness of the tree baiting and harvesting program. Attack indices in baited stands can be valuable information.



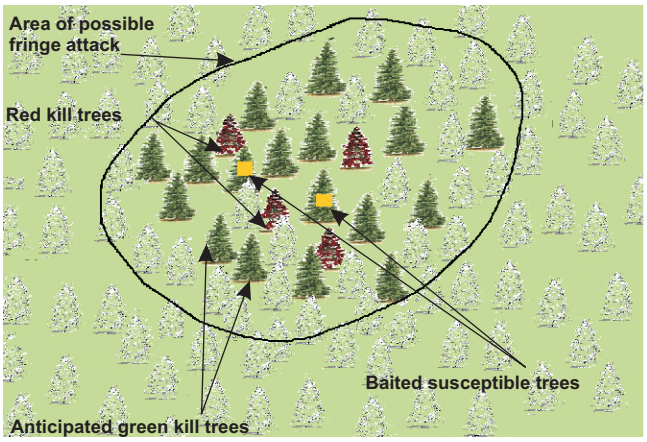
Example of an IPM plan incorporating semiochemicals with other tactics for bark beetle management

MASS BAITING

- Can be routinely employed by forestry personnel and is fully operational.
- Is of particular value where systematic harvesting is ongoing. Note: all attacked trees must be processed to kill beetles before they emerge.
- Is useful to contain beetles within current infestation boundaries for one, and possibly more years.
- Can concentrate beetles in target areas for more effective beetle removal.
- Can be used to mop up residual populations in successive years following management efforts.

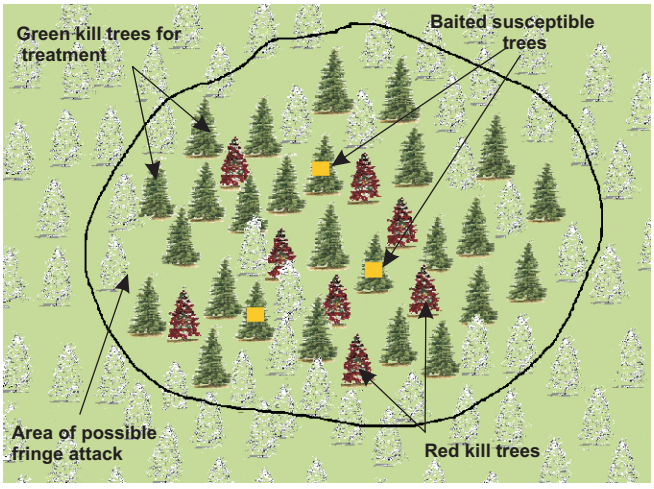
Deployment tactics

SPOT BAITING - To contain and concentrate small infestations



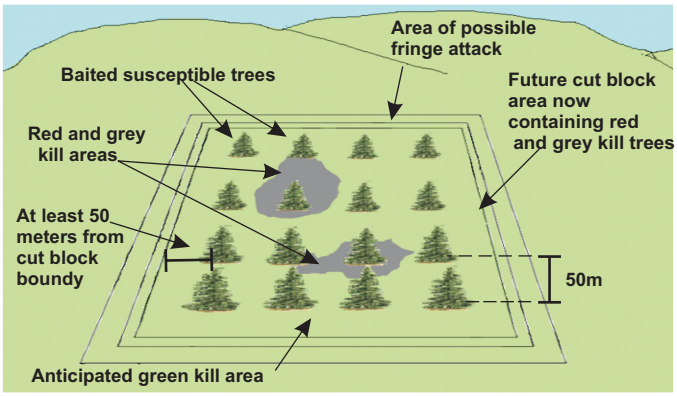
- For use where infestations are limited to less than 30 trees (50 trees when dealing with Mountain Pine Beetle).
- Bait no less than 2-3 susceptible (unattacked) trees in the center of each spot, space baits at least 10 - 15 meters (yards) apart and up to 50 meters.
- Ensure all attacked trees are treated or removed and processed. (refer to – Tree Inspection and Removal)

LETHAL TREE BAITING (with systematic pesticides) - To focus beetle attack on insecticide or herbicide treated areas



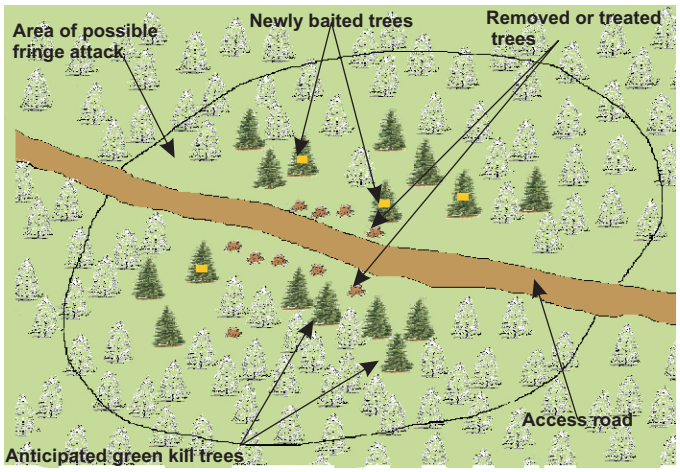
- For use in spot infestations where tree removal or destruction is not possible.
- Bait a minimum of 2-3 susceptible trees at the center of each infestation, space baits at least 10 meters (yards) apart and up to 50 meters;
- Timing of insecticide application (prior to beetle attack) and herbicide (immediately after beetle attack) is critical.

GRID BAITING - To contain and concentrate beetles in infestations exceeding 50 trees or > 20 hectares:



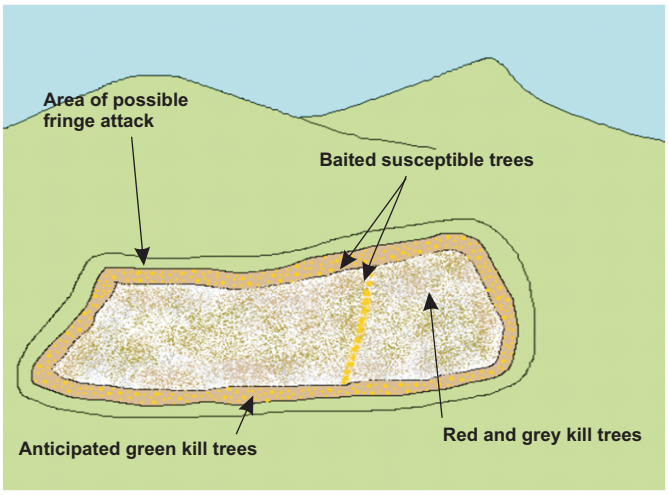
- Bait standing susceptible trees at 25 to 50 meter (yard) intervals to form a grid.
- Bait at least 25 meters (50 meters for Mountain pine beetle tree baits) within infestation or cut block boundaries to minimize beetle dispersal outside the boundaries; also known as spillover effect.

MOP-UP BAITING - To contain any residual beetles following baiting and tree removal:



- Place baits in the spring following the initial management attempt (of the previous season);
- Bait trees immediately surrounding the management site and trees within the site at 25-50 meter intervals.
- When dealing with Mountain pine beetle, bait susceptible unattacked trees immediately surrounding susceptible trees that are still left within the management site;
- For spot baiting mop-up, use at least as many baits as used in the initial baiting;
- For grid baiting mop up bait in intervals along the edge of the clear cut.

BARRIER BAITING - To contain largest infestations <u>under specific circumstances</u>:



- For use where infestations are very large but beetle activity is primarily along expanding edges (the inner core of infestation typically consists of grey trees devoid of beetles);
- Concentrate baits at least 50 meters (yard) intervals along these active edges in 2 or 3 staggered lines or barriers;
- Space staggered lines 50 meters apart;
- Place additional baits within the inner core to ensure containment.
- Ensure that the outermost barrier is at least 50-70 meters (yards) away from stands you wish to protect.

- Note: Grid baiting might be more effective for containment of Spruce beetles in particular, therefore barrier baiting should only be used when grid baiting is impractical.

Notes for Field Placement

When tree baits are used, trees are mass attacked and must be removed or destroyed. Ensure that tree removal or destruction is compatible with management objectives. Do not use where tree preservation is paramount.

TREE SELECTION:

- Bait healthy large diameter trees
- Bait situated in elevated but not overly exposed locations (ie. avoid gullies, draws, etc.)
- Where feasible, bait trees on south facing slopes to attract earliest flying (pioneer) beetles.
- Note: 50 meter grid spacing is equivalent to 4-5 baits per hectare.

BAIT PLACEMENT ON TREES:

- Staple baits on tree trunks well above underbrush for maximum semiochemical dispersal (2.5 meters or more above ground is best).
- Staple tree baits on the north side of trees to protect them from excessive light or heat.
- Bait at least 2-3 weeks ahead of anticipated beetle flight.

Tree Inspection and Removal

- Initiate tree inspection as early as September (does not apply to pesticide treated trees);
- Check for attack on baited trees and trees in the immediate vicinity (spill over attack);
- Survey well beyond current infestation boundaries and anticipated cutblock boundaries to ensure all attacked trees have been identified;
- Mark all attacked trees for removal or destruction;
- Remove or destroy all marked trees prior to April of the following year (well before beetle flight);
- Beetle brood is viable in harvested trees unless treated with pesticides or debarked.
- Ensure all harvested trees are treated or debarked prior to the next beetle flight;

Monitoring Baiting Results

	Low Attack	High Attack
Attack Ratio: Attacked baited trees to all baited trees	<20%	>80% High priority harvesting
Spillover Radius: Distance From attacked baited tree to attacked tree furthest out	<10 meters	>10 meters Possible high priority harvest
Attacked ratio + spillover radius	<20 % <10 meters Declining population	<80% ->10 meters Inclining population Priority harvest

Data obtained after baited stands have been attacked can help assess the severity of attack and the effectiveness of each program.

Attack Ratio – the ratio of baited trees that attacked to all baited trees (baited attacked/(baited attacked + baited unattacked)). In every active infestations almost every baited tree will be attacked.

Spillover Radius – The distance from the baited attacked tree to the unbaited attacked tree furthest out. In every active infestations this distance will exceed 10 meters (yards) and go up to a 50 meter radius. Additional data can help forest managers better understand beetle and stand conditions.

Green/red ratio – A comparison of current successful attacked trees (broad containing, green to green pale foliage) to trees successfully attacked the previous year (not containing broad , red foliage). The ratio in expanding infestations will be greater than 1 and can exceed 20.

Green/pitchout ratio – A comparison of current successful attacked trees to unsuccessful “Pitchout attacks”. High ratios indicate low tree vigor and possibly high beetle numbers. Production of new brood will likely be very successful.

Site to site comparisons of the above data helps identify future areas of high concern. Historical comparisons of this data within drainage or similarly bounded area can indicate overall management success; decreasing attack ratios or spillover radius reflect a successful program. All data should be evaluated in concert with other available data such as tree and size, stand density, proportion pine, habitat type, etc.

For Further Information

For further information on this or other Synergy Semiochemicals products, contact our sales, service or research staff. We can update you on the latest research and assist you with your management plan.

Synergy Semiochemicals Corp.

Phone: 604-454-1122
Email: synergy@semiochemical.com
www.semiochemical.com