

MANAGEMENT



NOTES

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An overview of Bark beetle control methodologies

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Introduction

Bark beetle outbreaks are becoming more common on Prince Edward Island. Damage and mortality in larch (*Larix laricina* (DuRoi)K.Koch) is common in the western part of the Province and mortality has now become noticeable in eastern P.E.I. While many bark beetles are native pests, little attention has been paid to their control in the past. The situation in Europe however has been different and extensive efforts have been made to control these insects.

Ips typographus and *Pitogenes chalcographus* are two very aggressive bark beetles on Norway spruce in Bavaria, Germany. Damage and mortality caused by bark beetle has increased dramatically over the last 10 years as a result of a number of factors such as global warming, air pollution, and the use of non local seed sources which have resulted in a dramatic increase in bark beetle populations. In most southern German forests bark beetle damage control and damage prevention dominate annual harvesting plans.

This report gives an overview of bark beetle control methodologies as used in Bavaria that may be suitable for larch and spruce bark beetle control on Prince Edward Island.

Discussion

The aim of successful pest control is to reach the beetle in all stages of its development In principle all methods should be used together as an “integrated system.”

The following general strategies are important for the health of our forests because they improve the vitality of single trees, stability of stands and decrease the risk of primary infestation by bark beetle.

- A management plan drawn up with the life cycle of the bark beetle in mind.
 - in particular timing of thinning and harvesting, the months of September and October are the best time for thinning and harvesting as the branches, tops and other waste will dry and will be unattractive to the beetles the following spring.

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- Reducing the attractiveness of stands by using local tree species, proven seed sources and utilizing mixed wood stands.
- Maintaining soil quality
 - avoid soil compaction and rutting
 - no removal of organic matter (leaf litter)
- Encouragement of mixed wood stands, with shrubs and herbaceous flora (this has positive effects on humidity and temperature in the stand climate, the nitrogen cycle and bark beetle predators).
- Maintain vigorous tree crowns through stand management (early thinning and subsequent thinnings).
- Harvesting with care so as to avoid felling and extraction damage.

I. Prevention of bark beetle damage by “clean harvesting”

Strategies for controlling spruce beetle populations are similar to those for other bark beetles. Choice of management strategies for bark beetle control will depend on:

- C The size and pattern of the infestation.
- C The severity of the attack over each of the last three years.
- C The vigour and survival of the new broods of beetles.
- C The stand vigour/risk of attack (stands in poor health are more susceptible to attack).
- C Integrated resource management issues/constraints.
- C Existing and future access.
- C Harvesting operability.

In areas that have been harvested to limit the spread of bark beetles (sanitation cuts), there may be stem pieces, tops greater than 10 cm in diameter, roadside logs, and stumps containing mature spruce beetle adults. If the maturing beetles are not controlled they will emerge from the infected material to attack new host trees. To avoid this the infested material should be either burned, removed, milled, or otherwise treated.

Prudent work requires that:

- C Stumps are cut as low as possible.
- C Utilization should be to a minimum 10 cm top diameter and all tops should be scattered over the harvest site or piled and burned on the landing.
- C Long stem pieces should be piled and burned in a suitable location.
- C All recently killed potential host material such as recent edge blowdowns, large broken tops, and any other pieces of wood should be removed before they are attacked and provide breeding material for the beetle.

Elimination of breeding places

This is the most efficient method to fight the increase of bark beetle populations. Infested trees should be harvested and debarked immediately because air dried logs are not attractive to the beetles. Logs have to be removed from infested areas before the spring flights of the adult beetles start or they may become breeding places for the beetles. The length of storage of logs should be as short as possible. If log storage has to be long, then debarking the logs is recommended or alternately keep the logs wet with irrigation or treat with a chemical insecticide. The burning or chipping of residues, especially stem pieces, *as soon as possible* after felling is also a suitable treatment.

When beetles are in the immature stage in the bark of the tree or tree piece, allow the bark to dry out as this will kill the immature beetles. If the beetles are in the adult stage then the following options are appropriate:

- C Transport logs out of the stand into areas unattractive to the beetles (i.e agriculture areas, 500 metres from potential host trees).
- C Debark, burn or use insecticides. When debarking do so over a plastic sheet to aid removal of the bark from the site.
- C In small stands, bark can also be placed into plastic sacks and set in full sunlight - the beetles will die by over heating.
- C Crown materials and big branches should be chipped, burned or treated with insecticides before beetles flight start.

Adult beetles can live about 20 months and can produce many generations of offspring during this time. The situation in the Bavarian National Park has shown that even young stands (age < 15 years of age) are sufficient to provide enough food to support the beetle at low levels until larger material in which to breed becomes available.

II. Biological bark beetle control methods:

In conjunction with previously mentioned methods of integrated beetle control, pheromones can be used to lure beetles so that the beetle population can be reduced by mass trapping. *The aim is to reduce damage/infestation in the remaining stands.* It is not important how many beetle you catch, as every beetle disposed of reduces further damage.

A. Traps

Timing: (mid March to early June)
Beetles should be trapped any time temperature conditions allow flight. However, in their native ranges, most of the target beetles emerge from overwintering sites in both dead trees (just under the bark) and in the duff (10 cm below the surface around one or two meters from the base of infected trees) when the maximum daily temperatures are around 12°C for the first time. Active dispersal may not take place until air temperature is higher (15°C - 20°C). Therefore, spring flights could begin from late March to mid April depending on local temperature conditions. In some species of bark beetles a second flight occurs 2 - 5 weeks after the first. Make sure that traps have new baits by mid June - early July.



Trap Placement:

Whenever possible, place three traps at each site (Lindgren Funnel Traps, see also <http://rivers.oscs.montana.edu/dlg/aim/methods/lf.html>). Bait traps with one lure type only! Hang traps so that the top is two meters above the ground. Do not use “attractive” wooden material as hangers! Keep the collection bucket away from thick underbrush. Avoid sites exposed to strong winds. Place traps in partial shade, five - fifteen metres (to a maximum of 20 - 30 m) from the next/edge of host tree/stands (on the southern side of the site if possible). Be careful not to decoy beetles into the stand you want to protect! Traps should be placed about 20 to 50 meters apart. **Rule of thumb: One trap for 10 m³ of infested wood.**

Lures:

When placing lures/baits in the traps, use a new pair of vinyl or latex gloves for each component to avoid any cross-contamination between lures. Do not dispose of gloves in the vicinity of the trap as the beetles will be attracted to the gloves. Remove gloves before handling the trap to prevent contamination of the trap. All lure components should be hung from the funnel supports down into the center of the trap (Lindgren Funnel Trap). Do not open the plastic vials or bubble pacs. Chemical attractants are released through the container walls.

Trap Servicing:

Traps should be checked weekly once air temperatures are high enough for flight. During each visit the collection bucket should be emptied of all contents. On no account let beetles putrefy in the traps.

Separate and discard non-insect debris and any insects to be submitted for identification should be in vials of 70% ethanol. Include a label in each vial with the trap location and coordinates. After the season remove traps, clean them, examine for damage and store them for the next year.

B. Trap trees

Trap trees are living, large diameter material that are felled to attract bark beetles. Bark beetles prefer downed material which they attack more extensively and at a greater intensity than they do standing trees. *Trap trees felled into the shade* and left unbucked and unlimbed may absorb up to 10 times the number of beetles a standing tree will. Trap trees will effectively attract beetles from up to 0.4 km away, and less effectively for up to 0.8 km. Two types of trap trees - conventional and lethal - are used, depending on the feasibility of their subsequent removal.

The following trap tree considerations apply to both conventional and lethal trap trees:

- C Sites should be clearly flagged and must be mapped to facilitate felling and, in the case of conventional trap trees, subsequent extraction or treatment.
- C Trees must be uninfested.
- C Trees should be greater than 10 cm in diameter and preferably of 35 cm, and have thick bark.
- C Trees should be cut with low stumps.
- C Trap trees should be felled in a direction which provides the greatest amount of shade.
-if possible, fell conventional trap trees so that their butts face toward a road to simplify eventual skidding.
- C Trees should not be bucked or delimbed.
- C Trees should be felled as close to an infestation as possible and no farther away than 0.8 km.
- C Shaded, freshly windthrown spruce can be used as trap trees and must be removed or treated as other trap trees.

Trap tree quantities

The number of trap trees (conventional or lethal) to be felled mainly depends on the size of the attacking beetle population, which is usually estimated by the number of adjacent infested standing trees. One trap tree should be felled for every 10 infested standing trees for static infestations and ratios as high as 1:4 for more severe infestations. Note that felling more than one trap tree for every five standing infested spruce will excessively deplete the canopy and reduce shading. **Rule of thumb: Between 10% and 20% (usually two - three trees) of the infestation should be felled as trap trees.**

Trap trees are most effective when deployed against heavy infestations in very small areas or against light to moderate infestations over larger areas. In heavy infestations over larger areas it may not be efficient to fell sufficient traps trees to absorb such a large population. The more attractive material that there is in the area, the less positive are the results.

Conventional trap trees:

Conventional trap trees must be subsequently removed or treated to kill trapped beetles before

emergence.

Conventional trap trees should be felled in late winter (e.g., February till early March) before the first flight period so that such trees lie on top of most of the accumulated snow.

Infested trap trees should not be treated too early (debarking/insecticides) but must be treated before the 1st generation of beetles escape. Trap trees cut or treated after July should be removed early in the next winter logging season of the same year (e.g., late November) before they become covered with excessive snow and frozen in place. Most times the 2nd generation of beetles stay during the winter in those infested trees. Conventional trap trees left on the site after April of the following spring may yield early maturing adults that could attack adjacent timber.

Deployment tactics:

Although felling trap trees in a dispersed pattern throughout an infested stand may be the most effective deployment. This treatment is constrained by the problems of costs and safety in felling scattered, and the difficulties in trap tree extraction if the entire stand is not scheduled for harvest. Therefore, other tactics may be employed.

- C Trap tree patches are usually 12 – 25 trap trees felled into standing timber in a single, narrow, and shaded groups next to a road, to help eventual skidding and hauling.
- C Of all the deployment tactics, trap trees felled in patches have the best shading and, therefore, have been the most effective at attracting beetle adults.
- C Pre-felled road rights-of-way, landings, and cut block strips can be used during cut block pre-development as relatively large scale conventional trap tree programs.

C. Baiting: (associated with harvesting)

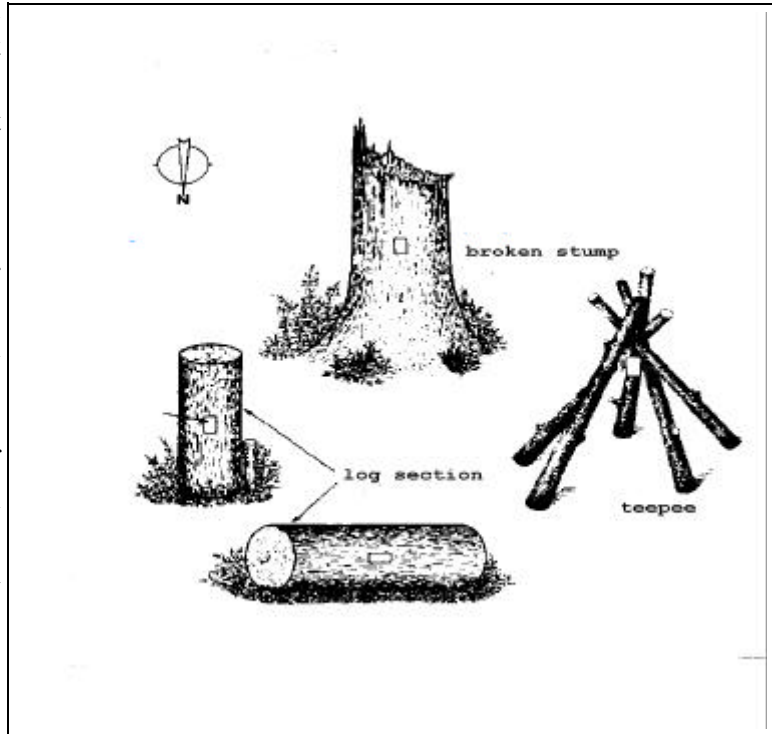
The use of pheromone baits in a grid pattern in bark beetle infested stands is a temporary holding tactic until the stand can be sanitation logged. Baiting should be done on a 50 by 50 metre grid throughout the entire infested portion of the stand(s) proposed for sanitation logging. Next uninfested trees should not be closer than 10 - 15 metres.

Do not forget subsequent extraction or treatment.

Appropriate situations for deploying poison baits for the beetle on standing trees:

- C Small or distinct blocks having a light scattered attack with no heavily infested patches.
- C Stands where it does not matter if additional trees are attacked within the stand before sanitation logging.

- C Stands where sanitation cutting will be carried out should be cut as soon as possible after the beetle flight but before emergence from hibernation.
- C Stands where the contractor could not otherwise pick up smaller patches of attacked trees.
- C Were the extractions of conventional trap trees would be difficult due early deep snow (e.g., at the bottom of a shaded slope).



D. Lethal trap trees:

Lethal trap trees are large-diameter, uninfested trees which are treated with a contact or systemic insecticides before the beetle attack period or before the beetles emerge. This treatment kills the beetles as they attack the trap tree, thus avoiding the need for subsequent extraction or treatment of the infested material.

Attacking adult beetles are killed and, therefore, lethal trap trees do not require further treatment. Lethal trap trees should be no further than 0.8 km from infested trees. As with conventional trap trees, lethal traps are most cost-effectively felled in patches.

Pesticides for lethal trap trees

MSMA: (monosodium methane arsenate)

A continuous ax-frill is cut in early spring into the phloem as close to the ground as possible. The frill is immediately injected with 1/4-strength MSMA at a rate of one ml of formulation per 2.5 cm of circumference. Applications are normally done in mid-May once translocation starts. A period of two weeks should pass to allow translocation of the MSMA throughout the bole, the trees are then felled into the shade and left intact.

MSMA is registered for use in Canada for the control of mountain pine beetle and spruce beetle. It is sold under the trade name of Clean Crop Glowon MSMA, pest control registration number 10892.

FASTAC FORST and RIPCORD 40: (15 g/l Alphacypermethrin, 400 g/l Cypermethrin)

Spray or dip trap trees or logs. This treatment kills the beetles as they attack the tree.

(These products are not registered for use in Canada but are widely used in Germany.)

C	Prevention:	0.25% - up to 12 weeks
		0.50% - up to 24 weeks
C	Before emerge:	0.25% - up to thin bark
		0.50% - up to thick bark
C	After infestation (curative):	0.50%

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