Ministry of
Forests, Lands, Natural
Resource Operations
and Rural Development

BRITISH
COLUMBIA

A Guide to Managing Douglas-fir Beetles in B.C.'s Coastal Region

FACTS ABOUT THE DOUGLAS-FIR BEETLE

The Douglas-fir beetle (*Dendroctonus pseudotsugae*) is a native pest of mature Douglas-fir trees in the Coast Area. The appearance of these beetles frequently follows stand disturbances caused by fire, wind or disease, and infestations are often associated with root rot or abiotic stressors such as drought. Although such outbreaks are typically sporadic and short in duration, they are capable of killing large numbers of trees.

The Douglas-fir beetle primarily attacks Douglas-fir trees. Usually, the trees that get attacked have been recently felled, windthrown, injured, diseased, or otherwise stressed. If beetle population levels increase to epidemic proportions, the beetles will frequently attack live, large-diameter, mature Douglas-fir trees.

Adult Douglas-fir beetles are robust, cylindrical insects that range in length from 4.4 mm to 7.0 mm (Figure 1). They are dark brown to black in colour, with black heads and red wing covers.

Figure 1: Adult Douglas-fir beetles are dark brown and black, and are 4.5 mm to 7 mm long.

DESCRIPTION AND LIFE CYCLE

Typically, Douglas-fir beetles take flight and attack susceptible trees between mid-April and June. If conditions are favourable, some adults may re-emerge in the summer to attack new trees and establish a second brood. The female beetles seek out Douglas-fir trees and burrow into the living tissue under the bark. They then release a chemical messenger called a pheromone that attracts male beetles (and other females). After mating, the beetles excavate a vertical egg gallery that runs parallel to the grain of the wood.

The female will lay about 50 eggs in small groups on alternate sides of the gallery. The eggs hatch into larvae, which mine horizontally out from the main gallery (Figure 2). At the end of each larval tunnel, larvae construct a chamber where they pupate and become adults. The brood overwinters as larvae or immature adults, and mature adults emerge in the spring to attack new host trees.

Figure 2: Douglas-fir beetle larvae

TREE DAMAGE AND DETECTION

Adult beetles carry a blue stain fungus, which they introduce into the tree when they attack. The feeding of the larvae, combined with the growth of the fungus, kills the tree by inhibiting the flow of food and water between the roots and the crown. On the coast, crowns of an attacked tree typically turn red and then a dark rust colour, beginning in June or July and continuing throughout the summer (Figure 3).

A pale green or yellow crown may indicate that a tree is currently under attack, whereas red to dark brown foliage indicates that the attack is one to two years old. A grey crown indicates that the attack is older than two years and beetles are no longer attacking the tree.
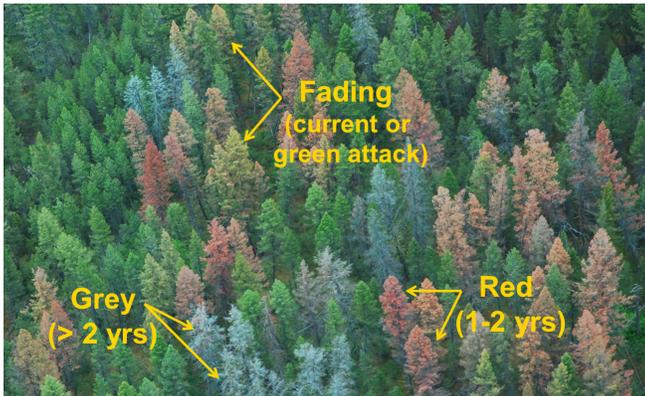

Figure 3: The needles of attacked Douglas-fir trees change colour in stages.

EXTERNAL INDICATORS OF A DOUGLAS-FIR BEETLE ATTACK

» The tree has red foliage or a thinning, pale green crown (Figure 3).

» Red-orange "frass" (fine sawdust) appears on the tree's bark (Figure 4). Note that wind or rain may displace some of the frass, which can make it harder to spot on the bark's surface. Look for frass all around the tree trunk, at eye level and above.

» An excessive amount of fresh sap is running down the tree trunk (Figure 5).

» Woodpeckers have been feeding up and down the tree trunk (Figure 6).

Figure 4: Frass (fine sawdust) on a tree trunk can be an indication that beetles have bored into a tree.

Figure 5: Sap streaming on the mid-bole or upper-bole of a Douglas-fir tree that has been attacked

Figure 6: Damage caused by woodpeckers feeding on beetles in a fire-damaged Douglas-fir tree

INTERNAL SIGNS OF A DOUGLAS-FIR BEETLE ATTACK

» Beetle galleries (the shallow tunnels that beetles create while feeding) are etched into the underside of the bark (Figure 7).
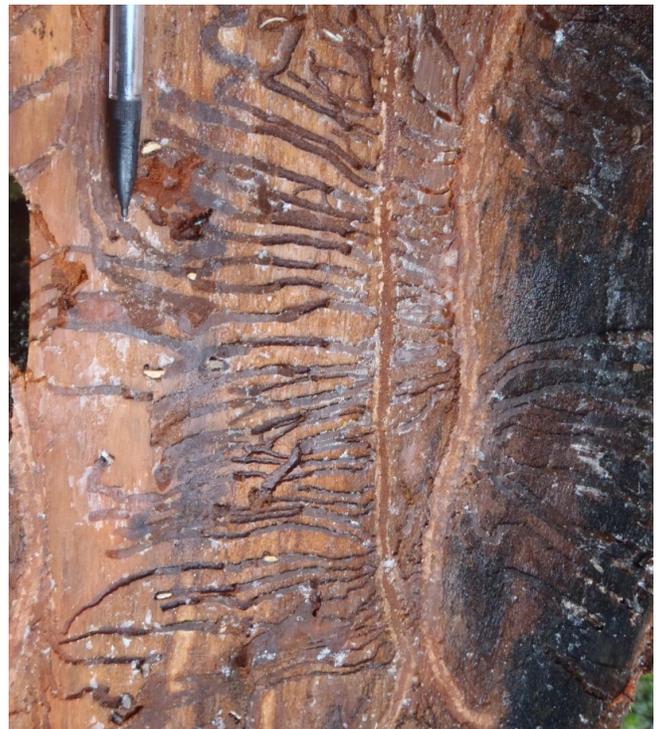

Figure 7: Douglas-fir beetle gallery under the bark, with visible larvae

» Live beetles or larvae are present (Figure 1 and Figure 2). If it is cold out and you are not sure if an adult beetle is alive, warm it up in your palm to see if it starts wriggling. You could also try the "squish test". A dead beetle will be dry and crumbly.

» The cambium (the layer of tissue between the bark and the wood) may be brown and crumbly (Figure 8). The cambium of a tree that was only partially attacked (for example, where the flow of the tree's sap successfully dislodged the beetles) will be pink. Carefully use a hand axe to peel back a small section of bark to determine if the cambium is alive or dead.

Figure 8: Brown cambium on a tree that has been attacked (left) and pink cambium on a healthy tree (right)

CONTROLS AND MANAGEMENT

Natural controls for Douglas-fir beetles include unseasonable cold snaps in late fall or late spring, and birds (e.g. woodpeckers). Insect predators and parasites also help maintain beetle populations at low levels.

Managing Douglas-fir beetles involves locating infestations, harvesting or destroying trees with beetles still in them, and managing accumulations of slash to minimize the amount of host material where Douglas-fir beetles could breed. Given that these beetles have the potential to move into and attack healthy, live trees, slash management is extremely important to minimize beetle populations in high-risk areas (i.e. areas adjacent to recent windthrown trees, and stands that have been stressed by wildfire or drought).

A commonly used control method is "sanitation harvesting", whereby groups of infested trees are removed and milled. If infested trees are less accessible, they may need to be felled and burned on site. Alternately, large-diameter slash (with a diameter greater than 12 cm at breast height) should be bucked to less than 30 cm and left in full sun, if burning is not feasible.

The use of trap trees is another tactic that can be used to manage expanding Douglas-fir beetle populations. Live, healthy, large-diameter fir trees are felled in early spring and left lying on the ground. Douglas-fir beetles prefer downed wood and will concentrate in a trap tree rather than a healthy standing tree.

Trap trees should be placed in shaded areas within 100 or 200 metres of an infested area, but they must be removed or processed before the beetle's next flight period. Trap trees can be hauled and processed at a mill, or bucked and burned on site. In special circumstances, where traditional management tactics are not feasible or are insufficient, specially designed traps baited with beetle attractants may be used to collect beetles as they fly through an area.

In addition, anti-aggregant pheromones such as methylcyclohexanone (MCH) can be applied to disperse beetles from an area or repel beetles from vulnerable areas to protect high-value stands. Anti-aggregant pheromones are most effective when the number of infested trees or susceptible trees is relatively low, and when the pheromones are applied before the annual beetle flight occurs (mid-April) on windthrown trees, large and susceptible trees, and damaged or severely stressed trees.

It is recommended to consult a forest health professional to assist with the establishment of trap trees, baiting stands or anti-aggregation pheromone treatments.

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