refers specifically to sustainable *forest* management of *indigenous forest land.*

2. The RMA is effects based, the Forests Act is prescriptive. For example beech management under the Forests Act is limited to coupes up to 0.5 ha in size, unless the Director General of Ministry of Agriculture and Forestry approves otherwise. Imagine if plantation managers were told that the largest size compartment that they could harvest was 0.5 ha unless MAF approved otherwise.

The RMA requires a great deal more scope than the Forests Act and meeting the latter does not necessarily mean meeting the former. Graining one approval does not necessarily mean gaining the other.

The intention of previous Governments in introducing the RMA was to simplify legislative requirements for natural resource managers. This has certainly not occurred for indigenous forest managers. Either the Forests Act needs modification to bring it into line with the RMA, and tidy up some loose ends in the legislation itself, or the RMA needs attention. Some reconciliation between the two Acts would certainly be useful for indigenous forest managers.

## Summary

I am well aware that even within forestry circles in New Zealand there is a lot of debate, and indeed negativity, over continuing indigenous forest management for production. It's an interesting paradox that overseas, particularly in Europe and North America the debates are not over indigenous forest management but about plantation forest management. Here it is the reverse, although increasingly there are questions being asked about plantation management in New Zealand.

The investment needed in indigenous forest management today is not in the forest. It's in people. The "have nots" in the developing world who so desperately rely on the forest for so many of their needs; the politicians in New Zealand whose job it is to create order out of conflicting demands; and the landowner in New Zealand who wants to make a return as best they may out of their patch of forest — whether that be for conservation or production purposes.

And what level of investment are we talking about. Internationally the amount needed to retain natural forests at some semblance of current levels is beyond mere monetary values. Domestically within New Zealand, the investment needed to maintain and indeed enhance our indigenous forest, may not be anything more than a broader vision of the role that our indigenous forests play in our economy.

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# ARTICLES

# The Effects of the Burnt Pine Longhorn Beetle and Wood-staining Fungi on Fire Damaged *Pinus radiata* in Canterbury


**Paul M. Bradbury**[1]



## Abstract

*Decline of standing Pinus radiata burnt by fire was assessed over a six month period with particular reference to wood degrade caused by the burnt pine longhorn beetle Arhopalus tristis and wood-staining fungi. Wood-stain associated with subcortical destruction and wood boring by the larvae of A. tristis was the primary limiting factor for the salvage of fire damaged trees. Between forty and ninety days after adult insects had laid their eggs 67% of the trees had developed wood-stain. After approximately five and a half months over 90% of the trees had wood-stain and insect infestation, with an average maximum wood boring depth by the larvae of 20mm.*


## Introduction

In the event of a large pine plantation fire in Canterbury the burnt pine longhorn beetle *Arhopalus tristis* (Mulsant) and wood-stain fungi may be a major limiting factor when attempting to maximise the recovery of logs. Adult beetles are strongly attracted to fire damaged pine and the wood boring activity of the larvae can severely limit recovery times to less than a year (Hosking and Bain 1977). *Arhopalus tristis* is believed to have been established in New Zealand since the mid-1950s (Hosking 1970) and was first recorded in Canterbury in 1979 (C. Barr pers comm., Ministry of Agriculture Forestry files). Establishment throughout Canterbury has been rapid and high incidental populations have been reported from many production forests (P. Bradbury pers comm., Ministry of Agriculture and Forestry files).

A study site was established in the Spencer Park Plantation north of Christchurch after a fire affecting about ten hectares in November 1995. Twenty-two year old *P. radiata* D.Don sustained varying degrees of main stem and crown damage. The unprunned stand had a stocking of approximately 500 stems/ha and a mean diameter at breast height (dbh) of twenty-four centimetres.

Insect activity in the bark, subcortical zone and wood and the


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development of wood-stain fungi were the primary factors in formulating a chronology of wood degrade over a seven month period between November 1995 and May 1996.

## Methods and assessment techniques

One plot containing thirty trees was established five days after the fire. Initially, weekly assessments looked for any sign of bark frass (golden brown) from recently hatched larvae on the burnt stems. The first appearance of frass was used to give an indication of the time of oviposition (egg laying), which would be nine to twelve days prior (Hosking and Bain 1977). Once the larvae had hatched, assessments of crown condition; insect activity; wood-stain and any other log degrade factors continued for six months.

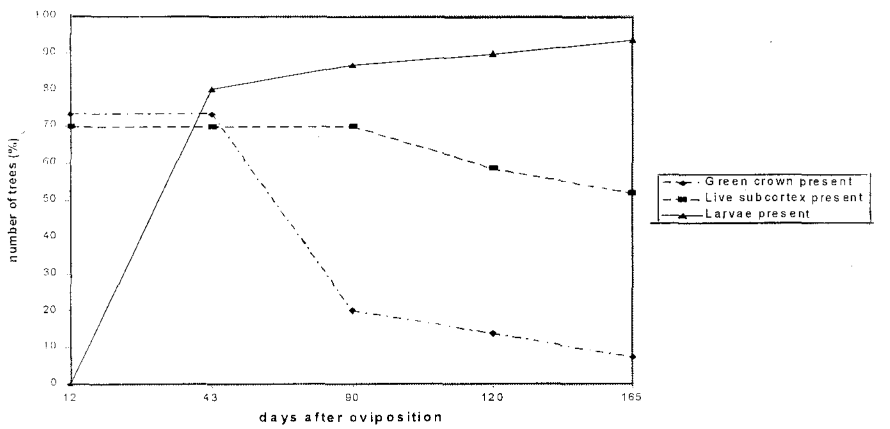


**Fig 1. Decreasing number of trees with green crown and live subcortex with increasing incidence of insect infestation over time.**

### Crown condition:

The upper two metres of the tree crowns were visually assessed as having some green needles (live) or no green needles (dead).

### Subcortical condition:

Assessed between 0.5 — 1.5 metres above ground level. Small 5cm x 5cm (approx.) sections of both fire damaged and undamaged bark were removed with a sharp axe at several points within the sample zone of each tree. Subcortex that appeared fresh and moist, with good bark adherence and no underlying wood discoloration was scored as 'live'. Any sample square with insect damage; obviously heat damaged subcortex or underlying wood-stain was scored as 'dead'.

### Wood-stain:

Trees with any evidence of blue or black staining penetrating the wood under a freshly removed bark section were scored as having wood-stain. Over the assessment period twelve trees were felled and cross cut at one, two and three meters from the base. The presence or absence of wood-stain was recorded in each quarter of the cross-section.

### Measurement of larvae:

The presence or absence of larvae in the subcortical zone was determined by removing a small section of bark and wood from each tree with an axe and observing larvae or feeding damage. The largest larvae found in each tree were recorded and the radial penetration of the deepest larval tunnel was measured at 5mm increments. The presence of any other wood or bark boring insects was recorded.

## Results

Hatch of larvae appeared to be well synchronised, with the first signs of frass appearing on 60% of the trees at about the same time (Table 1). This suggests that large-scale oviposition did not occur until early December, some four weeks after the fire*. The timing of oviposition is consistent with the results from light traps maintained around sawmills in Nelson, which register peak flights of adults from late November (J. Cross pers comm., Ministry of Agriculture and Forestry files).

Forty-three days after oviposition, 26 (80%) of the trees were found to have larvae under the bark, this increased to a 97% incidence by 120 days.

Frass from newly hatched *Arhopalus* larvae was still being observed on over half the trees almost three months after the first sign of egg hatch, suggesting oviposition by adult females continued, despite high populations of larvae having already depleted the subcortical zone. Larvae resulting from the later oviposition were often no more than 2-3 mm long and immediately started wood boring alongside much larger larvae 15-30 mm in length. Although no specific data was collected, the absence of small larvae observed at the 120 day assessment indicated there was a high level of mortality amongst the later hatching larvae.

**Table 1. Longhorn beetle incidence in radiata pine following fire**

| Time after oviposition* | Green Crown | External Frass | Live Subcortex | Wood-stain present | Larvae present in Subcortex | Mean max-length of larvae | Mean max-depth of wood boring | Bark beetles |
|---|---|---|---|---|---|---|---|---|
| Days | % of trees | | | | | mm | mm | % of trees |
| 12 | 73 | 60 | 70 | 0 | 0 | 0 | 0 | 10 |
| 43 | 73 | 73 | 70 | 0 | 80 | 2 | 0 | 10 |
| 90 | 20 | 67 | 70 | 67 | 87 | 12 | 5 | 0 |
| 120 | 14 | 0 | 59 | 93 | 90 | 22 | 10 | 0 |
| 165 | 7 | 0 | 52 | 93 | 93 | 25 | 20 | 0 |

*An assumption has been made that oviposition was 12 days prior to the first appearance of frass.

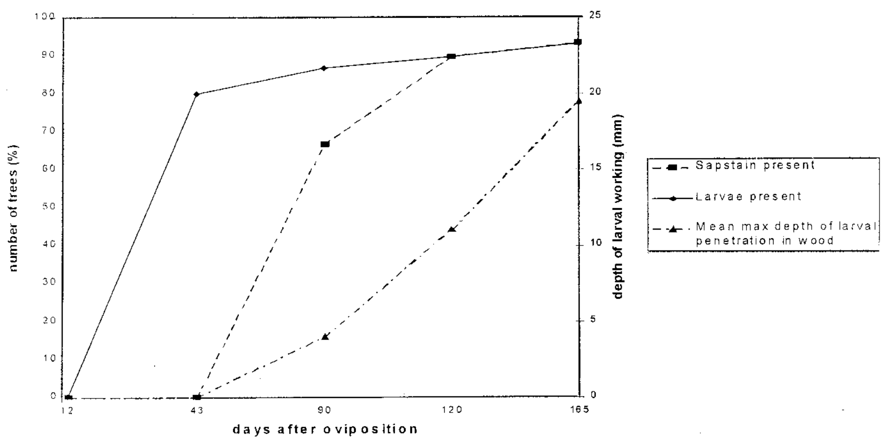


**Fig 2. Increase in insect activity and wood-stain over time.**

Forty-three days after oviposition, 21 (70%) of the trees retained areas of undamaged subcortex on the stem and 22 (73%) still had green foliage in the upper crowns (Fig 1). Despite this, 24 (80%) of the trees overall were found to have some degree of insect infestation. By the final assessment at 165 days after oviposition, only two trees had remnants of green foliage no insect infestation.

Resin response and resin encased larvae were found in a number of trees up to 43 days after oviposition, indicating abortive feeding attempts on live phloem/cambium.

Between the assessments made at 43 days and 90 days after oviposition there was a rapid development in the incidence of wood-stain. Destruction of the subcortex and initial wood boring by larvae (<= 10mm penetration) appeared to be a major factor in facilitating the development of wood-stain (Fig 2). At the 90 day assessment, after the larvae had bored to a mean maximum depth of 5mm, 20 (67%) of the trees were found to have wood-stain. After 120 days and a mean maximum wood boring depth of 10mm, 27 (93%) of the trees remaining had some degree of wood-stain. Although wood-stain did not always immediately occur after subcortical destruction, no wood-stain was ever recorded associated with zones of undamaged 'live' subcortex.

The trees that were felled and sectioned had wedges of wood-stain closely matched to the zones of insect activity and wood-stain was often found emanating into the wood from larval tunnels (Figs 3&4).

### Wood-stain fungi:

Two fungal wood-stain associations were isolated by the Forest Research Institute, Rotorua. One was *Ophiostoma piceaperda* that produced a typical blue stain and the other a Sporothrix/ *Graphium* complex associated with a black stain. Unfortunately, the latter failed to produce a sexual stage in culture which would have enabled a full identification. Both types of wood-stain usually developed as a radial wedge or multiple wedges through the stem.

There was generally a marked decrease in the amount of wood-stain higher on the stem (Table 2). This was probably a feature of a decreasing intensity of fire further up the tree, resulting in the host material being less attractive to attack and subsequent damage by *Arhopalus*. Hosking and Bain (1977) found host material as small as 6cm diameter susceptible to attack.

In the seven trees felled at the final assessment at 165 days, all of the trees apart from one, which had no larvae present, had at least 25% of the log diameter affected by wood-stain one metre above the ground.

## Discussion

*Arhopalus* was the predominant insect affecting the study trees. Oviposition (egg laying) occurred some 28 days after the fire,

**Table 2. Levels of wood-stain at cross-sections 1m, 2m and 3m above the ground 165 days after *A. tristis* beetles had laid eggs.**

| Tree Number | DBH (cm) | Wood-stain (% of cross-section) | | |
|---|---|---|---|---|
| | | 1 metre | 2 metre | 3 metre |
| 19 | 13.1 | 50 | 25 | 0 |
| 20 | 27.6 | 75 | 75 | 50 |
| 21 | 19.6 | 25 | 25 | 0 |
| 22 | 29.4 | 25 | 0 | 0 |
| 23 | 22.8 | 50 | 25 | 0 |
| 30 | 34.1 | 75 | 50 | 100 |
| 1 | 35.0 | *0 | 0 | 0 |

*** No larvae present**

**Fig 3. Wood-stain in an area of subcortical feeding by *A. tristis* larvae.**

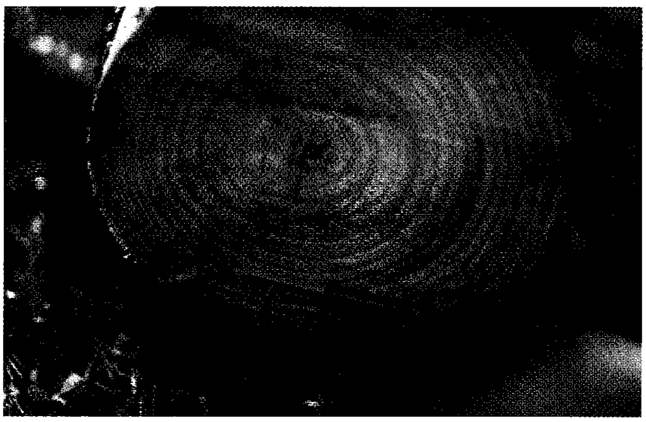

**Fig 4. Wood-stain associated with a larval tunnel.**

which probably coincided with a period of peak adult emergence from adjacent pine plantations. Low numbers of the bark beetle *Hylurgus ligniperda* were recovered initially but presumably failed to compete for the available food supply with the growing *Arhopalus* populations. Although *Arhopalus* larvae are effective wood-borers, the preferred feeding zone was in the nutrient rich subcortical area (Hosking and Hutcheson 1979). This study also confirmed work by Hosking and Bain (1977) who reported that entry into the wood was only after the subcortical area was depleted. Wood-boring commenced some time between 40 and 90 days after oviposition and was initially confined to the slab-wood zone of a saw log. Only after 120 days were larvae found penetrating deeper than 10mm.

*Arhopalus* adults were adept at finding and gaining entry to the wood through very small zones of damaged cambium/ phloem. Fire damaged stands can often grow with apparent good health for several years and then suffer heavy breakage due to insect infestations at the time of the fire. Hosking and Bain (1977) reported heavy wind breakage at all of their study sites 12 to 14 months after initial attack.

Wood-stain associated with the insect activity proved to be the main wood degrade factor and was found to be predominantly associated with insect damage. In this study the majority of wood degrade from both insect activity and wood-stain occurred in the lower two metres of the stem which effectively accounts for the most valuable section of the bottom log.

The presence of a green crown and live subcortical tissue on a tree weeks or even months after being damaged by fire should not be used as an indicator of future survival and good health. Unless a fire is of very low intensity an early decision should be made to salvage or 'write-off' damaged trees.

In the event of a pine plantation fire during the *Arhopalus* flight period from November – April, adult beetles will immediately be attracted to damaged trees and early salvage will be needed to maximise the value of standing timber. Ideally trees should be processed within six weeks of a fire, as after eight to ten weeks wood-stain becomes a problem. Trees damaged by fire outside the main flight period may well have their recovery period extended to the following summer although this could not be confirmed in the present study.

**Acknowledgements**

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# Making Your Mark: The Use of Branding in New Zealand Forest Products

**Hugh Bigsby and Lucie Ozanne**[1]

**Abstract**

*The paper presents the results of a study of the use of branding by New Zealand lumber manufacturers. The study found that in general, as the volume and value of firm's output increases, the amount and variety of product identification and branding used increases. Product identification and branding were most commonly linked to legal requirements for some types of labelling, or because protective packaging provides a cheap opportunity to use brands. Large firms (>15000m³ p.a.) also use brands to identify superior product characteristics, as a method to assure quality, to encourage repeat purchasing, and a high proportion believe that branding adds value to the product they market. Large firms are the only ones to report using bar coding on sawn timber, possibly reflecting the need for greater control in inventory management.*

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## Introduction

New Zealand is one of a number of nations or regions in which the forest products industry has developed around a plantation-based resource. As a result of past planting programmes, wood supply in New Zealand is expanding, and over the next 15 years the plantation resource will be able to almost double to 32 million $m^3$ (Ministry of Forestry 1996). Because domestic wood consumption is anticipated to grow only slowly and requirements are anticipated to be less than 8 million $m^3$ per annum (Horgan and Maplesden 1995), new markets for this expanded production will have to be developed. Part the development of new markets will depend on marketing activities by forest products producers, of which a key component will be product differentiation. Product differentiation involves developing consumer awareness of product characteristics which distinguish one producer's product from another's (Schnaars 1991). With New Zealand's products being built around plantations, and being based on a resource which is 93% radiata pine, two areas of differentiation are provided for producers.