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FOREST RESOURCES SERIES NO. 17

**INSECT ATTACK OF EUCALYPT PLANTATIONS  
AND REGROWTH FORESTS IN  
NEW SOUTH WALES - A DISCUSSION PAPER**

BY

CHRISTINE STONE



**FORESTRY COMMISSION OF NEW SOUTH WALES**

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IN NEW SOUTH WALES - A DISCUSSION PAPER**

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**FORESTRY COMMISSION OF NEW SOUTH WALES  
SYDNEY  
1991**

Forest Resources Series No. 17  
November 1991

Published by:

Forestry Commission of New South Wales,  
Wood Technology and Forest Research Division,  
27 Oratava Avenue, West Pennant Hills, 2125  
P.O. Box 100, Beecroft N.S.W. 2119  
Australia.

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ODC 453:238.228.82 (944)  
ISSN 1033-1220  
ISBN 0 7305 5615 8

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## SUMMARY

The Forestry Commission of New South Wales has an on-going commitment to the establishment of economically viable eucalypt plantations. The artificial dynamics of an even-aged monospecific tree community greatly increases its vulnerability to insect attack. Also, as the intensity of management of eucalypts increases, the acceptable level of insect damage will become lower. Insect pests directly reduce the economic viability of eucalypt plantations through tree mortality and indirectly through lowered growth rates, poor form and reduced timber quality. This paper identifies some insects with the potential to be of economic significance to eucalypt plantations in New South Wales and identifies the kinds of damage they may cause. Suggestions on appropriate ways of minimising the impact of these pests are also presented including monitoring and silvicultural strategies.

## INTRODUCTION

The Forestry Commission of New South Wales has over 25,000 ha of eucalypt plantation in New South Wales. It is Commission policy to increase the area of eucalypt plantations where they can be economically justified (Eucalypt Plantations - Current Policy and Future Options, Draft Report 1990, Forestry Commission of New South Wales). Included in this commitment is the planting of 50 ha per annum as a trial programme in the Eden Region.

The Draft Report acknowledges that "there is greater risk of serious damage occurring to trees, individually or collectively, in a plantation of single native species, with its various natural pests and diseases, than there is to areas of native forest with their inherent dynamic response to environmental change". This is supported by Ohmart (1990) who thinks it is likely that insect problems in intensively-managed eucalypt plantations will differ from those occurring in naturally regenerated forests. Elliott *et al.* (1990) suggest that the greatest risks from insect pests in eucalypt plantations will arise from reduced genetic diversity (example, use of vegetative propagation) and the use of species outside their natural range.

Unfortunately, recorded experience in Australia of insect problems associated with eucalypt plantations is very limited. In Tasmania valuable experience is currently being gained in an attempt to control chrysomelid leaf beetle in *Eucalyptus nitens* plantations (Leon, 1989). Chrysomelid leaf beetle attack has been recognized for several decades in Tasmania (Kile, 1974), however, it has only been since the early 1980's that these insects have been causing consistent and significant economic damage. This increased level of attack paralleled the expansion of the eucalypt plantation programme in Tasmania.

The purpose of this paper is to identify those insects with the potential to be of economic significance to eucalypt plantations in New South Wales, to identify the kinds of damage they may cause and to suggest appropriate means of managing these pests.

## LEVEL OF INSECT HERBIVORY IN AUSTRALIAN EUCALYPT FORESTS

In recent years the level of insect herbivory occurring in Australian eucalypt forests has been a controversial topic in the entomological literature. Several authors (example, Fox and Morrow, 1986) have claimed that insect defoliation in eucalypt forests in Australia is chronically higher than defoliation levels in temperate forests in the northern hemisphere. Ohmart (1984) however, disagrees and claims that the average defoliation rates in temperate eucalypt forests may not be any different than that recorded from other temperate forests in other parts of the world. The discrepancy arises, in part, from comparisons being made between previous studies which have varied in terms of:

- i) Measurement being obtained during insect outbreaks (example, Carne *et al.*, 1974; Kile, 1974) or during non-outbreak situations in forests (example, Fox and Morrow, 1983);
- ii) Measurements obtained from different forest types;
- iii) Measurements obtained from trees of different ages (example, seedlings, saplings or mature trees) or
- iv) Sampling methodologies.

Comparisons of levels of insect herbivory must therefore be treated with caution. After a thorough examination of the literature, however, it appears that when the estimates are confined to non-outbreak situations on mature trees in forests, the average level of insect defoliation ranges from approximately 3 to 20% leaf area loss annually (Fox and Morrow, 1986, Landsberg and Ohmart, 1989). During an outbreak situation this figure can rise to almost total defoliation in localized areas.

## INSECTS PRESENT IN EUCALYPT FORESTS IN NEW SOUTH WALES

With the exception of the studies associated with the *E. grandis* plantations near Coffs Harbour (example, Carne *et al.*, 1974) no regional scientific survey has been conducted of insects present in New South Wales eucalypt forests. To assist in overcoming this deficiency a survey questionnaire was sent in July 1990 to all Districts where eucalypts are grown commercially. This information, together with notes taken during visits by the author to Wyong, Dungog, Urunga, Wauchope, Eden and Bombala Districts in 1990 were used to compile a list of the most damaging insects in eucalypt forests in New South Wales (Table 1).

**Table 1.** List of the most damaging insects in eucalypt forests in New South Wales, collated from a questionnaire survey sent to Regions of the Forestry Commission of New South Wales in July 1990.

Common name	Insect Pest Scientific name	Most commonly reported tree host(s)
<u>Leaf &amp; Sap Feeders</u>		
Psyllids	e.g. <i>Cardiaspina maniformis</i> <i>Cardiaspina fiscella</i> <i>Glycaspis</i> spp.	<i>E. grandis</i> <i>E. robusta</i> , <i>E. botryoides</i> <i>E. saligna</i>
Cup moth larvae	<i>Doratifera</i> spp.	<i>E. maculata</i> , <i>E. camaldulensis</i>
Gumleaf skeletonizer	<i>Uraba lugens</i>	<i>E. dalrympleana</i> , <i>E. camaldulensis</i>
Phasmatids	e.g. <i>Didymuria violescens</i>	<i>E. delegatensis</i> , <i>E. dalrympleana</i>
Chrysomelid beetles	e.g. <i>Chrysophtharta cloelia</i>	<i>E. grandis</i>
Christmas beetles	<i>Anoplognathus</i> spp.	<i>E. grandis</i>
Autumn gum moth	<i>Mnesampela privata</i>	<i>E. globulus</i> , <i>E. nitens</i>
Sawfly larvae	e.g. <i>Perga dorsalis</i>	<i>E. globulus</i>
Coreid bugs	e.g. <i>Amorbus</i> sp.	<i>E. globulus</i>
Leaf blistersawfly	<i>Phylacteophaga eucalypti</i>	<i>E. saligna</i>
Gumtree scale	<i>Eriococcus coriaceus</i>	<i>E. pilularis</i>
<u>Wood feeders</u>		
Hepialid wood-boring moths	e.g. <i>Zelotypia</i> spp. <i>Aenetus</i> spp.	<i>E. grandis</i> <i>E. grandis</i>
Cossid wood-boring moths	e.g. <i>Zeuzera</i> spp.	<i>E. grandis</i>
Cerambycid bullseye borer	<i>Tryphocaria acanthocera</i>	<i>E. grandis</i>
Sinuate moth	Yponomeutid sp.	<i>E. grandis</i>
Ambrosia beetles	e.g. <i>Austroplatypus incompertus</i>	<i>E. pilularis</i>
Termites	e.g. <i>Coptotermes acinaciformis</i> <i>Coptotermes frenchi</i> <i>Glyptotermes</i> spp.	<i>E. pilularis</i> <i>E. pilularis</i> <i>E. pilularis</i>

The two main ways insects cause economic damage to eucalypt forests is either by defoliation or log degradation. While only about a dozen genera have been regularly reported as causing significant damage, the suite of species on eucalypts in New South Wales is enormous (example, Moore 1961). Many of these insects have yet to be formally described and even in well studied groups there are significant taxonomic problems (example, Brown *et al.*, 1990).

### 1. *Psyllids*

The insects most commonly mentioned in the survey were psyllids. In dry woodland areas, example, *E. camaldulensis* forests, psyllids sporadically cause high levels of defoliation. In wet sclerophyll forests psyllids are associated with widespread chronic defoliation of infested trees. A unique case of

psyllid defoliation exists in moist hardwood stands in the presence of Bell Miner (*Manorina melanophrys*) colonies and *Glycaspis* spp. (Loyn *et al.*, 1983). Their work suggests that the presence of both Bell Miners and psyllids have a synergistic detrimental effect on tree health. One of the main food sources of the Bell Miner is provided by psyllids in the form of sugary excretions and their carbohydrate lerp coverings. The Bell Miner harvests the lerp but not the sap-sucking insect. Other birds eat both insect and lerp. The Bell Miner is extremely aggressive in its defensive behaviour and is frequently successful in driving competing birds from its territory. By this action, the Bell Miners protect the psyllids from predation enabling them to attain high population levels. Over time, the level of feeding damage caused by the increasing psyllid population results in premature leaf fall. If repeated, this defoliation can cause tree death.

Estimations are that approximately 2000 ha of the Wyong Management Area is currently suffering from dieback caused by psyllid infestations nurtured by Bell Miners. This area represents virtually all the low altitude regrowth moist hardwood type in the District (C. Makowski, *pers. comm.*). This form of dieback appears to be most severe in moist sites possessing a dense understorey. Conditions of high humidity favour survival and increase in populations of *Glycaspis* spp. and interferes with the efficiency of many of their parasitic natural enemies (Moore, 1962). It is hypothesized that disturbance of the understorey by fire, logging or cultivation would alter the Psyllids Bell Miner complex by:

- i) Changing the microclimate of the site and
- ii) Destroying nesting sites of the Bell Miners.

The possible implications of understorey disturbance would have to be verified and quantified through a programme of research, especially as they appear to contradict findings associated with rural dieback where the re-establishment of the understorey is recommended to encourage natural enemies. A field survey and research programme aimed at quantifying some of the relationships between the psyllids, Bell Miners and their tree hosts is being developed by the Commission's Wood Technology and Forest Research Division, commencing in 1991.

## INSECT THREAT TO EUCALYPT PLANTATIONS

### 1. Factors Contributing to Insect Attack

It should be recognized that insects are opportunistic and capable of a population explosion when favourable conditions develop. The circumstances that favour or disadvantage a population are dependent on a large array of interacting variables including climatic history, condition of the host trees, age and composition of the forest and status of the natural disease and enemy complex. To date only a very few forest insects have been studied in such detail as to quantify any of these variables (example, Carne *et al.*, 1974; Clark and Dallwitz, 1975). Even when an insect pest of eucalypts has been studied, identification of the factors contributing to the outbreaks can be conflicting. Research by Mazanec (1988) has implicated weather, logging and fire in causing leafminer (*Perthida glyphopa*) outbreaks in Western Australian Jarrah (*E. marginata*) forests. Abbott (1990), however, claims that only weather and possibly fire contribute to the leafminer outbreaks. The contribution of repeated hazard reduction burning to the aetiology of Jarrah leafminer outbreaks remains a controversial point (Mazanec, 1988). These discrepancies may reflect the different research approaches used.

Although our experience and knowledge of insects in eucalypt plantations is very limited, several potential outcomes should be heeded. Firstly, extrapolation from agricultural insect pest problems suggests that there is a greater risk of an insect species not initially considered a pest escaping from its normal population oscillations under the artificial conditions existing in an even-aged monospecific tree community. Secondly the potential for switching to new hosts also exists. For example, the chrysomelid leaf beetle *Chrysophtharta bimaculata* is endemic to Tasmania and until the early 1980's had only been observed on species of *Eucalyptus* subgenus *Monocalyptus* (de Little, 1989). *Chrysophtharta bimaculata* is now, however, the most significant pest of *E. nitens* plantations in Tasmania. This host is exotic to Tasmania and is a species of subgenus *Symphomyrtus* (Elliott, 1990).

## 2. *Difference in Insect Attack Between Young and Mature Stands*

From field observations and a few specific trials (example, Carne *et al.*, 1974) it is known that the suite of insects occurring in young eucalypt plantations can differ from that found in mature stands. The age of canopy closure frequently marks the change from one suite to the next. The following is a separation of potential insect pests into their possible preference for either young or mature eucalypt plantations (Table 2). Some insects are known to have no preference.

**Table 2.** List of potential insect pests and their possible preference for either young or mature eucalypt plantations.

Young Plantations	Mature Plantations
<u><i>Leaf and Sap Feeders</i></u>	<u><i>Leaf and Sap Feeders</i></u>
Christmas beetles	Psyllids
Sawfly larvae	Phasmatids
Autumn gum moth larvae	Chrysomelid leaf beetles
Coreid bugs	Gumleaf skeletonizer
Eucalyptus weevil	Cup moth larvae
Gumtree scale	
Chrysomelid leaf beetles	<u><i>Wood Feeders</i></u>
Gumleaf skeletonizer	Wood-boring beetles
Cup moths larvae	Wood-boring moths
Wingless grasshopper	Termites
<u><i>Wood Feeders</i></u>	
Wood-boring beetles	
Wood-boring moths	

During the establishment phase of even-aged monospecific stands, defoliators are the main problem. After canopy closure, wood-boring insects and termites increase in importance. Two common circumstances for accentuated attack by wood-boring insects and termites are:

- i) Stressed trees, example, trees suffering from drought, nutritional imbalance or being "off-site" and
- ii) The presence of wounds, e.g. created through logging operations, storm damage, or fire. These can be minimised by increased care during logging operations (i.e. felling, snagging and movement of machinery).

It is proposed that solutions to controlling insect herbivores in young eucalypt plantations are achievable, however the effective management of wood-boring insects in mature plantations may be much more difficult to develop. This supposition arises from the differing ecologies of the two groups of insects. For example, differences in life histories, exposure of the larval stage and natural enemy complexes.

## 3. *Seasonal Implications*

Healthy mature eucalypts possess a relatively high capacity to recover from periodic attacks by insect herbivores, especially if the attack occurs in Spring. A young sapling's ability to recover from severe defoliation at other times, however, is much more limited with a greater chance of death. The timing of defoliation is critical because the plant's ability to tolerate and recover from defoliation varies with its level of energy reserves (Bamber and Humphreys, 1965). The ability of eucalypts to recover from severe defoliation is minimal at the end of the growing season. For this reason, attack by the Autumn gum moth, for example, can cause high mortality in a young plantation (R. Farrow, *pers. comm.*).

## SURVEILLANCE AND MONITORING

The current inability to predict what may happen in terms of insect attack within eucalypt plantations reinforces the need for regular surveillance. An insect damage assessment form, Appendix 1, was prepared by C. Stone and V. Jurskis (O.I.C., Eden Research) to initiate this monitoring task. It is intended that this form be utilized in two different situations:

- i) After detection of an insect 'hot spot', the form would accompany the notification of attack and the provision of associated site and stand details and be directed to the Biology Section at the Wood Technology and Forest Research Division, or
- ii) Be incorporated into the regular monitoring programme of the eucalypt plantation trials, at present concentrated in the Eden Region.

Unfortunately there is no simple way to record a meaningful quantitative description of an insect attack on eucalypts. Consequently filling out the assessment form may, at first, seem arduous and therefore it is recommended that foresters wishing to use the monitoring sheet contact the Biology Section, Wood Technology and Forest Research Division, for details and clarification before they do so. Data collected using this procedure will form the basis for an accurate evaluation of the impact of any particular insect pest on plantation productivity.

## INTEGRATED PEST MANAGEMENT (I.P.M.) STRATEGY

### 1. *Development of an I.P.M. Strategy*

If an insect outbreak is sufficiently damaging then the aerial application of a chemical insecticide may be deemed advisable. Justification of aerial insecticide application would need to be in terms of demonstratable growth losses affecting commercial viability. Under certain circumstances a single application of an insecticide may cause the insect population to collapse and provide enough lag-time for the plantation to grow into a less susceptible condition.

If, however, a particular species of insect is detected regularly in plantations and annually causes significant damage then there would be a need to develop a more sophisticated specific monitoring programme and different control procedures. That is, there would be a need to develop an Integrated Pest Management (I.P.M.) Strategy. Ohmart (1990), suggests that in forestry, I.P.M. can be thought of as a decision-making system, based on knowledge of the insect population dynamics and forest stand dynamics, which analyses the impact of a pest insect on a stand of trees and then evaluates and recommends available treatment options. Before an I.P.M. Strategy could be implemented it would be necessary to obtain information on the following:

- i) The population dynamics and ecology of the insect,
- ii) The relationship between the insects' population levels and the level of damage incurred from which an 'economic injury level' could be determined, and
- iii) An efficient cost-effective insecticide. This insecticide could be either chemical or biological, however, it is highly desirable that its action specifically targets only the insect pest.

The apparently simpler alternative strategy of repeated application of a broad-spectrum insecticide has failed to control the pest insects in numerous agricultural crops. The major reason being that the insect pests are capable of developing resistance to the insecticides after repeated exposure while their natural enemy complex remains susceptible (example, *Helicoverpa* spp. in cotton crops in northern New South Wales).

During the period from 1954 to 1963 several aerial spraying operations were undertaken in both southern New South Wales and in Victoria to control outbreaks of the phasmatid *Didymuria*

*violascens* in large stands of *E. delegatensis* and *E. regnans*. Initially the two insecticides utilized in this control programme were dieldrin and gamma-HCH (Lindane), both these insecticides are broad spectrum persistent organochlorines (Shepherd, 1957). The application of such chemicals in Australian forests is now totally unacceptable and, therefore, specific and preferably non-chemical control agents would be given a high priority for incorporation into any new control programme.

Although the use of non-chemical agents is environmentally much more acceptable, the development of such programmes in eucalypt plantations, however, may be much more difficult to establish than it has been in pine plantations. In the past, biological control programmes have been more successful in exotic host/pest systems (example, the success of controlling *Sirex noctilio* with the nematode *Deladenus siricidicola*) than in native host/pest systems. This is partially due to the co-evolution of insect herbivores with a complex of natural enemies and diseases. Price (1975) argues that the establishment success of an introduced biological control agent can be dependent upon the number of indigenous natural enemies already present, irrespective of their ability to control the insect pest. The effectiveness of the indigenous natural enemies is, in turn, influenced by their respective complex of secondary natural enemies (example, hyperparasites).

## 2. An I.P.M. Strategy in Tasmania

Since 1986 there has been a major research programme conducted by the Forestry Commission of Tasmania aimed at establishing an I.P.M. Strategy to control chrysomelid beetles in *E. nitens* plantations with the use of the selective bacterial biocide *Bacillus thuringiensis* strain 'san Diego' (Leon, 1989). The operational I.P.M. technique relies heavily on population monitoring and precise timing of the aerial application of the *B. thuringiensis* formulation. It has been determined that the optimal time of application is when the bulk of the chrysomelid population is in the first and second larval instar stages. That is, after heavy egg predation has occurred and before significant defoliation can take place. It should be noted, however, that although the use of *B. thuringiensis* is far more environmentally acceptable than the use of broad-spectrum insecticides, its success is dependent on a higher level of precision in both timing and application than that which is necessary for chemical insecticides (A. Leon, pers. comm.).

## 3. Silvicultural Considerations

In conjunction with the development of any I.P.M. Strategy will be the need to develop and maintain silvicultural practices which ensure the continued vigour of the plantation. As mentioned previously many forest insects are opportunistic and quickly take advantage of trees growing under stressful conditions. Stresses imposed on trees, whether due to poor site quality, drought, frost, flood, fire, mechanical damage or competition with other vegetation, appear to pre-dispose trees to insect attack while concurrently reducing their capacity to recover from the damage inflicted (Carne and Taylor, 1978).

A factor in the rural dieback problem appears to be exposure and lack of protection from surrounding mature trees (Heatwole and Lowman, 1986). Thus on an exposed windy site, the possibility of planting a fast-growing barrier on the wind-ward side of a young plantation may be considered. These barriers could also assist in breaking up the homogeneity of the plantation and thus possibly reduce the rate of spread of a potential insect pest as well as providing additional habitat for the natural enemies. The additional costs associated with ensuring the establishment of a healthy vigorous plantation can be compensated for by the increased probability that losses through insect attack would be reduced when compared to the susceptibility of stressed trees.

Site history and preparation should also be taken into consideration in terms of insect control. Site history has been shown to influence potential insect pests attacking newly established plantations. For example, Christmas beetle (*Anoplognathus* spp.) attack can be more severe on young trees planted on ex-pasture sites or on sites neighbouring pasture than on trees planted on ex-native forest sites. Termites, especially *Coptotermes* spp., are not likely to be a problem in first rotation eucalypt plantations on ex-pasture sites, however the destruction of large nests remaining on ex-native forest sites during site preparation may be considered (Greaves *et al.*, 1967). This situation does not apply,

however, for all insect pests. The chrysomelid problem in Tasmania appears to be independent of site history (D. deLittle, *pers. comm.*).

Site preparation techniques used to establish and manage eucalypt plantations can lead to a different environment from that existing in the natural forest ecosystem and this may influence susceptibility to insect attack (Elliott *et al.*, 1990). For example, the fertilizer regimes used in plantations may result in a changed plant nutrient status (Elliott *et al.*, 1990). Several studies have demonstrated that eucalypt defoliators respond to the altered nutrient status of their host plants (example, Landsberg, 1990) and consequently alter their pest status.

A complication associated with site preparation was recently observed in Queensland (R. Wylie, *pers. comm.*). The giant wood moth (*Xyleutes cinereus*) and ringbarking longicorn (*Tryphocaria solida*) were observed to have caused severe damage in an experimental plantation of *E. grandis* (3-year-old) at Toolara in south-east Queensland. Incidence of borer attack was significantly higher in plots which had been fertilized than in those which were unfertilized. Yellow-tailed black cockatoos (*Calyptorhynchus funereus*) were exacerbating the damage by tearing open stems to predate these larvae, in some cases almost severing the stem.

#### 4. Tree Selection and Breeding

The long term alternative solution to minimising insect attack in eucalypt plantations must involve the selection of natural genetic resistance through breeding programmes. Thus there is a need to ensure the conservation of the genetic diversity of taxa and provenances to be used for plantation forestry to allow flexibility of response to pest problems. Two research programmes investigating genetic resistance to chrysomelid attack on *E. nitens* have already commenced in Tasmania (D. deLittle, *pers. comm.*; C. Raymond, *pers. comm.*).

### CONCLUSION

The view held by some foresters that eucalypt insect herbivores are acting as natural thinning agents by attacking the weaker debilitated trees is worrying. A similar complacent attitude may have contributed to the 1987 *Sirex* outbreak in South Australia, where 1.8 million *P. radiata* trees, valued at more than \$5 million, were killed by *Sirex noctilio* (Haugen and Underdown, 1990). The perception that insects are just a natural way of removing suppressed trees could develop into a problem of similar magnitude in monospecific eucalypt plantations.

Because of the higher establishment costs associated with eucalypt plantations in comparison to natural regeneration there is less tolerance for factors interfering with growth rates (i.e. the economic threshold for acceptable damage will drop). Therefore, although the following three scenarios of:

- i) Sporadic high levels of defoliation;
- ii) Chronic low levels of defoliation, or
- iii) Timber degrade through borer or termite attack,

may not cause tree mortality in a eucalypt plantation they could well threaten the targeted volume of merchantable wood required for economic sustainability. Repeated defoliation not only reduces M.A.I., it can also affect growth form through a reduction in apical dominance and increase susceptibility to other biotic agents such as decay fungi.

In summary, forester managers need to be aware of the following points in regard to the management of insects in eucalypt plantations and regrowth forests:

- i) The potential economic threat posed by insects.
- ii) The beneficial synergistic effects of maintaining vigorous unstressed stands.
- iii) Control of an insect pest in eucalypt plantations will involve an integrated approach requiring both technical expertise and perseverance.
- iv) The threat of insect attack can be minimized through appropriate silvicultural practices and tree selection.

## **RECOMMENDATIONS**

1. Entomological input should be an essential component of feasibility studies, and of all stages of planning in future eucalypt plantation programmes.
2. Provision for regular surveillance and monitoring of insects should be incorporated into the Management Plans of all eucalypt plantations.
3. Regular surveillance and reporting of insect attack in regrowth forests should form part of an annual pest and disease survey.

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## Appendix 1 Insect Damage Assessment Form.

1. When insect damage is detected in a plantation, specimens of the insect should be collected, placed in alcohol and returned to Wood Technology and Forest Research Division. Include as many stages of the insect as you can find example, eggs, grubs, cocoons, adults. Complete the Insect Damage Assessment Form and include it with the package\* containing the insects. Both a completed form and insect specimens are necessary.
2. In small trials (example, 5-tree row plots) it may be possible to assess every tree. However, in large trials it will usually be possible to sample only a proportion of the trees. A sample of 6 to 10 trees will usually be adequate. Don't sample and assess only heavily attacked trees. Include dominant, codominant and suppressed trees in the sample.

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\* Specimen bottles within the package must be well sealed and protected against damage during transit.

## INSECT DAMAGE ASSESSMENT SHEET

LOCATION:..... ASSESSOR:..... DATE:.....  
 PLOT No:..... SPECIES:..... TREE No:.....  
 TREE HEIGHT:..... AV. CROWN DIAMETER:..... STAND AGE:.....

### GENERAL TREE APPEARANCE

Normal	Stunted	Mainly Epicormic Foliage	Lower Branches Dead	Serverely Defoliated	No Insect Damage

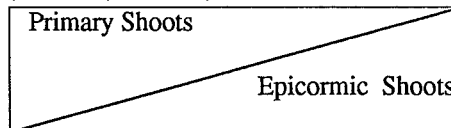
Refer to "other" if necessary

### DAMAGE TO POSITION ON TREE

Amount	General Crown	Upper Crown	Lower Crown	One Sector of Crow	General Stem	Upper Stem Branches	Lower or mid Stem
Negligible							
1/8							
1/4							
1/2							
3/4							
Most							

### DAMAGE TO TREE STRUCTURES AND INSECT ABUNDANCE

Use code: 1 (rare), 2 (apparent), 3 (common), 4 (abundant) for causative insects attacking primary shoots or epicormic shoots



Amount	Growing Tips	Young Leaves	Mature Leaves	Mixed Aged Leaves	Flowers Buds Capsules	Branchlets < 1 cm	Branches Stem
Negligible							
1/8							
1/4							
1/2							
3/4							
Most							

### DAMAGE TYPE

Holes	Bites	Holes & Bites	Leaf Removal	Skeleton-ized	Blistering or Mining	Galls	Necrosis e.g. Psyllids	Chlorosis e.g. Aphids	Curling Webbing	Fungal Spots
Leaves										
Stems & Branches			Galls	Lesions Cuts	Borer Holes	Fungi	Oozing Kino			
Other			Drought	Frost	Animal	Cockatoo	Witches Broom			



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