Primary Industries Standing Committee

Forestry and Forest Products Committee

Research Priorities and Co-ordination Committee

RESEARCH WORKING GROUP 7
FOREST HEALTH

Annual Pest, Disease & Quarantine Status Report for Australia and New Zealand 2008/2009

November 2009

Table of Contents

KEY ISSUES & THREATS

Key Issues & Threats in each State are outlined in this section. These could be new and emerging pest, disease or quarantine issues, an increase in the pest status of known pests or diseases, or forestry-related issues relevant to forest health.

New South Wales

In softwood plantations, *Ips grandicollis,* in combination with drought, continues to cause problems for the Sirex biological control program in several areas (especially Hume Region). A large research project, with funding from ARC and NSCC, will be investigating various aspects of the problems and trialling management options in 2010/2012. Although levels of drought-related tree mortality were significant lower in the 2008 surveys of pine plantations in Hume Region than observed in 2007, widespread tree mortality was recorded in early 2009.

In hardwood plantations, the psyllid *Creiis lituratus* is still the major threat to young *Eucalyptus dunnii* plantations in northern NSW. Significant damage was observed in both young (1-2 year old) and older (5-8 year old) stands, resulting in tree mortality. Winter bronzing bug caused damage to several areas of spotted gum plantations.

Queensland

In softwoods, detection of a single female *Sirex noctilio* wasp in a static trap near the NSW border has heightened preparedness for the potential establishment of this pest in Queensland. Doubt remains over the potential impact of this pest on plantations in the subtropics given the recent experiences in similar climatic zones in South Africa where biological control has been less effective than in temperate climates.

Considerable expansion in the plantation hardwood estate in the tropics is now occurring, with a focus on red mahogany (*Eucalyptus pellita*), teak (*Tectona grandis*) and African mahogany (*Khaya senegalensis*), as well as sandalwood (*Santalum* spp.). Red mahogany and teak plantations are mainly being established on ex-sugarcane sites on the coast while African mahogany is being planted on drier sites further inland. Insect threats identified include swarming leaf beetles, (*Geloptera miracula* and *Rhyparida discopunctulata*), free-living psyllids (*Blastopsylla* sp. and *Ctenarytaina* sp.) and gum tree scale on young *E. pellita*, and teak defoliator (*Hyblaea puera*) on teak. Further assessments to determine the longer term incidence and severity, impact on growth, and research on management of these emerging issues are required. Disease threats to these plantations that have now been identified include bacterial wilt and Kirramyces leaf blight (*Kirramyces epicoccoides*) on *E. pellita* and teak rust (*Olivea tectonae*) on teak. Cedar tip moth (*Hypsipyla robusta*) has been recorded on *Khaya senegalensis*, but only at very low incidences. Assessments of sandalwood plantings are due to commence in 2009/2010.

In subtropical Queensland, erinose mites (*Rhombacus* spp. and *Acalox* spp.) and leaf beetles (mainly *Paropsis atomaria*) remain the major invertebrate threats to eucalypt plantations. Quambalaria shoot blight (QSB; *Quambalaria pitereka*) remains the major

health issue restricting expansion of *Corymbia* taxa hardwood plantations, while Kirramyces leaf blights have effectively halted further expansion of *E. grandis* hybrids plantations in central coastal regions. Development of a glasshouse screening method for seedlings/cutting of *Corymbia* taxa for QSB susceptibility should enable more rapid deployment of germplasm to enhance current breeding programs and supply future industry needs.

Victoria

Research is needed into:

1. Predisposing factors and ongoing impacts of pine aphid defoliation in *Pinus radiata* plantations after the release of the biological control program.
2. Potential impacts of climate change on insects and pathogens covering native invertebrate populations, insect pests, fungi, pathogens and exotic incursions (covering for example, impacts of expected increased frequency of fire regimes on invertebrates, increased plantation estate for carbon sequestration and its impacts on pest population dynamics, and potential for new pest incursions to enter and develop given changes in rainfall and temperature patterns).
3. Development of an effective integrated national system of health surveillance monitoring and reporting using quantifiable, comparable data.
4. Targeting, monitoring and control of pathways for entry of insects and pathogens to Australia.
5. Evaluation of the risk that exotic agents such as *Phytophthora ramorum* and *P. pinifolia*, are to Australia's natural ecosystems and forest industry.

Tasmania

No new or emerging pest, disease or quarantine issues were recorded in Tasmania.

South Australia

No new or emerging pest, disease or quarantine issues were recorded in South Australia.

Drought continues to have an impact on tree health in South Australia this year, especially in the Mid-North forests (north of Adelaide). The impact of drought has been compounded by attack of stressed trees by *Ips grandicollis*.

Western Australia

In the south west of Western Australia, tuart, wandoo and marri decline continue to be major concerns. A decline in peppermint (*Agonis flexuosa*) health was also recently reported and research suggests that an endophyte may be involved. Monitoring the extent and impact of *Phytophthora cinnamomi* in native forest, woodlands and coastal heaths and

protecting threatened flora communities is a priority within the Department of Environment and Conservation. In the north of the State, surveys of boabs (*Adansonia gregorii*) in the Kimberly resulted in seven new species of Botryosphaeriaceae being described, with one species, *Lasiodiplodia theobromae*, displaying high pathogenicity in tests. In *Eucalyptus globulus* plantations, three new species of *Mycosphaerella* were recently described.

New Zealand

Overseas regulatory action in response to the perceived threats of *Neonectria fuckeliana* and *Phytophthora kernoviae* is the major issue facing the plantation forestry industry in New Zealand.

Collar rot of *Agathis australis* (kauri) associated with *Phytophthora* taxon Agathis (PTA) in indigenous forests continues to be a major concern.

SUMMARY

The main issues in each State are briefly summarised in this section.

New South Wales

Softwood plantations

Sirex wood wasp continues to cause significant tree mortality in several State Forests in Hume Region, with a slight increase in the area affected from last year. Low parasitism rates were observed in the biological control program over the 2007/2008 season. *Ips* bark beetles continue to attack *Sirex* trap trees, potentially detrimentally affecting the biological control program. Only low levels of *Sirex* attack were observed in Macquarie Region. Tree mortality associated with drought (and *Ips* or *Diplodia*) was significantly reduced in Hume Region this year compared to 2007, with no areas with tree mortality higher than 5%. The area affected was 5385 ha, compared to over 17,795 in 2007. Importantly, *Ips* activity was significantly lower than in 2007. Lower levels of tree mortality were also observed in Macquarie Region. Few management options are available to reduce tree mortality associated with drought stress. *Essigella* was again widespread in Hume region in 2008. The area affected was slightly lower than last year; however, damage observed in September was much more severe than has been observed in previous years, with trees being almost totally defoliated in some areas. Damage from *Essigella* was also widespread throughout Macquarie Region, occurring in the majority of State Forests. Although the area affected was lower than last year, levels of damage (severity) were higher than last year, with current aphid activity observed in many areas. *Ips* bark beetles continue to breed and cause damage in the Billo Road Fire area. There was moderate numbers of new deaths of trees that had been damaged by fire but not originally killed. We observed *Ips* in many of these trees, indicating that these trees are continuing to be a good resource for *Ips* to continue to breed and build up. *Dothistroma* needle blight was severe in several State Forests on the Northern Tablelands. The area of damage was mapped in the Forests NSW helicopter, with maps provided to Northern Region for control spraying with copper oxychloride fungicide. Approximately 1800 ha were targeted for control.

Hardwood plantations

Bell miner associated dieback (BMAD) was again observed in several plantations, on a range of hosts, including *E. saligna, E. grandis* and *E. dunnii*. There was little change to the extent and severity of damage from last year. We have also identified areas where active bell miner colonies are adjacent to plantations, and as such potential for future BMAD problems. Cardiaspina psyllids again caused damage to *E. grandis* at one plantation, similar to previous years. Cardiaspina psyllids were observed in many areas on the north coast last year, including native forest and mature plantations around Coffs harbour. The Winter bronzing bug, *Thaumastocoris* sp., was confirmed for the first time attacking eucalypt plantations in NSW during the surveys in October. This insect pest was previously only known from Sydney street trees and an isolated area of plantation in south-east Queensland (a different species has caused extensive damage to eucalypt plantations in South Africa). This tiny bug causes chlorosis of spotted gums, resulting in premature defoliation. It was

observed during aerial surveys in several localised areas (total 5 ha) in plantations around Casino, and in one plantation west of Port Macquarie during ground surveys in February. Eucalypt sawflies caused extensive and severe defoliation of *E. dunnii* in several plantations in the Bonalbo area in mid- to late-2008, with approximately 460 ha affected. We observed small areas (10-20 ha) of defoliation in previous years, but were never able to confirm the causal agent. During the 2008 aerial survey we landed within the plantation and observed sawfly larvae feeding on trees. Severe, repeated damage from Creiis psyllids has resulted in dead-topping and tree mortality of *E. dunnii* in approximately 153 ha, all in plantations with previous outbreaks. Outbreaks of Creiis continue to cause significant problems in younger stands owned/managed by MIS companies in the region. We question the efficacy of chemical control with currently registered insecticides. We have been coordinating a collaborative project through the Subtropical Forest Health Alliance (includes private and public growers) investigating new insecticides, and delivery mechanisms, to control Creiis (see below). Stem borers are a continuing problem in the ageing estate, and we have been conducting specific surveys for stem borer damage over the past few years, including identifying the causal agents of damage (various species of cossid moths and longicorn beetles) and associated fungal damage.

Queensland

Routine forest health surveys were carried out by Forestry Plantations Queensland (FPQ) in their softwood plantations. No formal surveys were undertaken within their hardwood plantation estate although a number of specific issues relating to nursery seedlings and field trees were investigated. FPQ has been testing the use of aerial imagery (e.g. NRI & NDVI) to assist in better targeting ground surveillance, particularly of softwood plantations. In 2008/2009 the forest health team in Horticulture & Forestry Science, Queensland Primary Industries & Fisheries focussed on RD&E in support of hardwood plantation development and expansion, including assessments of the expanding hardwood estate in the tropics in November 2008. The team also assisted in limited pest and disease identifications for Subtropical Forest Health Alliance members.

The main health issues in 2008/2009 were:

Softwood plantations

- *Sirex* wood wasp was detected for the first time in Queensland in March (a single female in a static trap) but intensive follow-up surveys and expansion of static trapping as well as trap tree plots has to date not found evidence of establishment.

- Following identification of *Ips grandicollis* at the Port of Townsville, static trapping indicated that the internal Marlborough quarantine line (north of Rockhampton) was breached and this insect is now present in plantations up to Cardwell.

- Monterey pine aphid, *Essigella californica,* has been causing significant damage (in the form of blanket needle and stem coverage by black mould fungi) to young *Pinus taeda* in the Southern Downs region, as well as to similar aged *P. caribaea* var. *hondurensis*

(PCH) in Byfield State Forest north of Rockhampton. *Essigella* is also commonly associated with needle cast and chlorotic trees. The bio-control wasp *Diaeretus essigellae* has now been released within the Southern Downs Region.

Hardwood plantations

- Erinose mites (*Rhombacus* spp. and *Acalox* spp.) remain the key invertebrate pest in young *Corymbia* taxa plantations in SE Queensland.

- The leaf beetle *Paropsis atomaria* is consistently the main defoliating pest of a range of eucalypt taxa in SE and central coastal Queensland.

- Quambalaria shoot blight (*Quambalaria pitereka*) continues to be a significant problem in young *Corymbia* taxa plantations in SE Queensland and northern NSW.

- Extensive damage by Kirramyces leaf blights to young *E. grandis* hybrid plantations in central coastal regions has halted plantation expansion in this region.

- Following the expansion of hardwood plantations in the tropics, a number of significant pest and disease problems have been identified, including swarming leaf beetles, (*Geloptera miracula* and *Rhyparida discopunctulata*), free-living psyllids (*Blastopsylla* sp. and *Ctenarytaina* sp.) and gum tree scale on young *E. pellita*, and bacterial wilt, Kirramyces leaf blight (*Kirramyces epicoccoides*). Teak defoliator (*Hyblaea puera*) and teak rust (*Olivea tectonae*) problems have been identified on teak.

- Poor pruning of stems has resulted in exposed wounds that allow entry of stem boring insects and associated fungi.

Victoria

The drought and scorching temperatures over summer 2008/2009 has resulted in the mortality of trees and understorey particularly on drought prone landscapes. In February 2009, fire burnt almost 430,000 hectares of agricultural, forest and residential land in the worst bushfire on record in terms of lives and property lost. While much of the forest will recover from the fires, much of the old-growth *Eucalyptus regnans* in the Wallaby Creek and O'Shannassy catchments have been killed by the fires. However, good seed production in the previous year should provide for adequate regeneration.

The drought has continued to result in a reduction in disease reports from native forest communities during 2008/2009. Isolated outbreaks of leaf beetle have been observed in Alpine ash, *E. delegatensis*, forests in Gippsland, while the redgum basket lerp, *Cardiaspina retator*, continues to causes moderate to high localised levels of defoliation in River red gum, *E. camaldulensis*, in northern Victoria. No significant tree mortality has been associated with this defoliation at this time.

Phytophthora cinnamomi continues to be a focus of the Department of Sustainability and Environment (DSE) as it implements the strategy for its management. Modelling of sites where disease impact is greatest is to be used to prioritise management activities.

In radiata pine plantations, Monterey pine aphid (MPA) populations continue to cause significant discolouration and defoliation within radiata pine in Victoria, with damage in 2009 being the highest since surveillance using the plot-based system, commenced in 2001. Average levels of defoliation ranged from 30 to 50% across Victoria, with some plot maximums of up to 80% defoliation observed. In terms of the incidence of damage across the State, 92 of the 123 plots surveyed were affected by MPA. New areas of plantation are now showing significant defoliation and this is most likely due to drought conditions. The surveillance/monitoring program again has highlighted the threat that MPA has on radiata pine growth.

Generally, the incidence of sirex over summer 2008/2009 remained at relatively low levels across the state. Similarly, *Ips grandicollis* was not observed as a significant pest during the 2009 survey, which is in contrast to the previous two years surveys.

Surveys for Dothistroma needle blight, *Dothistroma septosporum*, Cyclaneusma needle cast (CNC) and Diplodia dieback have recorded a relatively low level of damage to radiata pine plantations across Victoria. However, some localized higher levels of damage (hot spots) were identified.

Within hardwood plantations, autumn gum moth, *Mnesampela privata*, has caused localized severe damage in a number of young *Eucalyptus globulus* plantations in the Corangamite region of west central Victoria during autumn/winter of 2008. Observations will continue next year, given that most trees will still have juvenile foliage at this stage and therefore, still be susceptible to attack. Leaf beetles and Christmas beetles continue to cause low to moderate levels of defoliation in plantations of predominantly *E. globulus* and *E. nitens* in Victoria during summer 2008/2009, with damage generally greater in the upper 50% of the tree canopy. Sawflies were observed causing trace levels of defoliation in south, eastern and north central Victoria during winter 2008/2009, with damage generally confined to individual and small clusters of trees of predominantly *E. globulus* and to a lesser extent *E. camaldulensis*. Other insect pests of eucalypts were also recorded inflicting low levels of damage.

Mycosphaerella leaf disease (MLD) was observed within Gippsland and the Otwyas causing moderate to severe (21-70%) damage in the lower crowns and trace to low (0-20%) levels of damage in the upper crowns in localised plantations of *E. globulus* and *E. nitens*. These MLD levels are higher than the previous surveys with the disease extending into the upper crown on some sites with potential direct impacts on tree growth.

Stream monitoring for the presence of *Phytophthora* species in catchments in Victoria, continued to December 2008 in 16 streams/rivers across Southern Victoria. A variety of different baits, including leaves of *Rhododendron*, *Eucalyptus regnans*, *Pittosporum undulatum* and cotyledons of *E. sieberi* were continued to be evaluated. The results showed

that the techniques could detect species of *Phytophthora* from all streams tested. Several species were isolated and none were of known quarantine concern to Australian biosecurity agencies. It is recommended that stream monitoring for the presence of *Phytophthora* species be incorporated into routine surveillance activities across all States and Territories of Australia to aid in early detection of exotic *Phytophthora* species and recording of the current species status. Further research is also needed to determine the timing of stream monitoring to maximise detections (e.g. time following rainfall).

Monitoring of the ports of Melbourne, Geelong and Westernport continued for the Asian gypsy moth, *Lymantria dispar*, over summer 2008/2009 as part of a nationwide monitoring program. Apart from native lepidopterous species being trapped, no exotic species including gypsy moths were detected during the survey. The City of Melbourne continued to support surveys for Dutch elm disease in the main gardens and boulevards under their management. These surveys help to confirm the absence of the pathogen from Australia and maintain awareness and therefore early detection should it arrive.

The Forest Health Surveillance Group has been working closely with industry developing and conducting ongoing insect pest and disease surveillance programs in both softwood and hardwood plantations throughout the state to meet their varying operational and stewardship requirements. Research is also currently underway in native forests of Victoria to design a system of health monitoring suitable for implementation on Victoria's public lands. The plot-based system that was piloted in 2008/2009 is now being evaluated for the potential rollout across the state with many forest health indicators being examined.

Tasmania

Surveillance of *Pinus radiata* plantations was largely restricted to the north of the state in 2008/2009. Additionally some 13600ha of eucalypt plantations on State Forest did not receive the full spectrum of surveillance this season, primarily because growers did not require surveillance services due to the economic climate.

Populations of the pine aphid *Essigella californica* have declined following prolonged heavy rain during the winter months. *Essigella* was detected in an isolated outbreak some forty kilometres north of Hobart but with the pest still absent from northern plantations. Sirex remains at low population levels, but widespread, although static trap surveys detected developing populations in two plantations, which will be treated with nematode biocontrol agents.

Bark stripping by browsing mammals was recorded across almost 700ha of *P. radiata* plantation, the largest area seen for a number of years. *Cyclaneusma* remains widespread but damaging levels *Dothistroma* were still only recorded over a very limited area. Top death due to *Diplodia* also had limited distribution this season.

Autumn gum moth was recorded in a number of areas and around 150ha required spraying. Around 28% of eucalypt plantation monitored for chrysomelid leaf beetles was over threshold, most of which was sprayed. The proportion of environmentally friendly

chemicals uses increased from 5% in 2007/2008 to 15% in 2008/2009. Almost half of the moderate/severe damage recorded was caused primarily by late season adult beetle feeding. Damage by *Uraba lugens* was widespread around plantation edges across the state. An easing of drought conditions saw a decrease in mortality from desiccation and *Phytophthora.*

The elm leaf beetle has expanded its southern distribution from northern Hobart suburbs to Cambridge, near Hobart Airport. Surveys conducted during the summer months failed to find evidence of the beetle in midland towns.

South Australia

Drought continues to have an impact on tree health, especially in the Mid-North forests (north of Adelaide). The impact of drought has been compounded by attack of stressed trees by *Ips grandicollis*. *Ips* and drought have been the main health issues this year.

In radiata pine plantations, Essigella numbers have remained low and damage has been less this year (minor defoliation and some growth loss) compared with previous years in both the Green Triangle and Ranges Regions. Large numbers of ladybirds have been observed this year in the Ranges Region. And it is thought that weather conditions have not been conducive to population build up. Sirex numbers are low in the South East with scattered activity in the Ranges Region. It is thought that drought stressed/killed trees to drying out too quickly to attract sirex. Ips has caused little damage in the South East this year. In the Ranges Region, approximately 200ha were attacked, mainly in areas around clearfell, where high levels of residue were present. In the Mid-North, Ips continues to be a major cause of tree deaths. Approximately 700ha were affected this year. Many trees are still feeling the impact of drought and are providing ideal habitat for build-up of Ips. Areas that are being affected include areas next to or near clearfell, areas where thinning is overdue and areas on northern facing slopes. A number of strategies are being put in place to manage Ips in these forests, particularly in view of possible future changes in climate. Cyclaneusma has affected trees in some areas.

After many years of dry conditions, there were good rains in the region in spring. This has improved the health of trees within hardwood plantations. The new growth is likely to have masked the effect of insect damage to some extent and so far there are no reports of increased insect or disease activity.

A Digital Aerial Sketch Mapping program, developed by ForestrySA, was used in annual forest health surveys this year. The program is based on the ESRI Arcmap platform and features include: “smart” buttons; direct writing on screen; GPS tracking and autorotation of maps. However the main feature is the ability to directly download data into the ForestrySA Corporate database, without the need for further processing. A web based version is also being developed.

Western Australia

No new outbreaks or records of significant damage from pests or diseases were recorded in Western Australia during 2008/2009.

In plantations, surveillance, monitoring and control measures for established pests continued. The eradication and surveillance program for European house borer (*Hylotrupes bajulus*) in *Pinus pinaster* plantations continued and the EHB response group is confident that eradication is a possibility. Recent molecular research on Eucalyptus weevils (*Gonipterus scutellatus*) in WA has shown that beetles in WA are all one species and the likely source of the population is Tasmania. Three new species of *Mycosphaerella* were described from *Eucalyptus globulus* plantations.

In native forest, dieback in jarrah forest caused by *Phytophthora cinnamomi* and tree decline in tuart and wandoo woodland continues to command attention. Recently a decline in peppermint (*Agonis flexuosa*) was also reported and research suggests that an endophyte may be involved. A total of 33, 230 ha of forest and other native vegetation was surveyed and mapped by the Department of Environment and Conservation (DEC) for the presence of *P. cinnamomi*. In conjunction with the mapping, 1,789 soil and plant samples were tested to confirm the presence of *P. cinnamomi*. Molecular techniques have identified at least 9 new *Phytophthora* taxa from previous sampling of which one, *P. multivora*, has been described. Four new non-pathogenic species of Botryosphaeriaceae have also been described from various hosts in declining tuart forest. Trials with injection of phosphate on declining tuart have shown promising results as trees are still showing signs of an increase in crown health four years after treatment.

Surveys of boabs (*Adansonia gregorii*) in the Kimberly have resulted in seven new species of Botryosphaeriaceae being described, with one species, *Lasiodiplodia theobromae*, displaying high pathogenicity in tests.

New Zealand

Levels of Dothistroma needle blight and Cyclaneusma needle cast of *Pinus radiata* were low in 2008/2009. Low summer rainfall and decreasing area of susceptible trees resulted in little Dothistroma needle blight. It is likely that elimination of highly susceptible genotypes from the population has resulted in lower disease levels of Cyclaneusma needle cast over the past decade than those commonly recorded in previous years.

There has been no further extension to the range of *Neonectria fuckeliana* which remains restricted to the lower half of the South Island. Stem flutes nearly always fully occlude with no outward signs of damage and no residual internal damage, unless pruned stubs are large. Research has shown that Nectria flute canker can be managed through manipulation of silviculture regimes.

Armillaria root disease, caused primarily by *Armillaria novae-zelandiae*, remains widespread in many *Pinus radiata* plantations throughout much of the country**.**

Phaeophleospora eucalypti (agent of Septoria leaf blight) and Mycosphaerella leaf blotch (primarily due to *M. cryptica*) continue to be the cause of the most serious foliage disease in *Eucalyptus nitens* plantations. The eucalypt tortoise beetle *Paropsis charybdis* (Chrysomelidae) continues to be a major pest, particularly in *Eucalyptus nitens* plantations.

Uraba lugens (Nolidae), the gum leaf skeletoniser, is widespread in the greater Auckland region, in the Waikato region, and at Mt Maunganui. It has not yet been reported as a concern in commercial plantations, and is causing significant damage only in the Auckland region.

NEW SOUTH WALES

Dr Angus Carnegie (Forest Health Management,
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PLANTATIONS

Pinus spp.

Insect pests

Forest health surveillance

Only two softwood plantation Regions were fully surveyed this year, as requested by Forests NSW: Hume Region and Macquarie Region, in winter 2008. Northern Region softwoods on the northern tablelands were surveyed due to severe Dothistroma needle blight. The extent and severity of pests, diseases, vertebrate pests, climatic disorders, nutritional imbalances and weeds limiting growth or affecting survival were mapped and reported on.

Sirex noctilio (sirex wood wasp)

Sirex wood wasp continues to cause significant tree mortality in several State Forests in Hume Region, with a slight increase in the area affected from last year. Low parasitism rates were observed in the biological control program over the 2007/2008 season. *Ips* bark beetles continue to attack sirex trap trees, potentially detrimentally affecting the biological control program. Only low levels of sirex attack were observed in Macquarie Region. Recommendations for management of sirex across both Regions included increasing the biological control program in high risk areas.

Ips grandicollis (fivespined bark beetle)

Ips bark beetles continue to breed and cause damage in the Billo Road Fire area. There was moderate numbers of new deaths of trees that had been damaged by fire but not originally killed. We observed *Ips* in many of these trees, indicating that these trees are continuing to be a good resource for *Ips* to continue to breed and build up.

Essigella californica (Monterey pine aphid)

Essigella was again widespread in Hume region in 2008. The area affected was slightly lower than last year; however, damage observed in September was much more severe than has been observed in previous years, with trees being almost totally defoliated in some areas. Damage from *Essigella* was also widespread throughout Macquarie Region, occurring in the majority of State Forests. Although the area affected was lower than last year, levels of damage (severity) were higher than last year, with current aphid activity observed in many areas. Forests NSW is currently involved in a national project investigating biological control of *Essigella* (see below for management of *Essigella*).

Diseases

Dothistroma needle blight

Dothistroma needle blight was severe in several State Forests on the Northern Tablelands. The area of damage was mapped in the Forests NSW helicopter, with maps provided to Northern Region for control spraying with copper oxychloride fungicide. Approximately 1800 ha were targeted for control.

Drought

Tree mortality associated with drought (and *Ips* or *Diplodia*) was significantly reduced in Hume Region this year compared to 2007, with no areas with tree mortality higher than 5%. The area affected was 5385 ha, compared to over 17,795 in 2007. Importantly, *Ips* activity was significantly lower than in 2007. Lower levels of tree mortality were also observed in Macquarie Region. Few management options are available to reduce tree mortality associated with drought stress. Early thinning of affected stands may reduce further tree mortality by reducing waster stress on retained trees. However, research is required to determine whether this is operationally feasible/effective. Another option is to identify high risk sites (such as those with a low water-holding capacity) and plant trees at a lower stocking or prescribe early thinning on these sites. Research within NSW DPI is currently investigating this issue.

Pest and disease management

Current pest and disease management strategies were reviewed and management efficiencies identified where appropriate to improve performance. Several research projects are aimed at improving the efficiency and effectiveness of management strategies to reduce the impact of pests and diseases:

Sirex noctilio (sirex wood wasp)

- The effectiveness of the biological control program is continually monitored by looking at nematode parasitism rates from sirex wasps that emerge from trap tree plots. In recent years this has been sub-optimal, with levels in Hume Region in recent years being 45-55%, Monaro in 2007/2008 at 39% (no emergence from 2008/2009) and Macquarie Region at ~60% over the past 2 emergence seasons. Too few wasps have emerged from trap trees in Northern Region to provide reliable data. Ideally these should be closer to 90%. The reason for this reduction in parasitism is being investigated, but could include attack of trap trees by *Ips* bark beetles and sub-optimal timing of nematode inoculation. We have recommended that inoculation of trap tree plots with nematodes occur from April to May. Due to dry conditions trap trees may be drying out too quickly for the nematodes to effectively migrate throughout the whole tree and infect sirex larvae. Furthermore, cold winters may slow down the breeding cycle of the nematode such that fewer eggs are laid and thus fewer nematodes produced to effectively infect a high proportion of sirex larvae within trap trees.

- The FHSU released sirex parasitoids (*Ibalia leucospoides*), which were originally captured from Hume Region, in Nowendoc State Forest to supplement the biological control program.

- The APVMA permit to use dicamba (PER10524) to establish trap trees was renewed.

- In recent years *Ips* bark beetles have been attacking sirex trap tree plots, potentially having a detrimental affect on the effectiveness of the biological control program. NSW DPI conducted a trial to investigate the potential of pheromones to deter *Ips* from attacking sirex trap tree plots, funded by the National Sirex Coordination Committee (NSCC), with assistance from Hume Region. Anti-aggregation pheromones were attached to trap trees in an attempt to deter *Ips* from attacking them before sirex was able to oviposit. Unfortunately we found no significant effect of the treatment, with the majority of trees attacked by *Ips.* However, we did find that sirex was still able to oviposit in trees attacked by *Ips.* Further research on this problem and fine-tuning trap tree establishment techniques, is planned, with funding from the NSCC.

***Essigella californica* (Monterey pine aphid)**

- Forests NSW is part of a national Forests Wood Products Australia (FWPA) project to develop a biological control program for *Essigella*. A parasitic wasp has been imported from USA, undergone extensive testing in a quarantine facility in South Australia and is planned for release in winter-spring 2009 following final approval. First releases in Australia are planned for Hume Region, with data collected during forest health surveys used to identify high risk sites to target for initial release. Monitoring of the effectiveness of the biological control agent will be conducted in the following years.

- A trial has been established in Hume Region to investigate the potential for remedial fertiliser to reduce the impact of *Essigella* defoliation.

- A clone trial in Hume Region was assessed in 2008, with preliminary identification of clones superior for growth and *Essigella* resistance. Further trials are being identified for assessment in the coming year.

***Eucalyptus* spp.**

Insect pests

Forest health surveillance

In August 2008 aerial surveys were conducted of a large proportion of the young hardwood estate in northern NSW. [Surveys were also conducted for Dothistroma needle blight in pine plantations and of Forest Enterprise Australia's hardwood plantations in the

same week.]. Ground surveys were conducted in October 2008, February 2009 and April-May 2009. The FHSU liaised with the Plantations Forester, as well as Plantation Officers, prior, during or following surveys. A report, including GIS maps and management recommendations, was sent to Northern Region following the aerial and October ground surveys.

Perga spp. (sawflies)

Eucalypt sawflies caused extensive and severe defoliation of *E. dunnii* in several plantations in the Bonalbo area in mid- to late-2008, with approximately 460 ha affected. We observed small areas (10-20 ha) of defoliation in previous years, but were never able to confirm the causal agent. During the 2008 aerial survey we landed within the plantation and observed sawfly larvae feeding on trees. Few management options are available for this pest and we recommend continued monitoring of the extent and severity of damage and for tree recovery in following surveys.

Borers

Stem borers are a continuing problem in the ageing estate and we have been conducting specific surveys for stem borer damage over the past few years, including identifying the causal agents of damage (various species of cossid moths and longicorn beetles) and associated fungal damage. This forms part of a project on stem degrade focusing on hardwood plantations in subtropical Australia, funded mainly by the Queensland Government (see below).

Cardiaspina spp. (psyllids)

Cardiaspina psyllids again caused damage to *E. grandis* at one plantation, similar to previous years. Cardiaspina psyllids were observed in many areas on the north coast last year, including native forest and mature plantations around Coffs harbour. There are limited management options for this pest.

Creiis spp. (horn lerps)

Severe, repeated damage from Creiis psyllids has resulted in dead-topping and tree mortality of *E. dunnii* in approximately 153 ha, all in plantations with previous outbreaks. Outbreaks of Creiis continue to cause significant problems in younger stands owned/managed by MIS companies in the region. We question the efficacy of chemical control with currently registered insecticides. We have been coordinating a collaborative project through the Subtropical Forest Health Alliance (includes private and public growers) investigating new insecticides and delivery mechanisms to control Creiis (see below).

***Thaumastocoris* sp. (winter bronzing bug)**

The winter bronzing bug, *Thaumastocoris* sp., was confirmed for the first time attacking eucalypt plantations in NSW during the surveys in October (Fig. 1). This insect pest was previously only known from Sydney street trees and an isolated area of plantation in south-east Queensland (a different species has caused extensive damage to eucalypt plantations in South Africa). This tiny bug causes chlorosis of spotted gums, resulting in premature defoliation. It was observed during aerial surveys in several localised areas (total 5 ha) in plantations around Casino (Fig. 2) and in one plantation west of Port Macquarie during ground surveys in February. Recommended management is to monitor tree recovery in future surveys and for any expansion of the current infestations. The initial outbreaks were picked up during the aerial survey and would have been difficult to detect from the ground. As such, we highly recommend the continuation of the aerial survey of hardwood plantations.

Figure 1. The winter bronzing bug on spotted gum in NSW plantations.

Figure 2. Damage (yellowing and bronzing) to spotted gum caused by the winter bronzing bug, newly identified in plantations in NSW during forest health surveys in 2008.

Vertebrate pests

Bell miner associated dieback

Bell miner associated dieback (BMAD) was again observed in several plantations, on a range of hosts, including *E. saligna, E. grandis* and *E. dunnii*. There was little change to the extent and severity of damage from last year. We have also identified areas where active bell miner colonies are adjacent to plantations and as such potential for future BMAD problems. Recommended management of BMAD in young plantations includes continued monitoring of the extent and severity of damage, and of bell miner colonies and weed control of lantana, which will reduce bell miner habitat.

Pest and disease management

Operational pest and disease management advice is provided to Regions on completion of surveys where required, or as requested during an "unplanned intervention response". Examples are provided above and include continued monitoring of outbreaks or damaged stands and weed control. Current pest and disease management strategies were reviewed and management efficiencies identified where appropriate to improve performance. Several ongoing sub-projects are aimed at improving management strategies for pest and diseases in hardwood plantations.

- Pest and disease assessment of tree improvement trials: assessment of insect damage in an *E. dunnii* provenance and family trial were carried out in 2008. Future assessments are planned. No other trials were identified for assessment in 2008/2009.

- Impact of stem defect agents on wood quality in subtropical hardwood plantations: this is a multi-agency (growers and research providers) project which is funded largely by the Queensland Government's Plantation Hardwoods Research Fund. The main aims are to identify the major factors that determine a plantation (or trees) susceptibility to stem degrade, quantify the economic impact of degrade on solid wood crops and develop prescriptions and tools to reduce the impact of stem defect agents in current and new plantings. The FHSU is involved via provision of forest health data and expertise and assisting in quantifying the impact of stem degrade via destructive sampling and sawmilling studies.

- Improved management of Creiis psyllids: Creiis is still the single major health threat to profitable *E. dunnii* plantations in northern NSW. Current insecticide control has proven sub-optimal. Through the Subtropical Forest Health Alliance we are assisting in testing and trialling new chemicals and application techniques, with registration of a new insecticide (Sumitomo Shield Systemic Insecticide) in October 2009. The APVMA permit to control Creiis with dimethoate was renewed (PER11322).

- New and emerging pest and disease threats: A major benefit of surveillance by trained experts is that new and emerging threats are identified early. In recent years we have identified several eucalypt leaf spot fungi new to science, as well as the first outbreak of the winter bronzing bug in plantations in NSW.

QUEENSLAND

Dr Simon Lawson (Forest Health, Queensland Primary Industries and Fisheries) and
Michael Ramsden (Plantation Health Officer, Forestry Plantations Queensland)

PLANTATIONS

Pinus spp.

Insect pests

Sirex noctilio (sirex wood wasp)

The first sirex wood wasp (*Sirex noctilio*) was caught within the private Sugarloaf *Pinus radiata* plantation, which is approximately 20 kilometres from Forestry Plantations Queensland (FPQ) Southern Downs Management Area in the Queensland/NSW border region. The single female wasp was intercepted in a static insect panel trap baited with a specific Sirex lure in February 2009 (Fig. 3). Biosecurity Queensland was informed (as required) with briefs and updates on the FPQ response. FPQ response strategy was guided by the National Sirex Co-ordination Committee (NSCC) operational guidelines. The FPQ Plantation Health Officer is a member of this National Committee. The sirex response has required considerable resources both in staff, time and materials and supplies.

Figure 3. First trapped *Sirex noctilio* female within Queensland, 10 February 2009.

In support of increased ground surveillance, additional static insect intercept traps and trap tree plots; the Plantation development and Innovation group within FPQ organised aerial imagery (LREye) over Sugarloaf and FPQ plantations in the Southern Downs region. This work was completed early May 2009 with duplicate flights in September 2009. The primary aim was to compare NDVI (an index of vegetation stress) over time to try and identify sirex-struck trees or at least unhealthy stands likely to be subject to sirex infestation. If successful

this technique will enable tracking of the progression of sirex into new areas providing valuable information for sirex research. The data from this work will also be evaluated regarding usefulness as a general forest health assessment tool and used for general plantation surveying and management activities.

As part of the co-ordinated response the Plantation Health Officer organised and partook in sirex field training at Tumit NSW 14-16 April 2009. Angus Carnegie (DPI, NSW) and Dick Bashford (Forestry Tasmania) undertook the field instruction. Angus organised additional NSW operational staff involved in field inspections and bio-control inoculations to be present and give instruction. FPQ Southern Downs field staff involved in on-site static trap and trap tree establishment as well as tree and log stack inspections for sirex also partook in the training.

Collaborative work with the National Sirex Co-ordination Committee continues, specifically the environmental (temperature) limits of *Amylostereum areolatum*, the damaging decay fungus associated with the sirex. This research was undertaken under both laboratory and field conditions. Importantly, it has been found that the presence of the exotic fivespined bark beetle (*Ips grandicollis*) and its associated symbiotic fungus *Ophiostoma ips* may act as antagonists to sirex. Ambient and internal tree temperatures may also be inhibitory to sirex in SEQ.

Ips grandicollis (fivespined bark beetle)

Within our plantation estate we have the exotic *Ips grandicollis* which is the least aggressive of the beetles within this group. Following identification of *Ips grandicollis* at Townsville Port by AQIS officers FPQ static trapping found that it had breached our Marlborough Quarantine line (north of Rockhampton) and is now present up to Cardwell.

Essigella californica (Monterey pine aphid)

The Monterey pine aphid, *Essigella californica*, has been associated with extensive defoliation and growth losses in *Pinus radiata* plantations in south-eastern Australia since it was first detected in 1998. The FPQ Plantation Health Officer is a member of the *Essigella* Bio-control Steering Committee with FPQ providing past financial support based on a "low risk" status. This status is now being adjusted to high in order to reflect field findings of high to extreme *Essigella* numbers. The majority of young *Pinus taeda* within the Southern Downs estate of Passchendaele State Forest are commonly black due to sooty mould fungi (Fig. 4) growing on the honeydew exudates from *Essigella* infestations. This phenomenon has also been observed on similar aged *P. caribaea* var. *hondurensis* (PCH) growing in Byfield State Forest north of Rockhampton. *Essigella* has been found on all *Pinus* species including *P. caribaea* var. *hondurensis* × *P. elliottii* var. *elliottii* hybrids. Field observations of extreme *Essigella* numbers date back to 2002. In older age class plantations *Essigella* is more frequently found in high numbers on trees with thin/sparse canopies, chlorotic canopies. These same trees may also be experiencing potassium (K) deficiency and/or seasonal needle cast.

Figure 4. Black needles due to sooty mould fungi.

Following host specificity testing of the *Essigella* bio-control parasitoid wasp *Diaeretus essigellae* and a final required test against the native aphid *Neophyllaphis lanata,* approvals were gained for the bio-control release. Initial spring release was scheduled to 15 sites - 5 in each of Victoria, New South Wales and South Australia (spring prime season releases). Following these releases if parasitised aphid mummy's available releases then were scheduled to one site in each of Western Australia, Queensland and Tasmania (March/April late season releases). Due to low aphid numbers being reported in all States, except Queensland, the first Australian release was changed and undertaken within the Passchendaele State Forest. A second release is scheduled at the time of this report.

Diseases

Requests for follow-up pest and disease inspections came from Fraser Coast, Beerburrum, Pechey, Esk, Byfield and Passchendaele Management Areas. Most did not require field inspections as information was readily available to answer queries. Appropriate samples were requested before any field inspections were undertaken. Commonly, inspections found canopy decline/browning with this phenomenon being scattered but seasonal within Beerburrum, Fraser Coast and Byfield. Compartments within Pechey were specifically inspected as thinning canopies, dieback and stem bleeds warranted confirmation that sirex was not present. Commonly thin canopies are due to annual needle fall which peaks around mid-spring and again around February, which follows a good wet season and a drier winter/spring (such as occurred this year). Needle cast can be elevated during this mid-spring peak. Also, connected with a lot of the foliar symptoms seen during this period is a classic potassium (K) deficiency (older needles chlorotic and new green), which again appears to be a seasonal affect.

***Araucaria* spp.**

Insect pests

Last financial year and again this year insects have been observed to be defoliating the margins of young plantation hoop where these adjoined clear-felled compartments with concurrent observations within Mary Valley estate (primarily Myravale and surrounding compartments west of Gympie) to Bulburin State Forest Monto. Mature hoop retained within gullies for slope control as well as all surrounding *Araucaria cunninghamii* and *A. bidwillii* turned brown due to the extreme level of defoliation and lateral branch damage sustained. In September 2008 the Plantation Health Officer arranged for Dr John Moss, to accompany and assist with identifications at the Myravale site. During subsequent surveys the hoop pine jewel beetle *P. aurantiopictus* was found to be present in large numbers on individual trees and was the main defoliating agent. The longicorn beetles *Temnosternus imbilensis* and *Temnosternus niveoscriptus* were responsible for branch dieback as they were feeding on branch and stem bark.

All these beetles have in the past been regarded as secondary so enquiries were undertaken to establish if another factor had stressed the trees attracting the beetles. Long dry period of drought followed by substantial rainfall is believed to have been the "environmental trigger" for the mass emergence of hoop specific insects. The consequences of litter retention, in particular retention of large hoop stem sections, assists in sustaining populations of forest "pests", as many species of beetles lay their eggs in this detritus where their larvae then feed eventually emerging as the adult beetle.

Interestingly, beetle populations collapsed with the parasitic clavicipitaceous fungus *Beauveria* sp. aff. *bassiana* infecting and killing a range of beetle species (numerous new host species records) (Fig. 5).

Figure 5. Hoop-pine jewel beetle killed by a parasitic clavicipitaceous fungus.

White grub larvae (primarily belonging to Scarabaeidae) have been causing extensive losses immediately following 2R plantings at Yarraman (north west of Brisbane). Investigations and field inspections are continuing but generally control is difficult (especially chemical) with damage again commonly seasonal and infrequent, with specific sites sustaining greater damage. Litter retention again advantageous as larvae feed on organic material in soil.

Insects found associated with hoop damage (all laboratory identifications by Mr Murdoch De Baar):

Specific hoop pine boring/grazing beetles:

1. *Prospheres aurantiopictus* Buprestidae (hoop-pine jewel beetle)
2. *Araucariana queenslandica* Buprestidae (hoop-pine jewel beetle)
3. *Temnosternus imbilensis* Cerambycidae (longicorn beetle)
4. *Temnosternopsis niveoscriptus* Cerambycidae (white-inscribed longicorn beetle)
5. *Illacuris laticollis* Curculionidae (hoop-pine weevil)
6. *Eriococcus araucariae* Hemiptera (felted pine coccid)
7. *Brachybelus undulates* Curculionidae (hoop pine branchlet galler weevil)
8. Belidae Curculionidae (small weevil found in cones)
9. *Aesiotes notabilis* Curculionidae (pine bark weevil)

Non-specific grazing insects:

1. *Disterna plumifera* Cerambycidae (longicorn beetle)
2. Katydid Tettigoniidae (bush katydid)

Strongylurus decoratus Cerambycidae (hoop-pine branchcutter) not found but likely present. All beetles (bar one) were specific to hoop pine: only two other insects were generalist host grazers.

Diseases

"Traditionally" the most common causes of death and tree decline within the *Araucaria* estate are due to root diseases such as *Phellinus noxious* and *Rigidoporus vincta*. These diseases cause losses in specific areas up to two years of age after planting and then commonly become less prevalent. Percentage losses increase when planted immediately post clear-fall due to hoop stumps becoming infection foci. In north Queensland plantations these diseases affect trees through to maturity with trees frequently displaying healthy crowns even though their supporting root systems are in advanced stages of decay (safety hazard). Such trees were found and reported at Marys SF Mary Valley.

Eucalyptus spp.

Insect pests

Geloptera sp. and *Rhyparida* sp. (swarming leaf beetles)

Two species of swarming leaf beetles, *Geloptera miracula* and *Rhyparida discopunctulata* (Fig. 6), were observed causing severe patch damage to trees < 1 y.o. in several plantations around the Tully region in November 2008.

Figure 6. *Rhyparida discopunctulata* feeding on *E. pellita*.

***Blastopsylla* sp. and *Ctenarytaina* sp. (psyllids)**

Free-living psyllid species (*Blastopsylla* sp. and *Ctenarytaina* sp.) were observed causing stunting and multiple stemming of scattered *E. pellita* saplings near Tully in November 2008 (Fig. 7).

Figure 7. Stunting and loss of apical dominance of *E. pellita* caused by *Blastopsylla* sp. and *Ctenarytaina* sp.

***Eriococcus* sp. (gum tree scale)**

Gum tree scale (*Eriococcus coriaceus*) caused severe patch defoliation to *E. pellita* saplings near Tully in November 2008.

Rhombacus spp. and *Acalox* spp. (erinose mite)

Pest and disease resistance assessments of 32 plots within the Maynard hardwood plantations found that there was variation in erinose mite (*Rhombacus* spp. and *Acalox* spp.) severity.

Chrysomelid leaf beetles

The most common seasonal insect damage sustained to young hardwood plantation tress was leaf chewing by chrysomelid larvae.

Cicadas

Stem samples from Stanwell seed orchard were examined by the Principle Entomologist Shaun Winterton (DEEDI). Damage was considered likely to be caused by Cicadas although tree crickets cause similar damage. Cicada damage is sustained when Cicadas gouge oviposit "channels" in lateral branches. As Cicadas emerge on mass, damage within young plantations can be considerable with branch death and breakages common.

Stem borers

Recent surveys at Proston "Glencoe" within *Corymbia* and *Argophloia* found that poor form pruning was allowing entry of beetle and moth larvae resulting in swellings, stem bleeds and fungal infections (Fig. 8). Damage was caused when limbs were crushed and torn resulting in open wounds, lifting bark, stubs etc. Damage following form pruning generally affects end product use.

Figure 8. Poor form pruning allowed entry of beetle and moth larvae.

Diseases

Quambalaria shoot blight

Pest and disease resistance assessments of 32 plots within the Maynard hardwood plantations also found considerable variation in Quambalaria shoot blight severity.

Bacterial wilt

Symptoms of bacterial wilt (Fig. 9) were identified from young *E. pellita* plantations in the Tully and south Johnstone areas. Trees losses were patchy and appeared to be exacerbated by extensive flooding during the wet season.

Figure 9. Symptoms associated with bacterial wilt in 6 month old *Eucalyptus pellita* plantation near Tully in north Queensland.

Kirramyces leaf blight

Kirramyces leaf blight caused by *K. epicoccoides* was also detected on *E. pellita* causing early senescence of lower foliage. The impact on tree health did not appear to be significant.

***Tectona grandis* (teak)**

Insect pests

Teak defoliator (*Hyblaea puera*) damage was widespread in young plantations on the coast causing severe defoliation in several plantations (Fig. 10).

Figure 10. Teak defoliator (*Hyblaea puera*) damage to young teak near Tully.

Diseases

Teak rust, *Olivea tectonae*, was widespread but damage appeared limited to lower foliage at the time of the surveys.

Acacia mangium

Insect pests

Acacia shoot borer (*Cryptophlebia* sp.) was observed causing widespread shoot dieback in an *Acacia mangium* seed provenance trial in Silkwood in far North Queensland.

Diseases

Acacia phyllode rust caused by *Atelocauda digitata* was also identified in the seed provenance trial in Silkwood (Fig. 11). Variability in susceptibility was noticeable and assessments for resistance were due to be conducted before the end of 2009.

Figure 11. Acacia phyllode rust, *Atelocauda digitata*, on *Acacia mangium* in north Queensland.

NURSERIES

Nursery inspections were carried out at both the Toolara and Beerburrum production nurseries. During these inspections general adherence to nursery hygiene was documented. Three species of *Phytophthora* (*P. cinnamomi, P. nicotianae, P. cryptogea*) have been detected within the old Wollemi (*Wollemia nobilis*) growing areas of Toolara nursery (in-ground and in external adventitious pot roots only), as well as the root pathogens *Cylindrocarpon* and *Cylindrocladium*, thus the potential to now move into *Pinus* production areas exits. *Phytophthora* inadvertently made its way into the nursery within potted Wollemi sourced from a nursery in another State. Water pooling along drainage lines within the *Pinus* growing area is a potential source for *Phytophthora* inoculums. No insect pest problems or damaging outbreaks were identified during these nursery surveys.

Palmwoods nursery

In the past the Plantation Health Officer inspected the SCTN Palmwoods nursery at Nambour finding hygiene problems and isolated *Phytophthora* at the entrance to their hydroponic cutting facility. Currently FPQ staff are not involved in screening or inspections of privately operated hardwood seedling suppliers although inspections continued within FPQ facilities.

Gympie nursery

Free living psyllids, mainly belonging to the family Psyllidae, were found to be causing clumped damage on occasion within the FPQ Gympie hardwood nursery.

Inspections regularly found the facility hygiene to be lower than required with accumulated detritus surrounding and within grow houses, within and under seedling trays. *Rhizoctonia* was found in large batches of failed cutting trays where failure of the cuttings was mistakenly being blamed on missed watering. In addition powdery mildew has been problematic on *Corymbia* hybrid hedge plants (*Corymbia torreliana* × *citriodora*) and in the past *Phytophthora cinnamomi* made its way onto the benches where potted Wollemi were grown at the time. As *Rhizoctonia* was found to be constantly associated with poor cutting strike rates it was essential that sources or inoculums (detritus) were removed regularly.

The fungus *Thielaviopsis* was isolated from diseased hardwood cuttings at the same nursery (close relatives *Cylindrocladium* include a number of prominent plant pathogens). One of these relatives is the black root rot fungus, *Thielaviopsis basicola* = *Chalara elegans* which has been isolated from sphagnum moss destined for nursery use. Molecular analysis of the isolate identified *Falcocladium thailandicum***.** This fungus, named after its country of origin (Thailand), has been associated with disease in *Eucalyptus camaldulensis* plantations in Thailand.

Various advices were given re maintenance of nursery hygiene with appropriate applications of controlling fungicides recommended e.g. Banrot - active ingredient thiophanate methyl, Zyban etc. On each inspection, pest and disease issues were identified but, although nursery staff were aware of problems, they had not been regularly reported. The Gympie nursery has now been de-commissioned.

RESEARCH AND DEVELOPMENT

Corymbia spp. Insect Pest and Disease Management

The project looking at the development of pests and disease management strategies for *Corymbia* spp. concludes in December 2009.

Rhombacus spp. and *Acalox* spp. (erinose mite)

- The population dynamics and phenology of the two co-occurring pest species, *Rhombacus* sp. and *Acalox ptychocarpi* were examined over a one-year period in a commercial plantation of *Corymbia citriodora variegata* and population trends were compared with site rainfall, temperature and humidity. Positive correlations were found with leaf moisture content and mite numbers, and with mite numbers and damage severity. *Rhombacus* sp. was always numerically dominant, representing over 80% of all adult mites encountered, but both species were distributed equally throughout the canopy and on both leaf surfaces. Adult and immature mites were active year-round, and immature mites occurred in similar abundance throughout the canopy and on both leaf surfaces. Mite movement within hosts was found to be primarily by crawling, and inter-host movement occurs via wind dispersal.

Chrysomelid leaf beetles

- To assist in developing risk models for plantations for *Paropsis atomaria*, mark and recapture experiments have been carried out to look at beetle movement within plantations at different times of the year, particularly early and late season populations. Other methods of tracking beetles, such as harmonic radar and miniature radio transmitters, are also being investigated to refine our knowledge of beetle dispersal. Knowledge gained from this work is being incorporated into the Dymex model already developed for this beetle and will lead to more accurate predictions of beetle populations.

- Patterns of *P. atomaria* herbivory between allopatric pure and commercial hybrid species of *Corymbia* in relation to leaf thickness, trichome density, moisture content and specific leaf weight were examined. The hybrid susceptibility hypothesis was not supported by field or laboratory studies, and there was no strong relationship between adult preference and larval performance.

Stem borers

- A sex pheromone for the cossid moth *Culama australis* has been successfully isolated and tested in the field. This moth has a wide geographical range and so a range of blends of the component chemicals were tested at sites in SE Queensland and Tasmania. At both locations large numbers of male moths were trapped, with very little by-catch of non-target insects. The pheromone has the potential to be used as a monitoring tool for borer populations in eucalypt plantations.

- The $560,000 Plantation Hardwoods Research Fund project "Impact of stem defect agents on wood quality in subtropical hardwood plantations" was approved for funding and was expected to start in the 2009/2010 FY. The project aims to: map the incidence and severity of stem defects, identify causal agents and determine the seasonal, temporal, spatial and environmental correlates of stem defect; establish the economic impact of stem defect agents in solid wood crops across the subtropics/tropics; review the use of external signs of stem defect in relation to internal defect to improve forest health surveillance and monitoring of plantations; and, develop prescriptions and tools to reduce the risk of stem defect to new plantings and to manage stem defect in existing plantation resources.

Quambalaria shoot blight

Outcomes:

- Disease development and impact studies have been concluded. Repeated infection results in significant growth reduction and poor form (Fig. 12). Heavy branching is also associated with high levels of infection on young trees.

- Significant variability in isolate aggressiveness has been identified using artificial inoculation methods (Fig. 13). Further analysis of AFLP data is required to examine the degree of variability in the pathogen population and factors influencing the variability.

Figure 12. (a) Impact of *Q. pitereka*. Trees with high levels of infection often remain shrub like (foreground) with growth significantly reduced in comparison to trees showing low levels of disease susceptibility (background). (b) Some trees do recover from infection. However, poor form and large branches will impact on plantation maintenance and timber quality.

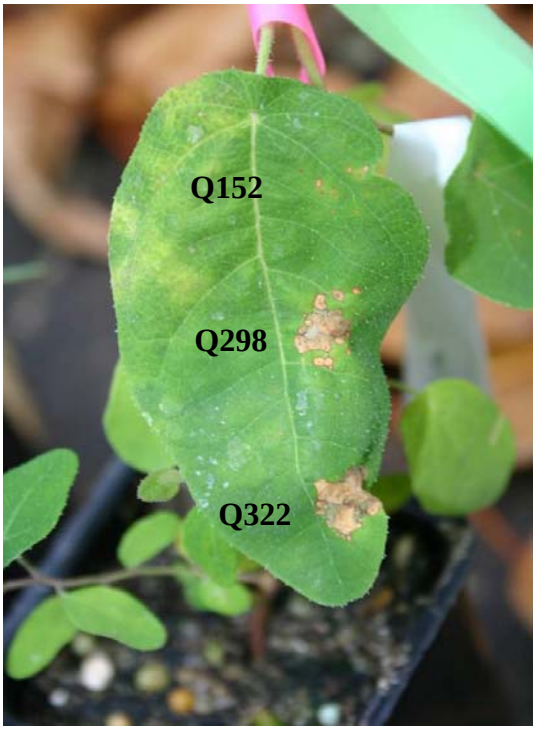

Figure 13. Variability in pathogen aggressiveness was identified in glasshouse studies. Differences in aggression were determined by lesion size 14 days after inoculation. Three isolates were tested: Q152 and Q298 from Beaudesert in Queensland and Q322 from Grafton in New South Wales.

- An artificial screening method has been developed. However, further work is required to determine the number of isolates of *Q. pitereka* needed for effective screening. A field trial based on glasshouse inoculation and susceptibility screening of 3 month old seedling has been established in Traveston, south east Queensland.

Plant Pest Indicator Species Surveillance (previously Hazard site surveillance)

Under the DAFF funded "Securing the Future - Plant Pest Indicator Species Surveillance Program", trapping was undertaken at a number of locations throughout Queensland to monitor the presence and abundance of the target species, *Ips grandicollis* and *Sirex noctilio*, and also survey for forestry and timber pest species. Intercept Panel traps charged with sirex lures were set in North Queensland (4 sites), Brisbane region (3 sites), and Beerburrum district (2 sites). At all locations traps were placed within the vicinity of pine trees, either within a plantation or close to a stand of trees. Two traps were placed at each site, and were emptied fortnightly for eight weeks during Feb/Mar and June/July. All specimens within the following taxa were removed and identified: Scolytinae, Platypodinae, Cerambycidae, Bostrichidae and Buprestidae.

Throughout the survey only 14 *Ips grandicollis* were collected, 13 from Brisbane, and a single specimen from North Queensland. No *Sirex* were collected from these sites. In total 2888 specimens from 40 species of interest were collected; 2328 specimens in 32 species from North Queensland, and 560 specimens in 16 species from the Brisbane region. *Xyleborus perforans* was the most abundant species in North Queensland, comprising 78% of the total catch, and *Hypothenemus seriatus* was the most abundant in Brisbane, comprising 52% of the total catch.

The next phase of this surveillance program will commence in early 2010 with continued trapping in Brisbane and North Queensland.

***Toona ciliata* (red cedar)**

Work has commenced to investigate chemical interactions between the cedar shoot borer, *Hypsipyla robusta* and its host *Toona ciliata*. The shoot borer is a specialist feeder, with a great capacity to locate hosts over long distances and in complex environments. We will be using flight tunnel assays to assess the relative attractiveness of different hosts, different cedar clones and plant parts at different phenological stages. We will also investigate the effects of time of day, moth age and mating status on female behavioural responses. This work is a first step towards developing a host-plant based lure to aid in the monitoring and management of this pest.

VICTORIA

David Smith and Nick Collett (Department of Forest and Ecosystem Science,
The University of Melbourne, Victoria)

PLANTATIONS

Pinus radiata

Insect pests

Sirex noctilio (sirex wood wasp)

Generally the incidence of sirex over summer 2008/2009 remained at relatively low levels across the state. However, one area in North East Victoria is still recording high levels of sirex damage resulting in early thinning and a nematode inoculation program subsequently instigated in this area. Emphasis has been placed on ensuring sufficient inoculations are done using the more effective Kamona strain nematode coupled with timely surveillance and thinning of susceptible stands. Populations of the parasitoid species *Ibalia* continue to emerge at elevated levels providing a useful secondary means of sirex control, although this year, no *Megarhyssa* or *Schlettererius* were recovered. Given their trace contribution to biocontrol of sirex, their absence from this year's samples is not of concern. The sirex parasitoid species *Rhyssa* were recovered for the first time in many years. This parasitoid species originated in the drier areas of the southern United States and may possibly reflect the drier than average conditions presently being experienced in Victoria encouraging populations to recover. A paper detailing the history of sirex biocontrol was also published in the journal *Agricultural and Forest Entomology* (Collett and Elms 2009).

Ips grandicollis (fivespined bark beetle)

Ips grandicollis was not observed as a significant pest of radiata pine plantations during the 2009 survey, which is in contrast to the previous two years surveys. However, trees within a few smaller compartments were still being subject to *Ips* attack, although there were only a few trees dying as compared to previous years. The dead and dying trees as a result of the bush fires that occurred in early 2009, have the potential to provide a significant food source for the beetles and damage due to *Ips* attack may be exacerbated. Areas affected will need to be closely monitored for further development of beetle attack.

Essigella californica (Monterey pine aphid)

Monterey pine aphid (MPA) populations continue to cause significant discolouration and defoliation within radiata pine in Victoria, with 2009 being the highest since surveillance using the plot based system, commenced in 2001. While plantations >10 years of age have been worst affected in the past, increasingly discolouration and defoliation of younger trees under ten years of age has been observed and analysis of the datasets is been revisited taking into account all trees above the age of 6.

In 2009 average levels of defoliation ranged from 30 to 50% across Victoria, with some plot maximums of up to 80% defoliation observed. In terms of the incidence of damage across the State, 92 of the 123 plots surveyed were affected by MPA. New areas of plantation are now showing significant defoliation compared to previous year's survey and this is most likely due to drought conditions. These surveys confirm the observed trend that incidence of MPA increases as the age class increases. However fluctuations in incidence characterise age classes up to 15 years of age, while in all age classes 16 years and over, all plots were affected.

While fluctuations in damage intensity have been recorded across Victoria over many years, north-east Victoria is continually subjected to chronic levels of attack, with other areas usually recording varying degrees of intensity between seasons. In the 2008 and 2009 surveys, all areas were subject to chronic damage. The surveillance/monitoring program again has highlighted the threat that MPA has on radiata pine growth.

Diseases

Dothistroma needle blight

Surveys for *Dothistroma septosporum* have recorded a relatively low level of damage to radiata pine plantations grown across the north east of the state. Although during the surveys some localized higher levels of defoliation and discolouration (hot spots) were identified. While a potential spray program was identified for one specific area, this was not conducted due to other site factors. Other areas identified as hot spots, were generally overall at levels below the economic threshold for which management actions would be normally considered. If a wet and warm spring/summer is experienced, these hot spot areas may result in an increase in spore levels and a return to higher levels of disease as seen in the late 1980's and early 1990's. *Dothistroma* resistant stock has continued to be planted in areas prone to disease development. This is particularly relevant since the areas burnt by bush fires in the Central district in 2009, are areas considered prone to DNB.

Cyclaneusma needle cast

Cyclaneusma needle cast **(**CNC) caused defoliation and discolouration in six out of the eight districts surveyed. However the damage caused by CNC across all districts was at trace to low levels and overall very little discolouration was observed (which indicates the amount of current infection was low). However, some individual trees within some plots showed significant defoliation and in southwest Victoria and Gippsland there were some patches of significant damage observed. As the pathogen generally only affects older needles and is primarily located in lower crowns, little impact on growth of trees is expected during this growing season.

Diplodia dieback

While damage from *Diplodia* was observed at only trace to low levels across Victoria during the 2009 survey, at one location in the upper most north eastern regions of the

state many new deaths were recorded due to the pathogen. The damage was also associated with drought conditions and un-thinned stands between 15 and 20 years of age.

***Eucalyptus* spp.**

Insect pests

***Mnesampela privata* (autumn gum moth)**

Autumn Gum Moth has caused localized severe damage in a number of young *E. globulus* plantations in the Corangamite region of west central Victoria during autumn/winter of 2008. Outbreaks were generally earlier in the year than usual (by approximately four weeks), possibly due in part to the warmer than average temperatures experienced through autumn this year, coupled with availability of suitable host material on which to feed. Observations will continue next year, given that most trees will still have juvenile foliage at this stage and therefore, still be susceptible to attack.

***Chrysophtharta* and *Paropsis* (chrysomelid leaf beetles) and *Anoplognathus* spp. (Christmas beetles)**

Leaf beetles and Christmas beetles continue to cause low to moderate levels of defoliation in plantations of predominantly *E. globulus* and *E. nitens* in Victoria during the 2008/2009 summer with damage generally greater in the upper 50% of the tree canopy. Christmas beetles and Chrysomelid leaf beetles were observed in Gippsland plantations causing defoliation levels ranging from low to severe in individual plots of both *E. globulus* and *E. nitens.* Damage was observed in all age-classes above the age of five, with no tree species preference observed. As summer is the optimal period for Christmas beetle and Chrysomelid activity, defoliation levels observed in surveys carried out in the winters of 2008 and 2009 do not represent maximum levels of damage, due to tree foliage recovery in autumn.

***Perga* spp. (sawflies)**

Sawflies were observed causing trace levels (<10%) of defoliation in south, eastern and north central Victoria during winter 2008/2009, with damage generally confined to individual and small clusters of trees of predominantly *E. globulus* and to a lesser extent *E. camaldulensis*. Defoliation was predominant in the upper 50% of tree crowns, although in severe cases, lower crowns were also affected.

***Phorocantha* spp. (longicorn borers)**

Phorocantha acanthocera (Bullseye borer) continues to occur at low levels in *E. globulus* plantations in East Gippsland. Observations confirmed that *Eucalyptus saligna* and *E. viminalis* remains the preferred host tree species, with attack confined to individual trees of these species within stands although an individual *E. globulus* was observed as

being attacked by this species. Low numbers of *P. semipunctata* have been caught in flight traps in Gippsland in summer of 2007/2008 although no trees affected by this insect species have been observed in either native forests or eucalypt plantations.

Cardiaspina spp. (psyllids)

Cardiaspina retator has been observed causing generally low levels (approximately 10-20%) of defoliation to *E. camaldulensis* plantings in northern Victoria, although some isolated stands have recorded higher levels. While the damage is at relatively low levels, defoliation is generally spread over a wide area rather than confined to smaller locations. This contrasts to patterns observed over the past two years where defoliation tended to be more sporadic over a wide area. This defoliation continues similar trends observed over past years where damage is more pronounced in trees aged four years and over with defoliation predominating in the lower crown of trees.

Other insect pests of eucalypts included:

- Low levels of defoliation and tip dieback damage were observed over summer 2007/2008 to *E. globulus* plantations in northern Victoria by the bluegum psyllid (*Ctenarytaina eucalyptii*). Damage was generally confined to young juvenile foliage on young trees.
- Low levels of light brown apple moth (*Epiphyas postvittana*) continue to cause damage on the growing tips of two year old *E. globulus* plantations in south west and west central Victoria and recently established *E. muelleriana* plantations in South Gippsland during early autumn 2009.
- A small outbreak of the manna gum lerp (*Cardiaspina squamela*) was observed on *E. viminalis* near Ballarat in summer 2007/2008. The defoliation was generally confined to a small area south west of Ballarat. Monitoring will continue next summer as previous outbreaks of this species in the region have been recorded.
- Moderate levels of scarab beetles (*Heteronyx* spp.) were observed in *E. globulus* in south west Victoria over late summer 2009 although no substantial damage to trees was associated with the population levels observed.
- Small isolated outbreaks of witches broom scale (*Maskellia globosa*) were observed on roadside plantings along major highways and roads in northern Victoria in late 2007, with infestations mainly confined to larger, individual trees.
- Low levels of defoliation damage were observed over late spring and early summer to *E. grandis* plantations in northern Victoria by the leaf blister sawfly (*Phylacteophaga froggatti*). Damage was generally confined to young juvenile foliage on young trees.

Diseases

Mycosphaerella

Mycosphaerella leaf disease (MLD) was observed within *E. globulus* and *E. nitens* plots causing moderate to severe (21-70%) damage in the lower crowns and trace to low (0-20%) levels of damage in the upper crowns in localised plots across the state. These sites

were primarily in the wetter regions of South Gippsland and the Otways. These MLD levels are higher than the previous surveys with the disease extending into the upper crown on some sites with potential direct impacts on tree growth. Competition from increased weed growth due to light availability (from the defoliation) may also result in significant growth losses.

NURSERIES

Pinus radiata

Phytophthora cinnamomi remains a high priority to reduce the further spread of the pathogen and close future pathways for spread of new *Phytophthora* species should they enter the nursery industry. Some reports also of root strangulation after 2-3 years from planting needs to be investigated to ascertain if it is associated with a move back to the use of containerised stock.

Eucalyptus spp.

No reports of damage due to diseases were recorded in 2008/2009.

MANAGED NATURAL FORESTS

Insect pests

Chrysomelid leaf beetles

Outbreaks of chrysomelid leaf beetle defoliation in *Eucalyptus delegatensis* (alpine ash) forests in East Gippsland around Swifts Creek were reported in February 2008. Defoliation was determined to be of low to moderate intensity with the most likely causal agent to be *Chrysophtharta agricola*. This outbreak follows up a previous outbreak recorded in 2002 which caused substantial damage to *E. delegatensis* in the same region. Apart from the defoliation impacts, a side-effect of the defoliation is that the bark tends to stick to the trees making it difficult for contractors to debark logs. It was recommended monitoring continue, as ash species have low thresholds to defoliation before mortality commences.

Didymuria violescens (spurlegged phasmatid)

Some minor levels of defoliation damage were observed in mountain ash (*E. regnans*) forests of the Victorian central highlands during summer 2007/2008. However, this damage was confined to individual trees only rather than spread across a wide area and tended to concentrate on younger 2-3 year old trees. Ongoing surveillance will continue with the possibility of some egg surveys being conducted at strategic sites to determine background levels and whether any eggs are at the first or second year of their lifecycle.

Cardiaspina bilobata (mountain ash psyllid)

An inspection for mountain ash psyllid was conducted in monitoring plots in autumn 2008 and 2009, with both surveys indicating that populations are at barely detectable levels and as a consequence, unlikely to cause defoliation. It is now over 10 years since any measurable level of defoliation has been detected within the mountain ash forests of the Victorian central highlands. As outbreaks have been linked to cooler than average summers persisting over a prolonged period and given the prevailing drought conditions, it is anticipated that is it is unlikely outbreaks will occur in the foreseeable future.

Cardiaspina retator (redgum basket lerp)

Infestations of *E. camaldulensis* by the redgum basket lerp (*Cardiaspina retator*) have continued over the 2007/2008 summer, with high levels of defoliation again observed in northern Victoria. However compared to previous years, levels of defoliation appear to have decreased in some areas, possibly due in part to a combination of insect herbivory and drought conditions leading to less foliage available for feeding. As in previous years, while individual trees have died, there has been no widespread mortality associated with the defoliation despite the prevailing conditions.

Uraba lugens (gum leaf skeletoniser)

Ongoing surveys were conducted in late 2007 and early 2008 in East Gippsland to evaluate recovery of trees from *U. lugens* defoliation in previous years. The survey determined that although tree crowns were carrying less foliage, this was more a result of the ongoing effects of drought conditions rather than any insect related (i.e. *U. lugens*) defoliation. Consequently, it was determined that despite the impacts of drought, trees had substantially recovered foliage lost in feeding by the insect.

Research

Two students undertaking honours studies have been working in the mountain ash forests of the Victorian central highlands on projects involving 1) assessing the long-term impacts of strip thinning on litter and flighted invertebrates and, 2) the use of Coleoptera as bio-indicators of forest health. Both projects commenced in early 2008 and were completed in January 2009. Initial findings have been promising and established viable research leads which are now being followed up. Reports on both studies have been completed and it is anticipated the findings of this work will be published in the following year.

Diseases

Few diseases were reported from managed natural forests during 2008/2009.

NATIVE PLANT COMMUNITIES

Phytophthora cinnamomi

Phytophthora cinnamomi continues to be a focus of DSE as it implements the strategy for its management:

http://www.dse.vic.gov.au/CA256F310024B628/0/DEB373E02078E238CA257412001D29ED/$File/Phytophthora+cinnamomi+Strategy.pdf .

Modelling of sites where disease impact is greatest is to be used to prioritise management activities.

Chalara australis (myrtle wilt)

Myrtle wilt continues to cause some deaths of mature *Nothofagus cunninghamii* in rainforests across Victoria although at low levels. The low levels of disease appear associated with the continued drought.

Other

The drought has continued to result in a reduction in disease reports from native forest communities during 2008/2009. However the drought and scorching temperatures over summer has in itself resulted in the mortality of trees and understorey particularly on drought prone landscapes.

In February 2009, fire burnt almost 430,000 hectares of agricultural, forest and residential land in the worst bushfire on record in terms of lives and property lost. While much of the forest will recover from the fires, much of the old-growth *E. regnans* in the Wallaby Creek and O'Shannassy catchments have been killed by the fires (CRC for Forestry 2009). However, good seed production in the previous year should provide for adequate regeneration.

MONITORING AND SURVEILLANCE

Plantations and Native Forest Monitoring

The Forest Health Surveillance Group has been working closely with industry developing and conducting ongoing insect pest and disease surveillance programs in both softwood and hardwood plantations throughout the state to meet their varying operational and stewardship requirements (Smith *et al.* 2008). It is pleasing to note that industry as a whole has recognised the need for formalised forest health surveillance programs within their plantations and native forest remnants and on an individual company basis has either implemented programs or are in the process of developing such systems. Training programs have been implemented by DPI Plantation Biosecurity staff and eight field training days been carried out. A further six field days are planned for the 2009/2010

year. Research is also currently underway in native forests of Victoria to design a system of health surveillance suitable for implementation on Victoria's public lands. The plot based system that was piloted in 2008/2009 is now being evaluated for the potential rollout across the state with many forest health indicators being examined.

URBAN, RURAL AND AMENITY

Mundulla yellows

No further work on Mundulla yellows was undertaken during 2008/2009. The underlying physiological basis for symptom development is still to be determined and requires further research. Climate change factors such as the increase in CO_2 in the atmosphere with increase in bicarbonate uptake from the soil may be contributing to the development of the 'disease'. A third paper on the results of the investigations on Mundulla Yellows is in preparation to add to the previously published papers (Luck *et al.* 2006, Czerniakowski *et al.* 2006).

Armillaria

Armillaria luteobubalina was recorded causing dieback of trees and shrubs in gardens, Parks and Reserves across Melbourne and the Dandenong Ranges during 2008/2009.

BIOSECURITY

Insect pests

Lymantria dispar (Asian gypsy moth)

Monitoring of the ports of Melbourne, Geelong and Westernport continued for the Asian gypsy moth over summer 2008/2009 as part of a nationwide monitoring program. Apart from native lepidopterous species being trapped, no exotic species including gypsy moths were detected during the survey.

Diseases

Dutch elm disease

The City of Melbourne continued to support surveys for Dutch elm disease in the main gardens and boulevards under their management. Symptoms found resembling DED were attributed to ringbarking of branches by possums and elm bark beetles and fruit tree borers. The fungus could not be isolated from wood of any trees exhibiting flagging due to beetles. These surveys help to confirm the absence of the pathogen from Australia and maintain awareness and therefore early detection should it arrive.

Phytophthora fallax

No further soil sampling for *Phytophthora fallax* occurred during 2008/2009 from the Kinglake State Park north-east of Melbourne, where the first isolation in Australia of *Phytophthora fallax* was made in September 2006, as most of this area was burnt during the February 2009 fires. The use of rain-gauges containing baits to pick up potential aerial dispersal spores continued to be successful in its isolation from two monitoring plots established in Mountain Ash forests (*E. regnans*) in the Central Highlands. As yet no symptoms on *E. regnans* have been observed on these sites.

Stream monitoring for *Phytophthora*

Stream monitoring for the presence of *Phytophthora* species in catchments in Victoria, continued to December 2008 in 16 streams/rivers across Southern Victoria. A variety of different baits, including leaves of *Rhododendron*, *Eucalyptus regnans*, *Pittosporum undulatum* and cotyledons of *E. sieberi* were continued to be evaluated. The results showed that the techniques could detect species of *Phytophthora* from all streams tested. Species isolated included *Phytophthora cinnamomi, P. citricola*, *P. cryptogea*, *P. gonapodyides*, *P. gchlamydo*, *P.* taxon from Clade 2, *P.* taxon from Clade 8, an unknown *P.* taxon from an unknown clade and several unidentified species from Clade 6. None of *Phytophthora* species isolated were of known quarantine concern to Australian biosecurity agencies. It is recommended that stream monitoring for the presence of *Phytophthora* species be incorporated into routine surveillance activities across all States and Territories of Australia to aid in early detection of exotic *Phytophthora* species and recording of the current species status. Further research is also needed to determine the timing of stream monitoring to maximise detections (e.g. time following rainfall).

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TASMANIA

Karl Wotherspoon (Forest Health Surveillance, Forestry Tasmania)

PLANTATIONS

Pinus radiata

Insect pests

Sirex noctilio (sirex wood wasp)

Traditional aerial and roadside health surveillance of the softwood plantation estate in the north of the state did not detect any sirex-killed trees this season. Kairomone charged static traps were placed in four regions across the north of the State in eight-year-old sirex-free compartments. In three of these compartments sirex females were captured in static traps. The egg parasitoid *Ibalia leucospoides* was also collected in two of the three compartments. Dead trees with exit holes were found, within a 100 metre radius of the traps, in two of the five compartments. At Virginstowe a number of old and new sirex-struck trees were located within 5 km of a heavily infested private planting. The trap tree/nematode program will be put into place in the Retreat and Virginstowe compartments as more than three killed trees were located at each site.

Sirex females were also captured at most sites during trap monitoring for exotic bark beetles. Several females were also caught in traps monitoring eucalypt woodborer populations many kilometres from the nearest softwood stands. Sirex females were caught on Flinders Island and tested negative for the nematode biocontrol agent.

Ips grandicollis (fivespined bark beetle)

Monitoring for *Ips grandicollis*, using ipsenol and ipsdienol pheromone charged static traps, has continued in *P. radiata* plantations. *Ips* continues to be absent from Tasmania.

Essigella californica (Monterey pine aphid)

Crown symptoms similar to *Essigella* defoliation were detected in Virginstowe in northeast Tasmania during aerial surveillance in July 2008. Follow-up in October 2008 and again in early 2009 failed to detect any evidence of the insect or any typical needle damage symptoms. Crowns had significantly recovered by the time of aerial surveillance in May 2009.

Essigella pine aphid is still restricted to the south of the State. Severe damage to *Pinus radiata* windbreaks at Kempton (40km north of Hobart) was noted in March, 2008. A very high population of nymphs was observed in a beating tray survey with lacewing adults present. A subsequent survey in September, following heavy rain periods, failed to find any nymphs and trees were recovering quickly with new needles.

Compartments in the Plenty Valley in southern Tasmania, which had severe damage in June 2008, were surveyed in November 2008. Trees were recovering well and no life stages of *Essigella* were found. Again heavy extended rain periods in winter seem to impact on aphid populations.

***Eulachnus thunbergii* (pine aphid)**

Not recorded from Tasmania.

***Pineus laevis* (pine aphid)**

Has widespread distribution in Tasmania but seldom causes commercial damage. Mainly present on young roadside wildlings.

Vertebrate Pests

In northern Tasmania bark stripping by browsing mammals affected around 693ha; substantially more that the 359ha last season but closer to the 536ha of the 2006/2007 season. We need to go back to 2004/2005 to see a greater area of damage when some 739ha was affected. At 31% the proportion of severe damage (incidence >50%) was similar to that seen over the last few years.

The greatest areas affected were in Payanna and Saddleback in the northeast and Oonah in the central northwest. Damage levels dropped off drastically this year in Wilmot block as trees moved out of the vulnerable age class. The affected area in Payanna was unusual in that the trees were very young, having only been established in 2008 (Fig. 14).

Figure 14. Young *P. radiata* seedling ringbarked by browsing mammals in the northeast of the state.

Mammal shoot browsing was determined to be a problem across some 50ha of young plantation, down on the 95ha reported last season. The worst affected area was again in Payanna in the northeast where up to 60% of the seedlings were damaged in affected compartments.

Possum damage causing top death was detected across some 37ha exclusively in Oldina block in the central northwest of the state. Incidence reached ~25% in localised hot-spots.

Diseases

Cyclaneusma needle cast/spring needle cast

This remains the most significant disease of radiata pine in the state, affecting all high, wet (>400 metres and > 1200 mm rainfall) plantation areas. Management strategies remain the same as reported previously and include the use of resistant genotypes and appropriate silvicultural regimes.

Dothistroma needle blight

Needle blight due to *Dothistroma* has been a chronic problem throughout Ringarooma Block in the northeast for some years. This year current infection was primarily evident in roadside trees in two compartments but symptoms had largely abated in another two. However, crowns within the stands were carrying far less foliage than would be expected due to the effects of the disease the crop would have suffered growth impacts over the last few years (Fig. 15).

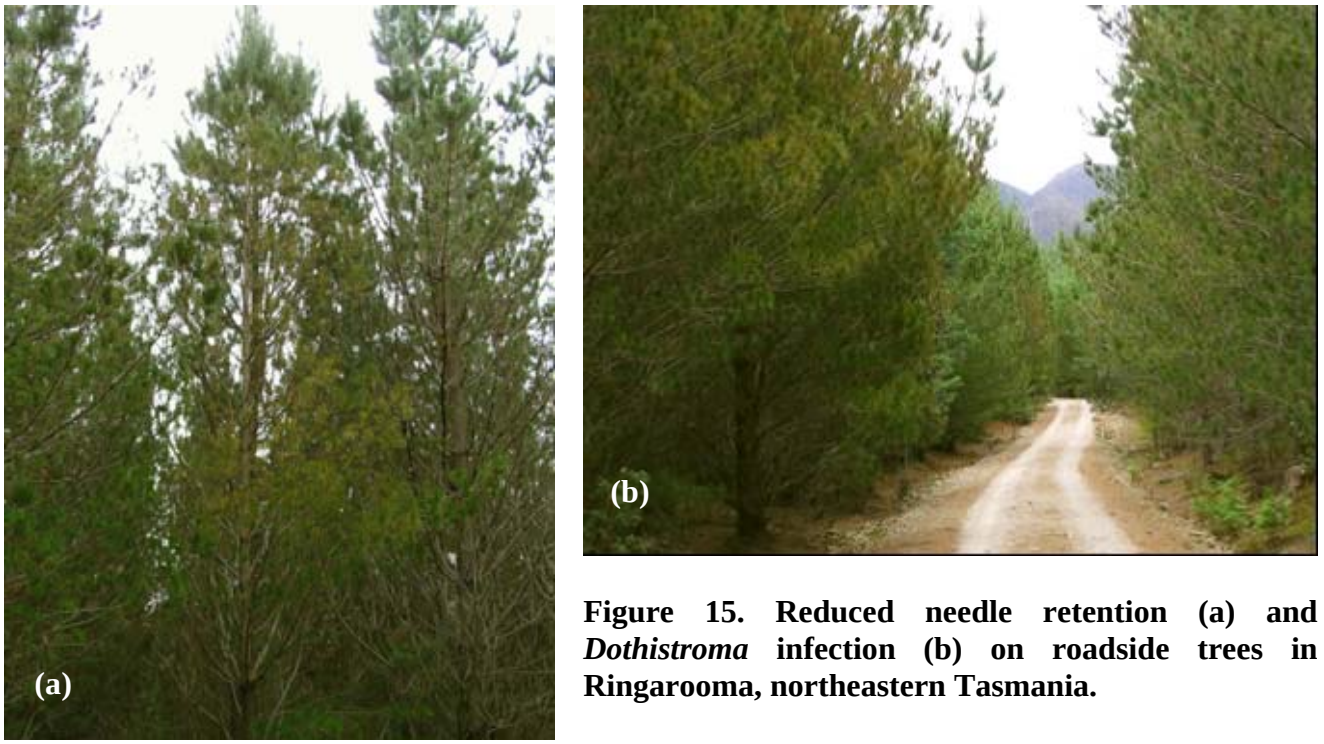

Figure 15. Reduced needle retention (a) and *Dothistroma* infection (b) on roadside trees in Ringarooma, northeastern Tasmania.

Diplodia/Sphaeropsis shoot blight/crown wilt

Top death in older trees due to *Diplodia* infection continued to have a very limited distribution this season in contrast to the large areas affected in 2006/2007. Again damage was largely limited to drier areas in the northeast, in particular Retreat block where around 150ha suffered shoot death.

No problems caused by *Diplodia* shoot wilt in recently established seedlings were observed this season.

Other

Phytophthora root rot was suspected to be contributing to the mortality observed amongst seedlings across 35ha in the central north of the state. Although collar staining and root rot were observed laboratory tests were inconclusive.

Environmental and site related problems

Fire

No fresh fire damage was detected this year.

Wind

Only two incidents of wind damage were detected this season affecting an area of around 5ha. Both cases were ongoing incidences of previously reported damage.

Lightning

No fresh lightning damage was detected this year.

Exotic weeds

No new gorse (*Ulex europaeus*) detections were made in the northeast of the state but two large pampas plants were found in Springfield block. Multiple gorse detections were made in the central north as well as a single large infestation in the central northwest in Oonah block (Fig. 16).

Boron deficiency

No new symptoms of boron deficiency were detected this year.

Drought

Mortality of young transplants attributed solely to drought was only reported for 15ha in the northeast of the state this year. Mortality at least partly due to desiccation was reported for a further 60ha in the central north but the cause of this desiccation was unclear.

Frost/cold

Frost, cold and desiccating winds were suspected to have caused failed root initiation and mortality across some 40ha in the northeast.

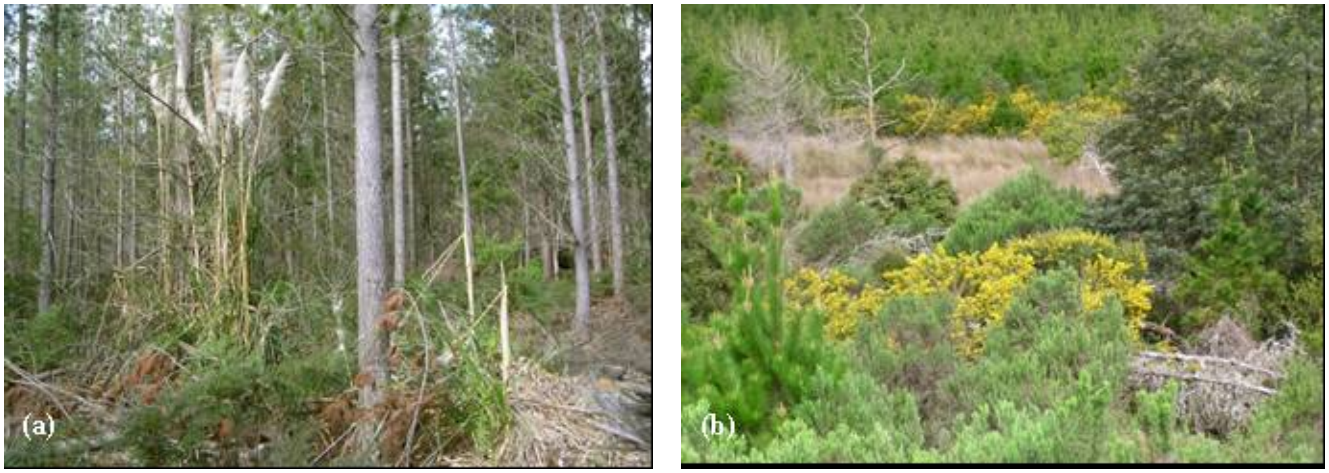

Figure 16. Large pampas plant in flower on the edge of Springfield block (a) and significant gorse infestation in Oonah (b).

***Eucalyptus* spp.**

Insect pests

***Mnesampela privata* (autumn gum moth)**

Autumn gum moth (AGM) was detected in a number of areas around the state covering around 258ha (Fig. 17). This resulted in spray operations using alpha-cypermethrin across 150ha.

Figure 17. AGM damage and larvae in a young compartment in the south of the state.

***Paropsisterna* spp. (chrysomelid leaf beetles)**

Chrysomelid (primarily *Paropsisterna bimaculata* and *P. agricola*) defoliation severe enough to cause an impact on growth was detected across just over 2000ha this season, far greater an area than any of the previous five years. Of this 1486ha was assessed as moderate (around 3.6% of the area of eucalypt plantation on State Forest) and 520ha as severe (around 1.2% of the area of eucalypt plantation on State Forest). Over half or the total damaged area was in the northeast (1093ha).

The greater levels of damage reported this season is at least partly due to a more intensive surveillance this year, particularly in plantations greater than 6 years old that would not normally be monitored for beetle larvae and are not routinely included in ground surveillance. In fact almost half the damage (1002ha) was recorded in compartments older than 6 years. Furthermore around 50% of the defoliation damage was due primarily to late season adult feeding which is a problem because spray operations target larval damage, which tends to occur early to mid summer, while damage due to adult beetle feeding tends to occur mid to late summer.

Overall, 20515ha on State forest were monitored for beetle populations with 5712ha (28%) of this being over the threshold. Most of the area over the threshold was sprayed (4161ha) with the three insecticides, Success (2%), Entrust (13%) and alpha-cypermethrin (85%). There was an increase in the proportion of environmentally friendly chemicals used from 5% last year to 15% this year.

Gonipterus spp. (eucalyptus weevils)

No significant *Gonipterus* damage was detected this season.

Uraba lugens (gum leaf skeletoniser)

Damage by the gum leaf skeletoniser *Uraba lugens* has become widespread around coupe edges where they abut native forest over a number of years. Such damage is generally fairly limited and only extends a short distance in to the plantations, but has put affected edge trees under chronic stress. Normally such limited areas would not be mapped as they are usually insignificant in relation to the whole compartment area. However, this season we commenced mapping these thin strips in an attempt to get a better picture of the total area affected.

Approximately 81ha were assessed as having significant *Uraba* damage this season. This included 34ha of a single compartment in the east of the state which had to be sprayed in early January. The remaining 48ha consisted solely of edge damage which consisted largely of severe defoliation and stunted performance but also included 17ha where significant mortality was occurring. Mortality could be as high as 50% along the worst affected strips and although the final cause was usually borer infestation this was a direct result of chronic stress caused by multiple *Uraba* defoliation events (Fig 18).

Beetles (Christmas, scarab, spring, etc.)

No significant damage was observed on State Forest this season.

Perga spp. (sawflies)

No significant damage was observed on State Forest this season.

Figure 18. Mortality and defoliation caused by chronic *Uraba* damage along a compartment edge in the northeast of the state.

Borers

Mortality due to insect borer attack was an ongoing problem in a small number of drought affected, mid-rotation compartments in the northeast of the state. The worst affected sections were cleared and re-established in 2008. Also, as mentioned previously, borer infestation was the ultimate cause of mortality in edge trees under chronic stress due to repeated *Uraba* defoliation.

Monitoring continued at Blackwood Creek *E. nitens* plantation, a site with low rainfall and divided into thinned and un-thinned areas. Thinning occurred at the onset of a three year drought period of < 500mm annual rainfall. The past two years have been average (630mm) or above (748mm) rainfall. The thinned area now has 12% mortality due to wood-borers while the un-thinned area has 33% mortality. Cumulative totals for woodborer species is 59 species. *Phorocantha mastersi* is now emerging as a major mortality factor in this plantation with 9% of all trees killed this year caused by *P. mastersi*. Many 'healthy' trees, in both thinned and un-thinned areas, are showing symptoms of *P. mastersi* attack. Due to the 2-3 year life cycle the full extent of *P. mastersi* damage will not emerge for several years despite several years of relieved water stress. The long term monitoring has shown the change in woodborer species composition as drought stress increased and is now back to high soil moisture levels. Cossid moth damage (*Xyleutes eucalypti*) is increasing especially in larger diameter classes (>20cm DBHOB) and appears to be causing an increasing proportion of stem defect often not detected high in the bole until Cockatoos locate the larvae.

Cardiaspina spp. (psyllids)

No significant damage was observed on State Forest this season.

Tortricids (leafroller moths)

No significant damage was observed on State Forest this season.

Vespula spp. (European wasps)

Due to above average rainfall in many parts of the State, populations of both the European wasp *Vespula germanica* and the English wasp *Vespula vulgaris* were low at most sites. Overwintering nests were damaged by moisture and few nests survived. Autumn baiting was conducted in one southern plantation site and at the Tahune Airwalk. The English wasp, *Vespula vulgaris*, first found in southern Tasmania in 2000, was caught in traps at a number of central and north eastern sites during summer, greatly increasing its known distribution. Specimens were also found in the south at Tasman Peninsula sites.

Vertebrate Pests

Significant damage, attributed solely to browsing mammals, on State Forest covered by health surveillance this season only affected 68ha. The major consequence of this damage was severe stunting (Fig. 19) with only 6ha being classified as "missing". No new areas of substantial possum damage were detected this season.

Figure 19. Stunting caused by severe shoot browsing in a 2008 plantation.

Diseases

Mycosphaerella and *Phaeophleospora* (leaf diseases)

The fungal leaf diseases *Mycosphaerella* and *Phaeophleospora* (*Kirramyces*) were causing significant (25-50% of crown) defoliation and premature leaf senescence across approximately 77ha, comprising 47ha in the northwest and 30ha in the wetter part of Payanna in the northeast (Fig. 20).

Botryosphaeria (top death)

No substantial damage was observed on State Forest this season.

Cryphonectria (stem canker)

Cryphonectria eucalypti (syn. *Endothia gyrosa*) was usually observed in association with damage and mortality caused by boring insects.

Figure 20. Premature leaf senescence and leaf spotting caused by *Phaeophleospora* in the northwest.

Phytophthora (root rot)

Significant mortality (>1%) caused by *Phytophthora* was recorded across 62ha this season, all in a single compartment in the northeast block planted in 2008. Mortality throughout the compartment was estimated to be in the vicinity of 3-4%, rising to 10% in the worst affected hot-spots.

Armillaria (root rot)

A single small patch of *Armillaria* mortality was detected in the northeast.

Environmental and site-related problems

Wind

No significant wind damage was detected during the 2008/2009 surveillance season.

Drought/desiccation

Drought damage and desiccation of seedlings was greatly reduced from last year when over 500ha was affected. Very small, localised patches of mortality around ridges and knolls were observed on the Tasman peninsula in the southeast while the driest areas of the northeast and the central north were still showing signs of stress and ongoing scattered mortality due to borer attack as mentioned previously. Minimal seedling mortality due to drought was observed and overall only 25ha were recorded as being primarily drought affected.

Copper deficiency

Symptoms associated with copper deficiency on poor soils, such as microphylly, stunting and branch distortion (Fig. 21), were recorded on 78ha, this season. These were primarily observed in young plantations in the north of the state.

Figure 21. Copper deficiency symptoms in a young compartment in the northwest.

Weeds

Macquarie vine (*Meuhlenbeckia gunii*) appears to be becoming an increasing problem across the state. It was observed to be getting in to and smothering a proportion of young trees across at least 129ha (Fig. 22). This is in addition to any competition a thick cover of Macquarie vine might be causing. Other issues across a further 18ha included stunting due to grass and thistles and stocking problems due to overtopping silver wattle (*Acacia dealbata*).

Figure 22. Macquarie vine smothering 2-year-old trees in the northeast.

Scattered instances of the exotic, invasive weed gorse (*Ulex europaeus*) were detected in the north of the state but the major issue was a substantial infestation on State Forest in the west where it was starting to encroach into plantation.

Herbicide damage

There was a very small, localised patch of shoot deformation, necrosis and dieback caused by the use of herbicide to control an infestation of ragwort (*Senecio jacobaea*).

Soil fertility

Symptoms associated with poor soil and therefore nutrient deficiency, were recorded for an area of 1264ha. The main consequences were stunted performance (579ha), variable growth (495ha) and foliar discolouration (190ha). The areas most affected were across the drier soils in the northeast of the state and poor soils in the northwest.

Multiple causes

Problems are placed in this category when there is more than one contributing factor. This year 1285ha were determined as having health issues due to multiple causes. The main symptoms were variable performance (400ha), foliar discolouration (366ha) and stunting (230ha) followed by mortality (162ha), missing trees (66ha), thin crowns (41ha) and stem damage (15ha). The cause of stunting and variability most commonly included a combination of poor, rocky or shallow soils; steep slopes, poor cultivation, past mammal browsing or desiccation and weed/grass competition (Fig. 23). Some 285ha of foliar discolouration in the central south of the state was due to restricted nutrient uptake caused by cold soils and possibly restricted rooting conditions. Scattered mortality was largely due to environmental stresses such as cold air ponding, restricted drainage, water deficit or exposure followed by borer attack. Missing trees generally occurred in recently established areas and were usually due to a combination of cold/frost, desiccation, weed competition and mammal browsing.

Figure 23. A compartment exhibiting stunting and variable performance due to multiple causes as seen from the air.

MANAGED NATURAL FORESTS

Eucalyptus spp.

Insect pests

Localised patches of minor defoliation by *Uraba lugens* occurred throughout the State this year.

Diseases

The status of the crown rot disease of *Xanthorrhoea* spp. associated with *Fusarium* aff. *babinda* remains unresolved. A low-level biosecurity response (addressing harvesting of plants from affected areas and restricting access into affected areas) to the detection has been adopted pending further studies to resolve the taxonomic uncertainty and distribution within the state.

Environmental and site-related problems

Extensive areas of predominantly high altitude forests and woodlands remain in chronic poor health with symptoms of severe dieback. Past drought events, grazing of mature trees by possums and seedlings by livestock have all contributed to the problem.

NURSERIES AND SEED ORCHARDS

Pinus spp.

There were no reports of significant pest or disease problems of conifers in production nurseries during the past year.

Eucalyptus spp.

There were no reports of significant pest or disease problems of eucalypt seedlings in production nurseries during the past year.

Acacia spp.

Blackwood psyllids, *Acizzia conspicua,* caused significant shoot damage to *Acacia melanoxylon* in a seed orchard.

URBAN AND RURAL

Insect pests

A small population of the Elm Leaf Beetle, *Xanthogaleruca luteola*, was found defoliating several trees in outer suburb of Hobart. A survey was conducted of elms in the city parks in Hobart and Burnie. No other populations were found. The Hobart Council will make an attempt with Quarantine Tasmania to use a soil injected systemic insecticide to eradicate the outbreak.

Reforestation plantings of *E. pauciflora* in the midlands have suffered severe infestations of lepidopteran borers, Family Xyloryctinae, probably *Cryptophasa* sp., that have caused branch breakage and death (Fig. 24). The infestation probably followed drought stress.

Figure 24. Xyloryctinae larval moth stem damage on *E. pauciflora* (Photo: Keith Churchill).

Diseases

The status of Mundulla Yellows remains unchanged with symptoms continuing to develop on urban trees in the Hobart area. *Eucalyptus sideroxylon* remains the most severely affected species.

A program of quarry inspections to determine their freedom or otherwise from *P. cinnamomi* continues to expand. A further 20 quarries were inspected during the year with all but two returning negative for *P. cinnamomi*.

QUARANTINE

Trapping for a number of exotic bark beetle species, of importance to softwood forestry, was conducted within the National Indicator Species Program (NISSP) funded through the DAFF/OCPPO National Urban Surveillance program. Four species *Hylastes ater*, *Hylurgus ligniperda*, *Ernobius mollis* and *Ips grandicollis* were targeted in Tasmania. Static intercept panel and funnel traps baited with pinene lures were set up in softwood plantation areas for which records of the target species were not available. A total of 46 traps were established at 11 sites including Flinders Island. At all of the sites at least one of the target species was collected. *Ips grandicollis* was not recorded at any site and has not been recorded from Tasmania.

Records of the four target species were obtained from APPD, museums and forestry collections from the mainland States. That data has been mapped and the CLIMATCH model used to obtain potential distributions in Australia (a) based on countries of native origin and (b) known Australian distribution. An example of the data produced from the model shows that Tasmania is climatically adverse to the establishment of *Ips grandicollis* despite its widespread establishment in south-eastern Australia.

Within the same program surveys were conducted of Elm trees in the midland towns of Oatlands, Ross, Campbell Town and Evandale targeting the Elm Leaf beetle, *Xanthogaleruca luteola.* This defoliating beetle has recently become established in several Hobart suburbs after being present in Launceston, northern Tasmania, for a number of years. The beetle has expanded its range in the Hobart area with damaged trees found at Cambridge near Hobart Airport. Elm Leaf Beetle was not found at any Midlands town during searches in November and March.

RESEARCH AND DEVELOPMENT

A CRC Forestry project involving collaboration between UTas and Forestry Tasmania to screen native, deployment and breeding populations of *E. globulus* for resistance to *Mycosphaerella nubilosa* infection assessed four trials in Circular Head this year. Preliminary analyses have isolated three components of disease resistance each with significant genetic variation:

(i) genetic variation in the timing of phase change to resistant adult foliage;
(ii) variation due to a positive correlation with height growth (driven by the amount of susceptible foliage);
(iii) variation in the resistance of juvenile foliage to disease.

There was a strong north-south gradient of decreasing resistance to *M. nubilosa* in *E. globulus* races. Models are now being developed to predict disease resistance of *E. globulus* genotypes.

Work continues on the Lethal Trap Tree project to provide proof-of-concept that treatment of a small number of "attractant" trap trees (0.1% of planted trees) with insecticide, to render them lethal, can provide whole of season protection to the plantation from chrysomelid defoliation. A second series of trap-tree plots (*E. regnans* or *E. delegatensis*) was established in *E. nitens* plantations in preparation for future field testing (once the *E. nitens* change to adult foliage). Trap-tree plots have now been established in a total of 16 plantations. Stem infusion with imidacloprid found that lethal concentrations persist for at least three months. Choice experiments demonstrated that the chemically-infused foliage is not repellent to beetles.

An ARC-Linkage project involving UTas and several plantation companies successfully isolated two sex-pheromones from autumn gum moth (*Mnesampela privata*). The ratio of the two pheromones was critical in eliciting an attraction response by male moths and that ratio seems to vary among regional populations of autumn gum moth in southern Australia. Field testing of the pheromones in Tasmanian plantations resulted in

significant capture rates of autumn gum moth. The CRC for Forestry is evaluating the potential to develop a commercial lure for monitoring autumn gum moth populations.

A field survey of wood-borer populations and tree damage/mortality was conducted in a mid-rotation low rainfall plantation at Jetsonville in NE Tasmania. Static panel traps were erected one hundred metres apart with five traps in each of four transects. Two transects in *Eucalyptus globulus* and two in *Eucalyptus nitens*. At each trap site a block of nine trees were assessed for tree health. Every tree in each transect length was also measured (DBH) and tree health assessed. Populations of wood-boring insects were substantially higher in the *E. globulus* transects as measured by trap catches. There was substantially more tree stem damage, but not more mortality, in the *E. globulus* transects. *Eucalyptus nitens* had the same mortality levels but less stem damage and 28% higher DBH. Analysis is under way to relate the species assemblages of wood-boring insects with damage levels in the two tree species and the relative accuracy of tree health between plots and transects for both tree species.

A post-thinning assessment of the levels of internal defect in a stand of *E. obliqua / E. regnans* regrowth found decay levels were unchanged from those measured prior to thinning. This suggests that revised tree selection guidelines designed to reduce the levels of decay are not achieving their potential using the current method of tree selection by the operator of the harvesting machine. A CRC Forestry project is comparing the performance of operator selection versus tree marking in commercial thinning of regrowth. The initial study found operator selection retained just over 50% of trees judged to be the best to retain compared with 95% with tree marking. Further studies will: (i) compare production levels of commercial thinning operations done using tree marking and operator selection; (ii) evaluate opportunities for improving tree selection by the machine operator.

TABULAR SUMMARY OF THE ACTIVITY OF THE MAIN PESTS AND DISEASES OF *PINUS* AND *EUCALYPTUS* PLANTATIONS IN TASMANIA

Pinus spp.

Pest	Area with moderate damage (Ha)					Area with severe damage (Ha)					Area inspected (Ha)	Area treated (Ha)	Hosts
	<10	10-100	100-500	500-1000	>1000	<10	10-100	100-500	500-1000	>1000			
Browsing mammals			✓					✓			57000		*P. rad*
Bark beetles (*Ips*, *Hylastes*)											57000		*P. rad*
Sirex wood wasp											57000		*P. rad*
Monterey pine aphid											57000		*P. rad*
Wingless grasshopper											57000		*P. rad*
Armillaria spp.											57000		*P. rad*
Phytophthora spp.							✓				57000		*P. rad*
Dothistroma septosporum		✓									57000		*P. rad*
Spring needle cast / *Cyclaneusma*					✓					✓	57000		*P. rad*
Sphaeropsis sapinea		✓									57000		*P. rad*

***Eucalyptus* spp.**

Pest	Area with moderate damage (Ha)					Area with severe damage (Ha)					Area inspected (ha)	Area treated (ha)	Hosts
	<10	10-100	100-500	500-1000	>1000	<10	10-100	100-500	500-1000	>1000			
Browsing mammals	✓						✓				28054		*E. nitens & globulus*
Autumn gum moth			✓								28054	150	*E. nitens*
Christmas beetle											28054		
Paropsines					✓				✓		20515	4161	*E. nitens & globulus*
Gum leaf skeletoniser	✓						✓				28054	34	*E. nitens*
Sawfly											28054		
Leaf blister sawfly											28054		
Spring beetles (scarabs)											28054		
Jarrah leaf miner											28054		
Phasmatids											28054		
Weevils (defoliating)											28054		
Psyllids											28054		
Phoracanthines											28054		
Wood moths											28054		
Wood borers - cerambycids		✓						✓			28054		
Wood borers – buprestids											28054		
Wingless grasshopper											28054		
Mycosphaerella spp.		✓									28054		*E. nitens*
Aulographina eucalypti											28054		
Armillaria spp.	✓										28054		*E. nitens*
Phytophthora spp.							✓				28054		*E. nitens*

SOUTH AUSTRALIA

Information on pines has been obtained from ForestrySA, Green Triangle Forest Products and Auspine (Gunn's). Information on eucalypts has been obtained from ForestrySA with limited additional input from private companies in the Green Triangle region. Collated by Dr Charlma Phillips (Forest Health, ForestrySA**).**

Drought continues to have an impact on tree health, especially in the Mid-North forests (north of Adelaide). The impact of drought has been compounded by attack of stressed trees by *Ips grandicollis*. *Ips* and drought have been the main health issues this year.

Annual Forest Health Surveillance flights were again conducted in the Green Triangle in 2009. A Digital Aerial Sketchmapping program, developed by ForestrySA, was used very successfully for the first time this year. This program rests on the ESRI Arcmap platform and features "smart" buttons (to record [point or polygon] forest health information which can be directly downloaded into the ForestrySA Corporate database, without the need for post-processing of data); direct writing on screen (stores text as an annotation feature class which has spatial reference); GPS tracking; autorotation of maps; easy export to other users. This program will be further refined in the future.

PLANTATIONS

Pinus radiata

Insect pests

Annual aerial surveys of the whole ForestrySA South East estate were conducted in July 2009. These surveys were followed by ground inspections to verify or determine the cause of problems identified from the air.

Sirex noctilio (sirex wood wasp)

In the Green Triangle Region sirex remains at a low level with minor tree deaths in some stands pre-T1. In the Ranges Region, sirex activity is scattered throughout a number of plantations, including in and around areas that have been damaged by fire. In the Mid-North forests, sirex is present but in low numbers, possibly due to the very dry conditions these forests are encountering.

The nematode inoculation program has continued in all regions in 2009, with similar numbers of nematodes released as last year. *Megarhyssa* or *Ibalia* emerging from billets have been released back into the forest.

Ips grandicollis (fivespined bark beetle)

Ips is present in plantations in the Green Triangle Region but has caused little damage this year. In the Ranges Region, approximately 200ha were affected by *Ips*, mainly in areas around clearfell and areas that had been spot mounded, where high levels of residue were present. In the Mid-North, *Ips* continues to be a major cause of tree deaths (Fig. 25). Approximately 700ha were affected in the Mid-North this year. Many trees are still feeling the impact of drought and are providing ideal habitat for build-up of *Ips*. Areas

that are being affected include areas next to or near clearfell, areas where thinning is overdue and areas on northern facing slopes. A number of strategies are being put in place to manage *Ips* in these forests, particularly in view of possible future changes in climate.

Figure 25. Trees killed by *Ips* – Wirrabara Forest.

***Essigella californica* (Monterey pine aphid)**

Overall, *Essigella* numbers are low across the whole plantation estate. Damage has been less this year (minor defoliation and some growth loss) compared with previous years in both the Green Triangle and Ranges Regions. Large numbers of ladybirds have been observed this year in the Ranges Region. It is thought that weather conditions (very hot over summer, then relatively wet in spring) have not been conducive to population build up. South Australia will be one of the first states to release the biological control agent, *Diaretus essigellae*, when permission for release has been finalized.

Diseases

In the Green Triangle Region this year there have been a few reports of individual trees being affected, by *Cyclaneusma minus* but in general disease levels are low. There have been no reports of disease affecting trees in the Ranges Region or the Mid-North this year.

Other

Several hundred hectares of young pines were treated for Zn deficiency.

Deaths associated with salt have occurred in some areas of the Green Triangle and the Ranges Region this year (Fig. 26). Some of these have been in low lying areas near recent clearfell operations.

Figure 26. Salt affected *P. radiata* needles.

***Eucalyptus* spp.**

Little information is available this year on the health of eucalypt plantations in the Green Triangle Region due to two of the major companies in the region going into receivership. The information below has been supplied by ForestrySA. After many years of dry conditions, there were good rains in the region in spring. This has improved the health of the trees. The new growth is likely to have masked the effect of insect damage to some extent and so far there are no reports of increased insect or disease activity.

Insect Pests

***Mnesampela privata* (autumn gum moth)**

No major damage this year. It is common in young plantations but most plantations in the region are older and have adult foliage.

***Perga* spp. (sawflies)**

Sawflies are widespread throughout the region but have caused little damage this year. No control measures have been taken.

Chrysomelid beetles (various species)

These are always present and cause varying degrees of damage. No major outbreaks have been detected and no control undertaken.

Longicorn beetles

Longicorn beetles have caused damage in some plantations. Impact is being monitored.

***Perthida* sp. (shothole miner)**

Damage is common (Fig. 27). No further work has been done on the impact of this insect.

Figure 27. Shothole miner (*Perthida* sp.) damage (Photo: S. Shaw).

Diseases

There have been no reports of disease this year. However, *Mycosphaerella* is always present at low levels in some plantations.

NURSERIES

No major health issues reported.

WESTERN AUSTRALIA

Compiled by Dr Richard Robinson (Science Division, Department of Environment and Conservation) and Ian Dumbrell (Science and Resources Branch, Forest Products Commission).

PLANTATIONS

Pinus radiata

Insect pests

Sirex noctilio (sirex wood wasp)

The Forest Products Commission (FPC) in Western Australia conducts an annual monitoring programme throughout its estate. Monitoring in WA is now done using static (panel) traps, which are effective in detecting very low numbers of sirex. The traps are erected in pairs in open areas of plantations that would likely be used as flight paths for the wasp. Last year they were deployed in plantations from Perth to Albany, as well as Albany town site and a Bunbury sawmill. It is planned to further increase the coverage of the traps outside of plantations to cover 'points of entry' such as borders, sea ports, airports, container depots and along transport corridors.

No sirex wood wasps (*Sirex noctilio*) were detected in any of the traps in the 2008/2009 flight season.

Ips grandicollis (fivespined bark beetle)

Bark beetle distribution and abundance were monitored in conjunction with the sirex trapping programme. *Ips* was found in all plantation areas over the length of the trapping season. No *Ips* was detected in the Albany town site traps. Numbers were highest in the west coastal plantations of Gnangara, McLarty and Myalup as well as the pine mill near Bunbury. Numbers peaked in February for McLarty, Myalup and the mill and in March for Gnangara. No significant reports outside of the trapping areas were received in 2008/2009.

Essigella californica (Monterey pine aphid)

Although *Essigella* is present it is still not regarded as a problem in WA. Ian Dumbrell (FPC) is the WA representative on the *Essigella* biocontrol project steering committee. (I. Dumbrell, FPC)

Hylurgus ligniperda (golden hatred bark beetle)

Hylurgus was only found in traps from the west coast plantations and the Bunbury mill and generally only in February. The exceptions were Myalup plantation where numbers caught were steady (but not high) through February, March and April and the pine mill where numbers were higher peaking in February and tapering off through March and April.

Pinus pinaster

Insect pests

***Hylotrupes bajulus* (European house borer)**

Management

In June 2008, the European house borer (EHB) response group was fairly confident the infestation had been contained and that eradication was a good possibility.

- Currently clear falling infested plantations (including a 2km buffer)
  - Total clean up of clear fall sites
  - Option to further clean up the site and remove wildings after 12-18 months (in discussion)
  - Plans to have all areas within Restricted Movement Zone's harvested and cleaned up by 2015 and the areas declared 'all clear' by 2021

Regulations have now been enacted (Agricultural and Related Resources Protection (European House Borer) Regulations 2006) which place restrictions on the movement of pine wood, of certain types within certain geographical and seasonal constraints.

Surveillance

- Visual surveillance
  - Ongoing in RMZ
  - Annual from Geraldton to Esperance
  - 75% effective
- Sniffer dogs (2 beagles)
  - Can detect larvae before they emerge
- Trap poles
  - 1000 currently deployed
  - Visual and sniffer dog detection
  - Automatic acoustic detection being trialed

Research

Previous research has focused on biology (Life cycle, Mating habits, movement).
A number of new research activities have been undertaken into the EHB, such as DNA profiling to validate movement theory, acoustic detection technology, pheromone trapping and efficacy of insecticidal timber preservatives. Two replica houses have been built to monitor infestation of timber 'in-service'.

Education

An intensive media campaign to educate the public is in place and includes

- Newspapers
- Door-knocking and mail-outs in RMZ
- Posters on buses etc
- Shopping centre displays
- Website
- Working directly with timber suppliers and the building industry
- New road signs

So far the response to this campaign has been generally positive.

***Phaulacridium* sp. (wingless grasshopper)**

From November 2008 to March 2009, the usual annual incursions of wingless grasshoppers occurred in plantations throughout the South West, but were not in plague proportions. Misting with alphacypermethrin was undertaken on affected properties on a fortnightly basis.

***Nysius vinitor* (Rutherglen bug)**

Rutherglen bugs are a regular problem in plantations from October to late December. Infestations are misted in conjunction with wingless grasshopper control.

Diseases

No major problems reported.

Eucalyptus globulus

Insect pests

***Gonipterus scutellatus* (eucalyptus weevil)**

The Eucalyptus Weevil or Eucalyptus Snout-Beetle, generally referred to as *Gonipterus scutellatus* Gyllenhal, is a significant pest of *Eucalyptus* species in Africa, South America, North America, Europe and New Zealand. Within its native range in south-eastern Australia, it is controlled effectively by an egg-parasitic wasp, *Anaphes nitens*. However, in the state of Western Australia, where the weevil is thought to have been introduced, the rapid expansion of eucalypt plantation forestry in the last 20 years has seen the Eucalyptus Weevil become a significant pest in spite of the presence of *A. nitens*, suggesting that the egg parasitoid is not able to effectively control the Eucalyptus Weevil. This could be possible if *G. scutellatus* was a complex of cryptic species or made up of locally distinct populations. A phylogenetic analysis and morphological analysis to determine identity and the origin of *G. scutellatus* in Western Australia has been conducted. For molecular analysis, a 413 bp fragment of mtDNA from the cytochrome oxidase I gene corresponding to protein coding region and also a 317 bp region of nuclear DNA corresponding to the 5′ end of elongation factor 1 alpha (EF-1α) was used. Examination of the male genitalia, in particular in the shape of the internal armature of the aedeagus was also conducted. Molecular analysis revealed seven distinct clades and morphological analysis confirmed that each clade corresponded to a distinct species based on male genitalia. All specimens from Western Australia were found to belong to one species. The very low variability observed in Western Australia supports that this species was introduced to Western Australia recently, with the source population likely to be from Tasmania. (T. Mapondera, honours Murdoch University).

Diseases

No major problems reported.

***Eucalyptus* spp. (*E. cladocalyx, E. maculate* and *E. saligna*)**

Insect pests

***Phylacteophaga froggatti* (leafblister sawfly)**

Leaf blister sawfly has been noted on stress exposed *E saligna* (G. Hodgson, FPC).

***Liparetrus jenkinsi* (spring beetle)**

Spring beetle features as a significant problem in establishment of *E saligna*, *E cladocalyx* and *E maculata* plantations. Attacks predominate in late September/October. 2008 spring season was not an unusual season and limited damage recorded.

***Santalum spicatum* (sandalwood)**

Insect pests

***Nysius vinitor* (Rutherglen bug)**

FPC is finding significant Rutherglen bug attacks on newly established sandalwood seedlings. This is providing new challenges in taking sandalwood into the pastoral areas in the intermediate/low rainfall zones of the South-west. (G. Hodgson, FPC). This insect is generally a seasonal pest within plantations in the Midwest region of WA from October to January. 2008/2009 saw this sap sucking pest in large proportions from October right through to early June, the last misting was carried out in June 2009. The Rutherglen bugs were associated with the *Acacia* host plants.

MANAGED NATURAL FORESTS

***Eucalyptus marginata* (jarrah)**

Insect pests

***Perthida glyphopa* (jarrah leafminer)**

Populations still exist extensively throughout the forest but levels are below severe damage thresholds. A cut-out boundary survey is due to be conducted in late October 2009 (A. Wills, DEC).

***Uraba lugens* (gumleaf skeletoniser)**

Populations of gumleaf skeletoniser (*U. lugens*) remain very low in the southern Jarrah forest (J. Farr, DEC).

***Opodiphthera helena* (helena moth)**

Although not normally recognised as a serious pest of native forests, populations of Helena gum-moth were significantly higher during 2007 (Table 1). Adult numbers, as

measured from light trap captures for spring 2007, have been recorded at over 100 individuals in some sites with consistent captures across most sites. This compares with isolated captures of only one or two individuals in previous years. Helena gum moth still higher in numbers than it used to be (prior to 2007) but no trapping was conducted in Spring 2008 to confirm actual numbers (A. Wills, DEC).

Table 1. Helena moth captures from FORESTCHECK sites using light traps from 2001/2008.

Year	Helena abundance
2001	4
2002	1
2003	0
2004	6
2005	0
2006	No data
2007	633
2008	No Data

Diseases

No new major disease problems were reported. Management and survey of *Phytophthora* root disease in jarrah forests continues to command attention (see Forest Health Surveillance and Diagnosis and Research and Development).

***Eucalyptus diversicolor* (karri)**

Insect pests

No major pest problems reported.

Diseases

Recently *Cryptosporiopsis actinidiae* was identified from karri scantling using molecular sequencing on isolates that had been stored since 1986. *Cryptosporiopsis actinidiae*, an important post-harvest pathogen of kiwi fruit and New Zealand research suggests that there may be a number of diseases of woody plants that can cause opportunistic post-harvest infection. This is of interest because there may be a number of other potential diseases harbouring in native forest (E. Davison, Curtin University).

NURSERIES

No major problems have been reported in either conifer or hardwood seedlings in nurseries.

NATIVE PLANT COMMUNITIES

Phytophthora in natural ecosystems

For 30 years large-scale aerial photography has been used to map the extent of Phytophthora dieback disease in native forests in the south-west of Western Australia, with validation of the observations involving routine testing of soil and root samples for the presence of *Phytophthora cinnamomi.* In addition to *P. cinnamomi*, six morpho-species have been identified using this technique: *P. citricola, P. megasperma, P. cryptogea, P. drechsleri, P. nicotianae* and *P. boehmeriae.* In recent years many new *Phytophthora* species have been described world-wide, often with similar morphology to existing species, thus, as many of the isolates collected in Western Australia have been difficult to identify based on morphology, molecular identification of some of the morpho-species is required. Based on amplification of the internal transcribed spacer (ITS) region of the rDNA gene sequence data of over 230 isolates were compared to that of existing species and undescribed taxa. *Phytophthora inundata, P. asparagi*, *P.* taxon Pgchlamydo, *P.* taxon personii and *P.* taxon niederhauserii were identified based on sequence data. Phylogenetic analysis revealed that nine potentially new and undescribed taxa can be distinguished. Several of the new taxa are morphologically indistinguishable from species such as *P. citricola, P. drechsleri* and *P. megasperma*. In some cases, the new taxa are closely related to species with similar morphology (e.g. *P*. sp. 4 and *P. citricola*). However, the DNA sequences of other new taxa such as *P*. sp. 3 and *P*. sp. 9 show that they are not closely related to morphologically similar species, *P. drechsleri* and *P. megasperma,* respectively. Most of the new taxa have been associated with dying *Banksia* spp. while *P*. sp. 2 and *P*. sp. 4 have also been isolated from dying *Eucalyptus marginata* (jarrah). Some taxa (*P*. spp. 3, 6 and 7) appear to have limited distribution, while others like *P*. sp. 4 are widespread. Burgess, T. I., Webster, J. L., Ciampini, J. A., White, D., Hardy, G. E. StJ and Stukely, M. J. C.

A new *Phytophthora* species (previously known as *P*. sp. 4), isolated from rhizosphere soil of declining or dead trees of *Eucalyptus gomphocephala*, *E. marginata*, *Agonis flexuosa* and another 13 plant species and from fine roots of *E. marginata* and collar lesions of *Banksia attenuata* in Western Australia, is described as *Phytophthora multivora* sp. nov. It is homothallic and produces semipapillate sporangia, smooth-walled oogonia containing thick-walled oospores and paragynous antheridia. Although morphologically similar to *P. citricola,* phylogenetic analyses of the ITS and *cox*I gene regions demonstrate that *P. multivora* is unique. *Phytophthora multivora* is pathogenic to bark and cambium of *E. gomphocephala* and *E. marginata* and is believed to be involved in the decline syndrome of both eucalypt species within the tuart woodland in south-west Western Australia. (P.M. Scott, T.I. Burgess, P.A. Barber, B.L. Shearer, M.J.C. Stukely, G.E.St.J. Hardy, T. Jung).

DEC Phytophthora Research Project

Funded through the State Government's Biodiversity Conservation Initiative a research project was commenced in late 2006 into the epidemiology and control of *P. cinnamomi* on the south coast of WA. The project is investigating the seasonal disease dynamics of *P. cinnamomi* including the mechanisms to disease centre extension and survival. Further the project is also investigating the use of phosphite basal stem application to prevent disease centre expansion and its effect on the epidemiology of the pathogen.

Results from the epidemiological investigations have shown that season has little effect on the inoculum distribution of *P. cinnamomi* on sandy coastal sites, however it does appear to effect pathogen isolation rates in the rocky soils of the Stirling Range National Park. The highest amount of inoculum is concentrated in the shallow part of the soil profile (0-40 cm) and although inoculum distribution appears non-uniform there is a strong correlation between isolation and the presence of plants roots. Rainfall, soil moisture and temperature had only a limited effect on the probability of isolating the pathogen from soil. The pathogen can be isolated all year around including periods of very low soil moisture and can be isolated with a high probability from around the root systems of susceptible plants species over a year after the plant has died from the disease.

The use of high intensity phosphite application (ie basal stem application) at 30% active ingredient seems to be able to reduce disease centre expansion in *P. cinnamomi* infested sites. Although its still too early to judge success of applying phosphite at this very high rate it appears to reduce *P. cinnamomi* inoculum within soils. Some severe phytotoxicity was observed in the weeks and months after treatment, however, after 1 year over 90% of plant species had fully recovered. A few particular species such as *Banksia falcata* appear sensitive to the treatment (C. Dunne, DEC).

URBAN AND RURAL

Insect pests

See section on wandoo decline (below).

Diseases and Declines

Pathogens of boabs

Surveys for fungi associated with boab (*Adansonia gregorii*) are underway in both South Africa and Western Australia. In this study, seven new species of the Botryosphaeriaceae are described from baobab (*Adansonia gibbosa*) and surrounding endemic tree species growing in the Kimberley region of northwestern Australia. Members of the Botryosphaeriaceae were predominant endophytes isolated from apparently healthy sapwood and bark of endemic trees; others were isolated from dying branches. Phylogenetic analyses of ITS and EF1-α sequence data revealed seven new species: *Dothiorella longicollis*, *Fusicoccum ramosum Lasiodiplodia margaritacea*, *Neoscytalidium novaehollandiae*, *Pseudofusicoccum adansoniae*, *P. ardesiacum* and *P. kimberleyense*. The most commonly isolates species was *Lasiodiplodia theobromae*. A pathogenicity test has shown that this species is highly pathogenic to boabs (Monique Sakalidis, T. Burgess and G. Hardy, Murdoch University and M. Wingfield, Tree Pathology Cooperative Program (TPCP) South Africa).

Pathogens of marri

Corymbia calophylla is an important, endemic eucalypt species throughout the south west of Western Australia. It is currently in decline in its native habitat due to the presence of the canker pathogen *Quambalaria coyrecup*. Few fungal leaf pathogens have been described from *C. calophylla*. We have isolated and described two new species of *Teratosphaeria* from *C. calophylla, Teratosphaeria calophylla* sp. nov and *T. rubidae* sp.

nov. *Teratosphaeria australiensis* (=*Leptomelaconium australiense*) was isolated from symptomatic leaves of *C. calophylla*. This species was originally described from *C. ficifolia* (V. Andjic, K. Taylor, P. Barber, T. Burgess and G. Hardy, Murdoch University).

Peppermint dieback

Agonis flexuosa, commonly known as the Western Australian Peppermint, is a tree native to the south-west of Western Australia and severe dieback symptoms have been recently observed in some areas. A species of fungus was believed to be the causal agent. For this project, fungi were collected, isolated, identified and tested for pathogenicity to determine the causal agent of the decline of *A. flexuosa* in natural ecosystems in Western Australia. Fungi were isolated from symptomatic and asymptomatic material collected from *A. flexuosa*, cultured and then identified using molecular taxonomy, microscopy and vegetative compatibility trials. Pathogenicity trials using *A. flexuosa* seedlings were carried out to prove Koch's Postulate. All isolates caused lesions in the seedlings and there is no significant difference between lesions caused by isolates from symptomatic and asymptomatic material. This suggests that the causal agent could be an endophytic fungus which has become a pathogen (N. Dakin, BioGENIUS student, T. Burgess, D. White and G. Hardy, Murdoch University).

Mundulla yellows

Monitoring of the occurrence and symptom development of Mundulla yellows (MY) in WA has continued. Symptomatic eucalypts (both planted trees and remnant native trees) have been observed in several additional locations. Spread of symptoms within affected sites appears generally to be slow and diseased and apparently-healthy trees can grow alongside each other. The observed distribution of MY symptoms in the south of the state is from north of Geraldton to Esperance and it occurs on alkaline coastal sands as well as on acid soils including laterites. As in South Australia, MY in WA is only seen in vegetation in disturbed sites or modified landscapes such as road verges and medians, parks and gardens and in parkland or paddock remnant stands where symptomatic trees can be several hundred metres from, and sometimes upslope from, any road. Symptoms have not been observed within undisturbed native forest or woodland stands in WA. Collaboration is continuing in the investigation of the cause(s) of MY with D. Hanold and J. Randles from the University of Adelaide. (M. Stukely, DEC).

Tuart decline

In recent years, tuart (*Eucalyptus gomphocephala*) woodland within Yalgorup National Park, south of Mandurah has suffered a severe decline in health. Research carried out by the Tuart Health Research Group (THRG) has shown from surveys of tuart across the range, that the major decline syndrome is confined to the Yalgorup region. A new species of *Phytophthora*, *P. multivora,* has been recently isolated from a number of rhizosphere soil of declining or dead trees of *E. gomphocephala* and other species in the Yalgorup region (Scott et al. 2009 Persoonia 22: 1-19). Further work is being conducted to determine the pathogenicity of these isolates and to characterise them (P. Scott, Murdoch University). A very close correlation between foliar zinc levels and crown health has been observed and treatment trials with nutrient implants have shown promising results. Trials with injection of phosphite have also shown promising results (P. Scott, Murdoch

University). Trees are still showing signs of an increase in crown health four years after treatment. Strong correlations also exist between crown health and soil microbial function and diversity (Y. Cai, Murdoch University). Studies on the role of fire and competition show a lack of fire may be contributing to the decline of tuart, however, it is not a major factor (R. Archibald, Murdoch University). Monitoring and capture of fauna within sites throughout the Yalgorup region have also shown a strong correlation between the abundance of particular reptile species and crown health of tuart (K. Wentzel, Murdoch University). A new project is looking at restoring sites where soils have lost their tuart seed banks (Katinka Ruthrof, Murdoch University) (P. Barber, THRG, Murdoch University- http://www.tuarthealth.murdoch.edu.au/).

Botryosphaeriaceous taxa have been isolated as endophytes and canker pathogens from numerous hosts in many parts of the world and have been implicated in the decline of *E. gomphocephala*. In a current study, endophytic fungi were isolated from a wide variety of native woody plant species (*Acacia cochlearis, A. rostellifera*, *Allocasuarina fraseriana, Agonis flexuosa, Banksia grandis, E. gomphocephala*, *E. marginata* and *Santalum acuminatum*), at two locations in native *E. gomphocephala* woodland; a site in decline at Yalgorup National Park and a healthy site at Woodman Point Regional Park. Of the 226 isolates obtained, 154 were botryosphaeriaceous taxa, 80% of which were found to be *Neofusicoccum australe*, isolated from all hosts at both collection sites. Four new species are described; *Dothiorella moneti*, *Dothiorella santali*, *Neofusicoccum pennatisporum* and a species belonging to a genus only recently included in the Botryosphaeriaceae, *Aplosporella yalgorensis*. The other species isolated were *Botryosphaeria dothidea* on the new hosts *A. rostellifera*, *A. cochlearis* and *E. marginata* and *Dichomera eucalypti*, on the new host *E. marginata.* None of the new species formed lesions on excised stems of their host species, *E. gomphocephala* or a common plantation species *E. globulus*. However, *Neofusicoccum australe* formed lesions on excised stems of *E. globulus* and *E. gomphocephala* (K. Taylor, P. Barber, G. Hardy and T. Burgess, Murdoch University).

Wandoo decline

Crown decline of wandoo (*Eucalyptus wandoo*) in southwest Western Australia has escalated over the last 15 years, so that very few unaffected stands remain. This decline is widespread and a cause of significant concern. The Wandoo Recovery Group's (WRG) role is to support research to identify possible causes of crown decline and communicate knowledge and information about wandoo. To date, research efforts to examine the causes of wandoo crown decline have been undertaken by the University of Western Australia (UWA). The new State Centre of Excellence for Climate Change; Woodland and Forest Health will now drive coordinated research into wandoo, tuart and other tree declines (L. Manning, WRG).

There has been no active research into wandoo decline during 2009, but there has been progress in the reporting of previous research and in the planning of future research. Scientific publication of wandoo water relations research is being prepared. A PhD thesis was submitted in July 2009 (R. Hooper, UWA) and a second PhD on ecophysiological differences between wandoo provenances is not expected before late 2010 (E. Dalmaris, UWA). Discussions are ongoing regarding the focus, approach and location(s) for research to be undertaken by postdoctoral research associates at UWA and Murdoch. DEC managers have been involved in these discussions (L. Manning, WRG).

A wood boring insect (Coleoptera: Buprestidae), has been identified as the primary contributing factor in dieback and decline of wandoo trees. Fungal pathogens isolated on dying branches were not particularly aggressive and are commonly found in *Eucalyptus* trees. Rather, it is thought activity of the insect and its high emergence rate during the recent severe decline in Talbot forest (in the 1990's) facilitated damage by these normally benign organisms. Active populations of the borer were evident in areas recently affected by decline. Understanding the balance between borer populations and tree response is a crucial factor in the decline and recovery cycle, which must be viewed in a time frame relevant to wandoo's life span. Ryan Hooper has been monitoring phenology (development of bud formation, flowering and seed set) and growth in the wandoo forest (R. Hooper, UWA).

Abiotic stress can deteriorate tree health directly or through a reduced ability to withstand attack by pest and disease organisms. Central to the research effort regarding abiotic stress has been the hypothesis "Does drought play a role in wandoo crown decline, and if so, to what extent are declining trees drought stressed?" During hot summer months as leaves and stems dry out, tensions develop that cause the loss of cell integrity (and the capacity to grow and function well), and also the loss of ability to transport water. Measurements on the hydraulic characteristics of powderbark wandoo (*E. accedens*), jarrah (*E. marginata*), and marri (*Corymbia calophylla*) confirm large differences in water status and water use patterns between these species. Preliminary results show that wandoo and powderbark are adapted to operate at greater tensions and can lose more water before they lose turgor than jarrah and marri. Moreover wandoo and powderbark can accumulate more osmotically active compounds, allowing greater tissue dehydration and better water uptake from dry and clayey soils. Their stems are much more resistant to high tensions. Although tensions in wandoo reach higher values than the other species, they don't cause greater loss of stem functionality (E. Veneklaas, UWA).

Broad-scale survey and mapping over the last ten years have identified temporal and spatial trends in wandoo health that indicate decline patterns are broad scale, variable and not continuous across the landscape. While crown decline still occurs across wandoo's range (albeit at low levels), at other sites decline has stabilised and trees have started to recover (J. Mercer, WRG, K. Whitford, DEC).

FOREST HEALTH SURVEILLANCE AND DIAGNOSIS

Dieback mapping and management

Mapping the presence of symptoms of the plant disease caused by *P. cinnamomi* was carried out by accredited interpreters to determine areas suitable for protection. Hygiene requirements were specified for activities likely to result in the movement of soil (and as a consequence, *P. cinnamomi*) on lands managed by DEC. A total area of 33,230 ha was mapped to assist the planning of roading and timber harvesting operations undertaken by the FPC. This included 10,210 ha of previous mapping that was checked for further spread. Mapping and hygiene planning were undertaken on a further 4,720 ha for the Parks and Visitor Services, Nature Conservation Service and Sustainable Forest Management Service of DEC and 1,600 ha for external parties. Interpretation from helicopter, coupled with field sampling, was undertaken to explore for new infestations in the Fitzgerald River National Park. Training programs were carried out in disease mapping and hygiene management (G. Strelein, DEC).

In the year to 30th June 2009, a total of 1,789 samples was tested for the presence of *Phytophthora* by DEC's Vegetation Health Service (VHS). These samples were associated with verification of dieback mapping for the above projects, as well as external requests. DNA sequencing has been carried out at the Centre for *Phytophthora* Science and Management (CPSM), at Murdoch University, on various recent and historical isolates of unidentified *Phytophthora* in the DEC culture collection, from a range of WA locations and ecosystems. This had earlier led to the identification of *P. inundata, P. asparagi* and *P. niederhauseria*. At least nine new and undescribed *Phytophthora* taxa occurring in native vegetation in WA have been distinguished, based on their ITS rDNA sequences. Several of them are indistinguishable, on morphological characters, from known species such as *P. citricola*, *P. drechsleri,* or *P. megasperma*. The formal description of the first of these new WA species, *Phytophthora multivora*, was published. (This species had previously been identified as *P. citricola* from morphological characters; however, no true *P. citricola* has yet been found among the VHS cultures tested). Most of the newly identified Phytophthoras have been associated with multiple species of dying native plants in natural vegetation communities. A PhD project commenced in April 2007 at Murdoch University to describe several of the new Phytophthoras and to test their pathogenicity (A. Rea – see Research and Development). In addition, there is now strong new evidence of naturally-occurring *Phytophthora* hybrids in WA native ecosystems; these are being further investigated. (M. Stukely, DEC).

RESEARCH AND DEVELOPMENT

General

Western Australian State Centre of Excellence for Climate Change, Woodland and Forest Health.

This new Centre was approved for funding in 2008 is made up of four programs: Climate Change, Woodland and Forest Declines; Decline Ecology; Restoring Biodiversity Values; and Policies and Action for Woodland and Forest Restoration. Murdoch University together with the University of Western Australia and the Department of Environment and Conservation are the primary proponents, with cash and in-kind support from 27 agencies, non-government agencies and industry and collaboration with Universities and agencies in eastern Australia and overseas. Three Post-Doctoral fellows and a Manager have been appointed within the centre with another three post-doctoral fellows to be employed. The focus of this centre will initially be the decline of tuart and wandoo, however, student projects under the centre have been initiated investigating the decline of other iconic WA species including *E. marginata, Corymbia calophylla, E. rudis, Agonis flexuosa* and *C. ficifolia.* Further information about the Centre can be found at www.treehealth.murdoch.edu.au (G. Hardy, Murdoch University).

Molecular Diagnostic Facility at Murdoch University

Nari Anderson (Research Associate, CPSM) has developed Real Time PCR methods to diagnose *P. cinnamomi* from soil samples. She is now developing the method for high throughput and on large (250g) soil samples in order to make the process commercially viable. (Supervisors: P. O'Brien and G. Hardy, Murdoch University).

Plantations

Eucalyptus globulus is the predominant exotic hardwood plantation species in Western Australian (WA), and is often planted adjacent to native eucalypt forests. The increase in a number of *Mycosphaerella* species associated with Mycosphaerella Leaf Disease (MLD) in *E. globulus* plantations in WA in the past decade has raised concern about the possible movement of pathogens between the native forests and plantations. In order to determine whether the introduction of new *E. globulus* genetics into WA may have further exacerbated this situation, juvenile and adult foliage were taken from a genetics trial near Albany, WA consisting of 60 full-sib families and *Mycosphaerella* species identified using morphological and molecular tools. Eleven species of *Mycosphaerella* were identified from one plantation: *Mycosphaerella fori* (*Pseudocercospora fori*) and *M. ellipsoidea* are new records for Australia; *M. tasmaniensis* (*Passalora tasmaniensis*) and *M. suttoniae* (*Kirramyces epicoccoides*) are new records for WA; and *M. nubilosa*, *M. cryptica*, *M. marksii*, *M. molleriana*, *M. lateralis*, *M. aurantia* and *M. parva*, previously recorded for WA. The most frequently isolated species from juvenile foliage was *M. marksii* (77%) followed by *M. nubilosa* (33%). *Mycosphaerella nubilosa* was most frequently isolated from adult leaves (88%) followed by *M. parva* (7.5%). Three species, *M. molleriana*, *M. lateralis* and *M. cryptica*, were only isolated from adult leaves while *M. ellipsoidea* was only isolated from juvenile leaves. These records increase the number of known *Mycosphaerella* species from eucalypts in WA from ten to thirteen. The increase in the number, distribution and impact of *Mycosphaerella* species contributing to MLD in WA is of concern both to the potential productivity of the plantations and the biosecurity of native WA *Eucalyptus* species. Continued monitoring of the plantation estate is required to understand the dynamics of the host-pathogen interactions. (Incidence and new records of *Mycosphaerella* species within a *Eucalyptus globulus* plantation in Western Australia A. Maxwell, AQIS, S. Jackson, T. Burgess, G. Hardy and B. Dell, Murdoch University).

PhD project 'A detailed study of *Mycosphaerella cryptica* and *M. nubilosa* in Western Australia, focusing on the threat to native remnants'.

Collaborative Project - Murdoch University and the Tree Pathology Cooperative Program (TPCP) South Africa.

The project 'New and emerging pathogens threatening the biodiversity of Australia's eucalypts' continues and concentrates on some of the major eucalypt pathogens worldwide (*Kirramcyes* spp. *Mycosphaerella* spp., *Botryosphaeria* spp. *Cryphonectria* spp.). The aim is to determine their origin, movement and the risk they pose to Australia's eucalypts (T. Burgess, MU and M. Wingfield, TPCP).

PhD theses in progress at Murdoch University

Francisco (Paco) Tovar: The cause of basal stem rot in second rotation *Eucalyptus globulus* plantations (Supervisors: T. Burgess, G. Hardy, MU and R. Robinson, DEC). Surveys completed during 2005/2007 indicated that 6 main species of fungi were associated with white rot of *E. globulus* coppice stumps. These species were identified as *Trametes versicolor*, *Stereum hirsutum, Stereum illudens*, *Pycnoporus coccineus, Bjekandera adusta* and *Lopharia crassa.* Levels of fungal colonisation of stumps across all plantations surveyed averaged 56% and were as high as 86% at a plantation in Collie.

Nonetheless, an average of 85% of stumps coppiced successfully, indicating that fungal colonisation was not interfering with coppice shoot emergence. Surveys also showed that less than 1% of stumps lost major shoots due to windthrow. Previous reports of 'significant' losses due to wind throw were attributed to observational bias, possibly, an edge effect. A two year trial testing antifungal treatments on coppice stumps was set up to determine the possibility of preventing fungal colonisation. None of the anti-fungal preventative treatments were effective. A number of other trials and surveys have been undertaken, including:

- An inoculation trial on *E. globulus* coppice shoots was set up to determine the capacity of the above mentioned fungi to move from the stump into the new coppice shoots and cause further rot during the rotation. First results are expected in December 2008.
- An experiment investigating the effect of harvest season on subsequent fungal colonisation is due to be completed in August 2008.
- Further surveys of both 1st and 2nd rotation plantations are currently being conducted to ascertain if there is an overall increase in levels of rot from first to second rotations.

Katherine Taylor: A detailed study of *Mycosphaerella cryptica* and *M. nubilosa* in Western Australia, focusing on the threat to native remnants (Supervisors: T. Burgess, G. Hardy and P. Barber, MU, C. Mohammad, Forestry CRC and A. Carnegie, SF NSW).

Monique Sakalidis: Investigation and analysis of taxonomic irregularities within the fungal genus *Botryosphaeria.* This thesis is answering questions that have arisen within the genus *Botryosphaeria* relating to divisions amongst and within taxa (Supervisors T. Burgess, G. Hardy, MU and B. Wingfield University of Pretoria).

Sarah Jackson: Taxonomy and biology of *Mycosphaerella* species found on *E. globulus* (Supervisors: G. Hardy and B. Dell, MU).

Patsy Stasikowski: An investigation into the mechanism of action of phosphite mediated resistance of plants to *P. cinnamomi* infection. Patsy is also in the process of developing a rapid analytical method to rapidly and cheaply determine the levels of phosphite in plant tissues under field conditions. We hope to be commercialising this in a kit form in the near future (Supervisors: G. Hardy, J. McComb and P. O'Brien, MU).

Leila Eshraghi: The role of plant defense pathways in Phosphite induced protection of *Arabidopsis thaliana* from *Phytophthora cinnamomi* infection (Supervisors: P. O'Brien, J. McComb and G. Hardy MU).

Kylie Ireland: Susceptibility of Australian plants to *Phytophthora ramorum,* an emerging potential threat to Australian plant industries and ecosystems. Kylie is working at the University of California Davis (UCD) screening Australian species for potential susceptibility to *P. ramorum.* She has found a large number of sporulating hosts and will start to look at 'dead-end' hosts in the near future. She will also use risk modelling to determine areas in Australia most at threat to *P. ramorum.* This project is funded by the CRC National Plant Biosecurity and The Department of Environment, Water, Rivers and Heritage (Supervisors: G. Hardy and D. Huberli, MU, I. Smith DPI Vic. and D. Rizzo, UCD).

Alexander Rea: Classical and molecular taxonomy and pathogenicity testing of *Phytophthora* species. Alex is currently describing five new *Phytophthora* species from the Department of Environment and Conservation's Vegetation Health Service culture collection. This is also including pathogenicity screening and ecological studies. This project is funded by the CRC National Plant Biosecurity (Supervisors G. Hardy, T. Burgess, MU and M. Stukely, DEC).

Papori Barua: Screening *Lambertia* species for susceptibility and resistance to *Phytophthora cinnamomi* to develop a model plant system to examine resistance mechanisms (Supervisors: G. Hardy, J. McComb, MU and B. Shearer, DEC).

Peter Scott: The potential role of *Phytophthora* species in *Eucalyptus gomphocephela* (Tuart) decline. Peter has isolated a *P. citricola*-like *Phytophthora* from the fine roots and rhizosphere of tuart. Morphological and sequence data indicate that the pathogen is undescribed and he is currently working on describing this organism. He also has field and glasshouse pathogenicity trials in place. Trees in the decline treated with phosphite respond very well in comparison to control treatments further indicating that this new *Phytophthora* species could be playing a role in the decline syndrome (Supervisors G. Hardy, P. Barber, MU and B. Shearer, DEC).

Honours theses in progress at Murdoch University

Katherine Edwards: Phytophthoras associated with *E. rudis* (Supervisors: G. Hardy, W. Dunston and T. Jung, Murdoch University).

Cielito Marbus: *Quambalaria* spp. Associated with marri (*C. calophylla*) (Supervisors: G. Hardy, B. Dell and T. Paap, Murdoch University).

Anna Bedford: Soil-borne Phytophthoras associated with marri (*C. calophylla*) (Supervisors: G. Hardy, T. Burgess and T. Jung, Murdoch University).

Collated and summarised by John Bain, Dr Lisa Berndt, Lindsay Bulman, Margaret Dick, Ian Hood, Tara Murray and Dr Michael Watson (Scion) from data and information from the Forest Health Database, *Forest Health News* (Scion) and the Forest Health Reference Laboratory.

PLANTATIONS

Pinus radiata

Insect pests

No insect problems of any note were recorded in *Pinus radiata* plantations.

Diseases

Dothistroma needle blight

Last year we predicted that the spray programme to control Dothistroma needle blight would be extremely small at less than 30,000 ha. This proved to be correct with only 25,500 ha being sprayed throughout the North Island. This is the smallest programme for 30 years (Fig. 28). It would have been even smaller had not one major forest company decided to reduce the threshold disease level of which to spray to 10%. The dry weather over the past three summers and consequent low inoculum carried over from previous seasons led to the extremely low levels of Dothistroma needle blight. It should also be noted that there has been limited new planting over many years in the regions where Dothistroma needle blight is a problem. The area occupied by trees in the susceptible age class has decreased accordingly. A small spray programme (under 50,000 ha) is expected for the 2009/2010 season.

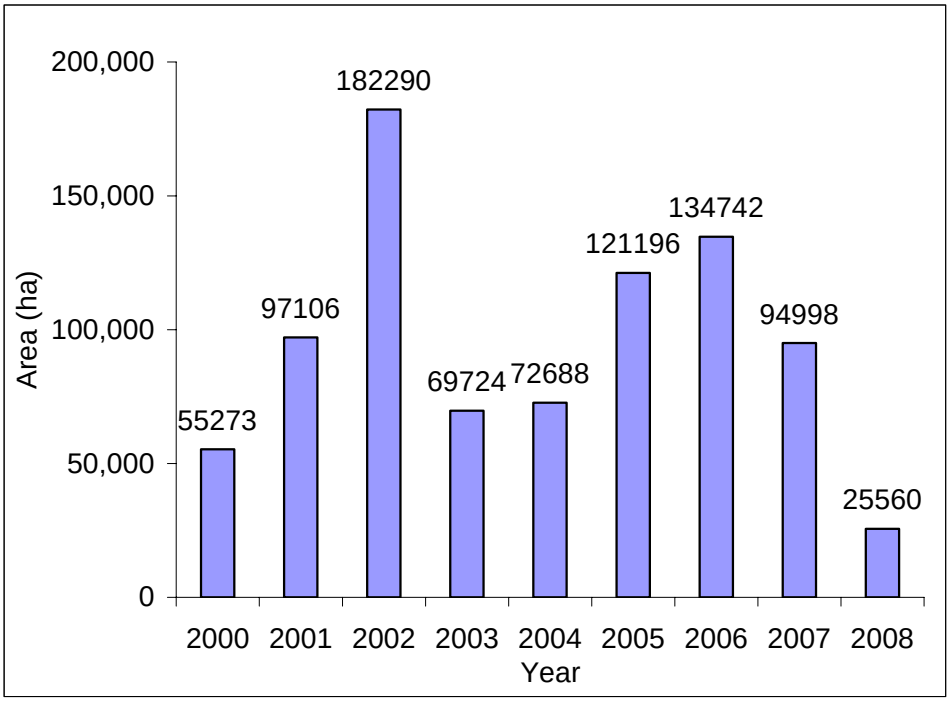

Figure 28. Area sprayed annually for Dothistroma control in the North Island.

Cyclaneusma needle cast

Based on observations, the severity of Cyclaneusma needle cast increased slightly but not significantly from low levels experienced over the past few years. An economic impact report based on aerial assessments of a number of forests undertaken in 2005 and 2006 suggests that losses due to Cyclaneusma needle cast are now lower than those estimated previously. The total financial loss attributable to Cyclaneusma needlecast over the New Zealand *P. radiata* estate aged between 6 and 20 years is estimated to be $38 million per annum. This is considerably lower than estimates of over $60 million per annum that were made based on data collected in the mid 1980s. Smaller susceptible area contributed to the reduced loss, but not entirely. Disease levels seen this decade are lower than those seen in the 1970s and 1980s and it is highly likely that elimination of highly susceptible genotypes from the population has resulted in lower disease levels.

Bulman, L S; 2009. Economic Impact of Cyclaneusma Needle-cast in New Zealand. http://www.fbrc.org.nz/pdfs/Cyclaneusma_economic_loss_final_May_2009.pdf

Physiological needle blight and atypical Cyclaneusma needle cast

In contrast to the previous year when very few reports of the physiological needle blight (PNB) or the atypical Cyclaneusma needle cast were received there were some pockets of needle cast during the late winter and early spring of 2008. The regions commonly affected in the past, the East Cape of the North Island, Northland and parts of the central North Island (also reported in spring 2006), were once again the sites where the disorder occurred.

Neonectria fuckeliana

Results of a pruning trial established in 2003 to determine the effect of season of pruning on Nectria disease development, effect of stub size, how long freshly pruned stubs are susceptible to infection and to monitor the development of cankers or flutes over time have been analysed. Over 20,000 individual stubs were assessed on each of 11 occasions over the 6-year period of the trial. Results can be summarised as:

- Pruning or inoculation with *N. fuckeliana* in winter resulted in a higher incidence of fluting than pruning or inoculation in summer.
- The incidence of fluting is not stable over time. Fluting incidence increased after pruning for about a year, after which it slowly declined over three years, and remained stable after that. That trend was similar after first and second lift pruning operations.
- Fluting is positively related to stub size. Six years after first treatment, almost all the flutes that have persisted are associated with stubs larger than 60 mm.
- Many trees with flutes that fully occlude with no outward signs of damage are left with no residual internal damage.

This applied research has provided the means to manage Nectria flute canker through manipulation of pruning regimes.

There has been no further extension to the range of *N. fuckeliana* which remains restricted to the lower half of the South Island (Fig. 29). The fungus has not been found in Nelson, Westland, or anywhere in the North Island where surveys have been carried out. The spread of *N. fuckeliana* appears to have slowed in Canterbury. There is an apparent contradiction between distribution and spread of the fungus as determined by these surveys and the finding that the fungus is present in trees pruned in the 1980s. More work needs to be done to explain this contradiction.

Figure 29. Known distribution of *N. fuckeliana* in June 2009.

Armillaria root disease

Armillaria root disease, caused primarily by *Armillaria novae-zelandiae*, remains widespread in many *P. radiata* plantations throughout much of the country. In second or third rotation stands mortality of young trees is less common. It was recently shown that significant growth loss during the first half of the rotation attributed to *A. novae-zelandiae* was not sustained in an older infested second rotation stand, possibly due to increased resistance in the larger trees. Monitoring the presence of the pathogen is still important, however, since past practice has demonstrated that inappropriate management can lead to severe losses. It was also shown that although early thinning led to an increase in the level of stand infection, presumably because thinning-stumps provide additional food base for the pathogen, later thinning had no effect on disease incidence. Thinning, therefore, provides no benefit, and the best control is still to remove previous-crop stumps prior to planting. It has also been shown that early losses can be reduced by planting with robust stock. However, a series of preliminary trials suggests that selection for genetic resistance may not be rewarding. Current research is examining the effectiveness of selected decay fungi for ability to compete with *A. novae-zelandiae* in the woody substrate as potential biological control agents.

Biological degrade following storm damage

Pinus radiata plantations are periodically subject to wind or snow damage leading to uprooting and breakage. There may be substantial financial losses from cosmetic degrade due to bark beetle and fungal attack before stems can be salvaged. Despite the risk, virtually no quantitative data are available on the rates at which degrade accrues following such destruction. A monitoring trial was established at five locations across an affected area shortly after snow and wind storm events during late winter in one South Island forest. The purpose was to provide forest managers with reliable information on periods available for log salvage following such occurrences. Provisional results indicate that moisture content decreased, and sapstain increased, more rapidly in snapped stems than in those in fallen trees that remained rooted. However, sapstain developed significantly only after 5-6 months in snapped stems, and not until moisture content fell below 100%. Sapstain in rooted trees (the majority) remains low nearly one year after the storms. Although bark beetles were trapped in large numbers over the first summer, attack to fallen stems did not occur during the first 6 months. An isolation programme is being undertaken in order to quantify and identify the stain and decay fungi present in fallen stems.

Pseudotsuga menziesii (Douglas fir)

Diseases

Phaeocryptopus gaeumannii (Swiss needle cast disease)

Swiss needle cast disease (*Phaeocryptopus gaeumannii*) was again recorded throughout New Zealand and remains the most significant disease of Douglas fir. Samples from a second survey undertaken in 2007 as part of a collaborative project to relate severity of infection with site and climate are being processed in the laboratory. All data will be used to derive a model to provide short and long term disease risk predictions.

Eucalyptus spp.

Insect pests

Chrysomelid leaf beetles

The eucalypt tortoise beetle *Paropsis charybdis* (Chrysomelidae) continues to be a major pest, particularly in *Eucalyptus nitens* plantations. Some forest managers continue to aerially spray their stands to control the pest. Work on the biological control of *P. charybdis* has found that the main biological control agent, *Enoggera nassaui* (Pteromalidae) continues to play a significant role in the control of *P. charybdis* throughout New Zealand. A second, self introduced parasitoid of *P. charybdis*, *Neopolycystus insectifurax* (Pteromalidae), is now known to have extended its North Island range from Northland to at least the Bay of Plenty and Gisborne and also occurs in the Marlborough, Kaikoura and North Canterbury regions of the South Islands. Like *E. nassaui* however it appears to be more effective against the second *P. charybdis* generation than the first (spring) generation. The self introduced hyperparasitoid *Baeonusia albifunicle* (Encyrtidae) is now also present in areas between the Northland and Taupo regions and Gisborne, as well as through the central South Island as far south as Roxburgh in Central Otago. Effective parasitism by *E. nassaui* is reduced by this hyperparasitoid but *N. insectifurax* remains free from attack. As a result the biological control of *P. charybdis* will not necessarily be reduced due to the presence of the hyperparasitoid but this has not as yet been assessed in the field.

Uraba lugens (gumleaf skeletoniser)

Uraba lugens (Nolidae), the gumleaf skeletoniser, is widespread in the greater Auckland region, as far north as Warkworth, and also in the Waikato region, and at Mt Maunganui in the Bay of Plenty, and at Whangapoua Harbour in the Coromandel. No further range expansions have been recorded over the past year. It has not yet been reported as a concern in commercial plantations, and is causing significant damage only in the Auckland region.

Uraba lugens has been recorded on 53 tree species in New Zealand, mainly from the genus *Eucalyptus* and related Australian myrtaceous species *Corymbia, Agonis, Angophora, Callistemon, Lophostemon* and *Tristanopsis.* It has caused significant damage in New Zealand on *Lophestemon confertus* and a variety of *Eucalyptus* species in amenity plantings. Twenty four of the 53 hosts recorded in New Zealand are new associations that have not been recorded as hosts of *U. lugens* in its native range. This includes minor feeding observed on New Zealand native *Metrosideros* species. Also notable are feeding records from eight deciduous Northern Hemisphere species from six different families (*Betula pendula, Fagus sylvatica f. purpurea, Fraxinus excelsior, Liquidambar styracifula, Populus* sp., *Prunus domestica, Quercus coccinea* and *Q. palustris*). The degree of impact on these species has not been quantified but appears minor and significant damage has only been recorded on *B. pendula*. However, as all these species are deciduous, they are only susceptible to the summer generation of *U. lugens* in New Zealand and the insect must return to evergreen hosts for the winter generation.

Research into biological control of *U. lugens* is ongoing. Of four candidate parasitoid species initially imported for testing, one species, *Cotesia urabae* (Braconidae) is currently the focus of biological control research, with host range testing completed and data currently being analysed in preparation for an application to the Environmental Risk Management Authority to introduce the agent**.** Stem injection of insecticides to control *U. lugens* is being used by the Auckland City Council to protect its amenity trees.

Diseases

Phaeophleospora and Mycosphaerella leaf disease

Phaeophleospora eucalypti (agent of septoria leaf blight) and mycosphaerella leaf blotch (primarily due to *M. cryptica*) continue to be the cause of the most serious foliage disease in *Eucalyptus nitens* plantations. A set of meteorological stations is being used to monitor climate variables in healthy and diseased stands of *E. nitens* affected by *K. eucalypti*, in order to help identify sites where this species may be grown successfully.

Cypresses

Diseases

Seiridium spp. (Cypress canker)

Cypress canker, caused by two species of *Seiridium* continued to cause damage in many cypress stands throughout the country, particularly *Cupressus macrocarpa*. A recent study in a young stand of this species indicated that pruning should be undertaken judiciously if there is substantial disease already present.

NURSERIES

Over the past two years, treatments for *Phytophthora* control of *Pinus radiata* were investigated in forest nursery trials. The trial area had a history of root disease that had not responded to an early-season single application of metalaxyl. Chemical and biological options were tested. The most effective treatment in both trials was phosphorous acid. Four monthly phosphorous acid applications from February reduced mortality to less than 1%, with only 0.1% disease incidence when seven applications were made at fortnightly intervals from February to May. Metalaxyl was more effective when applied at root pruning than at germination but did not provide the same level of control as phosphorous acid. *Trichoderma* seed treatment was not effective, possibly because the wet conditions in the trial area that favour pathogen development would be unfavourable to *Trichoderma* spp.

INDIGENOUS FORESTS

A joint agency response group has been formed to mitigate the impact of Phytophthora Taxon Agathis (PTA) on kauri (*Agathis australis*) and this got underway in October 2008. The joint agency consists of MAF Biosecurity New Zealand, the Department of Conservation along with the four regional councils that have kauri blocks within their territories. A Technical Advisory Group has been established to consider the science and

research questions around the response. Further research has been commissioned in three main areas – detection, symptoms and control.

BIOSECURITY

Post-border (eradication)

Dutch elm disease

The 2008/2009 control programme consisted of one continuous disease detection survey over the summer and a trapping programme in high risk areas to determine sources of infection or large amounts of breeding material. The first and only diseased elm was identified from Otara Reserve in south-east Auckland on 22 January 2009. A total of 51 traps was deployed in the Greater Auckland region for the entire season. Traps were inspected every week from 27 November 2007 to 2 April 2008, then on 13 and 27 April and 18 May 2009. A total of 3,013 beetles was trapped in the 2008/2009 season, of which two traps caught 11% of the total each. These were in West Auckland and in Pakuranga to the east of Auckland. No particular trends in distribution of beetle numbers or timing of catches were apparent. The most significant finding was that *Ophiostoma novo-ulmi* was not obtained from any of the beetles trapped: a first since 1998/99. Distribution of diseased trees found in the Greater Auckland region since 1989 is presented in Fig. 30.

Post-border (new records)

The following new records were validated and investigated in 2008/2009.

- *Pythium sylvaticum* was obtained from soil baited with rhododendron leaves when testing for presence of *Phytophthora* spp. The ITS region of the genome gave a 100% match with sequences of *P. sylvaticum* recorded in GenBank. *Pythium sylvaticum* is recorded in the Landcare Research Fungal Database as "occurrence uncertain". Vaartaja (1975) mentions an isolate from Auckland, New Zealand in his paper reporting *P. sylvaticum* in Canadian forest nurseries but does not reference it further. The USDA fungal database did not include New Zealand in the distribution list. *Pythium sylvaticum* is reported to cause damping-off of *Pinus resinosa* seedlings and to be slightly virulent to seedlings of other pine species in Canada. There are other references to it causing disease of conifers and there is a wider host range reported. It is recorded as a cause of rot of carrots and potatoes.
- *Antonina socialis* (Pseudococcidae) was found on *Bambusa multiplex*. This mealybug was first described from Broxbourne in southeast England on *Arundinaria japonica* (a species of bamboo) growing under glass. It is also found in Bermuda, China, Hawaii, Hong Kong, Japan and the continental USA. All recorded hosts are species of bamboo (see *Forest Health News 189*: 1).
- *Obolodiplosis robiniae* (Cecidomyiidae) on *Robinia pseudoacacia.* The larva of this cecidomyiid fly cause leaf margin "rolls" or "galls". The only known host is *R. pseudoacacia.* It is native to eastern North America and is also established in Europe, Korea and Japan.

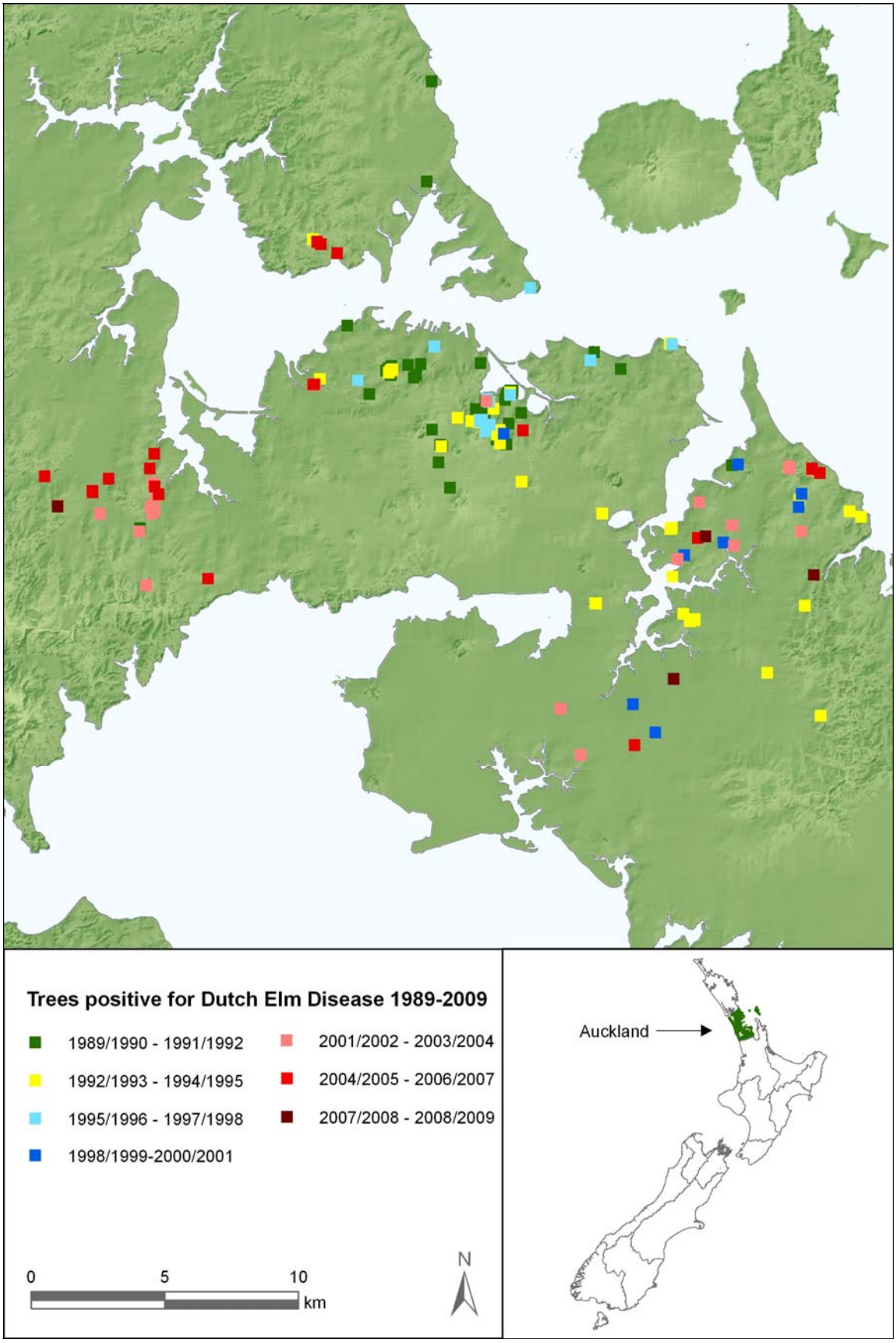

Figure 30. Location of Dutch elm diseased trees 1989/2009.

Biological control of buddleia

The buddleia leaf weevil, *Cleopus japonicus* (Curculionidae), a biological control agent for the weed buddleia (*Buddleja davidii*), was first released in New Zealand in spring 2006. Five field release sites have been established in commercial forests in the North Island. These were selected to maximise the climatic range the weevil might encounter in areas with buddleia in New Zealand. A total of 1000 weevils was released at each site from October 2006 to January 2007 and sites have been closely monitored to determine weevil survival, dispersal and life history at each site.

Buddleia leaf weevil has established at all sites and feeding damage to buddleia has exceeded expectations, with some individual plants estimated to be more than 95% defoliated in April 2008 and were again heavily defoliated in April 2009.

Weevil dispersal onto small buddleia seedlings planted at set distances from source buddleia has been tracked for one season and will continue for another season. Weevils were found on seedlings 1km from the source buddleia in April 2009. This trial will help to determine whether damage from the weevil is sufficient to reduce the growth of buddleia in the first two years of growth. The weevil has recently been released at two new sites on the edge of newly planted *P. radiata* stands to better understand weevil dispersal and the potential for this agent to suppress young buddleia in a commercial forest setting. This forms part of the work towards an Integrated Pest Management plan for buddleia. Preliminary laboratory studies on the impact of a range of herbicides commonly used in forestry, on the weevil have indicated there is no impact of the chemicals on adult survival or reproduction. However, small larvae may be killed by some chemicals. Further work will be undertaken on this.

RECENT PUBLICATIONS AND WEBSITE FEATURES:

The monthly Scion publication *Forest Health News* can be viewed on line. See:

www.foresthealth.co.nz.

To subscribe to this newsletter electronically, contact john.bain@scionresearch.com

The New Zealand Farm Forestry Association has extended and updated its website on the pests and diseases encountered in New Zealand's forests. The information has been compiled from the complete archive of Scion's Forest Health News, the Forest Pathology and the Forest and Timber Insects Leaflets and other material drawn from miscellaneous reports. The web address has changed and is now:

http://www.nzffa.org.nz/farm-forestry-model/the-essentials/forest-health-pests-and-diseases/

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