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 2009/2010

October 2010

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Key Issues and Threats

New South Wales

In late April a suspect Emergency Plant Pest (EPP) was identified from a cut flower grower on the Central Coast of NSW. It was identified as *Uredo rangelii* (Myrtle rust), an exotic rust that is a member of the guava rust complex. After initially declaring Myrtle rust an EPP, the Emergency Response was "stood down" by the National Management Group, whereby NSW (I&I NSW) decided to continue the response. The Forest Science Centre has lead surveillance of myrtle rust and containment operations for the ongoing emergency response. We have also conducted host testing, which has expanded the host range to include important commercial species (*Eucalyptus pilularis, E. cloeziana, E. agglomerata* & *E. grandis*). [NB: the Emergency response was re-initiated in July 2010]

A new and emerging health issue has been identified in eucalypt plantations: spotted gum canker in *Corymbia* spp. plantations. Several species of stem fungi have been identified, including *Caliciopsis pleompoprha,* and surveys are continuing to determine the distribution and severity of the disease.

Ips bark beetles are still an issue in trap trees used for the Sirex biological control program. Ongoing research is looking at the distribution and impact of the problem, investigating aspects of the interactions between the insects, fungi and nematodes involved, and attempting to identify and test management options.

Queensland

The increased detection of Sirex wasp in Queensland is of major concern to the health of pine plantations in Queensland. This coming flight season it is envisaged that Sirex will emerge in much larger numbers, thus it is critical that the bio-control nematode is successfully introduced. The success of trap trees in attracting Sirex is the key to the early control in FPQ's plantations, as trap trees struck by Sirex will be inoculated with the nematode, with emerging sterile Sirex carrying the nematode to new host trees and other Sirex larvae.

The detection of a stem canker pathogen occurring on teak in north Queensland is of concern to an emerging issue. The identity, host range (teak varieties) and distribution within plantations needs to be determined.

Quambalaria shoot blight continues to be a major problem in the establishment of spotted gum plantations. The development of a screening program to select for resistance and enable the establishment of a seed orchard is reliant on continued industry funding.

Myrtle rust is obviously a significant threat to commercial and native forest species in subtropical and tropical regions of Queensland. Restricted plant movement has been enforced and surveys will continue to take place in an attempt to reduce the risk of spread into Queensland.

Victoria

In softwood plantations, an emerging issue concerns the impacts of Ips bark beetle in general, and more specifically, their impact on Sirex trap tree plots and the associated implications for the Sirex monitoring and biocontrol program. It is anticipated the research project initiated by the National Sirex Coordination Committee as part of an ARC Linkage Grant will address some of these concerns. The ongoing release of biocontrol agents in relation to the Monterey pine aphid *Essigella californica* is also of concern and requires ongoing monitoring to assess the agents establishment and efficacy. The high levels of rainfall received in the plantation regions in the second half of 2009 have greatly assisted in alleviating the impacts of drought experienced in previous years. However, the associated impacts of this rainfall on disorders such as Dothistroma also require assessment in light of such rainfall received.

In hardwood plantations, no major issues or threats have been noted apart from ongoing monitoring of existing pests such as autumn gum moth, chrysomelid leaf beetles and *Mycosphaerella* leaf disease, although the Steelblue sawfly was observed causing some damage in the western areas of Victoria. Within the native forest estate, key issues surround the establishment of a native forest health surveillance network and the efficacy of any system implemented in being able to adequately detect pest outbreaks. Within nurseries, *Phytophthora cinnamomi* (PC) remains a high priority to reduce the further spread of the pathogen and close pathways for spread of new *Phytophthora* species should they enter the industry. As previously indicated by the increased recent rainfalls, environmental conditions have been conducive to PC development.

Tasmania

The potential existence of sub-lethal growth impacts of *Phytophthora cinnamomi* in *Eucalyptus nitens* plantations were identified during the year. This is a matter of great consequence to the species-choice decision for future eucalypt plantations. Projected future climates for Tasmania further add to the significance of this issue. A high priority has been given to research that aims to determine the existence and magnitude of sub-lethal growth impacts.

South Australia

Ips grandicollis and drought continue to cause damage in Mid-North plantations.

The Shothole Miner (*Perthida* spp.) is becoming a major threat to E. globulus plantations, causing widespread damage. Numbers appear to be increasing across the whole Green Triangle region.

Western Australia

No significant outbreaks or new records of damage from pests or pathogens were recorded in Western Australia in the 12 month period from June 2009 to June 2010. However, in *Eucalyptus globulus* plantations the introduced chrysomelid beetle, *Paropsisterna m-fuscum*, has expanded westward. In native jarrah (*E. marginata*) forest, new outbreaks of gum leaf skeletonizer (*Uraba lugens*) occurred in the southern region and are being monitored. Monitoring the extent and impact of *Phytophthora cinnamomi*

in native forest, woodlands and coastal heaths and protecting threatened flora communities continues to be a priority.

New Zealand

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

Summary

New South Wales

In late April a suspect Emergency Plant Pest (EPP) was identified from a cut flower grower on the Central Coast of NSW. It was identified as *Uredo rangelii* (Myrtle rust), an exotic rust that is a member of the guava rust complex. After initially declaring Myrtle rust an EPP, the Emergency Response was "stood down" by the National Management Group, whereby NSW (I&I NSW) decided to continue the response. The Forest Science Centre has lead surveillance of myrtle rust and containment operations for the ongoing emergency response. We have also conducted host testing, which has expanded the host range to include important commercial species (*Eucalyptus pilularis, E. cloeziana, E. agglomerata* & *E. grandis*). [NB: the Emergency response was re-initiated in July 2010]

In pine plantations, most of the key pests were less damaging than the previous reporting period. Sirex still causes issues in key areas in Hume and Macquarie Region, but damage is lower than previous years and biological control has improved. Ips bark beetles are still observed attacking trap tree, and research is underway to investigate the impacts of this on the sirex biological control program and identify and test management options. Essigella was again widespread, but at lower levels than in previous years. Stands that had been severely defoliated last year (75-95% defoliation) have recovered with new growth. The Essigella biological control was released in several forests, and ongoing releases and monitoring of establishment is continuing. Drought was again an issue in Hume Region, with 7,500 ha affected.

In eucalypt plantations, a new and emerging health issue has been identified: spotted gum canker in *Corymbia* spp. plantations. Several species of stem fungi have been identified, including *Caliciopsis pleompoprha,* and surveys are continuing to determine the distribution and severity of the disease. *Cardiaspina* psyllids and *Creiis* psyllids

Queensland

The Sirex wood wasp was detected for the first time in Queensland on 10 February 2009. A single female wasp was intercepted in a static insect panel trap situated within the remnant private *Pinus radiata* plantations at Sugarloaf, approximately 20 km from FPQ's *Pinus* estate near Stanthorpe. The panel trapping program for the 09/10 flight season was extensive and in February 2010 the first Sirex within FPQ plantations at Passchendaele was detected. Further trapping established that the Sirex flight season within the Stanthorpe region was from late December through to late March, with the peak from mid to late March (as determined by numbers intercepted). The panel trapping program resulted is a further 44 Sirex being intercepted during the 09/10 flight season, using a total of 51 traps. This coming flight season it is envisaged that Sirex will emerge in much larger numbers, thus it is critical that the bio-control nematode is successfully introduced.

A Wildfire resulted in around 550 hectares of plantation being burnt including total canopy loss (15%), severe scorch with few - no green needles (80%) and scorch but upper canopy still green

(5%). Within six weeks of the fire large populations of *Ips* were present within the remaining unharvested timber.

Bacterial wilt (*Ralstonia solanacearum*) continues to be an issue for plantations in and around the Babinda/Tully regions. Low lying areas have the greatest percentage of trees affected and an extended wet season appears to have magnified the problem. A stem canker causing dieback and death of teak has been reported from areas around Tully and Babinda in north Queensland. The causal agent is yet to be fully determined although *F. solani* has been identified and is reported as causing stem cankers on teak in other countries.

Victoria

Within the softwood plantation estate, although Sirex has remained at relatively low levels across the state, isolated areas in North East Victoria still contained higher than acceptable levels of damage. The Monterey Pine Aphid continues to cause significant discolouration and defoliation across the state, with average levels of defoliation ranging from 20 to 40%. Monitoring is also required to determine whether or not defoliation continues in districts where biological control agent aimed at reducing levels and associated defoliation have been introduced.. *I.grandicollis* was not observed as a significant pest of Radiata pine plantations, with only two small areas in North East and South West Victoria affected. Dothistroma levels have decreased compared to previously recorded levels, while overall levels of Cyclaneusma needle cast rated between trace to low, primarily due to the pathogen generally only affecting older needles in the lower crowns of trees and prevailing environmental conditions. Diplodia damage was minor in nature and generally confined to either individual trees or small groups of trees around areas that had been affected over the previous years surveys.

Insect pests of eucalypt plantations such as Autumn Gum Moth, chrysomelid leaf beetles, longicorn borers and psyllids have generally tended to cause only minor localized damage in a small number of plantations although the steelblue sawfly was observed causing significant damage in both plantations and native forests in the west and south of the state. *Mycosphaerella* leaf disease was observed in Gippsland where it caused low to moderate levels of discolouration and defoliation. Increased *Phytophthora cinnamomi* damage was observed across the state, ranging across native forest, eucalypt and Radiata pine plantations. Environmental conditions, for the first time in 10 years, have been conducive to development with late summer and early autumn rains promoting development.

Surveys were conducted in East Gippsland native forests to evaluate recovery of trees from *U. lugens* defoliation in previous years, with surveys determining that although tree crowns were carrying less foliage, this was more a result of the ongoing effects of drought conditions rather than insect related defoliation. *Phytophthora cinnamomi* continues to be a focus for DSE as it implements a strategy for its management, while Mytle Wilt continues to cause some deaths of mature *Nothofagus cunninghamii* in rainforests across Victoria although at low levels. 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. In collaboration with DSE, research has also been completed in native forests of Victoria designing a health surveillance system methodology suitable for evaluating the health of forest canopies in a variety of forest types for implementation on Victoria's public lands. Monitoring of ports within Victoria continued for the Asian Gypsy Moth as part of a nationwide monitoring program, while the City of Melbourne continues to support surveys for Dutch Elm Disease (DED) in the main gardens and boulevards under their management.

Tasmania

Bark stripping by mammals, *Sirex* and wind damage were the most significant influences on the *P. radiata* estate this year. *Sirex* populations increased at several northern plantation sites resulting in the introduction of nematodes during the past two years. Bark stripping by browsing mammals was recorded across almost 813ha of *P. radiata* plantation, the largest area seen for a number of years. Wind storms in the north west and north east caused locally severe windthrow and stem breakage in pruned and thinned plantations. A rare outbreak of *Clenias* caused severe defoliation in a southern plantation last experiencing an outbreak 20 years ago. The state remains free of *Ips grandicollis*, while *Essigella californica* remains confined to the south of the state where it is causing little damage.

Rainfall was a major factor affecting the eucalypt plantation estate. Heavy winter and spring rainfall occurred in most parts of the state. Good rains continued through the summer and autumn in the north contributing to increased levels of Mycoshaerella Leaf Disease, particularly in the north-east. After the wet spring, the south experienced record low rainfall for the first half of 2010 causing localised drought deaths in vulnerable situations. Leaf beetle (*Paropsisterna bimaculata*) populations were comparable with previous years with 30% of monitored plantations having above threshold populations. Heavy rains in early summer and the activity of natural enemies were sufficient to reduce 16% of the over-threshold populations to below the economic injury threshold: The remainder of the over-threshold plantations were sprayed with α-cypermethrin. The area of plantation suffering leaf beetle defoliation, particularly severe defoliation, were lower lower than last year with damage concentrated in plantations beyond the age currently targeted by the leaf beetle IPM.

A rare outbreak of the cup moth *Doratifera oxleyi* caused widespread defoliation and mortality of *E. amygdalina, E. pulchella* and *E. tenuiramis* in south eastern Tasmania during the past autumn. L

An analysis of the pest and disease threats affecting the *E. nitens* / *E. globulus* species choice decision on State forest was completed. Research to provide proof-of-concept for lethal trap trees to manage leaf beetles progressed to operational evaluation this year. Concurrently, refinements to the existing leaf beetle IPM are being investigated. The impact of defoliation on growth in later-age plantations is being examined so that the age-

range targeted for inclusion in the IPM can be reviewed. A spatial analysis of historical leaf beetle populations is being done in an attempt to identify site and landscape characteristics that may be useful in developing a risk-based approach of targeting areas to include in the leaf beetle IPM.

South Australia

Sirex remains at a low level in all regions. Annual surveillance and inoculation is continuing.

Ips grandicollis is active in the Mid North plantations of Wirrabara and Bundaleer. These areas have been drought affected for a number of years. There has been an increase in deaths in younger plantations (2005 and 2006 plantations) this year, especially near clearfell areas where *Ips* has bred up in logging residue.

Aphid numbers have generally been low this year. Releases of the biocontrol agent, *Diaeretus essigellae*, were made in the South East of the State (Green Triangle). It is too early to tell if the wasp has become established, but parasitised aphids have been found in some locations. Releases will continue at selected sites.

Chlenias spp. damaged a young plantation in the South East Region. Damage was mainly to new growth and was greatest on the edge trees. Many larvae were killed by a viral disease.

Continuing drought conditions affected many plantations – mainly in the Mid North. Many deaths occurred in the younger plantations (1994, 1995 and 1999) but older plantations (1950, 1960 and 1970) have also been affected.

Due to changes in ownership and restricted access in 2009-2010, limited information is available on the health of eucalypt plantations. Autumn Gum Moth continues to cause damage in younger plantations.
Christmas beetles (*Anoplagnathus* spp.) caused extensive damage to some plantations in the Wattle Range area of the South East.Cup Moths have caused damage to isolated plantations in the Branxholme area (in South Western Victoria).

Shothole miner continues to cause concern and numbers appear to be increasing. It is present throughout the South east region and is causing considerable damage in many plantations.

Newly emerged seedlings planted on an ex-pasture site at Glencoe Nursery were attacked by False Wireworms (adults and larvae) (*Gonocephalum* spp.) and by crows.

Western Australia

No significant outbreaks or new records of damage from pests or pathogens were recorded in Western Australia in the 12 month period from June 2009 to June 2010. However, several existing pests have re-emerged or expanded their range.

In *Eucalyptus globulus* plantations, *Liparetrus* beetles, *Heteronyx* beetles and wingless grasshoppers caused most damage to seedlings and young plantings in spring. Parrots and rabbits were also common problems. *Heteronyx* beetles and to a lesser extent chrysomelid beetles and adult eucalypt weevils caused most of the damage observed in +3 year-old plantations during the prolonged summer. The introduced chrysomelid beetle, *Paropsisterna m-fuscum* (commonly called yellow-belly), has had a westward expansion of its range.

In native forest, dieback in jarrah forest caused by *Phytophthora cinnamomi* and tree decline in tuart and wandoo woodland continues to command attention. A total of 15,864 ha of forest and other native vegetation were surveyed and mapped by the Department of Environment and Conservation (DEC) for the presence of *P. cinnamomi*. In conjunction with the mapping, 1,581 soil and plant samples were tested to confirm the presence of *P. cinamomii*. Molecular techniques have identified at least 9 new *Phytophthora* taxa from previous sampling of which one, *P. multivora*, has been described and seven other species descriptions are in preparation. New outbreaks of gum leaf skeletonizer (*Uraba lugens*) were reported in the southern jarrah forest in the summer of 2009 and are being monitored.

New Zealand

Levels of dothistroma needle blight and cyclaneusma needle-cast of *Pinus radiata* were higher in 2009-10 than in 2008-09 but were still low in comparison to levels during the previous three years. The change in severity of Cyclaneusma needle-cast is partly attributed to the elimination of highly susceptible genotypes from the breeding population. Changes in within-stand distribution is likely due to the planting of material with a narrower genetic base.

The latitudinal range of *Neonectria fuckeliana* has not changed in the last two years. The fungus remains restricted to the lower half of the South Island.
There is evidence to suggest that the management regimes to control Nectria flute canker have resulted in a significant reduction in the number of trees affected.

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 and is present in the Waikato, Bay Plenty and Coromandel regions. 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, Industry and Investment NSW)

Forest Health Surveillance

Surveys by the Forest Health Survey Unit (FHSU) identify important pests, diseases, vertebrates, nutrients and weeds that may be limiting growth and establishment of pine and eucalypt plantations, and that may need further research. Continued forest health surveys are essential to monitor and increase our knowledge of known pests and diseases and the factors influencing development of damaging outbreaks. Regular surveys also increase the probability of early detection of new pests and disease, including exotics.

Forest Health reports provide plantation owners and managers with a summary of important pests and diseases in their plantations, with recommendation on remedial or control action where appropriate. In most cases these options are discussed with relevant field staff soon after the survey. Through surveys and research on improving pest and disease management strategies we assist Forests NSW with the task of implementing Ecologically Sustainable Forest Management Plans.

Plantations

Pinus spp

Aerial surveys were conducted over the majority of pine plantations. The main focus in Hume Region was mapping tree mortality, and so not all the estate was surveyed; and due to inclement weather and the helicopter being required for fire suppression, we were unable to survey the northern tablelands. The extent and severity of pests, diseases, vertebrate pests, climatic disorders, nutritional imbalances and weeds limiting growth or affecting survival were mapped and reported. The main health issues are discussed below.

Insect pests

***Sirex* wood wasp** continues to cause significant tree mortality in several State Forests in Hume Region, although with a slight decrease in the area affected from last year. Levels of damage were also lower in Macquarie Region. Low to moderate parasitism rates were observed in the biological control program, with an overall improvement from last year. *Ips* bark beetles (*Ips grandicollis*) continue to attack *Sirex* trap trees, potentially disrupting the biological control program. Recommendations on management for *Sirex* included increasing the biological control program in high risk areas.

Essigella californica (Monterey Pine Aphid) was again observed widespread in Hume and Macquarie Regions, although levels of damage overall were lower than last year. Stands that had been severely damaged (50–95% defoliation) in Hume in 2008-2009 (e.g. Couragago State Forest) have recovered with new foliage production, although growth is expected to have been affected. *Essigella* was observed for the first time at significant levels in some areas in Monaro Region (e.g. Craigie State Forest), with this area not normally significantly impacted by *Essigella*.

Tree mortality associated with **drought** was significantly higher in Hume Region in 2009-2010, with approx. 7,500 ha affected. Ground surveys revealed that the majority of damage was associated with drought stress and infection by *Diplodia* canker (*Diplodia pinea*). There was no indication of significant levels of *Ips* bark beetles associated with this tree mortality. Shape-files of the damaged area were supplied to the Region to assist with identifying the impact on wood production. Damage in other Regions was less severe compared to last year.

Pathogens

***Dothistroma* needle blight** was less severe than last year on the northern tablelands (Northern Region), although the area of affected plantation was not significantly different. This indicates a combination of effective management (fungicide application of the previous years' outbreak) and less conducive environmental conditions.

Vertebrate pests

Possums are still a significant issue in Monaro Region (Bombala estate), with continued damage in high risk areas. The level of damage was slightly lower compared to last year.

Hardwood plantations

An aerial survey was conducted in winter over a proportion of the post-1994 hardwood estate, mainly concentrating on larger plantations and priority or high risk areas. Ground surveys were conducted to follow-up aerial observations but to also observe current pest and disease activity and damage at various times of the year (spring, summer, autumn). Damage overall was lower than last year.

Insect pests

***Creiis* and *Cardiaspina* psyllids** caused less damage this year compared to previous years. *Cardiaspina* psyllids again caused widespread damage and defoliation in *Eucalyptus grandis* plantations in high risk areas on the north coast. *Creiis* psyllids caused less damage this year, due in part to the ageing plantations being less susceptible to this pest. Levels of damage from **stem borers** were again static, with most plantations with high risk species (e.g., *E. grandis*) affected to some degree. Damage from **herbivorous insects** was lower compared to last year, due mainly to a reduction in the area affected by gregarious saw fly larvae that was observed last year on the north coast. The area affected by the **winter bronzing bug** (*Thaumastocoris* sp.), which was reported for the first time last year, was also lower.

Pathogens

A new and emerging health issue has been identified: **spotted gum canker** in *Corymbia* spp. plantations. Several species of stem fungi have been identified, including *Claiciopsis pleompoprha,* and surveys are continuing to determine the distribution and severity of the disease.

Other

Other pests and diseases or disorders caused minimal damage, including Bell Miner Associated Dieback (BMAD, with levels of damage static) and leaf and shoot fungi.

Pest and Disease Management

Sirex

Operational management of the sirex biological control program has been made more efficient by the introduction of a decision support system to improve identification of optimum placement of trap trees, based on the risk of *Sirex* damage (age class, silvicultural history) and evidence of previous *Sirex* activity. This system can reduce the number of trap trees required (and cost) without increasing the risk of a *Sirex* outbreak. Work has begun on the Australian Research Council (ARC) and National Sirex Coordination Committee (NSCC) funded project investigating the impact of *Ips* bark beetles on the *Sirex* biological control program. Initial work involves conducting a national survey of trap trees plots to identify where (and what factors) *Ips* may be disrupting the biological control program.

Essigella

Release of *Essigella* biological control agent (*Diaretus essigellae*) has begun, with several releases already in Hume and Macquarie Regions. Follow-up monitoring has identified early establishment of the parasitic wasp. Further releases are planned throughout the pine estate.

Spotted Gum Canker

A small research project has begun investigating various aspect of the newly discovered spotted gum canker, including further taxonomic work to identify all species involved, and work determing the pathogenicity on a range of important eucalypt.

Eucalypt leaf spot fungi

Several new species of leaf spot fungi have been identified in plantations and native forests in eastern Australia, none of which are currently impacting significantly on plantations or native forests.

Forest Biosecurity

In late April a suspect Emergency Plant Pest (EPP) was identified from a cut flower grower on the Central Coast of NSW. It was identified as *Uredo rangelii* (Myrtle rust), an exotic rust that is a member of the guava rust complex. After initially declaring Myrtle rust an EPP, the Emergency Response was “stood down” by the National Management Group, whereby NSW (I&I NSW) decided to continue the response. The Forest Science Centre has lead surveillance of myrtle rust and containment operations for the ongoing emergency response. We have also conducted host testing, which has expanded the host range to include important commercial species.

Queensland

Geoff Pegg & Simon Lawson

Plantations

Sandalwood

Surveys of sandalwood and associated host tree species were conducted in 2010 in Kununurra, W.A., and far north Queensland.

Pests

Hairy caterpillars

Moderate infestations of hairy caterpillars are defoliating *Sesbania* trees in most plantations. A full identification is yet to be given.

Grasshoppers

Infestations of grasshoppers were identified causing moderate damage in plantations.

Loopers

Looper caterpillars were identified causing moderate to severe defoliation to *Alternanthera nana*in within plantations Larvae were collected and identified as *Cleora* sp. and *Ectropis* sp. Moths swarming around the *Alternanthera* were identified as adult *Cleora* sp. and *Ectropis* sp.

Sandalwood logs

Widespread and severe borer damage was detected on older harvested logs in storage areas. Three distinct sizes of exit were detected (Fig 1).

Different sized exit holes caused by borers. A weevil was extracted from the larger hole.

Largest exit holes, possibly Bostrichids.

Sandalwood roots with fresh fras indicating recent damage.

Bostrichid beetle found in Sandalwood. (Image provided by Elders Forestry)

Fig. 1 Borer damage on stored sandalwood logs

Pathogens

Cathornium umbellatum leaf blight - *Kununurra*

Chlorotic and necrotic lesions or blights were identified from Cathornium trees within the sandalwood plantings. Affected trees had sparse levels of foliage due to premature shedding of older leaves as a result of infection. The causal agent of the blight was identified as *Camptomeris albiziae*, a common fungal pathogen of *Cathornium* and *Acacia* species (legumes). Species of *Camptomeris* have been identified in tropical areas of Africa, India, Pakistan and Bangladesh. Two species have been identified in northern Australia on *Acacia mearnsii*; *Camptomeris albiziae* and *C. verruculosa*.

Fig 2. *Camptomeris albiziae*

Fig 3. Cankers associated with branch and stem dieback on Sandalwood trees in north Queensland

Sandalwood Canker

Dieback of sandalwood was identified in both 2008 and 2009 plantings. Stem cankers (Fig 3) were found to be associated with dieback in the 2009 plantings. Stem death appeared to initiate from the branches and extend down into the main stem. There was no evidence of canker formation at the root collar. The causal agent has not yet been identified.

Leaf blight of *Dalbergia* was moderate to severe within a nursery south of Cairns. The causal agent is yet to be identified but symptoms are characteristic of *Cylindrocladium*. The "shot hole" appearance has been reported from *Terminalia* sp. caused by *C. quinqueseptatum*.

Foliage pathogens causing minor damage were identified from all host species and included *Cylindrocladium* (most likely *quinqueseptatum*) and *Camptomeris albiziae*.

Teak

Pests

Teak defoliator/skeletoniser

Foliage damage ranging from minor to severe was identified from establishing trees in plantation teak north of Cooktown. Both the teak defoliator (*Hyblaea puera*) and teak skeletoniser (Fig 4) (probably *Paliga damastesalis* which has been recorded from northern Australia previously, although no larvae were present to confirm) were observed, with the skeletoniser causing most damage on both old and young trees and *H. puera* causing damage predominantly on younger trees. The beehole borer, *Xyleutes ceramicus*, has been recorded from Cape York in the past, but no damage was observed in these plantations.

Fig 4. Teal skeletoniser damage to young teak plantation near Cooktown, North Queensland

Pathogens

Fusarium solani

A stem canker causing dieback and death of teak trees ranging in age was reported from areas around Tully and Babinda in north Queensland. The causal agent is yet to be fully determined through pathogenicity testing. However, *F. solani* has been reported as causing stem cankers on teak in other countries.

Eucalyptus pellita

Bacterial Wilt

Bacterial wilt (*Ralstonia solanacearum*) continues to be an issue for plantations in and around the Babinda/Tully regions. Low lying areas have the greatest percentage of trees affected and an extended wet season appears to have magnified the problem. Further surveys will be conducted in 2010 to determine distribution and impact on productivity.

Leaf blight

Pilidiella leaf blight (*Pilidiella fragériae*) was identified as one of the causal agents of moderate levels of defoliation of *E. pellita* plantings in north Queensland. *Pilidiella* has not previously been associated with high levels of defoliation in eucalypts. However, levels of severe damage were recorded by regional foresters; in some cases infection levels exceeded 70% of the tree canopy. In later surveys *Cylindrocladium quinqueseptatum* was also identified within the plantations. This pathogen is known to cause significant levels of defoliation.

Research

Corymbia pest and disease management

Development of management options for Quambalaria Shoot Blight

Fungal Biology

Factors influencing the development and spread of *Q. pitereka* within plantations are now understood as is the infection process. The pathogen population is variable genetically and differences in isolate aggressiveness have been identified.

Disease screening methods

Methodologies for artificial screening of *Corymbia* spp. for susceptibility have been developed. Focus must now be on linking population genetics with variability in pathogen aggressiveness to optimise the screening program. Seed being produced from progeny trials should be screened to determine the level of susceptibility to *Q. pitereka*.

QSB plantation management

Identifying resistance to *Q. pitereka* through the optimisation of current breeding strategies by implementing artificial screening protocols is key to managing the disease. Identifying specific field sites favourable for disease development is also beneficial for disease screening.

Elucidating the biology, ecology and host relationships in the *Corymbia* complex for the erinose mite

Erinose mite biology
A single mite species (the undescribed *Rhombacus* sp. nov.) was initially thought to infest *Corymbia* foliage, but additional, co-occurring species, were discovered during our research. Up to seven eriophyoid species are now thought to be associated with *Corymbia citriodora* subsp. *variegata*, with two of these species dominant and likely to be responsible for most damage.

A methodology was successfully tested using field collected mites to infest mature seedlings/cuttings. This method has the potential to be developed into a crude screening method for evaluating mite susceptibility. Further research is required to refine the method so that results can inform germplasm improvement programs.

Natural enemies were extremely rare and this is probably a large contributor to the severity of mite damage and the build-up of large populations in plantations. Their conspicuous absence warrants further investigation

Dispersal
Adults are the dispersive stage, with most new leaves (76%) infested by movement from already infested branches. Mite movement within hosts is therefore primarily by crawling, with inter-host movement occurring via wind dispersal.

Mites are capable of rapid colonisation of plantations from outside sources on the prevailing wind, but subsequent spread within the plantation is dependent on the phenology and susceptibility of the host trees.

Damage
Infestation induces significant changes to leaf physiology. In particular, loss of chloroplasts and damage to the integrity of stomatal guard cells suggest that mites will substantially reduce photosynthetic efficiency in susceptible plantation species.

Quantifying the impact of pests and diseases on *Corymbia* complex productivity
Measures of 3 year old plantations where disease levels have been closely monitored indicate that infection by *Q. pitereka* significantly impacts on tree growth and form.

Insects and mites were responsible for between 30 – 50% of total crown degeneration in Corymbia taxa trials assessed, with up to 95% defoliation recorded.

A DYMEX™ model, ParopSys, was produced that provides a basic tool enabling forest managers to use the number of generations and seasonal fluctuations in abundance of damaging lifestages to estimate the potential impact of *Paropsis atomaria* prior to plantation establishment, and to predict the occurrence and duration of damaging lifestages in the field.

Identifying tolerance/resistance to key pests and disease and incorporating in advanced breeding programs for the *Corymbia* complex
Resistance or tolerance to *Q. pitereka* does exist within species of spotted gum. However, identification of this resistance at the provenance level is unrealistic and variability between seed-lots within all provenances has been identified. Optimising the current

breeding strategy through the implementation of a screening program is important for future selection programs.

Large between-site variation in damage to *Corymbia* taxa was found that may be related to variation in insect pressure, site quality and other environmental factors.

Trade-offs were found in relative resistance and susceptibility to insect pests.

Physical foliar traits, chemical profiles and field and laboratory feeding preference to *Paropsis atomaria* suggest an additive inheritance pattern.

Static Trapping

The Multiple Pest Surveillance Program (MPSP) is a nationally coordinated surveillance program administered by The Office of the Chief Plant Protection Officer (OCPPO) DAFF. The primary objective of the program is to provide evidence of absence for selected serious pests that are exotic to Australia; and to provide data on pests that are present in Australia that may be subject to changes in distribution due to climate or environmental change.

Under the program a Forest Pest trapping program is operated in Queensland targeting a range of wood boring insects. Static intercept panel traps baited with a generalist α pinene lure are operated at a number of sites considered to be a risk for pest entry During 2010 traps were set at two sites in North Queensland, three in Brisbane, and two in the wider southeast Queensland region, and run for six week blocks. Setting and maintenance of traps was carried out by Biosecurity Queensland. All specimens within the following taxa were removed and identified: Scolytinae, Platypodinae, Cerambycidae, Bostrichidae, Buprestidae. Voucher specimens of all species have been retained in the Queensland Forest Insect Collection.

In total 2852 specimens from 25 species of interest were collected; 1713 specimens in 14 species from North Queensland, and 1139 specimens in 21 species from southeast Queensland. No species identified were of quarantine concern and all have been previously recorded from Australia. Eleven of the species trapped, are exotic species which have previously established in Australia.

Paropsis atomaria dispersal and modelling

Work is continuing to determine timing and extent of dispersal of the leaf beetle Paropsis atomaria. No marked beetles were recaptured using mark-recapture techniques, so our attention has turned to alternative methods of inferring the timing or extent of dispersal. One study has been investigating the physiological readiness of beetles to disperse at the end of the growing season (April-May) and has been tracking movement of sexually transmitted mites between beetles in order to infer dispersal of beetles within a plantation throughout the season. We are also investigating the extent and timing of P. atomaria colonization events into young plantations. The results from these studies will then be incorporated into an updated DYMEX model.

Stem defect risk modelling

The Plantation Hardwoods Research Fund project "Impact of stem defect agents on wood quality in subtropical hardwood plantations" will now start in November 2010, after some lengthy contractual delays. Spatial mapping data and plantation data are currently being collated to assist with site selection and an initial literature review has begun that will assist in selecting potential environmental correlates of stem defect to test.

International Projects

ACIAR project "Establishing Pest Detection Systems in South Pacific Countries and Australia"

This project, a collaboration between DEEDI, Forestry Tasmania and the Forestry and Quarantine agencies in Fiji and Vanuatu, was completed in May 2010. Key outcomes of the project for our Pacific partners included: pest detection systems now part of ongoing operational plans in the collaborating countries; preservation of the Fiji forest insect collection as a resource for the Pacific, and enhanced collaboration and cooperation between forestry and quarantine agencies. Outcomes of the project for Queensland included the successful testing and deployment pest detections systems suited to subtropical and tropical climates. These systems were demonstrated to be particularly effective in trapping key target forest biosecurity threats in the following groups: bark beetles, ambrosia beetles, longicorn beetles, buprestids, bostrychids and siricid wasps. The project has contributed significantly to Queensland's capacity to detect exotic forest biosecurity threats early and enable a rapid response, important in enhancing the possibilities for eradication as an option, as well as strengthening 'over the horizon' surveillance linkages with our Pacific partner countries.

CARD AusAID project "Protecting productivity, incomes and trade through improved health surveillance of Vietnam's plantations".

This two-year project in collaboration with the Office of Chief Plant Protection Officer of DAFF and the Forest Science Institute of Vietnam (FSIV) has now been completed. The project trained FSIV and MARD staff in forest health survey methodology and basic identification, developed and implemented a forest health database & field form system, curated and preserved the FSIV forest insect collection, set up early warning/rapid response trapping systems and established of a forest health network across 3 regional centres. The final component of the project resulted in the publication of a field guide ("Healthy Plantations: A field guide to pests and pathogens of Acacia, Eucalyptus and Pinus in Vietnam") in English and Vietnamese, as well as a series of pest fact sheets and posters for use in regional offices. Publication of the field guide and extension material will help plantation managers, operational staff and researchers in Vietnam to identify and manage pests in small and large-scale plantations.

Biosecurity

Suzy Perry/Fiona Giblin (Biosecurity Queensland)

Myrtle rust

"Myrtle rust" surveys have been conducted in a number of nurseries following the outbreak of rust in NSW. Nurseries were selected based on trace forwards of plant material moved from IP's in NSW with all plants retrieved and destroyed where possible. Areas of native forest surrounding bee hives moved from IP1 prior to a quarantine status being implemented were also surveyed. Surveys of "backyards" were also conducted based on reports from the general public following a newspaper article on the disease. "Myrtle rust" has not been detected from any sites in Queensland but surveys will continue.

ForestryPlantationsQueensland Pty Ltd

Plantation Health and Biosecurity

2009_2010 RWG7 Report

Michael Ramsden [1]

12 October 2010

[1] Plantation Health Officer, Forestry Plantations Queensland Pty Ltd

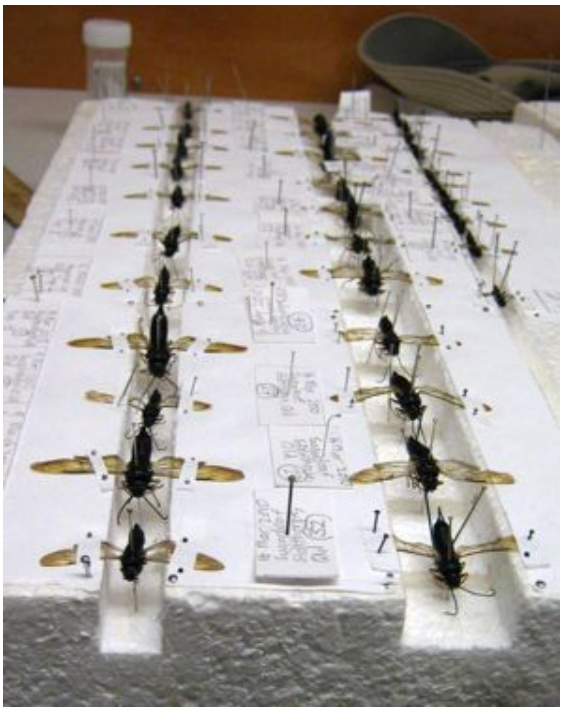
Forestry Plantations Queensland Pty Ltd (FPQ) undertakes routine plantation and nursery health surveillance (including site specific "call outs") throughout its exotic *Pinus*, native *Araucaria* and hardwood (*Eucalyptus* and *Corymbia*) plantation estates. Additional diagnostic and laboratory support, principally by Brisbane-based Plant Pathology staff within the Department of Employment, Economic Development and Innovation (DEEDI), enhances FPQ's in-house capabilities.

The recent and increasing detection of Sirex in Queensland's southern border region has resulted in this area being prioritised with subsequent reduction in general ground-based surveillance activities elsewhere. Exceptions include the investigation into and control of the destructive *Tiracola plagiata* caterpillar ('army worm') outbreak in several young hoop pine plantings in south east Queensland, monitoring of insect activity following a large wildfire within the exotic *Pinus* estate just south of Maryborough, involvement and monitoring of Queensland releases of the *Essigella californica* bio-control wasp *Diaeretus essigellae* and follow-up work associated with the detection of a Myrtaceous Rust in NSW.

EXOTIC PINE

Sirex wasp (*Sirex noctilio*)

The Sirex wood wasp was detected for the first time in Queensland on 10 February 2009. A single female wasp was intercepted in a static insect panel trap situated within the remnant private *Pinus radiata* plantations at Sugarloaf, approximately 20 km from FPQ's *Pinus* estate near Stanthorpe. Following the detection panel trapping was expanded throughout Sugarloaf and into FPQ plantations at Passchendaele (Stanthorpe region), Gambubal (east of Warwick), Pechey and Geham (Toowoomba region). Panel traps were also established at nearby sawing and log storage facilities. In addition, trap tree plots were established at the detection site and throughout the Passchendaele plantations. FPQ's response was



Sirex panel trap intercepts 2009/2010

guided by NSCC[1] operational guidelines. This expanded effort did not result in any further interceptions during the 08/09 flight season.

Throughout the year following the initial detection a large range of reporting and consulting activities were undertaken. Field surveys for struck trees were extended, bio-control nematode and chemical supplies organised, additional field training undertaken in NSW, an emergence and monitoring facility was established at Passchendaele and digital aerial imagery was captured over Sugarloaf and Passchendaele.

The panel trapping program for the 09/10 flight season was extensive and in addition trap tree plots were again established throughout the Passchendaele estate. On 7 January 2010 another 2 female Sirex were caught in separate panel traps at Sugarloaf and on 25 February 2010 the first Sirex within FPQ plantations at Passchendaele was detected. Further trapping established that the Sirex flight season within the Stanthorpe region was from late December through to late March, with the peak from mid to late March (as determined by numbers intercepted). The panel trapping program resulted is a further 44 Sirex being intercepted during the 09/10 flight season, using a total of 51 traps. The 09/10 trap tree plots failed to attract Sirex "strike" since trees died prior to Sirex emergence. Following the flight season extensive surveys were undertaken to locate naturally struck trees, but these proved elusive with only a few being found within Sugarloaf. The bio-control nematode (*Beddingia siricidicola*) was introduced into these trees with a small number of the parasitoid wasps, *Ibalia* and *Megarhyssa,* also released at Sugarloaf and Passchendaele.

Strategies and preparations are in place for the 10/11 flight season. Trap tree plots will be established in each of the five logging areas within the Passchendaele estate. A reduced number of panel traps will be established at Passchendaele with Sirex interceptions in these giving an indication of when trap trees should be inspected for strike. As Sirex can fly long distances and be moved artificially in unprocessed logs, static trapping will be extended to the coastal exotic pine estates at Beerburrum and Toolara in south east Queensland.

This coming flight season it is envisaged that Sirex will emerge in much larger numbers, thus it is critical that the bio-control nematode is successfully introduced. The success of trap trees in attracting Sirex is the key to the early control in FPQ's plantations, as trap trees struck by Sirex will be inoculated with the nematode, with emerging sterile Sirex carrying the nematode to new host trees and other Sirex larvae. In addition, limited silvicultural thinning has been initiated within Sirex susceptible compartments to remove vulnerable host trees within and/or negate the development of such trees. It is hoped that further large scale releases of parasitoid wasps combined with nematode introduction and enhanced silvicultural practices will ensure that Sirex populations remain at a level that does not significantly impact on plantation productivity and profitability.

Monterey Pine Aphid (*Essigella californica)*

1 National Sirex Co-ordination Committee

Empty mummified *Essigella* casings following parasitism by *Diaeretus*.

Monterey pine aphid has been associated with extensive defoliation and growth losses in *Pinus radiata* plantations in south-eastern Australia since it was first detected in 1998. Within FPQ estates needle cast normally attributed to seasonality appears to be pronounced in areas where *Essigella* numbers are high, such as at Passchendaele near Stanthorpe where *Essigella* numbers have remained very high for an extended period. In southern states *Essigella* numbers have declined dramatically in the cooler winter months in *Pinus radiata* plantations whereas at Passchendaele they remained at levels that supported the further introduction of wasp parasitoids.

FPQ is a co-investor in the FWPA project "Introduction of the wasp *Diaeretus essigellae* for the biocontrol of pine aphid (*Essigella californica*) in Australia". To date there have been seven separate releases of the biocontrol wasp in young (3 to 6 year old) plantations in Queensland including five at Passchendaele (in *Pinus taeda*) and two at Beerburrum in coastal south east (in *Pinus elliottii* var. *elliottii* × *P. caribaea* var. *hondurensis* hybrids).

Initial releases were in summer, then mid winter and finally late winter/early spring. *Essigella* numbers present at release times remained very high up until the July Beerburrum release where they declined but were still easily detectable. At the time of the July Passchendaele release *Essigella* dislodged from branches covered white collection sheets (black with aphids). *Pinus taeda* in these areas were also visually black as foliage was covered in sooty mould (fungi). This mould growth is believed to be a consequence of the abundant production of a sugary "honeydew" food source which is excreted by the *Essigella* as they feed on needle sap. The August Passchendaele release was undertaken at a time when specific surveys had to be undertaken to locate a site where adequate *Essigella* numbers were present to support the release.

Assessment of the successful establishment of *Diaeretus* is ongoing with very early indications (in the form of mummified *Essigella*) being found at release sites and some kilometres into the plantations within the Passchendaele estate. FPQ undertook a small netting

Covered biocontrol release bag containing mummified *Essigella*.

trial at the time of the June Passchendaele release where industrial insect netting was used to try and restrict emerged *Diaeretus*. The aim was for the *Diaeretus* to parasitise *Essigella* present and so provides evidence of field survival/success. Observations were that *Essigella* passed freely through the tight weave of the netting with the presumption that *Diaeretus* could do the same. Two months following trial establishment branch needles within were examined for evidence of mummified *Essigella*, but none were found. Examination of the release bags showed that *Diaeretus* had emerged in number therefore this trial provides further evidence that *Diaeretus* disperse readily following emergence. Wide dispersion will likely mean that it will take considerable time before high parasitism is detected within the wider plantations. Other Committee members have demonstrated that multiple releases onto the same tree have resulted in significant parasitism of resident *Essigella*. It is likely that wind plays an important role during the emergence/dispersal period.

The Research Coordinator of HVP Plantations (Sue Shaw) and co-member of the Steering Committee monitors and documents the establishment success of the biocontrol releases throughout Australia. Results are progressively being reported back to the co-ordinator to assist national reporting.

Post wildfire monitoring for the 5-Spined Bark Beetle (*Ips grandicollis)*

At around midday on 14th October 2009 under very high fire danger conditions, a fire commenced on council dump lands in remnant native vegetation (*Banksia*, *Melaleuca* and *Xanthorrhoea*). It quickly developed into a wildfire that crossed the Maryborough-Cooloola Road with ease and entered FPQ's mature slash pine plantation estate in Melaleuca Logging Area, Tuan State Forest. By late afternoon, the fire was contained by ground crews and several helicopters, as well as a fortunate drop in wind strength. It resulted in around 550 hectares of plantation being burnt including total canopy loss (15%), severe scorch with few - no green needles (80%) and scorch but upper canopy still green (5%). Immediately following the fire salvage logging was commenced with removals based on severity of scorch i.e. harvested from most to least severe scorch. Since the devastating 1994 September and November Beerburrum wildfires in south east Queensland salvage operations have concentrated on the swift removal of affected timber with no attempts to store logs (e.g. under water spray) for delayed processing. The exotic 5 Spined Bark Beetle *Ips grandicollis* quickly infests such timber, usually being visually detectable in the lower butt of the stem within 6-8 weeks following the event. The symbiotic fungus *Ophiostoma ips* is carried by this bark beetle and causes blue-staining throughout the timber over a short period of time, reducing economic returns further.

Static insect panel trap baited with generalist attractant lure post wildfire.

Following the wildfire insect panel traps were established using *Sirex* lures as these lures have proved to be excellent generalist beetle attractants. In addition to the panel traps periodic transect surveys were undertaken to detect and monitor the establishment of damaging boring and bark beetles. Within six weeks of the fire large populations of *Ips* were present within the remaining unharvested timber. *Ips* presence was confirmed by multiple pin-like exit holes in the bark and by

its typical red/brown frass which was commonly clumped in bark fissures or heaped at the stem base. *Ips* presence was confirmed within the panel traps prior to them being detectable in the stems.

The fungus *Neurospora* was found intermittently following the wildfire with it growing and covering stems and bare ground. The pink coloured growth of *Neurospora*, which is of no consequence to timber quality, is a common sight following wildfires with it also a common surface growth on CCA treated round timber stored in sawmills stacks. Bees (native & exotic) are frequently observed collecting the spores of *Neurospora* in-lieu of pollen. Due to the speed of the salvage operation that targeted in the first instance the most severely scorched stems i.e. those most attractive to *Ips*, no significant blue-stain was encountered. Blue-stain was found to be well established in a few areas that were harvested much later.

Cyclone damage Cathu State Forest

In March 2010, tropical cyclone Ului crossed the coast near Proserpine and damaged approximately half of the 460 ha of mature *Pinus caribaea* var. *hondurensis* (PCH) plantation at nearby Cathu State Forest. Hoop pine plantations on the leeward side of the range were relatively unaffected. Damage to plantation PCH was extensive and similar to that experienced in March 2006 when tropical cyclone Larry affected north Queensland plantations at Ingham-Cardwell on the coast and on the Atherton Tablelands west of Cairns. Salvage operations commenced in early August and it is hoped to harvest most of the damaged resource, estimated at 50,000m3 by December 2010. Blue stain and borer damage is evident in the salvage logs, but is hoped this will not cause significant problems for the proposed export sale.

HOOP PINE: *Araucaria cunninghamii*

Mass beetle defoliation

During the summer of 08/09 and again in 09/10 beetles emerged on mass from retained clear-fall harvesting residues in the Mary Valley (Gympie region) through to Bulburin near Monto, central Queensland. These beetles primarily defoliated only the margins of adjacent young plantation hoop pine. In places they also defoliated mature plantation hoop retained within gullies as well as hoop pine and bunya pine (*A. bidwillii*) in surrounding retained vegetation. Plantation losses were minimal with the majority of defoliated trees eventually recovering.

Twelve insects were found causing this defoliation, most being specific to hoop pine and only two being generalist host grazers. The insects involved were *Prospheres aurantiopictus* Buprestidae (Hoop Pine Jewel beetle), *Araucariana queenslandica* Buprestidae (Hoop Pine Jewel beetle), *Temnosternus imbilensis* Cerambycidae (Longicorn beetle), *Temnosternopsis niveoscriptus* Cerambycidae (White-inscribed Longicorn beetle), *Illacuris laticollis* Curculionidae (Hoop Pine Weevil), *Eriococcus araucariae Hemiptera* "bug" *(*Hoop Pine Branch Galler a non-lerp forming Scale insect), *Brachybelus undulates* Curculionidae *(*Hoop Pine Branchlet Galler Weevil), Belidae Curculionidae (small Weevil found in Hoop Pine cone cores) and *Aesiotes notabilis* Curculionidae (Hoop Pine Root Weevil). The Non-specific grazing insects were

Disterna plumifera Cerambycidae (Longicorn beetle) and a Katydid Tettigoniidae (Bush Katydid).

All these beetles have in the past been regarded as secondary pests with no such defoliation and especially such a mass emergence recorded previously within hoop plantations. A long period of drought followed by substantial rainfall is believed to have been the "environmental trigger" for the mass emergence of these hoop-specific insects. Litter retention, particularly large hoop pine stem sections, assists in sustaining populations of forest "pests", as many species of beetles lay their eggs in this detritus where their larvae feed eventually emerging as adult beetles. The beetle populations eventually collapsed with the parasitic clavicipitaceous fungus *Beauveria* sp. aff. *bassiana*, assisting this collapse by parasitising and killing a range of beetle species (numerous new host species records).

Mass army worm defoliation

In late March 2010 a field report was received that caterpillars were defoliating large areas of young plantation hoop throughout the Burnett Region in SEQ, as well as young hoop in the Jimna State Forest within the Conondale Range plantations. The most severe damage was to trees up to 3 years old with newly planted trees reduced to "twigs". Prior to defoliating the foliage and succulent stems of the hoop the caterpillars completely defoliated virtually every weed species within the plantation. Hoop two metres tall had hundreds of caterpillars present. At East Nanango, operators of mechanical harvesters reported that their machines were covered with caterpillars when mature trees were felled. After 2-3 weeks the caterpillars pupated on mass with pupae found predominantly under logging residue (stems, large bark sections, mulch) within encrusted earthen cocoons.

Defoliation of *Araucaria cunninghamii* by *Tiracola plagiata*

Murdoch DeBaar (retired DEEDI Entomologist) suggested that the caterpillars were *Tiracola plagiata* (Walker, 1857) or "Cacao Armyworm", related to *Achaea janata* (Caster Oil Looper). The FPQ PHO collected pupae and bred them through to adult moths with Ted Edwards (Black Mountain CSIRO Canberra) confirming they were *T. plagiata*, adding that within the Subtaxa Hadeninae Family Noctuidae (Synonym = *Agrotis plagifera*). Emerged moths lived for only a day or two spraying egg masses within the litter before they died. Pupation period was 10-12 days with adult moths hiding under the litter and coming out to feed readily on supplied nectar. Viable 1st instar larvae emerged from the egg masses immediately following misting with water.

Tiracola plagiata is listed in the literature as an intermittent pest attacking fruit, particularly agricultural crops and weeds within. It is also listed as a serious forest pest with another Noctuid *Achaea janata* (Caster Oil Looper), recorded as causing minor grazing of hoop (was also present but restricted to its main Caster Oil host plant). The Caster Oil Looper is an established exotic pest as are many of these Noctuids. *Tiracola plagiata* distribution is South East Asia to the South Pacific Islands including northern two thirds of Australia. Adult moths are believed to "overwinter" on mass in scrub/forests with large flights recorded March-April in SE Queensland with these lifecycle observations matching those experienced within FPQ plantations. Flights of these Noctuids are recorded overseas as following strict periodicity e.g. every second year, with some references to environmental triggers (odd or particular climate) that induce co-ordinated flights/emergence.

***Tiracola plagiata* bred through from field collected pupae.**

Like the previous year's beetle defoliation the severe defoliation by the caterpillars had not been recorded previously. Due to the severity of caterpillar damage an emergency off-label APVMA permit for aerial application of insecticide (Fastac Duo – active ingredient Alpha cypermethrin) was sought and obtained. A single application at one location (East Nanango) gave an almost immediate response and proved to rapidly reduce caterpillars sprayed. No further aerial application work occurred.

Periodic monitoring followed, however a second generation outbreak did not occur. Diseases and parasites eventually "catch up" causing pest populations to collapse. This was clearly demonstrated to be the case throughout FPQ plantations as insectory observations of field-collected *T. plagiata* larvae resulted in an initial burst of adult moths, followed by a predominance of the parasitoid wasp *Lissopimpla excelsa*. These wasps are common and usually seen over gardens lawns hunting lawn grubs.

***Lissopimpla excelsa* bred from parasitised *Tiracola* pupa.**

NATIVE HARDWOODS: *Eucalyptus* & *Corymbia*

In April 2010 a Myrtaceous Rust fungus given the name *Uredo rangelii* (Myrtle rust) was detected in a commercial Nursery on the NSW central coast. This Myrtaceous Rust is of concern to FPQ in relation to its potential effect if it spread and proved capable of infecting other Myrtaceous species within FPQ plantations and the native environment. Immediately following the detection FPQ carried out specific inspections of plantation hardwood seedlings previously sourced and supplied from northern NSW suppliers. Fortunately all of FPQ's future short-term hardwood nursery stock needs are being sourced from Queensland-based nurseries. FPQ are keeping a watching brief on efforts to delineate the extent of the incursion, its final range, its relationship to *Puccinia psidii* (Guava/Eucalyptus Rust) and eradication attempts.

VICTORIA

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PLANTATIONS

Pinus radiata.

Insect pests

Sirex noctilio (Sirex wood wasp)

The incidence of Sirex over the 2009-2010 summer remained at relatively low levels across the state. However, isolated areas in North East Victoria similar to those observed in 2008-2009 still contained higher than acceptable levels of Sirex damage. These areas were scheduled for early thinning, and nematode inoculation using Kamona strain nematode in areas not yet thinned. Parasitic nematodes were recovered from all pine growing regions of Victoria, while the parasitoid wasp *Ibalia* continues to provide a useful secondary means of Sirex control, with *Megarhyssa* and *Schlettererius* recovered albeit at very low levels. The increased rainfalls experienced across the state in late 2009 and early 2010 have assisted in reducing tree moisture stress and subsequent susceptibility to Sirex attack, although more rains are required to eliminate drought stress as a trigger for Sirex infestations.

***Essigella californica* (Monterey Pine Aphid)**

Monterey Pine Aphid (MPA) populations in 2010 continue to cause significant discolouration and defoliation across the state, with average levels of defoliation ranging from 20 to 40%. While this reflects a decline in MPA activity compared to the 2009 surveys, levels of current defoliation are generally reflective of those observed in previous surveys. Maximum defoliation levels remained severe in the north east of the state with up to 70% defoliation recorded in some stands. While plantations >10 years of age have been worst affected in past years, increasingly discolouration and defoliation of younger trees under ten years of age has been observed. While the surveys confirm the trend that incidence of MPA increases as age class increases, fluctuations in incidence characterise age classes up to 15 years of age, while in all age classes 16 years and over, most plots were affected by MPA to varying degrees. Monitoring is required to determine whether or not defoliation continues in districts where biological control agent aimed at reducing MPA levels and associated defoliation have been introduced

***Ips grandicollis* (Five-spined Bark Beetle) and other bark beetle species**

I.grandicollis was not observed as a significant pest of Radiata pine plantations during the 2010 survey, with only two small areas in North East and South West Victoria affected.

Pathogens

Dothistroma needle blight
Disease levels in the 2009 monitoring plots have decreased compared to 2008, and have also fallen to below levels observed in 2007. Average levels of current infection (discolouration) remain low across the estate, although some isolated pockets of high infection were recorded in roadside surveys in the North east of the state. It is recommended that the extent of the disease in this area be evaluated and further monitoring be considered, if a wet summer is predicted. No spraying program was conducted in spring 2009 due to the relatively low levels of infection recorded at the time of the survey.

Cyclaneusma needle cast
While Cyclaneusma needle cast (CNC) was observed throughout Victoria, overall levels rated between trace to low, primarily due to the pathogen generally only affecting older needles in the lower crowns of trees and prevailing environmental conditions within plantations during 2009. Minimal impact on growth of trees is anticipated.

Diplodia dieback
Damage from Dp within the plots assessed in 2010 was generally confined to two areas in Central and North east Victoria. The damage observed however was minor in nature to previous years and generally confined to either individual trees or small groups of trees around areas that had been affected over the previous years surveys.

***Eucalyptus* spp.**
Insect pests

***Mnesampela privata* (Autumn Gum Moth)**
Autumn Gum Moth has caused only minor damage in a small number of plantations throughout the state and has not been of concern over the past year.

Chrysophtharta and Paropsis (Chrysomelid Leaf beetles) and Anoplognathus spp. (Christmas beetles)
Chrysomelid defoliation within Gippsland plantations was observed in both *E. globulus* and *E. nitens*, with damage levels ranging from trace to moderate, and trace to severe in the upper and lower crowns respectively, while Christmas beetle defoliation of both *E. globulus* and *E. nitens* was generally confined to the lower crowns and ranged from trace to severe (0-70%). However, defoliation was not widespread in nature and either confined to individual trees or small isolated clusters of trees. No mortality was observed with the defoliation.

***Perga* spp. (Sawflies)**
Sawflies were observed causing significant damage within native forest and eucalypt plantations in Western and Gippsland districts. Damage was generally confined to distinct areas of trees of predominantly *E. globulus*, with defoliation generally ranging from the upper 50% of tree crowns to entire canopy defoliation.

***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* 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. This pest species has remained at low levels over many years despite the increasing age of plantation trees in the region. Espacement of the plantation coupled with some mortality due to abiotic causes in some plantations may have combined to reduce the impacts of borers although it is not possible to determine this as the cause with any certainty.

***Cardiaspina spp.* (Psyllids)**
Cardiaspina retator has been observed causing low levels (approximately 10-20%) of defoliation to *E. camaldulensis* plantings in North Central Victoria, with defoliation tending to be sporadic over a wide area rather than confined to specific locations. 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 Pests of eucalypts
- Low levels of Gumtree scale (*Erioccus*) were observed in an *E. globulus* plantation in central Victoria where it caused significant branch dieback although mortality was not generally observed.
- The Wingless grasshopper *Phaulacridium vittatum* caused some trace levels of damage to some young eucalypt plantations in south west Victoria although not on a scale to warrant widespread control measures to be implemented.
- Low levels of defoliation damage were again 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.

Pathogens
Mycosphaerella
Mycosphaerella leaf disease was observed in predominantly young *E. nitens* trees in a small number of locations in Gippsland in early 2010 in both the upper and lower crowns where it caused low to moderate levels of discolouration and defoliation.

NURSERIES

Pinus radiata
Phytophthora cinnamomi (PC) 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. During early 2010 increased PC damage was observed across the state, ranging across native forest, eucalypt and Radiata pine plantations. Environmental condition, for the first time in 10 years, have been conducive to PC

development with late summer and early autumn rains promoting development. Some reports also of root strangulation after 2-3years from planting needs to be investigated to ascertain if it is associated with a move back to the used of containerised stock.

***Eucalyptus* species**
No reports of damage due to pathogens were recorded in 2009/2010.

MANAGED NATURAL FORESTS

Insect pests

***Uraba lugens* (Gum leaf skeletoniser) and *Doratifera* spp. (Cup moth)**
Surveys were conducted in early 2010 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*/*Doratifera*) defoliation. Consequently, it was determined that despite the impacts of drought, trees had substantially recovered foliage lost in feeding by the insect.

Pathogens

Few diseases were reported from managed natural forests during 2009/2010 apart from the increase threat of PC due to the environmental conditions conducive to development.

NATIVE PLANT COMMUNITIES

Phytophthora cinnamomi
Phytophthora cinnamomi continues to be a focus of DSE as it implements the strategy for its management. State wide modelling of PC risk and impact is being evaluated to help prioritise forest management activities.

Chalara australis (Myrtle Wilt)
Mytle 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.

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. 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 a number of field training days have

been undertaken to train plantation staff in basic surveillance methodologies. In collaboration with DSE, research has been completed in native forests of Victoria designing a health surveillance system methodology suitable for evaluating the health of forest canopies in a variety of forest types for implementation on Victoria's public lands. The plot based system established in late 2009, early 2010 is now being evaluated in East Gippsland 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 2009/10. 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'.

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 2009/10 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.

Pathogens

Dutch Elm Disease

The City of Melbourne continues to support surveys for Dutch Elm Disease (DED) in the main gardens and boulevards under their management. Symptoms 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 beetle activity. These surveys help to confirm the absence of the pathogen and maintain awareness and, early detection should it arrive in Australia.

Staffing Changes

Due to a decision by the Victorian Department of Sustainability and Environment in early 2010 to no longer fund forest health activities within their custodial native forests, forest health staff Nick Collett and David Smith were placed on redeployment in August 2010. However, due to the intervention of Department of Primary Industries (DPI), both officers have been seconded to Plant Standards Branch, DPI in the role of Forest Biosecurity Officers. These positions have a primary focus in forest biosecurity threats to the native and plantation forest estate and are funded until June 2011 in the first instance.

Tasmania

Plantations (Exotic pines / *Pinus* species especially *P. radiata)*

Insect Pests

Sirex wood wasp (*Sirex noctilio*)

Standard 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. However kairomone charged static traps were placed in each of five blocks in the north of the state caught good numbers of *Sirex* females in two areas which required nematode introductions. *Sirex* females were captured in all blocks along with some *Ibalia leucospoides* adults.

During static trap monitoring for exotic bark beetles a number of *Sirex* females were captured including sites on King and Flinders Islands in Bass Strait, and a *Megarhyssa* male caught at Highcroft on the Tasman Peninsula.

Ips grandicollis

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.

Monterey pine aphid (*Essigella californica*)

There is no evidence of *Essigella* damage in the north of the state.
In the south of the state populations are at very low levels.

Pine aphid (*Eulachnus thunbergii*)

Not recorded from Tasmania.

Pine aphid (*Pineus laevis*)

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

Other insect pests

An outreak of the the native geometrid moth Clenias caused near complete defoliation of about 100 ha of mid-age *P. radiata* in the Pittwater plantation (now a State Recreation Reserve). A similar outbreak last occurred in this area about 20 years ago.

Vertebrate Pests

In northern Tasmania bark stripping by browsing mammals affected 813 ha which is greater than observed over the last five seasons. The past areas affected were 693ha in 08-09, 359ha in 07-08 and 536ha in 06-07 and 739ha in 04-05. About one third of the affected areas suffered severe damage (>50% trees affected): a proportion that was similar to that seen over the last few years.

The areas most affected were Saddleback and Scamander in the northeast and Oonah in the central northwest (Figure 1). Consistent and substantial increases in damage were also observed in Tower Hill (NE) and Smiths Plains (NW). Damage levels had dropped off significantly in Payanna , (down to <10ha from 136ha last year) where damage was associated with shoot browsing in 2008 plantations.

Figure 1. Bark stripping, ringbarking and dead top in young *P. radiata* seedlings in the northwest of the state.

Damage caused by shoot browsing in young plantations was up substantially from last season: 229ha, compared to 50ha in 2008-2009. Payanna (100ha) and Saddleback (81ha), both in the northeast, were the areas most affected (Fig. 2).Notable areas of damage were also observed in Nicholas in the northeast and Smith's Plains in the northwest.

Figure 2. Mortality and patchy stocking caused by mammal browsing in the northeast of the state.

The area of dead tops caused by possum damage had almost doubled this season up to 62ha from 37ha last season. Most damage was in Oldina Block with localised damage in Oonah Block, both in the northwest.

Pathogens

***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**

Little has changed in Ringarooma block since last season. Scattered trees, usually along the road edge, were still expressing symptoms on one year old needles throughout much of the crown. Trees within the compartments showed little current infection but variable levels of needle retention, due to both shading and the effects of the disease, with a proportion of crowns only carrying needles at the very top (Fig. 3).

Figure 3. Currently infected (*Dothistroma*) one year old needles on an edge tree (left) and poor needle retention within the compartment (right) in Ringarooma, northeast Tasmania.

***Diplodia*/*Sphaeropsis* shoot blight/crown wilt**

Top death in older trees caused by *Sphaeropsis* was detected across 171ha this season, exclusively in Bass District. The largest area of damage (117.9 ha) was present in Retreat block. Damage levels were generally low with the exception of a localised area of damage around a hill in RT238C, where the incidence was as high as 30%, and the northwest slopes of PA105B where up to 20% of the trees had been affected.

Other biotic agents

With the possible exception of a single compartment in Nicholas there was limited mortality directly attributable to drought stress and/or *Phytophthora* detected this season. This may largely be due to well above average rainfall across much of the north of the state over the last 6-12 months

Environmental and site related problems

Fire

A very small patch of fire damage was detected in a compartment of Oldina Block, in the northwest. There was no evidence of subsequent *Sirex* attack.

Wind

Substantial areas of severe wind damage were observed in Oonah and Oldina Blocks in the northwest, following the severe southerly storms in August 2009. Over 80ha were mapped as affected but this is likely to be a significant under-estimate because of restricted access to many areas due to fallen trees blocking roads. Much of the damage was in high - value pruned and thinned compartments (Fig. 4). There was also a patch of catastrophic wind-snap in two compartments in Payanna Block in the northeast.

Lightning
No lightning damage was detected this year.

Exotic weeds
Two incidences of gorse (*Ulex europaeus*) were reported for Bass this season along with two cases of pampas grass. Multiple gorse detections were made in Mersey, primarily in Castra block. In Murchison gorse remains a common occurrence throughout Oonah block in the northwest.

Figure 4. Severe, high incidence windthrow of high - value trees in Oonah Block (left) in the northwest of the state and wind-snap in Payanna Block (right) in the northeast of the state.

Boron deficiency
A number of localised areas in Payanna block were detected with trees exhibiting symptoms similar to those associated with boron deficiency. Symptoms included low apical dominance, shoot dieback, resin soaked tissue below the affected area and pith breakdown (Fig. 5). Boron deficiency symptoms were reported for nearby compartments some years ago in 2005-2006). Confirmation would require tissue/needle nutrient status analysis.

Figure 5. Fused needles and shoot dieback (left) and affected shoots showing pith breakdown and resin soaked tissue in Payanna in northeast Tas.

Drought
With the possible exception of a single compartment in Nicholas there was limited mortality directly attributable to drought stress and/or *Phytophthora* detected this season. This may largely be due to well above average rainfall across much of the north of the state over the last 6-12 months

Frost/cold
No frost or cold damage was detected this in *P. radiata* plantations this year.

Plantations (*Eucalyptus* species)

Insect Pests

Autumn gum moth (*Mnesampela privata*)
No significant outbreaks of autumn gum moth (AGM) were detected this year.

Leaf beetles (primarily *Paropsisterna bimaculata and P. agricola)*
Chrysomelid defoliation severe enough to cause an impact on growth was detected in 2315ha. Of this 2196ha was assessed as moderate (around 4.3% of the area of eucalypt plantation on State Forest) and 120ha as severe (down from 520ha last season). A privately-owned mid-rotation plantation of *E. nitens* in the Gunns Plains area of northwestern Tasmania suffered near-complete defoliation by chrysomelids in autumn

2009. Over 100 ha were affected and refoliation had not commenced by the end of spring.

Once again this season extensive defoliation assessments were conducted across the estate; incorporating plantations in older age classes that would not normally be monitored for beetle larvae and are not routinely included in roadside surveillance. Over 80% the damage (1949ha) was recorded in plantations older than 6 years, 1633ha (70% of total area) of which was in plantations 10 years old or older.

Overall, 25690ha of state forest was monitored for beetle populations, an increase of 5175ha from last year. This increase was due to the inclusion of older plantations that had severe or moderate damage detected during 2008-9 health surveys. Of the total area monitored 30% (7713ha) had a beetle population that was over-threshold, with the potential to cause economic loss; this is similar to the 28% observed last year. The northeast of the state had the greatest area over threshold as well as the highest beetle populations. Most of the area over the threshold was sprayed (5939ha) with the broad spectrum insecticide α–cypermethrin. However 16% of over-threshold populations did not require spraying because subsequent re-monitoring found populations had been controlled naturally by heavy rain and strong winds, or by the activity of natural enemies. Sticky trap monitoring in several trial plantations (for lethal trap trees – see research section) established widely throughout the state found populations of new generation beetles were very low. This coincides with the reduced area of plantation suffering severe defoliation, much of which is the result of late season feeding by next generation adult beetles.

Eucalyptus weevils (*Gonipterus spp.*)
No significant *Gonipterus* damage was detected this season.

Gum leaf skeletonizer
Mapping of edge damage caused by the gum leaf skeletoniser *Uraba lugens* continued this year and a further 17ha was added to the 48ha mapped last year. Such damage is generally fairly limited and only extends a short distance in to the plantations, but puts affected edge trees under chronic stress. Defoliation usually occurs annually and is often severe resulting in poor performance. Mortality caused by borer infestation commonly results from consecutive defoliation events.

Beetles (Christmas, scarab, spring, etc.)
A small population of *Anoplognathus* caused minor damage in a privately-owned *E. nitens* plantation in the Pipers River area of north-eastern Tasmania..

Sawflies
No significant damage was observed on State Forest this season.

Borers

The incidence of borer mortality had generally decreased this year, possibly influenced by good rainfall over the last 12 months.

Continued monitoring at Blackwood Creek shows that the cerambycids *Phoracantha mastersi* and *Phacodes obscurus* continues to kill trees in both thinned and un-thinned sites despite improved soil moisture conditions. The species of cerambycids which are early colonisers of recently stressed trees, such as *Epithora dorsalis* and *Coptocercus rubripes,* are no longer active at this site.

Psyllids

No significant damage was observed on State Forest this season.

Tortricids

No significant damage was observed on State Forest this season.

European Wasps

Populations of wasps were severe in northeastern plantation areas but light in the rest of the state. Autumn baiting was conducted in several southern softwood plantation sites, prior to pruning operations, and several forestry tourist venues managed by Forestry Tasmania. The English wasp, *Vespula vulgaris*, first found in southern Tasmania in 2000, has continued to increase its distribution range with specimens trapped in the Devonport area. The species is still absent from the east coast and north-west areas of the state.

Vertebrate Pests

Intensive pre- and post-plant management of browser populations coupled with the use of seedling stockings was largely effective in preventing significant browsing damage. Significant damage, attributed solely to browsing mammals, on State Forest covered by health surveillance was detected in only 19ha this season.

Diseases

***Mycosphaerella* and other leaf diseases**

After very wet conditions in the northeast of the state this year Mycosphaerella Leaf Disease caused significant damage, both leaf lesions and defoliation, to *E. nitens* in a number of areas (Fig. 6). Plantations ranged in age from 3 – 12 years old with levels of crown damage between 25 – 35% recorded. In plantations also affected by chrysomelid damage trees had lost up to 80% of their effective leaf area. Overall nearly 200ha were affected.

Figure 6. Top-down damage caused primarily by *Mycosphaerella* in a 4 year-old coupe in northeastern Tasmania.

Botryosphaeria top death

No substantial damage was observed on State Forest this season.

Cryphonectria stem canker

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

Phytophthora root rot

Significant mortality (>1%) caused by *Phytophthora* was recorded in 98ha this season, most of which was ongoing damage in a single plantation in the northeast. One other 2009 plantation, also in the northeast, recorded damage in the vicinity of 1-2%.

Armillaria root rot

No instances of significant *Armillaria* mortality were detected this year.

Environmental and site-related problems

Windthrow

Several small patches of windthrow were reported in addition to two more significant areas, the largest being around 39ha (Fig. 7).

Drought/desiccation
Drought damage was detected in localised areas on ridges and knolls in a small number of plantations in the south following a protracted autumn drought. Lush spring growth following heavy rainfall in winter-spring 2009 may have contributed to the drought stress.

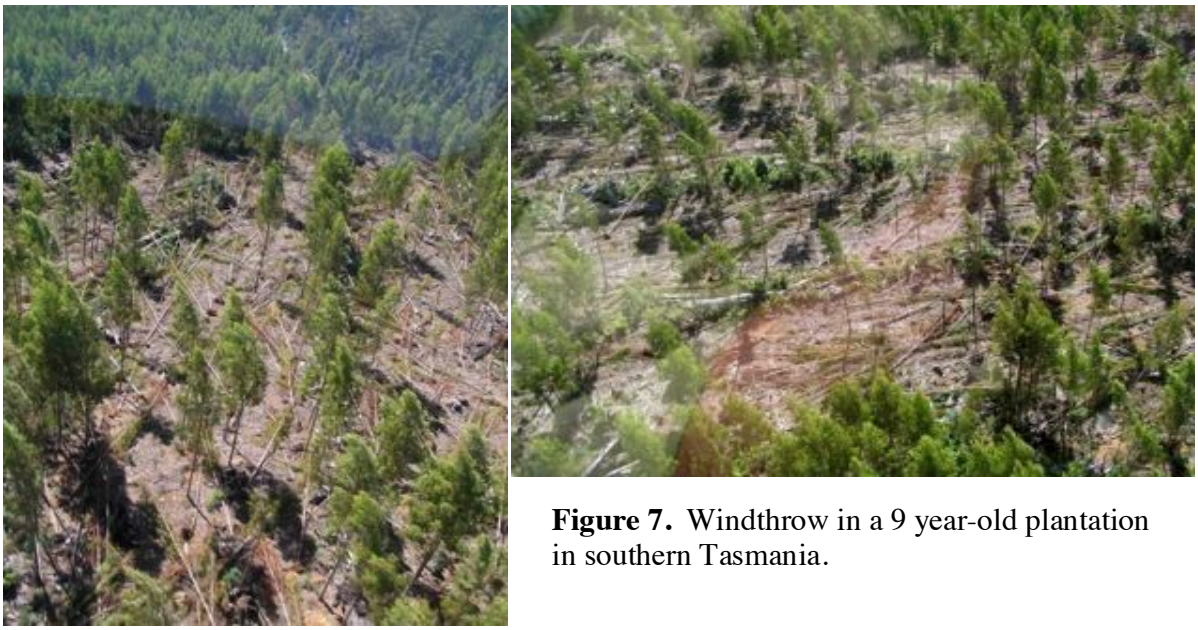

Figure 7. Windthrow in a 9 year-old plantation in southern Tasmania.

Cold/exposure
Significant damage consisting of leaf tearing and shoot death was observed in higher elevation (>500m) areas. With the compounding effect of chrysomelid damage many of these plantations are developing chronically thin crowns. Winds are further damaging foliage already attacked by leaf beetles, bare stems are being killed by cold/desiccation, recovery is slow over the short summer period and any new growth is damaged again by the same agents the following year. Over 750ha of high elevation plantations were mapped as being affected by cold/exposure effects and over 600ha of this area was considered at risk of developing chronically thin crowns (Fig. 8).

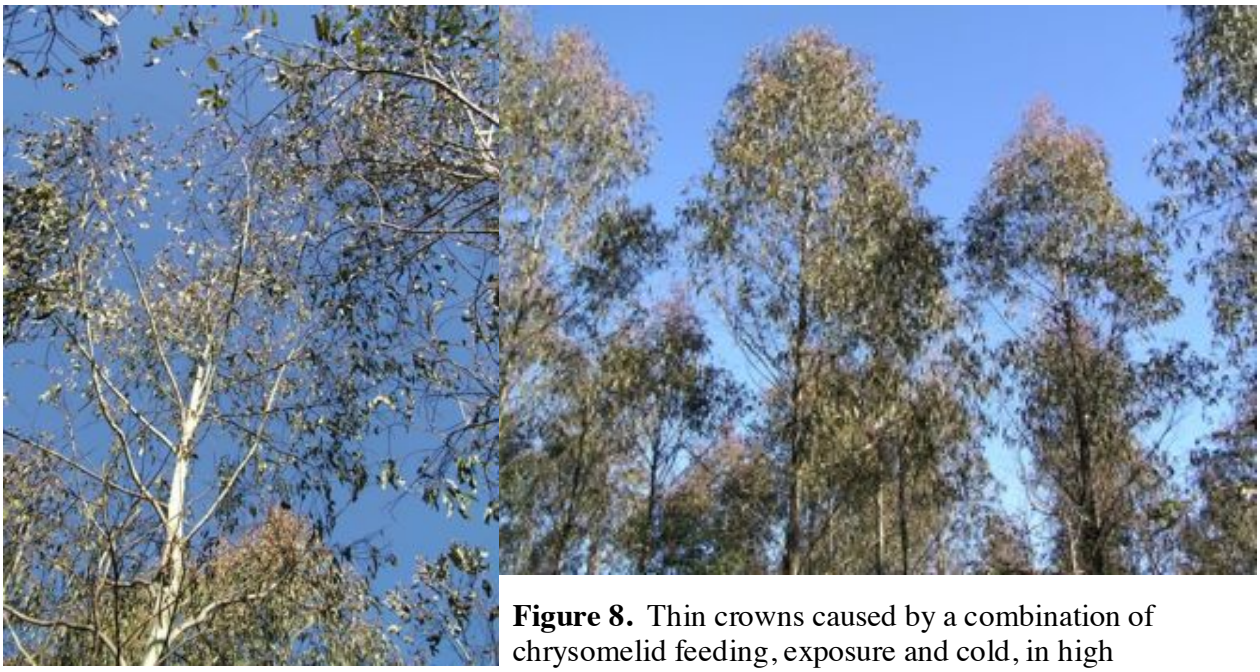

Figure 8. Thin crowns caused by a combination of chrysomelid feeding, exposure and cold, in high elevation plantations in northeast Tasmania.

Frost
Around 150ha of 1-year-old plantations (2008 plantings) in high elevation sites in the northeast experienced varying levels of foliar scorch due to an early, severe frost event.

Waterlogging
Extensive areas of recently planted *E. nitens* along the east coast suffered heavy mortality on flat sites that became waterlogged following heavy spring rainfall.

Copper deficiency
Symptoms associated with copper deficiency on poor soils, such as microphylly, stunting and branch distortion, were recorded on 43ha, this season. These were largely limited to young plantations in the northwest of the state.

Weeds
Macquarie vine (*Meuhlenbeckia gunii*) was present and growing up a proportion of young trees in 109ha of young plantation. Dense cutting grass (*Gahnia grandis*) was contributing to reduced performance and possibly causing access difficulties in two plantations totalling 79ha. Grass was having a significant impact on growth in 69ha. Dense woody weeds, primarily silver wattle (*Acacia dealbata*) were associated with reduced vigor in 112ha of young plantations (generally < 6-years-old.

Scattered instances of the exotic, invasive weeds gorse (*Ulex europaeus*) and pampas grass (*Cortaderia* sp.) were detected in various locations. Thick California (*Cirsium avense*) thistle was hampering the establishment of young seedlings in one coupe (Fig.9).

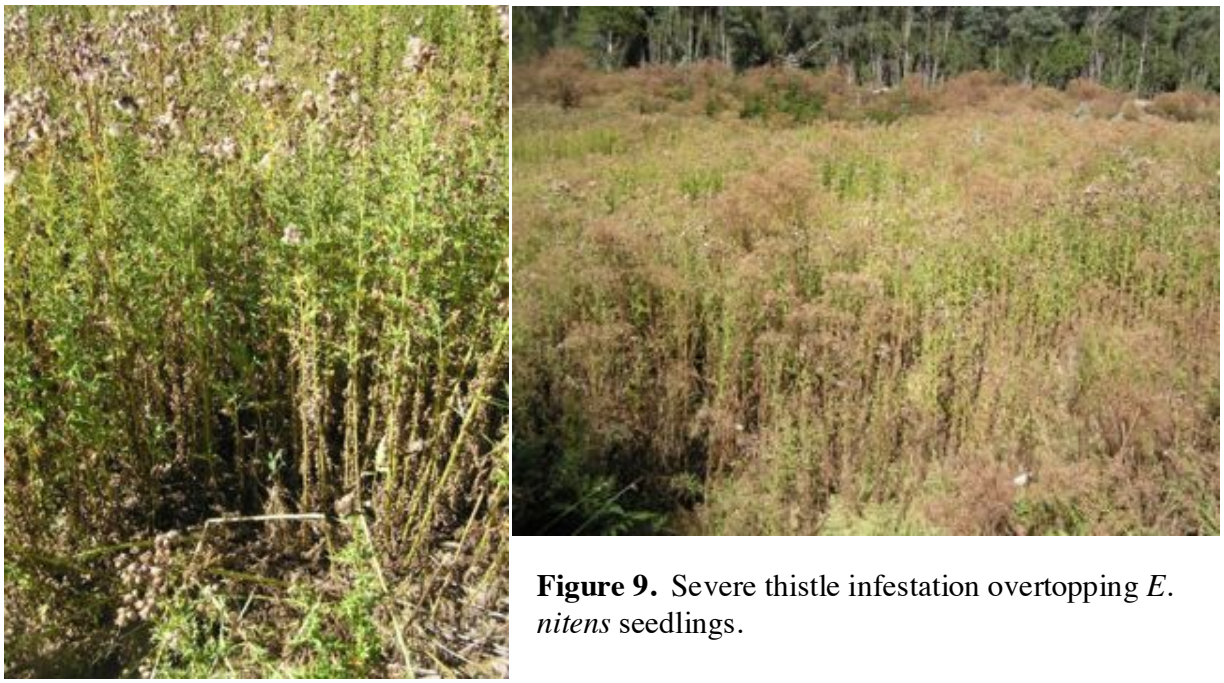

Figure 9. Severe thistle infestation overtopping *E. nitens* seedlings.

Soil fertility

Symptoms associated with nutrient limited soils were recorded in 1926ha of eucalypt plantations. The main consequences were reduced (538ha) or variable growth (938ha) and foliar discolouration (284ha). Most of these areas will receive secondary fertilisation.

Multiple causes

Problems are placed in this category when there is more than one contributing factor.
This year 1300ha were determined as having health issues due to multiple causes. The main symptoms were stunting (407ha), variable performance (402ha), thin crowns (173ha), early branch death (126ha), foliar discolouration (73ha) and reduced stocking (85ha). The cause of stunting and variability most commonly included a combination of poor, rocky or shallow soils; steep slopes, past mammal browsing, restricted drainage, frost and weed/grass competition. Thin crowns were generally caused by a combination of insect defoliation, cold air ponding and waterlogged soils in high elevation areas in the northeast, following significant heavy rainfall over the last two winters (Fig. 10). Scattered dead trees were observed and there is likely to be significant mortality in the worst affected areas.

Figure 10. Extremely thin crowns, epicormic development and low level mortality in poorly drained, cold, high elevation plantation in northeast Tasmania

Managed natural forests *(*Eucalyptus *species)*

Insect Pests

An outbreak of the psyllid *Cardiaspina squamula* caused moderate defoliation of roadside *E. dalrympleana* in the upper Derwent valley.

Regions of native forest south of Hobart; including areas around Taroona, Bonnet Hill, Snug and Ridgeway; had suffered extensive foliage death caused by feeding of painted cup moth larvae *Doratifera oxleyi* (Fig. 11). Species affected included the peppermints *E. amygdalina*, *E. tenuiramis* and *E. pulchella*.

Figure 11. Foliage death across the slopes of Badger Hill, Ridgeway, south of Hobart. Close-up showing distinctive pattern of feeding damage and larva of the painted cup moth *Doratifera oxleyi*

Pathogens

The crown rot disease of *Xanthorrhoea* spp. associated with *Fusarium* aff. *babinda* that was detected in the Waterhouse State Reserve is considered most likely to be native. Crown rot symptoms identical to those seen at Waterhouse have been detected in a newly discovered population of the nationally-listed *X. bracteata* on State forest in the Pipers River area of northeastern Tasmania.

Armillaria (likely *A. leteobubalina*) was constantly associated with mortality of naturally-regenerated blackwood (*A. melanoxylon*) in a research trial at Togari in the Circular Head area. The stand established following harvesting and fencing (to protect blackwood from browsing) is approaching the scheduled age (12-15 years-old) for pre-commercial thinning (of neighbouring *E. obliqua*). The extent of this problem within stands managed for growing blackwoods remains to be determined.

Armiallaria (likely *A. novae-zelandiae*) is associated with ongoing mortality of myrtle (*Nothofagus cunninghamii*) and celery-top pine (*Phyllocladus asplenifolius*) at the Tahune Forest Airwalk.

Environmental and site-related problems

Patches of drought death in young (2-3 years-old), silviculturally-regenerated *E. obliqua* were widespread in the Picton Valley, southern Tasmania. Mortality followed low summer and autumn rainfall following a wetter than average spring.

Nurseries and Seed orchards

Conifer species

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

Eucalyptus species

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

Urban and rural

Insect Pests

An outbreak of wingless grasshopper (*Phaulacridium vittatum*) cause severe defoliation of mid-aged shelterbelts of *P. radiata* in the southern Midlands,

Diseases

No diseases were reported.

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, South Australia, New South Wales, Western Australia and Queensland. 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. In Tasmania a total of 34 traps were established at 5 sites including Flinders Island and King Island. At all of the mainland sites at least one of the target species was collected. *Ips grandicollis* was not recorded at any site in Tasmania.

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*. Elm Leaf Beetle was not found at any Midlands town during searches in November and March.

Research and development

A CRC Forestry project testing "proof of concept" of lethal trap trees progressed to operational evaluation this year. Six *E. nitens* plantations in which 200-tree blocks of *E. regnans* or *E. delegatensis* trap trees were established 2 years earlier were treated. This

involved treating the trap trees with imidaclopriod via stem injection or bark spray in early summer. Treatment coincided with the *E. nitens* plantations transitioning to adult foliage and all six plantations were in areas that supported over-threshold populations of *P. bimaculata* the previous season. Monitoring of beetle populations in the six plantations recorded a range of population sizes varying from well above economic injury threshold to virtually absent. Earlier than expected beetle populations in three of the plantations caused heavy defoliation of the trap trees prior to their treatment with insecticide (rendering them unattractive to beetles until they refoliated in mid-summer). Sticky trap monitoring found that the treated trap trees were more attractive to *P. bimaculata* (but not *P. agricola* or *P.* aff. *gloriosa*) in five of the six plantations (wildfire compromised results in the sixth plantation) by the end of summer or earlier. Preliminary analysis indicate that the trap trees treated by stem injection remained lethal throughout the summer and killed large numbers of leaf beetles. However, *E. nitens* surrounding the lethal trap trees had higher beetle populations and suffered higher levels of defoliation than control areas distant from the trap trees in five of the six sites.

An anaysis of the pests and diseases affecting the species choice decision (*E. nitens* or *E. globulus*) on State forest was completed. Mycosphaerella leaf disease, *Gonipterus scutellatus, Phytophthora cinnamomi* and drought death soon after transplanting were identified as the most important pest and disease threats affecting the species choice decision. Mapping of the climatic distribution of these pests and diseases identified different parts of the plantation estate where their respective damage was most prevalent: Five discrete climate regions based on the prevalence of each of these pests and diseases and geographic proximity of the plantations were delineated. In three of the five regions the defoliators (*Mycosphaerella* and *Gonipterus*), which preferentially affect *E. globulus* were the main threat. On the other two regions *Phytophthora* and drought, which preferentially affect *E. nitens* were the main threat. Modelling estimated impacts from these pests and diseases in the five regions enabled the financial performance of growing either *E. globulus* or *E. nitens* after accounting for the pest and disease impacts to be evaluated. By this process key uncertanties were highlighted. In those regions where *Mycosphaerella* and *Goniperus* were the main threat, *E. globulus* would only be financially superior to *E. nitens* if anticipated genetic gains in wood quality (pulp yield and basic density) were achieved and if those superior wood properties translated to price premiums for pulpwood and peeler logs. In those regions where *Phytophthora*, in particular, was the main threat, *E. globulus* would be financially superior to *E. nitens* regardless of any price premiums for superior wood properties in *E. globulus*, if plausible growth impacts from chronic sub-lethal root damage by *Phytophthora* in *E. nitens* occurred. Research is planned to commence this year to measure the existence and magnitude of growth impacts from chronic, sub-lethal root disease in *E. nitens* plantations infested with *P. cinnamomi*.

Linking the operational leaf beetle IPM with outcomes measured by FHS has enabled the effectiveness of the IPM in protecting plantations from leaf beetle defoliation. It found that the IPM reduced the proportion of plantations suffering moderate or severe defoliation by between 70-80% compared with untreated plantations with comparable leaf beetle populations. As reported earlier, most moderate and severe defoliation from

leaf beetle occurs in plantations beyond the ages currently targeted by the leaf beetle IPM. As study is planned this year to use Cabala Health to model later-age growth impacts from chrysomelid defoliation and validate predictions with growth measurements in mid-rotation plantations that suffered defoliation this year. This will enable predictions of economic impact from defoliation to be made at all stages of the rotation as the basis for determining priority areas to target the IPM. This is likely to result in a considerable increase in the area of plantation monitored for leaf beetle populations based on current approaches. A collaborate study with UTas is underway to analyse spatial pattern of beetle populations from historical records to in an attempt to identify site and landscape factors associated with variation in populations. If successful, this may pave the way for a hazard-based approach for determining areas to include in the leaf beetle IPM.

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

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		✓				✓					1214 (<3yo)		*E. nitens* & *globulus*
Autumn gum moth											20343		*E. nitens*
Christmas beetle											20343		
Paropsines					✓			✓			7713	5939	***E. nitens* & *globulus***
Gum leaf skeletoniser	✓						✓				20343		*E. nitens*
Sawfly											20343		
Leaf blister sawfly											20343		
Spring beetles											20343		
Jarrah leaf miner											20343		
Phasmatids											20343		
Weevils (defoliating)											20343		
Psyllids											20343		
Phoracanthines											20343		
Wood moths											20343		
Wood borers - cerambycids							✓				20343		
Wood borers – buprestids											20343		
Wingless grasshopper											20343		

Mycosphaerella spp.			✓				✓				20343		**E. nitens**
Aulographina eucalypti											20343		
Armillaria spp.	✓										20343		**E. nitens**
Phytophthora spp.		✓									20343		**E. nitens**

Pinus spp.

	Area with moderate damage (Ha)					Area with severe damage (Ha)					Area inspected (Ha)	Area treated (Ha)	Hosts
Pest	<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*

SOUTH AUSTRALIA

Dr Charlma Phillips (Principal Forest Health Scientist, ForestrySA)

PLANTATIONS

Pinus radiata

Annual aerial surveys of plantations in the South East and Mid-North were conducted in June / July 2010. These surveys were followed by ground inspections where necessary to determine/verify the cause of any problems.
Note: Information on pines has been supplied by ForestrySA, Gunn's Limited and Green Triangle Forest Products.

Insect pests

***Sirex noctilio* (sirex wood wasp)**
Sirex remains at a low level. A few scattered trees in the South East Region, identified by aerial observation, have been affected, mainly as a result of lightning strikes. All companies set up trap tree plots, carry out annual surveillance and inoculate nematodes.

***Ips grandicollis* (fivespined bark beetle)**
Ips is particularly active in the Mid North plantations of Wirrabara and Bundaleer (approx. 150km north of Adelaide). These areas have been drought affected for a number of years (see "Other" section below). There has been an increase in deaths in younger plantations (2005 and 2006 plantations) this year, especially near clearfell areas where *Ips* has bred up in logging residue.
In the South East Region, *Ips* has been active in 5-20 year old trees located near clearfell operations.

***Essigella californica* (Monterey pine aphid)**
Aphid numbers have generally been low this year although there has been moderate damage recorded in some thinned stands. Releases of the biocontrol agent, *Diaeretus essigellae*, were made at several locations in the South East. One of the problems in releasing the biocontrol agent, has been the low aphid numbers at the time of release, and while it is too early to tell if the wasp has become established, parasitised aphids have been found in some locations. Releases will continue at selected sites, with the intention to "flood" the area to maximise the chances of successful establishment.

Chlenias spp.
Chlenias spp. damaged a young plantation at Noolook in the South East Region. Damage was mainly to new growth and was greatest on the edge trees. Larvae were present in surrounding older trees but caused less obvious damage. Many larvae were killed by a viral disease.

(Photo:C.Phillips)

Fig 1: Chlenias Spp larva

Pathogens

Cyclaneusma minus has affected some younger plantation in the South East (mainly plantations due for a first thinning).

No reports of other disease incidents.

Other

Drought: Continuing drought conditions have affected plantations in the Mid North (Wirrabara and Bundaleer forests) with large areas of drought deaths in the younger plantations (1994, 1995 and 1999). Older plantations (1950, 1960 and 1970) are also showing increased drought deaths (up to 50% on thinner soils).

Salt: Small, isolated areas in the Ranges and South East Regions have been affected by salt.

***Eucalyptus* spp.**

Note: Due to changes in ownership and restricted access to many eucalypt plantations in 2009-2010, limited information is available on the health of these plantations. The information below has been compiled from information from ForestrySA, from observations and general discussion of forest health issues with companies in the Green Triangle Region (South East South Australia and Western Victoria).

Insect Pests

***Mnesampela privata* (Autumn Gum Moth)**

Autumn Gum Moth continues to cause damage in younger plantations. No major outbreaks noted.

Christmas beetles (Anoplagnathus spp)

Christmas beetles caused damage to most plantations in the Wattle Range area in the South East. The adult beetles were only present for a short time (a few weeks) but caused extensive damage in some plantations.

Cup Moths:

Cup Moths have caused damage to isolated plantations in the Branxholme area (in South Western Victoria).

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

Shothole miner continues to cause concern and numbers appear to be increasing. It is present throughout the South east region and is causing considerable damage in many plantations.

Diseases

None reported

NURSERIES

Newly emerged seedlings planted on an ex-pasture site at Glencoe Nursery were attacked by False Wireworms (adults and larvae) (*Gonocephalum* spp.) and by crows. Some seedlings were snapped off, others "pruned" (Figs 2-4) or pulled out of the ground. Large numbers of crows were present and examination of their stomach contents revealed they had been feeding on the seeds and seedlings. In patches where False Wireworms were present, few seedlings survived.

(Photos :C.Phillips)

Figs 2 and 3: Seedlings chewed off at or below ground level

Fig 4: “pruned” seedling

WESTERN AUSTRALIA

Richard Robinson[1] and Ian Dumbrell[2] (Compilers)
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Plantations

Pinus radiata

Insect pests

***Sirex* spp.**

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 Esperance, 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 noctillio*) were detected in any of the traps in the 2009/10 flight season.

Bark Beetles

Bark beetle distribution and abundance were monitored in conjunction with the Sirex trapping programme; numbers were low and not causing problems.

Five-spined Bark Beetle *(Ips grandicollis)*

Ips were found in all plantation areas over the length of the trapping season. No *Ips* were 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 pine mill and in March for Gnangara.
No significant reports outside of the trapping areas were received in 2009-10.

Golden Haired Bark Beetle (*Hylurgus ligniperda*)

Hylurgus distribution and abundance around the Bunbury area was monitored in conjunction with the Sirex trapping programme, but numbers were low and not causing problems.

Monterey Pine Aphid *(Essigella californica)*

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). WA will receive its first release of the control agent *Diaeretus essigellae* in spring 2010.

Pinus Pinaster

European House Borer (*Hylotrupes bajulus*)

Management of this pest is ongoing and eradication is still the objective.

Wingless Grasshopper (*Phaulacridium* sp.)

No unusual activity

Rutherglen Bug (*Nysius vinitor*)
Rutherglen bug is usually a problem in plantations from October to late December, but an unusually late infestation occurred in the Esperance region in February 2010. Infestations were misted in conjunction with wingless grasshopper control.

'Spring' beetle (*Liparetrus jenkinsi*
Unusal spring beetle activity was noted in mid-winter on a property north of Badgingarra (approx. 250km north of Perth).

Pathogens
No major problems reported.

Eucalyptus globulus
The Industry Pest Management Group (IPMG)
Pest and pathogen research has historically been undertaken through the Industry Pest Management Group (IPMG), a collaborative body of industry companies, state government forestry agencies and institutional partners. Current members of the IPMG are; Albany Plantations Forestry Limited (APFL), Elders Forestry (EF), WA Plantation Resources (WAPRES), Forest Product Commission (FPC), Forestry SA, Murdoch University and the CRC for Forestry.

The IPMG restructured over the 2009-10 period and has appointed Francisco Tovar as its new research scientist. Relevant projects that are currently being developed by the IPMG include;

1. Publication of a field guide to aid foresters and contractors to accurately identify common pests and pathogens in the field
2. Development of mobile device software to allow foresters and contractors to report plantation pest and diseases in an accurate and timely manner
3. Development of a web-based database of records of pest and pathogen outbreaks irrespective of plantation ownership. Data will be compiled at a regional level, individual company level and at a plantation level (F. Tovar, IPMG).

In 2009-10 about 25 000 ha of the WA bluegum plantation estate was inspected frequently, comprising mostly 1- 3 year old plantations. Approximately 8 000 ha were found to have significant problems due to biotic and abiotic problems, with 200 ha having to be replanted and 1100 ha being treated or managed in some way (Table 1). The remainder were left untreated. Summaries of specific pest and disease activity are given below (F. Tovar IPMG).

Insect pests
Weevil (*Catasarcus* sp.)
Extensive low levels of damage (160 ha) were caused by a species of *Catasarcus* at a 1-year-old plantation in Esperance. Historically *Catasarcus* spp. have been the main weevil species causing moderate damage to the lower canopies of mid-rotation plantations in the Esperance Region.

Eucalyptus weevil *(Gonipterus scutellatus)*
The distribution range of *G. scutellatus* has now expanded to encompass all south west WA growing areas, with the exception of Esperance. Traditionally damage has been significant in areas east of and around Albany, though this year little damage was reported. In south-western interior areas, usually unaffected, moderate damage was reported with 50 ha moderately damaged (30 50% defoliation) in Manjimup and Bridgetown. The reasons for this apparent increase in damage are unclear.

Lesser shoot weevil (*Myllorhinus dentiferus*)

M. dentiferus is thought to be responsible for damage to growing shoots of 3-7 year-old second rotation plantations in the Boyup Brook area. Repeated damage over a number of seasons has resulted in reduced growth, highly branched trees, and poor apical dominance. There seems to be an interaction between recent reduced rainfall, weevil damage and subsequent growth of what were previously productive plantations. The extent of this emerging problem is currently being investigated.

Eucalypt leaf beetles (Chrysomelidae)
Paropsisterna m-fuscum was found in several plantations east of Albany in the spring of 2007-08. It had never been recorded in WA, and its identity was confirmed by Chris Reid of Australian Museum in Sydney. Current observations suggest that the species range is expanding, having been reported west of Albany, to Denmark and in south-western interior areas such as Manjimup, Bridgetown and Donnybrook. In these areas the species is found on seedlings and juvenile trees in most 1-3 year-old plantations; though at this stage damage seems minimal. In a 30 ha plantation in Bridgetown, moderate damage was caused by an unidentified chrysomelid species.

***Heteronyx* spp.**
Damage by larvae and adults of *H. elongatus* caused severe damage to a P2009 plantation near Esperance with 60 ha needing to be replanted. Other species of *Heteronyx* (commonly *H. proxima*) have caused repeated damage to the tops of trees in young to mid rotation plantations from January to March. Plantations affected are east of Albany from Cheyne Beach to Wellstead and Esperance. Interior zones such as Boyup Brook and Rocky Gully are also affected. In the last season it is estimated that around 5000 ha were moderately to severely affected. Prediction of outbreaks and subsequent control and is hampered by the randomness of the timing and distribution of attacks from year to year.

Spring Beetle (*Liparetrus jenkinsi*)
Less damage than in previous year was reported for this species. In total 120 ha were damaged in Rocky Gully, Manjimup and Bridgetown. Around 65 ha had to be replanted.

Wingless Grasshopper
Wingless grasshoppers caused severe damage to a number P2009 and P2008 plantations east of Albany, Rocky Gully and Mount Barker. Approximately 180 ha required replanting. In Esperance 510 ha of P2009 were moderately affected and were aerially sprayed.

Vertebrate pests
Parrots
Lake Muir Corellas, an endangered and protected Corella subspecies, have been reported to cause localised damage in areas east of Manjimup and around Rocky Gully. They generally pull up seedlings as they search for food resulting in deaths. Port Lincoln parrots (locally called Twenty Eights) are the most destructive and commonly reported species affecting WA bluegum plantations. They peel the bark off young trees and/or snap the tops, resulting in poor form or death. Affected areas this season were west of Albany to Denmark, Rocky gully and around Collie. Around 40 ha required replanting.

Rabbits
Browsing damage to seedlings by rabbits was reported at Manjimup, Boyup Brook, Mount Barker and east of Albany. Approximately 60 ha were affected with 35 ha having to be replanted.

Table 1. Area of *E. globulus* plantation estate monitored and area affected by pests and pathogens in Western Australia in 2009-10*.

PESTS	Area with moderate damage (ha)					Area with severe damage (ha)					Area inspected (ha) †	Area treated (ha) ‡	Host
	<10	10-100	100-500	500-1000	>1000	<10	10-100	100-500	500-1000	>1000			
Catasarcus sp.		X											E. globulus
Eucalypt weevil (*Gonipterus Scutellatus)*		X											*E. globulus*
Lesser shoot weevil (*Myllorhinus dentiferus*)				X									*E. globulus*
White fringed weevil (*Naupactus leucoloma*)						X							*E. maculata*
Weevils (defoliating)													*E. globulus*
Heteronyx (establishment)		X					X						*E. globulus*
Heteronyx (post-establishment)					X					X			*E. globulus*
Chysomelid beetles		X											*E. globulus*
'Spring' beetles (*Liparetrus* spp.)		X					X						*E. globulus*
Wingless grasshopper				X				X					*E. globulus*
Parrots							X						*E. globulus*, *E. Saligna*
Rabbits		X					X						*E. globulus*
PATHOGEN													
Teratosphaeria spp.				X									*E. globulus*
										TOTAL	15,000	1,300	

* Data contained in the above table is of a general nature and reflects the lack of a formal pest and pathogen data collection process to date. Not all companies undertook monitoring in 2009-10.
† Area inspected was roughly calculated from the known area of plantings from 2007- 2009 (1-3 years old), as plantations in this age group are known to be frequently inspected. Additionally older plantations that were reported as having damage were also counted. Again this is an underestimation
‡ Area Treated was taken to mean that some control or management action had taken place, including replanting

(F. Tovar IPMG)

Pathogens

***Teratosphaeria* spp. (formerly *Mycosphaerella*)**

Teratosphaeria spp. caused moderate damage to about 500 ha of plantation in the Denbarker and Mount Barker areas as well as a single plantation east of Albany.

Abiotic problems

Drought

Drought stressed plantations were reported in Collie and Boddington, areas east of Albany and Esperance. Approximately 30 ha of seedlings failed due directly to drought, though some other areas thought to have succumbed to pests may have been predisposed due to drought stress.

Nutrient Deficiencies

Nutrient deficiencies were reported for both first rotation plantings and second rotation. Copper (Cu) deficiency was the most commonly diagnosed, especially in first rotation plantings, with approximately 450 ha reported as needing treatment.

Other *Eucalypus* spp. (*E. cadocalyx, E. maculate & E. saligna*)

Insect pests

Leaf blister sawfly (*Phylacteophaga froggatti*)

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

White fringed weevil (*Naupactus leucoloma*)

A small experimental planting of *Eucalyptus maculata* (2 ha) was severely attacked, resulting in death of 90% of trees (F. Tovar IPMG).

'Spring' beetle (*Liparetrus jenkinsi*)

Spring beetle features as a significant problem in establishment of *E saligna*, *E cladocalyx*, and *E maculata* plantations. Attacks predominate in late September/October. 2009 spring season was not an unusual season apart from one swarming approx 50km northeast of Dumbleyung (inland wheatbelt). This insect has not been reported this far from a forested area before.

Autumn Gum Moth (*Mnesampela privita)*

An outbreak of *M. privita* was reported on York Gum (*E. loxophleba*) in the northern inland area of the Esperance region. This was a first time experience of *M. privita* in the area and as such staff were not prepared for it.

Termites

In the Esperance region live eucalypt mallee species in plantations (young trees) have been attacked by termites (species unknown).

Sandalwood (*Santalum spicatum*) plantations

No major insect or fungal problems reported.

Managed natural forests

Jarrah forest (*Eucalyptus marginata)*

Insect pests

Jarrah leaf miner (*Perthida glyphopa*) (JLM)

Surveys for jarrah leaf miner (JLM) in October & November 2009 showed that there was northwards spread of JLM outbreak into northern regions of Jarrah forest, but severe browning due to JLM was recorded in the Albany hinterland (A. Wills, DEC).

Gum leaf skeletonizer (*Uraba lugens*)

Two separate outbreaks of gumleaf skeletonizer (GLS, *Uraba lugens*), one SE and one NW of Manjimup occurred in 2009-10. Forty seven sites were inspected, with GLS identified at 12 and a further 4 showing symptoms of damage. In the NW outbreak, at 5 sites from to two forest blocks, 5-40 % of trees were affected with some experiencing 80% defoliation. At 5 sites within the SE outbreak 5-70 % of trees were affected with some being 90% defoliated. Prior to 2009 and following the 1982-1992 outbreak populations of this defoliator were so low that its presence in the southern jarrah forest was rarely recorded. With the current increase in the GLS population the Department of Environment and Conservation intend to reactivate a former quantitative sampling program in summer 2010 such that comparisons with the previous outbreak can be made (J. Farr & A. Wills, DEC).

U. lugens at Warren NP (*left*) and Canopy chewing by GLS at Yanmah forest block February 2010 (*right*).

Pathogens

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).

Karri forest (*Eucalyptus diversicolor*)
Insect pests
No major pest problems reported.

Pathogens
No new major disease problems were reported. Management and survey of *Armillaria* root disease in karri forests continues to command attention.

Nurseries

No major problems have been reported in either hardwood or conifer 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. *P. 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, 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 (T. Burgess, G. Hardy, D. White, Murdoch University; J. Webster, J. Ciampini, M. Stukely, DEC).

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. Scott, T. Burgess, P. Barber, G. Hardy, T. Jung, Murdoch University; B. Shearer, M. Stukely, DEC).

ARC Linkage Project. Susceptibility to *Phytophthora cinnamomi* and sensitivity to phosphate in native Australian plants: why are they linked?

Currently, phosphite is the most effective and economically viable treatment available to prevent the spread of *P. cinnamomi*. Phosphite is applied to infested areas in state forests, national parks and urban bushland. The use of phosphite, whilst being of great benefit to control the spread of *P. cinnamomi*, may inadvertently be driving ecological change by disrupting the natural process of phosphorus (P)-sensing in Australian native plants. Phosphite disrupts normal root responses to plant P status. However, phosphite is microbially oxidised to phosphate, the plant-available form of P. Long-term use of phosphite to control *P. cinnamomi* therefore has a fertilisation effect by increasing the total phosphate status of extremely low-P ecosystems in which it is used. Fertilisation of environments that are naturally extremely low in P may have undesirable effects, as it will promote invasion by weeds and plant species that perform better under conditions where P is more readily available. It may also negatively impact on P-sensitive species. It is therefore imperative that we understand how phosphite reduces plant susceptibility to *P. cinnamomi*, so that we can search for a non-P-containing chemical alternative for the management of this pathogen. It is essential that we understand the genetics of *P. cinnamomi* resistance in order to develop new tools for dealing with this pathogen. (Research Fellows: O. Berkowitz, Murdoch University; S. Pearse , Xuanli Ma, R. Jost, University of WA; PhD student Daniel Kollehn, MU; Chief Investigators H. Lambers, P. Finnegan, Yan, UWA; G. Hardy, P O'Brien, MU).

DEC Phytophthora Research Project

A research project, funded through a State Government Specific Nature Conservation Project, to study the epidemiology and control of *P. cinnamomi* on the south coast of WA was initiated in late 2006. The project is investigating the seasonal disease dynamics of *P. cinnamomi* including the mechanisms to disease centre extension and survival. In addition the project is also investigating the effect of phosphite basal stem application on the epidemiology of *P. cinnamomi* to test whether it will prevent disease centre expansion. The initial results from high intensity phosphite application (HIPA) (ie basal stem application) field trials using 30% active ingredient seems has been promising. After three years of monitoring at the Gull Rock, Stirling Ranges and Fitzgerald River National Parks, HIPA has significantly reduced mortality in target species and reduces inoculum levels of the pathogen within soil. Only a minor (and not significant) reduction of disease centre expansion was recorded. Only minor, and mostly temporary, phytotoxicity was observed. The treatment appears to be most effective along disease fronts in south coast plant communities with deep sands where the main transmission is root-to-root contact. A large scale (3 km) HIPA treatment has been conducted at the Bell Track infestation within the Fitzgerald River National Park as a component of a containment strategy. Two years of monitoring using Plant

Cell Density measurements captured using Digital Multi-Spectral Imagery has shown promising results. Further, field investigations using the HIPA technique is planned for the Jarrah forest in early 2011 (C. Dunne, DEC).

State NRM Phytophthora Containment and Eradication Research
In late 2009 a State NRM grant was received to undertake a number of Phytophthora dieback management initiatives. Included in this project are attempts at management scale containment and eradication of *Phytophthora cinnamomi* infestations within the Fitzgerald River and Cape Arid National Parks. Substantial project planning, hydrological modeling, pathogen occurrence mapping and development of eradication techniques have been completed. The integrated management approach plans to trial a number of new and novel techniques including: run-off diversion and treatment; use of silt membranes to prevent zoospore and inoculum movement down the catchment; host removal; soil sealants; fungicide treatment; and possible fumigation. Significant logistic and project management issues will need to be overcome if the eradication attempt is to be successful (C. Dunne, R. Hartley, P. Scott, DEC; B. Dunstan, T. Paap, N. Williams, G. Hardy, Murdoch University).

Canker pathogens as endophytes in endangered species
Isolates of *Botryosphaeria* complex, a putative *Microthia*, *Cryptodiaporthe* and *Cytospora* spp. have been isolated from cankers on *Banksia baxteri*, *B. coccinea, B. verticillata* and *Lambertia orbifolia* in the SW of WA. All except *Cytospora* spp. have also been isolated at a low level from healthy asymptomatic tissue suggesting that they have some degree of benign endophytic role and that the environment may moderate the host-pathogen relationship. The systemic fungicides fenarimol, prochloraz and tebuconazole are being investigated as control options in *B. verticillata* and *L. orbifolia* – initially *in vitro,* then *in vivo,* for the four main canker causing pathogens (C. Crane, S. Barrett, B. Shearer, C. Dunn, DEC)

Urban and rural

Insect pests
See section on wandoo decline (below).

Pathogens and Declines

Cypress canker
Branch death and flagging caused by *Pestalotiopsis* sp. (closely related to Cypress canker, *Seiridium* sp.) has been affecting Sequoia (*Sequoidendron gigantium*, planted 1984), Morroccan juniper (*Juniperous oxycedrus*, planted 1999) and cypress (*Cypressus macrocarpa*) hedge trees in the Golden Valley Tree Park near Balingup in the SW of WA since 2005-06. Subsequent treatment with Mancozeb and Pentrabark in March 2007 and December 2009 has allowed the cypress hedge to recover and minimised spread of the canker and recovery of other trees (B. Hingston, DEC).

Moroccon juniper showing severely affected tree (*left*) and infected and dead branch tips (*right*).

Sequoia with single infection (*left*) and close up of infected broach tip (*right*)

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, G. Hardy, Murdoch University; M. Wingfield, Tree Pathology Cooperative Program (TPCP) South Africa).

Marri decline

Decline of *Corymbia calophylla* (marri) in the south-west of Western Australia (WA) has been an increasing source of concern in recent years, due to a canker disease caused by *Quambalaria coyrecup*. More recently *Q. pitereka* has been implicated in leaf and shoot blight, which has been observed over the last five years to extend to flowering parts at all stages of development. This symptomology is not typical of Quambalaria shoot blight (QSB) in its origin of eastern Australia, and this study is the first investigation of the disease on flowering structures. Marri flowers are invaluable to the WA beekeeping industry and to native fauna, for which reason this study was

conducted to ascertain the extent, causes and possible impacts of the disease. Six surveys conducted over a 13 month period determined that QSB was widespread over the *C. calophylla* distribution range, causing deformities and early termination of flowering structures, and was associated with three different species of *Quambalaria*. DNA sequences of 23 isolates obtained in this study confirmed the presence of *Q. cyanescens* and *Q. pitereka* with the latter identified as the primary blight pathogen of both vegetative and reproductive tissues. A third and new species is described as *Q. pseudocyanescens* C. Marbus sp. nov. and is closely associated, along with *Q. cyanescens,* with a new symptom of 'horizontal' fruit growth which is considered a separate syndrome to the traditional form of QSB and is linked to reduced seed output. The precise nature of the interactions between the diseased fruit and the *Quambalaria* spp. found has not been confirmed, and further studies are required in this area to determine the role of insects and other fungal pathogens, which in turn will shed light on possible management strategies for these pathogens in WA's native forests. (C. Marbus, T. Paap, B. Dell, 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, G. Hardy, Murdoch University)

Mundulla Yellows

Monitoring the occurrence and symptom development of Mundulla Yellows (MY) in WA continues. Symptomatic eucalypts (both planted trees and remnant native trees) have been recorded and monitored 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. Results of research carried out by the Tuart Health Research Group (THRG) include:

- Survey shows that the major decline syndrome is confined to the Yalgorup region
- A new species of *Phytophthora*, *P. multivora,* associated with declining trees has been described (Scott *et al*. 2009, Persoonia 22: 1-19)
- A very close correlation between foliar zinc levels and crown health has been observed and demonstrated
- Trees are still showing signs of an increase in crown health five years after treatment with zinc and phosphite
- Ther is a strong correlation between crown health and soil microbial function and diversity (Y. Cai, Murdoch University)
- Lack of fire may be contributing to the decline of tuart, however, it is not a major factor (R. Archibald, Murdoch University).
- Botryosphaeriaceous taxa have also been implicated in the decline of *E. gomphocephala* and the potential roles of a number of other endophytic taxa are being investigated (K. Taylor, P. Barber, G. Hardy, T. Burgess, 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).

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. Management of research on wandoo decline is presently being co-ordinated by the State Centre of Excellence for Climate Change; Woodland and Forest Health. Previously research and monitoring was co-ordinated by the University of WA and DEC. Results of research and monitoring to date include:

- *Cisseis fascigera*, wood boring insect (Coleoptera: Buprestidae), has been identified as a primary contributing factor in dieback and decline of Wandoo trees (R. Hooper, A. Wills, B. Shearer, K. Sivasithamparam 2010, Australian Journal of Entomology 49: 234-244).
- Wandoo and powderbark wandoo (*E. accendens*) appear to be better 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 identified temporal and spatial trends in wandoo health that indicate decline patterns are broad scale, variable and not continuous across the landscape. Although crown

decline still occurs across the range for wandoo (albeit at low levels) at some 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 15864 ha was mapped to assist the planning of roading and timber harvesting operations undertaken by the FPC, while FPC also arranged significant areas of mapping by private contractors. This included 7,552 ha of previous mapping that was checked for further spread. Mapping and hygiene planning were undertaken on a further 1,707 ha for the Parks and Visitor Services, Nature Conservation Service and Sustainable Forest Management Service of DEC, and 3,319 ha for external parties. Training programs were carried out in disease mapping and hygiene management (G.Strelein, DEC).

In the year to 30th June 2010, a total of 1,581 samples were 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 new records for WA of *P. inundata, P. asparagi* and *P. niederhauserii*. At least nine new and undescribed *Phytophthora* taxa occurring in native vegetation in WA have been distinguished, based on their ITS rDNA sequences. Most of the newly identified Phytophthoras have been associated with multiple species of dying native plants in natural vegetation communities. Several of them are difficult to distinguish, 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 in 2009, and the descriptions of another seven species are in preparation. 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. While the pathogenicity of many of the new taxa is still to be fully investigated, the precautionary principle should be applied by managers to ensure that the spread of all Phytophthoras to new areas is minimised. Hygiene practices should be applied in the same way as for *P. cinnamomi*. (M.Stukely, DEC).

Forest health monitoring

An automated annual monitoring program is being developed to identify changes in satellite reflectance information over time and correlate this with known or past causes of changes in forest health and vigour. This information is then used to classify the changes, with levels of confidence, to causal factors. Those with unknown or low

levels of confidence or changes in magnitude are then targeted for further investigation including field checks to confirm causes and recalibrate the annual data updates. The system includes spatial modeling algorithms to incorporate both known datasets (harvesting, fire, mining) and surrogate datasets (landform, soils, vegetation) that can be correlated with possible causes and inform the decisions on causes that as yet have no spatial history to guide classification (G. Strelein, 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 late 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. Six Post-Doctoral fellows and a Manager have been appointed within the centre. 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 (MU)

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

Research on the incidence and new records of *Teratosphaeria* (formally *Mycosphaerella*) species within a *Eucalyptus globulus* plantation continues in Western Australia. *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 *Teratosphaeria* 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. Results so far include:

- Eleven species of *Teratosphaeria* have been identified by morphology and confirmed using molecular tools
- The most frequently isolated species from juvenile foliage was *T. marksii* (77%) followed by *T. nubilosa* (33%)
- *Teratosphaeria nubilosa* was most frequently isolated from adult leaves (88%) followed by *T. parva* (7.5%)
- Thirteen species of *Teratosphaeria* have now been identified from eucalypts in WA

Monitoring of plantations continues in order to understand the dynamics of the host-pathogen interactions (A. Maxwell, AQIS; S. Jackson, T. Burgess, G. Hardy, B. Dell, Murdoch University).

Work under the following grants is in progress at Murdoch University (MU).
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. *Teratosphaeria* 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; M. Wingfield, TPCP).

PhD Theses in progress at Murdoch University (MU)

Francisco (Paco) Tovar: The cause of basal stem rot in second rotation *Eucalyptus globulus* plantations (Supervisors: T. Burgess, G. Hardy, MU; R. Robinson, DEC).

Katherine Taylor: A detailed study of *Teratosphaeria cryptica* and *T. nubilosa* in Western Australia, focusing on the threat to native remnants (Supervisors: T. Burgess, G. Hardy and P. Barber, MU; C. Mohammad, Forestry CRC; 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; B. Wingfield University of Pretoria).

Sarah Jackson: Taxonomy and biology of *Teratosphaeria* species found on *E. globulus*. (Supervisors: G. Hardy, 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, McComb, 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, McComb, 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, D. Huberli, MU; I. Smith DPI Vic.; 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; 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; 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; B. Shearer, DEC).

Amy Smith: The introduction, transmission and spread of plant pathogens in plant nurseries: using Phytophthora as a model. Amy has started to isolate *Phytophthora* species from plants obtained from a range of wholesale and retail nurseries and from substrates (e.g. sand, bark, peat) that are used to make container substrates. She is also looking at how fungicides might suppress rather than kill *Phytophthora* species and hence facilitate their movement. She also intends to look at (a) fungicide resistance and (b) the populations structures of *Phytophthora* species in nurseries. (Supervisors G. Hardy, D. Huberli, K. Baylis, MU).

Endah Yulia. Fungal pathogens affecting urban eucalypts in Western Australia: Red Flowering Gum (*Corymbia ficifolia*) case study. Endah has isolated a large range of foliar and stem fungi from across Perth and towns in the lower south-west of WA. She has also isolated from natural stands of *C. ficifolia*. She is also rating tree health to site characteristics and urban management. *Quambalaria* species in particular *Q. coyrecup* (canker causing pathogen) are widespread and causing significant loss of trees through death and removal. She is in the process of isolating soilborne pathogens in the spring and summer of 2010. Pathogenicity tests will be conducted on the most frequently isolated taxa from diseased material. (Supervisors B. Dell, P. Barber, G. Hardy, MU).

Lily Ishaq. Role of mycorrhizal fungi in tuart (*Eucalyptus gomphocephala*) health. Lily started in late 2009. The primary aim of this study is to investigate the importance of mycorrhizal fungi in the healthy functioning of *E. gomphocephala* woodlands. The following hypotheses are proposed:

- The ecto and endo-mycorrhizal inoculum potential in soil changes with *E. gomphocephala* health status
- Mycorrhizal diversity and abundance changes with changes in crown health of *E. gomphocephala* ,
- Mycorrhizae can promote the health of *E. gomphocephala* seedlings on recalcitrant soils through improved nutrient acquistion, and

- Mycorrhizal abundance on roots is affected by root disease caused by *Phytophthora multivora*.

(Supervisors B. Dell, P. Barber and G. Hardy, MU).

Honours Theses in progress at Murdoch University (MU).

Katherine Edwards: Phytophthoras associated with *Eucalyptus rudis*: *E. rudis* (Flooded gum) is in decline across its range in the south-west of Western Australia. It is a keystone species in riparian ecosystems and provides important ecosystem functions such as habitat provision and water quality maintenance. Symptoms of decline resemble those of dieback caused by *Phytophthora* pathogens. This study sampled several watercourses and rhizosphere soils across the south-west for species of *Phytophthora* found in association with *E. rudis* and tested their pathogenicity to *E. rudis*. Several different treatments, including phosphite, insecticide and complete nutrients, were tested on *E. rudis* in a Perth wetland to compare their effectiveness in restoring health. The health of these *E. rudis* were also assessed using aerial remote sensing imagery. Currently, two *Phytophthora* species and a number of *Pythium* species found in association with. *rudis* are being sequenced (Supervisors: G. Hardy, W. Dunston, T. Jung, MU).

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

ANNUAL PEST AND DISEASE STATUS REPORT
NEW ZEALAND 2009/2010

Collated and summarised by J. Bain, L. Berndt, L. Bulman, M. Dick, I. Hood and M. Watson (Scion) from data and information from the Forest Health Database, *Forest Health News* (Scion), and the Forest Health Reference Laboratory.

Plantations

Pinus radiata

Pests

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

Pathogens

Dothistroma needle blight

Last year we predicted that the spray programme to control dothistroma needle blight would be small at less than 50,000 ha. In fact only 31,495 ha were sprayed throughout the North Island. This is the second smallest programme for 30 years, following on from the smallest in the previous season. The dry weather over the three summers starting 2007 has abated somewhat and Dothistroma needle blight is starting to build up in some forests in the central North Island. We anticipate a spray programme of about 50,000 ha during the 2010-11 season.

Disease levels were assessed during routine forest health surveillance activities. Mean severity increased to 28% over 2009-10, compared with 24% in 2008-09, and 21% the season before that. The assessment data are useful to demonstrate gross trends and should not be viewed as true means because there is no requirement to record low disease levels or absence of disease.

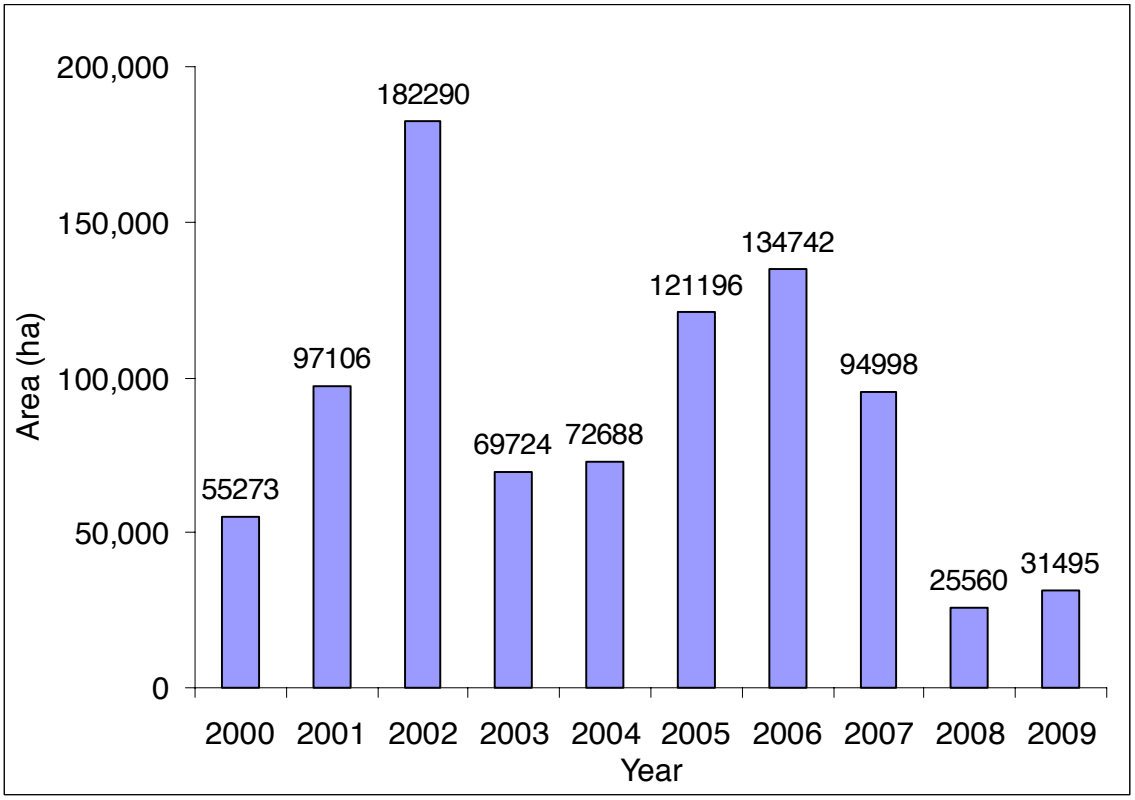

Figure 1 – Area sprayed annually for Dothistroma control in the North Island

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. A forester responsible for forest health operations in a central North Island forest commented that the pattern of disease has changed over the years due to changed management practice. Previously, Cyclaneusma needle-cast presented as highly susceptible trees randomly scattered throughout an affected stand. Over the past few years disease incidence has increased and severity has reduced. Disease is more uniform in stands. This change is attributed to planting material with a narrower genetic base, thus reducing between-tree variation in Cyclaneusma susceptibility. On the other hand, elimination of highly susceptible genotypes from the breeding population has reduced overall severity.

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*

As in the previous year, a few reports of the physiological needle blight (PNB) were received in early spring. Most reports were from two regions on the East Cape of the North Island and from a number of very small locations in the central North Island. Northland was not affected.

Neonectria fuckeliana

There is evidence to suggest that the management regimes to control Nectria flute canker have resulted in a significant reduction in the number of trees affected. A research plan is being prepared to quantify the effect of avoiding winter pruning and reducing pruned branch stub size.

There has been no further extension to the range of *Neonectria fuckeliana* which remains restricted to the lower half of the South Island (Figure 2). The fungus has not been found in Nelson, Westland, or anywhere in the North Island where surveys have been carried out. Intensive monitoring in mid-Canterbury and Bank Peninsula revealed an increase in the number of sites on the Banks Peninsula where *Neonectria fuckeliana* was recorded (Figure 3). Of the 11 sites examined on the Banks Peninsula, in 2010 *N. fuckeliana* was successfully isolated from trees at seven sites compared with three in 2009. Incidence of fluting varied and no trend was established when comparing 2009 and 2010 assessments. In some locations fluting increased, in others it decreased.

Fluting typical of Nectria flute canker was not recorded and the fungus was not recovered from the three 100-tree plots established on the Canterbury plains (Figure 3).

Figure 2 - Known distribution of *N. fuckeliana* in June 2009

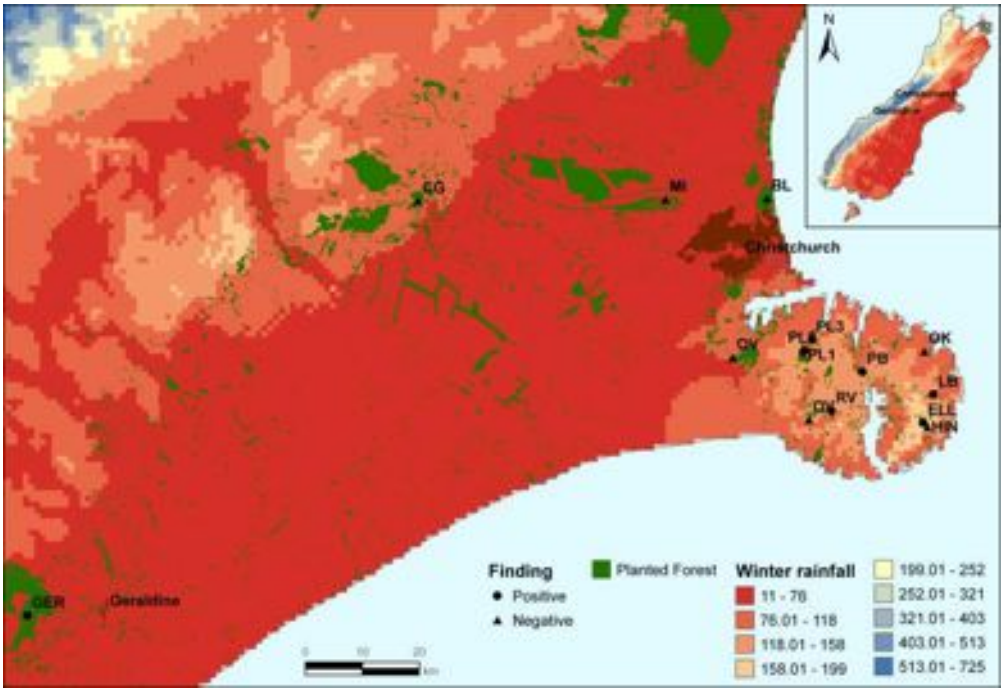

Figure 3 - Known distribution of *N. fuckeliana* in Canterbury as at August 2010

Armillaria root disease

Reports and samples confirmed that armillaria root disease remains widespread but scattered in impact in many P. radiata plantations throughout much of the country. Infection is mainly by Armillaria novae-zelandiae. Mortality of young trees is less common in second or third rotation stands. Despite its current generally low impact in contemporary plantations, it can be important locally, and the general distribution of infection means that there is a significant risk of a more severe effect should there be any adverse change in stand management.

Douglas fir (*Pseudotsuga menziesii*)

Pathogens

***Phaeocryptopus gaeumannii* (Swiss needle cast disease)**

Swiss needle cast disease (*Phaeocryptopus gaeumannii*) remains the most significant disease of Douglas fir throughout New Zealand. Recent work has shown that the cumulative volume growth increment loss following the introduction of this pathogen amounted to 32%, being greater in forests in the warmer North Island (35%) than in those in the South Island (23%). The impact of this disease appears to have offset potential genetic gains in volume growth made as a result of provenance deployment. Infection and the consequent growth reduction tend to be lower, and foliage retention higher, where temperatures are cooler. Growth loss is negligible on sites with average daily minimum October temperatures below 3.2°C. Maps have been prepared showing predicted levels of infection, foliage retention, and growth reduction due to disease, in order to advise growers where Douglas fir can still be grown with least disease impact.

Eucalyptus spp.

Pests

***Uraba lugens* (gum leaf skeletoniser)**

Uraba lugens (Nolidae), the gum leaf skeletoniser, is widespread in the greater Auckland region, as far north as Warkworth, and also in the Waikato region, at Mt Maunganui in the Bay of Plenty, and in the Coromandel. It has not yet been reported as a concern in commercial plantations, and is causing significant damage only on amenity trees in the Auckland region. Approval has now been given by the Environmental Risk Management Authority of New Zealand for Scion to introduce a biological control agent for *Uraba lugens*, the braconid parasitoid *Cotesia urabae*, obtained from Tasmania. First releases of this agent will be made in January 2011.

Pathogens

Kirramyces *and* Mycosphaerella *leaf disease*

Kirramyces eucalypti (agent of septoria leaf blight) and mycosphaerella leaf blotch (primarily due to *M. cryptica*) have resulted in a serious foliage disease in *Eucalyptus nitens* plantations in warmer parts of New Zealand. As a result of this, and defoliation due to *P. charybdis*, many young stands of *E. nitens* have been removed or replaced. A set of meteorological stations are 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 still be grown successfully

Low levels of foliage disease associated with the fungi *Fairmaniella leprosa*, *Pseudocercospora crousii*, *Kirramyces epicoccoides* and *Microsphaeropsis conielloides* were also recorded.

Cypresses

Diseases:

Cypress canker *(Seiridium* spp.*)*

Cypress canker, caused by two species of *Seiridium* continues to cause damage in many cypress stands throughout the country, particularly *Cupressus macrocarpa*.

Stigmina thujina

Defoliation of *Chamaecyparis lawsoniana* was recorded in the Buller region of the South Island.

Indigenous Forests

Phytophthora *taxon Agathis*

Further records of *Phytophthora* taxon Agathis (PTA) associated with stem cankers, dieback and mortality of kauri (*Agathis australis*) have been obtained from Northland and Auckland regions. *Phytophthora cinnamomi* is also commonly found in soil in kauri stands (both healthy and unhealthy).In stem inoculation tests *P. cinnamomi* did not behave as a pathogen to kauri seedlings (in contrast to PTA which killed plants

within a few weeks of inoculation) but it has been demonstrated to cause root disease of seedlings.

***Trichosurus vulpecula* (possum)**
Major damage to indigenous forests by the Australian brushtail possum (*Trichosurus vulpecula*) continues to occur throughout much of the country. Favoured food species are tall canopy species such as tawa (*Beilschmiedia tawa*), northern and southern rātā (*Metrosideros robusta* and *M. umbellata*), kohekohe (*Dysoxylum spectabile*), kāmahi (*Weinmannia racemosa*) and *Podocarpus cunninghamii* (Hall's tōtara). Many other species are browsed to a lesser extent.

Biosecurity

Post-border (eradication)

Dutch elm disease

The 2009-10 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. A total of 59 traps were deployed and they trapped 1,449 beetles, of which five were positive for the presence of *Ophiostoma novo-ulmi*. All positive beetles were trapped near the end of the season and were from three traps.

One elm positive for Dutch elm disease was found. The sample was collected on 30 Nov 09 and the *O. novo-ulmi* confirmed on 10 Dec 09. The fungus was isolated from the current and 1-year old wood. This elm was part of a same group where elms were removed the previous year, so it was not in a new location.

An interesting feature of the 2009-10 programme was the continued spread of the vector, *Scolytus multistriatus* throughout New Zealand. It was recorded further south at Palmerston North. The pathogen however has not been recorded outside greater Auckland.

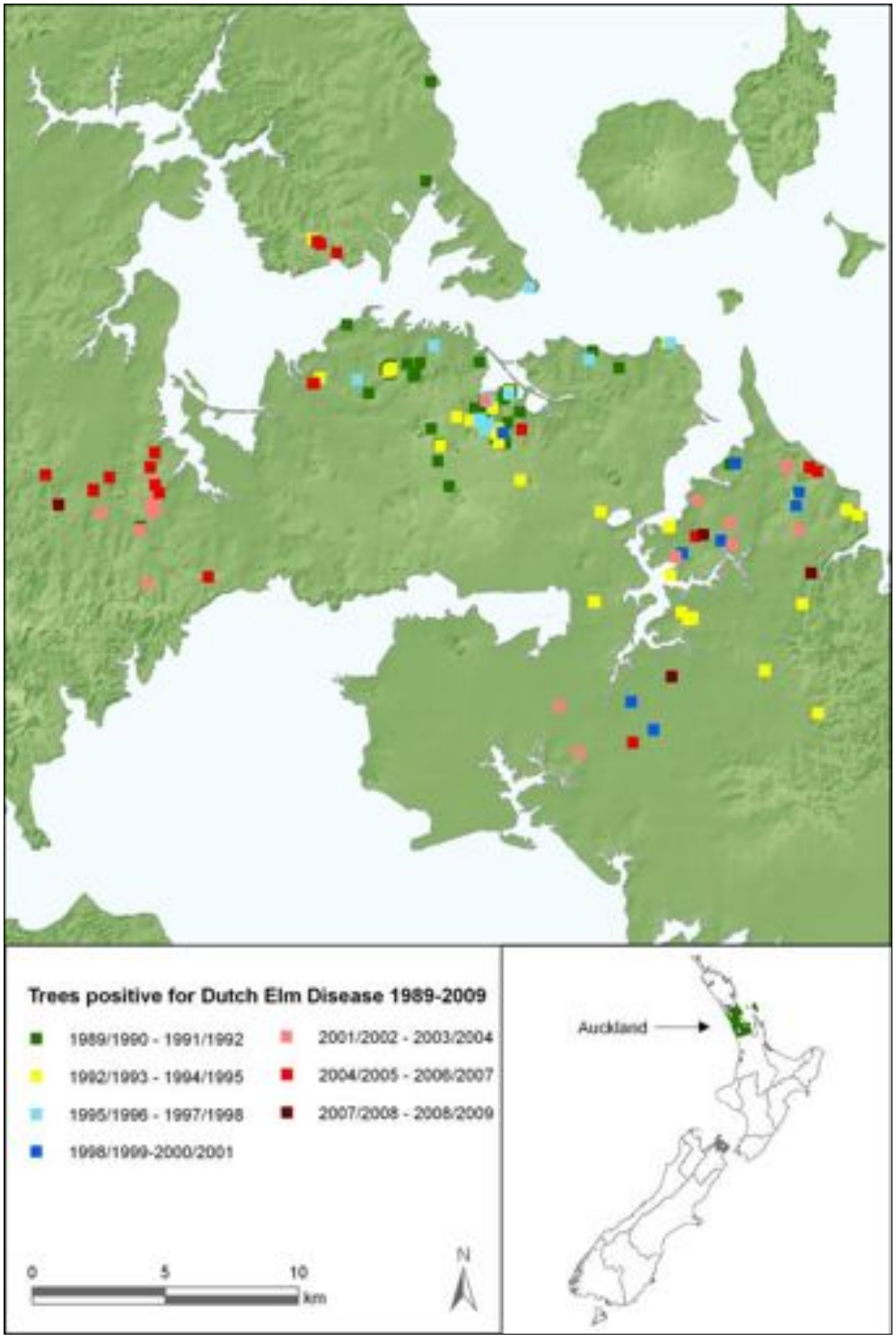

Figure 3 - Locations of diseased trees 1989-2009

Post-border (New Records)

The following new records were validated and investigated in 2009-10.

- *Phaeoacremonium rubrigenum* was isolated from branches of *M. azederach* with dieback symptoms. Other fungi, including a species of *Botryosphaeria* were also obtained from live/dead margins. Whether *P. rubrigenum* is contributing to the dieback is unknown. *Phaeoacremonium* is a recently

described genus associated with decline diseases of several woody hosts and with human infections (usually immuno-compromised). In the Northern Hemisphere *Phaeoacremonium rubrigenum* has been isolated from bark beetles and their galleries in *Quercus* and *Fraxinus*. In the Northern Hemisphere it has also been associated with Esca disease of grapevines and with a disease of kiwifruit vines.

- *Heptameria obesa* was isolated from dead twigs and small branches of *Pittosporum tenuifolium*. This fungus has been recorded from Europe and North America on dead stems and twigs of shrubby species of *Baccharis, Cirsium, Helichrysum Inula, Antirrhinum* and *Scabiosa*. It is considered to be saprophytic.
- *Carulaspis minima* (Diaspididae) was found on *Juniperus chinensis*. This European armoured scale insect has also been recorded from North and South America Africa, Bermuda and Hawaii on quite a range of softwoods. *Juniperus* spp. appear to be the favoured hosts. It is regarded as a serious pest of *Juniperus bermundiana* in Bermuda.
- An unidentified tenthredinid sawfly was found on *Salix babylonica* causing distinctive looking leaf curl galls. Preliminary DNA work indicate a 97% match with *Brachycoluma viduata*.Larvae are being reared.

BIOLOGICAL CONTROL

Buddleja davidii

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. The weevil is spreading faster than initial observations indicated and at many sites defoliation of buddleia is very noticeable. Work continues to quantify the rate of spread and the effect of the defoliation.

Recent Publications and website features

The monthly Scion publication *Forest Health News* can be viewed on line. See:
http://www.scionresearch.com/general/science-publications/science-publications/science-newsletters/forest-health-newsletter

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

The Forest Pathology Leaflets produced by the Forest Protection group at Scion have been updated and are available in pdf format on the Scion website at:

http://www.scionresearch.com/general/science-publications/science-publications/science-newsletters/forestpathology/

The New Zealand Farm Forestry Association has compiled information on the pests and diseases encountered in New Zealand's forests on its website. The information is 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.

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