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 2007-2008

October 2008

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KEY ISSUES & THREATS

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

New South Wales

The key issue in pine plantations in NSW in recent years has been the increase in *Ips grandicollis* and subsequent attack to pine trees. *Ips* caused extensive tree mortality of drought-stressed trees in 2007 in Hume Region, with over 17,000 ha affected to varying levels. *Diplodia pinea* was also associated with much of this tree mortality to drought-stressed trees. *Ips* has also been attacking trap trees established for the biological control of *Sirex*. The current concern is that *Ips* is threatening the effectiveness of the *Sirex* bio-control program by disrupting the ability to get nematodes into *Sirex* within trap trees. Current and future research, funded by the National Sirex Coordination Committee, is investigating several aspects of this problem. In hardwood plantations, the psyllid *Creiis lituratus* is still the major threat to young *Eucalyptus dunnii* plantations in northern NSW. Significant damage was observed in both young (1-2 year old) and older (5-8 year old) stands, resulting in tree mortality. Current research, conducted by members of the Subtropical Forest Health Alliance, is investigating various options for management of *Creiis*.

Queensland

Quambalaria shoot blight remains the major threat to development of *Corymbia* taxa plantations in Queensland. Severe stem cankers were detected in Queensland causing "measle" symptoms on *E. grandis* hybrids and *E. dunnii*, as well as in non-plantation eucalypts, similar to that caused by *Colletogloeopsis zuluensis* (Coniothyrium canker) in South Africa. A species of *Caliciopsis* was isolated from cankers. It is not yet known whether this canker could cause harvesting and wood quality problems similar to that of Coniothyrium canker in South Africa. Glasshouse pathogenicity studies on *Chrysoporthe cubensis* isolated from the Cairns Botanical Gardens in 2005 indicate that *Corymbia* species, including Spotted gum, Gadagii and the *Corymbia* hybrid are highly susceptible. Tent leafhopper (*Kahaono* sp.) is emerging as a problem on *Corymbia* hybrids in the South Burnett. This insect induces chlorosis on the lower third of foliage, and so is unlikely to have significant impacts on growth rates. Kirramyces leaf blight is a major emerging problem for plantation establishment in central coast regions of the state.

There were no significant health issues in Queensland's softwood estate. Sirex has not been detected in Queensland.

Victoria

Research is needed into:

1. Predisposing factors and ongoing impacts and potential control measures for pine aphid defoliation in *Pinus radiata* plantations

2. Potential impacts of climate change on insects and pathogens covering native invertebrate populations, fungi, pest insects, pathogens and exotic incursions (covering for example, impacts of expected increased frequency of fire regimes on invertebrates, increased plantation estate for carbon sequestration and its impacts on pest population dynamics, and potential for new pest incursions to enter and develop given changes in rainfall and temperature patterns).
3. Development of an effective integrated national system of health surveillance monitoring and reporting using quantifiable, comparable data.
4. Targeting, monitoring and control of pathways for entry of insects and pathogens to Australia.
5. Evaluation of the risk that exotic agents such as *Phytophthora ramorum* and *P. pinifolia*, are to Australia's natural ecosystems and forest industry.
6. Elucidating the underlying physiological basis for symptom development in Mundulla Yellows, and the development of species to be used for regenerating affected sites.

Tasmania

Effective management of the two key pests in Tasmanian eucalypt plantations, chrysomelid leaf beetles and browsing by native mammals, is challenging. Conventional approaches to managing over-threshold populations of leaf beetles has relied on contact insecticides that provide no residual protection. Multiple egg-laying peaks and inundation of plantations from surrounding areas by highly mobile adult beetles to feed prior to overwintering are not well managed using this conventional approach. Research by the CRC for Forestry to develop a cost-effective and socially-acceptable method of providing whole of season protection of plantations from leaf beetles has been in progress for the past three years. The use of 1080 for the management of browsing mammals has almost ceased in Tasmania. Alternative control relies on a more integrated approach using physical or chemical barriers in combination with culling by shooting or trapping. Costs have escalated using these alternative controls and a large multi-agency (Dept Primary Industries and Water, UTas, Forestry Tas, CRC for Forestry) research program is underway to improve cost-efficiency of browsing management.

South Australia

The main forest health issues in South Australia in 2008 were:

- In Pines:
    - Essigella: Higher numbers of Essigella this year have resulted in an increase in defoliation.
    - Ips: continuing drought conditions and high residue levels in plantations following clearfelling, together with clearfelling near young plantations has resulted in a buildup of Ips in many plantations, particularly in the Mid-North forests. There has also been an issue with Ips attacking trees in trap tree plots set up for Sirex monitoring and control.

- In Eucalypts

- Shothole Miner: Increased activity by Shothole Miner resulted in increased defoliation in 2008. This insect is related to the Jarrah Leafminer (*Perthida* sp.) but little is known of its ecology or impact in south eastern Australia.
- Sawflies and weevils: These continue to cause significant damage in some areas.

Western Australia

In the south west of Western Australia, the impact of Phytophthora cinnamomi in native forest, woodlands and coastal heaths and the widespread decline in tree health in tuart forest and wandoo woodland are major concerns. The widespread decline and deaths of marri trees, caused by Quambalaria coyrecup, is also emerging as a significant problem as is the recent discovery of at least nine new and undescribed Phytophthora taxa. Several are associated with multiple species deaths in native plant communities and work on their taxonomy, biology and ecology is urgently needed. Mapping the extent of P. cinnamomi and protecting threatened flora communities is a priority within the Department of Environment and Conservation. Mapping also shows that a marked increase in the extent of tuart decline has occurred since 1999. Mapping the extent of wandoo decline is in progress. The new Centre of Excellence for Climate Change, Woodland and Forest Health will be a major boost for forest health research in WA, but attracting and retaining high quality staff and students is becoming increasingly difficult in the current economic climate.

New Zealand

Nectria flute canker of *Pinus radiata*, caused by *Neonectria fuckeliana*, has been the key issue for New Zealand's plantation forest industry over the past two years. *Neonectria fuckeliana* remains confined to the lower half of the South Island although there has been some spread into Banks Peninsula east of Christchurch. Development of disease is strongly associated with pruning operations and second lift whorls having a higher incidence of canker formation than first lift whorls.

In indigenous forests further ill-health of kauri (*Agathis australis*) has been recorded in Auckland and Northland. *Phytophthora* taxon Agathis which was first identified from kauri on Great Barrier Island as *P. heveae* in 1972 has been isolated from the margin of bleeding lower stem lesions.

SUMMARY

This section, also new to the Annual Report, briefly summarises the main issues in each State.

New South Wales
Softwood plantations in all Regions were surveyed from May to August 2007. Sixty State Forests or Plantations were surveyed by helicopter, with the majority having follow-up ground surveys. The extent and severity of pests, diseases, vertebrate pests, climatic disorders, nutritional imbalances and weeds limiting growth or affecting survival were mapped and reported on.

The main health issues in 2007 were:
The main issue in softwood plantations was significant and widespread tree mortality in Hume Region associated with drought and *Ips grandicollis* (bark beetle) attack. *Ips* numbers have increased in recent years and are now threatening the effectiveness of the biological control program for another pest, *Sirex* woodwasp, as *Ips* beetles attack trees that are used to deliver the *Sirex* biological control agent. Research is currently underway, funded by the National Sirex Coordination Committee (NSCC) and undertaken by NSW DPI in collaboration with Forests NSW, to investigate methods to reduce the impact of *Ips* beetles on the *Sirex* biological control program.

Sirex woodwasp continues to cause tree mortality in several softwood plantations in NSW. However, this is being effectively managed - by annual surveys (by NSW DPI) and the biological control program managed by Forests NSW - to reduce the impact and spread of this major pest. Current research, again funded by the NSCC and undertaken by NSW DPI in collaboration with Forests NSW, is continuing to enhance and improve the biological control program for *Sirex.*

The Monterey Pine Aphid, *Essigella californica,* continues to cause widespread defoliation in many *Pinus radiata* plantations, especially those growing on nutrient poor sites. Forests NSW is part of a National collaborative project to develop a biological control program for *Essigella,* with release of the biological control agent planned for later in 2008. Previous research had indicated that this was one of the most environmentally sustainable methods for control.

In August 2007 the FHSU conducted an aerial survey of a large proportion of the eucalypt plantations as part of the annual survey program. This included *Creiis* monitoring as well as general forest health. A ground survey of selected plantations was conducted in November 2007 and again in February 2008. However, this was of fewer plantations than previous years due to a reduction in FHSU staff. The main aim of the ground survey was to follow-up on disorders observed in the previous aerial survey, as well as visit plantations highlighted by Northern Region as having forest health issues. Health issues were discussed with the Operations Forester and Field Officers.

The main forest health issues in the young eucalypt plantations in 2007-2008 were:
In hardwood plantations, the main issue continues to be the severe damage from the psyllid *Creiis lituratus.* This insect again caused widespread damage to *Eucalyptus dunnii* plantations in northern NSW. NSW DPI in collaboration with Forests NSW and private growers is investigating more environmentally acceptable management options to control *Creiis.*

Two softwood Regions (Northern & Monaro) and the hardwood plantations were surveyed using the new digital aerial sketchmapping (DASM) technology this year. The system utilises a PC tablet linked to a GPS (via Bluetooth), with shape-files, digital topographic images, satellite-based imagery or ortho-photos as background maps. The PC tablet has a daylight-readable, antiglare screen for use "outdoors". The system enables the aerial observer to collect digital data (points, lines or polygons) directly onto the tablet screen with a pen and quickly enter attribute data (e.g. host, causal agent, incidence and/or severity rating) using a 'one touch' keypad. An icon displays the locality of the aircraft on the screen 'live', so the observer can spend more time identifying and mapping damaged area, than attempting to track their position on a map. The DASM software, GeoLink, also has a feature that allows for automated background map rotation following screen regeneration, whereby the background map rotates so that the direction the aircraft is heading is orientated to the top of the tablet screen. The sketched features are later translated into ESRI shapefiles for download into a GIS, thus reducing the lengthy process of post-processing the maps into a digital format, ensuring rapid turn-around of data. This system has increased efficiencies and accuracy in data collection during surveys of plantations, and its possible use for fire mapping and mapping of forest health in native forests in NSW is currently being investigated.

Queensland

Improved growing conditions in southeast Queensland were observed over much of the season in 2007-08, driving changes in the abundance and severity of some insect pests and also increasing the ability of trees to compensate for minor damage, with some growers reporting reduced spray programs. Greater amounts of new flush foliage resources may have promoted increases in populations of *Paropsis atomaria* leaf beetles and erinose mites (*Rhombacus* sp.). Abundance of younger age-class foliage may have also led to a collapse in populations of leafblister sawfly (*Phylacteophaga* sp.), which is known to prefer older age-class foliage. Major issues are listed below:

- *Paropsis atomaria* leaf beetle damage continued to cause significant damage to *E. cloeziana* and *Corymbia citriodora* subsp. *variegata* plantations in the Gympie and South Burnett regions of the state.
- Erinose mite (*Rhombacus* sp.) damage on *C. c.* subsp. *variegata* increased in the South Burnett region in 2007-08 over levels observed in the previous year.
- Severe flea beetle (*Chaetocnema* sp.) damage to several *E. dunnii* plantations in the South Burnett was also observed.
- Quambalaria shoot blight (*Quambalaria pitereka*) damage to *C. c.* subsp. *variegata* plantations was moderate, but widespread in the South Burnett region.

- Kirramyces leaf blight (mainly *K. psuedoeucalypti*) is continuing to be a major issue in establishment of *Eucalyptus* plantations (particularly *E. grandis* hybrids) in central coast region plantations. Total defoliation has been observed with associated tree mortality, mainly in 1-2 y.o. plantations.

There were no significant health issues in Queensland's softwood estate. Sirex has not been detected in Queensland.

Victoria

In Victoria, the year has been marked by the ongoing issue concerning chronic levels of pine aphid (*Essigella californica*) defoliation in the state's softwood plantations, coupled with the impacts of drought conditions that still persist across the state. Such dry conditions have placed additional stresses on trees within plantations and native forests and have in some cases, either exacerbated the impacts of low level insect associated defoliation or masked the full impact of this defoliation making it hard to quantify accurately. The dry conditions are also reflected in the increased impact due to Ips bark beetles and the stem canker pathogen Diplodia. The dry conditions are also reflected by the relatively low levels of foliage pathogens (*Dothistroma* and *Cyclaneusma*) across the Radiata pine estate although some 'hot spots' were recorded.

Within the eucalypt plantation resource, generally only small isolated outbreaks of insect pest and pathogens have occurred over the past year. However, Autumn gum moth (*Mnesampela privata*) remains a pest of major concern especially in *E. globulus* plantations, and a small outbreak in young plantations in the Corangamite region will be monitored over the next year to see if it is a precursor to increasing populations in the region. The Redgum psyllid *Cardiaspina retator* continues to cause chronic low levels of defoliation, as does the Steelblue sawfly *Perga affinis affinis*. Mycosphaerella leaf disease (MLD) was observed causing localised severe damage in young *E. globulus* and *E. nitens* in the wetter regions of South Gippsland and the Otways. A field guide has been produced for private forest owners to assist in establishing surveillance programs in smaller tree lots.

Within the states native forests, isolated outbreaks of leaf beetle have been observed in Alpine ash (*E. delegatensis*) forests in Gippsland, while *C. retator* continues to causes moderate to high localised levels of defoliation in River red gum (*E. camaldulensis*) in northern Victoria. No significant tree mortality has been associated with this defoliation at this time. Research is currently underway in native forests of Victoria to design a system of health surveillance suitable for implementation on Victoria's public lands. A plot based system is being piloted in the Central Highlands and routine monitoring of crown damage and presence of insects and pathogens is being assessed. Part of this monitoring program is to identify key invertebrate group as indicators of forest health, and the impacts of thinning on invertebrate populations.

A new outbreak of *P. cinnamomi* was recorded in March 2008 in *Xanthorrhoea australis* in the foothill forests of the Otway Ranges (Figure 4a). This outbreak followed heavy rains during November and December 2007 followed by the continuation of the drought

during late summer and autumn. A new record for *P.cinnamomi* was also recorded from French Island in Western Port Bay. This is the first record for this island and methods to contain it are being developed

In Urban, rural and amenity trees, *Armillaria luteobubalina* was recorded causing dieback of trees and shrubs in gardens, Parks and Reserves across Melbourne and the Dandenong Ranges during 2007/08. No further research on Mundulla Yellows was undertaken during 2007/08 and the underlying physiological basis for symptom development is still to be determined and requires further study. The increase of CO2 in the atmosphere and bicarbonates in the soil, may be contributing to the development of the 'disease'.

Further surveys for *Phytophthora fallax* failed to yield the pathogen from soil samples from the Kinglake State Park north-east of Melbourne where the first isolation in Australia was made in September 2006, and no symptoms of disease were observed. However novel techniques using rain-gauges containing baits to pick up potential aerial dispersed spores successfully isolated the pathogen from two monitoring plots established in Mountain Ash forests (*E. regnans*) in the Central Highlands. Investigations are continuing to establish what the potential hosts of the pathogen are.

To enhance early detection, the Department of Agriculture, Fisheries and Forestry has continued to support monitoring around the major ports for the exotic pest *Lymantria dispar* (Asian gypsy moth). The City of Melbourne also continued to support surveys for exotic Dutch Elm Disease in the main gardens and boulevards under their management. Neither insect or pathogen was detected during the current surveillance program.

The Victorian Department of Primary Industry is funding a pilot program of stream baiting as a potential routine technique to monitor for the presence of *Phytophthora* species of quarantine significance. The aim of the study is for it to be adopted nationally to determine the presence of *Phytophthora* species in Australia, and provide an early warning for the introduction of new species. To date no *Phytophthora* species of current quarantine concern (*P.ramorum* and *P. kernoviae*) have been recorded.

Tasmania

Drought conditions over much of the state during 2007-8 were a strong modifying influence on the status of pests and diseases.

There was a sharp autumn increase in defoliation of *P. radiata* due to *Essigella californica* in the south of the State, with the pest still absent from northern plantations. Sirex remains at low population levels although static trap surveys detected developing populations in three plantations, two of which will be treated with nematodes. Dothistroma needle cast decreased in intensity compared with the previous year. Sphaeropsis top death stabilised in most northern plantations where it was active in previous year, however, there was an increase in Sphaeropsis in the south of the state. Shoot browsing by mammals was more widespread than previous years, however,

mammal bark stripping declined in extent. Windthrow increased sharply from previous years, while drought and frost caused significant transplant losses in northeastern Tasmania.

Populations of chrysomelid leaf beetles remained high for the third consecutive year with 35% of monitored eucalypt plantations recording over-threshold populations triggering spray operations. The extent of late season defoliation from leaf beetles was higher than previous years. Several outbreaks of autumn gum moth, mostly in northern Tasmania, required spraying. Localised scarab outbreaks caused significant damage to young plantations in northwestern Tasmania. Other defoliators (*Gonipterus, Uraba*) were less active than in previous years. Drought conditions resulted in considerable transplant losses throughout the state as well as mortality in mid-rotation plantations in the central north (in combination with stem-borers). Levels of mortality from Phytophthora root rot in northern Tasmania were higher than in previous years (possibly exacerbated by the drought conditions). Symptoms of copper deficiency continue to appear in many young plantations established on poor soils in the north of the state.

The elm leaf beetle was detected for the first time in southern Tasmania and eradication is being attempted. The exotic bostrichid *Xylotillius lindii* was detected for the first time in the state and appears to be established. Port surveys also detected the grass stem anthribid *Eucioides suturalis* for the first time in the state.

South Australia

Pine Plantations:

Annual Forest Health Surveillance flights were conducted in the Green Triangle and Mount Lofty Ranges in June 2008. The whole pine forest estate was covered and several areas were earmarked for further on-ground investigation. Drought is continuing to have an impact. The impact has been greatest in the Mid-North forests particularly where thinning is overdue or where plantations have not been thinned in the last 5 years.

Essigella was the main forest health issue and has caused significant defoliation throughout the whole plantation estate this year in both the Green Triangle and Ranges Regions. Damage has been more severe than in previous years.

Sirex remains at a low level with little increase in activity from last year. Some trees affected by *Diplodia* in 2007 were attacked by *Sirex* over the summer of 2007-08. Attacks were at the base of these trees, below the *Diplodia* infection. The nematode inoculation program has continued, with increased numbers of nematodes released this year.

In the Green Triangle Region *Ips* has caused less damage this year than last year. Most damage has been in young plantations near clearfell areas. Many trees affected by *Diplodia* in 2007 have been attacked by *Ips* in 2008.
Ips is a major cause of tree deaths in the Mid-North forests where many trees are stressed by drought. In the Mt Lofty Ranges, *Ips* continues to cause problems in many plantations. Increased activity at Mt Crawford is associated with drought, clearfelling near young

plantations and high levels of residue remaining after thinning and clearfelling. At Kuitpo and Second Valley, there are isolated pockets of *Ips* activity.

Death of seedlings has occurred in several areas due to lack of rain and in some cases salt.

In the Green Triangle Region there was an outbreak of *Cyclaneusma minus* this year. Plantations 8-12 years old and unthinned were the main age classes affected, though some older plantations were also infected.

There have been no reports of disease affecting trees in the Ranges Region this year.

Eucalypt Plantations:
Autumn Gum Moth, Sawflies (*Perga* sp.) and Weevils (*Gonipterus* sp.) caused significant damage in some plantations in the Green Triangle this year. Control was necessary in several plantations.

Chrysomelid beetles (various species) are always present and cause varying degrees of damage. *Cadmus* sp. caused minor damage in some plantations this year but no control measures were taken.

There has been an increase in the level of damage by the Shothole Miner (*Perthida* sp.)this year across the region.

There have been no reports of major disease problems in eucalypt plantations this year. However Mycosphaerella is present at low levels in many plantations.

Western Australia
No new outbreaks or records of significant damage from pests or pathogens were recorded in Western Australia in the 12 month period from June 2007 to June 2008.

In plantations, surveillance, monitoring and control measures for established pests continued. The eradication and surveillance program for European house borer (*Hylotrupes bajulus*) in *Pinus pinaster* plantations continued. EHB remains restricted to the Perth metro area but in order to detect, monitor and eradicate any spread all streets in the south west between Geraldton and Esperance were surveyed again in 2007-08 and all infested trees destroyed. In *Eucalyptus globulus* plantations, damage due to leaf beetles (*Paropsisterna* spp.) and *Mycosphaerella* spp. is increasing but is only locally severe, is not consistent and not yet at levels to cause widespread concern. *Paropsisterna m-fuscum* was recorded for the first time in WA in 2007, but has probably been present for some time. Eucalyptus weevils (*Gonipterus scutellatus*) are expanding their range, but their natural predators seem to be keeping their numbers under control. *Heteronyx elongates* caused local severe damage near Albany and spring beetle (*Liparetrus jenkinsi*) damage was severe and extensive in areas between Collie and Boyup Brook and east of Albany. Significant attacks by Rutherglen bug (*Nysius vinitor*) were recorded in newly established sandalwood plantations in low rainfall/pastural regions. Significant local

deaths in *E. camaldulensis, E. occidentalis* and *E. spathulata* plantings near Esperance were attributed to saline waterlogging.

Disease monitoring and research in *E. globulus* plantations is mostly funded by private industry and undertaken by graduate students at Murdoch University. The projects include the taxonomy of *Mycosphaerella* and *Botryosphaeria* spp. and investigations into wood decay fungi causing rot in stumps, coppice stems and 1st rotation trees.

In native forest, dieback in jarrah forest caused by *Phytophthora cinnamomi* and tree decline in tuart and wandoo woodland continues to command attention. Approximately 35, 000 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, 2,353 soil and plant samples were tested to confirm the presence of *P. cinamomii*. The development of Real Time PCR methods to diagnose *P. cinnamomi* from soil samples will further enhance the ability of research, mapping and monitoring this pathogen in WA.

The subjects of Post-Graduate Degree projects associated with *P. cinnamomi* at Murdoch University include investigations associated with the use of Phosphite to enhance host resistance, plant susceptibility, site susceptibility associated with 'black gravel' soils, impacts of thinning and burning on disease and detection of *P. cinnamomi* using molecular methods. The taxonomy and biology of other Phytophthoras identified as potential pathogens in Australian forests, including *P. ramorum*, are also being investigated.

In the South Coast region, DEC aerially sprayed about 650 ha of woodland and heath with Phosphite to protect threatened Ecological Communities and threatened species, including *Lambertia orbifolia* ssp. *Orbifolia* and *Banksia coccinea*.

The Western Australian State was approved for funding in 2008 is made up of four programs: Climate Change, Woodland and Forest Declines; Decline Ecology; Restoring Biodiversity Values; and Policies and Action for Woodland and Forest Restoration. The primary proponents are Murdoch University, the University of Western Australia and the Department of Environment and Conservation, with cash and in-kind support from 27 other agencies. The new centre will enable the present wandoo, *E. rudis* and tuart decline groups to operate under the same 'roof'.

New Zealand

Pinus radiata:

Pests:

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

Diseases:

Levels of needle disease were low in 2007-08 as a result of the 2006/07 summer experiencing both below normal rainfall and temperatures well below average. Rainfall was less than 75% of average in the west of the North Island and eastern Bay of Plenty,

and 50% of average in the central North Island, areas where Dothistroma needle blight is most common. The previous season was also dry and so inoculum levels of Dothistroma were already low. Similarly, as autumn 2007 was one of the driest on record for eastern North Island which is traditionally severely affected by Cyclaneusma needle cast, there was little of the spring needle cast which is attributed to *Cyclaneusma minus*. Likewise very few reports of the physiological needle blight were made in 2006-07.

Surveys were carried out in the northern half of the South Island and there was no northwards extension of the range of *Neonectria fuckeliana*, cause of Nectria flute canker, although there were additional records in stands on Banks Peninsula (east of Christchurch). *Neonectria fuckeliana* therefore still remains confined to the lower half of the South Island. Development of disease is strongly associated with pruning operations and second lift whorls having a higher incidence of canker formation than first lift whorls.

Diplodia whorl canker, caused by infection of pruned stubs by *Diplodia pinea* (syn. *Sphaeropsis sapinea*) was recorded in a number of forests on the east coast of the North Island from the Gisborne region south. This follows two consecutive years of drought. Incidence was generally low with scattered trees affected. Dieback of terminal and lateral shoots was recorded in the same locations and also more widely in the forests in the eastern areas that were subject to very dry conditions in 2007-08.

Armillaria root disease, caused primarily by *Armillaria novae-zelandiae*, remains widespread in many pine plantations throughout much of the country. Mortality occurred at low levels, in young stands prior to first thinning.

Eucalyptus:

Pests:

The eucalypt tortoise beetle *Paropsis charybdis* (Chrysomelidae) continues to be a major pest, particularly in *Eucalyptus nitens* plantations in the North Island where some forest managers continue to aerially spray their stands with insecticide.

Uraba lugens, the gum leaf skeletoniser, is now very widespread in the greater Auckland area where it is affecting a wide range of hosts. The range is steadily extending and although *U. lugens* has not yet reached regions where plantations of eucalypt are grown its expected arrival is causing concern.

Diseases:

*Phae*ophleospora eucalypti and Mycosphaerella leaf blotch (primarily due to *M. cryptica*) continue to be the cause of the most serious foliage disease in *Eucalyptus* plantations. Some *E. nitens* in the eastern Bay of Plenty have sustained high levels of infection for several years and growth in these stands is severely compromised.

Pseudotsuga menziesii:

Swiss needle cast disease (*Phaeocryptopus gaeumannii*) was again recorded throughout New Zealand and remains the most significant disease of Douglas fir. There are no significant insect pests of Douglas fir.

Cypresses:

Cypress canker, caused by two species of *Seiridium* continued to cause damage in many cypress stands throughout the country, particularly *Cupressus macrocarpa*. Levels of disease are higher in the North Island than in the South Island. There are no significant insect pests of cypresses.

NEW SOUTH WALES

This report summarises information and data collected during annual forest health surveys of pine and eucalypt plantations in NSW. For pine plantations, surveys were conducted from May 2007 to August 2007. For hardwood plantations, only the young hardwood estate was surveyed (planted post 1994), with surveys conducted in spring and summer 2007/2008. Most data is for plantations managed by Forests NSW. Some data is supplied from private hardwood plantations growers (FEA, GSP).

FOREST HEALTH SURVEILLANCE

In August 2007 the FHSU conducted an aerial survey of a large proportion of the eucalypt plantations as part of the annual survey program. This included *Creiis* monitoring as well as general forest health. A ground survey of selected plantations was conducted in November 2007 and again in February 2008. However, this was of fewer plantations than previous years due to a reduction in FHSU staff. The main aim of the ground survey was to follow-up on disorders observed in the previous aerial survey, as well as visit plantations highlighted by Northern Region as having forest health issues. Health issues were discussed with the Operations Forester and Field Officers.

Softwood plantations in all Regions were surveyed from May to August 2007. Sixty State Forests or Plantations were surveyed by helicopter, with the majority having follow-up ground surveys. The extent and severity of pests, diseases, vertebrate pests, climatic disorders, nutritional imbalances and weeds limiting growth or affecting survival were mapped and reported on.

Two softwood Regions (Northern & Monaro) and the hardwood plantations were surveyed using the new digital aerial sketchmapping (DASM) technology this year (2007). The system utilises a PC tablet linked to a GPS (via Bluetooth), with shape-files, digital topographic images, satellite-based imagery or ortho-photos as background maps. The PC tablet has a daylight-readable, antiglare screen for use “outdoors”. The system enables the aerial observer to collect digital data (points, lines or polygons) directly onto the tablet screen with a pen and quickly enter attribute data (e.g. host, causal agent, incidence and/or severity rating) using a ‘one touch’ keypad (Figure 1). An icon displays the locality of the aircraft on the screen ‘live’, so the observer can spend more time identifying and mapping damaged area, than attempting to track their position on a map. The DASM software, GeoLink, also has a feature that allows for automated background map rotation following screen regeneration, whereby the background map rotates so that the direction the aircraft is heading is orientated to the top of the tablet screen. The sketched features are later translated into ESRI shapefiles for download into a GIS, thus reducing the lengthy process of post-processing the maps into a digital format, ensuring rapid turn-around of data. This system has increased efficiencies and accuracy in data collection during surveys of plantations, and its possible use for fire mapping and mapping of forest health in native forests in NSW is currently being investigated.

Figure 1. Forest health officer conducting aerial survey using DASM system.

PINE PLANTATIONS
Pinus spp. *Araucaria* spp., *Pseudotsuga menziesii*

Drought-related tree mortality, Diplodia pinea & Ips grandicollis
The main issue in softwood plantations was significant and widespread tree mortality in Hume Region associated with drought, *Diplodia pinea* infection and *Ips grandicollis* attack (Figure 2). Over 17,000 ha were affected to varying levels. This is the first instance of *Ips* causing large scale tree-mortality in NSW. *Ips* numbers have increased in recent years and are now threatening the effectiveness of the biological control program for another pest, *Sirex* woodwasp, as *Ips* beetles attack trees that are used to deliver the *Sirex* biological control agent [see Carnegie (2008) *NSW DPI Bush Telegraph*, **Autumn**, 13]. Research is currently underway, funded by the National Sirex Coordination Committee (NSCC) and undertaken by NSW DPI in collaboration with Forests NSW, to investigate methods to reduce the impact of *Ips* beetles on the *Sirex* biological control program. Tree mortality, mostly associated with drought and *Diplodia*, was also significant in Macquarie Region, with over 12,000 ha affected at varying levels.

Figure 2. Tree mortality in Hume Region associated with drought stress and subsequent attack by *Ips grandicollis* and infection by *Diplodia pinea.*

Sirex noctilio

Sirex wood wasp continues to cause tree mortality in several softwood plantations in NSW, including a localised outbreak in one State Forest in Hume Region. However, this is being effectively managed – by annual surveys (by NSW DPI) and the biological control program managed by Forests NSW – to reduce the impact and spread of this major pest. Current research, again funded by the NSCC and undertaken by NSW DPI in collaboration with Forests NSW, is continuing to enhance and improve the biological control program for *Sirex.*

Essigella californica

The Monterey Pine Aphid, *Essigella californica,* continues to cause widespread defoliation in many *Pinus radiata* plantations, especially those growing on nutrient poor sites. A large proportion (~40%) of the Forest NSW estate had various levels of damage from *Essigella* in 2007. Forests NSW is part of a National collaborative project to develop a biological control program for *Essigella,* with release of the biological control agent planned for later in 2008. Previous research had indicated that this was one of the most environmentally sustainable methods for control.

Dothistroma septosporum

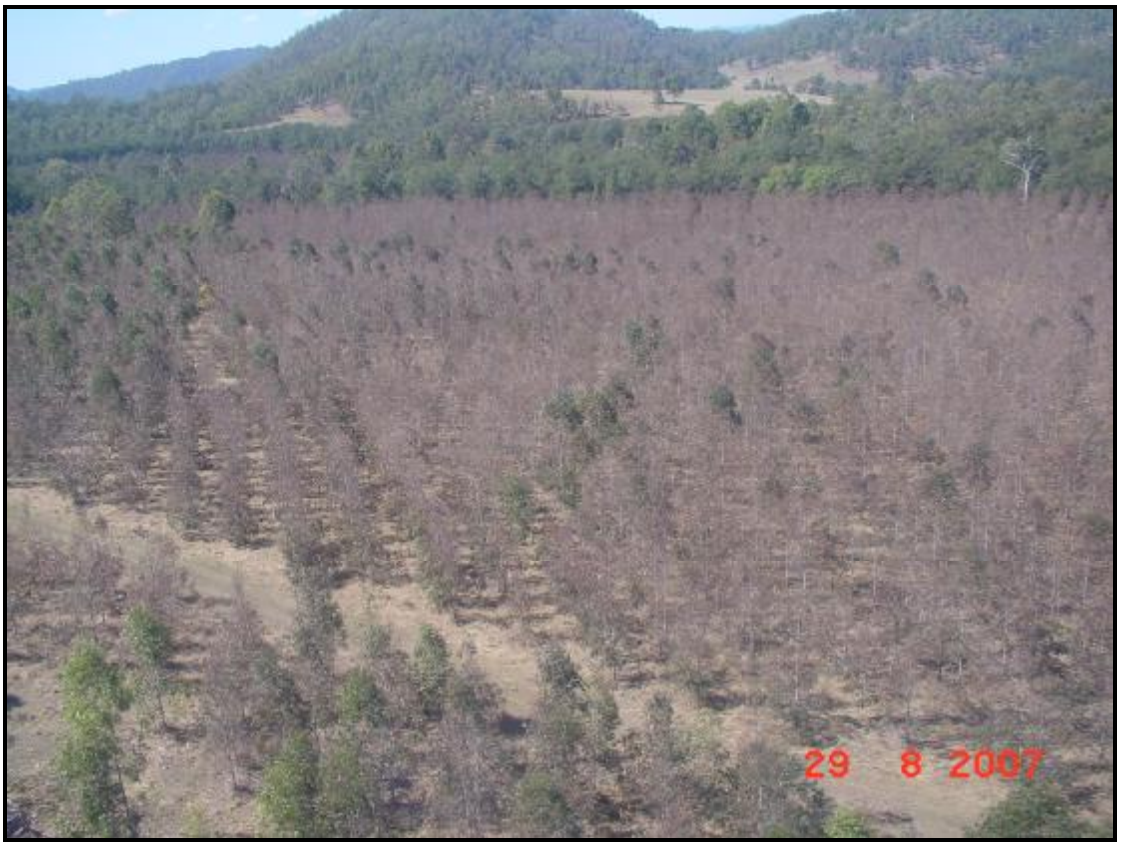
Due to continued drought, damage from Dothistroma needle blight was again relatively low in 2007. No control spraying operations were conducted.

Bark beetles (Hylurgus ligniperda)

High numbers of bark beetles (*Hylurgus ligniperda* and *Ips grandicollis*) were observed in stumps and slash in recently harvested areas within areas where a wildfire had caused significant damage in Hume Region. However, there was no evidence that beetles had moved into young seedlings planted in the area.

HARDWOOD PLANTATIONS
Eucalyptus spp. & *Corymbia* spp.

Psyllids
In hardwood plantations, the main issue continues to be the severe damage from the psyllid *Creiis lituratus.* This insect again caused widespread damage to *Eucalyptus dunnii* plantations in northern NSW. NSW DPI in collaboration with Forests NSW and private growers is investigating more environmentally acceptable management options to control *Creiis.*



Severe damage to *E. dunnii* from *Creiis lituratus.*

Bell-miner associated dieback (BMAD)

BMAD continues to be a concern in several of the young (<12 year old) hardwood plantations in northern NSW. BMAD, and bell miner colonies, have been observed in *E. grandis, E. saligna* and *E. dunnii* plantations. All affected plantations are adjacent to native forest with BMAD and have significant weed undergrowth (mostly lantana). Trials investigating management options, including clearing undergrowth, are being trialled in native forest stands by Forests NSW in collaboration with the BMAD Working Group.

Bell-miner associated dieback in *E. saligna* in 10-year-old plantation in northern NSW.

Eucalypt sawfly
A small area of *E. dunnii* sustained significant defoliation from saw fly larvae.

Defoliation of *E. dunnii* caused by saw fly larvae.

Stem borers
Longicorn beetles and cossid moths continue to cause damage in the majority of plantations. *E. grandis, E. saligna* and *E. grandis* x *E. camaldulensis* plantations are the most severely affected, as well as *E. dunnii* plantations that have sustained damage from *Creiis.*

Other insect pests
A range of insect pests were observed during surveys, but none causing significant damage. These include Eucalypt weevils, chrysomelids, leaf spotting bugs, coreid bugs.

Other diseases
A range of fungi were observed during surveys, but few causing significant damage. Quambalaria shoot blight is still the most significant disease in spotted gum plantations, with severe infection in some of the young private plantations. Older stands still have a proportion (5% to 25%) of trees that are repeatedly damage, resulting in small, bushy trees. Kirramyces leaf disease caused severe defoliation to some young *E. grandis* x *E. camaldulensis* plantations.

Frost

Severe frost caused significant foliar burn, especially of spotted gum in several plantations.

Frost damage to spotted gum.

QUARANTINE

Several trees exhibiting symptoms similar to Pine Pitch Canker were collected and sent to the Royal Botanic Gardens Diagnostic Unit for examination. All were "negative", with no *Fusarium circinatum* isolated from samples.

Data / Information supplied by private plantation growers in NSW

FEA *Eucalyptus* Plantation: 2007/2008 FY

Main issues are:

Psyllids (*Creiis lituratus* & *Cardiaspina spp*.): *E. dunnii* & *E. grandis.* Sprayed approximately total areas of 4000ha (with dimethoate) – also secondary fertilising (i.e. Urea).

Quambalaria pitereka: *C. variegata.* Fertiliser and Fungicide trial to be done ASAP (Geoff Pegg) – the percentage of spotty area (planted) has been reduced.

Cossid moth and Cockatoos damaged: *E. grandis* & *E. dunnii.* Nothing has been done with the current situation yet except no further planting of *E. grandis* in our current project.

Mycosphaerella leaf disease: on *E. nitens* at Walcha region in NSW. Caused defoliation on *E. nitens* and applying Urea fertiliser on new growth

Chrysomelid leaf beetles (*Chrysophtharta cloelia* & *Paropsis atomaria*): on *E. dunnii.* Sprayed approximately 200ha (with Fastac Duo) with no significant damaged but reduce tree growth.

Nutritional issues such as boron, Copper, Phosphorus, & Manganese deficiency etc… - secondary/late fertilising. Kirramyces and Mycosphaerella leaf spot – *E. saligna* in NSW (early stage)

Chrysomelids - if become established will greatly reduce growth. Easy to control if can be timely with spraying. There are some minor species that seem to be more significant this season.

Weevils - Seem to be short term effects on younger trees but we have a number of older plantations that growth has been restricted in spring and vigour of trees lost. Mostly in Dyraaba/Casino area. We have seen a good response from the limited spraying we have carried out.

Scarabs and Christmas Beetles - have caused a lot of damage in younger trees this season. Very difficult to monitor due to temperature effect on activity. Difficult to assess impact on older trees.

Mirids - appears to be an increasing problem but could be seasonal. Overall effect on growth is yet to be determined. Will attack a range of species.

Coreids - seem to be having a significant impact in low lying areas but may be a short-term effect.

Great Southern Plantations

Ongoing *Creiis* attack, though the levels much less than in 2007. Areas that were not subject to waterlogging have fared well overall, and recovered from damage. Wet areas infected in 2007 in general have failed. An area of around 300ha total.

Chrysomelid numbers were significant at the end of the season – April / May with the top 50cm of many trees being stripped. This has lead to high numbers being present in October 2008. Intervention is planned to be minimal in an attempt to allow some form of IPM to form.

Kirramyces leaf disease effected a large area of 1 and 2 year old GxC in lower lying areas. Many plantations suffered a significant amount of leaf loss. Height growth overall was comparable for 2 year old plantations. 3 year old plantations showed minimal leaf disease impacts along with several 2 year old. It is again thought that higher humidity has affected the prevalence of leaf disease. It is interesting to note that on one plantation 1 year old trees were nearly completely defoliated while adjacent 2 year old trees on the same property were unaffected.

Scattered occurrence of borer continues throughout the estate.

Small infestations of weevil noted.

QUEENSLAND

PLANTATIONS

Eucalyptus *species*

Insect pests

Insect pests recorded in Queensland plantations and trial plantations in 2006/07.

Tree species	Agent	Common Name	Severity
C. citriodora .ssp. *variegata*	*Rhombacus* & *Acalox* spp.	Erinose mite	Severe
E. cloeziana	*Paropsis atomaria*	Leaf beetle	Severe
E. dunnii	*Chaetocnema* sp.	Flea beetle	Severe
C. citriodora .ssp. *variegata*	Orthoptera	Katydid	Moderate
C. citriodora .ssp. *variegata*	*Thaumastocoris* sp.	Bronzing bug	Moderate
C. citriodora .ssp. *variegata*	Unknown sp.	Weevil	Moderate
C. torelliana	General insects	Chewing	Moderate
C. torelliana	*Kahaona sp.*	Tent Leaf hopper	Moderate
C. torelliana	*Phylacteophaga* sp.	Leaf blister sawfly	Moderate
Corymbia hybrid	*Kahaona* sp.	Tent Leaf hopper	Moderate
Corymbia hybrid	*Phylacteophaga* sp.	Leaf blister sawfly	Moderate
E. dunnii	*Eriococcus coriaceus*	Gum tree scale	Moderate
E. grandis	*Endoxyla cinereus*	Giant wood moth	Moderate
C. citriodora .ssp. *variegata*	*Eucalyptolyma maideni*	Spottedgum psyllid	Minor
Corymbia hybrid	Unknown sp.	*Cerambycidae*	Minor
E. argophloia	Unknown sp.	Lepidoptera larvae	Minor
E. dunnii	*Oxyops* & *Gonipterus* spp.	Weevil	Minor

Leaf Beetles

Significant *Paropsis atomaria* damage was observed in *E. cloeziana* (mean CDI approx 50% in one plantation) and *Corymbia citriodora* subsp. *variegata* plantations in the Gympie and South Burnett regions of the state. *ParopSys* (Nahrung et al. 2008), a Dymex™ predictive population model developed for *P. atomaria*, was used with one plantation to determine possible spraying strategies for control.

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

Moderate levels of damage by these mites continued to be found in young *C. citriodora ssp. variegata* plantations in the south Burnett region. Damage increased in the South Burnett region in 2007-08 over levels observed in the previous year, probably in response to an increase in the amount of preferred flush foliage.

Weevils

Weevils (*Oxyops* and *Gonipterus* spp.) ocurred in lower numbers this year than in 2006-07 in *E. dunnii* plantations in southern Queensland.

Leaf blister sawfly
In contrast to 2006-07, where more than 200 ha of *E. dunnii* plantations were severely affected, only minor damage by *Phylacteophaga* sp. was observed in the South Burnett, again mainly in *E. dunnii* plantations. Scattered infestations on *E. grandis* hybrids were also observed throughout the central coast region, with damage here also decreasing from that observed in 2006-07.

Grasshoppers
Only minor grasshopper chewing damage was recorded in 2007-08.

Christmas Beetles
No damage recorded.

Stem borers
Giant wood moth (*Endoxyla cinerea*) continues to be a significant problem in plantations of *E. grandis E. grandis* hybrids and *E dunnii* from the southeast through to central coast plantings. Attack is observed from 2 years of age and can continue for the lenghth of the rotation. Damage was particularly evident in older plantings of *E. grandis* in the sotheast.

***Thaumastocoris* sp. bug**
Isolated but severe damage was recorded by this bug in a single *C. citriodora ssp. variegata* plantation in the South Burnett. This was the same plantation where infestation of this bug was first recorded in 2004.

Flea beetles (*Chaetocnema spp.*)
Severe damage recorded in a single *E. dunnii* plantation in the South Burnett.

Flea beetle etching and leaf blister sawfly damage on young *E. dunnii*

Gum Tree Scale

Several *C. citriodora ssp. variegata* and *E. dunnii* plantations in the south Burnett again suffered moderate to severe patch damage by *Eriococcus coriaceus*.

Gum tree scale and sooty mould on twigs of *E. dunnii*.

Fungal Pathogens

Quambalaria shoot blight

Quambalaria shoot blight (*Quambalaria* pitereka) remains the main pathogen associated with establishment problems in spotted gum (*C. citriodora ssp. variegata*) plantations. However, the extended dry conditions have seen a fall in the incidence and severity.

Kirramyces leaf blight

Kirramyces leaf blight is continuing to be an issue within *Eucalyptus* plantations. There have been a number of species found to be associated with plantations but the main species causing defoliation in central Queensland appears to be *K. psuedoeucalypti*. Previously it was identified as *K. eucalypti* but DNA analysis has indicated that this is not the case.

Kirramyces leaf blight on 3 month old *E. grandis* hybrid

Caliciopsis stem canker

Severe stem cankers were detected in Queensland causing "measle" symptoms on *E. grandis* hybrids, similar to that caused by *Colletogloeopsis zuluensis* in South Africa. The disease was found to be widespread with the fungus found commonly associated with plantation and native trees was identified as a species of *Caliciopsis*. Pathogenicity tests have not yet been completed.

Caliciopsis stem cankers on the trunk of *E. grandis* hybrid in Queensland.

Research & Development

Corymbia Pest and Disease Management

Mites

"Erinose mite" was found to comprise at least two different species: *Rhombacus* sp. (93%) and *Acalox ptychocarpi* (7%) co-occurring on *Corymbia* foliage. Adult mites are the dispersive stage, mostly moving from within infested branches but also (~12%) dispersing between branches. Mite damage incidence (proportion of leaves infested) and damage severity (proportion of leaf surface damaged) are positively correlated. Mite damage symptoms manifest as patches or spots on the leaf surface, which may be chlorotic (yellow), anthanocyanic (red) or necrotic (brown). Patch-type damage is less frequent than spot-type damage, but is associated with higher mite numbers and damage scores, while discolouration symptoms relate predominantly to leaf age. Both leaf surfaces are used by mites. Older leaves have more damage than younger leaves, and higher mite populations correlate with higher damage scores.

Paropsis atomaria

A temperature-based DYMEX model was developed to provide a basic tool enabling forest managers to use the number of generations and seasonal fluctuations in abundance of damaging lifestages to estimate the pest risk of *P. atomaria* prior to plantation establishment, and to predict the occurrence and duration of damaging lifestages in the

field. The model also assists with targeted control, to predict how effective insecticide application at different times might be.

***Corymbia* hybrids and pests**

Three trials sites containing *C. citriodora* subsp. *variegata*, *C. torelliana* and the hybrids *C. torelliana* × *C. citriodora* subsp. *variegata* and *C. torelliana* × *C. citriodora* subsp. *citriodora* were monitored for pest incidence and severity. Pests caused about half (45%) of the visible crown damage to trees in these trials. Overall, there was no difference in pest damage between taxa. At the site that had the most insect damage, hybrid trees had higher damage scores and higher growth scores (height, DBH) than straight species. Site (and insects present at each site) was much more important than taxa in explaining damage scores. *C. citriodora* subsp. *variegata* was least attacked by *Kahaono* sp. at all sites, but consistently the most susceptible to eriophyid mites, with the reciprocal pattern exhibited by *C. torelliana*. Hybrid species generally showed some susceptibility to pests even where one parent was less preferred.

Quambalaria shoot blight

Fungal Biology

Detailed studies of the infection process of *Q. pitereka* are now complete.

Findings:

Infection process

- Following infection through the stomata, fungal hyphae of *Q. pitereka* colonise the leaf cells of *Corymbia* spp. by growing through the intercellular spaces. At no time does the fungus enter the cell. However, there is a reaction that occurs prior to and during contact with the host cell wall which results in the transfer of nutrient from the host to the pathogen. The chemical process that occurs is unknown but may be key in host resistance for future breeding programs using genomics. Submitted for publication in Plant Pathology September 2008.
- Current investigations are centred on identifying host resistance mechanisms. Field tolerant/resistant clones are being studied to identify differences in cellular structure and mechanisms preventing fungal colonisation. Different host species are also being studied including *C. torelliana* and hybrids.

Disease development

- Field trials have been established in Beaudesert, Moggill, Amamoor and Grafton looking at the development of disease within a plantation and on individual trees.
- The infection source is native spotted gum with wind born spores likely to be spread during rainfall events. *Q. pitereka* has been identified from juvenile foliage of under-storey seedlings, immature adult foliage from mature trees and from woody stem cankers.

- Disease develops rapidly following periods of rain with original infection foci appearing in close proximity to native spotted gum trees. The disease then rapidly spreads under continued periods of favourable conditions for disease development. Once infected, each individual tree then becomes a potential source of inoculum.
-

Fungal Variability

Initial studies investigating species of *Quambalaria* and variability within the pathogen population have been completed using ITS rDNA sequencing. AFLP studies are currently underway and will provide information on the level of fungal variability at a regional level as well as single farms, species of *Corymbia*, and a single tree. It will also aid in a better understanding of the pathogen lifecycle. We are currently identifying the correct primer sequence combination to enable completion of the studies.

Findings:

- Initial studies published: **Pegg GS, O'Dwyer C, Carnegie AJ, Burgess TI, Wingfield MJ, Drenth A, 2008. *Quambalaria* species associated with plantation and native eucalypts in Australia. Plant Pathology 57, 702-4.**
- Ten isolates from different haplotypes were tested for their virulence to spotted gum. Variability in pathogenicity exists within *Q. pitereka* making screening for disease resistance more complex.
- Host specificity exists within the *Q. pitereka* population, with isolates taken from *Corymbia* hybrids in north Queensland specific to *C. torelliana* and the hybrids in comparison to isolates collected from spotted gum.

Disease screening methods

Glasshouse techniques have been developed for some time utilising spores collected from field infected trees and fungal cultures. It is essential to determine how robust the system is before it can be implemented as a standard operational procedure

Findings:

- Assessments for levels of resistance in spotted gum clonal trials have been conducted in NSW. A selection of clones, both susceptible and resistant have been selected and subjected to controlled inoculation in glasshouse conditions. Similar results were observed in the glasshouse to those observed in the field suggesting that glasshouse screening could be operationally significant for future plantation development.
- Timing of assessments for QSB within field trials is essential. Disease development is predominantly during the warmer, wetter months of the year and is more rapid when plantations are in close proximity to stands of native *Corymbia* spp.

Chrysoporthe cubensis

In 2005 *Chrysoporthe cubensis* was identified from a species of *Tibouchina* in the Cairns Botanical Gardens. After clarification from Biosecurity on the Quarantine status, a series of glasshouse pathogenicity tests have been conducted. The studies determined that

Corymbia species, including Spotted gum, Gadagii and the *Corymbia* hybrid are highly susceptible. This data is being prepared for publication. It is still unclear if this was an incursion or if Chr. cubensis occurs within the native forest in this region. Surveys are yet to detect the disease within trial or commercial forest plantings.

Hazard site surveillance

There were no detections of target forestry pests or diseases during the 2007-08 survey period. However, 19 of the species and 60% of all specimens caught were exotics now established Australia. Since the trapping program commenced in February 2006 there have been a total of 7455 specimens from 94 species of wood boring beetles trapped and identified. This includes 4 species of Anobiidae, 13 of Bostrichidae, 3 of Buprestidae, 39 of Cerambycidae, 2 of Platypodinae and 33 of Scolytinae, demonstrating the effectiveness of the traps and lures in attracting target pests across a broad range of groups. Scolytines remain the most abundant taxa comprising 35% of the species and 80% of the specimens trapped.

DAFF Diagnostic Training scholarships.

Judy King and Manon Griffiths were awarded DAFF Training Scholarships in Diagnosing Emergency Plant Pests during 2008.
Judy's scholarship was for the preparation of Diagnostic protocols for Emerald Ash borer, *Agrilus planipennis*, and *Dendroctonus valens*, red turpentine beetle, and to look at *Dendroctonus ponderosae*, mountain pine beetle, damage in the field. Judy travelled to the USA and Canada.
Activities:

(1) Conference, Shepherdstown, West Virginia. Attended the IUFRO meeting 'Alien Invasive Species and International Trade' and gave a joint paper (Griffiths, King, Wylie and Lawson) on Hazard Site Surveillance in Australia and the Pacific.
(2) Emerald Ash Borer, USDA Forest Service and Michigan State University, East Lansing, Michigan. Spent a week with Drs Therese Poland and Leah Bauer and Prof Deborah McCullouch. Took part in field and laboratory work on the detection, behaviour and management of Emerald Ash borer. Also discussions with Prof. Anthony Cognato on the scolytine group Xyloborina and exchanged beetle specimens, with the intention of continuing an exchange program.
(3) *Dendroctonus valens* and *D. ponderosae.* Pacific Forestry Centre, CFS, Victoria BC. Visited Dr Lee Humble, worked in the insect collection, and spent a day in the field trying to collect *Dendroctonus* beetles and watching out for bears.

Manon's scholarship was for training in identification of the Lyctinae powder post beetles, particularly *Lyctus africanus*. Manon worked with Graham Goodyer in Sydney, visiting collections at NSW Forestry, Pennant Hills; AQIS and the Macleay Collection, University of Sydney.

VICTORIA

PLANTATIONS

Pinus radiata.

Insect pests

Sirex noctilio (Sirex wood wasp)

Generally the incidence of sirex over summer 2007-2008 remained at relatively low levels across the state. However one area in North East Victoria recorded high levels of sirex damage resulting in a nematode inoculation program subsequently instigated in this area. Emphasis has been placed on ensuring sufficient inoculations are done using the more effective Kamona strain nematode coupled with timely surveillance and thinning of susceptible stands. Parasitoid populations of Ibalia continue to emerge at elevated levels providing a useful secondary means of Sirex control, although this year, no Megarhyssa or Schlettererius were recovered. However, given their trace contribution to biocontrol of sirex, their absence from this year's samples is not of concern. A paper examining the history of sirex biocontrol in Victoria since 1970 has recently been accepted for publication (Collett and Elms 2008). The paper summarises the impacts and efficacy of various sirex biocontrol agents released in Victoria over the past 36 years. Included in the paper is not previously released data and should provide a concise record on which to base future research and operational efforts within Victoria.

Essigella californica *(Monterey Pine Aphid)*

Monterey Pine Aphid populations continue to cause significant discolouration and defoliation within Radiata pine in Victoria, with 2008 being the highest since surveillance using the plot based system commenced in 2001. While plantations >10 years of age have been worst affected, increasingly discolouration and defoliation of younger trees under ten years of age has been observed occurring on a more frequent basis. While fluctuations in damage intensity have been recorded across Victoria over many years, north-east Victoria is continually subjected to chronic levels of attack, with other areas usually recording varying degrees of intensity between seasons. In 2008 all areas were subject to chronic damage. The surveillance program again has highlighted the threat that MPA has on Radiata pine growth.

Research on the level of threat to plantation productivity that MPA presents (Smith *et al.* 1999, May and Carlyle 2003, May 2004), have assisted in clarifying these issues and provide justification for suitably designed control programs to be implemented in the future. However, as the quantification of growth losses generally involves evaluation of older trees (>15 years of age), the situation regarding defoliation of younger age classes (<11 years of age) still requires further study and assessment, to ascertain causality and impacts on growth. A paper published in 2008 provides details on research linking aphid

defoliation to fertiliser application in softwood plantations (Hopmans *et al.*, 2008).

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

For the 2007/2008 survey, *Ips grandicollis* was recorded as a significant pest of some Radiata pine plantations in northeast and southwest Victoria affecting trees from the ages of 9 to 30 (Figure 1). It is probable that current outbreaks are caused by drier than average conditions existing in plantations, causing the beetles to move from green slash material and conduct primary attacks on standing trees. Along with the current drought, the trees are often further predisposed by topographical features that enhance the moisture stress conditions (ridges and steep slopes). The populations of *Ips* in these trees were high with many live adult beetles under the bark. This is the 2nd year in a row that significant damage due to Ips has been recorded. If the drought continues, damage due to *Ips* attack may continue. At particular risk have been trap tree plots established to monitor sirex wood wasp populations which appear predisposed to Ips attack once trees have been artificially stressed with herbicides.

Figure 1. Death of a tree caused by *Ips grandicollis* in pine plantations in northeast Victoria in 2007-08.

Pathogens

Dothistroma needle blight

Surveys for *Dothistroma septospora* have recorded a relatively low level of damage to Radiata pine across plantations (Figure 2), although with some localized higher levels of defoliation and discolouration (hot spots) in northeast Victoria. While a potential spray program was identified for one specific area, this was not conducted due to other site factors. Other areas identified as hot spots were generally overall at levels below the economic threshold for which management actions would be normally considered.

Figure 2. Dothistroma needle blight in isolated pockets of young *P. radiata* plantations in north-east Victoria in 2007/08.

Cyclaneusma needle cast

Trace to low levels of defoliation and discolouration associated with *Cyclaneusma* were recorded in most plantations across Victoria, although some individual trees showed high to severe levels of damage within plots. Patches of significant damage were also observed particularly in southwest Victoria and Gippsland (Figure 3). In previous surveys, damage was generally observed mainly in the lower crowns. However during this year's survey, discolouration and defoliation was identified in younger foliage and in the upper crowns within some plots.

Figure 3. Localised discolouration and defoliation associated with *Cyclaneusma* in pine plantations in Gippsland, Victoria in 2007/08.

Diplodia dieback

Damage from *Diplodia* was observed across Victoria during the 2008 survey. In particular, damage continued in Gippsland in unthinned drought affected stands (16-20 year-old age class) following a significant hailstorm in summer 2007. While the area of plantation that was affected was partially salvage logged, with the continued drought many trees that remain continue to succumb to disease.

***Eucalyptus* spp.)**

Insect pests

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

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

Chrysophtharta and Paropsis *(Chrysomelid Leaf beetles) and* Anoplognathus spp. (Christmas beetles)

Leaf beetles and Christmas beetles continue to cause low to moderate levels of defoliation in plantations of predominantly *E. globulus and E. nitens* in Victoria during the 2007-2008 summer with damage generally greater in the upper 50% of the tree canopy. Of interest was some defoliation damage caused by the leaf beetle genus *Cadmus* in *E. globulus* in Gippsland. Damage was at trace levels only and confined to a small area of plantation. Previous outbreaks had been recorded over ten years ago in a similar area.

Perga spp. (Sawflies)

Sawflies were observed causing trace levels (<10%) of defoliation in eastern and north central Victoria during winter 2007 with damage generally confined to individual and small clusters of trees of predominantly *E. globulus* and to a lesser extent *E. camaldulensis*. Defoliation was predominant in the upper 50% of tree crowns although in severe cases, lower crowns were also affected.

Phorocantha spp. *(Longicorn Borers)*

Phorocantha acanthocera continues to occur at low levels in *E. globulus* plantations in East Gippsland. Observations confirmed that *Eucalyptus saligna* and *E. viminalis* remains the preferred host tree species, with attack confined to individual trees of these species within stands although an individual *E. globulus* was observed as being attacked by this species. Low numbers of *P. semipunctata* have been caught in flight traps in Gippsland in summer of 2007-2008 although no trees affected by this insect species have been observed in either native forests or eucalypt plantations.

Cardiaspina spp. *(Psyllids)*

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

Other Pests of eucalypts

- Low levels of defoliation and tip dieback damage were observed over summer 2007-2008 to *E. globulus* plantations in northern Victoria by the Bluegum psyllid (*Ctenarytaina eucalyptii*). Damage was generally confined to young juvenile foliage on young trees.
- Low levels of Light brown apple moth (*Epiphyas postvittana*) damage were observed on the growing tips of two year old *E. globulus* plantations in south west and west

central Victoria and recently established *E.muelleriana* plantations in South Gippsland during early autumn 2008.

- A small outbreak of the Manna gum lerp (*Cardiaspina squamela*) was observed on *E. viminalis* near Ballarat in summer 2007-2008. The defoliation was generally confined to a small area south west of Ballarat. Monitoring will continue next summer as previous outbreaks of this species in the region have been recorded.
- Moderate levels of scarab beetles (*Heteronyx* spp.) were observed in *E. globulus* in south west Victoria over late summer 2008 although no substantial damage to trees was associated with the population levels observed.
- Small isolated outbreaks of Witches *broom sc*ale (*Maskellia globosa*) *were observ*ed on roadside plantings along major highways and roads in northern Victoria in late 2007, with infestations mainly confined to larger, individual trees.
- Low levels of defoliation damag*e* were observed over late spring and early summer to *E. grandis* plantations in northern Victoria by the Leaf Blister sawfly (*Phylacteophaga froggatti*). Damage was generally confined to young juvenile foliage on young trees.

Control and Insect Pest Management

A paper published in 2007 provides information on the operational use of insecticide impregnated tablets in newly established *E. globulus* plantations (Collett and McBeath (2007). Use of such tablets greatly assisted in imparting resistance to defoliation in the first one to two years after planting to a range of invertebrate herbivores, as well as reducing the dependence on the use of broadscale insecticide spraying.

Pathogens

Mycosphaerella

Mycosphaerella leaf disease (MLD) was observed causing localised severe damage in young *E. globulus* and *E. nitens* in the wetter regions of South Gippsland and the Otways. These MLD levels are higher than the previous surveys with the disease extending into the upper crown on some sites with potential direct impacts on tree growth. Competition from increased weed growth due light availability due to the defoliation may also result in significant growth losses.

NURSERIES

Pinus radiata

Phytophthora cinnamomi remains a high priority to reduce the further spread of the pathogen and close future pathways for spread of new *Phytophthora* species should they enter the nursery industry.

Eucalyptus species

No reports of damage due to pathogens were recorded in 2007/2008.

MANAGED NATURAL FORESTS

Insect pests

Chrysomelid leaf beetles

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

Didymuria violescens (Spurlegged Phasmatid)

Some minor levels of defoliation damage were observed in mountain ash (*E. regnans*) forests of the Victorian central highlands during summer 2007-08. However, this damage was confined to individual trees only rather than spread across a wide area and tended to concentrate on younger 2-3 year old trees. Ongoing surveillance will continue with the possibility of some egg surveys being conducted at strategic sites to determine background levels and whether any eggs are at the first or second year of their lifecycle.

Cardiaspina bilobata (Mountain ash psyllid)

An inspection for Mountain ash psyllid was conducted in monitoring plots in autumn 2007 and 2008, with both surveys indicating that populations are at barely detectable levels, and as a consequence, unlikely to cause defoliation. It is now over 10 years since any measurable level of defoliation has been detected within the mountain ash forests of the Victorian central highlands. As outbreaks have been linked to cooler than average summers persisting over a prolonged period, and given the prevailing drought conditions, it is anticipated that is it is unlikely outbreaks will occur in the foreseeable future.

Cardiaspina retator (Red gum basket lerp)

Infestations of *E. camaldulensis* by the Red gum basket lerp *Cardiaspina retator* have continued over the 2007-08 summer, with high levels of defoliation again observed in northern Victoria. However compared to previous years, levels of defoliation appear to have decreased in some areas, possibly due in part to a combination of insect herbivory and drought conditions leading to less foliage available for feeding. As in previous years,

while individual trees have died, there has been no widespread mortality associated with the defoliation despite the prevailing conditions.

Uraba lugens (Gum leaf skeletoniser)

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

Research

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

Pathogens

Few diseases were reported from managed natural forests during 2007/2008.

NATIVE PLANT COMMUNITIES

Phytophthora cinnamomi

A new outbreak of *P. cinnamomi* was recorded in March 2008 in *Xanthorrhoea australis* in the foothill forests of the Otway Ranges (Figure 4a). This outbreak followed heavy rains during November and December 2007 followed by the continuation of the drought during late summer and autumn. Initially thought to be a new introduction to an area, surveys of the area showed evidence of remains of old dead stumps of *X. australis* suggesting the pathogen had been present in the area for many years (Figure 4b).. Isolation of the pathogen was made direct from base of leaves at the top of the stem (Figure 4c).

Figure 4. a) New outbreak of *Phytophthora cinnamomi* in March 2008 in Otway Ranges following heavy rain in November/December 2007, b) evidence of past outbreaks, c) Isolation direct from base of leaves at the top of the stem.

A new record for *P.cinnamomi* was recorded from French Island in Western Port Bay. This is the first record for this island and methods to contain it are being developed.

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.

Other

The drought has continued to result in a reduction in disease reports from native forest communities during 2007/2008. However the drought has in itself resulted in the mortality of trees and understorey particularly on drought prone landscapes.

MONITORING AND SURVEILLANCE

Plantations and Native Forest Monitoring

The Forest Health Surveillance Group has been working closely with industry developing and conducting ongoing insect pest and disease surveillance programs in both softwood and hardwood plantations throughout the state to meet their varying operational and stewardship requirements (Smith *et al.* 2008a). 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.

Over the past two years, a comprehensive book titled 'A Field Guide to Plantation Health Surveillance in Victoria' has been produced and recently published for the Department of Primary Industries by the Forest Health Group for use by small plantation managers in establishing health surveillance systems in plantations under their stewardship (Smith *et al.* 2008b).

Research is also currently underway in native forests of Victoria to design a system of health surveillance suitable for implementation on Victoria's public lands. A plot based system is being piloted in the Central Highlands and routine monitoring of crown damage and presence of insects and pathogens is being assessed. Foliage samples collected have shown the presence of at least 10 different species of insect pests and pathogens, some of which are new records for *E. regnans*. No significant damage has yet to be recorded.

URBAN, RURAL AND AMENITY.

Mundulla Yellows

No further work on Mundulla Yellows was undertaken during 2007/08. The underlying physiological basis for symptom development is still to be determined and requires further research. Climate change factors such as the increase in CO_2 in the atmosphere with increase in bicarbonate uptake from the soil may be contributing to the development of the 'disease'. A third paper on the results of the investigations on Mundulla Yellows is in preparation to add to the previously published papers (Luck *et al.* 2006, Czerniakowski *et al.* 2006).

Armillaria

Armillaria luteobubalina was recorded causing dieback of trees and shrubs in gardens, Parks and Reserves across Melbourne and the Dandenong Ranges during 2007/08.

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 2007/08 as part of a nationwide monitoring program. This

year's program changed from previous surveys with a 5km grid placed over each port and traps laid out on that grid up to 20km away from the port. This greatly extended the range of trapping out from the ports areas. 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 continued to support surveys for Dutch Elm Disease in the main gardens and boulevards under their management. Symptoms found resembling DED were attributed to ringbarking of branches by possums and elm bark beetles and fruit tree borers. The fungus could not be isolated from wood of any trees exhibiting flagging due to beetles. These surveys help to confirm the absence of the pathogen from Australia and maintain awareness and therefore early detection should it arrive.

Phytophthora fallax

Further surveys for *Phytophthora fallax* failed to yield the pathogen from soil samples from the Kinglake State Park north-east of Melbourne, where the first isolation in Australia of *Phytophthora fallax* was made in September 2006. No symptoms of disease were also observed on trap trees (seedlings of *Eucalyptus regnans*) planted in the area. The current drought may be continuing to mask the presence of the pathogen at low levels in the environment. Novel techniques using rain-gauges containing baits to pick up potential aerial dispersal spores also failed to isolate the pathogen from the Kinglake site. However the technique was successful in its isolation from two monitoring plots established in Mountain Ash forests (*E. regnans*) in the Central Highlands. Investigations are continuing to establish what the potential hosts of the pathogen are.

Stream monitoring for Phytophthora

A project assessing techniques for monitoring streams for the presence of *Phytophthora* was continued in 2008 in streams in Victoria using a variety of baits (Figure 5). *Phytophthora* species were isolated from all streams tested in the study. *Phytophthora* species of current quarantine concern (*P.ramorum* and *P. kernoviae*) were not recorded. The method provides an ability to relatively simply monitor catchments for the presence of *Phytophthora* species. The Victorian Department of Primary Industry is funding the testing of the technique through the expansion of the current program across Victorian rivers to monitor for the presence of *Phytophthora* species of quarantine significance. If the pilot program is successful it should be considered to be adopted nationally to determine the presence of *Phytophthora* species in Australia and provide an early warning for the introduction of new species.

Figure 5. Baiting of streams for the presence of *Phytophthora* in Victoria in 2007/08.

A paper was published in 2007 (Collett *et.al.* 2007) detailing forestry and agricultural invasive pests of concern to Victoria. This paper will form the basis of ongoing research and review work into the threats posed by exotic pest incursions to native and plantation forests in Victoria. The impacts of climate change will also be examined and potential impacts assessed in relation to any change in threat status posed by new exotic species.

REFERENCES

Collett, N.G., and Elms S. (2008) The control of sirex wood wasp using biological control agents in Victoria, Australia. *Agricultural and Forest Entomology* (in press).

Collett, N.G. and McBeath, J. (2007). Managing insect pests in *Eucalyptus globulus* (Labill.) plantations in Victoria using insecticide tablets at establishment. *Australian Forestry* **70:** 53-60

Hopmans, P.H., Collett, N.G., Smith, I.W. and Elms, S. (2008). Growth and nutrition of *Pinus radiata* in response to fertilizer applied after thinning and interaction with defoliation associated with *Essigella californica*. *Forest Ecology and Management* **255**; 2118-2128

Collett, N.G., Lefoe, G. and Yen, A.L. (2007). Invasive terrestrial Invertebrates in Victoria. *Victorian Naturalist* **124**: 87-102)

Czerniakowski B, Crnov R, Smith I W and Luck J E (2006) Soil properties associated with the tree decline 'Mundulla Yellows'. *Plant and Soil* **285**:197-206.

Luck JE, Crnov R, Czerniakowski B, Smith IW, and Moran J (2006). Investigating the presence of biotic agents associated with Mundulla Yellows. *Plant disease* **90:** 404-410.

May B, (2004) Assessment of the causality of *Essigella*-ascribed defoliation of mid-rotation radiata pine and its national impact in terms of cost of lost wood production. FWRDC Project No. PN04.4002, 41pp.

May, B and Carlyle, J. (2003). Effect of defoliation associated with *Essigella californica* on growth of mid-rotation *Pinus radiata. Forest Ecology and Management* **183**: 297-312.

Smith, I.W., Collett, N. and Hopmans, P. (1999) Impact on growth of defoliation associated with *Essigella californica* infestation of 23 year-old thinned *P. radiata* at Warrenbayne, Victoria. Report to a workshop on *Essigella*, Arthur Rylah Institute, Heidelberg, November 1999.

Smith, D., Smith, I.W. and Collett, N. (2008a) Forest Health Surveillance in Victoria, *Australian Forestry* **71**, 188-195.

Smith, D., Smith, I.W. and Collett, N. (2008b) A Field Guide to Plantation Health in Victoria. Editor: F. Hirst, Department of Primary Industries, pp 90.

TASMANIA

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

Insect Pests

Sirex wood wasp (*Sirex noctilio*)
Monitoring for *Sirex* killed trees, using traditional aerial and roadside surveys, was conducted throughout the softwood estate. *Sirex* killed trees were not located. In addition, kairomone charged static traps were placed in five regions across the north of the State in eight-year-old *Sirex* free compartments. In three of these compartments *Sirex* females were captured in static traps. The egg parasitoid *Ibalia leucospoides* was also collected in two of the three compartments. Dead suppressed trees with exit holes were found, within a 100 metre radius of the traps, in two of the five compartments. The trap tree/nematode program will be put into place in the Castra and Tower Hill compartments this summer as more than three killed trees were located at each site.

Sirex females were also captured at three sites during hazard site surveillance for exotic insect incursions. At Devonport and Burnie *Sirex* females were captured in city park panel traps charged with alpha-pinene. Twelve *Sirex* females and numerous *Ibalia leucospoides* were captured at the port of Bell Bay.

***Ips grandicollis* and other bark beetles**
Monitoring for *Ips grandicollis*, using ipsenol and ipsdienol pheromone charged static traps, has continued in *P. radiata* plantations and in urban/port quarantine surveillance programs. *Ips* continues to be absent from Tasmania.

Monterey pine aphid (*Essigella californica*)
Essigella pine aphid is still restricted to the south of the State. Severe damage to several *Pinus radiata* compartments in the Plenty Valley in southern Tasmania was recorded in June 2008 (Fig.1). Large numbers of the adult ladybird, *Harmonia conformis*, were present and also the lacewing *Drepanacra binocula*. A monitoring program will be introduced to this block in November 2008 to detect any build up in aphid populations that would severely impact on growth increment. Increased monitoring was conducted across the north of the State in late summer but negative results obtained.

Figure 1. Essigella defoliation in a southern Tasmania *P. radiata* plantation.

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.

Vertebrate Pests

In northern Tasmania bark stripping by browsing mammals was recorded across 358.7. ha during 2007-2008 compared to 536 ha in 2006-2007. The proportion of stands suffering severe damage (incidence >50%) was 137.6 ha. The Wilmot Block in Mersey in the NE of the state, was once again the worst affected area with one plantation having 56.7 ha of severe damage. There was a very high incidence (80-90%) of recent sublethal stripping and up to 10% of ringbarking . Bark stripping in southern Tasmania covered 101.2 ha with mainly moderate severity and at a low incidence.

Mammal shoot browsing had caused poor stocking and severe stunting across 94.7 ha in the central north and north east of the state. This is significantly more than last year when only 20ha were affected.

No possum bark stripping was detected in the north of the state this year. Dead tops due to possum bark stripping were however detected in the south of the state in the Derwent district. Damage was found in 5 compartments and damage ranged from low to severe across 132.6 ha.

Diseases

Cyclaneusma needle cast/spring needle cast

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

***Dothistroma* needle blight**

Needle blight due to *Dothistroma* has been a chronic problem throughout 80ha of plantation in Ringarooma Block for some years. Last season damage was consistently severe or above 50% at a high incidence (Fig.2b). However this year severity levels have dropped to 25-50% (moderate) of the crown and the incidence within a compartment was low (Fig. 2a).

Figure 2 . – Comparative levels of Dothistroma needle cast in a *P. radiata* plantation in northeastern Tasmania in **(a)** 2006-2007 and (**b)** 2007-2008

Sphaeropsis shoot blight/crown wilt

Sphaeropsis was far less extensive and severe this season affecting around 289 ha compared with some 1800 ha in 2006-2007. Bass District, in the NE of the state, was still worst affected but the large, severely damaged area in Payanna was showing little sign of current infection. Retreat block showed the most symptoms this season with around 151 ha of moderate damage and 29 ha of severe damage.

Symptoms of severe needle scorch and shoot wilt/death were found on young 2007 seedlings in the NW across 24.8 ha (Fig.3a). Seedlings had most likely been exposed to severe environmental stress such as frost, snow, cold and desiccating winds, shortly after planting. These factors had lead to needle scorch and rendered the seedlings vulnerable

to *Sphaeropsis* infection causing extensive shoot death. Many seedlings had 1-2 whorls of young healthy branches below the surface so a proportion of the seedlings with dead tops may re-sprout.

Top death due to *Sphaeropsis* was found in 9 older plantations across 132.6 ha in the Plenty Valley in the south of the state (Fig.3b). Most of these had moderate damage with a low-medium incidence.

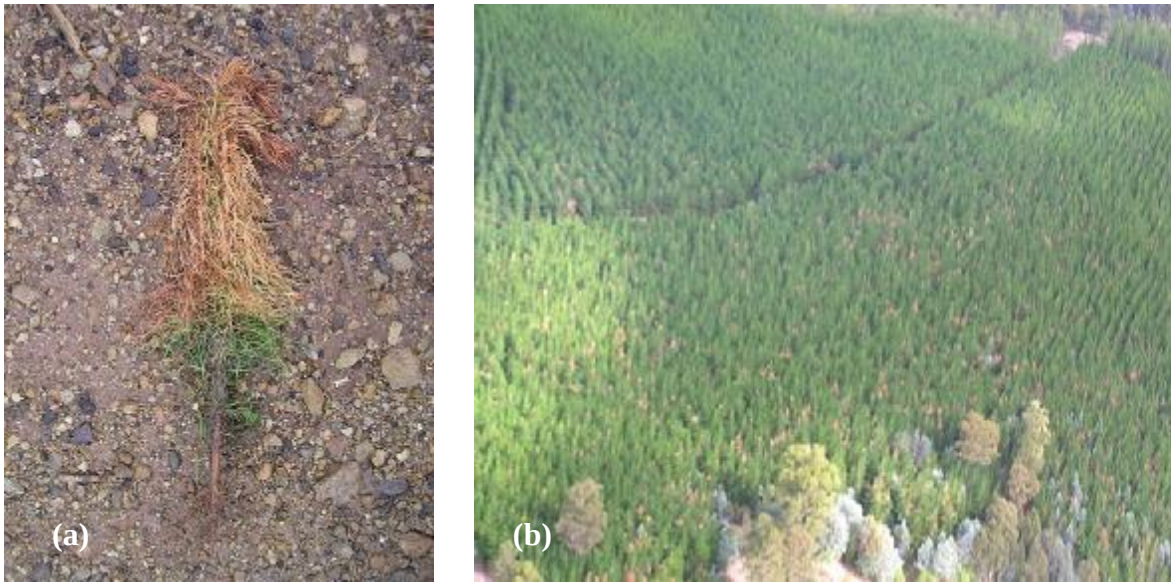


Figure 3. a- *Sphaeropsis* shoot wilt NW Tas. **b-** Aerial view of top death in southern Tas

Other biotic agents

Armillaria root rot was detected in one compartment in southern Tasmania where mortality was scattered in a small area of 2-3 ha at an incidence of 5%

Environmental and site related problems

Fire

There were only two small patches of fire scorch with severe damage across 2.8 ha in two compartments in northern and northwestern Tasmania

Wind

Wind damage (windthrow) was quite extensive this year with an area of 82.5 ha affected compared to last year when only small pockets (0.6 ha) of wind damage were detected. Only 18.8 ha of this damage was regarded as severe. Ten compartments across 5 blocks in Bass were affected.

Lightning
No lightning damage was detected this year.

Exotic weeds
Exotic weeds, primarily gorse, were detected in a number of compartments throughout Bass, Mersey and Murchison.

Boron deficiency
No symptoms of boron deficiency were detected this year.

Drought
A significant amount of mortality of young tranplants, following drought, was detected this year. A total of 67.3 ha were affected by drought in Northeastern Tasmania.

Drainage
Stunting caused by severe drainage problems was present in two compartments in Branches creek. This is a chronic problem carried over from 2005-2006.

Frost
Up to 16 ha in northeastern Tasmania were affected by frost with around 50% of seedlings dead or missing.

*Plantations (*Eucalyptus *species)*

Insect Pests

Autumn gum moth (Mnesampela privata)
Autumn gum moth was only found in 20.4 ha in southern Tasmania, in a young 2007 plantation (Fig 4). As the trees were small up to 25% of the leaf area was affected by defoliation from all larval stages. Several *E. nitens* plantations in northeastern Tasmania suffered significant defoliation by autumn gum moth, with several requiring aerial spraying with insecticide.

Note that Mimic (ai. tebufenozide), the insecticide registered for controlling autumn gum moth, will soon be removed from registration Australia-wide. Its replacement (Prodigy ai methoxyfenozide) will not include any registration for eucalypt insect pests so cannot be used for autumn gum moth, except under an off-label permit. Autumn gum moth could be added to the label if anyone collects any efficacy data in research trials or under permit. Meanwhile, Dipel HG (ai *Bacillus thuringiensis var. kurstaki*) can be used as an environmetally- friendly, organic alternative to alpha-cypermethrin.

Leaf beetles (primarily Paropsisterna bimaculata and P. agricola)
Chrysomelid defoliation was detected, by health surveillance, in 796.4 ha with 467ha of this being in the northeast and 329ha in the northwest. This year the area with severe defoliation was greater (373.7ha or 0.6% of area of eucalypt plantation on State forest) than last year (192ha or 0.25% of the area of eucalypt plantation on State forest) and most of this (298ha) was in northern Tasmania.
Overall, 20,379 ha on State forest were monitored for beetle populations with 7,213 ha (35%) of this being over the threshold. Most of the area over the threshold was sprayed (6,612 ha) with the three insecticides, Success (1%), Entrust (4%) and alpha-cypermethrin (95%). The areas monitored and sprayed include areas with *Gonipterus.*

Eucalyptus weevils (Gonipterus spp.)
During forest health surveys in 2007-2008 moderate defoliation caused by *Gonipterus* was detected in only 2 compartments in southern Tasmania over 43 ha. This is low compared to 166 ha detected in 2006-2007. The areas monitored and treated for *Gonipterus* are included in the areas listed above for chrysomelids since they were not recorded separately.

Figure 4. Damage by Autumn Gum Moth.

Gum leaf skeletonizer
Uraba lugins was detected in the northeast, covering a total area of 9.1ha. Native forest defoliation of mature trees by uraba in the north east seems to have been slight this year.

Beetles (Christmas, scarab, spring, etc.)
Scarab beetles (*Liparetus* spp.) caused significant defoliation in several recently planted *E. nitens* stands in upper Mersey Valley area of northwestern Tasmania. Damage was sufficiently severe in one plantation to require replanting.

Sawflies
No significant damage observed.

Borers
At the long term monitoring site at Blackwood Creek, in northern Tasmania, thinned and unthinned *E. nitens* compartments have suffered four years of below average rainfall (628mm). Mortality due to stem borers is now 10% in the thinned area (300 trees /ha) and 30% in unthinned area (2000 trees/ha). Stem breakage due to the cerambycid *Phoracantha mastersi* has increased to 10% of last year's mortality with many green trees containing larvae (Fig.5). We can expect ongoing high mortality levels for several years in these compartments even with improved rainfall conditions.

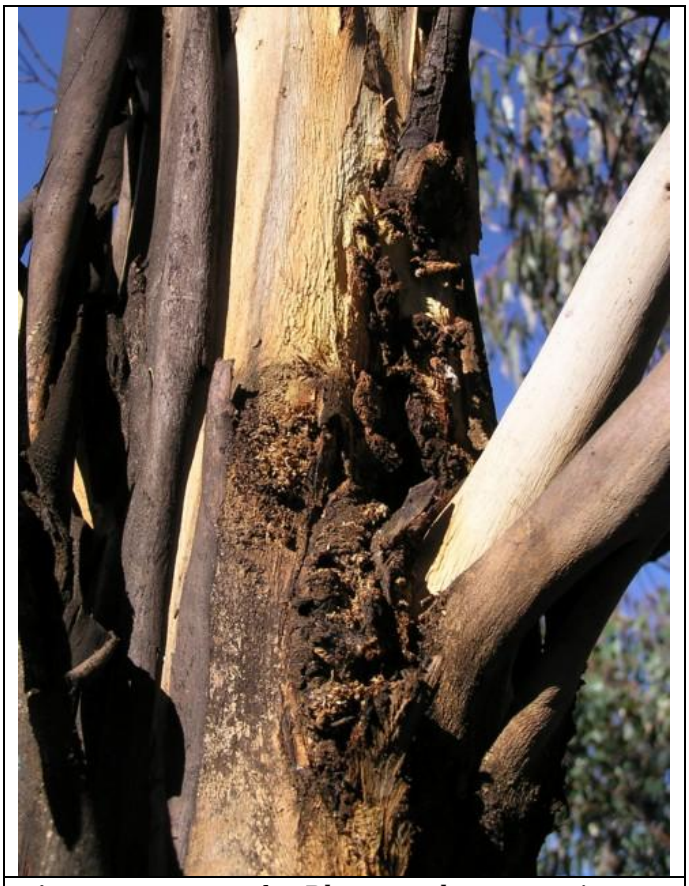


Figure 5. Damage by *Phoracantha mastersi*

Psyllids

No significant damage observed.

Tortricids

No significant damage observed.

European Wasps

The European wasp *Vespula germanica* was of considerable nuisance value in many plantation and regeneration sites across Tasmania. Large numbers of wasps in autumn resulted in several baiting operations, within southern coupes, to enable pruning operations to be conducted. Baiting was also conducted at the forestry tourist site at Tahune and at several helicopter bush-landing sites. The English wasp, *Vespula vulgaris*, first found in southern Tasmania in 2000, was found in a northern plantation this summer.

Vertebrate Pests

Damage attributed to browsing mammals covered a much smaller area (113.5 ha) this year compared to last season (379 ha). The northern (58ha) and southern (55.5 ha) parts of the state had similar amounts with damage mainly being severe. The main problems

resulting from mammal browsing were missing trees (68ha), stunting (22.3ha), variability (21.1ha),) and shoot damage/loss (2.1ha)).

Possum browsing and bark chewing were detected across 10.9 ha in Mersey, Bass and Derwent. In two compartments in southern Tasmania, the severe bark stripping detected in 2006-2007 had resulted in stem defects and breaks this year (Fig.6a)

Figure 6. Stem breakage resulting from bark stripping in the previous year

Diseases

Mycosphaerella leaf disease

Mycosphaerella activity was minimal in the E. nitens plantations. Several small experimental plantings of *E. globulus* in the northwest of the State (established to screen for Mycosphaerella resistance) suffered sufficient infection by *Mycosphaherella* spp. (*M. nubilosa* the dominant species) to allow disease assessment.

Botryosphaeria top death

No damage was detected in 2007-2008.

Cryphonectria stem canker
*C. eucalypti (*syn. *Endothia gyrosa*) was commonly associated with borer damage (reported previously).

Phytophthora root rot
Phytophthora caused mortality in three compartments in northern eastern Tasmania covering and area of 65.8 ha (Fig. 7). These three compartments were planted in 2005 or 2006 and were assessed as having a scattered (1-10%) incidence of *Phytophthora.* The compartments also have records for stunting and poor soils.

Figure 7. Example of *Phytophthora cinnamomi*

Armillaria root rot
The only detection of mortality due to *Armillaria* was for a 2003 *E. nitens* plantation in Mersey where a small patch (0.1ha) was affected.

Environmental and site-related problems

Wind
There was only 4.7ha of wind damage detected from January 2008 onwards. This was severe stem defects in one compartment in the northeast.

Drought/desiccation
Drought was detected in most parts of the state, across an area of 508 ha . This is more than last year (293ha) when a record drought hit northern Tasmania. A large proportion of the area (327.1ha) was in southern Tasmania where drought mortality occurred in 2004-2007 compartments. All the affected compartments in the northwest were 2007 and had suffered severe desiccation soon after planting. In the northeast 106.8 ha were affected over three compartments.

Copper deficiency
Symptoms associated with copper deficiency on poor soils, such as microphylly, stunting and stem defects, were detected across 277.7 ha. Most of this area (260.1 ha) had severe symptoms. These were primarily observed in plantations established in 2005-2007 in the northeast and northwest of the state. No copper deficiency symptoms were detected in the south of the state.

Weeds
Severe weed competition had caused stunted performance (12.6ha), missing trees (48.8ha) and poor access (35.3 ha) across a total of 96.7 ha. Most of this was detected in the northeast (47.5ha) and the far northwest (32.8ha).

Herbicide damage
Only 12ha of herbicide damage was detected in the northeast causing moderate stem defects and breaks.

Poor soil/Shallow soil
Problems caused by poor soil were detected across 2050ha, most of which (1932ha) were severe. The main problems resulting from nutrient deficiency associated with the poor soil were variability (734.2), stunting (1220ha) and foliage discolouration (95.4ha). Most of the soil problems were found in Bass (1082ha) and Murchison (588ha).
Shallow soil also caused severe problems such as stunting in 44.1 ha and missing trees in 33.5ha. Most of the shallow soil problems were found in Derwent and Murchison.

Multiple causes
Problems caused by multiple causes covered an area of 909 ha. The largest problems were variability (581.9 ha), stunting (196 ha), mortality (74.4 ha) and missing trees (56.7 ha). Areas of the state with problems caused by multiple factors include Bass 377.5ha, Murchison 203.4ha and Derwent 271.5ha. Huon and Mersey were less affected.

Other abiotic damage

Other abiotic factors causing health problems in 2007-2008 were poor site preparation (139.9ha), exposure (154.9ha, poor drainage (16.8ha), fire (15ha), unplanted area (15.9ha), frost (1.6ha) and steep slopes (8.2ha). The area that had problems with an unknown cause was found to be 243.3ha. The main problems arising were stunting (52.9ha), thin crowns (95.9ha) and variability (94.4ha). This was confined to the northern part of the state. In addition 243.3 ha were found to have replants with this area having problems such as stunting (81.2ha) and variability (161.9ha).

*Managed natural forests (***Eucalyptus** *species)*

Pests

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

Diseases

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

Environmental and site-related problems

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

Nurseries and Seed orchards

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.

Acacia species

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

Urban and rural

Pests

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

Reforestation plantings of *E. pauciflora* in the midlands have suffered severe infestations of lepidopteran borers, Family Xyloryctinae, probably *Cryptophasa* sp., that have caused branch breakage and death (Fig.9). The infestation probably followed drought stress.

Figure 9. Xyloryctinae larval moth stem damage on *E. pauciflora* (Photo: Keith Churchill)

Diseases

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

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

Quarantine

Trapping for a number of exotic woodborer insect species, of importance to forestry, was conducted within the Urban Surveillance program in association with Quarantine Tasmania. The bostrichid bark beetle *Xylotillus lindi* was caught in several Hobart area traps and also in a young eucalypt plantation in northern Tasmania. The grass stem anthribid *Euciodes suturalis* was found near the port of Bell Bay. During the six months of sampling a total of 13,336 beetles were collected and 3,289 woodborers mounted for the TFIC collection. A number of uncommon native species were captured and placed in the Tasmanian Forest Insect Collection. Exotics, established in mainland Australia but absent from Tasmania, *Arhopalus rusticus, Ips grandicollis, Scolytus multistriatus* and *Hylotrupes bajulus*, were targeted but not detected. Also targeted were the African Black beetle, a scarab pest of pastures, and the apple leaf roller tortricid moths *Planotortrix excessana* and *Ctenopseustis herana*

Research and development

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

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

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

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

An ARC-Linkage project involving UTas and several plantation companies successfully isolated two sex-pheromones from autumn gum moth (*Mnesampela privata*). The ratio of the two pheromones was critical in eliciting an attraction response by male moths, and that ratio seems to vary among regional populations of autumn gum moth in southern Australia. Field testing of the pheromones in Tasmanian plantations resulted in significant capture rates of autumn gum moth. The CRC for Forestry is evaluating the potential to develop a commercial lure for monitoring autumn gum moth populations.

Field surveys of borer populations and damage were conducted in mid-rotation plantations from low, moderate and high rainfall areas, in an ACIAR funded collaborative project between Forestry Tasmania and QDPI. Populations of wood-boring insects were substantially higher in plantations on dry sites. However, not all plantations with large populations of wood-boring insects suffered damage. Analysis is under way to relate the species assemblages of wood-boring insects with damage levels in the plantations.

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

TABULAR SUMMARY OF THE ACTIVITY OF THE MAIN PESTS AND DISEASES OF *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	**ü**							**ü**			67546		*E. nitens* &
Autumn gum moth		**ü**									67546		
Christmas beetle											67546		
Paropsines			**ü**					**ü**			20379	6612	
Gum leaf skeletoniser						**ü**					67546		
Sawfly											67546		
Leaf blister sawfly											67546		
Spring beetles (scarabs)											67546		
Jarrah leaf miner											67546		
Phasmatids											67546		
Weevils (defoliating)		**ü**									67546		
Psyllids											67546		
Phoracanthines											67546		
Wood moths											67546		
Wood borers -											67546		
Wood borers – buprestids											67546		

Wingless grasshopper											67546		
Mycosphaerella spp.											67546		
Aulographina eucalypti											67546		
Armillaria spp.						ü					67546		
Phytophthora spp.		ü									67546		

***Pinus* spp.**

Pest	Area with moderate damage (Ha)					Area with severe damage (Ha)					Area inspected (Ha)	Area treated (Ha)	Hosts
	<10	10-100	100-500	500-1000	>1000	<10	10-100	100-500	500-1000	>1000			
Browsing mammals			**ü**					**ü**			49000		**P. rad**
Bark beetles (*Ips, Hylastes*)											49000		**P. rad**
Sirex wood wasp											49000		*P. rad*
Monterey pine aphid											49000		*P. rad*
Wingless grasshopper											49000		*P. rad*
Armillaria spp.	**ü**										49000		*P. rad*
Phytophthora spp.											49000		*P. rad*
Dothistroma septosporum		**ü**									49000		*P. rad*
Spring needle cast / *Cyclaneusma*					**ü**					**ü**	49000		*P. rad*
Sphaeropsis sapinea			**ü**				**ü**				49000		*P. rad*

SOUTH AUSTRALIA

Annual Forest Health Surveillance flights were conducted in the Green Triangle and Mount Lofty Ranges in June 2008. The whole pine forest estate was covered and several areas were earmarked for further on-ground investigation. Drought is continuing to have an impact. The impact has been greatest in the Mid-North forests particularly where thinning is overdue or where plantations have not been thinned in the last 5 years. Essigella was identified as the main forest health issue over all regions but Ips is also a major problem in the Ranges and Mid-North forests. Death of seedlings has been recorded in some areas due to lack of rain and in some cases salt.

PLANTATIONS

Pinus radiata:

Pests:

Essigella californica: Essigella has caused significant defoliation throughout the whole plantation estate this year in both the Green Triangle and Ranges Regions. Damage has been more severe than in previous years. Large numbers of ladybirds have also been observed this year. ForestrySA is involved in the FWPA sponsored biocontrol project, to introduce and release a biological control agent, conducted by the South Australian Research and Development Institute. The agent, a small wasp, is due for release late in 2008.

Sirex: In the Green Triangle Region Sirex remains at a low level with little increase in activity from last year. Some trees affected by Diplodia in 2007 were attacked by Sirex over the summer of 2007-08. Attacks were at the base of these trees, well below the Diplodia infection. Sirex larvae are currently developing in these trees and billets will be taken later in the year to determine survival and emergence.
The nematode inoculation program has continued, with increased numbers of nematodes released this year in view of the potential for an increase in Sirex numbers, due to more trees being stressed by drought. Nematodes were inoculated into a number of naturally struck trees as well as into trap trees. Sirex wasps emerging from billets were sent to Victoria for infectivity testing as part of an ongoing project, funded by the National Sirex Coordination Committee, to investigate the level of infectivity of nematodes in plantations around Australia.
Large numbers of *Ibalia* emerged from billets collected in spring/summer 2007-08. These were released back into the forest. Very few *Megarhyssa* were recorded this year.

Sirex is well established in the Ranges Region, which includes the Mount Lofty Ranges and the Mid-North forests. In Second Valley Sirex is widespread and a number of trees have been killed in the small patches of *Pinus muricata* which still remain. *Megarhyssa* is also well established here. Sirex was detected in some areas of Kuitpo forest that had been burnt in bushfires in early 2008. Overall, Sirex activity is low in the Mt Crawford and Mid-North plantations. The last two years have been very hot and dry , particularly in ther Mid-North and there has been an increase in drought deaths, but possibly the trees have dried out very rapidly and conditions have not been suitable for Sirex attack and survival.
The inoculation program continued in this region with more nematodes released in 2008. Few *Megarhyssa* or *Ibalia* emerged from billets this year.

Ips grandicollis: Ips is present in many plantations in the Green Triangle Region but has caused less damage this year than last year. Most damage has been in young plantations near clearfell

areas. Many trees affected by Diplodia in 2007 have been attacked by Ips in 2008. Ips is also attacking the trap tree plots used in the Sirex control program.
In the Mt Lofty Ranges, Ips continues to cause problems in many plantations. Increased activity at Mt Crawford is associated with drought, clearfelling near young plantations and retention of high levels of residue after thinning and clearfelling. At Kuitpo and Second Valley, there are isolated pockets of Ips activity.
Ips is a major cause of tree deaths in the Mid-North forests where many trees are stressed by drought. Recommendations have been made re various management options to reduce the impact of this insect pest.

Diseases:

In the Green Triangle Region there was an outbreak of *Cyclaneusma minus* this year. Plantations 8-12 years old and unthinned were the main age classes affected, though some older plantations were also infected.
There have been no reports of disease affecting trees in the Ranges Region this year.

Eucalypts:

Pests:

Autumn Gum Moth: is widespread and has caused significant damage in some plantations in the Green Triangle this year. Some areas were sprayed. Autumn Gum Moth continues to be one of the main pests in plantations up to 3 years old.

Sawflies (Perga sp.): Sawflies are also widespread throughout the region. They caused significant damage in several plantations this year. Control was necessary in some cases. Sawflies are one of the main pests of plantations older that 3 years but they have occasionally been found in younger plantations.

Chrysomelid beetles (various species): These are always present and cause varying degrees of damage. *Cadmus* sp. have caused minor damage in some plantations this year but no control measures were taken.

Weevils: Gonipterus caused damage in some plantations and required treatment this year. They appear to be becoming more important in some areas.

Shothole Miner: There has been an increase in the level of damage by the Shothole Miner this year across the region. Damage has occurred in one year old trees in the Wattle Range area. Attack causes leaf necrosis and premature leaf drop. Exclusion trials are being carried out by the Green Triangle Industry Pest Management Group to examine the effect on growth. The Shothole Miner belongs to the *Perthida* genus and is related to the Jarrah Leaf Miner but is as yet an undescribed sp.

Diseases:

There have been no reports of major disease problems in eucalypt plantations this year. However Mycosphaerella is present at low levels in many plantations.

WESTERN AUSTRALIA

Richard Robinson[1] and Ian Dumbrell[2] (Compilers)
[1]Science Division, Department of Environment and Conservation, Manjimup, WA 6258
[2] Science and Resources Branch, Forest Products Commission, Bunbury, WA 6231

Plantations

Pinus radiata

Insect pests

***Sirex* spp.**
Sirex wood wasp (*Sirex noctillio*) trap trees were not monitored in FPC's mature pine estate during the summer of 07/08. Steely-blue wood wasps (*Sirex juvencus*) were detected in dunnage from Germany in April 2006**.** The initial detection was a Post Quarantine Detection at Laminex Dardanup in Bunbury, Western Australia. No further incursions have been detected. (I Dumbrell, FPC)

Ips grandicollis
No significant reports were received in 2007-08.

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)

Pinus Pinaster
European House Borer (*Hylotrupes bajulus*)

Above: Adult European house borer (*Hylotrupes bajulus*)

EHB was first found in Perth in 2004 and now more than 60,000 properties and 300,000 ha of pine plantation have been inspected for this pest. There are 129 infested sites, including nine pine plantations, centred about two main clusters in the Mundaring Hills and Gnangara/Ellenbrook areas.

EHB response surveillance crews are undertaking extensive surveys in the Perth Metropolitan area to determine the spread of EHB. Originally, dead pine trees in approximately 1200 sites throughout the greater Perth metropolitan area and the South-West were surveyed. There have

been no positive finds in regional areas, including the main softwood plantations and private plantations in the South-West. EHB Response staff have recently undertaken their third annual delimiting survey, driving every street from Geraldton to Esperence in the search for EHB, as well as continuing survey buffer regions within two kilometres of every confirmed infestation. Parts of the Gnangara and Mundaring pine plantations were infested, predominantly in dead standing pine trees. Infestation in the Peel pine plantation has also been confirmed. Peel plantation has now been clearfelled, debris burnt and not planned to be replanted.

EHB has not been found in any structural timber, although it was detected in an ornamental beam in a house in Parkerville. This timber was infested prior to installation. A wall beam in a house in Beechina has also been confirmed to contain EHB, however, this was also infested prior to installation. The current phase of surveillance includes targeted roof inspections in high risk areas and the placement of traps and lures to measure the existing population density and identify areas of concentrated pest activity.

Increased understanding of the biology of the EHB has resulted in an increase in the intensity of tree destruction activities by the EHB Response group on private properties. Regulations have now been enacted (Agricultural and Related Resources Protection (European House Borer) Regulations 2006) which place restrictions on the movement of pine wood, of certain types within certain geographical and seasonal constraints. These have resulted in modification of some of the FPC's harvesting activities. A number of research activities have been undertaken into the EHB, such as DNA profiling, acoustic detection, pheromone trapping and efficacy of insecticidal timber preservatives. FPC is currently awaiting approval for a permit to trial the application of Permethrin as a foam to the outside of logs which should allow transport out of restricted areas during the flight season. The latest innovation in detection is the use of sniffer dogs that can reliably detect adults and larvae inside timber prior to emergence. A group of industry and government representatives have travelled to South Africa to gather first hand knowledge of the behaviour and impact of EHB in similar climatic conditions.

Wingless Grasshopper (*Phaulacridium* sp.)
During November 2007 to March 2008, wingless grasshopper incursions occurred in plantations in the Esperance and Dinninup areas, but were not in plague proportions and were not as bad as the previous year. Misting with alphacypermethrin was undertaken on affected properties on a fortnightly basis.

Rutherglen Bug (*Nysius vinitor*)
Are a regular problem in plantations from October to late December. Infestations are misted in conjunction with wingless grasshopper control.

Diseases

No major problems reported.

Eucalyptus globulus
Insect pests (M. Matsuki, IPMG)
Psyllids
The blue gum psyllid (*Ctenarytaina eucalypti*) is common across the plantation. The impact of this species on growth of seedlings needs to be re-evaluated.

Autumn gum moth (*Mnesempela privata*)

There were some moderate levels of damage in two and three year old plantations near Albany.

Leaf beetles
Population levels of *Paropsisterna variicollis* has been increasing in south-west WA in the last three years or so, probably due to increased areas of coppice. However, damage due to this species is not consistent and widespread enough to trigger large scale management action. There is a suite of (so far effective) natural enemies that attack this species in WA. In spring 2007, *Paropsisterna m-fuscum* was recorded for the first time in WA in several plantations east of Albany between Manypeaks and Wellstead. The ID was confirmed by Chris Reid of Australian Museum in Sydney. Based on the extent and the number of individuals found, we suspect that this species has been in the area for two years or longer without being detected. This species has not been found in plantations outside of the above mentioned area.

Eucalyptus weevil (*Gonipterus* scutellatus)
The distribution range of *Gonipterus scutellatus* has now expanded to the northern and western limits of blue gum growing areas. In areas where the weevil has recently colonised, damage levels tended to be higher than areas where the weevil populations have been around for a number of years. We think that natural enemies are tracking the expansion of weevil distribution range. Along with chrysomelid beetles and *Heteronyx* beetles, adult *Eucalyptus* weevils defoliate tips of trees in January – March.

Black beetle (*Heteronyx* spp.)
Adult *Heteronyx elongates* caused severe damage in a P2006 plantation near Albany in the summer of 2006-07. Outbreak of *H. proxima* was observed in January – March 2007 in Esperance causing severe and extensive damage in young as well as mid rotation plantations. Outbreak of *H. proxima* in Esperance was repeated in February – March 2008.

African black beetle (*Heteronychus arator*)
The use of "socks" on seedlings prior to planting in known African black beetle areas continues to be effective. The impact of this insect has been reduced to minimum. This species has not appeared to be as much problem in the 2R sites.

Leaf blister sawfly (*Phylacteophaga froggatti*)
There was moderate damage by leaf blister sawfly around Esperance.

Wingless grasshopper (*Phaulacridium* sp.)
Wingless grasshoppers caused damage in P2008 plantations
from Bremer Bay to Esperance. A small area of P2007 plantation was affected on sand hill in Scott River late in the year.

"Spring" beetle (*Liparetrus jenkinsi*)
Damage due to this species was severe and extensive in areas between Collie and Boyup Brook and east of Albany in 2006. Due to more proactive management strategy in 2007, damage due to this species was much reduced in the area between Collie and Boyup Brook. Some damage due to this species was observed in Esperance in 2006 and 2007.

Small lucerne weevil (*Atrichonotus taeniatulus*)
High density of this species was found in one plantation about 100km E of Albany in spring of 2007. Distribution of this species within the plantation was restricted to areas that were ex-pasture.

Diamondback moth (*Plutella xylostella*)

Many pupae of this species were found on leaves of seedlings in one plantation near Boyup Brook in early summer of 2007. Affected seedlings were growing in high densities of wild radish. Therefore, larvae of this species probably moved from wild radish to blue gum seedlings.

Summary of the activity of the main insect pests of Eucalyptus globules plantations in Western Australia (M. Matsuka, IPMG)[1]

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			
Autumn gum moth				x						x	27935	0	***E. globulus***
Leaf blister sawfly					x					x	28359	0	*E. globulus*
"Spring" beetles (scarabs)					x					x	26600	354	*E. globulus*
Weevils (defoliating)					x					x	28359	2380	*E. globulus*
Heteronyx (establishment)			x							x	1730	0	*E. globulus*
Heteronyx (post-establishment)					x					x	25000	0	*E. globulus*
Wingless grasshopper				x			x				1700	354	*E. globulus*

[1]This table only summarises responses from APFL, Great Southern, and Timbercorp.

Diseases

***Mycosphaerella* leaf disease**

Mycosphaerella predominantly causes damage to the juvenile leaves of *E. globulus*. Plantations east of Albany affected by AGM and LBS are often also affected by *Mycosphaerella*. Another high risk area is near Northcliffe. *Mycosphaerella* is also found throughout the region at low levels. Damage by *Mycosphaerella* was less extensive and intensive in 2006-07 than in the previous season. Seedlings seem to be infected in the nursery. In May 2008, some P2007 plantations around Albany showed early signs of increased infection over the last two seasons (M. Matsuka, IPMG).

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).

'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. 2007 spring season was not severe as past years and no significant damage recorded (G. Hodgson, FPC).

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

Symptoms of what appeared to be an attack of JLM was noted in a *E. saligna* plantation east of Collie. Confirmation is currently underway.

Native budworm (*Helicoverpa punctigera*)

Large numbers of larvae of this species were found on older *E. saligna* plantations in drier areas in late spring of 2007. Larvae of this species were also found on *C. maculata* seedlings in a plantation near Kojonup at around the same time. Larvae of this species have been found feeding on blue gum in WA in the past.

Sandalwood (*Santalum spicatum*) plantations

Insect pests

Rutherglen bug (*Nysius vinitor*)

FPC is finding significant Rutherglen bug attacks on newly established sandalwood seedlings. This is providing new challenges in taking sandalwood into the pastoral areas in the intermediate/low rainfall zones of the South-west. (G. Hodgson, FPC).

Vertebrate pests (all plantations)

Kangaroos

There is a significant kangaroo issue on several plantation/farm sites. DEC accredited/licensed shooters are engaged to assist with controlling numbers. (Generally all kangaroos taken are for consumer or pet food use). The major impact is on the eucalypt/*Acacia* establishment sites across the Boyup Brook /West Arthur Shires. (G. Hodgson, FPC).

Port Lincoln (twenty eight) parrot:
Parrot control (trapping/shooting) has occurred for the last 4 years (since April 2004). Damage is occurring in eucalypt, *P. pinaster* and *Acacia* establishment sites. It is expected to have a significant control program in place as new plantations are established. A coordinated program for parrot control is in place. Trapping is under permit with DEC. (G. Hodgson, FPC).

Environmental and site related problems
Waterlogging
Tree deaths in the Lake Warden Catchment near Esperance started within a few weeks of the heaviest rainfall on record, which occurred in January 2007. Deaths were in plantings on duplex soils adjacent to saline areas, sites that would have become waterlogged within a few days of the rain. Farmers that had established these demonstration trials in the early 1990's were understandably disappointed at these deaths. An investigation of affected trees was conducted in association with the South East Forest Foundation and the Department of Agriculture and Food. A survey of affected plantings showed that some species (*E. camaldulensis, E. occidentalis* and *E. spathulata*) had survived better than others. Excavations of four affected trees showed that the root systems were shallow, being confined by the clay sub-soil. There was a high concentration of salts in the soil, and soil morphological evidence of protracted waterlogging and shallow perched water tables. There were no signs of pests or pathogens. Anatomical examination of roots showed low levels of starch, and changes consistent with waterlogging damage in some of the trees. Foliar analysis showed high sodium and chloride levels in some of the trees. The most likely cause of tree deaths is saline waterlogging. Future landcare and revegetation projects in this area should include species or provenances that are tolerant to saline waterlogging. (E. Davison, Curtin University of Technology).

Managed natural forests

Jarrah forest (*Eucalyptus marginata)*
Insect pests
Jarrah leaf miner (*Perthida glyphopa*) (JLM)
Populations still exist extensively throughout the forest but levels are below severe damage thresholds. A cut-out boundary survey is due to be conducted in 2009 (A. Wills, DEC).

Gum leaf skeletoniser (*Uraba lugens*)
Populations of gum leaf skeletonizer (*U. lugens*) remain very low in the southern Jarrah forest however some minor populations were located during the Donnelly spring FORESTCHECK survey at Easter and Thornton forest blocks (J. Farr, DEC).

Helena gum moth (*Opodiphthera helena*)
Although not normally recognised as a serious pest of native forests, populations of Helena gum-moth have increased significantly over the last two years (see table below). Severe crown decline due to larval feeding has not been quantitatively or

informally observed, however adult numbers, as measured from light trap captures for spring 2007, have been recorded at over 100 individuals in some sites with consistent captures across most sites. This compares with isolated captures of only one or two individuals in previous years (J. Farr & A. Wills, DEC).

Table: Helena gum-moth captures from FORESTCHECK sites using light traps from 2001-2007.

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

Above: Light traps overwhelmed with Helena gum moth (Nov 2007).

Diseases

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

Karri forest (*Eucalyptus diversicolor*)

Insect pests

No major pest problems reported.

Diseases

Karri is the second most important commercial timber tree in Western Australia. Results from surveys and studies conducted in the 1990s on decay in live trees were recently published (Donnelly and Davison 2008, *Australian Forestry* 71: 27-32,

Davison and Tay 2008, *Australian Forestry* in press). Sawlogs from regrowth trees had a discolouration in the heartwood that was more abundant than in sawlogs from mature trees. Other symptoms in regrowth logs included white rot, white pocket rot and brown rot. Fungal isolations and pathogenicity tests were conducted to determine whether this discolouration is incipient rot, and if so, what causes it, and which rot(s) would eventually develop. A sample of symptomatic discs from newly felled trees and freshly cut scantling had discolouration in 48%, white rot in 14%, white pocket rot in 12% and brown rot in 4% of pieces of wood. *Hymenochaete semistupposa* was isolated from 22% of discoloured wood and 39% of white pocket rot samples. *Stereum hirsutum* was isolated from 4% of discoloured wood and 13% of white rot samples. Koch's postulates in regrowth karri trees showed that *H. semistupposa* caused extensive discolouration, with white pocket rot developing in the heartwood within 4 years, while *S. hirsutum* caused extensive discolouration, with white rot developing in both the heartwood and sapwood within 2 years. It was concluded that the discolouration is incipient rot which will eventually develop into either white rot or white pocket. (E. Davison, Curtin University of Technology).

Nurseries

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

Native plant communities

Diseases

Aerial application of phosphite at sites of biodiversity significance funded through South Coast Natural Resource Management Inc. and Biodiversity Conservation Initiative was successfully completed in autumn 2008. Sprayed sites included the Stirling Range National Park (240 ha), Albany Coastal (93 ha), Bell Track in the Fitzgerald River National Park (377 ha), Cape Le Grand National Park, Esperance (35 ha), Mt Lindesay National Park (15 ha) and the Busselton Ironstone Threatened Ecological Community (TEC) (74 ha). This included five new rare flora target sites: one largely disease-free Montane mallee-heath TEC in the Stirling Range National Park; three new Albany coastal targets, two of these are off-reserve, and a tree injecting site in Narrikup to protect *Lambertia orbifolia* ssp. *orbifolia*. Phosphite target sites included a number of associations of the Montane mallee-heath and Montane heath and thicket TEC and the Mt Lindesay *Little Lindesay Vegetation Complex* TEC and one priority ecological community, Open low *Allocasuarina fraseriana – Eucalyptus staeri* woodland in association with *Banksia coccinea* thicket. Target rare flora included: 16 critically endangered taxa; 10 endangered taxa; three vulnerable taxa and two nominated vulnerable taxa (N. Moore, DEC).

Monitoring of occurrences and survivorship of individual flora species and rate of spread trials of Phytophthora dieback at target sites continues throughout 2008 including sampling to confirm disease status and species susceptibility within sites. An ongoing effort to increase community awareness of Phytophthora dieback disease and the establishment of strong partnerships between the Department of Environment

and Conservation and South Coast NRM Inc. also remains a priority focus. Awareness raising activities to date include: The Great Quiz on Legs Trail; Kings Park Wildflower Festival; Albany Agricultural Show; a dieback tree injecting workshop to the Friends of Twin Creeks; presentations at Mediterranean Ecosystems Conference by Nicole Moore and Sarah Barrett, presentations to the Albany Wildflower Society members and Land for Wildlife members and a local ABC radio interview, and distribution of the new Phytophthora dieback bumper sticker (N. Moore, DEC).

DEC Phytophthora Research Project

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

Eradication of *Phytophthora cinnamomi* from spot infections in native plant communities in Western Australia and Tasmania

Funded by the Department of Environment, Water, Heritage and the Arts funded projects, this project examined the potential to develop protocols to contain and eradicate *P. cinnamomi* from spot infestations that, if untreated, would destroy extensive areas of vegetation. We designed a treatment strategy based on two assumptions: in the absence of living hosts, *P. cinnamomi* is a weakly competitive saprotroph, and; within the experimental sites, transmission of the pathogen was most probably by root-to-root contact alone. At two *P. cinnamomi* infested sites, within scrub-heath in south-western Australia and woodland in Tasmania (2500 km apart), we applied a succession of increasingly robust treatments that included (1) vegetation (host) destruction, (2) fungicides, (3) fumigation, and (4) physical root barriers. *P. cinnamomi* was never recovered at any of three assessments over six to nine months after completion of the treatments. Given the high rates of recovery of *P. cinnamomi* from untreated infested soil, and the sampling frequency at each assessment, the probability that we failed to detect *P. cinnamomi* in treated soil ranged from $p < 0.0003$ to $p < 2 \times 10^{-12}$ depending on site and assessment. This study demonstrated that a devastating soil borne plant pathogen can be eradicated from spot infestations in natural ecosystems ((W. Dunstan (Research Fellow, Murdoch University), Supervisors: G. Hardy, B. Dell, B. Shearer, and T. Rudman).

Does the physiological status of the plant at the time of spraying affect the efficacy of phosphite?

This project examined the impact of waterlogging and drought pre and post phosphite application on the efficacy of phosphite to contain *P. cinnamomi* in native plant species. Re-sprouting and reseeding species were used. Drought or waterlogging did not impair the uptake and translocation of phosphite *in planta*, and phosphite was able induce host defence responses when plants were challenged by *P. cinnamomi*. However, not all plant species induced defence responses when challenged by *P. cinnamomi* despite having high concentrations of phosphite present in their tissues. (Daniel Hüberli (Research Fellow, Murdoch University), Supervisors: G. Hardy, B.

Dell, B. Shearer, B. Bowen and M. Calver).

The efficacy of phosphite to control *Phytophthora cinnamomi* in plants treated pre- and post-fire. (Daniel Hüberli (Research Fellow, Murdoch University), Supervisors: G. Hardy, B. Dell, B. Shearer, B. Bowen and M. Calver).

Urban and rural

Insect pests
See section on wandoo decline (below).

Diseases and Declines

Diseases of Boabs: Surveys for fungi associated with boab (*Adansonia gregorii*) are underway in both South Africa and Western Australia. Seven new species in the Botryosphaeriaceae have been identified: *Lasiodiplodia* sp. nov, *Dothiorella* sp. nov, *Botryosphaeria* sp. nov and *Pseudofusicoccum* sp. nov (3 species). The most commonly isolates species was *Lasiodiplodia theobromae*. A pathogenicity test has shown that this species is highly pathogenic to boabs (Monique Sakalidis, T. Burgess and G. Hardy, Murdoch University and M. Wingfield, Tree Pathology Cooperative Program (TPCP) Sth Africa).

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

Tuart Decline: In recent years, tuart (*Eucalyptus gomphocephala*) woodland within Yalgorup National Park, south of Mandurah has suffered a severe decline in health. Research carried out by the Tuart Health Research Group (THRG) has shown from surveys of tuart across the range, that the major decline syndrome is confined to the Yalgorup region. A *Phtophthora citricola*-like sp. has been recently isolated from a number of declining sites with the Yalgorup region. Further work is being conducted to determine the pathogenicity of these isolates and to characterise them (P. Scott, Murdoch University). A very close correlation between foliar zinc levels and crown health has been observed and treatment trials with nutrient implants have shown promising results. Trials with injection of phosphite have also shown promising results (P. Scott, Murdoch University). Strong correlations also exist between crown

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

Wandoo Decline: Wandoo (*Eucalyptus wandoo*) trees and woodlands have been affected by crown decline, sometimes resulting in the death of declining trees. The Wandoo Recovery Group (WRG) was established in 2003 and a Wandoo Strategy and Action Plan was developed, which included aims to support research, distribute information in the community and develop partnerships with stakeholders. UWA is the principal research provider for the WRG. Research strategy aims to increase the understanding of the relationships between climate, tree physiology and insect pests and pathogens associated with the decline. Future research will address links between environmental stress and susceptibility to pests and diseases. The recently approved State Centre of Excellence for Climate Change; Tree and Woodland Health will unite research efforts into wandoo, tuart and other tree declines (L. Manning, WRG).

Wandoo's physiology allows it to continue to take up water in fairly dry soils when species like jarrah and marri reduce their transpiration, however this ability may deplete soil water to dangerously low levels in a situation of long-term below-average rainfall, as is being experienced in WA at present. Despite the occurrence of the species in areas with more than 1000 mm to as little as 300 mm annual rainfall, differences among populations in drought tolerance in experiments with juvenile wandoo do not correlate with the provenance's rainfall or aridity index. Such trends are also largely absent in terms of salinity tolerance. These findings suggest that variation in wandoo crown decline across the species' distribution range is mainly due to local environmental factors (E. Veneklaas, UWA).

Wood boring insects and fungal pathogens are constantly associated with branch death. A wood-boring insect (known as Type-1 borer) has been found to exist in higher populations in Wandoo woodlands of declining health. The environmental factors driving population dynamics of Type-1 borer require further investigation. Monitoring phenology (development of bud formation, flowering and seed set) and growth in the wandoo forest will aid in this understanding (Ryan Hooper, UWA).

Broad-scale survey and mapping over a number of years is establishing a recorded trend in wandoo health. Temporal and spatial trends show decline patterns are broad scale, variable and not continuous across the landscape. A survey along three transects, encompassing wandoo’s east-west range in 2002 and repeated in 2008, shows that although wandoo decline is still occurring, recovery is also evident. Recovery appears most advanced in the northern transect (around York), intermediate in the central transect (Wickepin and Narrogin) and limited in the south (Jack Mercer).

Rudis decline: Rudis (*E. rudis*) has shown varying degrees of symptoms of crown decline throughout its range for many years. Collaborative research between Murdoch University, Serpentine-Jarrahdale Local Council and ALCOA has been initiated to investigate the efficacy of trunk injections to reverse canopy decline. Trials include treatments of phosphite, complete nutrient and also an insecticide. A trial established in spring 2005 at Pinjarra is currently in progress. Assessments of crown health are focusing at the crown, branch and leaf scale and the incidence and severity of a range of insect and fungal pests. Results indicate that stem injection with phosphite or a systemic insecticide induce an increase in crown health when compared to control and nutrient treatments. Workshops have been conducted to instruct stakeholders on methods of nutrient injection (P. Barber, Murdoch University).

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 22,276 ha was mapped to assist the planning of roading and timber harvesting operations undertaken by the FPC. This included 5,174 ha of previous mapping that was checked for further spread. Mapping and hygiene planning were undertaken on a further 6,059 ha for the Parks and Visitor Services, Nature Conservation Service and Sustainable Forest Management Service of DEC, and 6,783 ha for external parties. Interpretation from helicopter, coupled with field sampling, was undertaken to explore for new infestations in the Fitzgerald River National Park. Training programs were carried out in disease mapping and hygiene management (G.Strelein, DEC).

A major project to undertake Phytophthora dieback threat assessment and risk analyses for vegetation in the South West and Northern Agricultural Natural Resource Management regions on both DEC and non-DEC managed lands continued with the South Coast Natural Resource Management group. This included the collation of biological assets, strategic disease mapping, predictive modelling of the future spread of *P. cinnamomi*, and estimation of threat and risk categories (G. Strelein, DEC).

In the year to 30th June 2008, a total of 2,353 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 of *P. inundata* and *P. gonapodyides*; new records of *P. asparagi* and *P. niederhauseria* were added this year to the list of named *Phytophthora* species occurring in native vegetation in WA. At least nine new and undescribed *Phytophthora* taxa have been distinguished, based on their ITS rDNA sequences. Several of them are indistinguishable, on morphological characters, from known locally-occurring species such as *P. citricola, P. drechsleri*, or *P. megasperma*. Most

of the newly identified Phytophthoras have been associated with multiple species of dying native plants in natural vegetation communities. A PhD project commenced in April 2007 at Murdoch University to further investigate and describe these new Phytophthoras, and to test their pathogenicity (A. Rea – see Research and Development). A small number of other tree health and nursery problems were investigated (M.Stukely, DEC).

Research and Development

General

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

This new Centre was approved for funding in 2008 is made up of four programs: Climate Change, Woodland and Forest Declines; Decline Ecology; Restoring Biodiversity Values; and Policies and Action for Woodland and Forest Restoration. Murdoch University together with the University of Western Australia and the Department of Environment and Conservation are the primary proponents, with cash and in-kind support from 27 agencies, non-government agencies and industry and collaboration with Universities and agencies in eastern Australia and overseas (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

Eucalyptus globulus

Several projects at Murdoch University are focusing on eucalypt plantation health and risks to biodiversity of native forests in Australia. In the past 3 years, surveys have been conducted in collaboration with State departments and private forestry companies in eucalypt plantations in QLD and NT. The surveys provide a framework for a database on disease already present in Australia. Several new fungal species have been found causing leaf diseases and these are currently being described. A database of exotic eucalypt diseases and their proximity to Australia and the risk they pose to Australia's forests and industry is being compiled. A number of diseases are of particular interest, *Kirramcyes destructans, K. zuluensis* and *Chrysoporthe cubensis*. Molecular markers have been developed for *K. destructans* and are already in existence for *K. zuluensis* and *C. cubensis* (through collaboration with the Forestry and Agriculture Biotechnology Institute in South Africa). These markers will be used to determine the origin, diversity and movement of potentially destructive eucalypt diseases. The population of *K. destructans* in Asia was found to be genetically uniform providing evidence for a founder effect in Asia. Australia was thought to be the most likely origin and surveys in northern Australia have now found *K.*

destructans in two locations, Derby Western Australia and Melville Island in the Northern Territory. A project has been funded to test the susceptibility (in trials in Asia) of several tropical and sub-tropical eucalypt species to *K. destructans* and *K. zuluensis.* These trials have been established in Thailand, Vietnam and China and will be rated by the end of 2007. A matching trial will be established on Melville Island in 2008 (T. Burgess, 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. *Mycosphaerella* spp., *Botryosphaeria* spp. *Cryphonectria* spp.). The aim is to determine their origin, movement and the risk they pose to Australia's eucalypts (T. Burgess, MU and M. Wingfield, TPCP).

PhD Theses in progress at Murdoch University (MU)

Francisco (Paco) Tovar: The cause of basal stem rot in second rotation *Eucalyptus globulus* plantations (Supervisors: T. Burgess, G. Hardy, MU and R. Robinson, DEC). Surveys completed during 2005-2007 indicated that 6 main species of fungi were associated with white rot of *E. globulus* coppice stumps. These species were identified as *Trametes versicolor, Stereum hirsutum, Stereum illudens, Pycnoporus coccineus, Bjekandera adusta and Lopharia crassa.* Levels of fungal colonisation of stumps across all plantations surveyed averaged 56% and were as high as 86 % at a plantation in Collie. Nonetheless, an average of 85% of stumps coppiced succesfully, indicating that fungal colonisation was not interferring with coppice shoot emergence. Surveys also showed that less than 1% of stumps lost major shoots due to windthrow. Previous reports of 'significant' losses due to wind throw were attributed to obsevational bias, possibly, an edge effect. A two year trial testing antifungal treatments on coppice stumps was set up to determine the possibility of preventing fungal colonisation. None of the anti-fungal preventative treatments were effective. A number of other trials and surveys have been undertaken, including:

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

Vera Andjic: The movement of *Kirramcyes destructans* throughout Asia, a potential threat to Australias forests and plantations (Supervisors: T. Burgess and G. Hardy, MU and M.Wingfield, TPCP).

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

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

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

Michaela King: Genomic analysis of phosphite responsive genes from *Phytophthora cinnamomi* (Supervisors: G. Hardy, J. McComb, W. Reeve and P. O'Brien, MU). Submitted late 2007.

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 and P. O'Brien, MU).

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

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

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

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

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

Honours Theses in progress at Murdoch University (MU)

Mark Gresser: The impact of thinning and burning minesite rehabilitation infested or not infested with *hytophthora cinnamomi* on vegetation health and small mammal communities (Supervisors: M. Craig and G. Hardy, MU).

Tom Phillips: Detection of *Phytophthora cinnamomi* from bulk water and soil samples using real time polymerase chain reaction. (Supervisors: Nari Anderson, P. O'Brien and G. Hardy, MU).

Jayden O'Brien: The persistence and disease cycle of *Phytophthora cinnamomi* in high and low impact 'black gravel' sites in the jarrah forest. (Supervisors: D. Huberli, MU, V. Stokes, Alcoa Australia and G. Hardy, MU).

Managed natural forests

Jarrah forest (*Eucalyptus marginata*)

Diseases

Use of metham sodium to eliminate *Phytophthora* from roading gravel. The introduced pathogen *P. cinnamomi* can be spread to areas of native vegetation by the movement of soil and soil products including gravel. As gravel is widely used in road construction, many contracts for its supply specify that it must be sourced from gravel pits located on dieback-free sites. This will increase transport costs if the only source of dieback-free gravel is at a distance from where it is required. As uninfested gravel is in short supply, preliminary experiments have investigated whether it is possible to kill *P. cinnamomi* by treating gravel with the soil fumigant metham sodium. If this can be done reliably, economically and safely, gravel from infested gravel pits can be treated for use in road construction in areas of native vegetation without the environmental risk of spreading *P. cinnamomi* to uninfested areas. (E. Davison, B. Warton & F. Tay, Curtin University of Technology)

RESEARCH PROJECTS – CSIRO SUSTAINABLE ECOSYSTEMS, CRC FORESTRY AND BUSHFIRE, UNIVERSITY OF TASMANIA

Climate change and Australia's plantation estate: pest impacts on carbon stores. *CSIRO Sustainable Ecosystems, Australian Greenhouse Office*
This project used species distribution and population dynamics models for key plantation pest species to develop site-specific inputs for a process-based productivity model, CABALA Health, and examined the consequences of pest attack on plantation carbon sequestration under changing climate. Pest attack was confined in the analysis to the first 3 years of growth for *E. globulus*, and between age 20 and 25 for *P. radiata* (to simulate *Essigella californica* damage). The results suggest that, under current climate, pest attack was likely to have a relatively small impact on C sequestration (up to 15% reduction). However under changing climate pest impact was likely to increase irrespective of whether pest activity was predicted to increase or remain constant, with maximum reductions in C sequestration of 40% predicted under 2030 and 2070 climates. There was considerable between-site variation in responses to pest attack related to the climate changes predicted for each site. There was also considerable variation in results depending on the climate model used and assumptions of photosynthetic responses of *E. globulus* and *P. radiata* to elevated CO2. Although there is uncertainty around these estimates related to lack of knowledge of how plantation species will respond to particularly elevated CO2, and around how the climate will change at specific sites, the results suggest that the effects of defoliating pests will increase substantially in the future.
(Key researchers: Libby Pinkard, Michael Battaglia, Darren Kriticos, Caroline Mohammed, Trudi Wharton, Agathe Leriche)

CSIRO Sustainable Ecosystems - Predicting NPP of temperate forest systems: uncertainty associated with climate change and pest attack. *CSIRO Sustainable Ecosystems, Australian Greenhouse Office.*
Climate change has the potential to affect the productivity and biodiversity of Australian forests, both directly through the effects of predicted climate changes on individual species' vigour, and indirectly through changed competition between plant species, changes in plant/pest interactions and the effects of altered fire frequency on plant vigour and plant/pest interactions. However there is little understanding of how Australian plant species and communities will respond to changing climate. This ongoing project uses qualitative modelling, or loop analysis to develop a framework to give a qualitative understanding of the behaviour of cool temperate forest systems, that can help firm research questions and focus research into critical areas, and explore hypotheses about key processes and interactions among species. The Warra long term ecological site is being used as a case study. (Key researchers; Libby Pinkard, Morag Glen, Alexander Herr, Caroline Mohammed, Tim Wardlaw, Simon Grove)

Impact of stem defect agents on wood quality in subtropical hardwood plantations. *Plantation Hardwoods Research Fund, Queensland, with several participating industry partners; CSIRO Sustainable Ecosystems, QDPI and NSWDPI.*
Defects in eucalypts due to mechanical damage by insect borers and subsequent

fungal invasion can reduce sawlog timber value by up to 90% and impact on processed products through staining. In Queensland and N NSW the emerging eucalypt plantation estate is rapidly increasing in size and rotation age. MIS companies predominantly invest in eucalypt taxa that have some degree of susceptibility to borer damage. Industry is also increasing its investment in Corymbia taxa plantings, principally spotted gum, potentially expanding to 100,000 ha by 2016. Although young spotted gum has shown good resistance to insect borers compared to eucalypt taxa and even certain Corymbia hybrids, recent surveys of older spotted gum plantations have identified external signs indicative of borer and fungal damage. This recently awarded project will quantify the economic impact of defect agents. It will determine the environmental and biological drivers that dictate the level of damage and develop defect risk models from this data. Industry will use these risk models to assist in matching species to site in order to maximise productivity. This project is a critical step required to underpin a young industry where the need for defect free wood is critical to enhancing overall plantation profitability (Key researchers; Jeremy Brawner, Caroline Mohammed, Simon Lawson, Valerie Debuse, Christine Stone, Angus Carnegie and Martin Stone).

Disease detection, diagonostics and taxonomy – CSIRO Sustainable Ecosystems and the University of Tasmania. *Morag Glen and Caroline Mohammed*
The period 06-08 saw the completion or progress of various projects;

- the publication of the molecular diagnostic protocol for guava rust
- the development of the use of FTA cards for the collection on DNA direct from diseased material (MSc by Mila Sulistyawati)
- the application of the nested PCR detection system for eucalypt *Mycosphaerella* species to the investigation of resistance in Tasmanian trials
- the development of real time PCR to quantify *Mycosphaerella* mycelium present in necrotic or green leaf tissue
- a multigene taxonomic investigation of Cyclaneusma in pine (Istiana Prihitini)
- the identification of macrofungi associated with different rot types in coarse woody debris by direct extraction of DNA from woody material
- a taxonomic study of Ganoderma root rot pathogens causing damage to tropical hardwoods in Indonesia and Malaysia
- a training trip by Morag Glen to the USA and Spain to see guava rust in Hawaii and pine pitch canker in California and Spain – she undertook the molecular ID process using real time PCR in Matteo Garbelotto's lab, UC Berkeley as well as observing the disease in the nursery and field in USA and Spain.

CRC FORESTRY
Subproject 1.2.2 Measuring and Monitoring Forest Health
Key researchers:
NSW DPI:Christine Stone, Angus Carnegie
UMelb/DSE:Ian Smith, David Smith, Alieta Eyles
FT: Tim Wardlaw, Karl Wotherspoon
CSIRO/UTas: Karen Barry, Libby Pinkard, Mike Battaglia, Caroline Mohammed
Forestry SA: Charlma Phillips

Pine

Research at Green Hills project within CRC subprojects 1.2.2 and 1.1.2 (led by CSIRO scientists Darius Culvenor, Jan Verbesselt, and Neil Sims) is aiming to improve accuracy and cost-efficiency of estimating standing volume. This improvement will be effected by the use of remote sensing technology to provide better data than current conventional methodologies about the impact of forest health problems which results in defoliation or mortality (e.g. *Essigella* and *Ips grandicolis* at Green Hills respectively)

Research to define "canopy health result" can be classed into 3 ongoing studies.

- Digital aerial sketch mapping = location/extent/incidence/severity classification – Use ADS40 and Quickbird imagery to validate/calibrate accuracy of aerial sketch mapping.
- MODIS canopy change detection web based model based on selected spectral indices. This MODIS product would be immediate value in optimising existing plantation health surveillance programs (=multi-phase sampling system).
- Classified remotely acquired imagery in terms of: density of dead trees and canopy 'discolouration / defoliation damage index'(using ground plot data, Quickbird and ADS40 imagery). This study aims to quantify the relationship between the 'Damage index' and loss of stand volume.

The canopy health results will be integrated with other sources of data for the purpose of;

- scenario exploration e.g. identify site hazard parameters e.g. What is the moisture stress threshold of *P. radiata* for trees to become susceptible to attack from *Ips grandicollis*? What are the most influential spatial attributes contributing to stand moisture stress e.g. silviculture (delayed thinnings); rainfall/temperature; DEM, topographical; PAWC surfaces. The answer = Hazard site classification for Ips grandicollis attack.
- for operational activities. e.g. operational stand record systems – conventional text databases and spatial stand record databases. Classified imagery could be input into a spatial record system and the spatial health events recorded similarly to say fire mapping. Imagery could also be classified according to actual canopy symptoms (e.g. discolouration/defoliation crown index or NDVI) but also classified according to deviation in stand yield from 'healthy' canopy for a particular site (SQ) i.e. in terms of "health modifiers" = 'impact'

Companies within the radiata industry, in general, have made significant investment acquiring inventory plot-based data to develop customised (empirical) growth models. Process based modelling will continue to proceed, however, and in the near and mid future a hybrid approach may evolve.

In the immediate future, the FH module in CABALA will be used to predict impact of recent severe Essigella defoliation and to validate the model. Work mainly within the CRC to develop CABALA FH (see below) demonstrated that factors such as the pattern, timing and frequency of pest attack strongly influence long-term productivity and recovery of productive potential. Parallel information at the same level of detail is not available for *P. radiata*. A new project in pine led by Alieta Eyles focuses on investigating host responses to pest attack, in terms of whole plant physiology, biochemistry, and spectral properties. Acquisition of this baseline data will be used to

develop and refine relationships for predicting the effects of Essigella on long-term productivity and to calibrate remote-sensing imagery that is being developed to measure changes in crown condition following pest attack.

Eucalypts

Research undertaken at Pittwater near Hobart by Libby Pinkard, CRC postdocs Alieta Eyles and Karen Barry, and PhD student Audrey Quentin, has focused on the effects of water and nutrient stress on responses to artificial defoliation, in terms of gas exchange (foliar and stem) and patterns of resource allocation (biomass, nitrogen, carbohydrates) in both young (<12 months old) and post-canopy closure trees. A number of papers are being prepared from this research. The results have been used to test and validate CABALA Health, a version of the process-based model CABALA which predicts the rotation-length consequences of defoliation on *E. globulus* growth. CABALA Health was developed as part of the CRC project and a project funded by the Department of Climate Change, and is the first such model developed for eucalypts. Staff are now working with the forest industry investigating ways in which CABALA Health might be used operationally.

An additional component of work has been a comparison of the impacts of artificial and insect defoliation on *E. globulus* seedlings, carried out by Audrey. Her results indicate that it is difficult to mimic completely the bud damage that occurs as a consequence of insect defoliation, and that artificial defoliation results in slightly different patterns of stem growth and resource allocation compared with insect defoliation. At a whole-plant level, however, there was little difference in the impacts of artificial and insect defoliation, suggesting that use of artificial defoliation in experiments to examine effects on growth is appropriate.

Also within sub-project 1.2.2, honours student Sarah Ugalde has recently completed a study of constitutive characteristics of foliage of *E. globulus* growing with water and/or nutrient limitation. She found that abiotic (and particularly water) stress increased chemical defence and palisade density, which may increase resistance to pests and diseases, while abiotic stress reduced cuticle thickness, which may reduce resistance. These results help us better define risk associated with growing plantations under different environmental conditions. Luci Agustini as part of her MSc is studying the early physiological and biochemical changes associated with eucalypts infected with root rot.

Research to use forest health data derived from remote sensing imagery to inform decision support systems is underway in the Green Triangle, Wattle Ranges, near Penola in South Australia with *E. globulus* ages from 1-2 yo to 9 yo (ie. planting year 1999 through to 2006, with most represented by 2000 plantings). As a large team (with project 1.1.2), forest health assessments over 3 field campaigns have been completed starting in October 07. In April a different plot sampling scheme to that at Green Hills which is based on a USDA protocol which has 4 sub-plots within each site was used. A ground based health assessment has been developed and imagery at various resolutions has been acquired (MODIS, SPOT, QB and Hyperion). Two different approaches are being explored in respect to obtaining impact data resulting from damaging events i) the integration of information from a ground based health assessment protocol with data from imagery and ii) the application of optical canopy models (processed with high resolution imagery and single crown spectra) with

horizontal layers to attempt to quantify defoliation and necrosis in each of 3 crown zones. The latter requires access to high resolution, hyperspectral imagery (e.g. Hyspex, or new 8 narrow-band digital camera).

Fire management and eucalypt dieback: mycorrhizal indicators of declining forest health. CRC Forestry and CRC Bushfire. *Bryony Horton (PhD), Caroline Mohammed, Morag Glen, Neil Davidson, Dugald Close, Tim Wardlaw.*
The cause of eucalypt dieback is complex and has been related to altered management including European farming practices and changes in fire regime, especially the long absence of fire from forest communities adapted to a particular fire regime. One type of dieback is high altitude dieback, affecting *Eucalyptus delegatensis* forest in Tasmania. Early research has indicated that in this forest type, the application of fire can ameliorate dieback symptoms in the canopy, but the specific reasons for this are still unknown. An understanding of eucalypt dieback is essential for the maintenance of healthy forests.

There is some evidence to suggest that healthy and declining forests differ in their mycorrhizal communities. Mycorrhizal fungi are important components of ecosystems and are involved with many processes including nutrient cycling. Because of the keystone functions of the ectomycorrhizal community, this group of fungi has the potential to influence many aspects of forest ecology including vegetation dynamics and succession, soil chemistry and nutrient cycling processes, as well as tree health.

This study is exploring the relationship between *Eucalyptus delegatensis* dieback, fire and the ectomycorrhizal fungal community, in Tasmania, thereby increasing our understanding of forest ecology and improving forest management. Expected project outcomes are;

- An understanding of the spatial scale at which sampling for ectomycorrhizal fungi within eucalypt forest is most comprehensive and efficient
- A better understanding of fungal diversity within eucalypt forest ecosystems, especially in relation to fungal symbionts
- The application of this information to management of E. delegatensis, fungal biodiversity and conservation management
- A set of criteria that can be used to assess dieback/forest health in the field and be applied to a range of sites for the purpose of research or management
- A better understanding of the relationship between fire and the ectomycorrhizal fungal community and the effects of one on the other
- Identification of fungal/mycorrhizal indicators of forest decline
- Management guidelines based on indicators within the fungal community that can aid in the application and effect of fire on forest health

Macrofungal biodiversity as a tool for the sustainable forestry, with special reference to coarse woody debris. CRC Forestry and CRC Bushfire. *Genevieve Gates (PhD), Caroline Mohammed, Morag Glen, Tim Wardlaw, Neil Davidson*
The project has provided a full census of CWD on the forest floor of 4 sites in a *Eucalyptus obliqua* forest at different times since wildfire. The substrates wood, soil and litter were surveyed at approx fortnightly intervals for 14 months. The macrofungal assemblages were very much influenced by plot, the causes of which

were difficult to clarify due to differing site characteristics. However it was apparent that small adjacent areas of a forest contain very different species assemblages. This implies that in order to sustain macrofungal diversity, as large an area of habitat as possible should be left to encompass different age cohorts, different vegetation types, different soil types and differing microclimates to provide for these differing assemblages. Several large polypores were found only in forest greater than 250 years old either due to their being host specific or needing a long time to fruit. To prevent local extinction of these species, habitat must be left to attain such an age and in proximity to a source of spore inoculum.

Managing for persistence of the saproxylic biota in production forest landscapes *(ARC Linkage, Universities of Tasmania, Monash and Alberta (Canada), CSIRO Sustainable ecosystems, Forestry Tasmania) and SCION*

Not only will trees in future managed eucalypt forests be younger and smaller, but the level of utilisation, if current trends persist, will see less residue left after harvesting. This may result in serious reductions of CWD availability in the landscape and disadvantage those saproxylic species whose dispersal abilities are incompatible with the spatial and temporal scale at which CWD remains available.Scientists from SAFER will take part in a new ARC project run by the University of Tasmania which will

- Elucidate the scales at which several saproxylic beetle taxa can disperse
- Infer historic population patterns by characterising current population structures in an experimental forest landscape
- Relate these scales to landscape structure as measured by proximity to mature forest and by coarse woody debris volumes
- Using these findings to formulate management guidelines to ensure the persistence of saproxylic biota.

This new project represents a specific ongoing research and training collaboration over 7 years between the University of Tasmania, Forestry Tasmania and CSIRO including four students and one postdoctoral fellow. The ARC SPIRT project 1999-2002 (C199067 *Ecologically sustainable forest management: fungal and invertebrate biodiversity*) was the first of these studies, providing the foundation, among other things, for an increasingly extensive collection of saproxylic beetles across successional stages in wet eucalypt forest and which will be used to identify target species for molecular analyses. The project brings together brings together established research groups from Australia, New Zealand and Canada all with excellent international reputations in the specialist fields of molecular ecology, landscape ecology and forest management in a way that will extend the molecular genetics approach to find spatially and temporally optimal solutions for wood production and biodiversity. *(Key researchers; Caroline Mohammed, Morag Glen, Paul Sunnucks, Tim Wardlaw, Simon Grove, John Spence, Ecke Brockerhoff).*

ARC Linkage 2006-2009 Linking environmental stress in pine plantations to bark stripping by browsers and fungal attack: developing novel options for management *(University of Tasmania, CSIRO Sustainable Ecosystems, Forestry Tasmania, NSW DPI, Universities of Aberdeen (UK) and OHIO (USA)).*

Pines on high wet sites in Tasmania appear more susceptible to bark stripping and fungal attack (Spring Needle Cast, SNC). Our original hypothesis was that browsers may be attracted to stress mediated high sap sugar levels; fungi may become pathogenic in response to stress. The project seeks a trait indicative of stress tolerance

that confers resistance to both browsers and fungi and that can be used to screen genetic trials.

Our data confirms the strong relationship between factors relating to cold environments (high altitude, low soil temperatures, colder aspects) and the incidence and severity of bark stripping. Other than the original hypothesis which is still being explored there may be several reasons for this severity and incidence in cold environments:

- Disruption of the bark boundary layer (between cambium and phloem) by frost is making bark easier to remove.
- There is an accumulation of sugars in the bark of trees on colder sites or aspects.
- There are different species of understorey plants that are not palatable to wallaby.
- There is less biomass of understorey species due to poorer growing conditions.

Results currently available suggest that food availability is playing a major role in the incidence and severity of bark stripping in Tasmania. There was no significant relationship between the presence of wallaby on a site and the severity of bark stripping at that site but the inter-plantation results suggest that if a compartment has forest types that are rich in alternative food (e.g. native regrowth or native oldgrowth/regrowth mixed) adjoining, there will be less bark stripping at that compartment. Forest types devoid of understorey plants (e.g. older pine plantations) not only provide good shelter for wallabies but encourage them to move into adjoining younger pine plantations for food. It is suggested that management options are deployed on borders between young plantations and older pine plantations or wattle forest. Management measures should also be encouraged on compartments or sections of compartments of young 1-3 year old pine plantations that have easy access (e.g. flat and without slash) and allow easy movement into and within the plantation. Plantations with southerly or south westerly aspects also have a higher incidence and severity of bark stripping. Reasons behind this higher incidence related to aspect are being investigated.

Tree architecture plays a major role in determining bark stripping in a compartment. Trees with a larger number of branches at the base and shorter internode lengths are presumably less accessible for wallaby. Selection for these traits may improve the probability of survival in high risk areas however there may be trade-offs with wood quality by having more branches around the bottom part of the stem. It is also likely that the density of foliage on branches around the base of the stem is defined by nutrient and water availability at the site. Increasing foliage density through nutrient application may also be an option.

Models being developed in this project to predict browsing risk need to be validated using additional pre-existing data on bark stripping both in Tasmania, Victoria and Southern NSW. Information required for this work will be GPS points of affected trees, scores for these trees and GIS layers of forest types, rivers and roads and soil type (if possible) for VIC and NSW. Data to determine whether the presence of certain species of understory plant (alternative feed) or combinations of plants have any effects on bark stripping incidence or severity is being analysed. Do differences in the seasonal patterns of bark stripping result from differences in quantity and quality of other food resources, in comparison to that offered by the bark of the tree?

Needles from sites with young pines in the browser trials and older pines at other sites have been sampled to determine i) the fungal endophytes associated with healthy trees and ii) the fungi associated with SNC. Fungi have been isolated and identified using

morphological and molecular identification methods. In addition a *P. radiata* SNC Marker Aided Selection Trial showing symptoms of SNC has been sampled to identify the fungi associated with high and low levels of fungal damage. *(Key researchers; Anna Smith, Istiana Prihatini, Caroline Mohammed, Chris Beadle, Morag Glen, Tim Wardlaw, Enrico Bonello, Steve Woodward).*

Disease-management strategies for the rural sector that help deliver sustainable wood production from exotic plantations *(AuSAID Public Sector Linkages Program, University of Tasmania, CSIRO Sustainable Ecosystems)*
This project scheduled for 08-09 aims to increase capacity in forest pathology and biosecurity in Indonesia by holding a training workshop and post-workshop field trip which will achieve the above goal so that outcomes are sustainable. Capacity building in the generic concepts of plant/forest pathology, their application, and establishing links with Australia and internationally will allow both countries to contribute more effectively to global bio-security (preventing movement of pests and pathogens) and address new disease threats associated with climate change e.g. guava rust. *(Key researchers; Caroline Mohammed, Chris Beadle, Morag Glen, Anthony Francis).*

Key publications for 06-08:

Barry, K.M., C. Stone and C.L. Mohammed 2008. Crown-scale evaluation of spectral indices for defoliated and discoloured eucalypts. International Journal of Remote Sensing. 29:47-69.

Beadle, C., P. Volker, T. Bird, C. Mohammed, K. Barry, E. Pinkard, D. Wiseman, C. Harwood, R. Washusen, T.J. Wardlaw and G. Nolan 2007. Solid wood production from temperate eucalypt plantations; a Tasmanian case study. Southern Forests. 70:45-57.

Glen, M., A.C. Alfenas, E.A.V. Zauza, M.J. Wingfield and C. Mohammed 2007. *Puccinia psidii*: a threat to the Australian environment and economy a review. Australasian Plant Pathology. 36:1-16.

Glen, M., A.H. Smith, S.R.H. Langrell and C.L. Mohammed 2007. Development of nested polymerase chain reaction detection of *Mycosphaerella* spp. and its application to the study of leaf disease in *Eucalyptus* plantations. Phytopathology. 97:132-144.

Langrell, S.R.H., M. Glen and A.C. Alfenas 2008. Molecular diagnosis of *Puccinia psidii* (guava rust) - a quarantine threat to Australian eucalypt and Myrtaceae biodiversity. Plant Pathology. 57:687-701.

Pietrzykowski, E., N. Sims, C. Stone, L. Pinkard and C. Mohammed 2007. Predicting Mycosphaerella leaf disease severity in a *Eucalyptus globulus* plantation using digital multi-spectral imagery. Southern Hemisphere Forestry Journal. 69:175-182.

Pietrzykowski, E., C. Stone, E. Pinkard and C. Mohammed 2006. Effects of Mycosphaerella leaf disease on the spectral reflectance properties of juvenile *Eucalyptus globulus* foliage. Forest Pathology. 36:334-348.

Pinkard, E., W. Gill and C. Mohammed 2006. Physiology and anatomy of lenticel-like structures on leaves of *Eucalyptus nitens* and *Eucalyptus globulus* seedlings. Tree Physiology. 26:989-999.

Pinkard, E.A., C. Baillie, V. Patel and C.L. Mohammed 2006. Effects of fertilising with nitrogen and phosphorus on growth and crown condition of *Eucalyptus*

globulus Labill. experiencing insect defoliation. Forest Ecology and Management. 231:131-137.

Pinkard, E.A., C.C. Baillie, V. Patel, S. Paterson, M. Battaglia, P.J. Smethurst, C.L. Mohammed, T. Wardlaw and C. Stone 2006. Growth responses of *Eucalyptus globulus* Labill. to nitrogen application and severity, pattern and frequency of artificial defoliation. Forest Ecology and Management. 229:378-387.

Pinkard, E.A., M. Battaglia and C.L. Mohammed 2007. Defoliation and nitrogen effects on photosynthesis and growth of *Eucalyptus globulus*. Tree Physiology. 27:1053-1063.

Pinkard, E.A. and C.L. Mohammed 2006. Photosynthesis of *Eucalyptus globulus* with Mycosphaerella leaf disease. New Phytologist. 170:119-127.

Pinkard, E.A., V. Patel and C. Mohammed 2006. Chlorophyll and nitrogen determination for plantation-grown *Eucalyptus nitens* and *E. globulus* using a non-destructive meter. Forest Ecology and Management. 223:211-217.

Smith, A.H., W.M. Gill, E.A. Pinkard and C.L. Mohammed 2007. Anatomical and histochemical defence responses induced in juvenile leaves of Eucalyptus globulus and *Eucalyptus nitens* by *Mycosphaerella* infection. Forest Pathology. 37:361-373.

Smith, A.H., E.A. Pinkard, G.C. Hunter, M.J. Wingfield and C.L. Mohammed 2006. Anatomical variation and defence responses of juvenile *Eucalyptus nitens* leaves to Mycosphaerella leaf disease. Australasian Plant Pathology. 35:725-731.

Wiseman, D., P. Smethurst, L. Pinkard, T. Wardlaw, C. Beadle, M. Hall, C. Baillie and C. Mohammed 2006. Pruning and fertiliser effects on branch size and decay in two *Eucalyptus nitens* plantations. Forest Ecology and Management. 225:123-133.

NEW ZEALAND

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

1. Plantations:

PINUS RADIATA:

Pests:

No insect problems of any note were recorded in *Pinus radiata* plantations. The Monterey pine aphid, *Essigella californica* (Aphididae), has been associated with severe upper crown yellowing and premature needle cast in *P. radiata* forests in Australia, however it has not been associated with any damage in New Zealand.

Diseases:

Dothistroma needle blight

Dothistroma needle blight was less severe in the summer of 2007-08 than in recent years. This was a result of the 2006/07 summer experiencing below normal rainfall and temperatures being well below average. Rainfall was less than 75% of average in the west of the North Island and eastern Bay of Plenty, and 50% of average in the central North Island, areas where Dothistroma needle blight is traditionally most common. The 2007/08 summer was extremely dry in the North Island. The dry weather and low inoculum carried over from the previous season led to extremely low levels of Dothistroma needle blight recorded in aerial surveys carried out in June 2008.

At 94,998 ha the aerial spray programme in the North Island for 2007-08 was smaller than the previous season when an area of 134,742 ha was sprayed (figures provided by the Dothistroma Control Committee). An extremely small spray programme (under 30,000 ha) is expected next season.

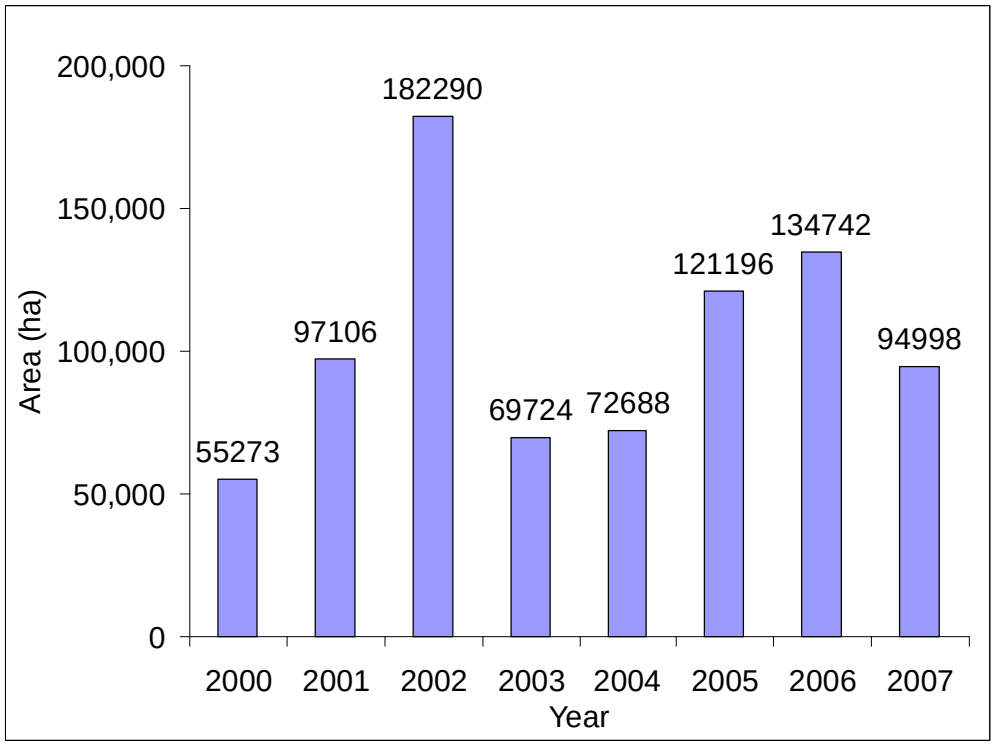


Figure 1 – Area sprayed annually for Dothistroma control in the North Island

Cyclaneusma needle cast

Based on Forest Health database records and observations, the severity of Cyclaneusma needle-cast was again low, as it was in recent seasons. Autumn 2007 was one of the driest on record for eastern North Island (one of the areas traditionally severely affected by Cyclaneusma needle cast). After a summer drought over most of New Zealand, higher than average autumn rainfall was experienced over many areas previously affected by drought, including those prone to Cyclaneusma needle cast. Increased disease levels are expected during October 2008.

Physiological needle blight *and atypical Cyclaneusma needle cast*

Very few reports of the physiological needle blight (PNB) were made in 2007-08. Regions commonly affected in the past, such as East Cape of the North Island and Northland, were unaffected. A monitoring trial set up to measure water potential differences in roots and shoots of trees in a forest where PNB had been recorded in previous years was unsuccessful because symptoms of PNB did not appear during the July-November 2007 monitoring period.

The atypical needle cast event seen in a central North Island forest during spring 2006 (figure 2) did not reappear.

Figure 2 - Needle cast symptoms on trees along road side observed in 2006

Neonectria fuckeliana

Nectria fuckeliana has been redesignated *Neonectria fuckeliana.* Taxonomists have been reviewing the diverse genus *Nectria* for several years and many species have been grouped together based on a series of microscopic features and placed into other genera (some of which have been newly described).

Surveys were carried out in the northern half of the South Island and there was no northwards extension of the range of *N. fuckeliana,* although there were additional records in stands on Banks Peninsula. *Neonectria fuckeliana* therefore still remains confined to the lower half of the South Island (figure 3). Surveys will be undertaken in the lower and central North Island in late 2008.

Studies on conditions affecting ascospore viability have shown that cold stratification of perithecia leads to an increase in percentage germination over a period of 12 months in comparison to those held at ambient temperatures. Trials examining potential entry points into the stem were established and a major trial where trees are pruned at fortnightly intervals over a 1-year period was set up and started in April 2008. Weather is monitored on site and relationships between development of flutes and weather immediately after pruning will be examined.

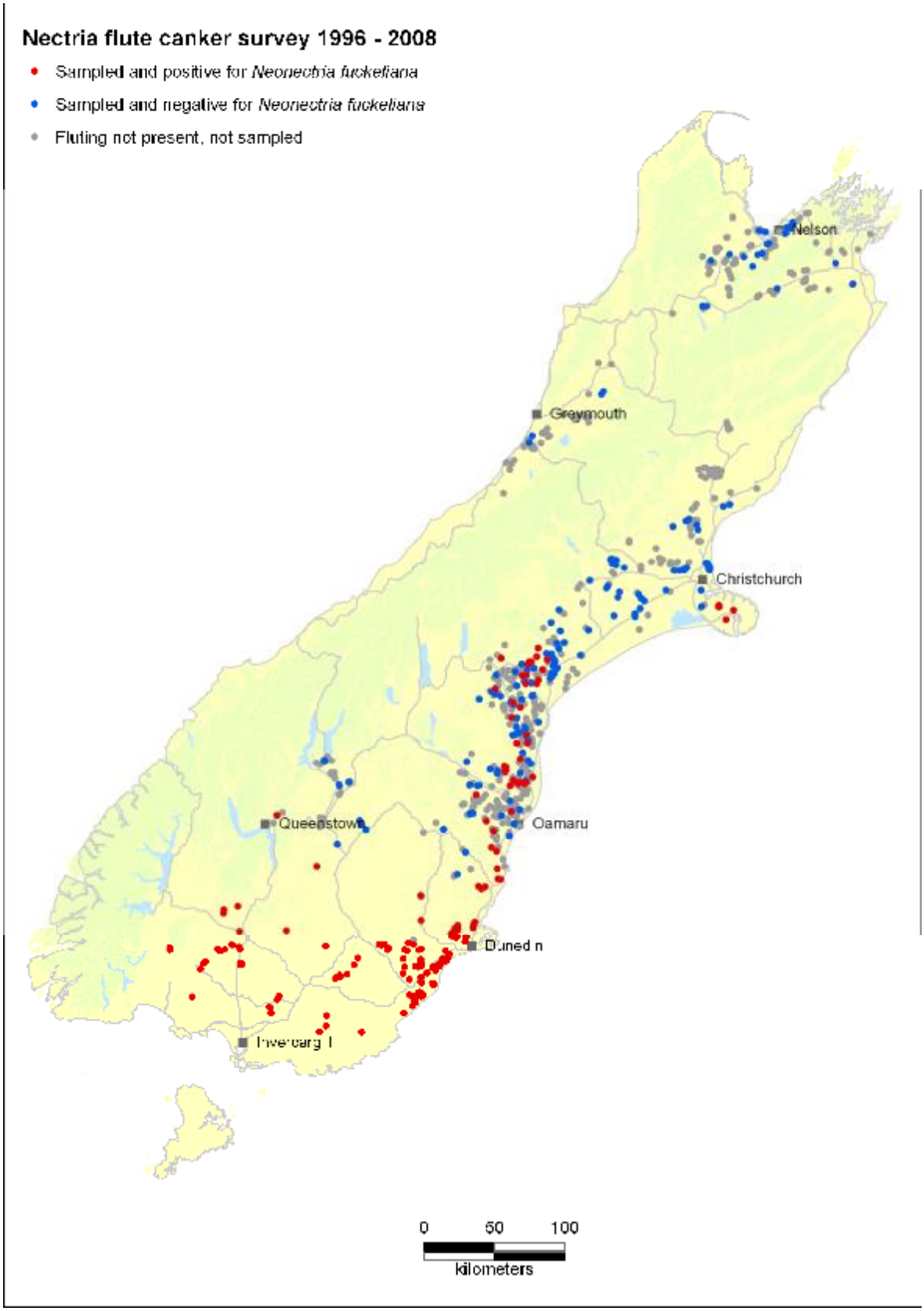


Figure 3. Known distribution of *Neonectria fuckeliana* as at June 2008.

***Diplodia pinea* (syn. *Sphaeropsis sapinea*)**
Whorl canker, attributed to infection of pruned stubs by *Diplodia pinea* (syn. *Sphaeropsis sapinea*) was recorded in a number of forests on the east coast of the North Island from the Gisborne region south. This follows two consecutive years of drought. Incidence was generally low with scattered trees affected. Dieback of terminal and lateral shoots was recorded in the same locations and also more widely in the forests in the eastern areas that were subject to very dry conditions in mid-late summer and through autumn into early winter. Significant Diplodia disease problems were not recorded in the South Island where areas that have had high levels of dieback in the past experienced cooler than average temperatures and generally greater than average rainfall.

Armillaria root disease

Armillaria root disease, caused primarily by *Armillaria novae-zelandiae*, remains widespread in many pine plantations throughout much of the country. In second or third rotation stands mortality of young trees is less common. However, chronic, non-lethal infection of older trees can still lead to significant increment loss. Results were evaluated from a series of annual inoculation screening studies. At total of 25 superior clones of *P. radiata* representing material that is now commonly planted were tested. The clones were unrelated, with just a few exceptions. All *P. radiata* clones tested were susceptible to four isolates of *A. novae-zelandiae*. While there were significant differences in infection between studies and between isolates, there were no such differences between clones. This work indicates that although heritable resistance to the disease cannot be ruled out within the radiata pine gene pool, gains from screening trials are likely to be minimal and costly to achieve. Spore trapping was again undertaken this winter in order to investigate directly the ability of basidiospores of *A. novae-zelandiae* to invade forest plantations. Results have so far demonstrated that although a high proportion of spores remain within the indigenous forest, others escape beyond the stand edge and are potentially free to disperse more widely.

NURSERIES

Phytophthora cinnamomi continues to be a problem in some nurseries and *P. cactorum* was been found in one nursery associated with high levels of root rot of *Pinus radiata*.

As a consequence of the dry summer experienced through much of the country levels of terminal crook disease caused by *Colletotrichum acutatum* f. sp. *pineum* were low.

DOUGLAS FIR (PSEUDOTSUGA MENZIESII):

Diseases:

Phaeocryptopus gaeumannii (Swiss needle cast disease)
Swiss needle cast disease (*Phaeocryptopus gaeumannii*) was again recorded throughout New Zealand and remains the most significant disease of Douglas fir. Preliminary results of a collaborative project to relate severity of infection with site and climate have now been published. A further survey was conducted in November and December 2007 and all data will be used to derive a model to provide short and long term disease risk predictions.

EUCALYPTUS SPP.:

Pests:

The eucalypt tortoise beetle *Paropsis charybdis* (Chrysomelidae) continues to be a major pest, particularly in *Eucalyptus nitens* plantations. Some forest managers continue to aerially spray their stands to control the pest. Work on the biological control of *P. charybdis* is on-going.

Uraba lugens (Nolidae), the gum leaf skeletoniser, although eradicated from the Bay of Plenty in 2001 is now very widespread in the greater Auckland region, as far north as Warkworth. In the past year its range has expanded to the south, with larvae found in Hamilton and Cambridge in the Waikato region, in Mt Maunganui in the Bay of Plenty, and at Whangapoua Harbour in the Coromandel.

Uraba lugens has been recorded on 42 *Eucalyptus* species and on other myrtaceous species such as *Agonis, Angophora, Callistemon,* and *Metrosideros.* It has also been recorded on a number of Northern Hemisphere species, such as *Betula pendula, Quercus* spp., *Liquidamber styraciflua, Fraxinus excelsior, Fagus sylvatica,* and *Populus* sp. It is not yet known what effect *U. lugens* will have on these trees, as this pest has not been recorded from Northern Hemisphere species in its native Australia.

Research into biological control of *U. lugens* is ongoing. Of four candidate parasitoid species initially imported for testing, one species, *Cotesia urabae* is currently the focus of biological control research, with host range testing due for completion in 2009. Abundance of *U. lugens* appears to be highest over the winter generation in Auckland. Further research is underway into stem injection techniques, and the relationship between laboratory bioassays and population dynamics in the field. Training of a pest management contractor is underway to enable the public to access control methods for *U. lugens* for amenity trees.

Diseases:

Phaeophleospora *and* Mycosphaerella *leaf disease*

Phaeophleospora eucalypti and Mycosphaerella leaf blotch (primarily due to *M. cryptica*) continue to be the cause of the most serious foliage disease in *Eucalyptus* plantations.

CYPRESSES:

Diseases:

*Cypress canker (*Seiridium *spp.)*

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

Phyllosticta spinarum

Phyllosticta spinarum is associated with dieback of foliage of a range of species in the Cupressaceae and was recorded for the first time on *Chamaecyparis*.

INDIGENOUS FORESTS

Further ill-health of kauri (*Agathis australis*) has been recorded in indigenous stands in the Waitakere Ranges, west of Auckland, and in Trounson Kauri Park in Northland. Affected trees show foliage yellowing, canopy thinning and sometimes death associated with bleeding lower stem lesions or collar rot. *Phytophthora* taxon Agathis (PTA) has been isolated from the margin of lesions. PTA was first identified from Great Barrier Island as *P. heveae* but recent molecular analysis has shown that it is more closely related to *P. katsurae.*

2. Biosecurity:

POST-BORDER (ERADICATION):

Dutch elm disease:

MAF Biosecurity New Zealand withdrew funding for the Dutch elm disease management programme prior to the start of the 2007-08 season. The disease was deemed to be of lower priority than other invasive organisms requiring attention (Biosecurity No. 86 2008). A reduced campaign, funded by local authorities, continued in Auckland with the aim of controlling the incidence of the disease within the current known infected area and to slow or to prevent the spread of the disease. One targeted survey was carried out in areas considered to be at highest risk based on results from previous years and three diseased elms from 3 locations were found and removed. Two of the three locations were new. A targeted beetle trapping programme was undertaken, with 51 traps deployed in high risk areas. Of the 8,256 beetles trapped, 6 (0.04%) carried *Ophiostoma novo-ulmi*. The infective beetles were trapped in East Auckland. It is anticipated that a similar programme will be run in 2008-09.

Pheromone traps to determine further distribution of the vector *Scolytus multistriatus* were placed in Rotorua, Taupo, Havelock North, Greytown, Stokes Valley, Nelson, Richmond, Picton, and Christchurch. Beetles were trapped in Taupo and Havelock North extending the known distribution by about 240 km. Rotorua appears to have been bypassed. *Scolytus multistriatus* adults and larvae were also found in a dead elm limb in Napier.

POST-BORDER (NEW RECORDS):

Pestalotiopsis clavispora was isolated from *Rhododendron catawbiense* leaves in Rotorua. *Pestalotiopsis* spp. are typically saprophytic or associated with minor leaf spotting. There are no published records of *P. clavispora* as a plant pathogen. The *Rhododendron* leaves were free of blemish-free and the fungus appears to a non-pathogenic endophyte. It was found in the course of high risk site work.

Botryosphaeria australis was isolated from *Vitis vinifera* in Mid Canterbury and from *Cytisus scoparius* in Nelson. It causes stem cankers and lesions resulting in stem dieback. Overseas it has been recorded from *Acacia, Banksia, Eucalyptus, Pistachio, Protea, Sequoiadendron, Widdringtonia, and Wollemia.*

Pythium heterothallicum was isolated from soil associated with *Malus sylvestris* in Wellington. It has been isolated from soil at various locations in Canada and the USA.

Roesleria subterranea has been found infecting the roots of *Vitis riparia* in Auckland. When root decay is advanced the host exhibits stunted, weak and/or chlorotic shoots. Overseas (North America and Europe) it has been recorded from *Cydonia, Malus, Paliurus, Pyrus, Rosa, Salix, Tilia,* and *Vitis.*

Phaeolus schweinitzii was found in Wellington in April 2008. *Phaeolus schweinitzii* is a common tree decay fungus in the Northern Hemisphere. Collections of this species in New Zealand have been previously made from *Pinus radiata*, or from litter, in Southland, Dunedin, and Auckland. The new distribution record fills in a large gap of what is probably a widely-dispersed fungus. It does not appear to be associated with disease in New Zealand, but infection has been shown in the UK to interrelate with

that of *Armillaria*. The role of *P. schweinitzii* will be elucidated in the new Scion FRST biosecurity programme starting in October 2008.

In November 2007, *Seimatosporium* cf. *kriegerianum* was isolated from *Callistemon comboyensis* growing in Mid Canterbury. *Seimatosporium kriegerianum* is listed as a regulated pest in New Zealand, but on the MAF Unwanted Organisms list, *S. kriegerianum* is listed as an anamorph of *Paradidymella tosta* (synonym = *Discostroma tostum*). The anamorph of *D. tostum* is *S. passerinii*. The only record on Landcare's database is from Hawke's Bay in 1981.

SURVEILLANCE

Forest health surveillance systems revised

In 2007, the NZ Forest Owners' Association were awarded a Sustainable Farming Fund grant to design and implement a long term forest health condition monitoring scheme. Data will be used for Forest Stewardship Council (FSC) certification purposes and will link with a carbon monitoring system being developed and run independently. The first stage of the project was completed by producing a review of forest condition monitoring systems and evaluating in the field methods of assessing crown condition. Two field methods were compared with data obtained remotely by LiDAR. At Puruki Forest, where leaf area and tree growth were directly measured, crown transparency and needle retention was assessed by two experienced observers. These results were compared with two LiDAR metrics (p50fp and %veg) that were collected from the air in August 2006. All estimates of crown condition (LiDAR, crown transparency, and needle retention) were shown to be strongly related to measured leaf area. Relationships between crown transparency, needle retention, and LiDAR with tree volume were also remarkably strong at R^2 >0.80. These results demonstrate that crown transparency and needle retention are associated with tree growth, primarily through their relationship with leaf area and crown health.

In November 2007, NZFOA funded an independent review conducted by two international experts, Brenda Callan, a mycologist from Canadian Forest Service in British Columbia and Sandy Liebhold, a research entomologist with the USDA Forest Service in Morgantown, West Virginia. The review team concluded that the current forest pest surveillance programme should be continued with no major modification. Minor changes were recommended and 90% of these have been followed. The document stated "The program deserves commendation as part of a progressive approach to forest biosecurity that exceeds the sophistication level attained by forest health surveillance programs elsewhere in the world....." This review provided independent validation of a system developed jointly by the NZ forest industry, Government, and researchers over a number of years.

3. BIOLOGICAL CONTROL OF *BUDDLEJA DAVIDII*

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

Buddleia leaf weevil has established at all sites and feeding damage to buddleia has exceeded expectations, with some individual plants estimated to be 95% defoliated in early April 2008. Damage was typically greatest closer to the release area, but larvae and adults were found more than 600 metres from the release area at one site in 2008. Early signs are that the weevil is well suited to the New Zealand climate.

In addition, both native and non-native New Zealand plant species were planted alongside buddleia at the release sites to test for potential damage to these species. The results of these trials support previous host-specificity testing in the laboratory which showed *Cleopus* to have a strong preference for buddleia. Damage to non-target species was almost entirely to the two weed species and was the result of spill-over of larvae from heeavily defoliated buddleia onto plants growing directly underneath

RECENT PUBLICATIONS AND WEBSITE FEATURES:

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

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

Three new fact sheets have been established on the NZFRI Ltd website. The signs, symptoms, distribution and management options for *Neonectria fuckeliana, Essigella californica* and *Seiridium* spp. causing cypress canker are covered. These can be viewed at http://www.ensisjv.com/ResearchCapabilitiesAchievements/ForestHealthBiosecurityandFire/ForestPestFactSheet/tabid/344/Default.aspx

The New Zealand Farm Forestry Association has built a new website, with assistance from the Sustainable Farming Fund and Scion, on the pests and diseases encountered in New Zealand's forests. The information has been compiled from the complete archive of Scion's Forest Health News, the Forest Pathology and the Forest and Timber Insects Leaflets, and other material drawn from miscellaneous reports. Revision of the historical information and updating of names assigned to insects, micro-organisms and host plants will be undertaken over the next 12 months. Pending that revision the website is a still valuable source of a considerable body of information on forest pests and diseases in New Zealand. It can be viewed at www.nzffa.org.nz/pests/Forestry_pests_and_diseases.html