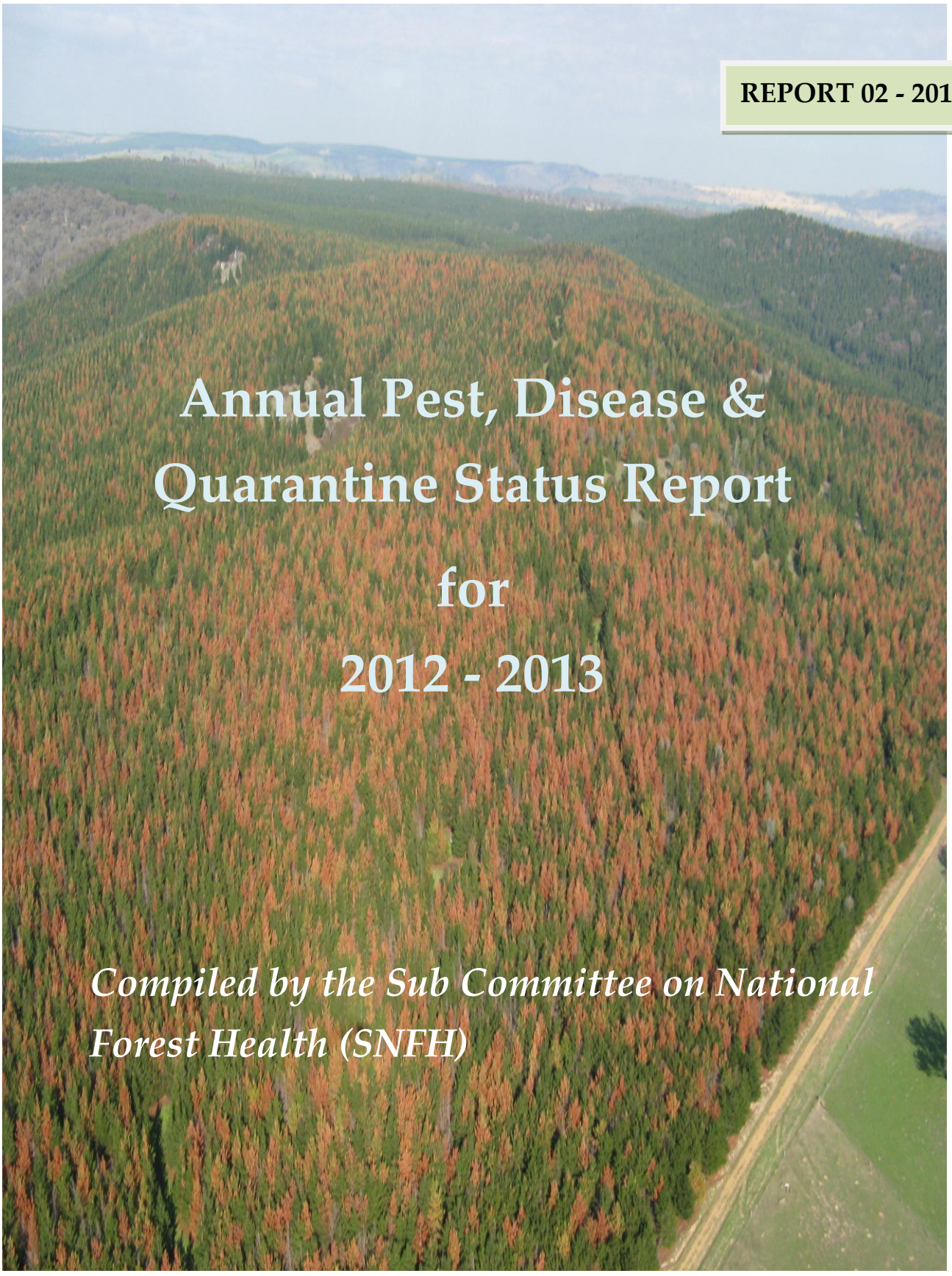

REPORT 02 - 2013

Annual Pest, Disease & Quarantine Status Report for 2012 - 2013

Compiled by the Sub Committee on National Forest Health (SNFH)

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1.0 Annual Report of Subcommittee on National Forest Health (2012/2013)

1.1 Introduction

Presented here is a state-by-state overview of the status for 2012-13 of pest, disease and quarantine issues in Australia's forests. The report has its major focus on the approximately 2 million ha of plantation forestry in the country, but, where appropriate, issues in native forests, nurseries, urban and rural trees, built environment, biosecurity and research and development are included. As an observer on the Subcommittee on National Forest Health and Plant Health Committee, New Zealand also contributes with a report on key forest health issues in that country.

1.2 Background

The former Research Working Group 7 and its predecessors under previous national committee structures have for around 30 years produced the "Annual Pest, Disease and Quarantine Report" as a key part of their terms of reference. The past twenty years have seen major changes in the structure of the forest industries particularly with a change from state to private ownership. This has inevitably impacted on the way forest health surveillance and R & D is carried out in Australia. Most expertise in forest health in Australia still resides within the relevant state agencies which contract surveillance and R & D with private or corporatised forest growers. There is also an increasing trend for some of this expertise to be housed within Australian Universities. This report reflects these trends within a funding environment that is seeing a decline in forest health capability within Australia.

1.3 Purpose of report

The purpose of this report is to:

- provide an annual snapshot of the health status of Australia's forests that also becomes part of a longer term view of trends in forest health.

- communicate this information via Plant Health Committee (PHC) to plant health stakeholders nationally.
- act as a source of information on forest health for Australia's reporting obligations under Criterion 3.1a "Scale and impact of agents and processes affecting forest health and vitality" of the state of the forests reporting.
- assist in defining the key forest pest, disease and quarantine issues for the country.

2.0 NATIONAL SUMMARY

2.1 Surveillance

Systematic forest health surveillance was carried out in eucalypt and/or pine plantations in NSW, Victoria, Tasmania, SA and WA, with ad hoc surveillance in Queensland and ACT. Only a proportion of the plantation estate is surveyed though, with not all growers conducting surveillance operations. Systematic surveillance for a range of pests and diseases (e.g. phytophthora dieback) was carried out in native forests in WA, with generally ad hoc surveys in native forests in Tasmania, Victoria and NSW. Port-environ biosecurity surveys and trapping are generally carried out in all states.

2.2 Plantations

2.2.1 Softwood (pine)

Sirex wood wasp continues to remain low in NSW, Victoria and SA, with localised outbreaks actively being controlled; very low levels were reported from Tasmania and Queensland. Sirex remains absent from WA and subtropical regions of NSW and Queensland. Dothistroma needle blight caused moderate to high levels of damage in localised regions in NSW, Victoria and Queensland, with low levels elsewhere. Essigella pine aphid caused extensive damage in several regions in NSW and Victoria, with low levels of damage in SA, WA, Queensland and Tasmania. Diplodia canker (often associated with drought stress) caused extensive damage in regions in SA, but generally low levels in NSW, Victoria and Queensland. Ips bark beetles were associated with localised damage associated with tree stress in NSW, Victoria, SA and Queensland, and is still absent from Tasmania. Vertebrate pests (wallabies and possums) continue to be a major issue in Tasmania, and in localised regions in NSW.

2.2.2 Hardwood (eucalypt)

Psyllids caused extensive damage to *E. saligna* in eastern Victoria, with localised regions being affected in WA and NSW (a range of pest and host species). A range of herbivorous insect pests (chrysomelids, Christmas beetles, autumn gum moth, weevils) were associated with severe damage across the country, with high levels in regions in Tasmania (chrysomelids) and WA (weevils), and generally localised areas severely affected in Victoria, NSW, SA and Queensland. Stem borers (longicorns beetles and/or giant wood moth) continue to be a problem mainly in mid-rotation stands in Tasmania, NSW and Queensland. Damage from leaf (mycosphaerella, kirramyces) and shoot blight (quambalaria) fungi was mostly low in NSW, Tasmania and Queensland, with an increase in levels of damage in young stands in WA and in older stands in Victoria.

2.3 Native forests

Monitoring of range of pest outbreaks continues in native forest in WA, including jarrah leaf miner and gum leaf skeletoniser. Damage from armillaria and phytophthora in managed forests remains relatively static, but there has been an increase in damage from phytophthora in remnant bushland. A range of forest declines are also being monitored in WA. In Victoria, outbreaks of cup moth, leaf spot fungi, phytophthora and myrtle wilt were reported. Monitoring for myrtle rust in native forest in NSW continues.

3.0 REGIONAL SUMMARY

3.1 New South Wales

This report concentrates on the plantation estate managed by Forestry Corporation of NSW (FCNSW), as it is the only plantation estate in NSW where formal forest health surveillance occurs. Forest health surveys were conducted of FCNSW 210,000 ha pine plantation estate in winter–spring 2012. This involved aerial surveys of the majority of the estate, with targeted, follow-up ground surveys. A proportion of the young (less than 20 year-old) hardwood estate managed by FCNSW was surveyed, approximating 30,000. This included aerial surveys over ~8,000 ha in spring 2012 and extensive ground surveys during spring 2012, summer 2012-2013 and autumn 2013.

The majority of the softwood plantation estate was healthy. Levels of dothistroma needle blight were higher than last year due mainly to an increase in area affected in plantations in the Murray Valley[1] (Hume) and to a lesser extent in Central Tablelands (Macquarie); the area affected on the Northern Tablelands, while significant, remains relatively static. Drought-related tree mortality (and dipodia canker and Ips attack) remained static, with only a slight increase from last year. Levels of essigella pine aphid were higher than last year, due mainly to a larger area affected in Murray Valley (Hume), although severity there was mostly low; other regions had minimal damage from essigella. Possum damage, mainly in East Gippsland/Bombala (Monaro), remains static at low levels. The area affected by sirex wood wasp remained static; however, the damage within affected stands was significantly lower, with control of two outbreaks (Green Hills SF in Murray Valley [Hume] and Canobolas SF in Central Tablelands [Macquarie]) following effective management activities. Levels of *Sirex* were low in other regions. *Sirex* has not established in North Coast NSW plantations.

The majority of the hardwood plantation estate was healthy. A smaller area was surveyed via aerial surveillance this year compared to last year, with more extensive ground surveys. The area affected by Bell-miner associated dieback (BMAD) remained relatively static, and a very small proportion of the estate. There was a slight increase in psyllid damage (both creiis and cardiaspina psyllids), due mainly to large outbreaks in several *E. dunnii* and *E. grandis* plantations, respectively. Damage from herbivorous insects was slightly higher, due mainly to outbreaks of christmas beetles in several *E. dunnii* plantations. Damage from leaf and shoot blight fungi remained relatively static, with the older plantation estate less susceptible now. The area affected by stem borers, mostly in *E. grandis* plantations, remains static. Several second rotation plantations of *E. pilularis*, planted previously with *E. grandis,* experienced scattered mortality associated with *Phytophthora cinnamomi.*

Myrtle rust (*Puccinia psidii*) is now established along the east coast of NSW from Batemans Bay to the Queensland border. Monitoring continues of key species in native forest, with severe impact to *Rhodamnia rubescens* and *Rhodomyrtus psidioides.* Myrtle rust has been observed in young eucalypt plantations planted on second rotation sites, but at this stage not causing significant impact.

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[1] **Region names used based on National Plantation Inventory.**

Minor issues with *Botrytis cinerea* were observed in a commercial pine nursery, related to severe frost events.

Suspect exotic plant pests found during forest health surveys are sent to a nationally recognised diagnostic lab for verification. Symptoms similar to nectria flute canker (*Neonectria fuckeliana*) were observed on *Pinus radiata* – killed as part of sirex biological control program – in Bombala. The causal agent was identified as *Pleonectria pinicola*; this is the first time this species has been found in Australia. It is not believed to be a primary pathogen.

Table 1: Change in percentage (%) of area affected by key damage agents in softwood and hardwood plantations in NSW[2]

Agent	2011–2012	2012–2013
Softwood plantations (based on ~210,000 ha surveyed)		
Dothistroma needle blight	2.0	4.1
Drought-related tree mortality (and associated diplodia canker and ips bark beetles where appropriate)	0.01	1.0
Essigella pine aphid	1.5	7.1
Sirex wood wasp	0.25	0.3
Hardwood plantations (based on ~30,000 ha surveyed)		
Psyllids	0.1	1.5
Herbivorous insects	0.85	1.9
Leaf and shoot fungi	0.05	0.09
Stem borers	11.0	10.0
Phytophthora root rot	0.0	0.05
Bell-miner associated dieback (BMAD)	0.1	0.05

[2] Data supplied to Forestry Corporation of NSW as part of annual reporting obligations.

3.2 Victoria

The Department of Environment and Primary Industries (DEPI) aims to provide a better and more efficient management approach for public and private land, and water for the people of Victoria.

DEPI works closely with industry and state government and local government agencies to develop and conduct ongoing targeted forest health surveillance programs for established and exotic pests and pathogens. Forest health surveillance programs include road-side surveys, plot monitoring, diagnostic surveys and aerial surveys and pest/pathogen reports from the community. The establishment of 159 sentinel sites for the monitoring of myrtle rust is one example where DEPI has partnered with other state/local governments and the general public to provide informed decision making and monitoring.

Dothistroma needle blight is the most significant pathogen attacking young *Pinus radiata* plantations in Victoria. Defoliation levels are the highest recorded since 1994 with some isolated pockets above the economic threshold. In the spring of 2012, a proportion of plantation was aerially sprayed with a copper fungicide in an attempt to reduce the inoculum load and reduce future production losses.

Levels of *Kirramyces eucalpti* have increased in both juvenile and adult foliage in *E.nitens* plantations in southern Victoria due to the previous three wet summers. Generally across the state levels, infections were at low to moderate levels in both upper and lower crowns. Septoria leaf blight was found in conjunction with *Mycosphaerella* spp. which is of concern because both pathogens are competing for the same space on the leaf surface and cause the same defoliating response.

Within managed natural forests cup moth has become a significant pest over the past four years. Significant infestations have defoliated large areas of native forest in the central district. Natural predators have not reduced the populations.

Myrtle rust has been found at 76 sites across Melbourne and localised areas in regional Victoria. Myrtle rust has still not been identified in the natural environment and new reports have been from public gardens and private backyards. Victoria is in Phase 3 of the Response Plan where the focus is on investigating reports of the disease in new

areas and on host species where the disease has not been previously detected.

A ports monitoring program was undertaken for Asian gypsy moth and pheromone traps continue to be deployed to help monitor for two recently intercepted exotic long horned beetles. The West Indian drywood termite, *Cryptotermes brevis*, was detected in a picture frame (ex-Brazil) in a residential building in the Melbourne metropolitan area. No extensive damage by the termite was identified and 6 monthly surveillance program is in place.

3.3 South Australia

This report summarises forest health issues in South Australia in 2012-13. Changes in company structure and ownership along with the retirement of key forest health expertise will require ongoing adaptation of forest health surveillance and reporting systems over the next 12 months. Information on the health of plantations has come from Australian Bluegum Plantations, ForestrySA and Green Triangle Forest Products.

3.4 Tasmania

After the wet summer of 2010-2011 a return to more normal rainfall patterns showed some easing of needle cast diseases such as *Dothistroma septosporum* across the north of the state. Bark-stripping of young, established trees by wallabies remains the most damaging problem affecting the *P. radiata* plantation estate in Tasmania.

Sirex populations, while detectable by static trapping, did not cause sufficient mortality to be detected during routine aerial inspections.

Further changes to the leaf beetle IPM, in the form targeting high risk areas and lowering spray thresholds for vulnerable coupes, saw a reduction in the area assessed as having chronic severely thin crowns at the end of the growing season, despite significant leaf beetle populations.

Quarantine efforts continue to be focussed towards protecting Tasmania's freedom from myrtle rust.

3.5 Western Australia

In native forest, dieback in jarrah forest caused by *Phytophthora cinnamomi* and tree decline in tuart and wandoo woodland continues to command attention. Research on the taxonomy and ecological implications of new phytophthora records and taxa from WA continues.

Frost and drought damage in susceptible stands in the northern jarrah forest continue to be monitored. New projects mapping and monitoring crown health in urban remnant vegetation in the Perth metropolitan area are underway.

An on-line training package has been developed which aims to enhance knowledge about European house borer (EHB). Participants will acquire enhanced skills on how to recognise and control EHB infestation and how to prevent damage, and future infestation and spread.

A species of weevil new to WA, temporarily termed *Gonipterus* sp. nov. 2, caused widespread damage to bluegum plantations in the interior regions of the south-west. Its phenology is different to *G. platensis*, a common species in WA, it is thought to reproduce at least twice during spring and summer and most damage is done by adults feeding throughout the year and on the entire canopy, not just juvenile shoots.

3.6 Queensland

HQPlantations forest health surveillance is currently a mix of pro-active and re-active surveys, inspections and associated research that are based on operational requirements and biosecurity importance. Project-specific tasks continue to dominate activities in response to specific risk issues. The fundamental aim of this surveillance and research work is to maximise productivity and timber quality by ensuring the plantations remain largely free from damaging pests and diseases. No new or significant pest and disease issues were detected.

The Sirex bio-control response continues to be a major focus, including a National Sirex Co-ordination Committee (NSCC) funded research component involving University of the Sunshine Coast (USC) and Department of Agriculture, Fisheries and Forestry (DAFF Qld) and HQPlantations staff. The project is investigating a range of operational impacts that could result from Sirex range expansion within sub-tropical conditions.

Reports that *Sirex* may have established at Pechey (North of Toowoomba) were investigated. *Sirex* was not detected, however longicorns were found to be causing similar emergence holes. HQPlantations, USC and DAFF Qld hosted the November 2012 NSCC annual meeting in Brisbane, which included a day tour to *Sirex*-infested plantations at Passchendaele (Qld/NSW border region).

Surveys within HQPlantations major production nursery at Toolara found only minor damping off within potted seed trays of *Pinus*. Widespread and significant dieback of leaders and upper laterals in young *Araucaria*, on raised nursery benches, was found to have been caused by sun-hardening issues associated with plant spacing. Wind-burning and drying of exposed edge plants on sun-benches was also found to be common.

Surveys within coastal and inland hardwood plantations for the presence of myrtle rust *Uredo rangelii* (*Puccinia psidii*) was another key operational objective. Angus Carnegie (Department of Primary Industries, NSW) was contracted to assist and oversee myrtle rust surveillance. Myrtle rust was found to be common on susceptible species such as *Melaleuca* which surrounded hardwood stands within coastal south east Queensland. It was also detected on highly susceptible *Rhodamnia rubescens* growing in retained vine-forest adjacent to Imbil district plantations. Even with this local inoculum pressure, no evidence was found to suggest that myrtle rust had established within any HQPlantations hardwoods. Wildfires initiated externally to Burnett region hardwood plantations caused significant damage within a number of areas.

HQPlantations continues to work closely with Landcare and a range of agencies seeking to limit the spread or even control the environmentally, and now economically damaging, cats claw creeper *Dolichandra unguis-cati*. Involvement in the rearing, release and monitoring of a third bio-control agent, the leaf-mining jewel beetle *Hylaeogena jureceki c*ontinues within high conservation value riparian zones in the Mary Valley. Significant numbers of "army grubs" were again observed within selected young *Araucaria* plantations in south east Queensland. Grazing damage was limited to ink-weed *Phytolacca octandra* growing within planted inter-rows. The caterpillar species involved proved not to be the "caco army worm" *Tiracola plagiata*, which caused extensive damage to *Araucaria* plantations early in 2010.

3.7 New Zealand

This report summarizes the pest and disease status in commercial, native and urban forests across New Zealand. A summer drought followed by a warmer and drier winter has led to reduced incidence and severity of dothistroma needle blight and red needle cast in *Pinus radiata* plantations. The levels of cyclaneusma needle cast and physiological needle blight also remained low. In eucalyptus, the distribution of the gum leaf skeletoniser has remained virtually unchanged, whilst the eucalyptus tortoise beetle continues to be a major pest. Bronze bug is slowly spreading but currently is not having a major impact in New Zealand.

Phytopthora taxon Agathis which causes kauri dieback is continuing to kill kauri trees of all ages. Measures have been undertaken to reduce the spread of this pathogen, and phosphite treatments are being trialled.

There has been a significant increase in the number of elms infected with *Ophiostoma novo-ulmi* (causal agent of Dutch elm disease) and the distribution of the pathogen has spread southward. It is unclear how much longer this pathogen will remain confined to the greater Auckland area.

4.0 KEY ISSUES AND THREATS

4.1 New South Wales

Drought continues to remain the single biggest threat to *Pinus* plantations in NSW. Drought kills trees and predisposes them to attack by ips bark beetles and diplodia infection resulting in tree mortality. Due to a scarcity of suitable land, many newer (first rotation) plantations have been planted on less optimum sites, with lower rainfall. Many of these have experienced prolonged and/or periodic droughts and tree mortality over the past 15 years. Gaining a better understanding of the factors that predispose sites to drought-related tree mortality will assist in managing drought deaths.

Puccinia psidii is a continuing major threat to several key Myrtaceae in native forests. Severe decline in some stands of *Rhodamnia rubescens* and *Rhodomyrtus psidioides* does not bode well for these species. Monitoring will assist in quantifying the long-term impact of myrtle rust.

Spotted gum canker in *Corymbia* spp. plantations is still being monitored to quantify the full extent and impact in spotted gum plantations. A reduction in staff resources and lower priority in NSW for hardwood plantations has slowed the research into gaining an understanding of this new disease.

4.2 Victoria

Dothistroma needle blight defoliation and discolouration levels have increased across the state in 2012-13. Above average rainfall has provided conducive conditions for disease development and localised areas above the economic threshold were identified. A proportion of plantation was aerially sprayed with a copper fungicide in an attempt to reduce the inoculum load and reduce future production losses.

Levels of *Kirramyces eucalpti* have increased in both juvenile and adult foliage in *E.nitens* plantations in southern Victoria due to the previous three wet summers. Damage has been observed across the state with some plantations being entirely defoliated. Septoria leaf blight was found in conjunction with *Mycosphaerella* spp. which is of concern because both pathogens are competing for the same space on the leaf surface and cause the same defoliating response.

Cup moth has become a significant pest over the past four years due to increasing population levels. Significant infestations have at some locations entirely defoliated large areas of native forest, and outbreaks have been widespread across the state. It appears that natural predators have not yet kept up with the increased population and reduced the infestation. No control programs have been undertaken.

Myrtle rust has been found at 76 sites across Melbourne and localised areas in regional Victoria. Myrtle rust has still not been identified in the natural environment and new reports have been from public gardens and private backyards. Victoria is in Phase 3 of the Response Plan where the focus is on investigating reports of the disease in new areas and on host species where the disease has not been previously detected.

4.3 South Australia

The management program of *Sirex* is in operation after the previous outbreak of *diplodia*. Also the management of residues from PCT/NCT is done to prevent build up of *Ips* and attack of nearby healthy trees. South Australia currently has an ongoing silvicultural management of residue particularly in the Mid-North to reduce *Ips* breeding sites and mitigate the risk of Ips outbreaks.

4.4 Tasmania

Protecting young, established *P. radiata* plantations from bark-stripping damage by wallabies remains an ongoing problem that is difficult to manage using currently available techniques. Most of the privately-owned eucalypt plantations in the state continue to get minimal management while under administration.

Detailed crown and shoot monitoring over the summer of 2012-2013 confirmed that leaf beetle feeding is largely driving the development of chronic thin crowns in northeast, mid-rotation, high elevation *E. nitens* plantations. Adult beetle defoliation was preventing any early season refoliation throughout November prior to the development of larval populations in December. Beetle populations were dominated by the recently renamed *Paropsisterna selmani*. Little is known of this beetle although observations in the field suggest it emerges from over-wintering earlier than *P. bimaculata* and studies in Ireland indicate much shorter larval development times. It is unknown how much of an ongoing threat this species represents.

Maintaining Tasmania's area freedom from myrtle rust remains a priority.

4.5 Western Australia

No new major pest or disease outbreaks were reported in native forest in Western Australia in 2012–13, but a suspected new species of gonipterus beetle caused widespread damage in bluegum plantations in the south-west interior growing region. The key issues in native forest continue to be forest decline associated with stress events such as drought and frost. Phytophthora-dieback and research on newly recorded species of phytophthora continues to command attention. The gum leaf skeletoniser outbreak reported in 2010-11continues to be monitored.

4.6 Queensland

Myrtle rust (*Puccinia psidii*) continues to be a threat to native and introduced Myrtaceae with the host range in Queensland now exceeding 150 species from 35 genera. Tree deaths as a result of repeat infection have now been recorded on two *Rhodomyrtus* species, *R. canescens* (native to north Queensland) and *R. psidiode*s (native to south-east Queensland and northern NSW). Impact on regeneration of species is still being studied, however preliminary results show a significant correlation with levels of rust infection and a reduction or prevention of flowering in *Melaleuca quinquenervia*. Glasshouse screening studies of Eucalyptus species of significance in Queensland clearly identify potential to select for resistance at the family level within the tested populations. However, the potential for *P. psidii* to detrimentally impact upon *Corymbia* and Eucalyptus species in the nursery and in young plantations was demonstrated. To date extensive surveys have been unable to detect myrtle rust within any of HQPlantations hardwoods in coastal south east Queensland and the drier Burnett regions in Queensland.

Sirex wood wasp remains the key insect threat to *Pinus* plantations in Queensland. Although its distribution is still limited to the Granite belt and Southern Downs regions, it is now well established in these regions. Releases of the biocontrol agents continue in this region, while static trap monitoring in the key Beerburrum and Fraser Coast estates is ongoing. An active research program into key aspects of the wasp/fungus/nematode interactions in relation to subtropical climatic conditions and a new encounter host tree (*P. caribaea* x *P. elliottii*) is continuing, supported by the National Sirex Coordination Committee.

The bark beetle *Ips grandicollis* remains a significant economic pest to wildfire, storm and drought stressed/damaged trees with its blue-stain fungus *Ophiostoma ips* visually degrading recovered products. Ips pressure also impacts significantly on harvesting regimes following such climatic events. In north Queensland, ambrosia beetles such as *Truncaudum agnatum* and *Xyleborus perforans* can and have caused extensive damage to cyclone damaged logs.

Specific pest and disease surveys within plantation species in Queensland over the 2012/13 period have not been carried out and therefore identification of further pest and disease threats has not been possible.

4.7 New Zealand

Needle diseases of radiata pine are the biggest threat to commercial forestry in New Zealand. This includes the diseases dothistroma needle blight, cyclaneusma needle cast, red needle cast and physiological needle blight. The occurrence and severity of these diseases varies across the country and is influenced by seasonal climate conditions. The combined impact of these diseases significantly reduces growth productivity. Research is underway to determine methods to reduce the impact of these diseases.

In eucalyptus plantations eucalyptus tortoise beetle remains the key threat, whilst the spread and impact of gum leaf skeletoniser and bronze bug are continuing to be monitored.

In New Zealand's native forest the Australian brushtail possum continues to damage a variety of tree species. Kauri dieback, caused by *P.* taxon Agathis, is the biggest concern

to *Agathis australis* (Kauri). The disease kills Kauri of all ages and efforts are underway to prevent the spread of the pathogen and protect the native estate.

Dutch elm disease (*O. novo-ulmi*) is a continuing major threat to *Ulmus* spp. planted in urban and rural areas across New Zealand. The pathogen is currently confined to the greater Auckland area, however, recently the disease has spread further southwards.

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5.0 Annual Forest Health and Biosecurity Status Report of NSW

5.1 Surveillance activities

Forest health surveillance was carried out over the plantation estate managed by Forestry Corporation of NSW (FCNSW); no other grower in NSW has a formal forest health surveillance program. Forest health surveys were conducted of FCNSW 210,000 ha pine plantation estate in winter–spring 2012 (**Fig. 1**). This involved aerial surveys of the majority (~95%) of the estate, with follow-up, targeted ground surveys. A proportion of the young (less than 20 year-old) hardwood estate managed by FCNSW was surveyed, approximating 30,000. This included aerial surveys over ~8,000 ha in spring 2012 and extensive ground surveys during spring 2012, summer 2012-2013 and autumn 2013. A concerted effort was made to survey second rotation sites for myrtle rust and phytophthora root rot. A smaller area was surveyed via aerial surveillance this year compared to last year, with more extensive ground surveys. The older hardwood plantations, soon to be harvested, were not surveyed.

Static traps with SIRNOC lures – specific for *Sirex noctilio* – were established over the summer–autumn in pine plantations in North Coast NSW (around Whiporie and Urbenville plantations) to detect *Sirex*.

Monitoring plots of *Rhodamnia rubescens* in native forest on the Central Coast of NSW were assessed approx. monthly for impact of myrtle rust (*Puccinia psidii*).

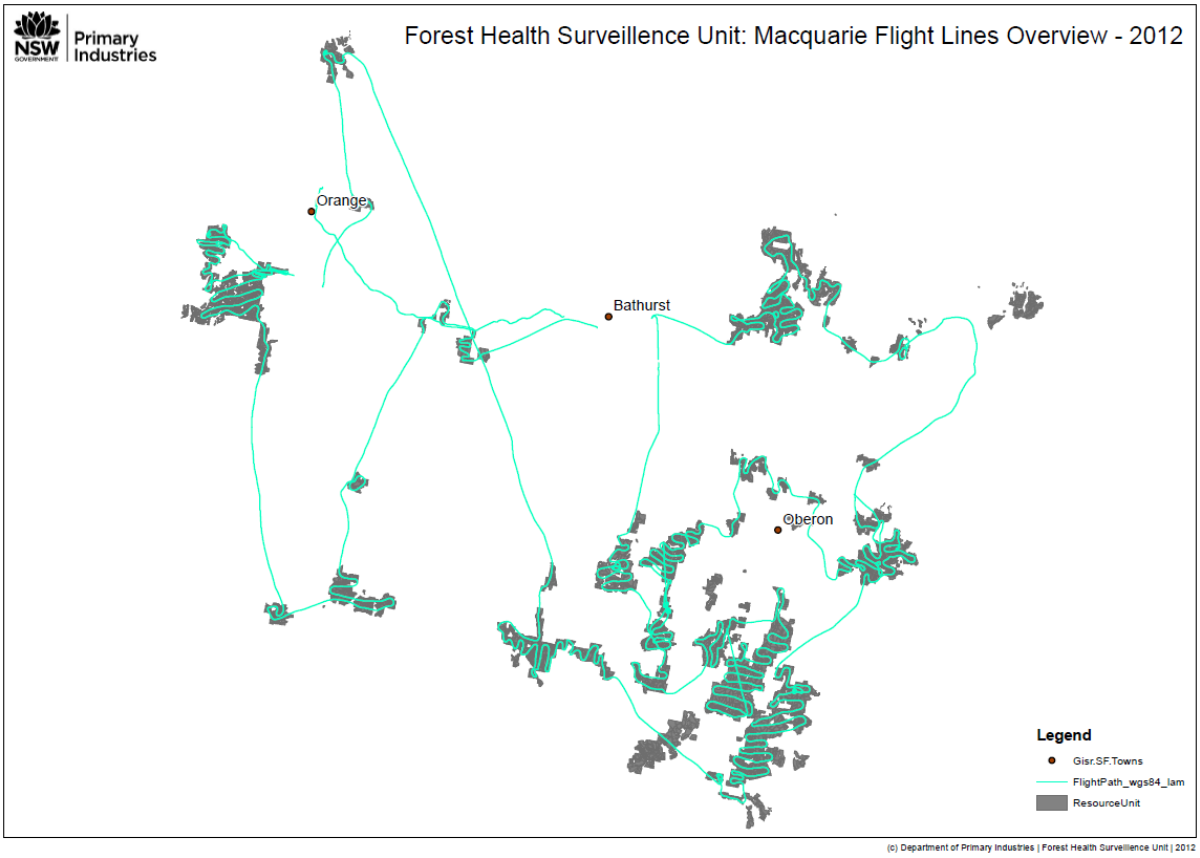

Figure 1: Example of aerial survey track-log over pine plantations in Central Highlands.

5.2 Plantations (Softwood)

5.2.1 Insect pests

a). Essigella pine aphid

Levels of essigella pine aphid were higher than last year, due mainly to a larger area affected in Murray Valley (Hume). Severity of essigella in this region, however, was mostly at low levels, and significantly lower than in previous years. Other regions had minimal damage from essigella.

Release of the biological control agent (Fig. 2), *Diaeretus essigellae,* occurred in plantations in Murray Valley (Hume), Central Tablelands (Macquarie), Bombala, Southern Tablelands (Moss Vale), Northern Tablelands (Walcha) and North Coast NSW (Whiporie). Levels of essigella have been significantly low over the past two years,

raising concern as to whether the biological control agent would establish. Monitoring for *D. essigellae* did not detect an established population in NSW in 2012[3].

Figure 2: Release of essigella biological control.

b). Sirex wood wasp (*Sirex noctilio*)

The area affected by sirex wood wasp remained static; however, the damage within affected stands was significantly lower, with control of two outbreaks (Green Hills SF in Murray Valley [Hume] and Canobolas SF in Central Tablelands [Macquarie]) following effective management activities (see story box). Levels of *Sirex* were low in other regions, with small active populations in both Bombala (Monaro) and Northern Tablelands (Walcha). *Sirex* has not established in North Coast NSW plantations.

[3] **An established population of *D. essigella* has since been detected in plantations in Murray Valley, Central Tablelands and Northern Tablelands (Carnegie, unpublished data, October 2013).**

Sirex outbreak controlled

An outbreak of sirex wood wasp (*Sirex noctilio*) was detected by the Forest Health Survey Unit (FHSU) in Green Hills SF (Monterey Road), Hume Region, in 2006. This outbreak resulted in 5-10% tree mortality for up to 6 years across a relatively wide area in Green Hills North (Fig. 3). Regional staff increased the number of releases of the biological control agent (nematode) into trap tree plots as well as inoculating the nematode into a large number of naturally struck trees. A T1 thinning operation also began in the affected area, which reduced tree susceptibility of retained trees. The FHSU continued surveillance and monitoring of the outbreak and effectiveness of biological control program. In 2012 we observed a significant decrease in the number of trees killed by *Sirex*, from around 10% in 2011 to 1% in 2012. Parasitism of naturally struck trees was exceptionally high in 2010/2011 (99% of wasps caught had nematodes), indicating the increase in the biological control effort had paid off. In concert with the T1 thinning operation in the southern end of the outbreak, the Sirex population has crashed. This is a good case study of effective pest management; surveillance identifying the outbreak and continuing to monitor it, introducing biological control agents to reduce the pest population, and silvicultural operations (thinning) to reduce stand susceptibility.

Figure 3: Outbreak of sirex wood wasp in Green Hills SF, with 10% tree

mortality

	2006	2007	2008	2009	2010	2011	2012
Tree deaths	5%	5-10%	5-10%	5-10%	5-10%	5-10%	1%
Biological control (BC)	Increased concentration of Trap Tree plots; inoculate Naturally Struck Trees						
BC monitoring	Low parasitism				Very high parasitism		
Silviculture			Operational thinning →				

Percentage of trees killed by sirex wood wasp in the Green Hills SF, from detection in 2006 to population crash in 2012; also showing increasing effectiveness of biological control program (parasitism) and when silvicultural operations assisted in control.

5.2.2 Pathogens

a). Dothistroma needle blight (*Dothistroma septosporum*)

Levels of dothistroma needle blight were higher than last year due mainly to an increase in area affected in plantations in the Murray Valley (Hume) and to a lesser extent in Central Tablelands (Macquarie), associated with a return to near-average rainfall. The area affected on the Northern Tablelands (Walcha), while significant, remains relatively static (Fig. 4).

Figure 4: Dothistroma needle blight in Walcha

Figure 5: Drought death in *Pinus radiata* in Hume

5.2.3 Vertebrate pests

Possum damage, mainly in East Gippsland/Bombala, remains static at low levels.

5.2.4 Climatic disorders

a). Drought-related tree mortality

Drought-related tree mortality (and dilpodia canker and Ips attack) remained static, with only a slight increase from last year (Fig. 5). Main affected areas were in lower elevation (drier) areas in Murray Valley.

5.3 Plantations (Hardwood)

5.3.1 Insect pests

a). Psyllids

There was a slight increase in psyllid damage (both *Creiis lituratus* and *Cardiaspina* spp. psyllids), due mainly to large outbreaks in several *E. dunnii* and *E. grandis* plantations, respectively **(Fig. 6)**.

Figure 6: Damage associated with *creiis psyllid* in *E. dunnii*

b). Herbivorous insects

Damage from herbivorous insects was slightly higher, due mainly to outbreaks of christmas beetles in several *E. dunnii* plantations.

Figure 7: Defoliation associated with Christmas beetles in *E. dunnii*.

c). Stem borers

The area affected by stem borers, mostly in *E. grandis* plantations, remains static.

d). Bell-miner associated dieback (BMAD)

The area affected by bell-miner associated dieback (BMAD) remained relatively static, and a very small proportion of the estate.

5.3.2 Pathogens

a). Leaf and shoot blight fungi

Damage from leaf and shoot blight fungi remained relatively static, with the older plantation estate less susceptible now.

b). Phytophthora root rot

Several second rotation plantations of *E. pilularis*, planted previously with *E. grandis,* experienced scattered mortality associated with *Phytophthora cinnamomi* along the east coast **(Fig. 8)**.

Figure 8: Mortality in *E. pilularis* plantation on North Coast associated with *Phytophthora cinnamomi*.

5.4 Native Forests

Myrtle rust (*Puccinia psidii*) is now established along the east coast of NSW from Batemans Bay to the Queensland border. Monitoring continues of key species in native forests, with severe impact to *Rhodamnia rubescens* and *Rhodomyrtus psidioides.* Myrtle rust has been observed in young eucalypt plantations planted on second rotation sites, but at this stage not causing significant impact.

5.5 Nurseries

Minor issues with *Botrytis cinerea* were observed in a commercial pine nursery, related to severe frost events.

5.6 Urban and Rural trees

Nothing significant to report.

5.7 Built Environment

Nothing significant to report.

5.8 Biosecurity

Suspect exotic plant pests found during forest health surveys are sent to a nationally recognised diagnostic lab for verification. Symptoms similar to nectria flute canker (*Neonectria fuckeliana*) were observed on *Pinus radiata* – killed as part of Sirex biological control program – in Bombala **(Fig. 9**). The causal agent was identified as *Pleonectria pinicola;* this is the first time this species has been fosnd in Australia. It is not believed to be a primary pathogen.

Figure 9:

***Neonectria fuckeliana* in NZ** ***Pleonectria pinifolia* in Bombala**

5.9 Research & Development activities

5.9.1 Improving management of sirex wood wasp

ARC and National Sirex Coordination Committee (NSCC) funded; collaborators include Charles Sturt University, NSW DPI, Forestry Corporation NSW, ForestrySA, CSIRO; investigating the impact of ips bark beetles and climate change on the Sirex biological control program. The outcomes of this project are listed below.

(1) identified factors predisposing Sirex trap trees to Ips attack and high-risk regions,

(2) proposed management strategies to increase efficacy of trap tree establishment and,

(3) gained a greater understanding of the mechanisms of disruption of Sirex biological control by *Ips*.

5.9.2 Improving efficacy of dothistroma needle blight control

Forest & Wood Products Australia and industry funded; collaborators include Forestry Corporation NSW, HVP Plantations and NSW DPI; testing efficacy on cuprous oxide for control of dothistroma needle blight in pine plantations in NSW and Victoria; preliminary results indicate effective control in trials in NSW.

5.9.3 Impact of myrtle rust in native environments

CRC Plant Biosecurity funded; collaborators include DAFF Qld, NSW DPI; monitoring impact of myrtle rust on key species in native environments; outcomes so far indicate significant impact to several key species.

5.10 Publications

(By SNFH committee)

Boissin E, Hurley B, Wingfield MJ, Vasaitis R, Stenlid J, Davis C, de Groot P, Ahumada R, Carnegie AJ, Goldarazena A, Klasmer P, Wermelinger B, Slippers B (2012) Retracing the routes of introduction of invasive species: the case of the *Sirex noctilio* wood wasp. *Molecular Ecology* **21**: 5728 – 5744.

Evans B, Lyon TJ, Barber PA, Stone C, Hardy G (2012) Dieback classification modelling using high resolution digital multi-spectral imagery and *in situ* assessments of crown condition. *Remote Sensing Letters* **3**: 541 - 550.

Evans B, Lyons T, Barber P, Stone C, Hardy G (2012) Enhancing a Eucalypt Crown Condition Indicator driven by high spatial and spectral resolution remote sensing imagery. *Journal of Applied Remote Sensing* **6(1)**: 15pp.

Gitau GW, Bashford R, Carnegie AJ, Gurr GM (2013) A review of semiochemicals associated with bark beetle (Coleoptera: Curculionidae: Scolytinae) pests of coniferous trees: A focus on beetle interactions with other pests and their associates. *Forest Ecology & Management* **297:** 1 – 14.

Mellor A, Haywood A, Stone C, Jones S (2013) The performance of Random Forests in an operational setting for large area sclerophyll forest classification. *Remote Sensing* **5:** 2838-2856.

Perez G, Slippers B, Wingfield MJ, Wingfield B, Carnegie AJ, Burgess TI (2012) Cryptic species, native populations and biological invasions by a eucalypt forest pathogen. *Molecular Ecology* **21:** 4452 - 4471.

Stone C, Melville G, Carnegie AJ, Smith D, Eyles A, Nagel A (2013a) Crown damage by the aphid *Essigella californica* in a *Pinus radiata* plantation in southern New South Wales: causality and management issues. *Australian Forestry* **76:** 16 – 24.

Stone C, Carnegie AJ, Melville G, Smith D, Nagel A (2013b) Aerial mapping canopy damage by the aphid *Essigella californica* in a *Pinus radiata* plantation in southern New South Wales: What are the challenges? *Australian Forestry* **76:** 101–109.

Stone C (2012) Book Review. Forest Entomology: A Global Perspective by Ciesla WM. *Australian Journal of Entomology* **51:** 141 - 142.

5.11 Forest Health Capability

(Active and available)

1. Dr Angus Carnegie, Biosecurity NSW, NSW DPI
2. Dr Christine Stone, Agriculture NSW, NSW DPI
3. Mr Martin Horwood, Biosecurity NSW, NSW DPI (casual employment)

David Smith

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6.0 Annual Forest Health and Biosecurity Status Report of Victoria

The Department of Environment and Primary Industries (DEPI) aims to provide a better and more efficient management approach for public and private land, and water for the people of Victoria. The Forest and Timber Biosecurity Framework has identified five key areas for implementation:

- risk analysis and threat prioritisation,
- preparedness,
- surveillance and reporting,
- incursion response,
- ongoing pest and disease management.

This framework describes the Victorian forest and timber biosecurity context, including legislation, policy standards, and other arrangements.

6.1 Surveillance activities

DEPI is contracted to undertake targeted forestry surveillance for:

- private plantation companies; predominantly to monitor established pest and pathogens,
- the Commonwealth government; multi-pest surveillance around high risk sites,
- City of Melbourne; Dutch elm disease.

These programs are supported by DEPI general surveillance whereby pest and

pathogen reports from industry, state government forest agencies and the general public are followed up.

6.2 Plantations (Softwood)

(*Pinus radiata*)

6.2.1 Insect pests

a). *Sirex noctilio* (Sirex)

Across Victoria, *Sirex* remained at relatively low levels with only small outbreaks occurring across the north east of the state. Remedial action such as thinning and releases of the biological control nematode via tree inoculations (Kamona strain nematode) has reduced Sirex population levels. The parasitoid wasp ibalia continues to provide a secondary means of Sirex control. Across the state five-spined bark beetle has attacked Sirex trap trees potentially affecting the efficacy of the biological control program.

b). *Essigella californica* (Monterey pine aphid) MPA

Monterey pine aphid was identified across Victoria with populations increasing across the state. MPA incidence was higher than the previous 3 years due to significantly dry spring and summer 2012-13 seasons. Fortunately defoliation levels have decreased or remained the same as the previous years. On average, *P.radiata* carries 2.5 years of foliage and it has taken four years for the significantly defoliated trees to recover. Levels of discolouration (active aphid infestation) were also at trace to low levels.

c). *Ips grandicollis* (Five-spined bark beetle)

Five-spined bark beetle continues to cause localised tree decline across Victoria. Active infestations were found in trees stressed by fire, lightning strikes, waterlogging, and in proximity of recently harvested coups with large piles of slash. Five-spined bark beetle remains an issue with Sirex trap trees established for the biological control program in Victoria. A research program has being undertaken to investigate the interaction of five-spined bark beetle and *Sirex* through the National Sirex Coordination Committee.

d). *Hylurgus ligniperda* (Golden-haired beetle)

Hylurgus ligniperda is a beetle similar to *Ips* and is widely distributed in Europe, the Mediterranean area, and Atlantic Islands. It has established as an introduced species in Japan, parts of South Africa and North and South America, Sri Lanka, and southern Australia. Generally it breeds in logging wastes, stumps, roots and logs of harvested pine species. *Hylurgus* can cause significant issue to young seedlings when in large numbers. In Gippsland, small swarms of *Hylurgus* were observed. In late April, pheromone traps were installed. The aim of the traps was to try and protect a research trial established on the site in winter 2013.

6.2.2 Pathogens

a). *Dothistroma septosporum* (Dothistroma needle blight)

Dothistroma needle blight continues to cause high levels of defoliation (not recorded since 1994) on high risk sites due to wet and mild weather. Discoloration (current infection) remained at moderate to high levels with some trees at 60-80% defoliation. There were some isolated pockets of severe infection above the economic threshold. In the spring of 2012, a proportion of plantation was aerially sprayed with a copper fungicide in an attempt to reduce the inoculum load and reduce future production losses. A research program has been established to look at the efficacy of the spray program.

b). *Cyclaneusma minus* (Cyclaneusma needle cast) CNC

Cyclaneusma needle cast (CNC) is widespread across all *Pinus radiata* growing areas in Victoria. Cyclaneusma needle cast is considered a monocyclic pathogen (i.e. one lifecycle in a year), as it only produces fruiting bodies on dead needles. Damage varied across the state and within growing areas generally ranging from trace to moderate levels, although not always causing obvious canopy damage. Cyclaneusma needle cast damage can be confused with aphid damage and many samples were collected across the state to diagnose the key symptoms of CNC.

c). *Diplodia pinea* (Diplodia)

Diplodia damage was primarily found in un-thinned stands across Victoria. The

damage was mainly at trace levels with isolated trees affected on some water logged sites. Damage was mostly confined to individual trees or small groups of trees around areas affected by other environmental stresses.

d). *Sclerophoma pithyophila*

Sclerophoma pithyophila is primarily an endophitic weak pathogen that can be isolated from symptomless or chlorotic needles. It commonly occurs overseas as a saprotroph or weak parasite that occasionally causes serious damage to trees under stress (e.g. drought). Across the state rainfall levels have been low over the summer of 2012-13 and schlerophoma was isolated *in situ* with other pathogens such as diplodia and ophiostoma. Testing identified the pathogen across Victoria. Difficulty lies in identifying the primary cause. Sites where the pathogen was found will be monitored for spread.

6.3 Plantations (Hardwood)

(Eucalyptus spp.)

6.3.1 Insect pests

a). *Mnesampela privata* (Autumn gum moth)

Autumn gum moth caused isolated damage within young *E.globulus* plantations in the South West of the state but it is unknown if remedial action was undertaken.

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

Christmas beetles and chrysomelid leaf beetles caused defoliation to both *E.globulus* and *E.nitens* plantations across Victoria. Defoliation levels ranged from nil to severe at surveillance sites. Damage was observed across all age-classes but preference for trees older than six years of age was observed. Surveys carried out for these pests are primarily timed during autumn and winter as part of a wider forest health surveillance program and may not represent the maximum levels of damage expected at the end of summer.

c). *Perga* spp. (Sawflies)

Sawflies caused low levels of damage in the south and central districts of the state in native forest and eucalypt plantations. Damage was also identified in parks and gardens around Melbourne, and was more extensive than the 2011-12 season, causing significant defoliation at some sites. Defoliation was primarily observed in the upper half of the tree canopy, although some trees were entirely defoliated. No treatment was undertaken in the areas surveyed.

d). *Cardiaspina* spp.

Cardiaspina rotator continues to cause severe discolouration and defoliation in Sydney Blue Gum (*Eucalyptus saligna*) plantations in West Gippsland. Low to high levels of *E. camaldulensis* defoliation was found in plantings along roadsides and paddock trees in the districts north of the great divide. Compared to previous years the defoliation tended to be more widespread and not isolated to individual trees. Severe infestations were identified in the North East of the state with entire defoliation of many trees.

e). *Phylacteophaga froggatti* (Leaf blister sawfly)

Leaf blister sawfly (*Phylacteophaga froggatti*) caused trace to low levels of defoliation to mixed species plantations across Victoria over late spring and early summer. Damage was generally confined to the lower half of the tree with no significant growth losses expected. Damage was also observed within native forest stands across the state usually in regenerating forest after recent fires (wildfire and control burns).

6.3.2 Pathogens

a). *Aulographina eucalypti* (Corky leaf spot)

Corky leaf spot has caused varied levels of defoliation across Victoria, from trace to high. Damage was identified within both the upper and lower crowns but discolouration was primarily identified in the lower crowns. Plantations in the Otways were identified with elevated levels of defoliation and discolouration within a complex of other leaf pathogens. Significant defoliation events have occurred in the native forests of the Central highlands previously but generally not in plantations. Corky leaf spot can be a significant defoliating pathogen because it attacks the leaves and the

petioles of the new and old growth and causes premature leaf drop thus reducing photosynthesis.

b). *Mycosphaerella* spp. (Mycosphaerella leaf disease) MLD

Statewide surveillance within eucalypt plantations identified many species of mycosphaerella as damaging agents primarily in the lower crown. Damage across the state was marginally reduced compared to the previous 2 years as dry environment conditions over the spring and summer were not as conducive to disease development. Even though dry conditions generally reduced damage some localised sites displayed severe infection in both the upper and lower crowns and some sentinel site trees were completely defoliated. Continued infection may impact directly on tree growth and secondary factors such as weed competition are being monitored.

c). *Kirramyces eucalypti* (Septoria leaf blight) SLB

Kirramyces eucalpti has been an increasingly significant pathogen of juvenile and adult foliage in *E.nitens* plantations in southern Victoria due to the previous three wet summers. In spring and summer of 2012-13, SLB damage had reduced due to drier environmental conditions. Defoliation was primarily from the previous year's infection but in mid winter 2013 levels of Septoria leaf blight increased. Generally across the states infections were at low to moderate (1-30%) levels and were present in the lower crowns with some infection moving into the upper crowns of young trees. Septoria leaf blight was found in conjunction with MLD which is of concern because both pathogens are competing for the same space on the leaf surface and cause the same defoliating response. The risk of further disease development is high due to high rainfall areas of the state transitioning from *E. globulus* to the highly susceptible *E. nitens*. If environmental conditions remain conducive, the pathogen may spread to natural stands of *E.nitens.* Research may be required to evaluate management options to reduce the potential of productivity losses. Previous research has shown that there is significant variability in disease expression of families of *E. nitens* with Victorian families most impacted (Hood *et al* 2002).

6.4 Native forests

(Managed natural forests and native plant communities)

6.4.1 Insect pests

a). *Doratifera* spp. (Cup moth)

Cup moth has become a significant pest over the past four years due to increasing population levels. Significant infestations have at some locations entirely defoliated large areas of native forest, and outbreaks have been widespread across the state. Reports of moth swarms causing inconvenience to residents have been reported. Some areas in the Central Gold district have been completely defoliated three years in a row and isolated trees have now succumbed to the repeated attack. It appears that natural predators have not yet kept up with the increased population and reduced the infestation. No control programs have been undertaken.

6.4.2 Pathogens

a). Fungal leaf pathogens

Mycophaerellas, allographina and kirramyces were the key species causing significant damage in localised areas in the central highlands and southern forests. Significant defoliation events have occurred in the native forests of the Central highlands in conjunction with psyllid infestations.

b). *Phytophthora cinnamomi* (Pc)

The increased interest in *Phythophthora cinnamomi* since the drought broke in 2010, has continued during the 2012/13 year with reports of Pc damage in new native forest areas. New hygiene protocols to reduce the spread of the pathogen are being investigated using the DEPI state-wide model for Pc risk and impact map. Management of Pc continues to be a focus for DEPI and Parks Victoria.

c). *Chalara australis* (Myrtle wilt)

Chalara australis continues to cause the death of some mature *Nothofagus cunninghamii* within the Otway Ranges in native and private stands. The damage during this survey period was found within undisturbed natural ecosystems and private forests. The infection observed in the Central Highland in the previous years report has not spread and the infected tree has now died with many platypus beetle exit holes observed.

6.5 Nurseries

Nothing significant to report.

6.6 Urban and Rural trees

Nothing significant to report.

6.7 Built Environment

Nothing significant to report.

6.8 Biosecurity

6.8.1 Insect pests

a). *Corythucha ciliate* (Sycamore lace bug)

Sycamore lace bug was first found in Victoria in several north-east towns in March 2012. In February 2013, forty four (44) high risk sentinel sites across Central and North East Victoria were surveyed. Sycamore lace bug was found to have extended its range to Chiltern, Wahgunyah and further south to Wangaratta and Shepparton. Fourteen sites (14) are now identified as infested covering an area of around 140km.

b). *Lymantria dispar* (Asian gypsy moth)

Asian gypsy moth was not detected in 2012-13. Thirty trap sites around the ports of Melbourne, Western port and Geelong were monitored in summer 2012-13 as part of the national program. A low number of native lepidopterous species were trapped this year compared to the relatively high number in the previous year's survey. Traps will be restabilised in the 2013-14 spring/summer period.

c). Longhorn/longicorn beetles

Two species of exotic longhorned beetles – black spruce longhorn beetle (*Tetropium castaneu*) and brown spruce longicorn beetle *(Tetropium fuscum)* – were found at the Melbourne port during the summer of 2012. Tetropium is a large genus of long horned woodborers found in conifer forests of Asia, Europe and North America. Intercept

panel traps were deployed around the interception at the port but todate no more beetles have been detected. Trapping continued throughout the 2012-2013 season with a trapping program that spread out to 6 km from the initial detection. The traps were located at high risk sites with appropriate host material and will be reinstated in the 2013-14 flight season.

The black spruce longhorn beetle has a wide host range including several species of spruce, fir, common juniper and sometimes larch. Occasionally hardwoods including oaks and walnuts are attacked. In Europe, the beetle is typically a pest of spruce and in Siberia, pines are the preferred host.

The brown spruce longicorn beetle attacks conifers, primarily spruce, pine, and fir. In Europe, it is a pest of Norway spruce. Typically, wind-thrown trees, trees damaged by lightning or exposed to fire and freshly cut logs are attacked.

d). *Cryptotermes brevis* (West Indian drywood termite)

The West Indian drywood termite, *Cryptotermes brevis*, a pest not previously found in Victoria, was detected in a picture frame (ex-Brazil) in a residential building in the Melbourne metropolitan area. It has previously been recorded in Queensland (where it is now considered endemic in some areas, but still subject to official control programs), NSW and WA. Drywood termites are a group of termites that can complete their lifecycle in harvested timber products and do not require access to soil to gain moisture. The infested picture frame was removed from the residence and a small colony identified. Examination of the apartment by pest controllers and DEPI staff identified a single live termite in the stud wall behind the picture frame. Further removal of plaster board, and examination of the apartment, did not identify any other live termites or frass. The wall has been treated and 6-monthly surveillance will be carried out with DEPI staff and the pest control company. Scientific advice was received from a Queensland DAFF C. Brevis expert.

6.8.2 Pathogens

a). *Ophiostoma novo-ulmi* (Dutch elm disease) DED

Dutch elm disease (DED) surveys were completed across eight of the main gardens and boulevards managed by the City of Melbourne. Early detection of DED through

effective surveillance improves the chances of eradication or containment. Four hundred and fifty six (456) of the 1536 trees surveyed showed some level of defoliation and 131 showed greater than 50% defoliation. Samples were collected across the survey area and no longitudinal brown streaking consistent with DED were observed. Animal browsing and bacterial wet-wood remain an issue throughout the survey area and elm leaf beetle populations were low in comparison to the high level of activity observed over the past 5-10 years.

b). *Seridium* sp. (Cypress canker)

The community continues to report large numbers of dead and dying cypress trees in rural Victoria to DEPI in recent years. DEPI has tested Cypress tree samples from south and west Gippsland, Mornington Peninsula and Central District. Results were positive for various fungal pathogens, including Cypress canker, *Botryosphaeria* sp., *Phomopsis* sp. and *Pestalotiopsis* sp. These fungi can cause dieback symptoms, especially when environmental conditions have caused stress to the tree. It is assumed that the last drought weakened the trees and left them vulnerable to infection. This has been exacerbated in some areas by waterlogging after substantial rainfall over the past 3 years, and by warm, humid conditions favouring disease development.

c). *Puccinia psidii* (Myrtle rust)

Myrtle rust was first identified in Victoria in December 2011. As at 30 June 2013, myrtle rust has been detected at 76 sites which include production nurseries, wholesale nursery outlets, private residences and public parks in metropolitan Melbourne, the Mornington Peninsula, Shepparton, Ballarat and near Bairnsdale. The transfer of myrtle rust into Victoria was via infected plant material.

The emergency response phase was followed by a phase of active management (Response Plan Version 2) when it was determined the disease was not eradicable from Victoria. The aim was to slow the spread while preparing potentially affected industries to manage the disease's impact.

From 1 July 2012 (when the disease was declared established), Phase 3 Disease Monitoring activities have focused on providing training and technical advice to help the nursery industry, other host plant distributors, general public and forest land managers to manage and minimise the impact of the disease. Priorities for this phase

will focus on investigating reports involving new areas and host species where the disease has not been previously detected.

Myrtle rust has still not been identified in the natural environment and new reports have been from public gardens and private backyards. At all sites containment actions are in place. One new species (*Lophomyrtus obcordata*) was identified which brings the total of 18 species in Victoria. Communication programs have continued with 25 information sessions presented and over 743 people have attended. Version 2 of the myrtle rust in Victoria CD was published and two myrtle rust media updates were released.

The sentinel site program has been well received and 159 sites have been established across the state and monitored on a fortnightly basis by the general public, Landcare groups, state and local government staff and Botanic parks staff. This program has identified two infected sites and has provided a good early detection program whereby containment programs have currently eradicated the pathogen from these two sites. This phase is likely to last a further 6 to 12 months and taper off when the disease becomes well and truly established across the state and the demand for technical assistance declines.

d). *Cryphonectria parasitica* (Chestnut blight)

Targeted surveys for Chestnut blight were carried out in the spring, summer and autumn of 2012-13 within the north east of the state. More than 20,000 chestnut trees are surveyed within each of the survey periods and no new infections have identified in the survey area. Eucalypts around the previously infected premises have been surveyed. Surveys will continue into 2013-14 with the aim to declare national eradication in mid 2015.

6.9 Research & Development activities

Nothing significant to report.

6.10 Publications

Not reported.

6.11 Forest Health Capability

1. Mr David Smith (Forest Pathologist – Biosecurity Officer)
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7.0 Annual Forest Health and Biosecurity Status Report of South Australia

7.1 Surveillance activities

Green Triangle annual surveillance flights were conducted in autumn/winter 2012 and 2013. The main cause of dead/unhealthy trees detected in 2012 was diplodia in 79% of incidents. Other causes were: environmental 13% (lightning, wind, fire, salt/waterlogging, harvesting damage), nutrition 4%; and *Sirex* or *Ips* 4%. In 2013 (preliminary data analysis) the equivalent proportions were: diplodia 38% of incidents; *Sirex* 37%; *Ips* 16%; nutrition 5% and environmental 4% of incidents **(Fig. 10)**.

Mount Lofty Ranges aerial surveillance was carried out in autumn/winter 2012 and 2013. Small numbers of dead/unhealthy trees were recorded, most caused by diplodia and *Ips* or lightning strikes in 2012 and predominantly drought in 2013 (commonly without Ips attack).

7.2 Plantations (Softwood)

(*Pinus radiata*)

7.2.1 Insect pests

a). *Sirex*

Green Triangle

Sirex was detected in diplodia affected trees so more Trap Tree Plots were set up and more nematodes were inoculated into affected trees in 2013. Essigella numbers remained low.

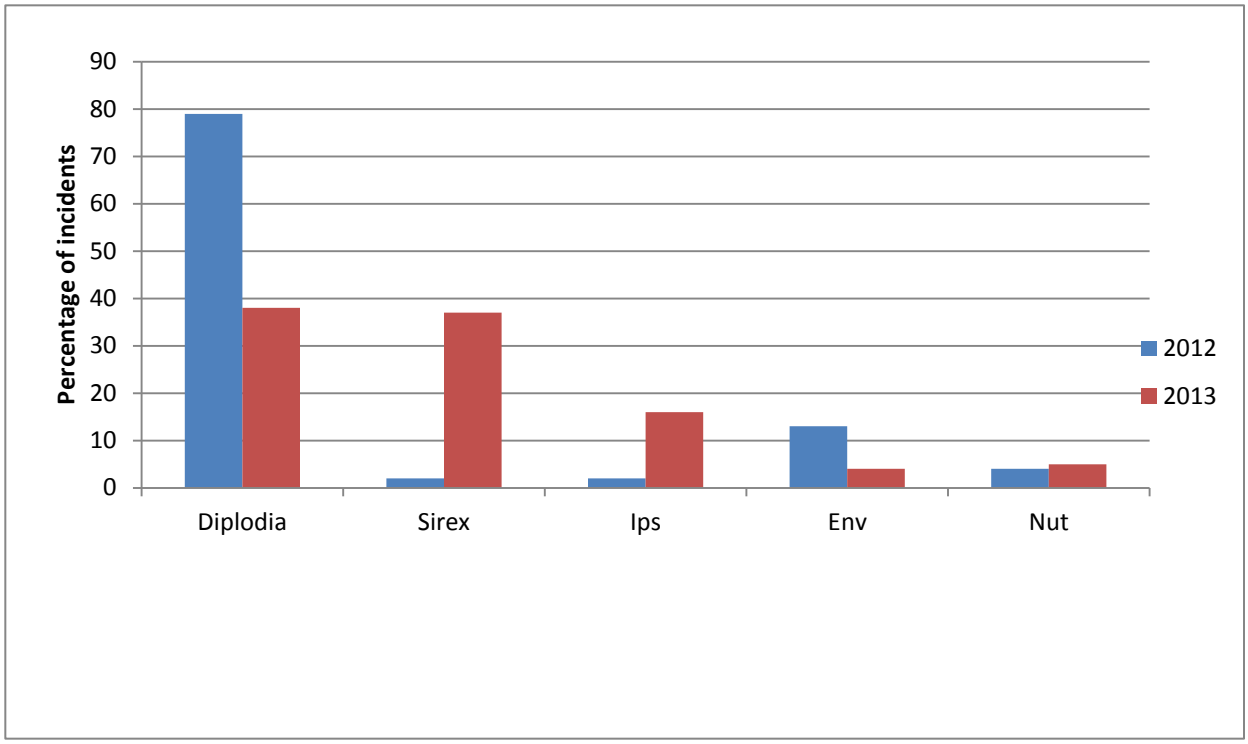

Figure 10: Percentage of incidents and cause of unhealthy trees - Green Triangle 2012 and 2013 (from ForestrySA aerial surveys).

Mount Lofty Ranges

Sirex numbers were low overall. Ips numbers were low but there were some tree deaths at Mt Crawford in the Mount Lofty Ranges and in the Mid-North at Wirrabara near areas of clearfall. Essigella numbers were low in all areas.

7.2.2 Pathogens

a). *Diplodia pinea*

Green Triangle

A major outbreak of the fungal disease, *Diplodia pinea*, was widespread over the ForestrySA plantation estate in 2012. Occurrence in 2013 was not as severe however it

has varied across company estates with others reporting 2013 being worse than 2012. In 2012 Green Triangle Forest Products had a small number of damaging outbreaks (3 or 4 plantations) in two regions (Caroline and Kongorong), whereas in 2013 it has been much more widespread with multiple plantations at Kongorong, Kentbruck, Caroline, Cafpirco and Dartmoor showing symptoms. In 2012 a total of about 10% of the ForestrySA estate was affected, comprising 7% with <5% trees affected; 2.5% with 5-10% trees affected and about 0.5% with 10-20% trees affected. No localities had >20% trees affected. 2013 data is currently being collated before analysis.

Mount Lofty Ranges and Mid-North

Good rains improved the overall health of forests in 2012 and 2013.

Diplodia pinea infection has occurred in all forests but was mild compared with the occurrence in the Green Triangle, particularly in 2012. Infection occurred mainly in Second Valley and Kuitpo forests. In general <1% trees were affected.

7.2.3 Vertebrate pests

Nothing significant to report.

7.2.4 Climatic disorders

Nothing significant to report.

7.2.5 Other

a). Biological control programs:

Sirex biocontrol program: This program was conducted as normal but as *Sirex* had been found in diplodia affected trees and it was anticipated that numbers may increase, extra Trap Tree Plots were set up for both years and extra nematodes were inoculated into naturally struck (diplodia affected) trees.

Essigella biocontrol program: This was conducted after the releases of *Diaretus essigellae* in 2012 in the Green Triangle and the ending of the project, monitoring for establishment will continue.

7.3 Plantations (Hardwood)

(Eucalyptus species)

7.3.1 Insect pests

Autumn Gum Moth (AGM), cup moths, chrysomelids, shot leaf miner, weevils, and sawfly may affect some areas but these are largely left untreated. There is some control via chemical use associated with these pests, but typically only in younger plantings. Generally this would be <1% of the estate. Australian Bluegum Plantations has reported damage from weevils and chrysomelids across their estate, moderate to severe in patches, but untreated. Control of Cadmus has been conducted on about 100 ha, with 12 ha treated with Shield® systemic insecticide for AGM and Heteronyx.

7.3.2 Pathogens

Pathogens are seldom reported.

7.3.3 Vertebrate pests

Nothing significant to report.

7.3.4 Climatic disorders

Nothing significant to report.

7.3.5 Other

a). Nutrition

There were no major nutrient issues in 2012 or 2013.

7.4 Native Forests

No significant activity.

7.5 Nurseries

There were no major pest or disease problems reported from regional nurseries. There are active programs in some nurseries to monitor nutrition and water quality.

7.6 Urban and Rural trees

No significant activity.

7.7 Built Environment

No significant activity.

7.8 Biosecurity

No significant activity.

7.9 Research & Development activities

7.9.1 Ips / Sirex project:

"Protecting Australia's pine plantations from exotic pests and climate change"

In collaboration with Charles Sturt University and the National Sirex Coordination Committee: ForestrySA provided sites for field work and collected billets in the Ranges region.

7.9.2 Biological control of *Essigella californica*

In collaboration with SARDI: as mentioned above after this project was extended for 12 months in 2012 monitoring for establishment of the biological control agent will continue.

7.10 Publications

Forestry SA (2013) Plantation Forestry Manual, Forest Health (Chapter 9) - 2013 Update, 92pp (Internal document).

ForestrySA (2012) Forest Health Report. Compiled by Dr Charlma Phillips, Principal Forest Health Scientist – Forestry SA, 20pp (Internal report).

7.11 Forest Health Capability

The only full–time forest entomologist employed by the industry in South Australia retired during the year. This will require adaptation of forest health surveillance and reporting systems over the next 12 months.

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8.0 Annual Forest Health and Biosecurity Status Report of Tasmania

8.1 Surveillance activities

Aerial surveillance was conducted in late May 2012 and roadside/ground surveys were conducted between October and December 2012 to cover approximately 46,000 ha of softwood (*Pinus radiata*) plantation on state forest. Static trapping was conducted for *Sirex* in softwood plantations across the north of the state. Roadside and ground surveys were conducted across approximately 38,000 ha of hardwood (*Eucalyptus nitens* and *E. globulus*) plantations on state forest between February and July 2013.

8.2 Plantations (Softwood)

(Exotic pines / *Pinus* species especially *P. radiata* - Surveillance season mid to late 2012)

8.2.1 Insect pests

a). Sirex wood wasp (*Sirex noctilio*)

No Sirex activity was detected during standard aerial and roadside health surveillance of the softwood plantation estate in the north of the state.

This summer a new three year cycle was commenced and four new high risk blocks were selected. These blocks included Tower Hill (Bass East), Lisle (Bass West), Badger

Hills and Oonah (Murchison). Five Kairomone charged static panel traps were placed in each block in Jan 2013, collected from in February and March, then removed. *Sirex noctilio* was detected only in Badger Hills where one female adult was caught in February and four in March. It is not surprising that *Sirex* was present in Badger Hills as this is not far from Long Hill where high numbers have been caught in previous years. The parasitoid, *Ibalia leucospoides,* was caught in low numbers in three of the four blocks. This is an indication that *Sirex* attacked trees are present from last summer. Due to the low numbers of *Sirex* caught, a struck tree survey was not conducted this year. The five Sirex adults were dissected for the presence of nematodes but none were found.

Two 10-tree trap plots were established in both Saddleback and Long Hill during December 2012. In April 2013 the trap trees were felled and inoculated with nematodes. Billets will be collected from these in November and adults will be reared from them between November and February 2014. Adults will be dissected to determine the rate of nematode infection.

b). *Ips grandicollis*

Ips continues to be absent from Tasmania.

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

There remained little evidence of essigella damage across the north of the state and no damage symptoms were observed in the south.

d). Pine aphid (*Eulachnus thunbergii*)

Not recorded from Tasmania.

e). Pine aphid (*Pineus laevis*)

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

8.2.2 Pathogens

a). *Cyclaneusma* needle cast/spring needle cast

This remains the most significant disease of radiata pine in the state, affecting all high, wet (>400 metres elevation 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.

b). Dothistroma needle blight

Although the area affected by dothistroma in Ringarooma in the northeast was similar to previous years (150 ha) a return to more normal levels of rainfall saw a decrease in the area affected in Oonah in the central northwest from 228 ha last year to 166 ha this year.

c). *Diplodia*/*Sphaeropsis* shoot blight/crown wilt

Top death caused by diplodia was very limited in 2012 being restricted to scattered small instances in the northeast of the state.

d). Phytophthora

No deaths from phytophthora were observed this year.

8.2.3 Vertebrate pests

Bark stripping by browsing mammals was again the most prominent problem by area across the softwood plantation estate on state forest. Over 1000 ha were affected but substantial mortality was only observed in approximately 180 ha. The main regions affected included Oonah and Smith's Plains (central northwest), Saddleback, Tower Hill and Payanna (northeast). Oonah and Saddleback have consistently had the greatest area of bark stripping damage in recent years and this trend continues (**Fig. 11**).

The area of young plantation affected by mammal shoot browsing was down again this year with no damage observed.

The area of dead tops caused by possum bark-stripping in the mid-upper crown saw an increase this year to 86 ha. These were generally localised patches around creek lines in Oldina in the central northwest (**Fig. 12**) but there was more widespread damage in two coupes in Inglis River in the same region.

Figure 11: Mortality and dead tops caused by browsing mammals in the central northwest of the state.

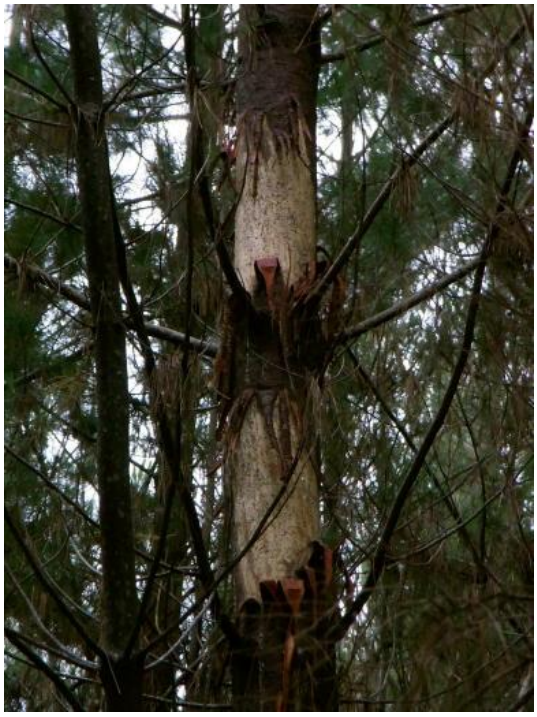

Figure 12: Severe bark stripping by possums on Oldina block, central northwest Tasmania.

8.2.4 Climatic disorders

a). Fire

No fire damage was observed during this surveillance season.

b). Wind

A very limited area of wind damage was detected in Oldina block (13 ha).

c). Lightning damage

No lightning damage was detected this year.

d). Frost/cold

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

e). Drought

No deaths from drought were observed this year.

8.2.5 Other

a). Exotic weeds

Isolated gorse plants (*Ulex europaeus*) were detected in several locations in the central north and northeast. The gorse infestation along Chatwins Rd. in Oonah in the northwest persists.

b). Boron deficiency

Shoot health and apical dominance of coupes affected by putative boron deficiency in Payanna in the northeast were similar to last season. Shoot dieback was uncommon and further improvement is expected in two recently thinned coupes.

8.3 Plantations (Hardwood)

(*Eucalyptus* spp. - Surveillance season early to mid 2013)

8.3.1 Insect pests

a). Autumn gum moth (*Mnesampela privata*)

No significant outbreaks of autumn gum moth (AGM) were detected this year.

b). Leaf beetles (primarily *Paropsisterna bimaculata* and *P. agricola*)

This year saw further changes to the leaf beetle Integrated Pest Management (IPM). Targeted, risk-based monitoring was further implemented meaning monitoring was greatly reduced or excluded from low-risk areas of the state. Furthermore, the population threshold for spray operations was significantly dropped in areas developing severe chronically thin crowns in an effort to protect trees from further damage and provide the best chance of crown recovery. There was evidence of recovery in a proportion of these plantations (**Fig. 13**). The area reported to be suffering from severely poor crown density due to an interplay of causes (including past fungal defoliation by kirramyces and mycosphaerella, cold, exposure, wind and leaf beetle defoliation) dropping from 3728 ha in 2012 to 1084 ha this year.

Figure 13: Example of mid-rotation coupe in northeastern highlands with chronically thin crowns. Mid-October early in the growing season (left), late November following feeding damage by adult *P. selmani* (centre) and significant crown recovery by March following spraying of larval population in December (right).

high levels of beetle activity in the northeast. This resulted in the greatest area of defoliation seen for many years with over 5000 ha suffering significant damage due solely to leaf beetle feeding. Some 80% of this damage was in the moderate category (25-50% leaf area loss) and most of the affected area was in the northeast. Given the level of leaf beetle activity, as well as the more targeted monitoring program, it was not unusual that a much greater percentage of the monitored area was over threshold this year compared to the previous summer. Consequently there was also an increase in the area across which control operations were conducted, up to 4741 ha this year from 2533 ha in 2011-2012. These control operations are likely to have ameliorated damage levels keeping them in the moderate category rather than progressing to severe where dramatic impacts on growth are known to occur.

The outstanding feature of the large leaf beetle populations this year was that they were dominated by the recently described species *Paropsisterna selmani* (**Fig. 14**) rather than the historically important *Paropsisterna bimaculata*. Little is known about the life history of this beetle although recent observations suggest it emerges from over-wintering earlier and may have faster larval development than *P. bimaculata*. Adult beetles were causing significant damage from late October removing a large proportion of newly flushed foliage. Few larvae were apparent through until late November but in early to mid-December there appeared to be a rapid explosion of the larval population causing problems for the monitoring and control program. It is currently unknown whether this species represents a significant, emerging pest species or whether unusual weather events triggered the observed population response. Research planned for spring 2013 aims to reveal more about the life cycle and behaviour of *P. selmani*.

c). Eucalyptus weevils (*Gonipterus* spp.)

Moderate (25-50% defoliation) gonipterus damage was restricted to 100 ha in the south of the state.

Figure 14: Adults and larvae of *P. selmani* caused extensive defoliation in the northeast during the summer of 2012-2013.

d). Gum leaf skeletoniser

Chronic defoliation by the gum leaf skeletoniser *Uraba lugens* continued this year in areas previously mapped. Damage remains limited and only extends a short distance in to the plantations. However, these stressed trees are often stunted and mortality caused by borer infestation following consecutive defoliation events is common.

e). Beetles (Christmas, scarab, spring etc.)

No significant damage was observed on state forest this season.

f). Sawflies

No significant damage was observed on state forest this season.

g). Borers

Borer attack played a role in mid-rotation mortality of suppressed and sub-dominant trees in four coupes in the northwest of the state. These coupes were hit hard by kirramyces in the recent past and it is the trees that were heavily defoliated, due to the high proportion of

juvenile foliage, at that time that have died.

h). Psyllids

No significant damage was observed on state forest this season.

i). Tortricids

No significant damage was observed on state forest this season.

j). European Wasps

Management to reduce populations at operational sites or tourism facilities is no longer conducted.

8.3.2 Pathogens

a). Mycosphaerella (Teratosphaeria) and other leaf diseases

A return to more typical rainfall patterns and a hot, dry summer saw a further drop in the incidence of defoliation from the fungal pathogens *Kirramyces eucalypti* and *Teratosphaeria* spp.. In fact no significant recent damage was observed due solely to these agents.

b). Botryosphaeria top death

No substantial damage was observed on state forest this season.

c). Holocryphia stem canker

No mortality specifically associated with *Holocryphia eucalypti* (Syn. *Endothia gyrosa, Cryphonectria eucalypti*) was detected this year.

d). Phytophthora root rot

No significant mortality (>1%) caused by phytophthora was recorded this year.

e). Armillaria root rot

Armillaria was commonly present in dead and dying trees in four coupes in the northwest as mentioned for borer attack above.

Figure 15: Damage caused by brushtail possums in a young *E. nitens* plantation in the central southeast.

8.3.3 Vertebrate pests

Intensive pre - and post-plant management of browser populations coupled with the use of seedling stockings was largely effective in preventing significant browsing damage. Furthermore there was a very limited planting program this year.

Branch breakage and broken-out tops caused by brushtail possums (*Trichosurus vulpecula*) were common in a number of localised areas in coupes in the central south affecting over 70 ha (**Fig. 15**).

8.3.4 Climatic disorders

a). Windthrow

No significant windthrow was observed this year.

b). Drought/desiccation

Mortality caused by drought stress was observed in two coupes in the south of the state and generally occurred along ridge-lines and around rocky knolls.

c). Cold/exposure

Exposure was the primary causal agent causing stunted performance in 19 ha of plantation primarily across ridges in the northwest. Cold and exposure were also involved in causing stunted performance across a further 280 ha of plantation above ~600 m elevation. They also play a role in the development and maintenance of poor crown density as discussed below.

d). Frost

No frost damage was detected this year.

8.3.5 Other

a). Water logging

Restricted drainage was the primary cause of problems such as stunted performance and foliar discolouration in localised regions of three coupes in the central south comprising approximately 19 ha.

b). Copper deficiency

Limited new plantings in vulnerable areas saw no new copper deficiency symptoms reported this season.

c). Weeds

Grass was contributing to stunted or variable performance and foliar discolouration across 81 ha of young plantation. Over-topping woody weeds were also having a growth impact

on 112 ha of young plantation in the south. California thistle (*Cirsium arvense*) continued to cause stunted performance and reduced stocking in areas of a 2011 plantation in the south of the state.

Scattered instances of the exotic, invasive weeds gorse (*Ulex europaeus*) were detected in various locations.

d). Soil fertility

Symptoms associated primarily with nutrient limited soils were recorded in 930 ha of eucalypt plantations. Consequences included reduced (308 ha) or variable growth (555 ha), early branch death (15 ha), and thin crowns (52 ha).

e). Multiple causes

Problems are placed in this category when there is a suite of factors contributing to particular symptoms and it is difficult to tease out primary causal factors; for example early branch death due to an interaction of poor soil, elevation and fungal infection as opposed to defoliation caused primarily by fungal infection. This year 2729 ha were determined as having health issues due to multiple causes including symptoms of stunting (361 ha) and variable performance (418 ha). Extensive early branch death was reported last year (637 ha) but a drop in fungal infection levels and conducting pruning operations has seen this drop to only 27 ha this year.

The main symptom of concern continues to be the development of chronically thin crowns in high elevation areas in the northeast of the state. This was thought to be caused by an interaction of leaf beetle feeding, *mycosphaerella/kirramyces* infection, cold and exposure. However, the syndrome continues in the absence of significant fungal activity and observations throughout the summer of 2012-2013 show it is largely driven by leaf beetle feeding. Damage is exacerbated by cold and exposure and recovery can be hampered by the limited growing season at higher elevations. As reported earlier good crown recovery was observed in a number of coupes where control operations were conducted. Nevertheless severely thin crowns due to these multiple causes were still observed across 1084 ha.

8.4 Native forests

(Eucalyptus species)

8.4.1 Insect pests

There were no reports of significant pest outbreaks during the past year.

8.4.2 Pathogens

There has been a noticeable spike of mortality in *Nothofagus cunninghamii* throughout north eastern and southern Tasmania during the past year. Detailed investigation hasn't been done yet, but it is suspected to be myrtle wilt (*Chalara australis*). A series of long-term plots to monitor the activity of myrtle wilt was established throughout Tasmania in the 1980's. These were last assessed in 2001 and are due for re-measurement, but their re-measurement is a low priority for Forestry Tasmania. Alternative avenues for their re-measurement are being explored.

8.4.3 Climatic disorders

Patch deaths of eucalyptus spp. in the southeast, particularly in the D'Entrecasteaux Channel area, were seen in autumn 2013 following a record heat wave coupled with near record summer drought in the region.

8.5 Nurseries and Seed orchards

a). Conifer species

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

b). Eucalyptus species

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

8.6 Urban and Rural trees

8.6.1 Insect pests

No pest outbreaks were reported.

8.6.2 Pathogens

No diseases were reported.

8.6.3 Climatic disorders

Mortality of several established shelterbelts of *P. radiata* in the irrigation areas of the northern Midlands were associated with soil salinity.

8.7 Built Environment

The floor of a newly constructed school building at Bothwell with inadequate sub-floor ventilation had to be replaced following severe damage by dry rot: an exceedingly rare event in Tasmania. *Serpula lacrymans* (**Fig. 16**) is suspected as the causal agent but its identity has not yet been confirmed.

8.8 Biosecurity

Tasmania continues to maintain strict quarantine restrictions on the importation of any myrtaceae species from interstate. State wide surveillance of nurseries and young eucalyptus plantations for myrtle rust (*Uredio rangelii* / *Puccinia psidii*) were done by staff from the Department of Primary Industries, Parks, Water and the Environment and, to a lesser extent due to the slowdown in plantation establishment, Forestry Tasmania to support the State's area freedom. There were no detections of myrtle rust in those surveys.

Figure 16: Damage caused by *Serpula lacrymans* infestation

8.9 Research and Development activities

A monitoring project conducted in some high elevation, mid-rotation *E. nitens* plantations helped shed light on the development of chronically thin crowns in these areas. Adult *P. selmani* were causing significant damage from early October, removing most of the newly flushed foliage. This continual feeding was followed by a rapid expansion of the larval population in early to mid-December. As such little crown recovery could be expected until after larvae pupated in late December/early January. The significant role adult beetle feeding was playing in causing and maintaining poor crown density in these high elevation regions had not previously been recognised.

University of Tasmania and Forestry Tasmania assembled a collection of 86 seed lots of all Tasmanian eucalyptus spp. for screening by NSW DPI (Dr Karanjeet Snadhu) for susceptibility to myrtle rust. The seed lot collection contains several families of each species and was chosen to sample the range of environments occupied by the species in their natural range.

Further measurements (defoliation and growth) of mid-rotation *E. nitens* plantations, being evaluated as part of a CRC Forestry project to validate CABALA HEALTH[4], were undertaken in August 2013. Data has yet to be assessed.

8.10 Publications

Elek J, Wardlaw T (2013) Options for managing chrysomelid leaf beetles in Australian eucalypt plantations: reducing the chemical footprint. *Agricultural and Forest Entomology* **15(4):** 351 - 365.

Hamilton MG, Williams DR, Tilyard PA, Pinkard EA, Wardlaw TJ, Glen M, Vaillancourt RE, and Potts BM (2013) A latitudinal cline in disease resistance of a host tree. *Heredity* **110**: 372 - 379.

Horton BM, Glen M, Davidson NJ, Ratkowski D, Close DC, Wardlaw TJ, Mohammed, C (2013) Temperate eucalypt forest decline is linked to ectomycorrhizal communities via altered soil nutrient conditions. *Forest Ecology and Management* **302**: 329 - 337.

Page DE, Close D, Beadle CL, Wardlaw TJ, Mohammed CL. (2013) Seasonal dynamics in understorey abundance and carbohydrate concentration in relation to browsing and bark stripping of Tasmanian *Pinus radiata* plantations. *Forest Ecology & Management* **296**: 98 - 107.

Prihatini I, Glen M, Wardlaw TJ, Mohammed CL (2013) Multigene phylogenetic study of *cyclaneusma* species. *Forest Pathology* (accepted).

8.11 Forest Health Capability

1. Tim Wardlaw,
2. Karl Wotherspoon,
1. Sue Jennings,
2. Nita Ramsden,
3. Leonie McCrossen - Forestry Tasmania (FT),

[4] **CABALA (CArbon BALAnce) is a growth model for predicting forest growth developed by the CSIRO. The HEALTH component is being developed to help predict the impact of pests and climate in carbon stores.**

4. Caroline Mohammed - University of Tasmania,
5. Angela Monks,
6. Tim Rudman - Department of Primary Industries, Parks, Water and Environment (DPIPWE).

Table 1: Summary of the activity of the main insect pests and pathogens of eucalyptus and pinus plantations in Tasmania.

Eucalyptus spp.

Pest	Area with moderate damage (ha)					Area with severe damage (ha)					Approx. 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		✓									1269 (<3yo)		*E. nitens* & *globulus*
Autumn gum moth											30000		
Christmas beetle											30000		
Paropsines					✓				✓		30000	4741	*E. nitens* & *globulus*
Gum leaf skeletoniser		✓					✓				30000		*E. nitens*
Sawfly											30000		
Leaf blister sawfly											30000		

Pest	Area with moderate damage (ha)					Area with severe damage (ha)					Approx. area inspected (ha)	Area treated (ha)	Hosts
	<10	10-100	100-500	500-1000	>1000	<10	10-100	100-500	500-1000	>1000			
Spring beetles (scarabs)											30000		
Jarrah leaf miner											30000		
Phasmatids											30000		
Weevils		✓									30000		
Psyllids											30000		
Phoracanthines											30000		
Wood moths											30000		
Wood borers - cerambycids							✓				30000		
Wood borers – buprestids							✓				30000		
Wingless grasshopper											30000		

Pest	Area with moderate damage (ha)					Area with severe damage (ha)					Approx. area inspected (ha)	Area treated (ha)	Hosts
	<10	10-100	100-500	500-1000	>1000	<10	10-100	100-500	500-1000	>1000			
Mycosphaerella spp.											30000		*E. nitens* & *globulus*
Kirramyces eucalypti											30000		*E. nitens*
Armillaria spp.							✓				30000		
Phytophthora spp.											30000		*E. nitens*

***Pinus* spp.**

Pest	Area with moderate damage (ha)					Area with severe damage (ha)					Approx. 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				✓				✓			46000		*P. radiata*

Pest	Area with moderate damage (ha)					Area with severe damage (ha)					Approx. area inspected (ha)	Area treated (ha)	Hosts
	<10	10-100	100-500	500-1000	>1000	<10	10-100	100-500	500-1000	>1000			
Bark beetles (*Ips, Hylastes*)											46000		*P. radiata*
Sirex wood wasp											46000		*P. radiata*
Monterey pine aphid											46000		*P. radiata*
Wingless grasshopper											46000		*P. radiata*
Armillaria spp.											46000		*P. radiata*
Phytophthora spp.											46000		*P. radiata*
Dothistroma septosporum				✓				✓			46000		*P. radiata*
Spring needle cast / Cyclaneusma					✓					✓	46000		*P. radiata*

Pest	Area with moderate damage (ha)					Area with severe damage (ha)					Approx. area inspected (ha)	Area treated (ha)	Hosts
	<10	10-100	100-500	500-1000	>1000	<10	10-100	100-500	500-1000	>1000			
Sphaeropsis sapinea		✓									46000		*P. radiata*

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9.0 Annual Forest Health and Biosecurity Status Report of Western Australia

9.1 Surveillance activities

9.1.1 Dieback mapping and management

Mapping the presence of symptoms of the plant disease caused by *P. cinnamomi* was carried out by certified 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 the Department of Parks and Wildlife (DPaW). A total area of 19,620 ha was mapped to assist the planning of roading and timber harvesting operations undertaken by the FPC, while FPC also arranged significant areas of mapping by private contractors. This included 8,454 ha of previous mapping that was checked for further spread. Mapping and hygiene planning were undertaken on a further 206 ha for the Parks and Visitor Services, Nature Conservation Service and Sustainable Forest Management Service of DPaW, and 165 ha for external parties. Training programs were carried out in disease mapping and hygiene management. A new manual for disease mapping was compiled for review by a range of stakeholders. A review of disease spread models indicated a slowing of the rates of disease spread across most zones and predictions of future disease extent were modified (G. Strelein, DPaW).

In the year to 30th June 2013, a total of 1,937 samples were tested for the presence of phytophthora at the DPaW 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 phytophthora in the DEC culture collection, and from other

projects, from a range of WA locations and ecosystems. This has led to the discovery of an unexpectedly large number of new phytophthora taxa (eleven of which have now been formally described), as well as new records for WA of several *Phytophthora* taxa known from elsewhere, and also a swarm of *Phytophthora* hybrids (see details under *Phytophthora* in natural ecosystems, above). While the pathogenicity of many of the new taxa is still to be fully investigated, the precautionary principle should be applied by managers to ensure that the spread of all of these soil-borne phytophthoras to new areas is minimised. Hygiene practices should be applied in the same way as for *P. cinnamomi* (M. Stukely, DPaW).

9.1.2 Softwood plantation survey and monitoring

Monitoring for sirex wasp (*Sirex noctillio*) in WA was undertaken by the Forest Products Commission (FPC) using static (panel) traps—which are effective in detecting very low numbers of *Sirex*. The traps are erected in pairs in open areas of plantations that would likely be used as flight paths for the wasp. Last year they were deployed in plantations from Perth to Esperance, as well as Albany town site and a Bunbury sawmill. No sirex wood wasps were detected in any of the traps in the 2012/13 flight season.

Eradication activities for European house borer (*Hylotrupes bajulus*, EHB) transitioned to ongoing management in 2011. There has been minimal activity since the transition with an emphasis on awareness and self-management (see 'Research and Development' section) (I. Dumbrell, FPC).

9.1.3 Private eucalypt plantations survey summary

Recent plantation company failures or restructuring has seen the WA bluegum plantation estate undergo a contraction both geographically and in terms of net area planted. Many plantations that are harvested in areas with marginal rainfall or distant from woodchip processing ports have been deemed uneconomic and not replanted. Further, approximately half of those plantations deemed suitable for a second rotation have been left to coppice (i.e. re-sprout from stump) rather than replanted with improved genetic material.

The industry-wide collaborative surveillance program commenced in 2011–12 was repeated in 2012–13. This year all the major companies not only collaborated in gathering crown damage data (Dec–March), but also undertook a series of pest population surveys (Sept–Nov). Target pest for population counts included chrysomelid species (*Paropsisterna m-fuscum* and *P. variicolis*) within young stands

(seedlings—2 yr.) and *Gonipterus* spp. within 3–4 year-old stands. Population counts demonstrated that is possible to capture region-wide differences in pest populations. For example, *Gonipterus* spp. egg counts were 2–3 time higher in interior west coast regions than in other parts of the estate. It is hoped that in the near future, collaborative collection of population data will aid with industry co-operation with regards to area-wide management of pests, rather than individual companies conducting their own discrete pest management activities.

Liparetrus beetles and chrysomelid species (*Paropsisterna m-fuscum* and *P. variicolis*) continue to be the species most commonly affecting seedlings and juvenile trees. However, the current industry trend to treat seedlings shortly after planting with systemic insecticides (clothianidin and imidacloprid) has seen a marked reduction in reports of defoliation and pest related deaths of seedlings throughout the estate. *Heteronyx* beetles and eucalypt weevils (*Gonipterus* spp.) continue to be the most frequently reported insect pests in +3 year-old plantations (F. Tovar, Integrated Pest Management Group).

9.2 Plantations (Softwood)

(*Pinus* spp.)

9.2.1 Insect pests

a). *Sirex* spp.

No sirex wood wasps (*Sirex noctillio*) detected in any traps in the 2012/13 flight season.

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

Although essigella is present in WA, it is not regarded as a problem. The biocontrol project has been finalised and no new releases of the biocontrol agent *Diaeretus essigellae* took place in 2012–13. Follow up monitoring has yet to determine if the wasp has become established.

c). European House Borer (*Hylotrupes bajulus*)

European house borer continues to be restricted to dead sections of live pine trees, dead pinewood material and untreated pine structural timbers (see also 'Built Environment' section)

d). Wingless Grasshopper (*Phaulacridium* sp.)

No unusual activity.

e). Rutherglen Bug (*Nysius vinitor*)

No unusual activity.

f). 'Spring' beetle (*Liparetrus jenkinsi*)

No unusual activity.

9.2.2 Pathogens

No significant issues.

9.2.3 Climatic disorders

a). Drought

No significant issues this year although soil water volumes beneath plantations were very low again. Summer and early autumn rainfall events prevented potential mortality. Until significant recharge events occur the risk of mortality will be high each year over the Summer/Autumn period (Ian Dumbrell, FPC).

9.3 Plantations (Hardwood)

9.3.1 Insect pests

(*Eucalyptus globulus*)

a). Eucalyptus weevil (*Gonipterus* spp.)

The average weather conditions experienced in most areas of the south coast during 2012–13 allowed many trees to recover from annual weevil spring defoliation and reports of severe damage were reduced from past years. Contrastingly, in western interior regions (Collie to Manjimup) there have been more reports of severe to extreme damage due to weevils. This is supported by high egg counts being recorded in this area (see map below). Damage to trees in this region is thought to be caused by a "new" species of weevil to WA temporarily termed *Gonipterus* sp. nov. 2 (**Fig. 16 & 17**). Its phenology is different to *G. platensis* (previously the more common species found in WA), it is thought to reproduce at least twice during spring and summer and most damage is done by adults feeding throughout the year and on the entire canopy, not

just juvenile shoots. Work is currently underway to determine its phenology, behaviour and distribution within WA.

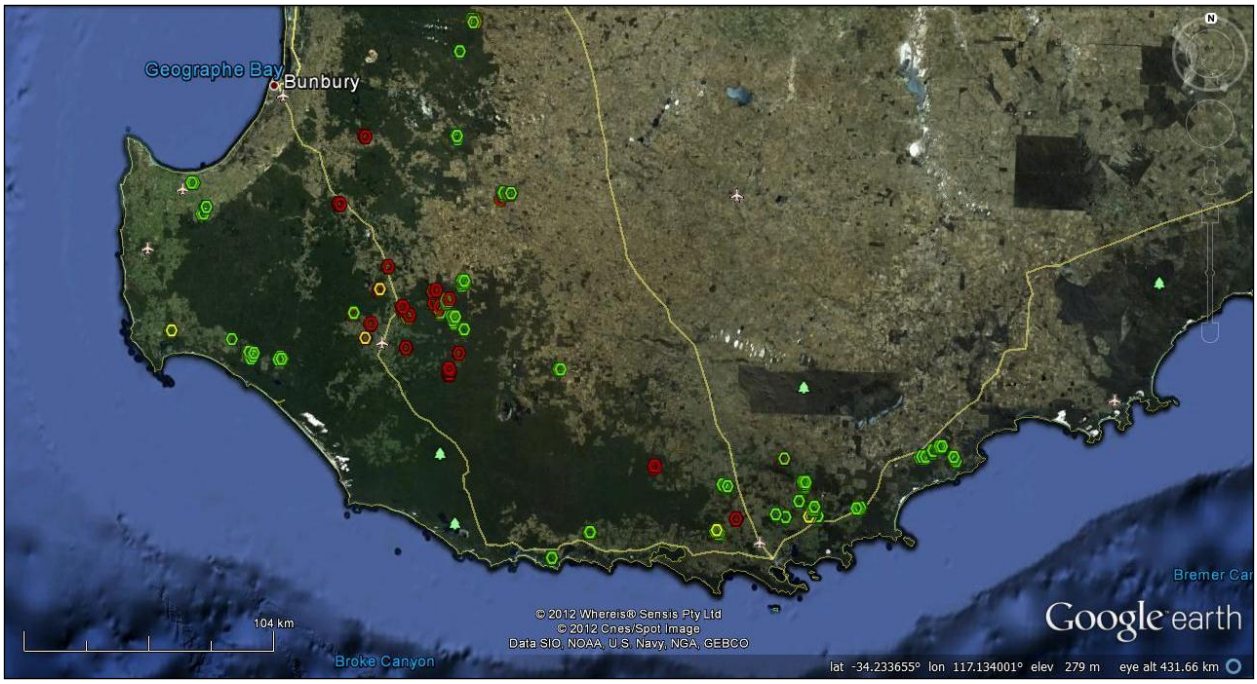

Figure 16: Map showing *Gonipterus* spp. egg population counts. Greatest weevil egg populations were observed in western interior areas (Donnybrook to Manjimup). Green <1 egg/30cm branch; Yellow 1-2.5 egg/30cm branch; Red >2.5 egg/30cm branch

Figure 17: *Gonipterus platensis* (left), *Gonipterus* sp.nov.2 (right); note the distinct X marking over the elytra and the white 'patch' between the elytra and the pronotum

b). Eucalypt leaf beetles (Chrysomelidae)

Chrysomelid species (*Paropsisterna m-fuscum and P. variicolis)* were observed causing low levels of damage to seedlings and saplings throughout the WA estate. Treatment of seedlings with systemic insecticides has greatly reduced damage reported by these insects.

c). *Heteronyx* spp.

Reports of significant *Heteronyx* spp. damage have decreased when compared to past years; especially in the south coast (Augusta to East Albany) where they are most active.

Eucalyptus (*E. cadocalyx, E. botryoides, E. loxophleba* ssp. *lissophloia, E. grandis, E. saligna*) and *Corymbia* (*C. maculata*) spp.

a). *Phylacteopohaga* spp.

An outbreak of Leaf blister sawfly (*Phylacteopohaga* spp.) in *E. botryoides* and *E. saligna* plantations on farmland south-east of Collie was reported—both these species have been heavily impacted by both adults and larvae. In addition gum leaf skeletoniser (*Uraba lugens*) was also found (in association with LBS) on *E. rudis* in an area of remnant vegetation within the plantation. Chemical spraying had limited success so plantations were thinned early which, it is assumed, may have prevented a further outbreak.

b). Autumn gum moth (*Mnesampela privita*)

This pest was identified in the low rainfall region of Salmon Gums (approx. 100 km north of Esperance) have been persistent since 2010 within the young York gum (*E. loxophleba* spp. *lissophloia*) plantations. Early chemical spraying operations did not eradicate the pest. In 2013 the Salmon Gums region along with the South Coast region has experienced well above average rainfall allowing the suppressed York gums to put on extensive new growth and it appears the impact of autumn gum moth is much reduced.

c). Brown basket lerp (*Cardiaspina fiscella*)

A severe outbreak of brown basket lerp (*Cardiaspina fiscella*) occurred on both *E. saligna* and *E. grandis* at a property near Nannup. *C. maculata* and *E. diversicolour* at the same site were unaffected. It is not known when the outbreak began but indications suggest it may have been associated with the 2010/11 drought event.

At the time of writing a high prevalence of a number of different galls on different plantation species across the south of the state have been noted, including two different forms (one on *E. saligna* the other on *C. maculata*) from this property with the outbreak of brown basket lerp (I. Dumbrell, FPC).

d). Case moth (*Hyalarcta heubneri*)

The damage was reported on *E. polybractea* in a plantation near Lake Magenta. *E. polybractea* is not noted to support insect pests (A. Wills, Department of Parks and Wildlife – DPaW).

9.3.2 Pathogens

Eucalyptus globulus:

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

Reports are increasing of young stands (<3-years-old) in Denbarker and Manypeaks being affected by outbreaks of teratosphaeria leaf disease. This is thought to be a result of a combination of:

1. Most stands in this area being at the susceptible juvenile leaf stage (1-4 year-old).
2. Mild winters and wet springs/summers in the last 2 years creating unusually warm moist conditions conducive to *Teratosphaeria* spp.
3. Poor soil nutrition being a contributing factor.

The Eucalypt plantation summary **(Table 2)** attached below provides further information associated with insect pests, pathogens and other pests for eucalyptus (contributed by F. Tovar, Industry Pest Management Group)

Table 2: Area of *E. globulus* plantation estate monitored and area affected by pests and pathogens in Western Australia in 2012–13[5]

PESTS*	Area with moderate damage (ha)					Area with severe damage (ha)					Area inspected (ha)[6]	Area treated (ha)[7]	Hosts
	<10	10-100	100-500	500-1000	>1000	<10	10-100	100-500	500-1000	>1000			
Eucalypt weevil (*Gonipterus scutellatus)*					X				X				*E. globulus*
Heteronyx spp. **[8]				X			X						*E. globulus*
Chrysomelid beetles			X										*E. globulus*
"Spring" beetles (*Liparetrus* spp.)		X											*E. globulus*
Wingless grasshopper (*Phaulacridium vittatum*)													*E. globulus*
28 Parrots (*Banardius zonarius*)			X										*E. globulus*
Rabbits		X											*E. globulus*

[5] Data contained in the table is of a general nature and incomplete as the IPMG currently only has data from collaborative surveys but is aware that companies collect more data when conducting yearly in-house audits.

[6] **No information was provided to IPMG regarding areas inspected or treated (F. Tovar, Industry Pest Management Group).**

[7] **No information was provided to IPMG regarding areas inspected or treated (F. Tovar, Industry Pest Management Group).**

[8] Data concerning *Heteronyx* spp. damage is an estimate based on anecdotal observations from foresters over many years.

PESTS*	Area with moderate damage (ha)					Area with severe damage (ha)					Area inspected (ha)[6]	Area treated (ha)[7]	Hosts
	<10	10-100	100-500	500-1000	>1000	<10	10-100	100-500	500-1000	>1000			
PATHOGEN													
Teratosphaeria spp.					X					X			*E. globulus*
WEEDS													
Kikuya grass			X										*E. globulus*
TOTALS													

9.4 Native forests

9.4.1 Insect pests

(Native jarrah - *Eucalyptus marginata* forest)

a). Jarrah leaf miner (*Perthida glyphopa*)

A survey of jarrah leaf miner (JLM) on sites within the southern jarrah forest region was undertaken in October 2012. JLM mine densities on ground coppice leaves are presented below **(Fig. 18).** Highest population densities were found north of Collie and south of Dwellingup. Forest north of Dwellingup is free of JLM infestation while forest south of Bridgetown had low JLM population densities (A. Wills and J. Farr DPaW).

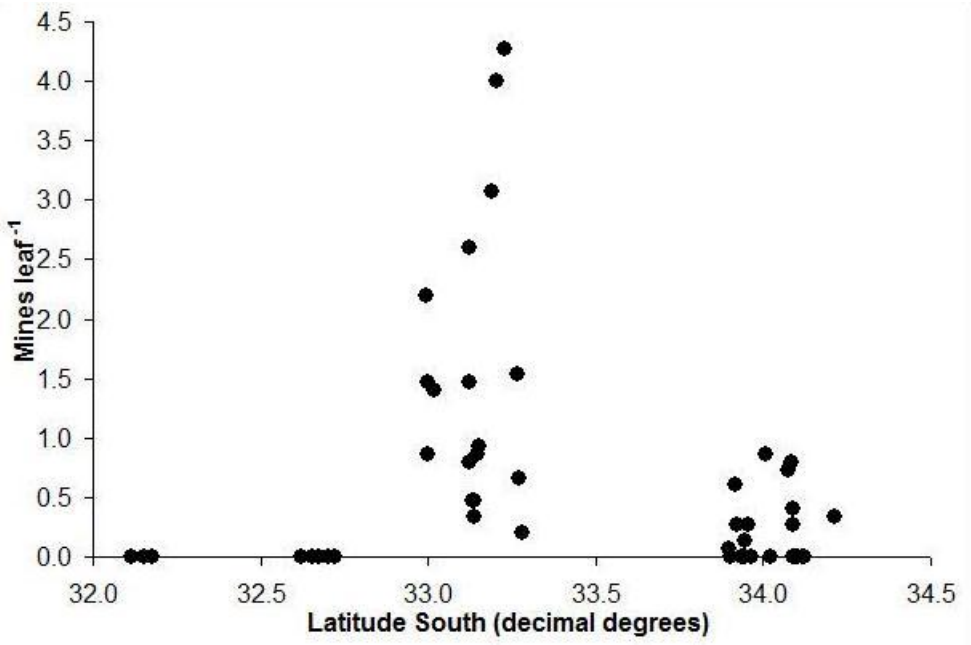

Figure 18: Jarrah leaf miner mine densities on ground coppice from FORESTCHECK sites October 2012 (15 leaves on one plant sampled per site)

b). Gum leaf skeletonizer (*Uraba lugens*)

The outbreak of gumleaf skeletonizer (GLS) continued in Dec-March 2012/13. Population monitoring used the New Zealand pheromone lure system. From ground observations, the forest area subject to defoliation had contracted and moved southeast, adjoining areas which had been defoliated the previous year. Although population

levels declined from the 2011/12 levels, they were still high in some monitoring sites compared with non-outbreak periods (J. Farr and A. Wills, DPaW).

(Native Karri - *Eucalyptus diversicolor* forest)

No major insect pest problems reported.

9.4.2 Pathogens

(Native jarrah - *Eucalyptus marginata* forest)

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).

(Native Karri - *Eucalyptus diversicolor* forest)

No new major disease problems were reported. Management and survey of armillaria root disease, caused by *A. luteobubalina*, in regrowth karri forests continues to command attention.

a). Armillaria root disease

Currently, the incidence of armillaria infection in regrowth karri stands is surveyed post thinning using a visual assessment of disease symptoms on trees (**Fig. 19**). One plot is assessed for each 2 ha of thinned forest. The ability of the surveys to represent the actual level of armillaria infection on the site is being assessed by carrying out whole of coupe surveys and comparing the results to the plot surveys. Additional assessments are required before a judgment can be made, but results so far suggest that the plot based survey method provides a good estimate of the whole of coupe incidence of armillaria. However, Karri forest can be difficult to traverse and butts of trees, where armillaria-caused lesions occur, are often obscured by litter accumulation. As an alternative, surveys of logs on landings is being trialed as a rapid method for estimating the number of trees infected with armillaria (D. Wiseman, H. Tabarestani, R. Robinson, DPaW)

Figure 19: Armillaria-infected karri regrowth thinnings logs on landings. Symptoms are: white stringy rot in sapwood and bark (left), occluded scar and associated discoloured wood (centre) and white internal rot associated with occluded scars (right).

9.4.3 Climatic disorders

a). Frost

During winter 2010 and 2012, frost events within the northern jarrah forest resulted in canopy dieback. Permanent monitoring plots have been established and over 700 trees are tagged. Monitoring in the Wandoo National Park suggested that:

- Canopy collapse occurred in the similar areas following both frost events.
- Species differential responses were clear, with marri *(Corymbia calophylla)* and jarrah (*Eucalyptus marginata*) being severely affected compared with wandoo (*Eucalyptus wandoo*).
- Reports are currently being prepared (G.Matusick, K. Ruthrof and G. Hardy, Murdoch University).

b). Drought

Unprecedented drought-induced deaths in the northern jarrah forest (NJF) were first observed in late February 2011 **(Fig. 20)**. Long term monitoring plots have been established to track recovery following the collapse. Re-monitoring was undertaken in 2012 and 2013 and included: resprouting, regeneration, fuel levels, canopy cover changes. Findings after monitoring 3, 6, 16 and 24 months include:

- There were contrasting patterns of recovery over time between forest experiencing different magnitudes of collapse.
- Epicormic resprouting was extensive within severely affected plots, with a much reduced response on minimally affected plots.

- A key impact was a reduced canopy height and proliferation of new stems formed from resprouting.
- Regeneration of *E. marginata* was found in higher densities in severely affected forest, predominantly as ground coppice.
- Size class distribution shifted downwards due to death of large diameter trees.

The resprouting response and high regeneration densities has led to major structural changes. However, the composition of the forest is not likely to shift away from the dominant species, *E. marginata*, thus far.

- The patterns of recovery also suggest that particular sites may be vulnerable to significant structural shifts with future drought-induced canopy dieback.

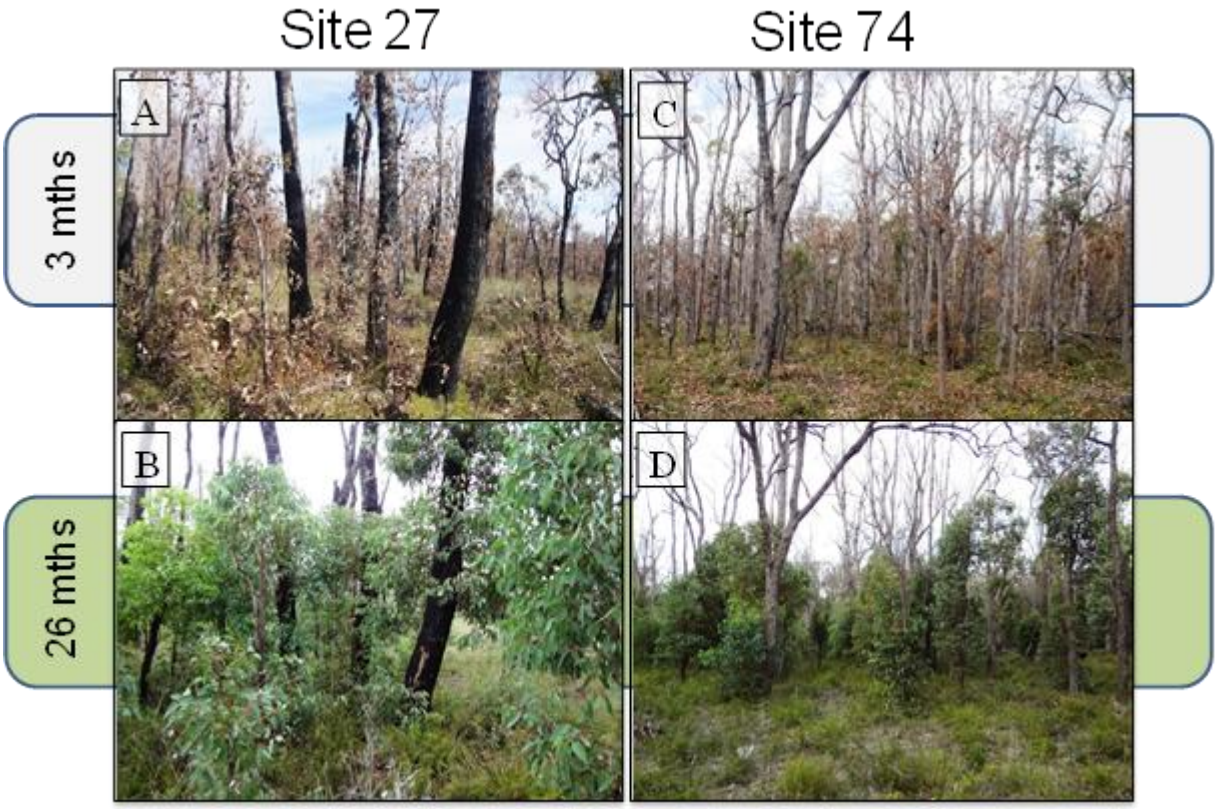

Figure 20: Recovery of trees following drought at two monitoring sites, Site 27 (A & B) and Site 74 (C & D), in the northern jarrah forest (Photos: George Matusick)

Sixteen months following the collapse, when differences in basal area were accounted for, plots severely affected by the forest collapse had significantly higher litter loads than areas minimally affected by the collapse. These increased fine surface fuel loadings (referred to as 1hr fuels) and the changed micro-meteorological conditions (temperature, relative humidity and wind speed) caused by the drought-induced

canopy collapse, both of which have significant implications for fire behaviour in the short term (K. Ruthrof, G, Matusick and G. Hardy, Murdoch University).

Drought-associated vegetation declines are increasingly observed worldwide. A study was undertaken to investigate whether differences in water relations can potentially explain the distribution and vulnerability to drought-induced decline of four common tree species in Mediterranean south western Australia. It compared seasonal and daily water relations of four eucalypt species (i.e. *Corymbia calophylla, Eucalyptus accedens, E. marginata, E. wandoo*) when co-occurring as well as on nearby typical sites for each species. When co-occurring, species generally inhabiting drier regions (i.e. *E. accedens, E. wandoo*) had lower summer leaf water potentials, osmotic potential, and vulnerability to cavitation and higher stomatal conductance and relative sapflow velocity. Both wetter zone species (e.g. *C. calophylla* and E. *marginata*) had remarkably high vulnerabilities to cavitation for Mediterranean-type tree species but showed greatly improved leaf water status on nearby sites where they dominate. Using local soil moisture retention curves of saprolitic clay layers underlying south western Australia showed the large disadvantage that wetter zone species have in terms of accessing tightly bound water in these layers. This work shows that species distribution and local dominance of four dominant overstorey species in south western Australia is largely a function of plant water relations interacting with local soil profiles. The observed differences in water relations amongst species are consistent with some of the declines that have been observed in recent decades (P. Poot and E. Veneklaas, University of Western Australia).

9.5 Nurseries

No major problems have been reported in conifer seedlings in nurseries.

An infestation of *Phytophthora alticola* (previously designated *P*. aff. *arenaria*) was found in a WA wheatbelt region nursery producing oil mallee (eucalyptus spp.) seedlings, in 2012 and again in 2013. This is being investigated further, including studies on its pathogenicity and mode of transmission, as well as control methods (M. Stukely, DPaW).

9.6 Urban and Rural trees

9.6.1 Insect pests

Extensive declines of *E. rudis* (flooded gum) associated with *Creiis periculosa* (western horn lerp) sometimes in association with *Perthida* sp. leafminer and/or *Phylacteophaga froggatti* (leaf blister sawfly, LBS) continue to be monitored in the south-west.

LBS activity in areas of on remnant marri (*C. calophylla*) in the valleys of the Darling Scarp in the vicinity of Mornington Road and the Ferguson Valley were also observed in 2012/13 (A. Wills, DPaW).

9.6.2 Pathogens and Declines

a). *Armillaria luteobubalina*

Symptoms of armillaria root disease (ARD) was found in *Melaleuca rhaphiophylla*. The infected trees were in remnant swamp vegetation between the Collie River and urban development, indicating that they may be subject to nutrient rich run off from nearby houses. ARD has also been noted to affect *M. viminea* in fertilised and watered situations in the south-west (D. Wiseman and A. Webb, DPaW).

b). Phytophthora in parks and remnant bushland

Surveys of dying vegetation within remnant bushland, parks and gardens and streetscapes throughout the urban forests of Perth and the south-west of Western Australia, revealed symptoms typical of those produced by phytophthora species. A total of nine phytophthora species, including *P. alticola, P. multivora, P. litoralis, P. inundata, P. nicotianae* and *P. palmivora* were isolated. In addition, three previously undescribed species, *Phytophthora* aff. *arenaria*, *Phytophthora* aff. *humicola* and *Phytophthora* sp. '*ohioensis*' were isolated. Isolates were recovered from a wide range of native and non-native host genera, including *Agonis, Allocasuarina, Brachychiton, Calothamnus, Casuarina, Corymbia, Dracaena, Eucalyptus, Ficus, Pyrus* and *Xanthorrhoea*. *Phytophthora multivora* was the most commonly isolated species. Out of 230 samples collected 69 were found to be infected with phytophthora. Of those 69, 54% were located within parks and gardens, 36% within remnant bushland, and 10% within streetscapes. These pathogens may play a key role in the premature decline in health of the urban forest throughout Perth, and should be managed according to the precautionary principle and given high priority when considering future sustainable management strategies (P. Barber, T. Paap, T. Burgess, W. Dunstan and G. Hardy, Murdoch University).

c). Mundulla Yellows

Monitoring the occurrence and symptom development of mundulla yellows (MY) in WA continues. Symptomatic eucalypts (both planted trees and remnant native trees) have been recorded and monitored in additional locations. Spread of symptoms within affected sites appears generally to be slow, and diseased and apparently-healthy trees can grow alongside each other. The observed distribution of MY symptoms in the south of the state is from north of Geraldton to Esperance, and it occurs on alkaline coastal sands as well as inland 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, DPaW).

9.6.3 Other

a). Canopy health of urban trees

Canopy cover of remnant urban native bush within the city of Perth has dramatically reduced over recent years, largely as a result of property development. What remains has become increasingly fragmented and is in a very poor state of health, due to a range of factors. Over the past 18 months, surveys at many sites have revealed a range of anthropogenic and biological factors contributing to the decline of these species. Within much of the urban bushland of Perth *Eucalyptus marginata, E. gomphocephala* and *Corymbia calophylla* have symptoms of severe crown decline. Diagnosis of the biological factors, including a range of pathogens, pests and nutrient disorders, has guided the selection and application of a range of systemic treatments to mitigate crown decline and improve crown health. Mitigating crown decline of mature trees in this way is much more cost-effective than annual pruning of dead wood (P. Barber, G. Hardy).

9.7 Built Environment

9.7.1 European house borer (*Hylotrupes bajulus*, EHB)

Records of EHB in timber in service remains restricted to the original house in the Perth metro area in 2005, and to one incidence of untreated timber in Albany which was transported from Perth. No recent infestations of timber in service have been recorded.

9.8 Biosecurity

9.8.1 Native plant communities

a). Phytophthora in natural ecosystems

Previously, large-scale aerial photography has been used to map the extent of Phytophthora dieback disease in native forests in the south-west of Western Australia, whereas currently most mapping is undertaken with intensive field survey. Validation of the observations may involve routine testing of soil and root samples for the presence of *Phytophthora cinnamomi.* In addition to *P. cinnamomi*, six morpho-species had been identified prior to 2005 using this technique: *P. citricola, P. megasperma, P. cryptogea, P. drechsleri, P. nicotianae* and *P. boehmeriae.*

In recent years many new phytophthora species have been described world-wide, often with similar morphology to existing species. Many of the isolates collected in Western Australia have been difficult to identify based on morphology, molecular identification of some of the morpho-species is required. Based on amplification of the internal transcribed spacer (ITS) region of the rDNA, sequence data of over 850 isolates (both recent and historical, from the DPaW Vegetation Health Service collection) have now been compared to that of existing species and undescribed taxa. This work is continuing.

A total of eleven new species of phytophthora have been described from WA natural ecosystems since 2009: *Phytophthora multivora, P. elongata, P. thermophila, P. gibbosa, P. gregata, P. litoralis, P. arenaria, P. constricta, P. fluvialis, P. amnicola* and *P. bilorbang*. Pathogenicity has so far been tested and confirmed on native plants for *P. multivora, P. elongata, P. arenaria* and *P. constricta*. *P. bilorbang* is pathogenic to the agricultural and forest weed, *Rubus anglocandicans* (European blackberry). Several additional new WA *Phytophthora* taxa await formal description.

New records for WA of *Phytophthora* taxa known elsewhere (identified since 2005 from recent as well as historical WA isolates) have included: *P. inundata, P. niederhauserii, P. asparagi, P. palmivora, P. rosacearum, P. lacustris, P. alticola, P. parvispora, P.* taxon personii, *P.* taxon PgChlamydo, and *P.* taxon humicola-like.

A number of naturally-occurring hybrid phytophthoras with significant genetic diversity have been identified from WA natural and plantation ecosystems: some from soil associated with dead plants, and also many from waterways in WA as well as in South Africa. Collaborative investigations of these hybrids and their origins are

progressing. The presence of these hybrids (all recovered from routine soil, root and water samples being tested for *Phytophthora* spp.) shows that they are sufficiently stable and resilient to survive in the harsh WA environment. Also, it raises the possibility of hybrids with significant pathogenic capability arising in the field at any time from interactions between compatible *Phytophthora* species. The formation of *Phytophthora* hybrids is believed to be a continuing process. Movement of infested soil and/or plant material between sites will clearly facilitate these interactions, and should be minimised.

Most of the newly-described phytophthoras (and some of those yet to be described) have been associated with multiple species of native plants dying in WA natural ecosystems, with some DPaW isolations from indicator plants dating back to the 1980s. Some phytophthoras are active in a broader range of site conditions than those favouring *P. cinnamomi* (e.g. *P. multivora* in limestone soils). Some species (e.g. *P. arenaria* and *P. constricta*) are believed to be endemic in WA. Most of the new taxa have been associated with dying *Banksia* spp. while *P. elongata*, *P. multivora* and *P. thermophila* have also been isolated from dying *Eucalyptus marginata*. *Phytophthora multivora* is pathogenic to bark and cambium of *E. gomphocephala* and *E. marginata* and is believed to be involved in the decline syndrome of both eucalypt species within the tuart woodland. *P. elongata* has also been isolated from dying *Corymbia calophylla* in mining rehabilitation sites. Some taxa appear to have limited distribution, while others like *P. multivora* are widespread.

The previously recorded presence in WA natural ecosystems of four *Phytophthora* species other than *P. cinnamomi* (*P. cryptogea, P. nicotianae, P. megasperma, P. boehmeriae*) has been confirmed by DNA sequencing of stored isolates. However, two species that were previously believed to be present based on morphological studies alone (*P. citricola* and *P. drechsleri*) are not present among the isolates tested todate. Land managers are being encouraged to apply the precautionary principle in dealing with all of these soil-borne *Phytophthora* species with the aim of minimising their spread (T. Burgess, G. Hardy, D. White, and A. Rea, Murdoch University; M. Stukely, J. Webster and J. Ciampini, DPaW).

b). Canker pathogens in natural ecosystems

Neofusicoccum australe, *N. macroclavatum*, *Cryptodiaporthe melanocraspeda* and *Luteocirrhus shearii*, a newly described pathogen of Proteaceae in the Cryphonectriaceae, were consistently isolated from cankers affecting *Banksia* and *Lambertia* spp. communities across the South West Australian Floristic Region. *Neofusicoccum* spp. were the most frequently isolated pathogens in *B. baxteri* and *B. coccinea*. *C. melanocraespeda* was

associated with cankers on *B. coccinea* and *L. shearii* on *B. baxteri*. Canker severity on *B. baxteri* had positive significant correlations with average monthly, maximum and minimum temperatures at sites. For *B. coccinea* there were no significant correlations.

Effectiveness of the fungicides Rovral, Switch® and Banrot® was compared to previously tested Sportak® fungicide and controls. Growth rates *in-vitro* were used to determine effective dose rates. The two most effective, Banrot® and Switch®, were then used *in-vivo* spray treatments on *B. baxteri*, *B. occidentalis*, *B. speciosa* and *B.verticillata* seedlings to assess pathogen-host-fungicide interactions. Seedlings were treated with fungicides then challenged by stem wound inoculation with the canker fungi and lesion extension rates compared. Switch® Fungicide produced a significant control effect on all canker pathogens in *B. verticillata* but none in *B. Baxteri.* Therefore, any applied fungicide spray program needs to consider pathogen-host-fungicide interactions prior to implementation (C. Crane and B. Shearer, DPaW).

9.8.2 Other

a). South Coast Region aerial Phosphite program to mitigate *Phytophthora cinnamomi* impact

In autumn 2013, 262 ha (27 targets) were sprayed targeting 20 Threatened flora species (13 Critically Endangered) and 2 Threatened Ecological Communities (Montane Heath & Thicket of the Stirling Range, Montane Mallee Thicket of the Stirling Range). Selected populations of Critically Endangered flora within targets were monitored and data collected on survival, growth, reproduction and plant health. Phosphite was applied at 12 kg/ha (30 L/ha) using 40% phosphite. Aerial phosphite application is a critical component in a suite of recovery actions for these species that include fencing, seed collection and translocations. While phosphite in general slows population decline, the additional threats of grazing and aerial canker, caused by *Luteocirrhus shearii* (formerly *Zythiostroma* spp.), *Neofusicoccum australe and Cytospora* spp., also impact on the health and survival of several critically endangered taxa and affect management outcomes (S. Barrett, DPaW).

9.9 Research and Development activities

9.9.1 European house borer (EHB) on-line training package

A new on-line training package has been developed by the Department of Agriculture and Food WA and Challenger Institute of Technology **(http://www.challenger.wa.edu.au/courses/ShortCourses/Pages/short-course-ehb-**

european-house-borer.aspx). The course targets technicians in the pest management industry and aims to enhance knowledge about EHB including how to recognise and control EHB infestation and how to prevent damage and future spread. Participants will acquire enhanced skills in the detection of EHB, the infestation signs to look out for and how to treat and prevent further infestation (I. Dumbrell. FPC).

9.9.2 Forest health monitoring

An automated annual monitoring program has been developed to identify changes in satellite reflectance information over time and correlate this with known or past causes of changes in forest health and vigour. This information is then used to classify the changes, with levels of confidence, to causal factors. Those with unknown or low levels of confidence or changes in magnitude are then targeted for further investigation including field checks to confirm causes and recalibrate the annual data updates. The system includes spatial modeling algorithms to incorporate both known datasets (harvesting, fire, mining) and surrogate datasets (landform, soils, vegetation) that can be correlated with possible causes and inform the decisions on causes that as yet have no spatial history to guide classification (G. Strelein, DPaW).

9.9.3 Forest health modeling

Frost occurrence is being modelled for the past 15 years and 15 years into the future at 1km resolution over the whole south-west of WA. This will give indications where native forest was and will most likely be affected and contribute to understanding potential regional climate change and variability. Associated datasets can further be used for making predictions into the future (T. Lyons, J. Kala, Murdoch University).

A model that aims to provide understanding of a tree's hydraulic strategy and the impact of this on its survival in a global climate change context has been developed. The model uses cell-level changes that allow for adaptation of trees to their environment. This model using the hydraulics of a single individual tree can be used to test different strategies for water uptake, transport and transpiration. It was used to analyse some overall strategies adopted by trees and discuss them in the light of drought tolerance. Results show that optimizations for water use occurs at different scales and are interrelated. The different scales in this strategy are at leaf level (stomatal regulation and leaf capacitance), organ level (trade-off between conductance and vulnerability to embolism); and whole tree level (allocation of carbon to root, leaves or trunk). It is intended that this model be used to estimate tree survival under global climate change scenarios, to estimate the range of change required under certain climate

projections and help estimate if real trees in the field can operate in this range and survive in drier and hotter climates (J. Chopard, Murdoch University).

Marri ARC Linkage - Western Australian State Centre of Excellence for Climate Change, Woodland and Forest Health.

An extensive survey of the incidence and severity of *Quambalaria coyrecup* canker disease across the entire marri range has been completed **(Fig. 21).** A total of 62 sites were examined, with 50 trees assessed for canker presence at each site. The survey targeted sites where marri canker disease was most likely to be present, e.g. roadsides and areas of high human impact. The survey shows the disease is widespread across much of the marri range; though the northern and south eastern extremities remain canker free. The Dunsborough-Margaret River-Augusta region has very high canker impact, along with other areas including parts of the south coast and the Perth hills where disease impacts up to 78% of trees. Further surveys will focus on distance from a disturbance, e.g. major road, as a predictor of canker presence, to verify that the extent of impact of the disease is strongly correlated with the level of human disturbance.

The role of phytophthora species as fine feeder root pathogens predisposing marri to canker disease continues to be investigated. Todate, a number of species including *P. cinnamomi, P. cryptogea, P. elongata, P. multivora* and *P.* sp. *ohioensis* have been isolated from marri roots and rhizosphere soil. Pathogenicity trials are underway to determine their impact on marri health.

A field trial is currently being conducted using artificially inoculated marri saplings to assess the efficacy of phosphite, Medicap (complete nutrients) implants and a range of fungicides in limiting canker development. These trials will also be replicated in stands of naturally infected trees to determine whether these single-tree treatments can slow, halt, or reverse the rate of marri decline.

Seed has been collected from marri to conduct a range-wide provenance trial. Seed will be germinated this summer for planting out next winter at field sites in Margaret River, Albany and Mundijong. These field trials and additional glasshouse trials will provide information on whether there is variation in susceptibility to *Q. coyrecup* and *Q. pitereka* in marri from different provenances, and whether susceptibility is influenced by disease condition of the parent tree, with the ultimate aim being to develop disease resistant lines for replanting in areas of high disease pressure. In addition, the trials will also assess whether genetics and environment interact to influence plant condition and disease progression, and examine the role of drought and waterlogging in predisposing marri to canker development (T. Paap, Murdoch University).

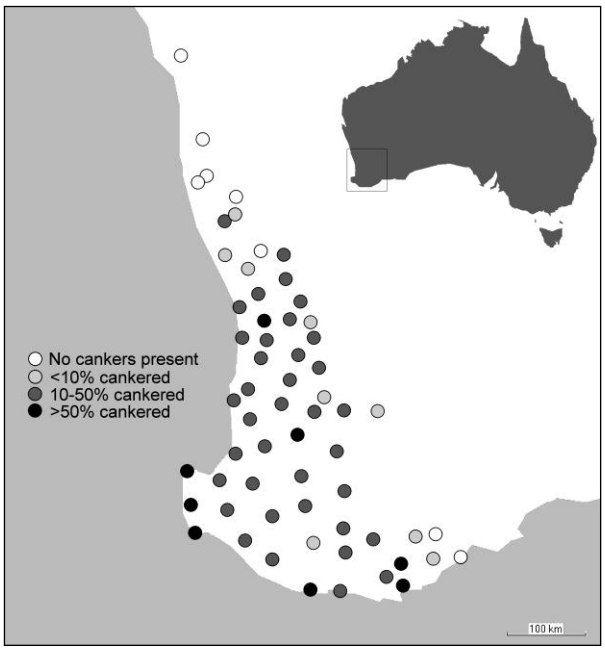

Figure 21: Incidence of marri canker across the range of marri in the south-west (above)

9.9.4 Student projects

a). PhD students

Agnes Simamora (Murdoch University) Multiple new phytophthora species from Western Australia: taxonomy, pathogenicity, and disease control (Supervisors: T. Burgess, G. Hardy, Murdoch University, M. Stukely, DPaW)

The aim of this thesis is to identify phytophthora isolates using DNA sequence data from rDNA internal transcribed spacer regions (ITS) and the mitochondrial cox1 genes in association with morphological and physiological characteristics. In addition, pathogenicity tests and the disease control of selected isolates from all the new species described will be undertaken. The outcome of this study will be to increase the knowledge about the species of phytophthora present in native plant communities in Western Australia, their pathogenicity and their potential control by phosphite.

A re-evaluation has been made for some phytophthora isolates with similar morphological characters to *P. arenaria*, but with some variation in ITS region sequences, and which have been referred to as *P.* aff. *arenaria* type I (with the vast majority of isolates coming from nurseries and urban tree plantings, and predominantly from eucalyptus) and type II (predominantly from natural vegetation on the northern sandplains). A re-evaluation of these species using morphological, physiological, and molecular characteristics using a combination of 4 gene regions, cox1, HSP90, enolase

and BT, suggests that type I isolates are *P. alticola,* while type II isolates are *P. arenaria.* Thus the species that has been found in the nursery on eucalyptus is *P. alticola*.

Pathogenicity trials using *P. alticola*, *P. arenaria*, and *P. cinnamomi* isolates on one- and three-month-old eucalyptus seedlings (*E. polybractea*, *E. kochii* subsp. *plenissima*, *E. kochii* subsp. *borealis*, *E. loxophleba* subsp. *lissophloia*, and two seedlots of *E. loxophleba* subsp. *gratiae*) in the glass house indicated that *P. alticola* can infect all eucalyptus seedlings whilst *P. arenaria* had no/less effect. *P. cinnamomi* infected *E. kochii* subsp. *plenissima*, *E. kochii* subsp. *borealis* and *E. loxophleba* subsp. *lissophloia* (A. Simamora, Murdoch University).

Louise Croeser (Murdoch University): Is the widespread decline in the health of *Corymbia calophylla* (Marri) driven by Phytophthora root disease?

It is thought that environmental or biological factors are contributing to the decline by predisposing the trees, and *Phytophthora multivora* has been isolated routinely from the soils underneath dying marri, leading to the hypothesis that phytophthora root disease reduces the health and vigour of marri, allowing the endemic pathogen *Quambalaria. coyrecup* to take hold. Field surveys have been done to determine the extent of phytophthora infection in the soils from underneath marri. The *Phytophthora* spp. isolated from soils were used in trials such as inoculating marri branches, as well as inoculating the soil of marri seedlings in glasshouse trials. Once these experiments are concluded and the effect of *Phytophthora* spp. determined, another set of experiments will be conducted to determine the synergistic effect of dual inoculation with both *Phytophthora* spp. and *Q. coyrecup*.

Lily Ishaq (Murdoch University): The role of mycorrhizal fungi in tuart (*Eucalyptus gomphocephala*) health (Supervisors: P. Barber, M. Calver, B. Dell, Murdoch University).

The health of tuart is declining within its natural range in south-western Australia. In a pilot study to assess whether changes in mycorrhizal fungi and soil chemistry might be associated with tuart decline, we set up a containerised bioassay experiment with tuart seedlings as the trap plant using intact soil cores collected from 12 sites with tuart canopy condition ranging from healthy to declining. Adjacent soil samples were collected for chemical analysis. The type of mycorrhiza (arbuscular or ectomycorrhizal) formed in containerized seedlings predicted the canopy condition of tuart trees at the sites where the cores were taken. Ectomycorrhizal fungi colonization was higher in seedling roots in soil taken from sites with healthy canopies, whereas colonization by arbuscular mycorrhizal fungi dominated in roots in soil taken from sites with declining

canopies. Furthermore, several soil chemical properties predicted canopy condition and the type of mycorrhizal fungi colonizing roots.

Other PhD projects at Murdoch University include:

- Brad Evans (Murdoch University): Climatic impacts on forest ecosystems in the south west of Western Australia
- Jason Hamer (University of Western Australia): Keeping up with climate change: the vulnerability of eucalypt species to a drying climate in south-western Australia.
- Sonja Jakob (University of Western Australia): The role of mycorrhizal fungi in healthy and declining eucalypts.
- Cielito Marbus (Murdoch University): The epidemiology and host-pathogen interactions of *Quambalaria pitereka* associated with marri (*Corymbia calophylla*).
- Tracey Moore (Murdoch University): Eucalyptus wandoo decline and its influence on wildlife.
- Emma Steel (Murdoch University): Migration of vegetation complexes in relation to the changing climate of the northern jarrah forest.

b). Honours students

Stephen Seaton (Murdoch University): The interaction of drought and the outbreak of *Phoracantha semipunctata* (Coleoptera: Cerambycidae) on tree collapse in the northern jarrah (*Eucalyptus marginata*) forest (Supervisors: G. Hardy, G. Matusick, Murdoch University).

Phoracantha semipunctata Fabricius is an endemic Cerambycid beetle to the northern jarrah forest (NJF) of south-western Australia that attacked collapsed trees following the recent drought and event in 2010/11 in the NJF. Results from this study showed that:

- There was a strong association between *P. semipunctata* infestation and the health of the trees, with the borers concentrated in trees in collapsed sites with an average of 4.5 emergence holes m^2 of *P. semipunctata* for the first 2m of the tree in collapsed areas compared to an average of 0.1 emergence holes m^{-2} in the healthy intact areas.
- *Phoracantha semipunctata* were attracted to trees that had lost all or part of their canopy or had died since the drought with 94 % of individuals in these trees and less than 1 % of *P. semipunctata* in healthy trees with an intact canopy.
- Infestation levels within trees were very high with a maximum of 429 emergence holes per tree for jarrah and 345 emergence holes per tree for marri. Averaged

across four collapsed sites, marri had higher levels of infestation with 15.42 emergence holes m^{-2} compared to jarrah with 10.55 emergence holes m^{-2} for the entire tree.

- The differences in the total *P. semipunctata* emergence holes m^{-2} between jarrah and marri was a result of a complex interaction of tree height and diameter over bark (DOB), where number of emergence holes m^{-2} decreased with height and tree species, giving a range of responses at different sites.
- However, a consistent feature of *P. semipunctata* infestation in the NJF was the occurrence of collapsed patches of various sizes and different numbers of *P. semipunctata* across the NJF (S. Seaton Murdoch University).

c). Other Honours projects at Murdoch University include:

- Briony Williams (Murdoch University): Insects as vectors of *Quambalaria pitereka* - the causal agent of shoot and flower blight on marri (*Corymbia calophylla*)

9.10 Publications

Not reported.

9.11 Forest Health Capability

Potential research/technical staffs that have expertise in areas of either Mycology or Entomology associated with forest health issues in WA.

2. Mr Ian Dumbrell (A/Manager)
   (Forest Science & Industry Development)

   Forest Products Commission, Robertson Drive
   Bunbury, WA 6230.

3. Mr Andrew Lyon
   (Principal Scientist & Manager – Science and Technical Standards)

   Forest Products Commission, 3 Baron Hay Court
   Kensington, WA 6151.

4. Dr Richard Robinson (Senior Research Scientist)
   (Science and Conservation Division)

   Department of Parks and Wildlife, Locked Bag 2
   Manjimup, WA 6258.

5. Dr Janet Farr (Research Scientist)
(Science and Conservation Division)

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Acknowledgements

This report is a compilation of information supplied by research staff and land managers from south-west WA. The names of the contributors and their institutions are acknowledged throughout the report.

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10.0 Annual Forest Health and Biosecurity Report of Queensland

10.1 Surveillance activities

HQPlantations forest health surveillance is currently a mix of pro-active and re-active surveys, inspections and associated research that are based on operational requirements and biosecurity importance. Project-specific tasks continue to dominate activities in response to specific risk issues. Surveys and research based monitoring of *Sirex* continues within the Passchendaele plantations (QLD/NSW border region), by way of a structured program using static panel traps, trap tree plots, nematode inoculations and billet monitoring and parasitoid releases. Trapping for *Sirex* was also undertaken within plantations north of Toowoomba (Geham, Pechey & Esk) and in coastal south east Queensland at Beerburrum and north to the Fraser Coast and surrounds. This

[9] HQPlantations continues to undertake specific forest health surveys and assist in Biosecurity responses with the fundamental aims being pest and disease freedom from seed to the final plantation product. The sirex bio-control response has been a major production focus with this work limiting general forest health surveillance during this reporting period. Surveillance methodology is based on a broad spectrum overview of plantation health although targeted pest specific surveys and responses are now tending to dominate. Priority management activities, other than the up-scaling of the sirex bio-control and monitoring program, have been the continued management of rat populations within Araucaria plantations, feral dog control, pine aphid monitoring, participation in the bio-control of cats claw vine and surveys for the presence of myrtle rust (*Puccinia psidii*) within hardwood plantations.

trapping program included the placement of static panel traps at the Queensland Commodity Exports (QCE) site at the Port of Brisbane.

Nursery surveys were undertaken within HQPlantations major production nursery at Toolara. No formalised surveys were carried out within Southern Pine (*Pinus* spp.) or *Araucaria* plantations although a number of identification and technical response investigations were undertaken. Extensive and wide-ranging surveys were undertaken within HQPlantations hardwood estates targeting the detection of myrtle rust. Identification and the recording of numerous other pests and diseases within the hardwoods also occurred.

10.2 Plantations (Softwood)

10.2.1 Insect pests:

No new insect pests were identified within any Southern Pine (*Pinus*) plantations. The exotic wood wasp *Sirex noctilio* continues to increase in population within its current known most northern range within the Passchendaele estate. Trapping at centres outside of this area have failed to intercept *Sirex*.

A range of established exotic beetles such as *Ips grandicollis*, *Xyleborus perforans* and *Truncaudum agnatum* continue to cause economic losses following events such as wildfires, tropical cyclones etc. Low key surveys continue for parasitised mummies of the aphid *Essigella californica*. A few mummies have been found on 7 year old *Pinus* within a single Passchendaele release site.

Significant numbers of "army grubs" were again observed within young *Araucaria* plantations throughout south east Queensland. Grazing damage was limited to wild ink-weed *Phytolacca octandra* in the plantation inter-rows. The caterpillar species involved proved not to be the "caco army worm" *Tiracola plagiata*, which caused extensive damage to *Araucaria* plantations early in 2010. No jewel beetle defoliation or longicorn grazing has occurred since the rare outbreak recorded in young *Araucaria* early 2008. The dominant insects involved in this significant and possibly weather-linked event (wet following extended drought) were the jewel beetles *Prospheres aurantiopictus* and *Araucariana queenslandica* and the longicorns *Temnosternus imbilensis and Temnosternopsis niveoscriptus*. All of these insects were *Araucaria* specific.

10.2.2 Pathogens

No new primary pathogen damage to the Southern Pine plantations was recorded. *Armillaria* spp. is present within Gambubal plantations (east of Warwick) and is associated with very old hardwood stumps dating back to the original land clearing. Deaths still occur due to this root rot pathogen in one area of a compartment adjacent to conserved rainforest. Although *Armillaria* was regarded as a benign and insignificant pathogen in coastal plantations (a few records exist) it contributed to extensive white rot within stored logs at Beerburrum in the early 1990's.

Dothistroma septosporum and *Cyclaneusma minus* persist at Gambubal and continue to cause extensive yet seasonal linked defoliation. Diplodia whorl canker (*Diplodia sapinea*) positioned in upper leader whorls is intermittent within *P. radiata* at Gambubal, especially in trees that are approaching or have obtained canopy closure. *Diplodia sapinea* typically is also associated with upper canopy dieback within *P. radiata* following severe hail events as well as deaths following severe frost to very young *Pinus* spp. No reports were received of severe hail or frost events. *Diplodia* has not been found to be associated with primary dieback in Queensland. Staining Ophiostomatoid fungi such as *Ophiostoma ips* continue to affect damaged, stressed and harvested timbers.

10.2.3 Vertebrate pests

Damage by vertebrates such as deer and rats are still common in *Pinus* and *Araucaria* plantations but only occasionally cause economic damage. Deers graze the leaders and bark of young trees which results in deformed stems and leaders throughout (e.g. Esk State Forest, Benarkin State Forest). Rat damage including tree death through root excavation and girdling of both the roots and stems within Araucaria plantations can be extensive but intermittent. Rat surveys in young Araucaria plantations over the past few years have determined minimal, non-damaging background populations needing no preventative or remedial actions. The last major rat outbreaks (winter2010 and to a lesser extent winter 2011) resulted in extensive plantation damage by the native pale field rat *Rattus tunneyi* var. *culmorum*.

Wild horses are now problematic within coastal areas from Beerburrum to the Fraser Coast. Estimates are that populations are increasing by 5% each year. They pose a safety hazard to the travelling public where they graze of the roadside verges and can cross the highways which cut through the plantation estate. A trapping and re-location

program has been instigated to reduce numbers and a draft management plan is being considered.

10.2.4 Climatic disorders

Drought/extended dry periods and wildfires continue to affect coastal *Pinus*. Insects such as *Ips grandicollis* can cause economic losses to harvested timbers following wildfires. No wide-scale dieback can be attributed to *Ips* within drought areas. The aphid *Essigella californica* may be associated with increased chlorosis of canopy needles and possibly defoliation during dry periods, especially on poorer sites e.g. shallow, rocky ridges.

10.2.5 Other

A number of bio-control programs in Queensland targetting cat's claw creeper *Dolichandra unguis-cati* including the Tingid *Carvalhotingis visenda,* the leaf mining Jewel beetle *Hylaeogena jureceki* and the leaf-tying moth *Hypocosmia pyrochroma*. HQPlantations is working with Gympie and District Landcare (who manage a biocontrol agent rearing facility) via the release and monitoring of biocontrol agents in high conservation value areas managed by HQPlantations in the Mary Valley and Toolara, west and east of Gympie, respectively.

10.3 Plantations (Hardwood)

Myrtle Rust *Puccinia psidii* is now established throughout coastal Queensland as well as within more inland regions such as Toowoomba in the south east and Atherton Tablelands in north Queensland. The Biosecurity Queensland "Transition to Management" group (in which HQPlantations participated) has been meeting every two months to discuss surveillance, monitoring and control activities related to the spread of myrtle rust. This group's focus was on minimising the potential economic impact of myrtle rust, but has now been disbanded, with myrtle rust now absorbed into the much larger Biosecurity Program.

Most of HQPlantations' hardwood plantations are within the inland Burnett region. Fifty properties from Beaudesert in south east Queensland to Gayndah in the South Burnett, were surveyed for during the reporting period. Wide ranging pest and disease surveys were carried out on a number of these properties with the target aim to ascertain if myrtle rust was present. While the leaf and shoot blight *Quambalaria* is widespread in these areas, myrtle rust was not detected. In coastal south east Queensland myrtle rust has continued at low incidence (although can be severe on

individual plants) within *Melaleuca quinquenervia* paperbark and riparian areas. Follow-up surveys during 2012/2013 within these areas found that new infections had developed on previously infected *Melaleuca*. It was not been detected within any coastal hardwood plantations.

Moisture stress to Dunn's white gum *Eucalyptus dunnii* quickly resulted in rapid growth loss. Dunn's white gum was largely free from pests and diseases as long as it was planted on wetter sites. Despite the diversity and sometimes severity of insect damage observed during these surveys, plantations looked healthy on the better sites. Species, site selection and exposure to water stress tend to determine the level of insect and pathogen damage sustained.

10.3.1 Insect pests

Within western white gum (*Eucalyptus argophloia*), leaf skeletoniser *Uraba lugens* and plate galling wasp *Ophelimus* sp. damage predominated. Damage caused by these insects was severe. Waves of upper crown "Christmas beetle" defoliation (predominately by *Anoplognathus boisduvalii* and *A. purosus*, and a "repsimus" beetle *Repsimus aeneus*) occurred throughout the summer, yet recovery of affected plantations was swift. Chrysomelid leaf beetles and their larva such as *Paropsis atomaria* and especially *Chrysophtharta* (*Paropsisterna*) *cloelia* were common but in low population density. Distinct alternating timeframes of scarab and chrysomelid chewing were observed with chrysomelid egg masses and newly hatched larvae following upper crown defoliation by scarabs.

A winter bronzing bug *Thaumastocoris safordi (?)* was commonly associated with plantation-wide chlorosis within *Corymbia* in the South Burnett. Erinose mite (*Acalox* spp./*Rhombacus* spp.) was prolific within *Corymbia* causing significant leaf damage followed by defoliation in predominately the lower to half canopy, particularly in trees up to 3 years old. Gum tree scale *Eriococcus* spp. and associated sooty mould was common and scattered throughout plantations up to approximately 18 months old.

The Psyllid *Eucalyptolyma maideni* had a high incidence with multiple lerps covering lower foliage especially in closed canopy situations. Psyllid presence was always associated with sticky and often sooty mould blackened foliage. Scale and psyllids presence tended to increase as moisture stress increased, again predominately on *Corymbia*. A weevil (likely *Gonipterus* spp.) was found in large numbers throughout a range of *Corymbia* plantations, yet direct damage could not be attributed to its presence.

10.3.2 Pathogens

No myrtle rust *Puccinia psidii* was detected on any *Corymbia* or *Eucalyptus* spp. within HQPlantations hardwoods, yet Quambalaria shoot and leaf blight was typically throughout all spotted gum (*Corymbia citriodora* var. *variegata*) plantations. Scattered stunting due to continual high levels of infection severity by *Quambalaria*, with up to 5% of plantings affected, was not uncommon. *Quambalaria* was more prominent in trees to two years of age with older trees tending towards a lower level of severity. Severity on stunted trees was severe but overall scores for the remainder of the plantations was minor, although infection of new expanding foliage in trees less than a year old had in some instances affected 100% of trees.

Other than *Quambalaria*, fungal pathogens affecting leaves were of low incidence. *Teratosphaeria* (=*Mycosphaerella*) was found in a number of plantations (Angus Carnegie, DPI NSW survey). An unknown and potentially serious basal stem canker was commonly scattered throughout a range of *Corymbia* plantations, becoming prominent when plantations were 8-10 years old. Another canker in *Cormybia*, thought to be different to the basal stem canker, appears to start in upper crown branches, working its way down into the stem before causing dead topping and/or tree mortality. Some reports have suggested that this canker follows severe defoliation by *Kirramyces* and *Mycosphaerella*.

10.3.3 Vertebrate pests

No vertebrate damage was reported.

10.3.4 Climatic disorders

An early and extended fire season resulted in a number of wildfires which affected a considerable number of younger plantations. Drought again was pronounced within the inland Burnett region. Insect activity (skeletonising & resultant leaf-fall) was high during this time, especially on *E. argophloia*. Dunn's white gum *Eucalyptus dunnii* grows well in wetter sites but quickly declines when exposed to water stress.

10.3.5 Other

Nil.

10.4 Native forests

Nil

10.5 Nurseries

Surveys at HQPlantations' Toolara Nursery found only minor damping off within potted seed trays of *Pinus*. Widespread and significant dieback of leaders and upper laterals in young *Araucaria* on raised nursery benches was due to sun-hardening associated with plant spacing. Wind-burning and drying of exposed edge plants on sun-benches was also common. Three species of *Phytophthora* have been isolated in the past from soil and plants roots within this nursery but following fumigation appear to have been eradicated.

10.6 Urban and Rural trees

Nil

10.7 Built Environment

10.7.1 West Indian Drywood Termite Management Program

Fumigations

In summary, 16 fumigations were carried out in 2012- 13. This included 10 houses in Brisbane, 2 houses in the Wide Bay area, 2 houses in Townsville (one found on survey), 1 boat on the Gold Coast and 1 lot of furniture in Brisbane. These fumigations were carried out a cost of $490,490 to the Queensland State Government.

Surveys

A total of 44 inspections were carried out in 2012- 13 (10 in Townsville, 34 in Brisbane). As part of the public awareness program, 241 letter drops were carried out in risk areas (i.e. nearby previous detections), including 12 in Townsville and 229 in Brisbane. There were no other timber-in-service issues.

10.8 Biosecurity

10.8.1 Surveillance at high risk sites

The surveillance at high risk sites program continued during 2012/13. Brisbane and Gladstone have been identified as high risk centres in Queensland due to the volume of risk material imported.

The Gypsy Moth Trapping Program: This is a National Program coordinated by DAFF, Australia. The Queensland surveillance network consists of pheromone traps installed at 22 sites across Brisbane and 5 sites at Gladstone. Traps were inspected fortnightly from October 2012 to May 2013 by DAFF Biosecurity staff. No lymantriid moths were collected, amongst 21 Lepidoptera specimens captured. As part of a national trapping array, these traps provide evidence that these pest species are absent from Australia.

The Multiple Pest Surveillance (MPS): This program targets forest and timber pests that have the potential to enter Australia on imported timber and timber products. Although the program targets forestry pests, many other exotic pest species are likely to respond to the lures. During the 2012/13 season three separate lures were trialled to compare their effectiveness in attracting target taxa. A series of Intercept Panel traps were run at six sites in Brisbane and two in Gladstone between January and May 2013. Sites were selected in consultation with staff from the DAFF Australia Operational Science program, based on the risk of introduction of particular pests.

Trapping across both locations resulted in the collection and identification of 93 specimens from 19 species of tree or timber borer, representing the families Cerambycidae (6 species), Bostrichidae (1 species) and Curculionidae, subfamily Scolytinae (12 species). From Brisbane 27 specimens from 16 species were trapped and from Gladstone 66 specimens from 8 species. There have been no detections of quarantine concern. All species collected were either natives (10 species) or exotics already known to be established in Australia (9 species). Due to frequent high rainfall and strong winds overall trap catches were low making it difficult to compare the effectiveness of the different lures.

10.9 Research and Development activities

10.9.1 Insect Pests

Sirex wood wasp research

Queensland sirex research aims to predict how novel hosts and subtropical conditions will impact the biology, behaviour and dispersal of the wood wasp and its biocontrol agents. Results from the 2012/13 season include:

A second year of Sirex emergence studies has indicated an extended emergence period commencing earlier than previously recorded. There is also some evidence for two emergence peaks separated by a decline in numbers in early February.

Overall nematode infection of *Sirex* emerging from billets was almost double that of the 2011/12 season, increasing from 36% to 62%. Nematode infection rate of trap-caught females was similar to last season, at 4.1%, suggesting observed increases in nematode infection are due to improved inoculation techniques. Infection rates were higher in Trap Tree Plots poisoned later in the season, suggesting poisoning trees between November and January may be more effective than poisoning in October.

- Nematodes perform less well in the F2 hybrid compared with the known host, *P. taeda*. This is true for standing trees, felled trees and billets for at least 3 months post inoculation. A number of wood properties, including pit diameter, tracheid width and wood density were compared for the two species, but do not clearly account for the observed differences in nematode performance or spread between the taxa.
- All Sirex females dissected to check for the presence of nematodes in eggs had nematodes present, increasing with progressive ovarian developmental stage from 0 – 100%. This finding allays concerns of the possible failure of nematodes to migrate into eggs under local conditions, but the absence of nematodes in immature eggs requires further investigation.

In summary, results to date suggest Sirex emergence patterns may differ to those from other regions; and nematode survival is lower in hybrids. Results also demonstrate an increase in the effectiveness of the The Trap Tree Plot inoculation program over time.

Stem Defect Modelling

The project began in November 2010 and addresses ways to reduce the impact of stem defects in some subtropical hardwood species in Queensland's plantations.

Susceptibility to damage by borers varies with tree species as well as site conditions and location. The research is developing a model that assesses the risk of stem damage by insect borers in relation to hardwood species grown in different locations and site conditions. This will enable the plantation industry to match tree species with appropriate growing conditions in Queensland in the future.

Tree surveys

Intensive surveys for stem defect agents, together with collection of tree and stand variables, of 20 spotted gum (*Corymbia citriodora* ssp. *variegata:* CCV) and 19 flooded gum plantations (*Eucalyptus grandis*) in southeast Queensland and northern NSW were carried out during the year. Preliminary analyses of the CCV data have been now carried out with the early results summarised below.

- *Phoracantha solida* was the predominant borer in CCV plantations.
- Preliminary results suggest that tree stress, through an association with high stocking rates and/or nutritional deficiencies is an important associate of attack by *P. solida*.
- Higher incidences of *P. solida* in older aged plantations (10 + years) or in landscapes with greater levels of habitat cover were expected, but high levels of variability within each category suggest there may be multiple predictors of borer incidence (such as those associated with tree stress) that need to be accounted for before the statistical significance of these variables can be tested individually.

Only a subset of the variables measured as a part of the study have so far been analysed. A large array of climate, management, landscape, stand and tree data is now being analysed.

Effect of *P. solida* attack on wood quality in CCV

A total of 24 trees with varying severity of borer attack were felled from two CCV plantations and billets from these trees processed by a spindleless lathe. High-resolution images of the veneer sheets were taken, pre-processed to identify borer associated defect and then stitched to give a continuous representation of peel. A program is under development that will use these images to virtually reconstruct the billet and quantify the volume of defect.

10.9.2 Diseases

Myrtle Rust

Disease screening

Screening for patterns of resistance to *P. psidii* has continued with a focus on selected seed orchard families of *C. variegata* (Woondum provenance). This work has also been coupled with studying the interaction between *Puccinia psidii* and *Quambalaria pitereka*. Results suggest that resistance to one pathogen does not infer resistance to the other. However, preliminary results do suggest approximately 20% of the population tested is resistant to both diseases suggesting that efforts to enhance these traits through breeding have reasonable prospects for success.

Other species screened recently include *E. grandis*, *E. dunnii*, *E. globulus*, *E. camaldulensis*, *E. camaldulensis* subsp. *simulata*, *E. pellita* and *E. urophylla*. Screening work has been done for these species in collaboration with FABI in South Africa as well as University of Tasmania and CSIRO investigating heritability and identification of resistance markers in species populations.

Impact assessments

The impact of *Puccinia psidii* in native ecosystems has continued with a focus on *Melaleuca quinquenervia*. Results to date show a correlation between infection levels and growth rate as well as reduced flowering rates. Epidemiological data is also been collected with close to 2 years worth of disease incidence and severity data in relation to climatic condition collected. Assessments into host range and susceptibility and geographic distribution have also continued but with a reduced capacity due to funding limitations.

10.10 Publications

Lewis T, Debuse VJ (2012) Resilience of a eucalypt forest woody understorey to long-term (34-55 years) repeated burning in subtropical Australia. *International Journal of Wildland Fire* **21(8)**: 980 - 991.

Hayes, RA, Nahrung HF, Lee DJ (2013) Consequences of *corymbia* (Myrtaceae) hybridisation on leaf-oil profiles. *Australian Journal of Botany* **61(1)**: 52 - 59.

Nadel RL, Wingfield MJ, Scholes MC, Lawson SA, Slippers B (2012) The potential for monitoring and control of insect pests in southern hemisphere forestry plantations using semiochemicals. *Annals of Forest Science* **69(7)**:757 - 767.

Nahrung HF, Hayes RA, Waugh R, Lawson SA (2012) Corymbia leaf oils, latitude, hybrids and herbivory: a test using common-garden field trials. *Austral Ecology* **37(3)**: 365 - 373.

Nahrung HF, Waugh R (2012) Eriophyid mites on spotted gums: population and histological damage studies of an emerging pest. *International Journal of Acarology* **38(7)**: 549 - 556.

Seeman OD, Nahrung HF (2012) Precopula and female-biased sex ratio in *Iphiolaelaps womersley* (Acari: Mesostigmata: Iphiopsidae). *Systematic and Applied Acarology* **17(4)**: 355 - 356.

10.11 Forest Health Capability

10.11.1 Department of Agriculture, Fisheries and Forestry

Dr Simon Lawson (Entomology)

Dr Geoff Pegg (Entomology)

Dr Manon Griffiths (Entomology)

Dr Andrew Hayes (Chemical Ecology)

Dr Valerie Debuse (Insect and landscape ecology)

Dr Tim Smith (Tree nutrition)

Ms Janet McDonald (Forest Health Surveillance)

10.11.2 HQPlantations

Mr Michael Ramsden (Forest Health Officer)

10.11.3 University of the Sunshine Coast

Dr Helen Nahrung (Entomology)

10.11.4 Timber-in-service capacity

Mr Jock Kennedy (West Indian Drywood Termite Program)

Mr Chris Fitzgerald (Entomology – Termites)

Mr John Bain, Mr Lindsay Bulman and Dr Rebecca Ganley

Forest Protection, Scion (New Zealand Forest Research Institute Ltd.), 49 Sala Street, Rotorua 3046, New Zealand.

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11.0 Annual Forest Health and Biosecurity Status Report[10] of New Zealand

11.1 Surveillance activities

New Zealand's forests are comprehensively surveyed annually for pests, diseases and disorders. The Ministry for Primary Industries (MPI) undertakes a High Risk Site Surveillance programme which targets high risk regions such as shipping ports, airports, parks and tourist regions. The surveys also involve surveillance of native forests and urban areas throughout New Zealand. The New Zealand Forest Owners' Association undertakes thorough ground and aerial surveys of its forestry estate. Samples from both surveillance programmes are sent to Scion's Forest Health Reference Laboratory for diagnosis.

11.2 Plantations (Softwood)

11.2.1 Insect pests

Pinus radiata

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

Douglas-Fir (*Pseudotsuga menziesii*)

No major insect pests are reported.

[10] **Collated and summarised by authors from data and information from the Forest Health Database, *Forest Health News* (Scion), and the Forest Health Reference Laboratory.**

Cypress spp.

No major insect pests are reported.

11.2.2 Pathogens

Pinus radiata

a). Dothistroma needle blight (*Dothistroma septosporum*)

A total of 60,566 ha were sprayed throughout the North Island during the 2012-2013 summer **(Fig. 28).** To put this in context, New Zealand has about 750,000 ha of *Pinus radiata* in the susceptible age class of 1-15 years, so well less than 10% of the susceptible area was sprayed. There have been significant variations in the area treated for *Dothistroma septosporum*, with levels building up over 3-5 years and then subsiding as a result of a very dry summer. The last three years have shown some stability return with the area treated being very similar The past year was initially on track to be considerably larger than what it finished up being. This was due to a significant drought in early 2013 that reduced the need to apply a second spray. This in turn will very likely affect the area requiring treatment in 2013/2014. A notable feature of the just completed season was the number of forests in Hawkes Bay requiring treatment. Traditionally dothistroma needle blight is not common in Hawkes Bay, but this year many of the foothills forests had spray programmes.

Forest health assessments taken during the Forest Owners' Association pest detection surveillance programme indicated dothistroma needle blight was most severe in the central North Island and the top of the South Island in Nelson and Marlborough. The number of dothistroma needle blight records decreased from almost 900 in 2011-2012 to just over 400 in 2012-2013, reflecting the dry conditions experienced in early 2013.

b). Cyclaneusma needle cast (*Cyclaneusma minus*)

Based on observations made during the pest detection surveys, the severity of cyclaneusma needle cast remained at low levels experienced over the past few years. There were 359 reports of cyclaneusma needle cast in the forest health database with the average severity lower than previous years. Cyclaneusma needle cast does not appear to be the significant problem it was 10 to 20 years ago, probably because the highly susceptible genotypes have been removed from the breeding population.

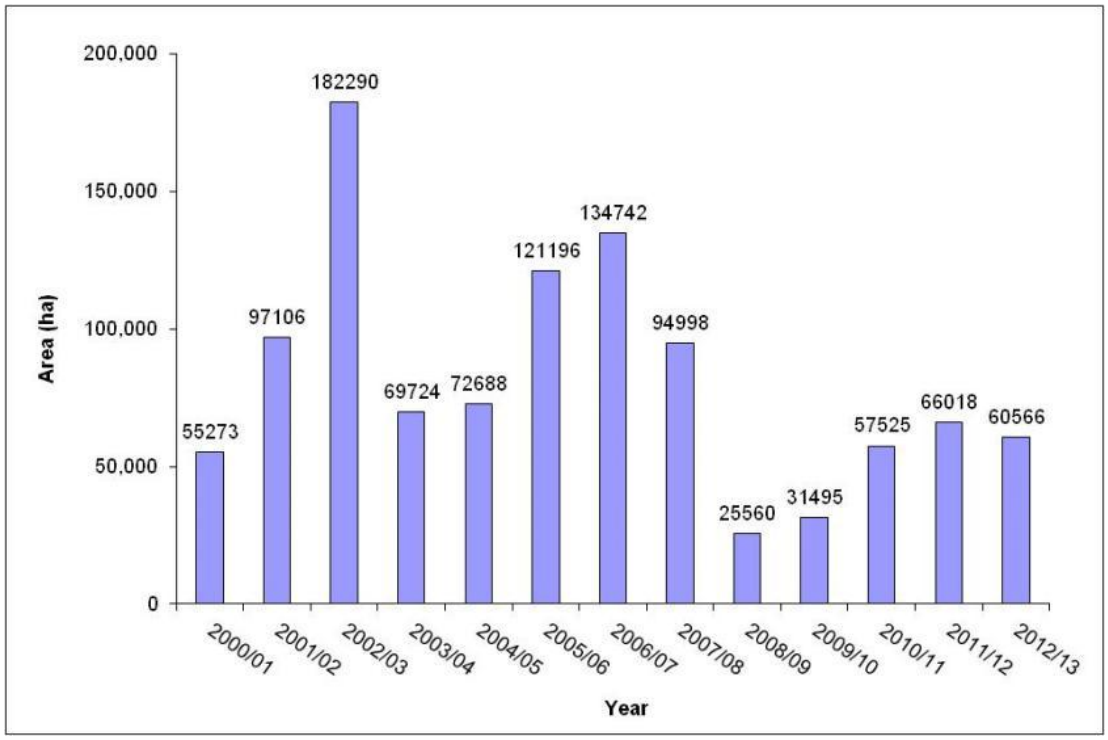

Figure 28: Area sprayed annually for dothistroma control in the North Island

c). Nectria flute canker (*Neonectria fuckeliana*)

As previously reported, management regimes to control nectria flute canker have resulted in a significant reduction in the number of trees affected. There has been no further northward extension to the range of *Neonectria fuckeliana* which remains restricted to the lower half of the South Island.

d). Armillaria root rot

Armillaria root disease, caused primarily by *Armillaria novae-zelandiae*, remains widespread but scattered in many *P. radiata* plantations throughout much of the country. There were 383 reports of armillaria root disease in the forest health database.

e). *Phytophthora cactorum*

Small patches of mortality associated with *Phytophthora cactorum* infection still occurred in some plantations in the northern South Island. Symptoms include severe resinosus at the root collar and lower stem, similar to that caused by *Armillaria* infection. There was no sign of armillaria, or of the other known causes of basal resinosus and *P. radiata* mortality. Overall the incidence is very low and appears isolated.

f). Physiological needle blight

Reports of physiological needle blight (PNB) were much lower for 2012-13 than previous years, again occurring in early to late spring. PNB tends to be sporadic and localised to a few regions.

g). Red needle cast (caused by a fungal complex)

Disease reports for red needle cast were low with only 332 reports, and the average severity of the disease was also lower than in previous years. Red needle cast was reported in early to late spring, however a summer drought and an uncharacteristically warmer and drier winter resulted in no confirmed disease reports for the remainder of the year. Red needle cast has been reported throughout the North Island and in the northern South Island.

Douglas-Fir (*Pseudotsuga menziesii*)

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

Swiss needle cast disease (*Phaeocryptopus gaeumannii*) remains the most significant disease of Douglas-fir throughout New Zealand.

Cypress spp.

a). Cypress canker (*Seiridium* spp.)

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

11.2.3 Vertebrate Pests

Nothing significant to report.

11.2.4 Climatic Disorders

Nothing significant to report.

11.2.5 Other

(Biological control agents)

a). Buddleia leaf weevil (*Cleopus japonicus*).

The buddleia leaf weevil, *Cleopus japonicus* (Curculionidae), a biological control agent for the weed buddleia (*Buddleja davidii*), continues to spread throughout New Zealand and each season the area defoliated by this weevil grows. The agent continues to be liberated in new areas by councils and forestry companies and is doing very well in most areas (**Fig. 29**).

Figure 29: Complete defoliation of *Buddleja davidii*.

b). Gum leaf skeletoniser (*Uraba lugens*)

The biological control agent (*Cotesia urabae* (Braconidae)) that was imported from Tasmania is now quite widespread in Auckland and has been released and recovered from Whangarei in Northland.

11.3 Plantations (Hardwood)

11.3.1 Insect pests

Eucalyptus spp.

a). Gum leaf skeletoniser (*Uraba lugens*)

The distribution of *Uraba lugens* (Nolidae), the gum leaf skeletoniser, has remained virtually unchanged; it is found mainly in the north half of the North Island and also in Nelson near the top of the South Island. It still has not yet been reported as a concern in commercial plantations, and is causing significant damage only on amenity trees in the Auckland region.

b). Eucalyptus tortoise beetle (*Paropsis charybdis*)

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. *Enoggera nassaui* (Pteromalidae) continues to play a significant role in the control of *P. charybdis* in some areas.

c). Bronze bug (*Thaumastocoris peregrinus*)

Last year the presence of *Thaumastocoris peregrinus* (Thaumastocoridae) in New Zealand (Auckland) was reported. It is still confined to Auckland but is slowly spreading. It has now been found approximately 16 km from the initial site. Studies by a University of Auckland student have shown that the bronze bug continues to breed all year round, slowing down but not stopping reproduction even over the cold winter months. Its favoured host is *Eucalyptus nicholii* and it can be severely "bronzed".

11.3.2 Pathogens

Eucalyptus spp.

a). Septoria leaf blight (*Kirramyces eucalypti*)

Low level of foliage disease.

b). *Fairmaniella leprosa*

Low level of foliage disease.

c). Mycosphaerella leaf disease (*Mycosphaerella cryptica*)

Low level of foliage disease.

11.3.3 Vertebrate Pests

Nothing significant to report.

11.3.4 Climatic Disorders

Nothing significant to report.

11.3.5 Other

a). Nutrition

There were no major nutrient issues in 2012 or 2013.

11.4 Native Forests

11.4.1 Insect pests

Nothing significant to report.

11.4.2 Pathogens

a). Kauri dieback disease and *Phytophthora* taxon Agathis (PTA)

Surveys to determine the distribution of PTA were completed. Although the known colonised area has expanded, PTA has not been detected in a number of the areas sampled. Improving track construction and drainage in forest areas where PTA is known to be present has been continued in an attempt to help reduce the spread of the disease. There have also been trial closures of walking and cycling tracks in some parks, or re-routing tracks away from kauri. Trials of injected phosphite to treat the disease have shown promising laboratory results and field tests established in the Waitakere ranges and in Northland are still ongoing.

11.4.3 Vertebrate pests

a). Australian brushtail possum (*Trichosurus vulpecula*)

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

11.4.4 Climatic Disorders

Nothing significant to report.

11.4.5 Other

Nothing significant to report.

11.5 Nurseries

Nothing significant to report.

11.6 Urban and Rural areas

11.6.1 Dutch elm disease (*Ophiostoma novo-ulmi*)

The pathogen, *Ophiostoma novo-ulmi*, currently remains confined to the greater Auckland region. One targeted continuous disease detection survey was carried out in the 2012/13 season. It started during December 2012 and finished during May 2013. A trapping programme for *Scolytus multistriatus*, the vector of the Dutch elm disease, in high risk areas to determine sources of infection or large amounts of breeding material was undertaken with 71 traps deployed. Diseased elms were found at 42 locations. The greatest majority of infected sites came from East (15) and South Auckland (18). Other sites were from North Shore (5), West Auckland (2) and central Auckland (2). The number of infected elms increased from 31 in 2011/12 to 166 this season. Of the 6,248 beetles trapped, 82 (1.31%) were found to be carrying *O. novo-ulmi* (**Fig. 30)**. The number of beetles trapped was significantly higher than the 2,200 beetles trapped in the previous year. The percentage of beetles carrying *O. novo-ulmi* was also higher than in 2011/12, when only 0.55% carried viable spores.

Over the five seasons prior to 2012-13, diseased elms were found in three main areas, North Shore, South Auckland, and East Auckland (**Fig. 31**). The pathogen and disease also existed in West Auckland and central Auckland. In the 2012-13 season, there has been a very significant expansion in area southwards through Papakura, along with the discovery of more infected elms in West Auckland and central Auckland. The number of locations where diseased trees have been found almost doubled from 24 to 42.

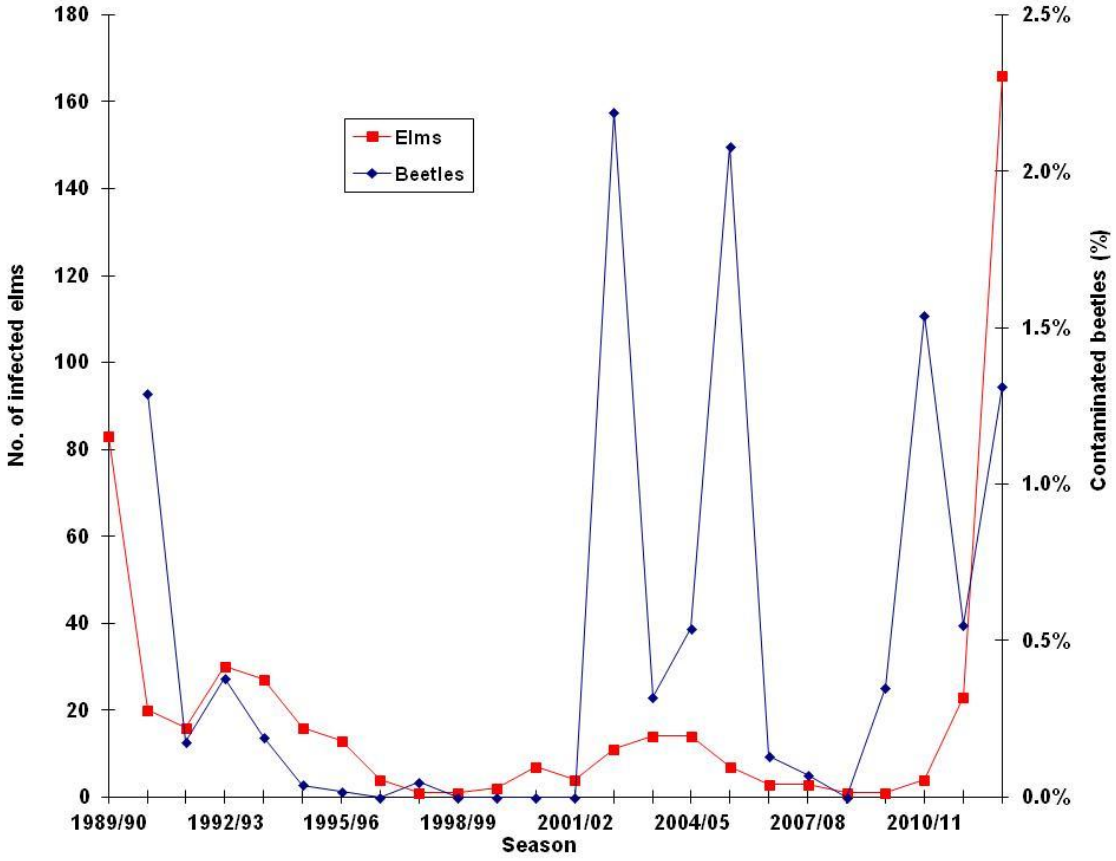

Figure 30: Infected elms and infective beetles 1989-90 to 2012-13

In February 2013, a very large group of dead and dying elms was found at Kingseat Hospital in Drury. This site was inspected in the very early days of the programme but had not been regularly inspected over the past 15 years. Approximately 200 trees were suspected to be infected. This is one of the largest outbreaks of the disease since its discovery **(Fig. 32).**

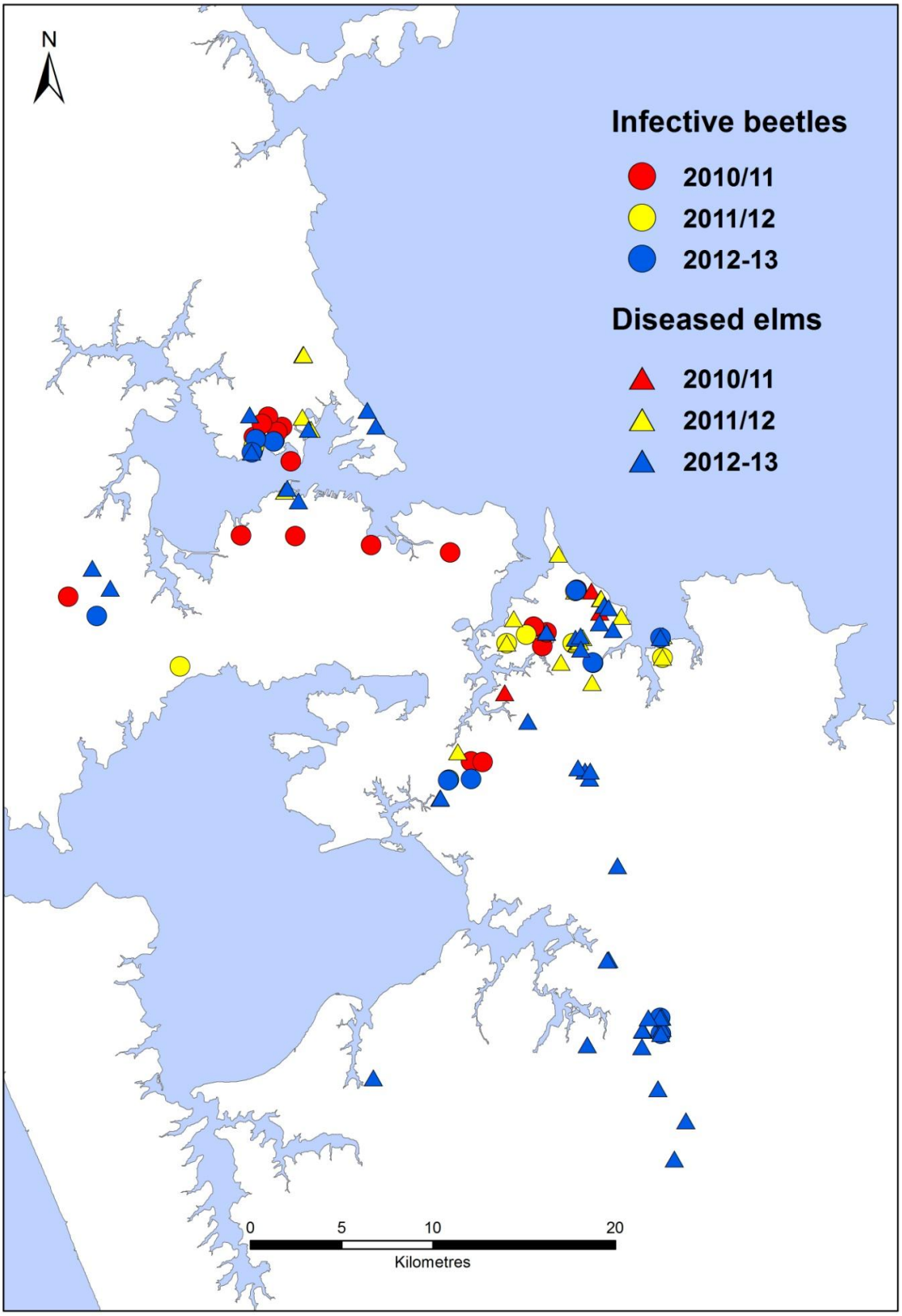

Figure 31: Geographic locations of diseased trees and infective beetles over the past three seasons

Figure 32: A large group of dead and dying elms at Kingseat Hospital in Drury

11.7 Built Environment

Not reported.

11.8 Biosecurity

The following new records were validated, investigated and reported in 2012-13.

11.8.1 Eucalyptus leaf beetle (*Paropsisterna beata*)

In August 2012, *Paropsisterna beata* (Chrysomelidae) was found on single property in Wightman's Valley, Upper Hutt, near Wellington on *Eucalyptus* species. Only adults and eggs were found. *Paropsisterna beata* is an Australian species and the adults and larvae feed on the foliage of eucalypts. In Australia it has been recorded from *E. bridgesina, E. camaldulensis, E. dunnii, E. grandis, E. moluccana* and *E. polyanthemos.* Its host range is almost certainly greater than this.

As part of an eradication programme the Ministry for Primary Industries carried out two aerial insecticide spray operations on the Whiteman's Valley property in late April, early May and October. More spray operations are planned for February 2014.

11.8.2 *Pythium macrosporum*

This oomycete was obtained from soil collected from under a *Grevillea robusta* with basal resin bleeding. Although *P. macrosporum* is a potential plant pathogen, it is unlikely that caused the resin bleeding on the *G. robusta*. *Pythium macrosporum* has been found causing minor cavity spotting on carrots in Canada (Allain-Boulé *et al*., 2004), root diseases of flowering bulbs in the Netherlands, and damping-off on cabbage and cucumber seedlings in Japan (Uzuhashi *et al*., 2008).

Allain-Boulé, Lévesqueb C, Martineza C, Bélangera RR, Tweddella RJ (2004) Identification of *Pythium* species associated with cavity-spot lesions on carrots in eastern Quebec. *Canadian Journal of Plant Pathology* **26**: 365 - 370.

Uzuhashi S, Tojo M, Kobayashi S, Tokura K, Kakishima M (2008) First records of *Pythium aquatile* and *P. macrosporum* isolated from soils in Japan. *Mycoscience* **49**: 276 – 279.

11.9 Research & Development activities

Scion is New Zealand's leading authority on forest health and biosecurity, with a scope that includes plantation, natural and urban forests. Scion has extensive research programmes in pathology, entomology and pest management. A summary of Scion's biosecurity and rural fire research can be found at http://www.scionresearch.com/general/publications/technical-reports/forest-biosecurity/forestbiosecurityand-protection-annual-science-reports.

11.10 Publications

Avila G, Berndt LA, Holwell GI (2013) Dispersal behaviour of the parasitic wasp *Cotesia urabae* (Hymenoptera: Braconidae) - A recently introduced biocontrol agent for the control of *Uraba lugens* (Lepidoptera: Nolidae) in New Zealand. *Biological Control* **66:** 166 – 172.

Avila G, Berndt LA, Holwell GI (2013) First releases and monitoring of the biological control agent, *Cotesia urabae* Austin and Allen (Hymenoptera: Braconidae). *New Zealand Entomologist* **36(2)**: 65 - 72.

Bain J, Sopow SL, Bulman LS (2012) The sirex wood wasp in New Zealand: History and current status In Slippers B, de Groot P, Wingfield MJ(Eds.),The sirex wood wasp and its fungal symbiont (pp. 167 - 173). *Springer*, The Netherlands.

Barbaro L, Brockerhoff EG, Giffard B, Van Halder I (2012) Edge and area effects on avian assemblages and insectivory in fragmented native forests. *Landscape Ecology* **27(10)**: 1451 1463.

Berndt LA, Sharpe AM, Gresham BA, Hayes D, Allen GR (2012) Laboratory rearing *of Cotesia urabae* Austin and Allen (Hymenoptera: Braconidae), a biological control agent of *Uraba lugens* Walker (Lepidoptera: Nolidae). *New Zealand Entomologist* **36:** 1 - 7.

Bradshaw RE, Ganley RJ, Kabir S (2013) An improved artificial pathogenicity assay for dothistroma needle blight on *Pinus radiata*. *Australasian Plant Pathology* **42**: 503 - 510.

Brockerhoff EG, Suckling DM, Roques A, Jactel H, Branco Twidle AM, Mastro V, Kimberley MO (2013). Improving the efficiency of lepidopteran pest detection and surveillance: Constraints and opportunities for multiple-species trapping. *Journal of Chemical Ecology* **39**: 50 - 58.

Brockerhoff EG, Suckling DM, Kimberley M, Richardson B, Coker G, Gous S, Kerr JL, Cowan DM, Lance DR, Strand T, Zhang A (2012) Aerial application of pheromones for mating disruption of an invasive moth as a potential eradication tool. *PLOSONE* **7(8):** e43767, 1 - 8.

Bulman LS, Dick MA, Ganley RJ, McDougal R, Schwelm A, Bradshaw RE (2013) Dothistroma Needle Blight. In Nicolotti G, Gonthier P (Eds.), *Infectious Forest Diseases* (pp. 436-457). Wallingford, United Kingdom.

Goodrick SL, Achtemeier GL, Larkin NK, Liu Y, Strand T (2013) Modeling smoke transport from wildland fires: A review. *International Journal of Wildland Fire* **22(1)**: 83 - 94.

Guichard S, Kriticos DJ, Leriche AMA, Kean J, Worner SP (2012) Individual-based modelling of moth dispersal to improve biosecurity incursion response. *Journal of Applied Ecology* **49(1)**: 287 - 296.

Haines ML, Emberson RM, Sheppard A, Syrett P, Withers TM, Worner SP (2013) Implications of individual variation in insect behavior for host specificity testing in weed biocontrol. *Biocontrol* **58(5)**: 703 - 713.

McCarthy JK, Brockerhoff EG, Didham RK (2013) An experimental test of insect-mediated colonisation of damaged *Pinus radiata* trees by sapstain fungi. *PLOS ONE* **8(2):** 1 - 9.

McGregor KF, Watt MS, Hulme PE, Duncan RP (2012) What determines pine naturalization - Species traits, climate suitability or forestry use? *Diversity and Distributions* **18(10)**: 1013 - 1023.

Paynter QE, Gourlay AH, Rolando CA, Watt MS (2012) Dispersal of the Scotch broom gall mite *Aceria genistae*: Implications for biocontrol. *New Zealand Plant Protection* **65**: 81 - 84.

Rowbottom RM, Allen GR, Walker PW, Berndt LA (2013) Phenology, synchrony and host range of the Tasmanian population of *Cotesia urabae* introduced into New Zealand for the biocontrol *of Uraba lugens*. *Biocontrol* **58(5)**: 625 - 633.

Su YY, Cai L (2012) Polyphasic characterisation of three new *Phyllosticta* spp. *Persoonia* **28**: 76 - 84.

Watt, MS, Bloomberg M (2012) Key features of the seed germination response to high temperatures. *New Phytologist* **196(2):** 332 - 336.

Withers TM, Carlson CA, Gresham, BA (2013) Statistical tools to interpret risks that arise from rare events in host specificity testing. *Biological Control* **64(3):** 177 - 185.

Zimmermann U, Bitter R, Schüttler A, Ehrenberger W, Rüger S, Bramley H, Siddique K, Arend M, Bader MKF (2013) Advanced plant-based, internet-sensor technology gives new insights into hydraulic plant functioning. *Acta Horticulturae (ISHS)* **991**: 313 - 320.

11.10.1 Website features

The monthly Scion publication *Forest Health News* can be viewed on line. See: http://www.scionresearch.com/general/publications/forest-health-newsletter. To subscribe to this newsletter electronically, contact john.bain@scionresearch.com

11.11 Forest Health Capability

There is extensive forest health capablity in New Zealand. Scion employs approximately 30 scientists and technicians who work on forest health; this includes entomology, pathology and pest management. In addition there is numerous capability within other crown research institutes and universities within New Zealand, including Landcare Research, Auckland University, Massey University, Lincoln University and the University of Canterbury. Surveillance is completed predominantly by forest health experts with forest companies or specialised companies such as SPS Biosecurity. There

is also forest health expertise within government organisations such as the Ministry for Primary Industries and the Department of Conservation, and regional councils.