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The Development of a Port Surrounds Trapping System for the Detection of Exotic Forest Insect Pests in Australia

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1. Introduction

This chapter traces the development of trap equipment and techniques over a decade, leading to an effective and efficient unban monitoring system to detect exotic woodborer insects of importance to Australian plantation forestry.

The interception of exotic forestry insect pests entering Australia through airports and seaports depends on a three-tiered system of zoning of inspection. Primary focus is placed at the port of entry with a detailed examination of goods and passengers by AQIS and Customs staff. The second zone is the port surrounds within a 5 kilometre radius of the port. Except for the Asian Gypsy Moth surveys within this zone there was no mechanism for the detection of exotic forest insect pests that have escaped barrier interception and have spread and possibly established in this zone. The third zone is the forest plantation estate existing beyond the port surrounds area. This zone is subject to regular forest health surveillance designed to detect all damaging forest insect pests and diseases.

The implementation of the GIMP, (Generic Incursion Management Plan for forest pests and diseases), provides a process to enable rapid response following detection of potential exotic incursions. Central to the GIMP is an effective surveillance system based on the three zones of interception.

A committee was established within RWG 7 (Forest Health) in 2000 with the aim of investigating ways to implement port environs surveys to detect the presence of exotic forest insects and diseases.

In 2004 additional money for biosecurity was made available through the 'Securing the Future' program. A portion of this new annual funding was to target the detection of exotic pests and diseases in the transition movement phase between ports of international cargo entry and forest plantations and agricultural crop sites. The value of monitoring the port surround area adjacent to sea or air ports is supported by data from New Zealand where, with 44 years of surveillance experience, Carter (1989) determined that 47% of first records of pests and diseases on living trees had been within the port surround zones.

The Forest Health Surveillance Unit of Queensland Forest Research Institute conducted intensive visual surveys (Blitz surveys) of port environs at five seaports and two airports in

Queensland during 1999 and 2000 (Wylie, *et al.*, 2000). Although no exotic forest pests or pathogens were found during these surveys the exercise demonstrated the necessity for rapid assessment surveys at specific times of the year to detect pathogens. The blitz visual assessment system is expensive to conduct, has only moderate detection rates (Bulman *et al* 1999) and samples only a narrow window of time. The Queensland exercise also emphasised the need to have a system in place for ongoing detection of insect pest species with cryptic life histories to augment visual surveys.

Static trapping techniques have been defined by Speight & Wylie, (2001), as having four functions. (a) detect presence of imported noxious insects (b) determine the spread and range of recently introduced pests in a region (c) determine the seasonal appearance and abundance of insects in a locality and (d) determine the need for application of control measures.

2. Assessment of trap designs and lures combinations

A number of static trapping techniques were evaluated including sticky banding of trees, a range of different trap types, and lure combinations.

2.1 Sticky banding

For two summer seasons sticky band traps were placed on a range of native tree species within 1 km of three major shipping ports and Hobart Airport in Tasmania (Fig. 1). Sticky waxed paper bands 400mm wide were stapled around the trunks of several species of *Eucalypus* and *Acacia* in differing stages of health at each site. The bands were coated with 'Tangle-Trap' (The Tanglefoot Company, Grand Rapids, USA). The bands were removed at monthly intervals during the flight period of native wood borer species. Specimens were removed from the sheets using mineral turpentine and individual specimens cleaned in 'De-Solv-It' (RCR International, Sandringham, Australia). In the 2001-2002 summer the port of Bell Bay on the north coast was targeted and that port and the ports of Burnie, Devonport as well as Hobart Airport were targeted for six summer months during 2002-2003. In all 960 specimens comprising 50 species within the coleopteron families Elateridae, Buprestidse, Scolytidae, Anobiidae and Cerambycidae were collected. The funding report (Bashford, 2002) demonstrates the effectiveness of this technique for a wide range of wood inhabiting insect species. The advantage of sticky traps is that continuous monitoring is achieved at very low cost compared to manual collecting. A comparison of sticky trap sampling of bark dwelling carabids with a hand collection technique at the same site was presented by Bashford (2001). It was estimated that 20 man-hours of manual searching of bark resulted in 14 species of carabids (36 specimens) being found. By comparison 5 man-hours of sticky trap servicing on the same number of trees yielded 15 species (247 specimens). However some larger species of beetle families such as cerambycids were only occasionally trapped. A total of 21 native species of cerambycids were collected using this technique, about one third of the known number at these sites. The technique has been used previously for monitoring a small species of cerambycid, the sugi bark borer *Semanotus japonicus,* by Shibata *et al* (1986). This study was able to correlate emergence hole numbers with adult populations attacking Japanese cedar and cypress trees. In more recent times the sticky band technique has been used in host selection monitoring over a four year period, of the exotic buprestid, *Agrilus planipennis,* in Canada (Lyons *et al.,* 2008).

Fig. 1. Examination of sticky band trap.

2.2 Field trial to evaluate lures

A large scale field trial was run in 2003 to test five commercially produced lures attractive to wood borer insects. Lures were obtained from Advanced Pheromone Technologies, Inc., and Phero Tech Inc. The five lures were ethanol, cineole, alpha-pinene, phellandrene, and a multilure (pinene, phellandrene, cineole, terpinene and cymene). The final selection for field testing was based on two other studies that included eucalypt attractants. (Brockerhoff *et al.*, 2006; Barata *et al.*, 2000). The lures were tested with four replicates of each in panel traps placed equally in a same age *Eucalyptus* plantation, half of which had been commercially thinned, following tree mortality caused by drought stress and subsequent wood-borer attack. As a result of the field trial the ethanol lure was selected to be used as a generalist lure for *Eucalyptus* wood-borers in the Bell Bay quarantine monitoring pilot study (Table 1).

	Thinned Plantation		Unthinned Plantation		
Lure	Species	Specimens	Species	Specimens	Total species
Ethanol	12	173	11	129	17
Pinene	11	102	10	78	16
Cineole	10	80	9	59	14
Multilure	10	68	7	23	11
Control	7	34	6	19	8
Phellandrene	5	21	5	35	6

Table 1. Attractiveness of tested lures on *Eucalyptus* wood-borer beetles

2.3 Portable static traps

Lindgren funnel traps, intercept panel traps, delta traps, chimney traps and bucket traps were tested against each other over a two season period using the same lures. The best performing traps in terms of both numbers of wood borers captured and number of species were the Intercept panel traps closely followed by the Lindgren funnel traps (Fig. 2).

Fig. 2. Intercept panel trap (left) and Lindgren funnel trap (right).

Lindgren funnel traps are currently used in warehouses at several western United States seaports to detect exotic insect pest species while imported goods are in storage. A series of lures within the traps are used to target likely incursions, especially those species with a history of incursion. The traps are quickly serviced and tests show high levels of detection of target species. It is important that the precise combination of lures/release rates/concentrations is used to attract target species/groups.

An evaluation of these traps and lure release mechanisms was warranted since many are now in commercial production and experience using these combinations has accumulated over the past two decades. For example several companies specifically researched the use of ethanol slow release lures within a range of different trap designs for timber insects including cerambycids. This is of special importance with the increasing threat of introduction of many exotic species into Australia. For example the Asian longhorn beetle, *Anoplophora glabripennis,* has in recent years entered several western countries including United States with devastating economic and environmental consequences.

In order to further investigate the products available and techniques used in operational trapping in forestry I was awarded a Gottstein Fellowship which enabled me to travel to USA, Canada and UK (Bashford, 2003). The information obtained during this Fellowship has been subsequently applied to the development of urban trapping systems around Australia. The study tour provided information on the methodology and static trapping techniques used in the United States, Canada and United Kingdom for the early detection of exotic forest insects, methods of containment and eradication, and community involvement in those programs. The visit also included visiting a number of commercial trap and lure suppliers to see the latest applications and developments.

2.4 Pilot studies

Some species of exotic timber insects would have a devastating economic impact on the forest industry and other land management agencies if they became established in Australia. The cost of eradication or control of any damaging exotic insect would be millions of dollars added to the loss of resource. It is now recognised in counties such as Canada, United States and New Zealand that early detection is the vital key in preventing huge economic and resource losses. Early detection within the 5-km zone around port entry sites enables eradication to be attempted and containment measures to be initiated under the Generic Incursion Management Plan (GIMP). Placement of traps within plantation and nursery areas would provide a further early detection zone specifically targeting exotics of orchard and forestry trees.

Port area. Entry of cargo into any entry port provides a transport mechanism for the arrival of exotic pests and diseases. In recent times extra emphasis has gone into the examination of pallet wood, packing crates and airport warehouses as pathways and centres of biotic invasion. Despite the high levels of inspection the movement of some exotic insects out of entry port areas is inevitable.

Port surrounds area. An area of 5 km radius of the entry port site is used for trap site selection. This area may consist of high intensity buildings in cities, urban parks and reserves, and residential areas. In urban areas large numbers of trees and shrubs comprising a wide range of species, especially exotic species, are present in parks, street trees and gardens. In rural areas blocks of native bush, hedgerows and planted shelterbelts consist mainly of native tree species.

It is the experience in New Zealand, Canada, and United States it is within this 5 km zone around port of entry sites that initial establishment of exotic pest species occurs. It is also the case that if containment within this area is not achieved within two years of establishment then eradication is not possible. In Australia there is no formal monitoring for the detection of exotic forest insects within this entry zone.

Plantations. In many parts of Australia forestry plantations have been established within or close to the 5 km radius zone of entry ports. Often this is a practical decision for movement of commodities to and from ports. Establishment of a pest species within the port surround area provides a pathway for rapid movement into the plantation estate and severe economic consequences for the forest industry.

Prior to the pilot study trapping had been conducted at the port site and surrounding areas for one flight season as part of the trap testing program. Using funnel, panel and pipe traps a total of 21 wood borer species (267 specimens) were collected. This provided, with the blitz survey collections, a baseline collection against which to assess the pilot trapping results.

2.5 Pittwater pilot study

In a small area adjacent to Hobart International Airport both native forest, mainly *Eucalyptus* and *Acacia* trees and a *Pinus radiata* plantation are present. Panel traps, funnel traps and pipe traps were set up and run for two summer seasons to determine the woodborer species present. This data was added to previous collections made at this site in previous years to form a baseline species list and voucher collection. In all 61 species (1957 specimens) of woodborer insects were included in the voucher collection.

2.6 Rapid visual assessment surveys (Blitz surveys)

Rapid visual search surveys of the five major port entry sites for insect presence on leaves and stems of all trees and shrubs within a 2 km radius of the facility was conducted in 2002 -2003. The surveys followed a protocol established in Queensland by Wylie *et al*. (2000). All trees in twenty 1000 metre transects of native forest were examined for insect pests and pathogens (Fig. 3). The surveys were conducted in the north of the State at Bell Bay and in the south at Hobart International Airport. The collection data for woodborer species combined with the data from tree banding and static trapping has provided baseline data on the species of native woodborer species present at each site. Identification of this material had the establishment of voucher series within the TFIC enables us to rapidly screen subsequent monitoring material for exotics. We were able to show that visual searching was both inefficient in terms of man-hours and also ineffective in detecting many cryptic species. In the blitz surveys 3200 specimens were collected including leaf fungi and cankers as well as herbivore insects.

2.7 Testing the use of individual trees for regular inspection

At the Bell Bay site eleven tree species were obtained in advanced growth forms from a commercial nursery. These were planted out approximately 100 metres from the wharf area with a clear view to the unloading areas. The trees were planted in September 2004. Three blocks, each with two pairs of six tree species were set up with a drip irrigation system and surrounded by a one metre high floppy top fence of plastic trellis supported by star pickets. The trees were examined for insect pests and plant diseases every two months during the summer months. The trees were sprayed with the insecticide Confidor (imidacloprid ai: 0.25g/kg) following each inspection. Several new host records for Tasmania resulted from leaf and lesion samples taken from these trees and opportunistic sampling in parks and reserves. Leaf spot fungi and lesions were identified by specialists at the Tasmanian Department of Agriculture.

Cryptosporiopsis sp. on *Platanus acerifolia*.
Idiocercus australis on *Betula* sp.
Cladosporium orchidearum on *Acer rubrum*.
Phaeophleospora eucalypti on *Eucalyptus viminalis*.
Fairmaniella reposa on *Eucalyptus obliqua*.
Spilocaea sp. on *Alnus incana*.

Fig. 3. Blitz surveys. Use of a beating trap to capture herbivorous insects.

An option to Blitz surveys is the establishment of sentinel planting plots. A sentinel tree plot consists of small plantings of a range of tree species pruned to 3 metres (Fig. 4). These plots enable rapid examination for herbivorous insect species such as aphids and psyllids and observation of disease symptoms. Three or four plots at each site containing 2 – 3 trees of each selected species. Tree selection would include commercial timber trees, urban street trees, and fruit trees. This technique is an adaption of blitz sampling. The plots would be maintained as part of entry port landscape program and be sampled four times a year.

Fig. 4. Planting potted advanced growth trees for sentinel plots (upper) and established plots (lower).

2.8 Bell Bay pilot study

A pilot study was established to determine the logistic and cost requirements of running a practical monitoring system at one major port area. This two year study was funded by the Australian Commonwealth government Department of Agriculture, Fisheries and Forestry, at a cost of $A33, 000. The northern port of Bell Bay is the major entry port for container cargo into Tasmania. Shipping from mainland Australian ports and world-wide international shipping use this port. Static traps were set up within a 5km radius of the wharf area to encompass warehouses industrial work sites, cargo container storage facilities and adjacent native forest, parkland and a commercial *Eucalyptus* plantation. 'Intercept 'panel traps and Lindgren funnel traps were set up in pairs throughout the area. Ethanol lures were used at sites near native tree species and pinene lures near softwood host species. A Gypsy Moth lure delta sticky trap was placed with each pair of traps. Within the plantation traps were placed in areas that were (a) fire damaged (b) drought stressed and (c) apparently healthy. An addition panel trap was included with each pair within the plantation areas charged with a generalist longhorn beetle lure. The three traps were set in a triangle some 5 metres apart. The traps were serviced monthly from September until May for two years. A total of 75 wood-borer species were collected.

The number of traps was dependant on the budget provide for the pilot project and this in turn by the projected future budget for operational monitoring at four port and one airport within Tasmania. Included in the financial assessment was cost of quarantine officers to service the traps, travel costs annual supply of lures and trap equipment, sorting of samples and subsequent diagnostics. The advantage of a baseline collection of woodborers for each site from previous sampling greatly reduced the diagnostic effort required.

2.9 Operational urban surveillance for woodborer insects using static traps

Commonwealth funding was obtained to place traps in urban areas around commercial ports and airports in Tasmania and two mainland ports (Brisbane - Queensland and Fremantle – Western Australia) for the detection of exotic woodborer insects.

2.9.1 2005-2006

In December 2005, the Urban Hazard Site Surveillance Project commenced in Tasmania targeting exotic wood-borer insects. Staff of Quarantine Tasmania, at each port site, was trained in trap servicing, specimen collection and transportation of those samples to the diagnostic laboratory in Hobart (Fig. 5). At each of the four port sites and Hobart International Airport static traps were set up within a 5km radius of the transit site. At each site, two types of static traps were used – panel traps (with ethanol lures) and funnel traps (with alpha-pinene/ethanol lures). In late February Elm Bark Beetle (*Scolytus multistriatus*) lures were added to park sites in Hobart where Elm trees were present . The addition of Elm Bark Beetle lures enhanced the detection of Elm Bark Beetle (which is a vector of Dutch elm disease). The beetle has not been recorded in Tasmania but is widespread in mainland Australia. Other target species were *Arhopalus ferus* (Cerambycidae), and *Ips grandicollis* (Scolytidae), both present in mainland Australia. Exotics of high threat indices for Tasmania which were targeted were the cerambycid species *Monochamus* species, (vectors of the Pine Wilt Nematode *Bursaphelenchus* sp.), *Stromatium barbatum*, *Hylotrupes bajulus* and

Anoplophora glabripennis. To select suitable sites City Councils in each region were consulted. The knowledge of parks and gardens managers proved very useful in identifying parks, gardens and land reserves suitable for the placement of traps. The traps were serviced fortnightly from late December to late April. This servicing involved the collection of the sample jar at the base of the trap (a mixture of dilute antifreeze (propylene glycol) and detergent) and change of lure at the appropriate time. The sample bottles were packed in tote boxes and transported to the diagnostic office by public transport bus cargo.

Fig. 5. Training quarantine officers in static trap assembly and set up.

A combined total of 39 species of woodborer insects were collected (4082 specimens). Four species were known established exotics and new records of establishment in the State were recorded for the two Australian native scolytids *Xyleborus perforans* and *Ficicis varians*.

Cost of the first year of monitoring, which included purchase cost of reusable traps and support pickets, was $A85, 230.

2.9.2 2006-2007

In the second year of operational monitoring the same port and airport areas were utilised but traps placed at different sites within those areas. The monitoring was expanded to include the main importing plant nursery in each port area. Five pairs of traps were placed in each nursery. In addition mature growth potted trees three meters in height were purchased to act as sentinel trees within wharf boundaries at all sites. The trees were a combination of street trees, commercial forestry trees and several orchard species. The aim was the early detection close to unloading wharf areas for insect species and leaf fungi. The bagged trees were placed were placed on wheeled frames so they could be moved easily if required. The trees were to be watered regularly and examined every two weeks for insect or fungal presence. Tree were pruned to 3 meters so all foliage could be examined. The tree species were as follows.

Urban street trees

Tilia cordata (Small-leaved Lime)
Betula alba (Silver Birch)
Ulmus carpinifolia (Elm)
Fraxinus americana (Ash)
Quercus robur (English Oak)
Acer pseudoplatanus (Plane)

Orchard trees

Malus spectabilis (Crab Apple)
Prunus armeniaca (Apricot)

Forestry plantation trees

Eucalyptus globulus (Blue Gum)
Acacia melanoxylon (Blackwood)
Pinus radiata (Radiata Pine)

The trees at Bell Bay were planted as part of the landscaping program on a cleared flat area overlooking the length of the wharf area. Problems were experienced with maintaining the health of the potted trees in the arid environment of the wharf areas. The trees suffered from infrequent watering and dessication due mainly to strong wind movements caused by traffic and the salt in offshore breezes. The result was that very few samples were collected and the general health of the plants resulted in the use of the trees ceased halfway through the summer season. The planted trees at Bell Bay thrived in being just outside the wharf area in a more benign site. The trees established well and many samples were collected.

A new initiative was the production of a leaflet outlining the aims of the project. These leaflets were letterboxed to all businesses and households within the survey areas to inform the public of the reason for the traps and to convey a sense of ownership.

A combined total of 33 species of woodborer beetles was collected (832 specimens).

Additional specimens of the two scolytids collected last year were added to the Tasmanian Forest Insect Collection (TFIC). Of interest were specimens of the anthribid *Euciodes suturalis* collected at two northern sites. This species has been established in New Zealand since 1921 being of European origin. (Penman, 1978). The species is a stem borer pest of cereals and the specimens collected are the first confirmed record for Tasmania.

A collection of exotic woodborer insect species has been established within the Tasmanian Forest Insect Collection. A large number of specimens of important species not yet established in Australia were donated by overseas colleagues has greatly enhanced Tasmania's diagnostic capability.

Cost of second year monitoring was $A63, 000.

2.9.3 2007-2008

The trapping program ran from October until the end of May at the same port and airport sites and nurseries as last year. Trap placement within the nurseries was refined to specifically target container unloading areas. A new initiative this year was to conduct exotic ant surveys at selected nurseries, town park areas and within wharf areas at ports. The methodology was established by Bashford and Pompa (2007) using 'BaitPlate' ant traps. Traps were set up in pairs bated with meat and honey. Two trapping periods in December 2007 and March 2008 resulted in a total of 7140 ants of fifteen species were captured. The established exotic Argentine ant, *Iridomyrmex humilis*, was a common capture at many sites.

A total of 3289 woodborer specimens of 37 species were collected in the routine trap monitoring. The bostrichid bark beetle *Xylotillus lindi* (Blackburn) was recorded for the first time in Tasmania with a total of 15 specimens caught in traps at Hobart International Airport. The scolytid *Cryphalus pilosellus* was collected, confirming the single previous record for the species in Tasmania. The grass anthribid *Euciodes suturalis*, first captured last season was again recorded from several northern locations. The Sirex Woodwasp *Sirex noctilio* and its associated egg parasitoid *Ibalia leucospoides* were captured in traps placed in pine windbreaks at two port surround sites.

The use of potted sentinel trees was deleted from the programs with the problems of tree maintenance being too labour intensive in relation to the results obtained. The planted trees at Bell Bay were pruned and continue to be monitored.

Cost of third year monitoring was $A64, 000.

2.9.4 2008-2009

A decision was made not to continue the trapping program as scheduled for the past three years. The rational being that a continues three year intensive monitoring program with a 5 km radius of each port would have detected the presence of newly established exotic woodborers, all of which have a generational period of at least one year in the climatically temperate island of Tasmania. Part of the annual funding was directed to compiling data on the distribution of three established exotic bark beetles within Tasmania. The other component of funding was directed to monitoring several exotic agricultural pests and diseases within Tasmania. The bark beetle information would give indications of rate of spread and potential distribution of a new exotic. The established bark beetles selected for a detailed trapping program were the anobiid *Ernobius mollis*, and two scolytids *Hylastes ater* and *Hylurgus ligniperda*, Both *Hylastes* and *Hylurgus* are potential vectors of pine pitch canker (*Fusarium subglutinous),* a very damaging *Pinus* fungal disease not yet recorded in Australia. All are of European origin and have been established for several decades in Australian *Pinus* plantations and are attracted to pinene lures. The Tasmanian Forest Insect Collection has numerous records for the three species selected and this enabled the selection of *Pinus* sites for which there were no records. Traps from the port surveillance program were placed in ten sites using funnel traps set with pinene lures. The traps were run for nine weeks from mid-January. Samples were removed from the traps every three weeks and new lures set. The funnel traps were set within recently logged or pruned coupes with four traps, spaced 100 metres apart in a transect within each coupe. During the trapping season 330 target beetles were captured. *Hylurgus* 81 specimens from 8 sites, *Hylastes* 85 specimens from 8 sites and *Ernobius* 33 specimens from 5 sites.

Cost for the bark beetle trapping program was $A24, 000.

2.9.5 2009-2010

Trapping for the three bark beetles was conducted in the remaining ten non sampled and negative record coupes using the same regime as the previous year. A total of 330 bark beetles were collected comprising *Hylurgus* 77 specimens from 7 sites, *Hylastes* 216 specimens from 6 sites, and *Ernobius* 37 specimens from 1 site. Of interest, the two large Bass Strait islands, which have small old plantings of *Pinus radiata,* both had *Hylastes* and *Hylurgus* present while *Ernobius* was found only on Flinders Island. *Sirex noctilio* was captured on both islands. The data has been incorporated into a national survey for these species (Bashford, unpublished).

The capture of three specimens of the rare platypodid, *Carchesiopygus dentipennis*, previously only recorded from Queensland and New South Wales as single specimens, is a surprising new record for Tasmania (Fig. 6).

Cost of the bark beetle distribution project was $A35, 000.

2.9.6 2010-2011

After a break of two years the wood-borer port surrounds trapping program was re-established at the three northern ports of Burnie, Devonport and Bell Bay. In the south the port of Hobart and Hobart International Airport were targeted. It was felt that any new wood-borer incursions which had established might have populations large enough to be detected by trapping. The radius of the trapping area outside the port environs was extended to 7 km in order to utilise a superior range of trapping sites. The lure combinations were changed to include generalist and specific target lures. The panel traps carried ethanol and *Monochamus* specific lures. The funnel traps carried pinene and ipsdienol lures to specifically target bark beetles and *Arhophalus ferus*. A total of 3208 wood borer specimens were collected comprising 34 species.

Two specimens of the cerambycid, *Atesta bifasciata,* were collected at a northern site, a new record for Tasmania. Numerous specimens of *Tropis oculifera*, an uncommon species of cerambycid, was collected in one trap at Burnie.

Cost of the woodborer urban trapping program this year was $A38, 000.

Fig. 6. Specimen of the rare platypodid *Carchesiopygus dentipennis*.

3. Conclusion

This paper documents the first attempt to monitoring outside port areas for exotic woodborer insects on a regular basis. The introduction pathway, through international cargo port into surrounding urban areas, has been well documented (Brockerhoff and Bain, 2000). Expansion of that initial population into forest areas including plantations is a secondary establishment phase where populations are generally deemed to be permanently established. To achieve successful eradication or containment exotic incursions need to be limited in their distribution and restricted to small defined populations. These populations can only be detected by a routine pattern of monitoring at the site of potential establishment.

A monitoring system within forestry plantations, both hardwood and softwood species has been developed that compliments the documented urban monitoring system (Bashford 2008). This system would allow the early detection within plantations of a new exotic wood-borer previously detected in the urban port surrounds monitoring. This system is vital if eradication or containment is to be achieved. However detection within plantations usually means a degree of establishment by an exotic wood-borer. By combining the two systems then early detection in port surrounds enables species specific monitoring to be conducted in nearby plantations.

In the future, depending on Commonwealth funding, trapping will be conducted every third year for wood borer insects of interest to commercial forestry. Since the initial trapping year in 2005 the post barrier program has been expanded to include monitoring for many agricultural plant pests and diseases, tramp ants, Asian gypsy moth trapping, and orchard pests.

There is scope within the program for the addition of surveys specifically to detect leaf spot fungi and cankers of commercial forestry tree species growing within the urban environment.

The program is an evolving process regulated by financial and manpower limitations. An ideal monitoring program would involve many more traps and the costs for servicing and diagnostics would be considerably increased. In the current program up to 120 traps are utilised which is the maximum that can be serviced in a single day at each port entry site. Although not ideal, having a fixed budget and a flexible system enhances the long term commitment of funding.

Another avenue of research that would enhance the system is the use of multiple lures within a single trap. It may be possible to add a number of lures to specifically targeted single species. The generalist kairomone lures currently used could be augmented by specific pheromone lures to attract a suspected new incursion or other woodborer species not attracted to the generalist lures. An example could be the European house borer, *Hylotrupes bajulus*, which infests seasoned softwood timber (Gove *et al.,* 2007). Some preliminary work has been reported by Reddy & Guerrero (2004), looking at the interactions between insect pheromones and plant semiochemicals. Work done on stored-product beetle species (Athanassiou & Buchelos, 2000) showed that a none pheromone multi- attractant (generalist attractant) could be more efficient if formulated for target species.

Although the program has not detected any new exotic (not Australian native species) wood-borer species, the potential to do so is illustrated by the number of new species records for Tasmania of mainland native species. The establishment of a large voucher series of native woodborer species for each international cargo entry site has greatly enhanced our ability to quickly determine the incursion of a new exotic or mainland species.

The establishment of an aggressive or fungal vector species of wood-borer insect could be devastating to Tasmanian forestry plantation given the transition out of native logging and a reliance on plantation timber production. Without a monitoring system, detection would only occur once a species was established and causing some visual damage. The cost of attempting eradication or containment at this stage would be considerably higher than early control and be of longer duration. (McMaugh, 2005).

The program described in this paper has been adopted by several major international shipping ports on the mainland of Australia and integrated into existing systems at ports in the United States, New Zealand and the pacific islands of Fiji and Vanuatu.

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5. References

Athanassiou, C.G., & Buchelos, C. (2000) Comparison of four methods for the detection of Coleoptera adults infesting stored wheat: efficiency and detection sensitivity. *Anzeiger fur Schadlingskunde Pflanzenschutz Umweltshutz* 73: 129-133.

Barata.; E.N.; Pickett, J.A., Wadhams, L.J., Woodcock, C.M., & Mustaparta, H. (2000) Identification of host and nonhost semiochemicals of Eucalyptus woodborer *Phoracantha semipunctata* by gas chromatography-electroantennography. *Journal of Chemical Ecology* 26(8):1877-1882.

Bashford, R. (2001) Some records of arboreal carabid beetles in Tasmania. *Victorian Entomologist* 31(6):97-100.

Bashford, R. (2002) The use of sticky traps as a long term monitoring tool for exotic saproxylic insects of importance to forestry. *Victorian Entomologist* 32:42-44.

Bashford, R. (2003) The use of static traps for the detection and monitoring of exotic forest insects. *J. W. Gottstein Memorial Trust Fellowship Award Report*. 55pp.

Bashford, R. (2004) Port surrounds monitoring for exotic forest insects and tree pathogens. Report to *Department of Agriculture, Fisheries and Forestry*, Canberra. 28pp.

Bashford, R. (2008) The development of static trapping systems to monitor for wood-boring insects in forestry plantations. *Australian Forestry* v71 (3): 236-241.

Bashford, R., & Pompa, Z. (2007) Development of an Urban Surveillance Protocol for Exotic Ants. *Technical Report* 11/2007. Forestry Tasmania, Hobart, Tasmania. Pgs15.

Brockerhoff, E.G., & Bain, J. (2000) Biosecurity Implications of Exotic Beetles Attacking Trees and Shrubs in New Zealand. *New Zealand Plant Protection*, 53:321-327.

Brockerhoff.; E.G., Jones, D.C., Kimberley, M.O., Suckling, D.M., & Donaldson, T. (2006) Nationwide survey for invasive wood-borer and bark beetles (Coleoptera) using traps baited with pheromones and kairomones. *Forest Ecology and Management* 228:234-240.

Bulman; L.S., Kimberley, M.O., & Gadgil, P.D. (1999) Estimation of the efficiency of pest detection surveys. *New Zealand Journal of Forestry Science* 29(1):102-115.

Carter, P.C.S. (1989) Risk assessment and pest detection surveys for exotic pests and diseases, which threaten commercial forestry in New Zealand. *New Zealand Journal of Forest Science* 19(2/3): 353-374.

Gove, A.D.; Bashford, R., & Brumley, C.J. (2007) Pheromone and volatile lures for detecting the European house borer (*Hylotrupes bajulus*) and a manual sampling method. *Australian Forestry* 70(2):134-136.

Lyons, D.B.; de Grout, P., Jones, G.C., & Scharbach, R. (2008) Host selection by *Agrilus planipennis* (Coleoptera: Buprestidae): inferences from sticky-band trapping. *The Canadian Entomologist* 141(1):40-52.

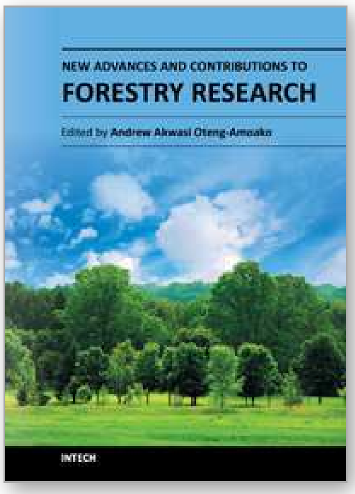
McMaugh, T. (2005) Guidelines for surveillance for plant pests in Asia and the Pacific. *ACIAR Monograph* No. 119, 192p.

Penman, D.R. (1978) Biology of *Euciodes suturalis* (Coleoptera: Anthribidae) infesting Cocksfoot in Canterbury. *The New Zealand Entomologist* 6(4):421-425.

Reddy, G.V.P., & Guerrero, A. (2004) Interactions of insect pheromones and plant semiochemicals. *Trends in Plant Science* 9(5):253-261.

Shibata, E.; Okuda, K., & Ito, T. (1986) Monitoring and Sampling Adult Populations of the Sugi Bark Borer, *Semanotus japonicus* Lacordaire (Coleoptera: Cerambycidae), by the Sticky Trap Banding Method in Japanese Cedar Stands. *Applied Entomology and Zoology*. 21(4):525-530.

Wylie, R.; Ramsden, M., McDonald, J., Kennedy, J., & De Baar, M. (2000) Port and Airport Environs Surveillance. *Queensland Forest Health Surveillance Report* 1999-2000. 40pp.



New Advances and Contributions to Forestry Research

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New Advances and Contributions to Forestry Research consists of 14 chapters divided into three sections and is authored by 48 researchers from 16 countries and all five continents. Section Whither the Use of Forest Resources, authored by 16 researchers, describes negative and positive practices in forestry. Forest is a complex habitat for man, animals, insects and micro-organisms and their activities may impact positively or negatively on the forest. This complex relationship is explained in the section Forest and Organisms Interactions, consisting of contributions made by six researchers. Development of tree plantations has been man's response to forest degradation and deforestation caused by human, animals and natural disasters. Plantations of beech, spruce, Eucalyptus and other species are described in the last section, Amelioration of Dwindling Forest Resources Through Plantation Development, a section consisting of five papers authored by 20 researchers. New Advances and Contributions to Forestry Research will appeal to forest scientists, researchers and allied professionals. It will be of interest to those who care about forest and who subscribe to the adage that the last tree dies with the last man on our planet. I recommend it to you; enjoy reading it, save the forest and save life!

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