Division of Forest Research and Development

annual report 2011

Forestry Tasmania

stewards of the forest

Division of Forest Research and Development

Mission

To provide research, development and information services to support Forestry Tasmania and clients

Vision

To be recognised for excellence in forest research and development

Pictured above: Pruned logs stockpiled for the Britton Timbers *E. nitens* milling study.

Forestry Tasmania is a REGISTERED RESEARCH AGENCY (RRA) under the Commonwealth Industry Research and Development Act 1986, for the purpose of performing contracted research and development (R&D) for eligible companies claiming the 125% R&D tax concession under Section 73B of the Income Tax Assessment Act 1936. Research is carried out in the forestry, botanical, zoological, horticultural, soil and water sciences. For more information, please refer to the Commonwealth Government Ausindustry Agency website at www.ausindustry.gov.au

Cover Photo: Pruned *E. nitens* logs being loaded at Meunna for delivery to Britton Timbers in Smithton for evaluation in a processing study.

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overview: FORESTRY TASMANIA

Tasmania

Tasmania is an island of 68,331 square kilometres and outstanding natural beauty located 240 kilometres below the south-east corner of the Australian mainland. It is Australia's southernmost state. Tasmania has a population of around 500,000, and benefits from a temperate climate.

Tasmania is rich in natural assets, including forests and a diversity of minerals, and is the most forested state in Australia. Its relatively unspoilt beauty attracts visitors from all over the world.

Forestry Tasmania

Forestry Tasmania is a Tasmanian State Government Business Enterprise. The business manages 1.5 million hectares (ha) of State forest for multiple uses, an area that contains 39 per cent of Tasmania's forests. Just less than half of the area of state forest is available for wood production, with the remainder being set aside for other values such as conservation and recreation. Forests on other public lands, mostly national parks and other conservation reserves, are managed by separate agencies.

Forestry Tasmania manages its operations with four administrative Districts across the State, and headquarters in Hobart. As of 30 June 2011, Forestry Tasmania employed 350 personnel and 975 contractors.

There are some 108,000 ha of plantations on State forest, comprising:

- 52,700 ha of softwood - *Pinus radiata*
- 55,700 ha of hardwood - predominantly *Eucalyptus globulus* and *E. nitens*

A portion of this plantation estate is in joint venture with private investors or customers, including buyers of finished forest products.

Forest Tourism

Forestry Tasmania also manages world-class tourist destinations in the forest, such as the Tarkine Forest Adventures, the Eagle's Eyrie and this year opened the AirWalk Lodge as an addition to the Tahune AirWalk.

The AirWalk Lodge is nestled among the trees at the Tahune AirWalk offering visitors an opportunity to 'sleep among the giants' of the southern forests

overview: FOREST RESEARCH & DEVELOPMENT

Forestry Tasmania manages State forest for the production of timber, water and other products, and for conservation of biodiversity. The Division of Forest Research and Development undertakes research to improve the sustainability, productivity and profitability of this management. These three goals – productivity, sustainability and profitability – and Forestry Tasmania's Sustainable Forest Management Objectives, Targets and Indicators therefore guide the Division's research planning. The Division is also committed to communicating research results and the scientific basis for forest management within Forestry Tasmania and to the wider community.

Dr Paul Adams measuring the large-end diameter of a Eucalyptus nitens *log which is being used in a processing study with Britton Timbers.*

The Division has been in existence for over 30 years and is headed by the Chief Scientist. A significant investment of approximately $3.5 million per annum from Forestry Tasmania's funds is directed to in-house research and extension, out-sourced research and collaborative programs, and is augmented by competitively gained research funds and other State and Commonwealth funding.

Forestry Tasmania is a core member of the Co-operative Research Centre (CRC) for Forestry, and is also a participant in the Bushfire CRC and the Landscape Logic Commonwealth Environmental Research Facility. Forestry Tasmania also leads the long-term research at Warra in Tasmania's southern forests.

Key challenges

The Division's key challenges are to make available to Forestry Tasmania the most up-to-date knowledge in forest science; to conduct focused research for strategic and operational implementation, thereby maintaining the scientific basis for forest management; and to conduct research efficiently, making maximum benefit of in-house scientific knowledge and external collaboration.

Our strategies

Forestry Tasmania is internationally recognised as a leader in research on the management of native forests and eucalypt plantations. Our activities towards organisational and community objectives are managed across three Branches within the Division: Biology and Conservation, Native Forests, and Plantations. The Division's key strategies are to:

- undertake research into new silvicultural techniques for native forests and for improved operational performance;
- develop sustainable management techniques and improved genetic material for plantations, focusing on profitability and high-value products;
- ensure conservation of biological diversity and habitat within production forests, and sustainable management of carbon, water and other values;
- undertake health surveillance of native and plantation forests, and develop integrated protection and remediation strategies.

Many of these strategies make use of the Warra Long-Term Ecological Research site in southern Tasmania: http://www.warra.com

chief scientist's report

Dr Steve Read
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Research has been described as the conversion of dollars into knowledge, whereas innovation is the subsequent conversion of that knowledge into a greater amount of dollars. The research and development group in any commercial organisation will thus thrive only while it can successfully argue that its work has positive impact on commercial outcomes. The front cover of this report illustrates a collaborative project in which the Forestry Tasmania plantation research team is following a plantation stand and genetics trial though timber milling to the final product and then its market uptake. With increasing volumes of plantation timber becoming available, the links between genetics, silviculture and product value can be directly investigated, resulting not just in the ability to grow better trees, but also in development of processing approaches specific to this new resource, and new markets.

This year also saw a focus on the cost-effectiveness of the integrated leaf-beetle management program run by Forestry Tasmania's forest health surveillance team. Both larvae and adults of the Tasmanian eucalypt leaf beetle *Paropsisterna bimaculata* consume the foliage of plantation eucalypts, and an extensive annual monitoring program, linked to modelling of potential timber volume losses, determines the coupes in which management actions will be undertaken. Analysis of data entered by Districts into the Forest Operations Database showed that each $1 spent on the program averted timber losses of $1.76 (net present value). The work also showed these financial benefits would almost double with a program that was more targeted and that extended into older plantations.

Research programs that have strategic benefit, or maintain access to forest resources, are of course not as amenable to this kind of analysis, so alternative ways of determining their impact need to be developed, but the ability to show savings greater than the research spend is an important incentive to maintain research and development capacity.

Another exciting achievement this year was seeing the Tasmanian Forest Insect Collection website (www.tfic.net.au) go live. Beetles have a key role both in forest biodiversity and as forest pests, and the TFIC, a satellite collection of the Tasmanian Museum and Art Gallery, was developed by Forestry Tasmania because of the importance of beetles and other insects in many of our research programmes. The TFIC web-site contains a page for each beetle species, with individual photographs as well as automatically generated distribution maps, and is a valuable resource for researchers and collaborators.

Formal conclusion and acceptance by the Commonwealth of the Alternatives to Clearfelling research program of the Tasmanian Community Forest Agreement also occurred in 2010/11. While clearfell, burn and sow is a practical approach to harvesting wet eucalypt forests, and gives good regeneration, repeated applications will lead to coupe-level losses of mature-forest species and structures that would survive into stands regenerating following natural wildfire. The proven alternative, aggregated retention, was developed by reference to the spatial patterns of the occasional, intense wildfires that are the natural disturbance regimes in Tasmania's wet sclerophyll and mixed forests, and allows coupe-scale persistence of mature-forest biodiversity, facilitates recolonisation of harvested areas by mature-forest species, and provides connectivity across the developing forest stand: it complements the reservation of forests elsewhere in the landscape.

More than 50 aggregated retention coupes have been harvested in mature forest across Tasmania in the last few years, and Robyn Scott is continuing to describe the nature of the regenerating stands. Combining the Warra Silvicultural Systems Trial with analysis of ecological metrics in operational coupes has provided Forestry Tasmania with a fresh and practical approach to adaptive management. Our learning in regard to monitoring ecological outcomes can now be applied to harvesting of younger forests of smaller trees for a range of newer products.

Fire - a driver of the dynamics of eucalypt ecosystems

Maintaining variability across the forest landscape is accepted as the key to sustainability, whether assessed from the perspective of biodiversity, or simply risk management of water yields, timber yields and carbon stocks against the inevitable wildfire. The "state-and-transition" models of landscapes developed over 20 years ago have evolved into modern thinking about the resilience of ecosystems and landscapes, and I was able to participate in Resilience 2011, the second international conference organised by the Resilience Alliance (http://www.resilience2011.org/).

The conference showed how far resilience has come as a guiding concept for ecosystem management. The various developmental ages of the wet eucalypt ecosystem – a burnt forest, young regrowth, mature forest, and old-growth forest with rainforest elements – spread across time and space together constitute a resilient ecosystem. A judicious combination of variable retention harvesting, fire management and wildfire will maintain this ecosystem, preventing either its simplification into a more open and flammable system that burns more frequently, or transition into the landscape trap of rainforest that does not support fire.

The incorporation of carbon as an explicit forest value in public debate – although not yet in the market – led Forestry Tasmania to develop a carbon research program. Key to understanding the role of forests in mitigating the effect of carbon dioxide as a greenhouse gas is to understand but look beyond the role of forests as simple carbon stores. Tall old-growth eucalypt forests certainly contain large stocks of carbon, but from any perspective are not a sensible place to store carbon – they are limited to relatively few potential locations in the landscape, have the lowest rate of carbon sequestration from the atmosphere of any stage of forest development, and are at constant risk of losing a substantial proportion of their stored carbon in the inevitable wildfire.

As important for the atmosphere is to consider the flow of carbon through the forest, whether into forest products in use or in landfill, or into forest products used to avoid emissions from fossil fuels. Thus, the use of harvested wood as a construction material or a biofuel is balanced by continued fixation of carbon dioxide by regenerating forest stands, but in addition achieves permanent emissions reductions as it substitutes for fossil fuels that would otherwise be used for manufacturing or energy.

Forestry Tasmania is thus working on the carbon stores in our forests and their dynamics. Indeed, construction of a carbon flux tower at Warra is a visible demonstration of the evolution of our research from biodiversity and silviculture to the fluxes of carbon, water, nutrients and energy through managed forest ecosystems. It is only through understanding these processes that we will be able to manage and adapt to the future effects of climate change on our forests.

Dr Steve Read

Forest carbon

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In 2009, Forestry Tasmania established a carbon research program. This program will evaluate the various forest carbon accounting tools that are available, collate data for describing the carbon stocks in Tasmanian State forest, and collect data to fill gaps in our knowledge of forest carbon. This work will therefore improve our understanding of forest carbon stocks, and our confidence in reporting them. Collaborations have been established with the University of Tasmania, the CRC for Forestry, the Commonwealth Department of Climate Change, the University of the Sunshine Coast, the Memorial University of Newfoundland, the Canadian Forest Service, and the Technical University of Dresden.

Data from over 4000 inventory plots across Tasmanian State forest have enabled us to estimate the carbon stock in standing trees, and its distribution across the forest landscape (http://www.hindawi.com/journals/ijfr/2010/690462/). Standing trees on State forest contained 163 million tonnes of carbon, equivalent to 123 tonnes carbon per hectare or (if the calculation is restricted solely to forested land) 133 tonnes of carbon per hectare. Very tall, wet eucalypt forest had the highest carbon density, with individual sites ranging up to 935 tonnes of carbon per hectare, but occupies just 0.2% of State forest, thus contributing a very small proportion of the total carbon stocks.

Forests both sequester and emit carbon over time-scales that vary from daily to centuries, and cannot simply be managed as stores of immobilised, absorbed carbon. Furthermore, State forest contains forest of a range of ages since fire, with many stands containing at least some regrowth component, with wildfire having prevented much of the eucalypt forest from becoming old growth. The low levels of fire across Tasmania in the last 50-80 years suggest that State forest carbon stocks will fall below current levels at the next landscape-level wildfire.

In addition, we have completed a formal review of the role of forest management in greenhouse gas mitigation in Australia (http://www.fwpa.com.au/sites/default/files/PRC162-0910_Final_Report_Greenhouse_gas_mitigation.pdf). This supported recent reviews by Lippke and coworkers, by the Food and Agriculture Organization of the United Nations, and by the International Energy Agency, that provide strong evidence that the optimal climate change mitigation strategy involves managing at least part of the native forest landscape sustainably to produce wood products, rather than managing all native forests as reserves. Indeed, over time, use of wood products is the main vehicle by which forest management can contribute to reduced emissions from fossil fuels.

Wood products themselves store millions of tonnes of carbon, but the wood products carbon pool is dynamic, just as is the forest carbon pool. Thus, as new wood products are produced, carbon is added to the wood products carbon pool, while old wood products are burned or decompose, releasing carbon. Both the forest products carbon pool and the wood products carbon pool can be thought of as dams, just as dams hold a varying level of water. However, new or recycled wood products can also substitute for materials that are more greenhouse-gas intensive, either for construction or for energy generation. When wood products are used as substitutes for other materials, emissions are permanently avoided, and these avoided emissions accumulate over time, akin to placing them in a safe. The framework encompassing the full role of forests in greenhouse-gas mitigation can thus be thought of as two dams and a safe, with maximal greenhouse-gas mitigation deriving from forest management that is both sustainable and productive.

Selective harvesting of myrtle-rich blackwood swamps

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Retention systems are increasingly used in forestry to maintain site ecological values while producing timber commercially. Forestry Tasmania has investigated the selective harvesting of older-aged blackwood (*Acacia melanoxylon*) swamp coupes that have a high proportion of older successional species such as myrtle (*Nothofagus cunninghamii*), to improve biodiversity outcomes.

Several problems needed to be overcome for successful operational implementation of this new system, including:

- windthrow of retained trees, which makes fencing of the coupe for browsing control difficult and maintenance expensive;
- removal of browsing animals from the large amount of intact habitat retained within the fence;
- selection by the harvesting contractor of stems to retain and stems to remove, to ensure both good commercial outcomes and good biodiversity outcomes;
- the potential for myrtle wilt to affect the retained myrtle stems if they are damaged during harvesting.

DFRD (Sue Jennings and Mark Neyland) worked with Murchison District staff to come up with a set of guidelines (tree selection rules) to be implemented during the harvest of Christmas Hills coupe CH041E in 2008/09.

The resource figures for the coupe showed that, if all blackwood stems >60 cm dbh were harvested, then 75% of the Cat 4 sawlog would be recovered. The harvesting contractor cooperated with selection of trees for harvest, thereby maximising the extracted blackwood sawlog volume while minimising damage to younger retained stems and patches of non-commercial forest (which are often rich in myrtle and other rainforest species).

The forest looked "messy' after harvesting, with an uneven retention of patches of vegetation. The coupe was fenced, and browsing mammals trapped from within the fence. Some of the piles of slash along the roadside were burnt during autumn to reduce the fire hazard, but the coupe otherwise remained unburnt. Windthrow over the next couple of winters was evident, but not excessive, despite some very strong wind storms.

Now, 2 years later, the blackwood regeneration is prolific, with much of it 1–1.5 metres tall, and there is a dramatic difference in stocking inside and outside of the fence. The fence has suffered several breaches due to fallen stems, but regular inspection has allowed timely maintenance. Some myrtles have succumbed to myrtle wilt, but there appears to be adequate retained forest to nurse the blackwood stems to good form. Monitoring of the coupe continues.

The successful outcome on this coupe resulted from excellent cooperative development of a silvicultural system that combined a biodiversity driver with the regeneration requirements of the different species - plus a maintained fence to ensure minimal browsing of the young regeneration!

Blackwood regeneration after selective harvest of a myrtle-rich coupe

Old trees: the elderly at the heart of the forest community

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Ten years ago, Forestry Tasmania initiated a comprehensive research program on the ecological importance and management of rotting logs, or coarse woody debris (CWD). Research on the internal composition of rotting logs has now put in place one of the final pieces of this program, and demonstrates that it's not only in human societies that the elderly are the heart of the community.

The various log decay classes are used to interpret forest stand dynamics and wildfire history, and to understand forest biodiversity values and carbon cycling capacity. Surveys or inventories of CWD attempt to categorise logs into discrete decay-classes based on readily observable features, but this assumes that the external appearance of a log is a good predictor of its internal state of decomposition. This study tests that assumption.

A total of 64 *Eucalyptus obliqua* logs were selected from locations in the Warra Long-Term Ecological Research site, representing the full range of decay classes, from Class 1 (freshly fallen) to Class 5 (becoming incorporated into the soil humus layer). We assumed that a log's diameter was a reasonable surrogate for its age, that is, that logs less than 60 cm diameter derived from regrowth-age trees and logs greater than 60 cm diameter derived from mature trees, and extracted three thin slices ('biscuits') from each log. Twenty different rotten-wood types were identified from the appearance of the wood (texture, colour, feel and smell). Decay by brown-rotting fungi (which preferentially attack cellulose, leaving lignin) was distinguished from decay by white-rotting fungi (which attack both cellulose and lignin), and the proportion of each biscuit occupied by each rotten-wood type or airspace and the extent of biomass loss were measured to determine how well the decay-class system reflects a log's internal state of decomposition.

There was a strong relationship between a log's externally determined decay-class and its loss of mass. This accords with earlier studies that showed that a log's decay-class gives a good indication of how long it has been decomposing. Since a log's relative mass is related to its carbon content, this gives information on the contribution that rotting logs make to carbon cycling.

However, a log's external appearance can mask considerable internal variation in the proportions of individual rotten-wood types. Some of this variation is related to a log's position on the continuum of decomposition from freshly dead wood to wood humus. But in addition we found that logs derived from regrowth-age trees decomposed differently from those derived from mature-age trees. Smaller logs presumed to be from regrowth-age trees were more likely to have decayed from the sapwood inwards towards the heartwood, and to have decayed predominantly by white-rotting fungi. Larger logs derived from mature-age trees were more likely to have decayed from the heartwood outwards towards the sapwood, and to have decayed predominantly by brown-rotting fungi.

These apparently simple differences between logs of different sizes, and this of potentially different origins, have important ecological and management implications. They also help account for the findings of other studies at Warra that highlighted the biodiversity differences between regrowth-age and mature-age trees and the logs arising from them. Mature-age trees harbour more species, and more unique species, than regrowth-age trees, and the same applies to the logs derived from these trees. Mature-aged trees are in many ways the heart of the forest community, and forests lacking them will lack a large amount of their potential biodiversity.

Markets for wood products, and reduced access to the forest, may increasingly dictate that much of the production forest estate be managed on relatively short rotations. Our studies demonstrate that it is ecologically important that we also find ways to maintain mature-age trees in the same landscapes. Formal reserves of old-growth forest can play their part, but they tend to be clumped in particular regions. At a finer spatial scale, informal reserves and other set-asides, including forest patches retained under aggregated retention silviculture, will also have an important role to play in maintaining the biodiversity in production forests.

Lee Stamm tests a chainsaw to its limits while extracting a 'biscuit' from a rotten log at Warra.

Managing leaf beetles: how well are we doing? Can we improve?

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For the past two years, the Forestry Tasmania Forest Health Surveillance system has been used to measure how well our leaf beetle management protects plantations from defoliation. Linking records from the Forest Operations Database of leaf beetle population monitoring and control (spray) events, to assessments of end-of-season defoliation, allowed calculation of how much defoliation was prevented. The costs of management were then compared to the value of growth losses avoided. We found that spending $540,000 annually on leaf beetle management prevented growth losses worth $955,000 – that is, each dollar spent on management saved $1.76 from the value of the plantation estate.

Leaf beetle management was most effective, and provided the greatest financial benefit, in plantations 5-6 years old. Financial benefit declined in older plantations because monitoring was less able to detect leaf beetle populations, and also because some defoliation was suffered by older plantations that were not monitored for leaf beetles: leaf beetle management has traditionally been done in younger plantations, and it is only recently that management has been extended into older plantations. If losses from no management or ineffective management in older plantations could be eliminated, the financial benefit of the program would nearly double.

In a separate study, Sophie Edgar from the University of Tasmania used our operational leaf beetle population monitoring records to examine whether variation in leaf beetle populations could be predicted by site, climate or landscape attributes. Two risk factors – altitude, and proximity to Poa grasslands – were the most useful predictors of leaf beetle populations: the likelihood of leaf beetle populations being above-threshold was 2-6 times higher in high-risk plantations than in low-risk plantations. Using these factors to segregate the plantation estate into areas of low, medium and high risk of supporting above-threshold leaf beetle populations could thus provide substantial efficiency gains in leaf beetle management. Shifting from age-based targeting of plantations to risk-based targeting is predicted to result in 35% more above-threshold leaf beetle populations being detected for the same monitoring effort.

Forestry Tasmania will thus be adopting risk-based targeting of plantations for managing leaf beetles in the 2011-12 season. Additionally, we are refining the way we monitor leaf beetle populations to better suit the larger trees found in older plantations.

This work has highlighted the value of information describing our plantation operations that has been captured in the Forest Operations Database. Combining this information with assessments of damage made by health surveillance provides a powerful tool to evaluate the effectiveness of our management.

Eucalyptus leaf beetle Paropsisterna bimaculata

Predicting *Eucalyptus nitens* plantation water use using growth parameters

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The use of water by trees and forest stands depends on their stage of development, so both natural processes and forest management activities can change water resources and catchment water balances over time. Forestry Tasmania's hydrology research program aims to understands these processes and manage forests accordingly.

One major project, funded by Forest and Wood Products Australia, is developing empirical models to predict annual plantation water use from readily available growth data, and will allow forest managers to assess the impacts of plantation management. Forest Estate Models will then be able to assess changes in water use, have water use entered as a constraint, and optimise wood production in a water-limited environment. Estimates of annual and monthly canopy interception, soil evaporation and transpiration were thus made in a chronosequence of five *E. nitens* plantations of different ages in the Florentine Valley, Tasmania, from 2008 to 2011, with growth data also being collected.

Hydrology Technical Officer Crispen Marunda checks instrumentation at the Florentine 021A trial

Total evapotranspiration increases as the plantation stand ages and its basal area increases. Just after planting, soil evaporation is large but becomes less important as the canopy develops. On the other hand, transpiration and canopy interception increase as the stand grows and reach their upper limit at around 10 years of age. Thinning causes a reduction in evapotranspiration because, even though soil evaporation increases when trees are removed, transpiration and canopy interception do not increase until the retained trees grow substantially.

The data thus show how water use varies with stand basal area, age and weather for a high-rainfall site, and we are now evaluating responses on a drier site. Furthermore, if the approach works in *E. nitens*, the study can be extended to other plantation species and native forests. Lastly, forest inventory data are increasingly available through remote-sensing technologies such as LiDAR, and this approach is ideally suited to predicting changes in stand water use directly from such data.

The relationship between genetics, silviculture, wood quality and wood products

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Two important processing studies undertaken in 2010-11 have provided important data on the wood products that Forestry Tasmania eucalypt plantations can produce and their utilisation by industry. These projects have reinforced our understanding that genetics, silviculture, wood quality and wood products are related, and cannot be viewed in isolation.

The first study investigated the potential for recovering higher-value rotary-peeled veneer products from plantations that had been managed for fibre (pulp), and was a collaboration between the University of Tasmania, Forest and Wood Products Australia, and Forestry Tasmania and other industry partners including Ta Ann, Carter Holt Harvey, the Engineered Wood Product Association of Australia, and Calibre Equipment. It included the first large-scale *Eucalyptus nitens* peeling trial in Australia, and provided baseline information on plywood properties and veneer quality, and their underpinning genetic parameters.

More than 700 peeler billets from a number of Forestry Tasmania's *E. nitens* and *E. globulus* genetics trials were sampled, harvested and peeled. Veneer strength was highest for *E. globulus* plantation logs, less for 26-year-old *E. nitens* logs, and less again for 16-year-old *E. nitens* logs. Commercial-grade recovery of plywood was limited to the lowest structural grades, potentially suitable as a supply of core veneer. Estimates of genetic correlations indicated that breeding programs that have improved pulp yields in plantation *E. nitens* have also improved desirable properties for rotary-peeled veneer; future selections will include veneer strength directly. Optimised drying, and improved log preparation (such as pre-steaming), would be likely to give significant improvements in recovery and utility.

A second important study harvested a 22-year-old Forestry Tasmania *E. nitens* silvicultural trial for processing and utilisation at Britton Timbers, Smithton. Logs from this trial are representative of the high-quality (pruned) logs that will become available routinely from Forestry Tasmania plantations within the next 5-10 years. This study will assess the complete value-chain, from grower through processor to manufacturer, and is an important part of improving industry acceptance of the *E. nitens* resource. A total of 192 pruned logs (about 140 m^3, and mainly *E. nitens* but a small amount of *E. globulus*) were quarter-sawn and are currently air-drying prior to reconditioning and kiln-drying. Final processing (docking, facing) and grading (select, standard and/or utility) will then be carried out, and the products placed with a number of manufacturers to determine utility and value.

Both projects highlight the increasingly important focus on research on processing and product development, and the value that this is adding to the eucalypt plantation estate.

E. nitens *sawn boards (19 mm thickness) racked and ready for air-drying. Colours represent log small-end diameter class (yellow 30 – 40 cm, green 40 – 45 cm, blue 45 – 50 cm, white >50 cm) to assist tracking during drying and processing.*

Forestry Tasmania

Biology and Conservation Branch
Principal Research Scientist: Dr Tim Wardlaw
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The Biology and Conservation Branch conducts research into the management of pests and diseases, and the conservation of natural values. Arising from this research are management prescriptions and monitoring systems to increase forest productivity and ensure ecologically sustainable management practices. The Branch also provides forest health surveillance services to Forestry Tasmania and external clients. During 2010-11 the Branch had 8 full-time and part-time research and technical staff employed primarily on fixed-term contracts of varying duration.

Dr Tim Wardlaw

Main outputs for 2010-11

- Documented the variation in coarse woody debris of mature forest and older silvicultural regeneration in terms of landscape context and the landscape prior to modern forestry.
- Analysed and documented the response of vascular plants in mature and older silvicultural regeneration to landscape context and other attributes of site and landscape.
- Analysed and documented changes in saproxylic beetle fauna during the first 10 years of the succession in mature and regrowth logs.
- Sue Baker completed a 12-month World Forestry Institute Fellowship and a study comparing and contrasting the adoption of variable retention in Tasmania with the Pacific Northwest and Canada. On her return to Tasmania, Sue selected suitable sites and established plots to measure forest influence in each of three clearfell, burn and sow age-classes.
- Tested insect samples from the Tasmanian Forest Insect Collection for their suitability for DNA barcoding, and screened DNA from beetles collected from CWD in southern forests plots using microsatellite markers developed for *Coripera, Prostomis* and *Lissotes.*
- Gained substantial funding from the Terrestrial Ecosystem Research Network to allow construction of a carbon flux tower at Warra, and establish Warra as a Supersite. Gave support for the University of Melbourne to run an automatic chamber system to measure soil CO_2 and trace gas fluxes at the carbon flux-tower site at Warra.
- Screened Forestry Tasmania *E. nitens* seedlots using near-infrared spectroscopy to rank these according to sideroxylonal levels
- Completed operational and financial analysis of the 2009-10 leaf beetle Integrated Pest Management program, and collaborated with University of Tasmania Honours student on a study relating leaf beetle populations to site, climatic and landscape attributes.
- Established and measured inventory plots in 13 *E. nitens* plantations infected with *Phytophthora cinnamomi* , to detect and quantify growth impacts of chronic infection.
- Developed and activated a web-page for the Tasmanian Forest Insect Collection http://www.tfic.net.au

Biology and Conservation - Key research and development projects

Sustainable Forest Management Objective	FT Staff and Collaborators	Project name and aims	2010-2011 Progress
1. Sustaining biodiversity and habitat			
1.1 Reserve system Maintain a reserve system in State forests in accordance with the Regional Forest Agreement and Tasmanian Community Forest Agreement. Work with other forest managers to maintain Tasmania's comprehensive, adequate and representative (CAR) reserve system.	S Grove T Wardlaw A Hingston S Read J Hickey M Yee R Gao **Collaborators** University of Tasmania, DSE, Victoria, NSW DPI, DEC, WA, FPA	**Effectiveness of CAR Reserves** Quantify the contribution of CAR reserves and complimentary off-reserve management to the conservation of biodiversity dependent on mature forest habitats in production forest landscapes across the continuum of forest management intensity.	Documented the variation in coarse woody debris of mature forest and older silvicultural regeneration in terms of landscape context and the landscape prior to modern forestry. Completed second summer / autumn of surveys for birds and beetles (flighted and ground-active) in SFEFL. Assembled a comprehensive set of site and landscape-level independent variables to use in analyses testing the responses of birds, beetles and vascular plants to attributes of site and landscape. Analysed and documented the response of vascular plants in mature and older silvicultural regeneration to landscape context and other attributes of site and landscape.
1.3 Threatened species, communities and habitats Maintain viable populations of all existing animal and plant species and communities found in State forests.	S Grove T Wardlaw L Stamm **Collaborators** CRC Forestry, University of Tasmania	**Coarse woody debris** Prescriptions to apply to integrated harvesting operations in wet eucalypt forests, which can be demonstrated to sustain coarse woody debris (CWD) habitat and its dependent biota.	Write-up of FT-funded PhD (Belinda Yaxley) on the autecology of selected saproxylic beetles has progressed and is nearing completion. Analysed Lee Stamm's decay data (from Hons thesis) to test the validity of FT's log decay-class classification. Resultant paper published in FEM. Paper resulting from Belinda Browsing's MSc studies on bryophyte succession in CBS and on logs as they progress through decay stages published in *Forest Ecology and Management*.
	S Grove **Collaborators** University of Tasmania	**Log decay** Develop ecologically sustainable management practices in relation to biota dependent upon the decaying log and mature timber habitat.	Analysed and documented changes in saproxylic beetle fauna during the first 10 years of the succession in mature and regrowth logs. Two papers published.

Biology and Conservation - Key research and development projects (continued)

Sustainability Objective	FT Staff and Collaborators	Project name and aims	2010-11 Progress
1. Sustaining biodiversity and habitat			
1.3 Threatened species, communities and habitats (cont.)	S Grove T Wardlaw **Collaborators** Forest Practices Authority	**Persistence of saproxylic beetles** 1. Elucidate the scales at which several saproxylic beetle taxa can disperse. 2. Infer historic population patterns by characterising current population structures in an experimental forest landscape. 3. Relate these scales to landscape structure as measured by proximity to mature forest and by coarse woody debris volumes. 4. Use these findings to formulate management guidelines to ensure the persistence of saproxylic biota.	DNA extracted from beetles collected from CWD in SFEFL plots screened using microsatellite markers developed for *Coripera, Prostomis* and *Lissotes.* Mapping of all pieces of CWD sampled for beetles in SFEFL plots completed.
1.4 Oldgrowth forests Maintain a minimum of 250,000 hectares of oldgrowth forests in reserves in State forests (25 per cent of Tasmania's reserved oldgrowth forests) for conservation values. Retain oldgrowth elements including large trees, stags, understoreys and logs across the forest estate.	S Baker D McElwee T Wardlaw M Neyland **Collaborators** CRC for Forestry, University of Tasmania, Oregon State University, World Forestry Institute	**VR Biodiversity** Verify function of retained aggregates in operational ARN coupes providing viable habitat for late successional species.	Sue Baker completed a 12-month World Forestry Institute Fellowship. Completed a study comparing and contrasting the adoption of VR in Tasmania with forestry companies in the Pacific Northwest and Canada.

Biology and Conservation - Key research and development projects (continued)

Sustainability Objective	FT Staff and Collaborators	Project name and aims	2010-11 Progress
1. Sustain biodiversity and habitat			
1.4 Oldgrowth forests (cont.)	S Grove A Phillips A Hingston **Collaborators** CRC for Forestry	**SST Biodiversity** Document the biodiversity impacts from the range of silvicultural treatments available for harvesting wet eucalypt forests.	Completed annual bird and ground beetle surveys of the SST in the control and treatments that have reached 10-year post harvest (CBS + UI 1 and 2, DRN-2).
	T Wardlaw A Hingston **Collaborators** University of Tasmania, Oregon State University, Washington State University	**Forest influence** Test the nature and magnitude of forest influence into harvest areas of old clearfells, and how influence effects vary dependent on the successional stage (wet sclerophyll versus mixed forest) of the adjoining retained forest.	Liaised with overseas collaborators to participate in global meta-study to measure forest influence. Selected suitable sites and established 5 plots to measure forest influence in each of three clearfell, burn and sow age classes (5-10 year-old, 22-28 year-old, 39-45 year-old). Tested sample of TFIC insects for their suitability for DNA barcoding.
2. Sustaining jobs for current and future generations			
2.4 Plantations Establish and manage plantations to maintain timber supply levels to industry.	T Wardlaw M Syme	**Dead branch defect in pruned plantations** Understand the risk factors associated with branch trace defects developing after pruning dead branches and develop appropriate mitigation measures.	Amended pruning prescription to reduce likelihood of branch trace defect following pruning of dead branches.

Biology and Conservation - Key research and development projects (continued)

Sustainability Objective	FT Staff and Collaborators	Project name and aims	2010-11 Progress
3. Sustaining carbon stores, clean air, water and healthy forests			
3.1 Carbon and climate change Manage State forests for long term carbon storage and provide a sustainable source of products which contribute to locking up carbon and reducing emissions Monitor emerging climate change scenarios and trends and adapt forest management practices.	T Wardlaw K Abetz D Bashford L Wilson S Read **Collaborators** CSIRO Marine & Atmospheric Research, (CMAR), University of Melbourne, University of Tasmania, CRC Forestry	**Warra carbon flux tower** Provide a focal point for intensive studies into carbon dynamics of tall, wet eucalypt forests. Key research objectives include: • Documenting fluxes of carbon, water and energy from mature / regrowth *E. obliqua* forest and relate fluctuations in those fluxes with climatic conditions and biotic events. • Determine the contribution of different components of the forest (soil, CWD, overstorey eucalypts, rainforest understorey) to the carbon fluxes.	Successful in garnering an additional $100k from TERN (through Supersites Project) to cover the additional cost of the tower. Access track to tower built. Soil pits for guy anchor blocks dug and soils tested. Engineering drawings for tower completed. Planning application for tower lodged with HVC. Flux instrumentation assembled and being tested. Running automatic chamber system (UMelb) to measure soil CO_2 and trace gas fluxes. The chamber has operated continuously for 12 months.
	T Wardlaw S Grove D Bashford **Collaborators** DPIPWE	**Baseline altitudinal monitoring plots (BAMPS)** Early detection of large-scale influences such as climate change on forest processes. Enable the effect of any large-scale influences such as climate change to be taken into consideration when interpreting small-scale treatment effects on biodiversity. Monitor emerging climate change scenarios and trends and adapt forest management practices.	Liaised with DPIPWE to develop action plan for second decadal sampling of floristics, invertebrates and birds.

Biology and Conservation - Key research and development projects (continued)

Sustainability Objective	FT Staff and Collaborators	Project name and aims	2010-11 Progress
3. Sustaining carbon stores, clean air, water and healthy forests			
3.4 Weeds, pests and diseases Control weeds, pests and diseases to protect State forests. Avoid use and minimise risks of chemical control methods.	T Wardlaw D Williams **Collaborators** University of Tasmania, Bushfire CRC, DPIPWE, University of Melbourne	**Browsing IPM** Cost-effective management of browsing that seeks to capture maximum benefit from low-cost non-lethal options through integration with operational monitoring and culling.	FT *E. nitens* seedlots screened (nursery and field) using near infrared spectroscopy to rank according to sideroxylonal levels. High and low sideroxylonal seedlots identified. Collaborated with CRC Forestry/UTas to develop experimental plan for demonstrator IPM (stockings + repellents + genetics with operational monitoring / culling) for establishment in spring 2011.
	D Bashford N Ramsden **Collaborators** University of Tasmania	**Sirex wood wasp** Prevent significant losses from outbreaks of Sirex wood wasp in *P. radiata* plantations.	Established and maintained static traps in five plantations and introduced nematodes into two plantations. Supervised post-doc and PhD in ARC-Linkage research project (Ips competition with Sirex in trap-trees).
	L Jordan T Wardlaw K Wotherspoon M Syme J Elek **Collaborators** University of Tasmania, CSIRO Sustainable Ecosystems, CRC Forestry	**Leaf beetle management** An IPM system that is efficient at preventing economic damage by leaf beetles in plantations.	Co-ordinated 2010-11 leaf beetle IPM. The program monitored 29,000 ha of which 33% were above-threshold: nearly 5,800 ha were sprayed (96%with Dominex), natural population reductions were measured in 1,300 ha. Refined guidelines to make Spinsad simpler and cheaper to to use: incentive did not result in substantial increase in useage. Completed operational and financial analyis of the 2009-10 leaf beetle IPM and documented in a Technical Report. Collaborated with UTas Honours student conducting an study that related leaf beetle populations to site, climatic and landscape attributes. Simple risk model was developed. Commenced study to map spatial heterogenity of leaf beetle populations: three plantations spanning a range of population levels were mapped. Installed and monitored growth plots to measure the impact of defoliation on growth in mid-rotation plantations. Documented refinements to leaf beetle IPM: two key changes proposed – risk-based targeting of plantations to include in IPM; hybrid roadside OLPS monitoring.

Sustainability Objective	FT Staff and Collaborators	Project name and aims	2010-11 Progress
3. Maintain Ecosystem Health and Vitality in State forest			
3.4 Weeds, pests and diseases (cont.)	J Elek T Wardlaw **Collaborators** University of Tasmania, CRC Forestry, Bayer Crop Science	**Lethal trap trees** Develop a novel delivery method for systemic insecticides as an alternative to aerial spraying, which offers the potential for better targeting defoliators and in particular adult beetles that are difficult to manage with current methods.	Results from 2009-10 trap tree trials were documented in a Technical Report. Additional leaf chemical assays were done to monitor late season insecticide concentrations to relate to measured beetle mortality. A further six trap-tree plantations were treated with insecticide and monitored throughout the 2010-11 summer – autumn. Manuscript reviewing options for managing leaf beetles submitted to Agricultural and Forest Entomology.
	T Wardlaw S Jennings N Ramsden **Collaborators** FPA, NRM South	***Phytophthora cinnamomi*** Ensure that susceptible plant species and communities of high conservation value are protected as far as possible from the adverse effects of *P. cinnamomi*.	Undertook quarry inspections for *P. cinnamomi* certification. Convened meeting with major land-managers and regulators to guage interest in adopting FT quarry surveys as industry standard. Provided advice to Districts on formulating Forest Practices Plan prescriptions for operations in Phytophthora Management Areas. Established and measured inventory plots in 13 *E. nitens* plantations infected with *P. cinnamomi*: aim is to detect and quantify growth impacts of chronic infection. Attended steering committee meetings of NRM South project to develop and implement hygiene protocols for aquatic pathogens threatening TWWHA.
	K Wotherspoon S Jennings N Ramsden L Jordan T Wardlaw	**Health surveillance of plantations (FT & external)** Maximise the health and productivity of plantations by ensuring health problems are detected and managed before significant impacts occur.	Health surveillance was completed of all Forestry Tasmania eucalypt plantations and all pine plantations on State forest. A total of 86 notification reports were sent to clients.

Biology and Conservation - Key research and development projects (continued)

Sustainability Objective	FT Staff and Collaborators	Project name and aims	2010-11 Progress
3. Sustaining carbon stores, clean air, water and healthy forests			
3.4 Weeds, pests and diseases (cont.)	S Jennings K Wotherspoon N Ramsden L Jordan K Swanepoel	**FHS: District liaison and quality standards** Provide pro-active responses to the management of detected health problems through effective liaison between Forest Health Surveillance staff (and specialists) and District staff. Increase awareness among field staff of the common health problems in pine and eucalypt plantations.	Meetings were held in all Districts to review the outcomes of actions in response to notifications made in 2008-09 and agree to actions in response to notifications made in 2009-10.
	T Wardlaw K Wotherspoon N Ramsden D Bashford L Clark R Gao	**FHS - policy** Ensure flow of information from FHS to inform policy and corporate reporting.	Data and narrative on pest and disease status and pest management was provided for the 2011 Stewardship Report. Annual pest and disease status report for Tasmania was prepared for inclusion in the RWG 7s national pest and disease status report.
	D Bashford N Ramsden **Collaborators** DPIPWE, OCPPO	**Port surveillance** Detect the early introduction of exotic forest pests and diseases.	Provided training on static trapping surveys in South Australia and sorted / identified static trap catches. Completed draft manuscript on climate distribution of established exotic forest insects. Screened trap catches from Tasmanian hazard sites.
	T Wardlaw **Collaborators** University of Tasmania, Queensland Dept of Employment, Economic Development & Innovation, NSW Dept Primary Industries	**Forest Biosecurity** Review and document current plant biosecurity arrangements in each jurisdiction, evaluate how those arrangements capture sector-specific issues for forestry; identify gaps and propose actions to improve forest biosecurity.	Interviewed various stakeholders, documenting current biosecurity structures and functional arrangements in each state, collated information collected and prepared a draft position paper (including case studies). Convened workshop (in association with RWG7) to consider priorities for investment to strengthen forest biosecurity. Final project report written. Submitted EOI to FWPA for best practise pest risk analysis study.

Biology and Conservation - Key research and development projects (continued)

Sustainability Objective	FT Staff and Collaborators	Project name and aims	2010-11 Progress
3. Maintain Ecosystem Health and Vitality in State forest			
3.4 Weeds, pests and diseases (cont.)	D Bashford K Wotherspoon N Ramsden T Wardlaw **Collaborators** ACIAR Queensland, DEEDI	**Forest health surveillance research and development** Refine methods for the detection of forest pests.	Final project report completed.
	J Elek E Trainer	**CERAS (Chemical Environmental Risk Assessment Scheme)** Develop and implement an improved system ("Chemical Environmental Risk Assessment Scheme") for rating and reporting on the environmental risk of pesticide operations.	Decided not to proceed to adoption.
3.5 Fire Use controlled fire to emulate natural conditions and achieve ecological, silvicultural and forest health benefits.	T Wardlaw S Grove **Collaborators** University of Tasmania, University of Melbourne	**Wildfire Chronosequence** Establish a set of long-term monitoring sites to provide natural disturbance benchmarks against which biodiversity and structural changes in the Warra SST can be assessed. These sites fulfil the scientific criteria of an extended "space-for-time" design.	Combined floristic / structural data with same from SFEFL CAR Reserves project for University of Tasmania PhD study (Jayne Balmer). Completed three seasonal field campaigns of a collaborative study with UMelb PhD student (Benedikt Fest) to measure soil fluxes of methane and nitrous oxide in chronosequence plots as part of a wider study examining the effects of forest disturbances on soil fluxes of non-CO_2 greenhouse gases.

Biology and Conservation - Key research and development projects (continued)

Sustainability Objective	FT Staff and Collaborators	Project name and aims	2010-11 Progress
5. Sustaining science-based stewardship			
5.3 Research Use science to inform continuous improvement in forest policy and management.	T Wardlaw S Grove **Collaborators** University of Tasmania, University of Melbourne	**Tasmanian Forest Insect Collection** Establish a set of long-term monitoring sites to provide natural disturbance benchmarks against which biodiversity and structural changes in the Warra SST can be assessed. These sites fulfil the scientific criteria of an extended "space-for-time" design.	Combined floristic / structural data with same from SFEFL CAR Reserves project for University of Tasmania PhD study (Jayne Balmer). Completed three seasonal field campaigns of a collaborative study with UMelb PhD student (Benedikt Fest) to measure soil fluxes of methane and nitrous oxide in chronosequence plots as part of a wider study examining the effects of forest disturbances on soil fluxes of non-CO_2 greenhouse gases.
	D Bashford A Phillips J Lesek	**Laboratory management** Maintain a functional laboratory facility to support research.	Routine maintenance and calibration of equipment undertaken.
	S Grove S Read T Wardlaw **Collaborators** University of Tasmania, University of Melbourne, CRC for Forestry, James Cook University, TERN	**Warra development** Maintain a high public and scientific profile of the Warra LTER. Develop a long-term research strategy based on the Warra Ecological Model. Promote collaborative research at the Warra LTER site.	Collaborated with James Cook University to develop investment proposal for Supersite Network as part of TERN 2 funding. Two small project grants were maintained during year. Provided summer student scholarship to sort, mount and identify beetles. Hosted visits to Warra LTER during Science Week.
	All research staff	**Communications** Maintain strong linkage between research and science-based forest management. Maintain a high profile for credible research within the scientific community.	Staff from the branch were involved in two radio interviews, presentations at 10 workshops and conferences; produced 18 technical reports and had 14 papers published or accepted for publication in peer-reviewed journals or book chapters.

Dr Mark Neyland

Native Forests Branch

Principal Research Scientist: Dr Mark Neyland
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Native Forests Branch conducts research on the silviculture of native forests to increase productivity and support continuous improvement for sustainable forest management. Major projects include:

- Researching alternatives to clearfelling in oldgrowth wet eucalypt forests,
- Assessing and reporting on carbon stores in State forests,
- Developing stand management regimes for native forest regrowth and blackwood.
- Managing and improving the Quality Standards system,
- Maintaining an up-to-date and accurate set of technical bulletins as a key reference tool for field staff,
- Improving practices for harvesting in Special Timbers Zones,
- Providing silvicultural support and training to field staff.

At June 2011, the Branch had 6 full-time and 3 part-time staff.

Main outputs for 2010-11

- Maintenance, monitoring and reporting of the Warra Silvicultural Systems Trial.
- Silvicultural support for and monitoring of operational aggregated retention coupes established throughout the State.
- Calculated distribution of carbon in trees across forest classes in Tasmanian State forest, and published major report on framework for managing impact of forest management on carbon emissions.
- Completion and reporting of the annual Quality Standards review.
- Provision of data and reports on native forests regeneration outcomes (site preparation, seed provenance and regeneration success by forest type) to the Forestry Tasmania Stewardship Report.

Native Forests - Key research and development projects

Sustainability Objective	FT Staff and Collaborators	Project name and aims	2010-11 Progress
1. Sustain biodiversity and habitat			
1.4 Oldgrowth forests Maintain a minimum of 250,000 hectares of oldgrowth in reserves in State forests (25% of Tasmania's reserved oldgrowth forests), for conservation values. Retain oldgrowth elements including large trees, stags, understoreys and logs across the forest estate. This will involve: continuing the TCFA variable retention program.	M Neyland L Edwards D McElwee R Scott S Read T Wardlaw	**Alternatives to clearfelling lowland wet eucalypt forest** To establish a replicated silvicultural systems trial (SST) in wet eucalypt forests at Warra and compare the standard clearfell, burn and sow system with potential alternatives.	Monitored and maintained the trial. Drafted long term monitoring plan for the SST.
	J Jarman M Neyland **Collaborators** Tasmanian Herbarium (G Kantvilas), University of Southern Illinois (P Minchin)	**Impacts of harvesting and regeneration operations on lichens and bryophytes in wet eucalypt forests** To assess the impact of various logging and regeneration treatments on the lichen and bryophyte floras of wet eucalypt forest.	Sampled plots in the aggregates of two coupes and completed the species identifications. Prepared the dataset for analysis by Dr Peter Minchin (University of Southern Illinois, USA). Made substantial progress with the draft manuscript on assessing the impacts of the treatments. Progressed paper describing the general ecology of the bryophytes and lichens at Warra. Progressed paper on cryptogam succession after harvesting and burning. Finalised establishment report for the project.
	M Neyland J Hickey S Read L Edwards	**Warra SST reporting** To report on aspects of the Warra silvicultural systems trial.	Manuscript summarising the results of the trial at age three years accepted by *Australian Forestry*.

Native Forests - Key research and development projects (continued)

Sustainability Objective	FT Staff and Collaborators	Project name and aims	2010-11 Progress
1. Sustain biodiversity and habitat			
1.4 Oldgrowth forests (cont.)	L Edwards D McElwee M Neyland	**Warra LTER support** Support and promotion for research at the Warra Long Term Ecological Research (LTER) site. To inform visitors to the Warra LTER site of the costs and benefits of various silvicultural treatments applied to wet eucalypt forests designated for wood production.	Assisted external researchers. Particpated in safety coordination with Huon District. Provided guides for 5 Site tours (31 participants). Research tracks established and maintained for long-term studies.
	R Scott D McElwee L Edwards M Neyland	**Operational development and evaluation of aggregated retention (ARN) in tall oldgrowth forests.** To develop aggregated retention as a reliable and cost effective silvicultural system. To monitor outcomes in all aggregated retention coupes until 2010 and a subset of coupes thereafter.	Database maintained on all ARN coupes and comparable CBS coupes. Monitored a subset of ARN coupes and comparable CBS coupes in 2010-11. Future monitoring will be via FOD. Advice provided to Districts on planned aggregated retention coupes.
	R Scott M Neyland T Blanks	**Regeneration burning of aggregated retention coupes** To assist the Districts to undertake successful regeneration burns in aggregated retention coupes. To identify approaches to regeneration burning in ARN coupes that can assist future burning.	Monitored burning conditions and outcomes in all VR coupes and a set of CBS coupes for comparison. 12 of 32 planned regeneration burns were completed in ARN coupes (326 out of 981 ha). To date 50 ARN coupes have been completed covering 1732 ha.
	R Scott D McElwee L Edwards M Neyland	**VR reporting** To communicate the results of the VR silviculture program and report on progress.	Annual progress reports on VR monitoring program completed. Progressed paper on VR burning. Progressed paper on harvesting and burning impacts on the soil, foliar and soil chemistry. VR manual finalised and published on line.

Native Forests - Key research and development projects (continued)

Sustainability Objective	FT Staff and Collaborators	Project name and aims	2010-11 Progress
2. Sustaining jobs for current and future generations			
2.3.1 Eucalypt forests Ensure an ongoing long term supply of the highest quality eucalypt timbers from native forests.	M Neyland L Clark T Osborn	**Rationalisation, measurement and maintenance of established thinning trials** To rationalise the existing thinning trials, to commence data analysis using existing data sets, and to determine the most efficient program of monitoring for the next few years.	Progressed bringing existing native forests data sets into corporate data bases.
	M Neyland D Mannes S Whiteley District Staff	**Operational plan and business case for expanded program of 'thinning'** To identify opportunities for intensive forest management on a sound economic and silvicultural basis. The aim is to produce more peeler logs now and more high quality sawlog in the future.	LiDAR data for Bass district was analysed and field checked. Developed a 'thinnability index' based on height and canopy cover from the LiDAR data together with information from PI (regrowth/regen).
	M Neyland L Edwards D McElwee R Musk District Staff	**Sowing trials** To examine the influence of sowing rate on seedling establishment rate. The aim is to determine whether higher seedling densities can be achieved through sowing at higher rates.	A replicated randomised block designed trial has been established at three sites in southern Tasmania, where the blocks have been sown at one of four different sowing rates. In addition, operational level trials have been established in 5 coupes throughout the state, where a randomly selected section of the coupe has been sown at double the normal sowing rate.
	M Neyland L Clark	**High altitude eucalypt forests** To provide silvicultural advice and to promote good silvicultural practice in high altitude forests.	The UAT procedure has become widely accepted as a useful tool for planning and monitoring the harvesting of high/dry *E. delegatensis* forest. Pre-logging assessments have declined recently due to a lack of staff. Progressive harvesting assessments continue to be useful In 2006-07, 1969 ha were treated and 94% met the standard. In 2007-08, 3078 ha were treated and 93% met the standard. In 2008-09, 3575 ha were treated and 93% met the standard. In 2009-10, 2653 ha were treated and 97% met the standard. In 2010-11, 2560 ha were treated and 86% met the standard. Two coupes failed to meet the required minimum damage level and assessment was not completed on two coupes.

Native Forests - Key research and development projects (continued)

Sustainability Objective	FT Staff and Collaborators	Project name and aims	2010-11 Progress
2. Sustaining jobs for current and future generations			
2.3.1 Eucalypt forests (cont.)	M Neyland	**Dry eucalypt forests** To develop and improve silvicultural treatments being applied to dry eucalypt forests, particularly in Bass, Derwent and Mersey Districts.	Advice provided as requested.
	L Clark D McKenzie L Edwards M Neyland	**Quality standards monitoring** To ensure 'best practice' standards are developed and met in native forest silviculture.	Provided support to Districts with inputting data into FOD. Formal Quality Standards visit held in each District. Statewide review held in September. Reported to General Management Team in October. 2010 Quality Standards Manual published.
	L Clark L Edwards	**Native forest coordinators group** Provide Districts with forum to exchange ideas on native forest management and to identify and update SEMS documents.	Maintained and improved regeneration survey database. Maintained mammal browsing database and browsing monitoring tool.
	M Neyland L Clark D McElwee L Edwards **University of Melbourne** P Ades **University of Tasmania** B Potts D Steane	**Genetics of *E. regnans* and *E. obliqua*** To use DNA studies to: (i) examine variability and similarity in and between populations; (ii) identify what environmental factors map with genetic variation; (iii) better understand mating systems.	Promoted the use of seed from as many well distributed parents as practicable when compiling seed lots. Introduced additional "distance measurement " on seed collection labels to better inform seed coordinators about the spacing (and therefore relatedness) of trees from which seed has been collected.

Native Forests - Key research and development projects (continued)

Sustainability Objective	FT Staff and Collaborators	Project name and aims	2010-11 Progress
2. Sustaining jobs for current and future generations			
2.3.1 Eucalypt forests (cont.)	L Clark	**Review of strategic seed reserves** To estimate the amount of seed required to fulfil 3 year plan requirements and compare that with present seed centre stocks. This will provide seed coordinators with a priority list for seed collection.	Provided on-going analysis of seed stock shortfalls and surpluses on an as-needs basis.
	L Clark	**Support for seed allocation program** To ensure that optimum seed mixes are used in all FT sowing.	Developed germination testing database as part of seed management system. Provided technical advice and support to seed centre staff on germination testing procedures. Supported seed allocation process for 2010 sowing.
2.3.2 Special species Ensure an ongoing long term supply of special timbers	S Jennings D McElwee M Neyland	**Remedial treatments in swamp-blackwood forests** To regenerate CH042B, a failed swamp blackwood coupe. The coupe was rough heaped, burnt in autumn 2009, re-fenced and sown.	Monitoring of the coupe continues and regeneration has improved. The coupe is due for its 3-year regeneration survey next year.
	S Jennings D McElwee M Neyland	**Regeneration strategies for swamp blackwood myrtle forests** To investigate the effectiveness of partial harvesting and fencing in achieving successful regeneration in swamp blackwood myrtle forests (CH41D and E), harvested in 2008 and 2009, and burnt in autumn 2009.	This coupe continues to progress well. The browsing control (fencing and trapping/shooting inside the fence) was expensive but is still proving to be very effective. Many of the blackwood seedlings are over 1 metre tall, and due to the retained partial canopy, there was no frost damage at all to the blackwoods, when a neighbouring clearfell suffered quite badly.

Native Forests - Key research and development projects (continued)

Sustainability Objective	FT Staff and Collaborators	Project name and aims	2010-11 Progress
2. Sustaining jobs for current and future generations			
2.3.2 Special species (cont.)	S Jennings D McElwee M Neyland	**Stand management of fenced-intensive-blackwood** To develop prescriptions for management of blackwood rich regeneration particularly in the far northwest.	Replicated thinning trial was established in TG021B during the early summer. Measurement of the PCT and Thinning Options trials in TG021A complete and blackwood height data collected.
	L Edwards M Neyland	**Silvicultural systems for harvesting special timbers from eucalypt forests rich in special timbers** To assist Huon District to develop and implement a safe, practical and economic silvicultural system for the sustainable production of low volumes of special timbers from eucalypt forests rich in special timbers.	An age 5 survey of the first series of patches to be harvested was completed this year. 62% of the plots are stocked with eucalypts, and 75% with at least one special species. Half of all plots had leatherwood present.
	S Jennings D McElwee M Neyland	**Planning, harvesting and monitoring of damage assessment in rainforest coupes** To train harvesting supervisors to monitor and report on harvesting damage in rainforest coupes.	No rainforest coupes were harvested for special species sawlog this year due to lack of a suitable harvesting contractor and a wet summer. 2010-11 was a mast myrtle seed year.
3. Sustaining carbon stores, clean air, water and healthy forests			
3.1 Carbon and climate change Manage State forests for long term carbon storage and provide a sustainable source of products which contribute to locking up carbon and reducing emissions.	M Moroni T Kelley M McLarin D Mannes S Grove	**Collation of all existing data** Collate all available data on C-mass or biomass of live standing trees, dead standing trees, downed dead wood and soil in State forest, to improve estimates of total forest C stocks. Identify key data gaps and undertake field assessments as required. provide data to forest C models..	Published manuscript describing carbon in standing trees. Technical report in advanced stages describing all woody debris studies undertaken in Tasmania. Inventory dead wood data collated and to be analysed.

Native Forests - Key research and development projects (continued)

Sustainability Objective	FT Staff and Collaborators	Project name and aims	2010-11 Progress
2. Sustaining carbon stores for current and future generations			
	M Moroni T Kelley M McLarin	**Evaluation of C accounting tools. Complete testing and refinement of CBM-CFS3 in Canada. Set up model within FT systems.** Evaluate FullCam and CBM-CFS3 for use in Tasmanian forests. The model is freely available to Tasmania but requires testing and refinement prior to use here.	CBM-CFS3 tested and reviewed in Canada using test data to assess suitability for and refinements needed prior to application in Tasmania. Completing compilation and analysis of existing data. Acquiring and commencing evaluation of most recent version of FullCam and CBM-CFS3 in collaboration with model developers.
	M Moroni	**Complete CRC/FWPA report on Carbon Carrying Capacity** To present a balanced view of the role of forests.	Published.
	M Neyland L Clark S Jennings R Scott L Edwards	**Technical bulletins** To maintain a comprehensive set of technical bulletins for native forest silviculture.	Technical Bulletins 5 and 8 revised. Technical Bulletin12 is in review.
	M Neyland L Clark R Scott L Edwards S Jennings	**Silvicultural training** To communicate recommended management practices and research results to staff and Technical Forester trainees through training programs, field days and seminars.	Provided training to Forest Practices Officers and Supervisors Courses. On-ground training for field staff based on needs identified at annual Quality Standards Reviews.

Plantations Branch
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The Plantations branch conducts research on the silviculture of plantations to increase productivity, quality and value of the resource and to support continuous improvement for sustainable forest management. Research and extension services include:

- Soil and site evaluation
- Tree improvement
- Nutrition and weed management
- Pruning and thinning
- Wood quality and processing
- Risk assessment
- Quality standards and auditing
- Tree water use and hydrology

These services are provided to internal clients (the Forestry Tasmania Districts) and also to external clients through Forestry Tasmania's Technical Services group. The Branch provides on-time research and technical services that are accurate and cost-effective, and our vision is to be recognised as a leading provider of plantation research and technical services in Australasia.

Main outputs for 2010-11

This year has been another very busy year for the Branch, with significant ongoing research programs in tree improvement, silviculture and hydrology along with a substantial tree improvement and silviculture project for the Yong'an Forestry Group in China. During the year, we have increased our focus on the interrelationships between genetics, site, silviculture, wood quality and processing through a rotary-peeled veneer project with the University of Tasmania (funded by Forest & Wood Products Australia), and a processing and end-product study with Britton Timbers in north-west Tasmania. Important ongoing guidance and support was obtained from the Plantation Productivity and Management Group (PPMG) and the Tree Breeding Strategy Group (TBSG) within Forestry Tasmania.

Key achievements for 2010-11 included:

- Establishing the new *E. nitens* seed orchard at Castra.
- Modelling of alternative hardwood plantation thinning regimes for production of high-quality sawlogs.
- Completion of field work for Florentine Plantation Water-Use Study and initiation of similar work at a drier site at Forestier
- Demonstrating that alternative sawing strategies, in combination with appropriate reconditioning, can effectively eliminate surface and internal checking in plantation-grown *E. nitens*
- Development and testing of the floating rising-stage sampler for automated water sampling
- Continued audits and training of the Pruning Assessment Tool (PAT), and development of a Thinning Assessment Tool (TAT) to the stage of field trials.

Dr Paul Adams

Plantations - Key research and development projects

Sustainability Objective	FT Staff and Collaborators	Project name and aims	2010-11 Progress
2. Sustaining jobs for current and future generations			
2.4 Establish and manage plantations to maintain timber supply levels to industry.	D Williams K Dransfield T Hancock P Moore **Collaborators** University of Tasmania, STBA, Plantplan Genetics, CRC Forestry, CSIRO, Ta Ann, Gunns Ltd	**Tree improvement and seedling supply** Maximising the production of high quality sawlogs, and associated products, from plantations through genetic improvement, pruning, thinning and fertilising to improve growth and wood quality.	Completed the FWPA-funded Rotary-Peeled Veneer study which provided baseline data on veneer quality and plywood properties of fibre-managed plantation *E. nitens* grown in Tasmania. It also identified genetic parameters that affect quality of rotary-peeled veneer and plywood to guide selection of families for future breeding programs. Established 3 new genetics trials (2 *E. nitens* progeny trials and 1 *E. nitens* demonstration-of-genetic-gains trial). Established a new *E. nitens* seed orchard. Modelling work by collaborators shows that DNA markers can be used in genetic analysis to improve the predictions of genetic values related to wood quality. Commenced the FWPA-funded Hottest 1000 project to look for more DNA markers in both *E. nitens* and *E. globulus*. Ongoing collaboration with Private Forests Tasmania on eucalypt species trials to test suitability for lowland cold and dry environments in Tasmania.
2.4 Establish and manage plantations to maintain timber supply levels to industry (cont.)	M Wood P Adams **Collaborators** CRC Forestry, Timberlands Pacific	**Eucalypt plantation silviculture** Maximising the production of high quality sawlogs, and associated products, from plantations through improved silviculture.	Initiated 'commercial'-scale processing study in collaboration with Britton Timbers Ltd to explore impact of sawing and drying schedules on product recovery, utility and value from plantation-grown *E. globulus* and *E. nitens*. A second major trial investigating the processing requirements and wood quality outcomes for plantation-grown *E. nitens* demonstrated that alternative sawing strategies, in combination with appropriate reconditioning, can effectively eliminate surface and internal checking. Further modelling of alternative thinning regimes for hardwood sawlog production and preliminary operational guidelines. Establishment (in collaboration with District staff) of 400 ha of demonstration sites for alternative thinning regimes. Completion of Derwent project (coupe analysis and development of coupe management plans).

Plantations - Key research and development projects (continued)

Sustainability Objective	FT Staff and Collaborators	Project name and aims	2010-11 Progress
2. Sustaining jobs for current and future generations			
	P Adams K Dransfield T Hancock **Collaborators** CRC Forestry, University of Sydney, Forest Industry Herbicde Research Consortium, BASF, Serve-Ag	**Nutrition and productivity** Maximising the production of high quality sawlogs, and associated products, from plantations through genetic improvement, pruning, thinning and fertilising to improve growth and wood quality. Long-term management of the sustainable productivity of the land and trees. Expansion of the plantation estate, where opportunities exist, on land that does not involve the broad scale clearing of native vegetation.	Continued work on starter fertiliser trials with Basacote-slow release fertiliser products. Commenced Organic Nitrogen project improving management of nitrogen fertilisation. Installed herbicide evaluation trials on behalf of Bayer Environmental Sciences. Provided advice and support for secondary fertiliser program.
2.4 Establish and manage plantations to maintain timber supply levels to industry (cont.)	M Syme D McKenzie P Adams P Smith	**Quality standards monitoring and extension** Meet plantation establishment quality standards provide best practice guidance on the establishment and management of plantations to operational staff.	Worked with District staff to continue and refine quality standards monitoring of operations, and performance indicators. Completed the 2010 Annual Quality Standards report for plantations and reported against revised Plantation Performance Indicators for 2010. Conducted field visits, advice sessions and field day on improving management of Forestry Tasmania plantation estate through site preparation techniques, alternative regime trials, species selection and controlled release fertilisers. Reviewed Safety & Environment Integrated Risk Registers according to new format for Plantations, Native Forests and Research sections. Progressed development of Thinning Assessment Tool (TAT) to the stage of field trials.

Plantations - Key research and development projects (continued)

Sustainability Objective	FT Staff and Collaborators	Project name and aims	2010-11 Progress
3. Sustaining carbon stores, clean air, water and healthy forests			
3.3 Water, soils and geodiversity Ensure availability of clean water from State forests. Protest soil values and geodiversity.	S Roberts K Abetz C Marunda **Collaborators** TCFA, CRC Forestry, FWPA, Southwood	**Hydrology research** Maintaining water quality above accepted standards. Conduct research into water quality and quantity to provide greater understanding of the effects of forest operations and to provide management solutions. Develop planning tools that incorporate water use by forest.	Completion of field work for Florentine Plantation Water Use Study and initiation of similar work at a drier site at Forestier. Further development and testing of the floating rising-stage sampler. A preliminary report on plantation water use in the Florentine Valley, and completion of main component of field study. Commencement of turbidity monitoring at Mole Creek and continuation of monitoring at TN26C. Ongoing hydrological monitoring at Warra with telemetry systems.
	P Adams	**Soil, site selection and productivity estimation** Forestry Tasmania will protect soil values and significant geoconservation features on State forest.	Provided information and advice on site preparation and other treatments required for sustainable development and management of plantations.

Plantations - Key research and development projects (continued)

Sustainability Objective	FT Staff and Collaborators	Project name and aims	2010-11 Progress
4. Sustaining community access and heritage			
4.6 Community engagement Actively promote open and constructive relationships with stakeholders and the broader community.	P Adams S Roberts M Syme D McKenzie D Williams M Wood	**Community engagement** Forestry Tasmania will seek to actively promote open and constructive relationships with its' stakeholders and the broader community.	Continued to build partnerships with organisations and community groups. Staff were involved in delivering two public presentations, three conference presentations, one presentation to West Wellington Protection Group.
5. Sustaining science based stewardship			
5.3 Research Use science to inform continuous improvement in forest policy and management.	P Adams S Roberts M Syme D McKenzie D Williams M Wood	**Science based stewardship** FT will use science to inform continuous improvement in forest policy and management.	Staff prepared 24 technical and extension reports, 2 scientific papers published and 4 manuscripts submitted.

Warra Long-Term Ecological Research (LTER) site

Dr Simon Grove
Forestry Tasmania Warra Research Co-ordinator
Simon.Grove@forestrytas.com.au

The Warra LTER site of 15,900 ha was designated in 1995 to encourage long-term ecological research and monitoring in wet forests in Tasmania. The site is supported by eight LTER site partners from Tasmanian and national research agencies. Continuing projects are listed at www.warra.com

Major activities for 2010-11

- Documented the variation in coarse woody debris of mature forest and older silvicultural regeneration in terms of landscape context and the landscape prior to modern forestry.
- Analysed and documented the response of vascular plants in mature and older silvicultural regeneration to landscape context and other attributes of site and landscape.
- Analysed and documented changes in saproxylic beetle fauna during the first 10 years of the succession in mature and regrowth logs.
- Gained substantial funding from the Terrestrial Ecosystem Research Network to allow construction of a carbon flux tower at Warra, and establish Warra as a Supersite. Gave support for the University of Melbourne to run an automatic chamber system to measure soil CO_2 and trace gas fluxes at the carbon flux-tower site at Warra.
- Completed three seasonal field campaigns of a collaborative study with University of Melbourne PhD student (Benedikt Fest) to measure soil fluxes of methane and nitrous oxide in chronosequence plots as part of a wider study examining the effects of forest disturbances on soil fluxes of non-CO_2 greenhouse gases.
- Provided summer student scholarship to Simon Ong to sort, mount and identify beetles.
- Hosted visits to Warra LTER during Science Week.

Dr Tim Wardlaw and University of Melbourne students Benedikt Fest and Julio Najera-Umana discussing soil chamber measurements at the Warra flux site.

library and information services

Library
library@forestrytas.com.au

Forestry Tasmania's Library is located in the head office at 79 Melville Street, Hobart. It contains an extensive collection of core technical information and resources that supports the diverse needs of Forestry Tasmania, including books, print images and slides, and serials. The Library also serves as a repository and archive for published technical reports and organisational materials from Forestry Tasmania and other forestry organisations nationally and internationally.

The existing collection of books, journals, videos and photographic images is augmented by on-line access to current journals.

The Forestry Tasmania Library also makes information available to students, other libraries and members of the public who have specific requirements not able to be satisfied from other sources, and thus makes a valuable contribution to community involvement by Forestry Tasmania.

Phone 03 6235 8160 or email library@forestrytas.com.au

http://www.forestrytas.com.au/science/forestry-library

Media Officer Melanie Page reviewing literature in the FT Library.

divisional services to external clients

Research Services

Staff from the Division of Forest Research and Development work with external clients, such as other forestry companies and land managers, in a number of ways, including research contracts and technical service consultancies.

The Division has significant experience in delivering contract research and consultancies to industry and other organisations both in Tasmania and abroad. A substantial body of know-how and other intellectual property has been gained by the Division through long experience of native forest management, and specialist skills have been developed in growing plantation pines and eucalypts for solid timber products.

Divisional staff provide training and operational advice to internal and external clients in harvesting, regeneration, thinning and pruning procedures. Specialist manuals, standard operating procedures, and quality assessment protocols for these operations have also been developed.

The Division works with clients in a number of ways such as collaborative research, research services contracts, and technical services consultancies on specific projects undertaken on a fee-for-service basis.

Key advantages for clients who use Research Branch Services are:

- Working with a service provider that has a long history of forestry research and development, and provision of technical solutions for a large native forest and plantation estate.
- Working with a team that specialises not only in high-quality science but also in converting project outcomes into operational realities in the forest.
- Buying knowledge and expertise at the leading edge in development of specialist hardwood silvicultural regimes for maximising solid wood production.

Specialist technical services are offered in:

- Native forest harvesting and regeneration, seedbed preparation, sowing and remedial treatments.
- Native forest silviculture, including pre-commercial and commercial thinning operations.
- Plantation silviculture including thinning and pruning regimes to produce clearwood in sawlogs from eucalypt plantations.
- Soil surveys to assess sites for plantation establishment.
- Health surveillance and audits of eucalypt and pine plantations, diagnosis of forest health problems (pests, diseases and abiotic issues), advice on the significance of their impacts, and advice on management options.
- Integrated management of major insect pests in eucalypt plantations, and use of environmentally friendly insecticides to control major insect pests of eucalypt plantations.
- Forest monitoring and assessment protocols for biodiversity, analysis and interpretation of biodiversity data, and development of appropriate management prescriptions for biodiversity.

Dr Matt Wood measuring tree height with Yong'an Forestry staff in a silviculture demonstration trial, Yong'an, China. Eucalyptus dunnii *aged 6 months.*

Forestry Tasmania has signed a commercial agreement with China's Yong'an Forestry Group (YFG). Under the agreement, Forestry Tasmania's business arm, Forest Technical Services, is working with YFG to improve the way trees are grown in eucalypt plantations in Fujian Province in south-eastern China. Forestry Tasmania is providing services to develop tree breeding and silviculture, and also helping develop sustainable management of plantations, which is becoming an increasingly high priority in China.

tasmanian forest insect collection

Tasmanian Forest Insect Collection (TFIC)
Dr Simon Grove
Simon.Grove@forestrytas.com.au

Insects are one of the most diverse groups living in our forests. Some are pests that cause damage to trees, and some are natural enemies of the pest insects. All insects contribute to the biodiversity of forests and are essential for the function of healthy forest ecosystems. We need to understand our insects to enable us to look after our trees, our forests and our biodiversity.

The Tasmanian Forest Insect Collection (TFIC) commenced in 1974 with an initial focus on forest pests and their predators and parasitoids, as well as wood borers.

More recently, a major focus has been on beetle biodiversity, particularly saproxylic (log-dwelling) and ground beetles. The insects collected during many studies done by university students, particularly those at Warra, are also added to the TFIC. The TFIC is one of only three State forestry-specific collections, is registered as a satellite collection of the Tasmanian Museum & Art Gallery, and is a member collection of the Council of Heads of Australian Entomological Collections.

The main value of the TFIC is in providing a reference that links insect specimens either with an accepted name, or, if un-named, with a consistent "morphospecies" (group of insects with the same physical characteristics).

As the TFIC was becoming established, most specimens were sent to the Australian National Insect Collection (Canberra) for identification. Now, however, many insect identifications are done in-house or in collaboration with overseas entomologists who specialise in particular groups. In the future we may rely more on DNA techniques to identify insect specimens.

All new specimens added to the TFIC are captured in the database and, progressively, many specimens already in the collection have been added to the database as well. The TFIC currently contains approximately 320,000 specimens in 24 ten-drawer cabinets, 40% of which are databased. The collection contains 1,944 species of beetles.

The TFIC has thus become a valuable resource for research on the link between forest management and biodiversity, and in supporting operational programs such as health surveillance and quarantine. As the TFIC continues to grow, it provides new opportunities for scientists to discover patterns across space and time - a critical aspect of forest management.

laboratory services

Laboratory
Laboratory Manager: Dr Sandra Roberts
Sandra.Roberts@forestrytas.com.au

Forestry Tasmania's main laboratory is located at Forestry Tasmania's head office at 79 Melville Street, Hobart.

Activities undertaken for Forestry Tasmania, and services that can be supplied to external clients, include:

1. **Pathology**

- Soil testing for *Phytophthora cinnamomi* (using standard lupin bait test).
- Diagnosis of diseased trees - isolation and identification of pathogenic fungi.

2. **Entomology**

- Identification of forest insect pests.
- Insecticide bioassays.

3. **Soil and foliage testing**

- Preparation of soil and foliage samples for chemical analysis by external labs.
- Assessment of soils for physical characteristics using wet sieve analysis.

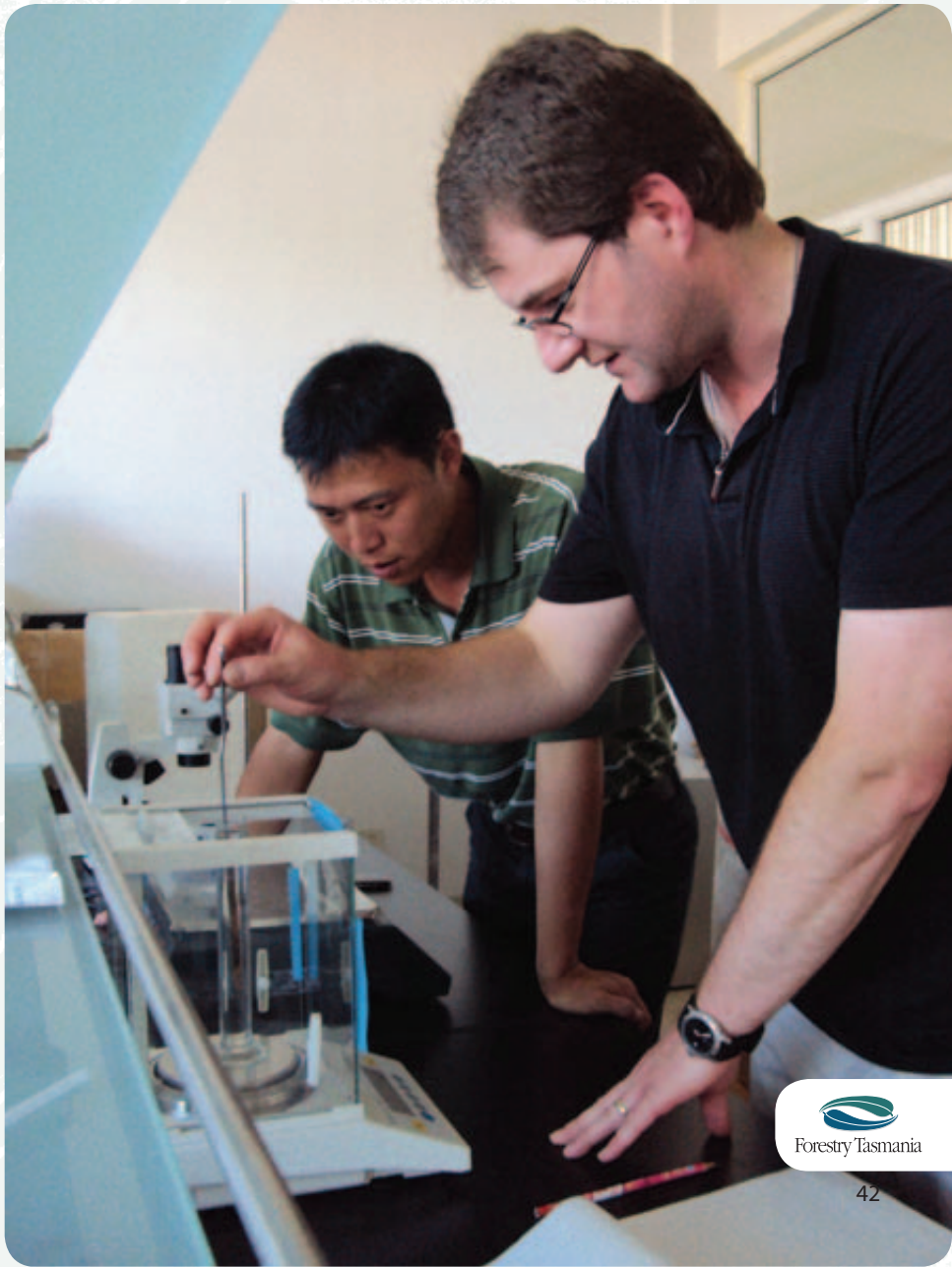
4. **Wood density for wood quality assessment**

- Processing wood samples including discs and cores to assess basic density.
- Cellulose content assessment.

5. **Water Quality Sampling**

- Initial sample preparation.
- Turbidity, pH testing and electrical conductivity.

The laboratory works in conjunction with other laboratories to obtain specialist analyses.



collaboration & linkages

The Division leverages more research than it can fund directly, through gaining grant funds and through working closely with other research providers.

Australian National Insect Collection

- Dr Simon Grove and Dick Bashford collaborated with ANIC in the identification of insect specimens from the Tasmanian Forest Insect Collection.

Bayer Crop Science

- Dr Jane Elek is involved in evaluating the efficacy of stem-injected imidacloprid for protecting foliage of plantation eucalypts from chrysomelid leaf beetles.

Britton Timbers Ltd

- Plantations Branch are collaborating with Britton Timbers on an integrated study of processing and market acceptability of *Eucalyptus nitens* timber derived from the Meunna genetics trial.

Canadian Forest Service

- Dr Martin Moroni is leading CRC Forestry project 1.6.1 'Carbon model assessment' which will collate and collect forest carbon data to evaluate CBM-CFS3 and FullCam in Tasmania and Queensland in collaboration with Robert Waterworth, Department of Climate Change, and Canadian Forest Service.
- Dr Martin Moroni is involved in the Newfoundland Boreal Ecosystem Latitudinal Transect examining the impact of climate change on forest systems. In addition Martin is helping develop a project aimed at the application of the Triad approach to forest management in Newfoundland.

Charles Sturt University

- Dick Bashford is co-supervisor with Professor Geoff Gurr and Dr Angus Carnagie (NSW-DPI) of a PhD student funded by the National Sirex Co-ordination Committee.
- Dick Bashford is a partner investigator in an ARC-Linkage project led by Dr Geoff Gurr examining the impact of *Ips grandicollis* on the management of Sirex in *P. radiata* plantations.

CRC for Forestry

- Dr Mark Neyland is collaborating with Dr Peter Ades (University of Melbourne), and Dr Dot Steane and Prof Brad Potts (University of Tasmania) on Project 4.2.7 Management of Genetic Resources investigating the genetics of *E. regnans* and *E. obliqua*, which will be used to assess the current seed zoning system and to inform changes if necessary.
- Dr Tim Wardlaw is Chair of Project Steering Committee for Project 4.2 (Biodiversity) and Project 1.1.2 / 1.2.2 (Measuring and managing forest health).
- Drs Simon Grove, Sue Baker, Jane Elek and Tim Wardlaw are involved in conducting / managing several research projects within Project 4.2 (Biodiversity).
- Dr Paul Adams works with Program 1 Managing and monitoring for growth and health.
- Dr Dean Williams works with Program 2 High-value wood resources.
- Dr Sandra Roberts works with Project 4.1 Water quantity and quality.
- Dr Steve Read chairs the Program Coordinating Committee for Program 4 Trees in the Landscape.

CSIRO Division of Forestry and Forest Products

- Work with Dr Chris Beadle on pruning and thinning, blackwood plantation silviculture, nutrient management and genetics in relation to wood quality.
- Collaboration with Dr Simon Southerton to identify genes that significantly affect wood quality in *E. nitens*.

CSIRO Marine and Atmospheric Research

- Dr Tim Wardlaw and Karl Abetz are collaborating with Dr Ray Leuning in the establishment and operation of the Warra Flux site as part of the Ozflux network (TERN-funded).

CSIRO Sustainable Ecosystems

- Dr Chris Beadle collaborates with Native Forests Branch on research needs for blackwood.
- Dr Tim Wardlaw, Dr Jane Elek, Karl Wotherspoon and Leonie Jordan are collaborating with Dr Libby Pinkard in a project modelling and validating the impact of leaf beetle defoliation in mid-rotation *E. nitens* plantations.

Department of Environment and Heritage

- DEH funds the CERF Research Hub Landscape Logic at University of Tasmania. of which Forestry Tasmania is a member. Forestry Tasmania hosts Dr Regina Magierowski, a post-doctoral researcher in that hub.

Department of Primary Industries, Parks Water and the Environment

- Dick Bashford is collaborating with Dr Megan Szczerbanik in conducting quarantine surveillance programs in Tasmania to detect exotic forestry insects as part of a National OCPPO funded program.

- Dick Bashford is a member of the Biosecurity Technical Committee and Dr Tim Wardlaw is on the Stakeholder Reference Group of the Tasmanian Biosecurity Committee.
- Dr Simon Grove, Dr Tim Wardlaw and Dick Bashford are collaborating with Michael Driessen to plan the second decadal monitoring of the Baseline Altitudinal Monitoring Plots.
- Nita Ramsden and Dick Bashford are collaborating with Benjamin Uren in conducting quarantine surveillance programs in Tasmania to detect exotic forestry insects as part of a National OCPPO funded program.

Forest Practices Authority

- Dr Sue Baker is collaborating with Drs Sarah Munks and Amy Koch on habitat trees retained in aggregates of aggregated retention coupes.

Forest and Wood Products Australia

- Dr Martin Moroni received funds from a CRC Forestry project funded by the FWPA to write a report describing the role of forestry in the greenhouse gas mitigation debate.

Herbarium, Tasmanian Museum and Art Gallery

- Dr Jean Jarman is collaborating with Dr Gintaras Kantvilas (Herbarium, Tasmanian Museum and Art Gallery) and Dr Peter Minchin (University of Southern Illinois) in her research into the impacts of harvesting on the lichen and bryophyte floras of wet eucalypt forest.

Memorial University of Newfoundland

- Dr Martin Moroni is an adjunct professor with the Memorial University of Newfoundland.

Monash University

- Drs Simon Grove and Tim Wardlaw are collaborating with Dr Paul Sunnucks on an ARC Linkage grant using molecular genetics approaches to examine landscape factors affecting the movement of log-dwelling beetles in the Experimental Forest Landscape.

National Sirex Co-ordination Committee

- Dick Bashford is Chair and Treasurer of the NSCC. The NSCC is a national body responsible for the development of the biological control program for Sirex.

Nova Scotia Department of Natural Resources

- Dr Martin Moroni is collaborating with Peter Neily to regionally evaluate CBM-CFS3 in hardwood forests of Nova Scotia.

Oregon State University

- Dr Tim Wardlaw is collaborating with Dr Tom Spies on an ARC-Linkage project examining the effect of forest influence on recolonisation of harvested areas.

Private Forests Tasmania

- Dr Dean Williams and Dr Paul Adams are undertaking collaborative research into selecting eucalypt species suitable for deployment on cold and dry sites in the Tasmanian Midlands.

Research Priorities Coordinating Committee

- Research Working Group 1 (Genetic Resources): Membership - Dr Dean Williams.
- Research Working Group 3 (Water): Membership - Dr Sandra Roberts.
- Research Working Group 4 (Native Forest Management): Membership - Dr Simon Grove, Dr Mark Neyland.
- Research Working Group 5 (Plantation Management): Membership - Dr Paul Adams, Dr Matt Wood.
- Research Working Group 7 (Forest Health): Membership- Dr Tim Wardlaw, Dick Bashford.
- Research Priorities Coordinating Committee - Dr Steve Read.

seedEnergy Pty Ltd

- Provision of contract services for training in Mass Supplementary Pollination of *E. globulus*.
- Supply of genetically improved *E. dunnii* seed to support the Genetic Improvement and Silviculture Program in China

Southern Tree Breeding Association Inc.

- *E. globulus* operational tree breeding and genetic improvement research is done through the STBA, and STBA undertakes TREEPLAN® analysis of FT *E. nitens* breeding populations under contract with PLANTPLAN Genetics.
- Dr Dean Williams is an elected member of the STBA Technical Advisory Committee.
- David Pilbeam (STBA) provides assistance and information for the Forestry Tasmania eucalypt breeding program.

St Francis Xavier University

- Dr Martin Moroni is collaborating with David Risk and Lisa Kellman on the use of isotopes to separate heterotrophic and autotrophic soil respiration.

collaboration & linkages

Swedish University of Agricultural Sciences

- Dr Mark Neyland and Dr Sue Baker are collaborating with Prof. Lena Gustafsson (Swedish University of Agricultural Sciences) and an international team of scientists, on a review of variable retention around the world.

Technical University of Dresden

- Dr Martin Moroni is collaborating with Professor Franz Makeschin investigating the forest carbon cycle in eastern Canada and evaluating the Carbon Budget Model of the Canadian Forest Sector (CBM-CFS3), and is supervising an honours student who will come to Tasmania in the second half of 2011 to examine soil carbon stocks in conjunction with Ian Riley's PhD from this University.

University of Guelph

- Drs Tim Wardlaw and Simon Grove are collaborating with UniversityGuelph to undertake DNA fingerprinting of a selection of saproxylic beetle taxa from the TFIC (as part of the ARC-Linkage project on forest influence).

University of Melbourne

- Dr Leon Bren provides advice on the Warra Hydrology project.
- John Hickey is collaborating with Dr Kath Williams, Professor Ian Bishop, Dr Rebecca Ford and Eric Smith to determine the social acceptability of alternatives to clearfelling.
- Drs Tom Baker, Yue Wang and David Forrester collaborate in CRC Forestry Program 2 (High Value Wood Resources), particularly in the area of growth and yield modelling in eucalypt plantations.
- Dr Steve Read is involved in a range of collaborations with the School of Botany, School of Zoology and School of Forest and Ecosystem Sciences and is an Honorary Associate Professor in Forest and Ecosystem Sciences.

University of the Sunshine Coast

- Mark Hunt is collaborating with Dr Martin Moroni on the role of forestry in the greenhouse gas mitigation debate.

University of Sydney

- Dr Charles Warren has been collaborating on work aimed at understanding the importance of organic nitrogen and improving soil nitrogen indicators.

University of Tasmania

- Drs Simon Grove and Tim Wardlaw are partner investigators on an ARC Linkage project led by Dr Caroline Mohammed and Dr Christina Schmucki as post-doctoral researcher using molecular genetics approaches to examine landscape factors affecting the movement of log-dwelling beetles in the Experimental Forest Landscape.
- Dr Tim Wardlaw is collaborating with Drs Greg Jordan, Chris Burridge and Sue Baker (Post-doctoral researcher) on an ARCLinkage project examining the effect of forest influence on recolonisation of harvested areas.
- Dr Simon Grove is co-supervisor of PhD studies by Belinda Yaxley on the autecology of saproxytic insects in the southern forests, and Lynne Forster on population structures of saproxylic beetles in the Experimental Forest Landscape.
- Dr Martin Moroni and Dr Mark Neyland are honorary research associates with the School of Plant Science at the University of Tasmania.
- Robyn Scott is enrolled at the School of Plant Science at the University of Tasmania as a part-time PhD student. Her topic is 'Effects of variable retention harvesting on productivity and growth in wet eucalypt forests'. Robyn is supervised by Assoc. Prof. Mark Hovenden (University of Tasmania), Dr Steve Mitchell (University of British Columbia) and Dr. Mark Neyland.
- Dr Tim Wardlaw is collaborating with Dr Greg Jordan in an honours study examining forest influence effect on the recolonisation by bryophytes into an old clearfell.
- Dr Tim Wardlaw is collaborating with Dr Caroline Mohammed in an FWPA-funded project auditing forest biosecurity arrangements and preparedness in Australia.
- Dr Dean Williams is collaborating with Professor Brad Potts and Associate Professor Rene Vaillancourt to examine genetic and phenotypic segregation in F2 families of *E. globulus*.
- Dr Paul Adams is collaborating with Dr Jane Sargison, Dr Mark Boersma and Anna Wrobel-Tobiszewska on biochar project.

Washington State University

- Dr Tim Wardlaw is collaborating with Prof (Emeritus) Jerry Franklin on an ARC Linkage project examining the effect of forest influence on recolonisation of harvested areas.

published papers, reports & presentations

Authors employed by Forestry Tasmania during 2010-11 are shown in boldface.

PAPERS IN REFEREED JOURNALS

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Gates G, Ratkowski D, Mohammed C, **Wardlaw T**, Davidson N (2010) The ecology and diversity of wood-inhabiting macrofungi in a native *Eucalyptus obliqua* forest of southern Tasmania, Australia. *Fungal Ecology* 4: 56-67.

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Hagemann U, **Moroni MT,** Gleißner J, Makeschin F (2010) Disturbance history influences downed woody debris and soil respiration. *Forest Ecology and Management* 260: 1762-1772.

Hagemann U, **Moroni MT,** Gleißner J, Makeschin F (2010) Accumulation and preservation of dead wood upon burial by bryophytes. *Ecosystems* 13: 600-611.

Horton BM, Close DC, **Wardlaw TJ**, Davidson NJ (2010) Crown condition assessment: An accurate, precise and efficient method with broad applicability to Eucalyptus. *Austral Ecology*, doi:10.1111/j.1442-9993.2010.02206.x

Jennings S, Neyland M (2011) Seedling regeneration of celery-top pine (*Phyllocladus aspleniifolius*) after harvesting of rainforest in north-western Tasmania. *Tasforests* 19, *in press.*

Keenan RJ, **Read SM** (2011) Assessment and management of old-growth forests in southeastern Australia. *Plant Biosystems, in press.*

Koch AJ, **Baker SC** (2011) Remotely assessing hollow availability using aerial photographs. *Biodiversity and Conservation* 20: 1089-1101.

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forest tours and lunchtime talk series

Forest Tours

During National Science Week 2010, Forestry Tasmania invited primary schools to visit the Tahune AirWalk to see a variety of science displays, and experience all the attractions at the AirWalk. Forestry Tasmania's scientists also accompanied the school groups on walking tours of the forest answering questions for the young enquiring minds and also highlighting the unique features of the Tahune Forest Reserve.

The scientists also provided an insight into the research being undertaken across the Tahune bridge at the Warra Long-Term Ecological Research (LTER) site. DFRD's scientists also hosted bus tours into the Warra LTER site, where participants saw first-hand the extensive research being undertaken.

Lunchtime Talk Series

The Division presents regular lunchtime talks in a series known as Forestry Talks. The broad theme is "Applying Science to Modern Forest Management". The presentations incorporate talks by Forestry Tasmania's scientists, and also by visiting scientists and from institutions such as the University of Tasmania.

For a complete listing of Forestry Talks and to obtain complimentary DVDs visit:
http://www.forestrytas.com.au/science/forestry-talks

Ben Greene (Forest Education Foundation) with a group of students on the Tahune AirWalk during National Science Week

Forestry Talks 2010 - 11

- 18 August 2010 **Dr Martin Moroni**
  Climate change and the carbon cycle
- 15 September 2010 **Dr Paul Adams & Dr Matt Wood**
  High-value products from hardwood plantation timber
- 13 October 2010 **Dr Tim Wardlaw**
  How do pests, diseases and wood value affect which eucalypt we grow?
- 17 November 2010 Prof Brad Potts & **Dr Dean Williams**
  Can good genetics protect our plantations from fungi and munching mammals?
- 8 December 2010 Dr Kathryn Williams
  What do people want from native forests?
- 19 January 2011 Dr Jacki Schirmer
  Social benefits and costs of plantations for rural communities
- 16 February 2011 Dr Sue Baker
  Ecologically sustainable forestry – comparisons between western USA, Canada and Tasmania
- 23 March 2011 **Dr Steve Read**
  Fire, carbon, burning and regeneration
- 13 April 2011 **Dr Simon Grove** & Dr Jayne Balmer
  Dynamic landscapes and the resilience of nature

divisional publications

The publications below are available from the Division
Tel: 03 6235 8219 or email research@forestrytas.com.au

A History of Innovation - 85 years of Research and Development at Forestry Tasmania

A New Silviculture for Tasmania's public forests

Native Forest Silviculture & Technical Bulletins

No. 1: Eucalypt Seed and Sowing

No. 2: *Eucalyptus delegatensis* Forests

No. 3: Lowland Dry Eucalypt Forests

No. 4: High Altitude *Eucalyptus dalrympleana* and *Eucalyptus pauciflora* Forests

No. 5: Silvicultural Systems

No. 6: Regeneration Surveys and Stocking Standards

No. 7: Remedial Treatments

No. 8: Lowland Wet Eucalypt Forests

No. 9: Rainforests

No. 10: Blackwood

No. 11 : Silvicultural Effects and Use of Fire

No. 12. Monitoring and Regeneration Protection

No. 13: Thinning Regrowth Eucalypts

Pests and Diseases & Leaflets

Insect Pests of Trees and Timber in Tasmania

Identifying pests in Tasmania's forests:

1 – Tasmanian Eucalyptus leaf beetle

2 – Southern Eucalyptus leaf beetle

3 – Autumn gum moth

4 – Gum leaf skeletoniser

5 – Gum tree corid bugs

6 – Large green sawfly

7 – Sirex wood wasp

Weed control in Tasmania's forests

1 – Docks (Rumex species)

2 – Bracken (*Pteridium esculentum*)

3 – Cumbungi/Bullrush (*Typha spp Pers.*)

4 – Gorse (*Ulex eruopaeus L.*)

5 – Ragwort (*Senecio jacobaea L.*)

6 – Thistles

7 – Wild radish (*Raphanus raphanistrum*)

8 – Silver wattle (*Acacia dealbata*) & Black wattle (*Acacia mearnsii*)

9 – Pampas Grass

10 – Grasses (*Poaceae*)

11 – Sorrel (*Rumex acetosella*)

Soils & Soil Bulletins

Forest Soils of Tasmania

No. 1: Soils of Tasmanian State forests. 1. Piper sheet, North-east Tasmania

No. 2: Soils of Tasmanian State forests. 2. Forester sheet, North-east Tasmania

No. 3: Soils of Tasmanian State forests. 3. Forth sheet, Northern Tasmania

Tasforests

Vol. 10 - 18 available in hard copy

Vol.1 - 18 available on-line

http://www.forestrytas.com.au/publications/tasforests

Zoology

Tasmanian Forest Insects and their Host Plants

Scientific Information Sheets

Use of pesticides in plantations

Why do we need regeneration burns in Tasmanian forests?

Selecting the best trees for eucalypt plantations

http://www.forestrytas.com.au/publications/scientific-fact-sheets

divisional management structure & key staff

The Division is headed by the Chief Scientist, who oversees the following management team:

Principal Research Scientist (Native Forests)
Manages research on techniques aimed at increasing productivity of the harvestable areas in native forests. Coordinates continuous improvement of ecologically sustainable forest management.

Principal Research Scientist (Plantations)
Manages research and extension on plantation silviculture and forest hydrology. Manages operational implementation of plantation research and quality standards monitoring.

Principal Research Scientist (Biology & Conservation)
Manages research into the conservation of natural values and management of pests and diseases. Manages the forest health surveillance program.

STEVE READ
(Chief Scientist)

Dr Steve Read commenced as Chief Scientist in 2004. Steve was previously on the staff of the School of Forestry, University of Melbourne, Creswick and the School of Botany, University of Melbourne, Parkville and has a PhD in plant development and biochemistry from the University of Cambridge, UK. His research interests range widely across forest science.

Steve was involved in the previous CRC for Hardwood Fibre and Paper Science and is part of the current CRC for Forestry. He has also; authored some 40 research papers and 60 conference publications and supervised 20 Masters and PhD students, served as Associate Dean (Coursework) in the University of Melbourne Institute of Land and Food Resources 2001 - 2004, and worked on the Land & Biodiversity Implementation Committee of the Glenelg-Hopkins Catchment Management Authority in western Victoria

Steve also maintains a position as an Honorary Associate Professor, Department of Forest and Ecosystem Sciences, University of Melbourne.

MARK NEYLAND
(Principal Research Scientist – Native Forests Branch)

Mark graduated from the Australian National University in 1980 with a Bachelor of Science in Forestry, and in 2009-2010 was a PhD student at the University of Tasmania. Mark has spent most of his career as a botanist and ecologist. His research has included the ecology and conservation of rare butterflies, and the conservation and management of relict rainforest in eastern Tasmania, tree ferns and dry forests and woodlands. Mark joined Forestry Tasmania in 1998 as a research officer and became the Principal Scientist in Native Forests Branch in 2005. The Warra Silvicultural Systems Trial has been a major focus of his work throughout that time. He has authored over 60 publications, from peer-reviewed scientific papers through to technical documents designed to transfer the results of research into forest management systems and guidelines.

PAUL ADAMS
(Principal Research Scientist – Plantations Branch)

Dr Paul Adams has been a forest researcher for nearly 20 years, for the last 10 focusing on soil, nutrition and productivity-related research in pine and eucalypt plantations. This work includes the development of secondary fertiliser programs, monitoring and decision-support systems to improve the productivity and quality of *E. nitens, E. globulus* and *P. radiata* plantations. Other interests include off-site impacts of fertilising, sustaining long-term productivity, and weed management.

TIM WARDLAW (Principal Research Scientist – Biology & Conservation Branch)

Dr Tim Wardlaw has a Bachelor of Science (Hons) and a PhD from the University of Tasmania. He has 25 years experience in applied forest pathology research, with particular emphasis on disease survey, impact assessment, diagnosis and development of management strategies. Tim introduced forest health surveillance to Tasmania in 1997. He has a strong record of successfully securing funds for research projects, and has undertaken many consultancies in the Asia-Pacific region. Tim has authored more than 25 peer-reviewed publications and book chapters as well as numerous technical reports and conference publications.

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