Research and Development Branch

annual report 2012

Forestry Tasmania

Research and Development Branch

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: Leigh Edwards, who retired at end July 2012, after nearly 40 years of outstanding service to Forestry Tasmania, mostly within Research and Development.

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 Photograph: Dave McElwee, research technician, completing a 'LiDAR' plot, designed to confirm airborne remote sensing data with on-ground assessment.

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Forestry Tasmania

manager's report

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The last year has been a period of very rapid change in Research and Development Branch. There has been a reduction in the number of people, as the Tasmanian Community Forest Agreement program has concluded, contracts have been completed and research projects have been finalised. A number of staff have also resigned to move onto other things. Following a review of Forestry Tasmania's research capacity by the Board in February this year it was agreed, amongst other things, to restructure Division of Forest Research and Development into a smaller Research and Development Branch that is focused on improving forest productivity and providing ecosystem services. This restructure is now complete; the new branch comprises two groups so named: Productivity and Ecosystem Services. The Board also recommended that the biodiversity and hydrology programs be wound down, and that a high level carbon policy capacity be maintained.

Despite the diversions of restructures and difficult markets, the research group still performed strongly over the year. Within the Ecosystem Services group, a major report for the Forest and Wood Products Australia (FWPA) on the effectiveness of the Comprehensive, Adequate and Representative (CAR) reserves system has been completed. This report broke new ground in landscape level understanding of the way the biota responds to disturbance, and will inform future thinking about coupe management. Significant refinements to the leaf beetle IPM delivered direct cost savings to the operational program. Provision of research services to external customers delivered significant income to FT.

Within the Productivity group, an FWPA-funded hydrology project has been completed which has shown that it is possible to manage for both water use and wood production in the long term. Regimes have been developed for managing plantations to maximise pruned log production and economic returns, and positive improvements in tree growth and wood quality are being achieved through the tree improvement program. As for the Ecosystem Services group, the provision of research services to external customers remains an important part of the Productivity group's work: the genetic development work in Yong'an Province in China in particular.

The Warra Long-Term Ecological Research Site continued to support a very active research program and is now formally a Supersite under the Terrestrial Ecosystem Research Network. Progress was made in establishing the flux tower at Warra, although delays in fabrication resulted in the tower erection being put back to spring 2012. Encouragingly, other Warra partners have become more active at the site. This is crucial if Warra is to continue to maintain its status as one of the pre-eminent long-term research sites in Australia, thus enabling us to attract investment from diverse sources.

Research within the Forest Management Division is centred on but not exclusive to Research and Development. One of the consequences of being a smaller group of people than in the past is a greater focus within the Division on collaboration between branches (R and D, Resources and Sustainability Planning, with Wood Planning being an honorary member). One excellent example of this collaboration is the recently created role of inventory coordinator, whereby all inventory work across the Division is now being coordinated by one person to ensure the most efficient use of resources.

The year ahead will be an interesting one. The focus of research is now very clearly on delivering value to Forestry Tasmania. The Productivity group is focussed on improving wood quality and quantity from our plantations, whilst maintaining a smaller but active role in native forests. Within Ecosystem Services, the key priority for the forest health program is to better understand the crown dynamics of mid-rotation plantations with chronically thin crowns. The conservation program will focus on adopting the findings from the Comprehensive Adequate and Representative reserves study; ensuring they inform the negotiations with Forest Practices Authority on coupe-context; and ensuring the findings are accessible to the public and other stakeholders.

E. nitens plantation water use research

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A method has been developed for simultaneously assessing water use and wood production from *E. nitens* plantations using FT's Forest Estate Model. This allows the hydrological impact of proposed plantation management regimes to be assessed during the planning process.

The FWPA/TCFA project "Predicting the water use of *Eucalyptus nitens* in Tasmania using a Forest Estate Model" involved measurement of transpiration, soil evaporation, canopy interception, rainfall and basal area in a chronosequence of plantations in the Florentine Valley and at a single site on the Tasman Peninsula.

A strong relationship was found between plantation basal area and plantation water use (Figure 1). This led to the development of a water use function for *E. nitens* plantations (Equation 1). WU = water use in mm/yr, BA = basal area in m^2/ha, and R = rainfall in mm/yr. Potential evaporation is used to set the upper limit for water use.

$$WU = 149.43+11.04*BA+0.36*R \quad \text{Equation 1.}$$

The Forest Estate Model already calculates basal area of plantations and native forests. It is easy to add rainfall information and potential evaporation data, so when Equation 1 is included in the model it simultaneously calculates plantation water use and wood production for an area of interest: plot, coupe, compartment, catchment, or property. These predictions can span long periods (e.g. 50 years) and take growth rates and harvesting and thinning schedules into consideration.

As a case study, the Forest Estate Model with the water use function built in (FEMWU) was used to predict the water use and wood production of all of the *E. nitens* plantations (1532 ha) occurring in the Florentine Valley. Water use constraints can be added to the FEMWU to determine the optimum way to harvest and regrow plantations to minimise changes to water availability or to stay below a threshold. Figure 2 shows evapotranspiration, volume cut and standing basal area for *E. nitens* plantations in the Florentine Valley when management attempts to keep water use stable through time.

In addition, the FEMWU produces schedules that detail which coupes should be harvested and thinned in which year in order to achieve the management objectives.

The FEMWU is unique in using a pre-existing model and good quality information on plantation size and growth to predict evapotranspiration over extended periods. It is unique in being able to generate a schedule of harvest and thinning activity for an area of interest. The FEMWU will be valuable for demonstrating whether plantation development is likely to significantly increase water use in the catchment and if it can be offset by harvesting and thinning. Similar research could be undertaken to develop the Forest Estate Model to predict the water use of Native Forests or other plantation types (*E. globulus, P. radiata*). If the water use of other land uses was also included this could ultimately result in a catchment management tool.

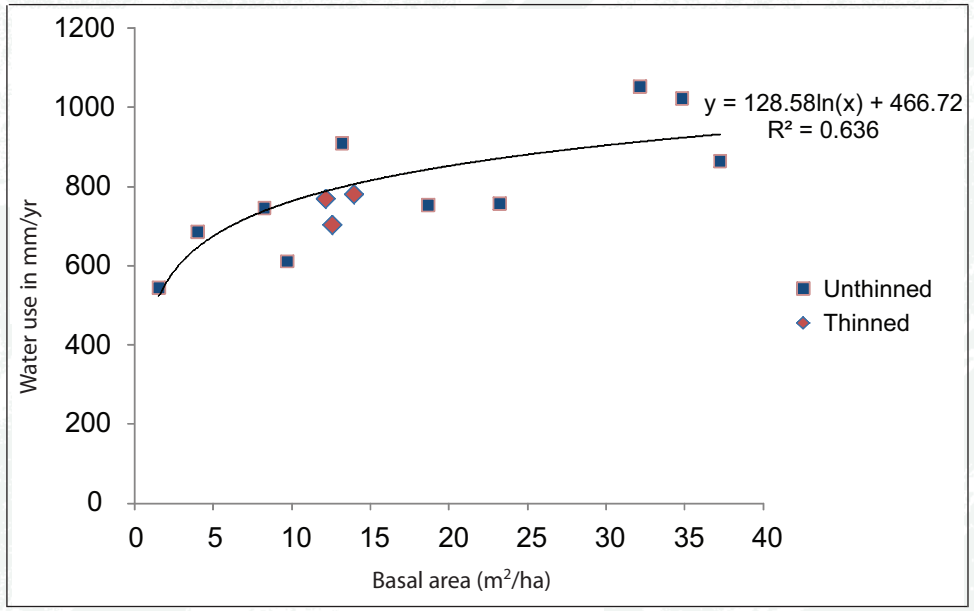

Figure 1. Relationship between Basal Area and Water Use for thinned and unthinned plantations in the Florentine Valley.

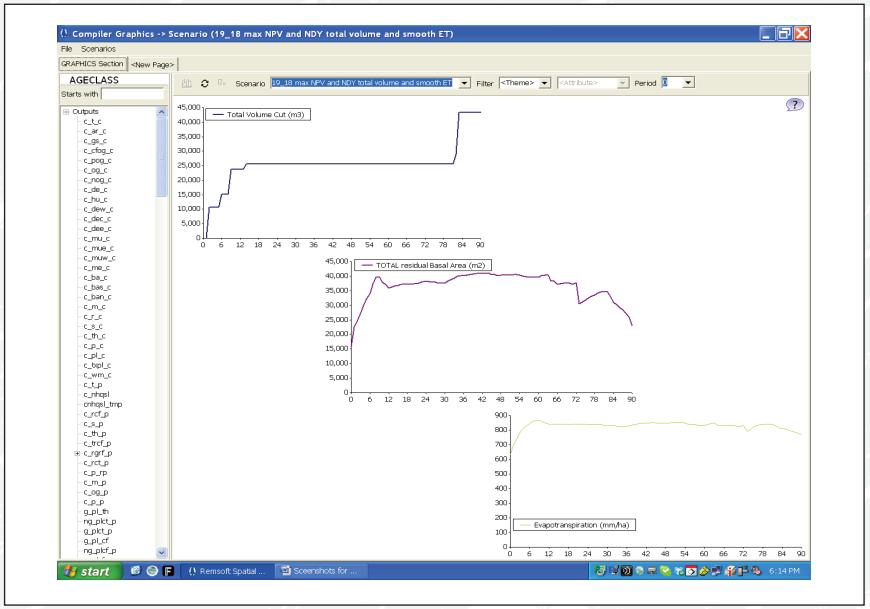

Figure 2. FEM screenshot showing Volume Cut, Standing basal area and evapotranspiration (water use) where objective is to have non-declining total volume cut and smoothed evapotranspiration (+/- 10%) scenario for 1532 ha of E. nitens *plantation in the Florentine Valley. The jump in Volume Cut towards the end of the cycle is an artefact of the modelling and should be ignored.*

Forestry Tasmania

Blue Gum Genomics - Accelerating the selection and development of thoroughbred plantation trees

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Forestry Tasmania has joined forces with CSIRO Plant Industry, other temperate hardwood plantation growers and Forest and Wood Products Australia to develop techniques that identify small changes in the DNA of *Eucalyptus nitens* (Shining Gum) and *E. globulus* (Tasmanian Blue Gum) that indicate, or indeed cause, positive improvements in tree growth and wood quality. In other words, identifying a DNA fingerprint for tree value. This project is known as the Blue Gum Genomics Project.

These small changes in the DNA, known as Single Nucleotide Polymorphisms or SNP's (pronounced "snips") are detected using technology similar to that used to sequence the human genome, but that's only half the job. As in humans, the DNA sequence of each tree is unique, and to find which change in the DNA sequence is associated with an observable change in growth and wood quality requires skilled detective work and a large field trial resource.

Forestry Tasmania has been building up a large *E. nitens* and *E. globulus* tree breeding trial resource for over 30 years, using traditional breeding practices to achieve genetic improvement in plantation value. In these breeding programs, tree characteristics such as growth, wood density and pulp yield have been assessed using conventional field and lab based techniques. The data are analysed using sophisticated statistical software packages to identify a small group of trees, superior in these valuable characteristics. This small group of superior trees is then used to produce seed for the establishment of the next generation of plantations.

When the vast amounts of traditional field and lab based data collected are compared to the SNP based DNA profiles, consistent and stable patterns have emerged. In a recently completed pilot study on *E. nitens*, involving a collaboration between CSIRO Plant Industry, FT, Gunns, PLANTPLAN Genetics, CRC Forestry and FWPA, the data from large groups of trees were assessed to compare the effectiveness of using either SNP data or traditional genetic analysis to select small groups of superior trees from those larger groups. Whilst only 6 SNP markers were used in the study, it was found that a small group of trees selected using the SNP technology had a mean economic value for pulp production of up to 12% greater than a group of trees identified using traditional techniques. The SNP technology demonstrated a higher accuracy in selecting the superior trees compared to the traditional method.

Whilst the use of SNP technology can increase the accuracy of selecting superior trees, it also has the potential to identify superior trees earlier in the breeding cycle and reduce the time needed to produce the next generation of superior trees. Traditionally, important wood quality characteristics could only be reliably assessed on mature or near-mature trees, which can mean waiting up to, or even well over, a decade from when the tree is planted in a trial to when it can have its wood quality tested. A SNP test can be done at any time in the life of the tree, meaning seedlings can be tested for these valuable wood characteristics, "snipping" many years off the testing program and bringing forward the deployment of superior trees into plantations.

The successful demonstration of the power of SNP technology inspired the development of the current Blue Gum Genomics project, to extend the development and application of SNP technology to *E. globulus*, to discover a greater number of effective SNP markers for growth and pulp yield, and to discover SNP's for the improvement of other wood characteristics such as stiffness and checking, two attributes currently keeping *E. nitens* in particular, out of favour with timber and veneer processers.

In the short term, the initial project wood quality and SNP data is being used to enhance the current traditionally based genetic analysis and superior tree selection program to deliver genetic gains as early as possible. In the medium term, the new suite of SNP data developed through the project will be incorporated into the routine genetic analysis for tree selection, and in the long term it's expected SNP data will be the major component of genetic analysis, selection and improvement in the hardwood breeding program.

Figure 1. Studying the DNA of trees, like these in an E. nitens *genetics trial near Scottsdale, means that we will be able to identify the key signs (SNP's) that will help us to rapidly select the best parents to improve the value of the next generation of plantations.*

Alternative silvicultural regimes for increasing production of pruned logs from plantations

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An evaluation of alternative silviculture regimes for the FT eucalypt plantations was undertaken using modelling methods to determine how to improve pruned log production (Figure 1) and economic returns from the FT eucalypt plantation estate. The modelling was comprehensive and used the FT modelling tool FTGrow2 where multiple scenarios could be processed efficiently.

The best alternative silvicultural regimes for increasing profitability are those that employ high pruning and target low residual stockings after thinning (100 – 200 stems per hectare). Two-stage thinning regimes (2SE and 2SL) were ranked highest for NPV across both species and at all site indices. The best two-stage regimes involved either (a) an early non-production thin at age 3 years to mid-level stocking (500 stems per hectare) followed by a production thin at age 12 years to 100 stems per hectare (2SE), or (b) a later-age production thin (age 8 years) to 500 stems per hectare followed by a 2nd production thin at age 12 years to 100 stems per hectare (2SL) Consideration has been given to operational and silvicultural factors associated with these two regimes. The 2SL regime appears to be the better regime in terms of cash-flow and flexibility under the current conditions; however, sufficient volume is required from the thinning operations to make it commercially viable.

It is recommended that a stocking of 200 stems per hectare be adopted as the target residual stocking to satisfy concerns about (a) the model limitations at low stockings, (b) flexibility and risk associated with wind damage, and (c) maintaining adequate site utilisation while optimising competition-free growth. Figure 2 shows an example of 200 stems per hectare in a trial at Goulds Country (aged 6 years).

Work is continuing on this research including the impact of low stocking on canopy and branch size development, improving the timing of pruning operations in relation to tree height, age and condition at different site productivities, and investigating the utility of the process-based model CABALA for predicting thinning responses and using it to guide ongoing work on the FTGrow2 model. A series of field demonstration trials were installed and more research sites will be installed in 2013.

The next major step is to examine potential conflicts with respect to future woodflows and follow this up with the development of a detailed plan for implementing appropriate regimes within the existing estate.

Figure 1. E. nitens *pruned logs harvested from the Meunna silviculture trial (aged 22 years). Trees had been 2-lift pruned to 5.4 m and thinned to 200 stems per hectare at age 6 years. Log lengths range from 3.5 m to 5.7 m with small end diameters from 30 cm to 57 cm. Log ends have been waxed to reduce end splitting.*

Figure 2. Thinning trial at Goulds Country (now harvested) showing 200 stems per hectare at age 6 years.

Effectiveness of CAR reserves in maintaining biodiversity in production forests

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The effectiveness of the CAR reserve strategy for maintaining forest biodiversity in production forest landscapes was demonstrated in the Southern Forests Experimental Forest Landscape (SFEFL). This 100,000 ha landscape supports tall, wet *E. obliqua* forests that have been modified by interspersed land-uses and wildfire over the past century to provide a gradient in the intensity of disturbance within a relatively uniform bio-physical environment. Context-class, reflecting the weighted proportions of different vegetation types in the surrounding 500-2000 m landscapes, measured the gradient in disturbance intensity. Context-classes ranged from 1-10 with 1 representing the highest intensity of disturbance.

Birds, beetles and vascular plants were used to measure biodiversity responses. We assessed their abundance and richness in plots within mature eucalypt forest and older (30-50 years-old) silvicultural regeneration. Mature eucalypt forests represent the primary target for reservation, while silvicultural regeneration represents the dominant forestry disturbance in the SFEFL. The plots were located to provide replicate samples (7) of the two forest types in each of four context-classes: 3-6 in older silvicultural regeneration and 4-7 in mature eucalypt forest.

Dense-forest bird species and rainforest plant species showed the strongest response to context-class. In mature eucalypt forest, these two groups were unresponsive to context-class (Figure 1). Thus mature eucalypt forest provided equivalent habitat in the most disturbed landscapes, where most is in CAR reserves, as in the least disturbed landscapes. In older silvicultural regeneration, dense forest birds and rainforest plants responded strongly, and positively, to increasing context-class (Figure 1). The response was so strong that in the least disturbed context-class sampled, the abundance and richness of these two groups was not significantly different from mature forest. This level of recovery was much faster than we expected for silvicultural regeneration that was only 30-50 years-old.

The positive response to context-class by dense forest birds and rainforest in older silvicultural regeneration reflected a strong positive correlation with the amount of mature forest in the surrounding landscape. That correlation persisted across a wide range of landscape scales from coupe-scale (125 m) to wide landscapes (4000 m). A simple measure, "proximity (of older silvicultural regeneration) to mature forest" captured that multi-scaled correlation: both dense-forest birds and rainforest plants increased strongly in abundance / richness as proximity to mature forest decreased. There was a clear threshold response at 400 m: the abundance of dense forest birds and richness of rainforest plants in older silvicultural regeneration increased sharply with decreasing proximity to mature forest when that mature forest was closer than 400 m (Figure 2).

- Thus the analyses found two criteria to test the effectiveness of our management in tall, wet eucalypt forest landscape in maintaining forest biodiversity:• Mature eucalypt forest in landscapes (500 m – 2 km) of context-class 4 or above
- Silvicultural regeneration closer than 400 m to the nearest patch of mature forest.

The SFEFL performed well against these two criteria: 92% of the area met criterion 1 and 72% met criterion 2. Areas not meeting the criteria were primarily in sections of the SFEFL shaped by practices and wildfires predating the RFA. These two criteria will be valuable for providing scientifically-based thresholds to develop forest practices guidelines for biodiversity; for evaluating other tall, wet eucalypt forest landscapes to identify areas deficient in mature forest and for ongoing monitoring of management against performance targets for biodiversity.

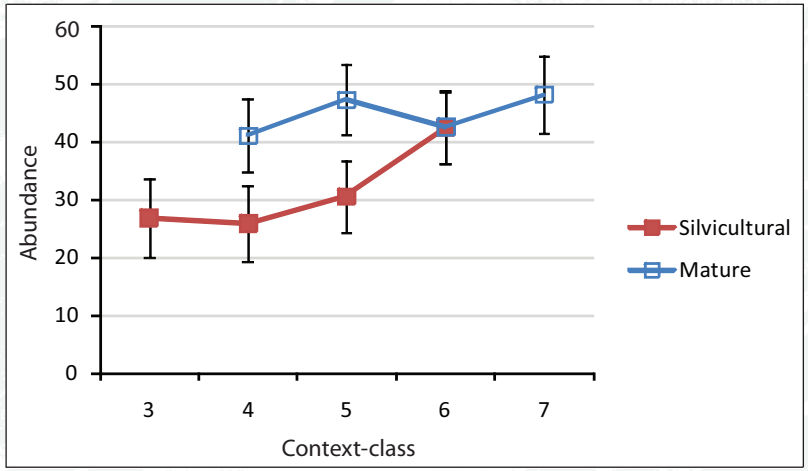

Figure 1. Mean abundance (and 95% LSD) of dense forest birds in mature eucalypt forest and older silvicultural regeneration embedded in landscapes with context-classes between 3 and 7. Abundance data have been adjusted map easting.

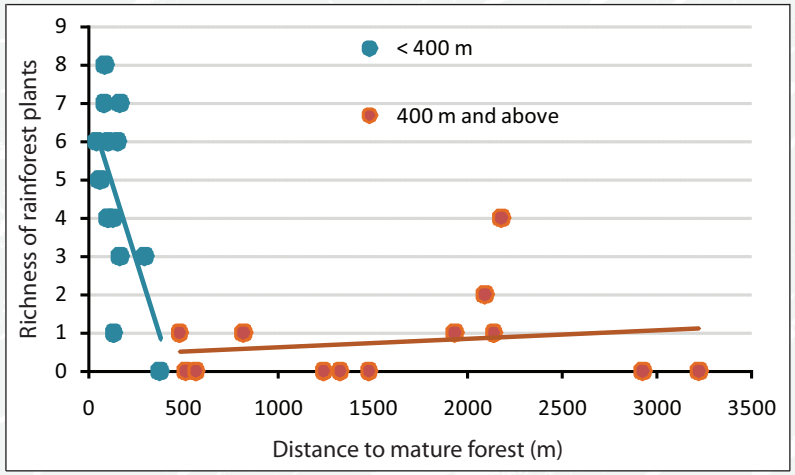

Figure 2. Richness of rainforest plant species with distance to mature forest. Separate models have been fitted for distance < 400 m and ≥ 400 m.

Risk-based management of leaf beetles

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The Integrated Pest Management (IPM) strategy to protect eucalypt plantations from significant damage by the eucalypt leaf beetle (*Paropsisterna bimaculata*) underwent substantial refinement in 2011-12. Instead of using an age-based criterion to target plantations to include in the IPM we used a risk-based criterion. Only plantations predicted to be in areas of moderate to high risk of supporting above-threshold leaf beetle populations were included in the IPM. Risk was determined based on altitude and proximity to *Poa* grassland – the two main risk-factors identified in an UTas honours study (by Sophie Edgar). The second change was to switch from a two-stage monitoring (roadside "quick and dirty" progressing to a full occupied-leaves-per-shoot assessment of 20 interior trees if above a threshold) to an occupied-shoots-per-tree (OSPT) monitoring of 15 roadside trees. This change was required to make it easier to do binocular assessment of leaf beetle populations in older plantations. Older plantations, beyond the age range traditionally targeted by the IPM, were disproportionately represented in areas mapped with moderate and severe defoliation during health surveillance over recent years (Figure 1). The third change was to increase the population threshold that triggered control operations. The existing threshold was designed to prevent moderate levels of defoliation. The revised threshold aims to protect against populations likely to cause severe defoliation. This change aims to maximise the financial benefit of control operations while keeping a cap on the total area being sprayed. The lower threshold was maintained in plantations recovering from previous defoliation.

The change to risk-based targeting resulted in fewer young plantations and more mid-rotation plantations being monitored for leaf beetle populations: 54% of the monitored plantations were 9 years and older in 2011-12 compared with 34% in 2010-11. The greater efficiency of risk based targeting was most apparent in Huon District: only 15% of monitored plantations had above-threshold populations in 2010-11 compared with 54% of monitored plantations in 2011-12 (comparison based on old threshold). In other Districts, the efficiency of risk based targeting was masked because a large area of plantations in low risk situations were monitored. This was because those low-risk plantations were given additional protection while they recovered from defoliation after an unusually severe epidemic of leaf disease the previous year.

The switch from the two-stage monitoring to the OSPT monitoring of roadside trees received favourable feedback from the Districts. Importantly, the switch made it easier to use binoculars to assess populations in older plantations with taller trees.

The lifting of the control threshold resulted in a substantial saving in spraying costs. While 32% of the monitored plantations had populations that exceeded the old threshold only 18% exceeded the new threshold. This represented a saving of $141,000 in spraying costs. Importantly, FHS did not detect severe defoliation in plantations that had leaf beetle populations exceeding the old threshold but were below the new, higher threshold. However, we have found the lower threshold, which was retained to provide additional protection to plantations recovering from defoliation in previous years, may need to be lowered further in some areas.

Figure 1. High-altitude mid-rotation plantation at Lisle showing chronically thin crowns.

Research program - Ecosystem Services

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The Ecosystem Services group (previously the Biology and Conservation Branch) holds Forestry Tasmania's expertise in forest health and conservation biology. It also oversees the biological research program at the Warra Supersite. As well as conducting research, the group is involved with operational health management programs including health surveillance, hazard site surveillance, quarry surveys, *Sirex* management and co-ordination of the leaf beetle Integrated Pest Management. The operational activities of the group are provided both to Forestry Tasmania, and to external clients on a contractual or fee-for-service basis.

Warra formally became a member of the Australian Supersite Network (ASN) this year. ASN has taken over from Australia's Long Term Ecological Research Network and provides Australia's link to the International Long Term Ecological Research Network (ILTER). It is part of the Terrestrial Ecosystem Research Network (TERN) funded by the Commonwealth government under the National Collaborative Research Infrastructure Scheme (NCRIS).

As with other sections of the organisation, the Ecosystem Services group contracted during 2011-12, with four staff departing. Despite this the group maintained all its existing contracts with external customers; delivered a major FWPA-funded project; oversaw significant refinements to the leaf beetle integrated pest management (IPM); and maintained strong linkages with research collaborators in other institutions. These activities delivered significant financial benefit to the organisation. External research contracts and consultancy services provided $331,100 in income; refinements to the leaf beetle IPM delivered savings to the operational program of $190,000; the findings from the Forest and Wood Products Australia (FWPA) Comprehensive,, Adequate and Representative (CAR) reserves program provided scientifically defensible evidence that minimum target levels for retention in wet eucalypt forests can be up to 10% less than those currently being considered (each % reduction in unneeded long-term retention equates to about $2.7M annually in opportunity value to the Tasmanian economy).

Progress was made in establishing the flux tower at Warra, although delays in fabrication resulted in the tower erection being put back to spring 2012. While the existing round of TERN funding only continues until the end of the 2013-14 financial year, planning is underway to seek an extension of funding from the federal government. Encouragingly, other Warra partners have become more active at the site. This is crucial if Warra is to continue to maintain its status as one of the pre-eminent long-term research sites in Australia thus enabling us to attract investment from diverse sources.

A challenging program is planned for 2012-13. A key priority for the forest health program is to better understand the crown dynamics of mid-rotation plantations with chronically thin crowns. This is a necessary step towards identifying the main causes of defoliation. Until that is done, we are limited in our ability to develop management guidelines to remediate affected plantations. The conservation program will focus on adopting the findings from the CAR reserves study; ensuring they inform the negotiations with the Forest Practices Authority on coupe-context; and ensuring the findings are accessible to the public and other stakeholders. The priority for Warra is to get the flux tower erected and commence collecting flux measurements – the aim is to be collecting good data from the beginning of 2013.

ECOSYSTEM SERVICES

Ecosystem Services - Key research and development projects

1. Sustaining biodiversity and habitat

Effectiveness of CAR Reserves Quantify the contribution of CAR reserves and complementary off-reserve management to the conservation of biodiversity dependent on mature forest habitats in production forest landscapes across the continuum of forest management intensity.	**FT Staff** Tim Wardlaw Simon Grove Andrew Hingston Steve Read John Hickey Ruiping Gao **Collaborators** Uni Tas, FPA DSE, Victoria DPI, NSW DEC, WA	**2011-12 Activities and outputs** Completed the sorting, identification and databasing of 90,000 beetles collected in flight-intercept traps. Completed all analyses and documented the results in a final project report (to FWPA).	**2012-13 Planned program** Liaise with Conservation Planning / Forest Practices Authority to ensure findings inform negotiations on landscape biodiversity guidelines. Review FT policy/practices/systems against findings. Disseminate results widely – public fora, other land managers, policy-makers, customers.

1.3 Maintain a diversity of natural habitats and mixed age forests to support biodiversity across the forest estate.

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.	**FT Staff** Simon Grove Tim Wardlaw **Collaborators** Uni Tas Monash University Scion	**2011-12 Activities and outputs** Completed microsatellite screening and genotype mapping of *Coripera*. Completed an initial screening of microsatellites of *Prostomis*. Undertook additional genetic sequencing of *Prostomis* and *Lissotes* to identify additional candidate microsatellites for genetic mapping.	**2012-13 Planned program** Screen *Lissotes* and *Prostomis* if additional microsatellites are detected. Complete analysis of genetic x geographic variation of *Coripera* and *Prostomis* (and *Lissotes* if useful microsatellites found) and document results. Develop a plan to bring this work to a logical conclusion.

Ecosystem Services - Key research and development projects (continued)

Coarse woody debris Develop 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.	**FT Staff** Simon Grove Lee Stamm Martin Moroni	**2011-12 Activities and outputs** Paper on CWD model submitted to *Tasforests* for review.	**2012-13 Planned program** Submission of PhD thesis by Belinda Yaxley.

1.7 retain oldgrowth elements including large trees, stags, understoreys and logs across the forest estate.

SST Biodiversity Document the biodiversity impacts from the range of silvicultural treatments available for harvesting wet eucalypt forests.	**FT Staff** Simon Grove Alison Phillips Andrew Hingston **Collaborators** CRC for Forestry	**2011-12 Activities and outputs** Completed annual surveys of birds and ground beetles in the SST control plots.	**2012-13 Planned program** Complete annual bird and ground beetle surveys of the SST control plots. Commence sorting beetle samples from completed 10-year post-harvest treatments.
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.	**FT Staff** Tim Wardlaw Andrew Hingston (contract) **Collaborators** Uni Tas Oregon State Uni Washington State University	**2011-12 Activities and outputs** Key collaborators engaged for a global study to measure forest influence. Fulbright Fellowship awarded to Sue Baker (UTas) will enable US component of study to be done. 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). Completed floristic, ground-beetle and bird surveys of all plots. Designed and installed a mechanistic study to test effects of shading and litter type on ground beetles.	**2012-13 Planned program** Complete sorting of ground beetles and analyse data to report on ground beetle responses to mature forest influence. Analyse and report on bird responses to mature forest influence. Analyse and report on vascular plant responses to mature forest influence. Complete surveys of bryophyte responses to mature forest influence. Complete second year of mechanistic study. Complete data collection for global forest influence study. Host visit by visiting US researchers.

2. Sustaining jobs for current and future generations

2.4 Ensure an ongoing long term supply of special timbers.

Stand management of fenced-intensive-blackwood To develop prescriptions for management of blackwood rich regeneration particularly in the far northwest.	**FT Staff** Sue Jennings Mark Neyland Rob Musk	**2011-12 Activities and outputs** TG005A was remeasured and results indicated measurements obtained using LIDAR would be best option for yield modelling. Completed establishment report for TG021B fenced-intensive-blackwood thinning trial.	**2012-13 Planned program** Complete remeasurement of TG021A (x 2) and TG021B. Progress stand management regimes for FIB coupes. Input to blackwood resource review (with Planning Branch) (ongoing from 2011/12). Input to blackwood inventory program (with Resources Branch).
Management options for swamp blackwood myrtle forests	**FT Staff** Sue Jennings Mark Neyland	**2011-12 Activities and outputs** Monitored operational trials of selective harvesting in swamp blackwood estate (CH041D/E).	**2012-13 Planned program** Assist district with selection of areas suitable for treatment recognising there are few opportunities for silvicultural intervention in routine swamp regeneration operations.
Silvicultural systems for special timbers To develop and implement safe, practical and economic silvicultural systems for the sustainable production of special timbers.	**FT Staff** Sue Jennings Robyn Scott Mark Neyland	**2011-12 Activities and outputs** No rainforest harvesting in 2011-12.	**2012-13 Planned program** Monitor harvesting in special timbers zones. Provide training in silvicultural systems and damage assessments to contractors and supervisors as required – no contractor, no activity. Send delegate to IUFRO uneven-aged forest management conference in Christchurch, November 2012. Prepare technical note on inoculation of sassafras to produce blackheart timber.

3. Sustaining carbon stores, clean air, water and healthy forests

3.1 Manage State forests for long term carbon storage and provide a sustainable source of products which contribute to locking up carbon and reducing emissions.

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.	**FT Staff** Tim Wardlaw Karl Abetz Leigh Edwards Alison Phillips **Collaborators** CSIRO Marine & Atmospheric Research Uni Melb Monash Uni Uni Tas CRC Forestry	**2011-12 Activities and outputs** Secured all council approvals for erection of tower. Footings for tower and guy anchors installed. Tower fabricated ready for erection. Flux instruments installed on a sub-canopy mast and run for six months in tandem with automatic soil chambers. Ran automatic soil chamber system (Uni Melb) to measure soil CO_2 and trace gas fluxes. The chamber has operated continuously for 18 months. Staff trained in methods for processing flux data to level required under Ozflux contract.	**2012-13 Planned program** Erect tower, install instrumentation. Commence data collection and processing to level three for supply to Monash University as per contract. Liaise with potential collaborators to develop science program and funding applications.
Carbon in forests Engage in the carbon debate in Australia.	**FT Staff** Martin Moroni	**2011-12 Activities and outputs** A number of papers published including 'Aspects of forest carbon management in Australia – A discussion paper', published in Forest Ecology and Management, which challenges a number of the assumptions presented in other literature. Active involvement in the National debate.	**2012-13 Planned program** Ongoing involvement in the National debate, but at a low level following Martin's appointment as Sustainability Manager. Masters Thesis (Patrick Dietrich) Technical University of Dresden completed. Complete evaluation of FullCAM and CBM-CFS3 modelled against measured carbon stocks in wet and dry forests. High level report written.

Ecosystem Services - Key research and development projects (continued)

3.2 Monitor emerging climate change scenarios and trends and adapt forest management practices.

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.	**FT Staff** Tim Wardlaw Simon Grove Dick Bashford **Collaborators** DPIPWE	**2011-12 Activities and outputs** Completed second decade of floristic surveys of BAMPs transects C and D (100-1300 m) and ecotonal plots. Completed second decade of beetle surveys of BAMPs transects C and D.	**2012-13 Planned program** Document results of floristic surveys. Sort beetles and database collated.

3.4 Control weeds, pests and diseases to protect State forests.

Sirex wood wasp Prevent significant losses from outbreaks of *Sirex* wood wasp in *P. radiata* plantations.	**FT Staff** Dick Bashford Nita Ramsden **Collaborators** National Sirex Coordination Committee	**2011-12 Activities and outputs** Monitored five compartments for *Sirex* as per Timberlands contract. Supervised post-doc and PhD in ARC-Linkage research project (*Ips* competition with *Sirex* in trap-trees). Attended National *Sirex* Coordination Committee meeting.	**2012-13 Planned program** Attend National *Sirex* Coordination Committee annual meeting. Monitor five compartments for *Sirex* using static traps (Timberlands contract). Continue providing supervision to ARC-Linkage research project (*Ips* competition with *Sirex* in trap-trees).

Ecosystem Services - Key research and development projects (continued)

Leaf beetle management Integrated Pest management (IPM) that is efficient at preventing economic damage by leaf beetles in plantations.	**FT Staff** Leonie McCrossen Tim Wardlaw Karl Wotherspoon Jane Elek **Collaborators** CSIRO Sustainable Ecosystems CRC for Forestry	**2011-12 Activities and outputs** Introduced changes to leaf beetle IPM – risk-based targeting of plantations to monitor; roadside occupied-shoots-per-tree monitoring; revised thresholds for control. Co-ordinated 2011-12 leaf beetle IPM. The program monitored 19,333 ha of which 18% were above-threshold: and 2,533 ha were sprayed (96% with Dominex), natural population reductions were measured in 892 ha. Remeasured growth plots to measure the impact of defoliation on growth in mid-rotation plantations. CABALA predictions of mid-rotation growth impact agreed with measured growth impact except in thinned plantations.	**2012-13 Planned program** Review guidelines for leaf beetle management of vulnerable plantations (high altitude, thin crowns). Co-ordinate 2012-13 IPM, including training contractors in using revised monitoring method. Market FT leaf beetle management system to Gunns. Document (with CSIRO) CABALA Health validation study for the case of mid-rotation defoliation by leaf beetles.
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.	**FT Staff** Jane Elek Tim Wardlaw **Collaborators** Uni Tas CRC Forestry Bayer Crop Science	**2011-12 Activities and outputs** Results from 2010/11 trap tree trials were documented in a Technical Report. Key outcome from the trap tree study: Lethal trap trees provided some, though limited, protection from defoliation to surrounding crop trees. Found that zone of protection only extends 50 m from treated trap trees. Conclude that lethal trap trees would be unviable as a control method. Manuscript reviewing options for managing leaf beetles submitted to Agricultural and Forest Entomology for peer-review.	**2012-13 Planned program** Project completed. No further work planned.

Ecosystem Services - Key research and development projects (continued)

Hygiene – exotic diseases and weeds (formerly *Phytophthora* management) Ensure that susceptible species and communities of high conservation value are protected as far as possible from the adverse effects of exotic diseases and weeds.	**FT Staff** Sue Jennings Tim Wardlaw Nita Ramsden **Collaborators** FPA NRM South	**2011-12 Activities and outputs** Undertook quarry inspections for *P. cinnamomi* / weed certification. Provided advice to Districts on formulating Forest Practices Plan prescriptions for operations in *Phytophthora* Management Areas. Prepared draft FT weed strategy. Assisted Bass District to develop a procedure for post-harvest monitoring of operations that had *Phytophthora* prescriptions included in their FPP. Attended steering committee meetings of NRM South project to develop and implement hygiene protocols for aquatic pathogens threatening TWWHA.	**2012-13 Planned program** Conduct quarry certification surveys as required. Finalise draft weed strategy and seek its adoption. Conduct refresher field days in each District on *Phytophthora* management. Progress decision for general adoption by Districts of post-harvest monitoring of operations that had *Phytophthora* prescriptions included in their FPP. Advise on options for adopting findings from NRM South TWWHA hygiene project into FT practices / procedures. Migrate quarry hygiene survey documents into INTEGRUM and quarry survey results onto FOD (in response to audit).
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.	**FT Staff** Karl Wotherspoon Sue Jennings Nita Ramsden Leonie Jordan Tim Wardlaw Rob Musk **Collaborators** DPIPWE	**2011-12 Activities and outputs** Health surveillance was completed of all Forestry Tasmania eucalypt plantations and all pine plantations on State forest. A total of 75 notification reports were sent to clients. Intensively monitored the recovery of *E. nitens* plantations from the 2010-11 *Kirramyces* leaf disease epidemic. Co-ordinated area-freedom surveys for myrtle rust on State forest as part of statewide effort.	**2012-13 Planned program** Conduct aerial and roadside and follow-up surveys of FT and privately-owned plantations (fee-for-service). Prepare and disseminate notification and summary reports to clients, and update datasets (including GIS). Continue seeking opportunities for external customers of FHS services (with FTS Manager). Intensively monitor plantations with chronically thin crowns to better understand the timing and cause of ongoing leaf loss. Validate GIS models for cold-air drainage and exposure using FHS surveys and progress towards developing criteria for coupe-level species choice decisions. Document efficacy of CRCF MODIS tool (satellite imagery analyses by computer) in detecting significant pest/disease events in plantations.

Ecosystem Services - Key research and development projects (continued)

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.	**FT Staff** Sue Jennings Karl Wotherspoon Nita Ramsden Leonie McCrossen	**2011-12 Activities and outputs** Meetings were held in all Districts to review the outcomes of actions in response to notifications made in 2009-10 and agree to actions in response to notifications made in 2010-11.	**2012-13 Planned program** Conduct annual debrief of the 2011-12 surveillance year with Districts and develop agreed action plans for remedial treatments.
FHS – policy Ensure flow of information from FHS to inform policy and corporate reporting.	**FT Staff** Tim Wardlaw Karl Wotherspoon Nita Ramsden Dick Bashford Lachie Clark Ruiping Gao	**2011-12 Activities and outputs** Data and narrative on pest and disease status and pest management was provided for the 2011 Stewardship Report and 5-year RFA review. Annual pest and disease status report for Tasmania was prepared for inclusion in the RWG 7s national pest and disease status report. Summary of response to key problems detected by FHS in 2010-11 reported to GMT.	**2012-13 Planned program** Prepare annual FHS summary for 2011-12 season and present to GMT. Compile tabular and narrative summaries from FHS for inclusion in SFM Report. Compile annual pest and disease status report for Research Priorities Coordination Committee. Provide liaison with Tasmanian Biosecurity Committee (Technical and Stakeholder Committee) and Federal Biosecurity agencies as required.
Port surveillance Detect the early introduction of exotic forest pests and diseases.	**FT Staff** Nita Ramsden Dick Bashford **Collaborators** DPIPWE Office of the Chief Plant Protection Officer	**2011-12 Activities and outputs** Completed manuscript documenting Australia's hazard site surveillance program.	**2012-13 Planned program** Assist DPIPWE in selecting monitoring sites. Screen trap catches to indentify suspected incursions. Complete health surveys of hazard sites.

FHS Research & Development	FT Staff	2011-12 Activities and outputs	2012-13 Planned program
Refine methods for the detection of forest pests.	Dick Bashford Karl Wotherspoon Nita Ramsden Tim Wardlaw **Collaborators** ACIAR DEEDI, Queensland	Completed paper examining relationship between populations of wood-boring beetles and damage in eucalypt plantations across a rainfall gradient.	Submit paper on static trap monitoring of wood-boring beetles for peer-review. Complete draft report on the spatial pattern of static trap catches and damage within a eucalypt plantation.

3.8 Use controlled fire to emulate natural conditions and achieve ecological, silvicultural and forest health benefits.

Wildfire Chronosequence	FT Staff	2011-12 Activities and outputs	2012-13 Planned program
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.	Tim Wardlaw Nita Ramsden **Collaborators** Uni Tas Uni Melb	Completed three seasonal field campaigns of a collaborative study with Uni Melb 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.	Complete analysis and write-up of soil greenhouse gas fluxes along wildfire chronosequence (Uni Melb). Sort, mount and identify baseline sampling of ground-active beetles. Integrate wildfire chronosequence plots long-term biodiversity monitoring plan with silvicultural systems trial monitoring plan.

4. Sustaining safety, community access and heritage

4.3 Promote safe work practices and safe use of State forests.

Occupational Health and Safety	FT Staff	2011-12 Activities and outputs	2012-13 Planned program
Promote safe work practices and safe use of state forests through effective staff training.	All staff	Staff training is undertaken on schedule in first aid, safety consciousness and gravel road driving and as required for specialist skills such as four wheel driving or the use of chainsaws. All staff attend regular toolbox meetings to maintain safety awareness.	Keep all staff up-to-date with required capabilities. Regular toolbox meetings.

5. Sustaining science-based stewardship

5.2 Maintain independent, third-party certification of forest management.

5.3 Use science to inform continuous improvement in forest policy and management.

5.4 Maintain accurate information, effective systems and procedures, and skilled personnel for forest management.

Annual reporting and auditing, support for certification	**FT Staff** Dion McKenzie All staff	**2011-12 Activities and outputs** Contributed to preparation of stewardship report. Collated data for data tables appendix to stewardship report. Contributed to external audits of FT for AFS and SEMS auditing.	**2012-13 Planned program** Contribute to preparation of stewardship report. Collate data for data tables appendix to stewardship report. Contribute to external audits of FT for AFS and SEMS auditing. Liaise with districts re systems.
Tasmanian Forest Insect Collection Develop a comprehensive, highly valued and widely used reference collection and database of Tasmanian forest insects.	**FT Staff** Simon Grove Dick Bashford **Collaborators** Australian National Insect Collection Uni Tas University of Guelph Numerous taxonomists	**2011-12 Activities and outputs** The TFIC was curated. Specimens collected from the CAR reserves project are being incorporated into the TFIC. A sample of TFIC insects were tested for their suitability for DNA barcoding. Specimens trapped in propylene glycol yielded excellent results.	**2012-13 Planned program** Commence process of migrating the TFIC to the Tasmanian Museum and Art Gallery.

Ecosystem Services - Key research and development projects (continued)

Warra Supersite 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.	**FT Staff** Tim Wardlaw Leigh Edwards Dave McElwee **Collaborators** James Cook University ANU FPA UTas TERN	**2011-12 Activities and outputs** 1-ha plot surrounding the flux tower was established and all trees >10 cm mapped. Conducted first of two campaigns to measure key physiological attributes of the main tree species in the 1-ha plot. Completed soil surveys of 1-ha plot and documented results. Commenced migrating datasets from Warra studies to the TERN Supersite portal. Contributed to tall eucalypt chapter of book being written on how long-term ecological datasets have informed management of Australian terrestrial ecosystems.	**2012-13 Planned program** Continue to support studies in Warra through the honours scholarship and small projects grant schemes. Install acoustic sensors to continuously monitor bird populations. Compare results with those obtained using conventional surveys (using "Bird Track" control). Conduct second field campaign to measure physiological attributes of the main tree species in 1-ha plot. Complete full vegetation survey of 1-ha plot. Select site and install piezometer to monitor groundwater beneath 1-ha plot. Migrate Warra beetle and bird datasets to TERN Supersite Portal.
Communications Maintain strong linkages between research and science-based forest management. Maintain a high profile for credible research within the scientific community.	**FT Staff** All research staff	**2011-12 Activities and outputs** Staff presented at 21 workshops and conferences; produced 22 technical reports and had 18 papers published in peer-reviewed journals or book chapters (see table at rear). Nine lunchtime talks were presented and guides were provided for a number of tours of Warra and the southern forests.	**2012-13 Planned program** Continue to communicate with key stakeholders to inform on the results of research and implications for management. Continue to showcase FT capability of science-driven forest management.
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.	**FT Staff** Tim Wardlaw Mark Neyland John Hickey	**2011-12 Activities and outputs** Assistance to external researchers. Safety coordination with Huon District. Guides for 12 Site tours (196 participants). Maintenance of LTER and SST infrastructure. Input to 'coupe context' and 'tree hollow' discussions with sustainability branch and FPA. Input to consideration of VR in coupes which lack 20% long term retention coupe context.	**2012-13 Planned program** Paper on relevance of German selection silviculture for Tasmanian wet eucalypt forests.

Research program - Productivity

Principal Research Scientist: Dr Paul Adams
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The Productivity group conducts research on the silviculture and genetic improvement of plantations to increase the productivity, quality and value of the resource, and to support continuous improvement of sustainable forest management. These services are provided to internal clients (districts) and also to external clients through the FT consulting arm, Forestry Services International (FSI). The objective is to provide research and technical services that are accurate, cost effective and on time. Our vision is to be recognised as a leading provider of plantation research and technical services in Australasia.

2011/12 achievements

There were three main achievements of the productivity group over the past 12 months.

The first achievement involved quantifying the water use of *E. nitens* plantations in the Florentine Valley (age class 1 – 10 years), developing a water-use model and then incorporation of this in the FT forest estate model to simultaneously predict water use and wood production. This work showed that it is possible to manage both water use and wood production in the long term and that schedules can be produced that detail which coupes should be harvested and thinned in which year in order to achieve the management objectives. This will be a valuable tool for demonstrating whether plantation development is likely to significantly increase water use in the catchment and if it can be offset by harvesting and thinning.

The second major achievement was completion of a detailed evaluation of alternative silviculture regimes to determine how to improve pruned log production and economic returns from the FT eucalypt plantation estate. The modelling was comprehensive and used the FT modelling tool FTGrow2 where multiple scenarios could be processed efficiently. Results showed that the best silvicultural regimes are those that employ high pruning and target low residual stockings through thinning. Two-stage thinning regimes were best for both *E. globulus* and *E. nitens* at all site indices. This work has identified key operational and silvicultural factors, including intensity and timing of pruning and thinning, which will guide implementation of suitable regimes within the FT eucalypt estate. The next step is to examine potential conflicts with respect to future woodflows and follow this up with the development of an implementation plan.

The third achievement was completion of the major sampling and fieldwork program for the Hottest 1000 genomics project, a large collaborative project that seeks to develop techniques that identify DNA fingerprints for tree value (positive improvements in tree growth and wood quality).

Finally, the provision of services through Forestry Services International (FSI) is an important initiative and new opportunities are regularly being assessed. During the year this work included nutrition research for Timberlands Pacific, herbicide efficacy trials for Bayer Environmental Services and ongoing activities in the Genetic Improvement Program for Yong'an Forestry Group. Such projects enable us to market our significant technical expertise and bring in much-needed external funds.

2012/13 aims

The primary aims for 2012/13 are to:

1. Increase our wood quality research through characterisation of the plantation estate and testing wood quality in a number of mature age genetics trials. This work will dovetail with the efforts of the Product Development Group.
2. Continue development of alternative silviculture regimes including the installation of two 3rd generation regime trials.
3. Document the advances made and systems developed for increasing productivity through the nutrition research program.
4. Finalise outcomes from Forestry CRC research and develop applications to optimise the uptake and adoption by FT.
5. Complete the Genetic Improvement Program (Yong'an III) and win a new consultancy contract for the next stage of genetic improvement.

The Plantation Productivity and Management Group (PPMG) and the Tree Breeding Strategy Group (TBSG) will continue to provide guidance and support in 2012/13.

Productivity - Key research and development projects

1. Sustaining biodiversity and habitat

1.7 Retain oldgrowth elements including large trees, stags, understoreys and logs across the forest estate.

Alternatives to clearfelling lowland wet eucalypt forest	**FT Staff** Robyn Scott Mark Neyland	**2011-12 Activities and outputs** Monitoring and maintenance of the Warra silvicultural systems trial. Three year review paper on the Warra trial accepted by Australian Forestry.	**2012-13 Planned program** Monitoring and maintenance of the trial.
Operational development and evaluation of aggregated retention (ARN) in tall oldgrowth forests	**FT Staff** Robyn Scott Mark Neyland	**2011-12 Activities and outputs** Database finalised on 2006 to 2011 ARN coupes and comparable CBS coupes. Monitored ARN coupes via FOD. Advice provided to Districts on planned aggregated retention coupes. Published paper on VR burning. Published paper on harvesting and burning impacts on the soil, foliar and soil chemistry.	**2012-13 Planned program** Advise on planned aggregated retention coupes. Submit journal paper on regeneration success in VR coupes compared to CBS coupes. VR for other reasons: Landscape, swift parrot etc. Contribute to coupe context discussions.

2. Sustaining jobs for current and future generations

2.3 Ensure an ongoing long term supply of the highest quality eucalypt timbers from native forests.

Rationalisation, measurement and maintenance of established thinning trials	**FT Staff** Dave McElwee Tim Osborn Robyn Scott Mark Neyland	**2011-12 Activities and outputs** Progressed bringing existing native forests data sets into corporate data bases. Gaps in existing knowledge and some inventory needs identified.	**2012-13 Planned program** Monitoring.

Productivity - Key research and development projects (continued)

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.	**FT Staff** Mark Neyland Dave McElwee Rob Musk District Staff **Collaborators** Uni Tas	**2011-12 Activities and outputs** 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. The regeneration survey database is now also providing useful information on the relationship between sowing rate and seedling density.	**2012-13 Planned program** Measure, analyse and report on results of the trials.
Silvicultural advice To provide silvicultural advice and to promote good silvicultural practice in native forests.	**FT Staff** Robyn Scott Mark Neyland	**2011-12 Activities and outputs** Advice and training on problematic coupes provided as required.	**2012-13 Planned program** Provide advice and training on problematic coupes as required.
Operational standards monitoring To ensure 'best practice' standards are developed and met in native forest silviculture.	**FT Staff** Dion McKenzie Mark Neyland	**2011-12 Activities and outputs** 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. Key issues were browsing management and seed supply. Districts urged to start browsing control earlier in the cycle – April, not December. 2012 Quality Standards Manual published. Maintained and improved regeneration survey database. Maintained mammal browsing database and browsing monitoring tool.	**2012-13 Planned program** Routine inspections of thinning and UAT operations. Support QS visits, review and reporting. Provide advice on QS reporting requirements from FOD. Prepare regeneration success report for 07/08 (three year old) eucalypt coupes and 2005/06 (five year old) special timbers coupes for FTs Annual and SFM reports. Address native forest QS issues arising from auditing against the Australian Forestry Standard and FTs EMS. Report on carry-over coupes, coupe sizes, regeneration burns. Convene meetings of the native forest coordinators group as required. Contribute to preparation of yellow book.

Productivity - Key research and development projects (continued)

Seed 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. To ensure that optimum seed mixes are used in all FT sowing.	**FT Staff** Dion McKenzie	**2011-12 Activities and outputs** Provided on-going analysis of seed stock shortfalls and surpluses on an as-needs basis. Seed management system can now calculate seed balances automatically provided that data in coupes database and FOD is correct. 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.	**2012-13 Planned program** Support all districts to use seed management system for 2011/12 seed stock analysis. Continue to manage browsing monitoring tool and browsing management database. Continue to support regeneration survey database. Maintain technical support to seed centre and sowing program. 'Seed' management system corporatised?

2.5 Establish and manage plantations to maintain timber supply levels to industry

Rationalisation, measurement and maintenance of established thinning trials	**FT Staff** Paul Adams Dean Williams Sandra Roberts Crispen Marunda Kristen Dransfield Mark Neyland	**2011-12 Activities and outputs** Progressed the rationalisation of the research program, and initiated migration of important datasets to FENRIS (corporate database) and plans for integration of effort with Resources branch.	**2012-13 Planned program** Full rationalisation of the productivity research program and integration of systems and efforts with resources branch.

Productivity - Key research and development projects (continued)

Tree improvement; genetics Maximising the production of pruned logs, and associated products, from plantations through genetic improvement, pruning, thinning and fertilising to improve growth and wood quality.	**FT Staff** Dean Williams Kristen Dransfield Crispen Marunda Sean Boucher Peter Moore Collaborators Uni Tas STBA Plantplan Genetics CRC Forestry CSIRO Ta Ann Gunns Ltd HVP Ltd NCFFI	**2011-12 Activities and outputs** Tree Improvement Strategy – identified new initiatives and progressed documentation of the strategy, under direction of the Tree Breeding Strategy Group. Cooperated in tree breeding activities including the STBA *E. globulus* breeding program and commenced a collaborative analysis of *E. nitens* programs with Gunns and HVP. Supported new *E. nitens* genomics of wood quality project (Hottest 1000) in partnership with CSIRO and Gunns Ltd. Grafting program undertaken in Spring 2012 to capture elite *E. nitens* stock for Castra seed orchard and continued refinement of site specific deployment of operational *E. nitens* seedlings. Trial establishment program focused on evaluating the relative performance (specifically growth rate, form and wood properties) of production seedlots under operational conditions.	**2012-13 Planned program** Complete documentation of FT's tree breeding strategy and identify new initiatives through the Tree Breeding Strategy Group. Finish collaborative TREEPLAN analysis of E. nitens breeding program with Gunns and HVP. Continue wood quality work (including checking, stiffness and pulp yield analysis) in *E. nitens* as part of H1000 molecular genetics project to extend our understanding of the quantitative genetic parameters for these traits. Work with collaborators to characterise FT's eucalypt plantation estate for wood quality (pulp, EWP and SWP). This work is to include the native forest regrowth resource. Sow seeds for new H1000 *E. nitens* association population and advanced generation trial (200-300 seedlots). Through Forestry Services International, complete Yong'an III (Genetic Improvement and Silviculture Program) and develop Stage IV.

Productivity - Key research and development projects (continued)

Tree improvement; seed and seedling supply Provide research and advice to improve the quality and efficiency of seed and seedling production.	**FT Staff** Dean Williams Peter Moore Carlton Cox **Collaborators** seedEnergy	**2011-12 Activities and outputs** Continued to refine site specific deployment of *E. nitens* seedlings and seedlot tracking (improved deployment). Continue to stock seed orchards with improved genotypes(advancing genetic deployment). Extra tree management protocols put in place. Supported work in CRC to examine practical methods to assess stem form of *E. globulus* (as part of program to address form issues in *E. globulus*).	**2012-13 Planned program** Commence establishment of back up orchard for Castra *E. nitens* seed orchard. Continue to produce trees to stock *E. nitens* and *E. globulus* seed orchards.
Eucalypt plantation silviculture Maximising the production of pruned logs, and associated products, from plantations through improved silviculture.	**FT Staff** Paul Adams Robyn Scott Dean Williams Robert Musk David Mannes Crispen Marunda Kristen Dransfield Sean Boucher Matthew Wood **Collaborators** CRC Forestry Timberlands Pacific	**2011-12 Activities and outputs** Undertook major project on alternative silviculture for improving production of pruned logs and economics of eucalypt plantations. Ongoing investigations on the relationships between silviculture, processing requirements and wood quality (CRC-F). Installed district monitoring plots to assess early responses to alternative cultivation / site preparation. Provided assistance with planning of silvicultural operations in all Districts.	**2012-13 Planned program** Continued research to improve understanding of alternative silviculture systems. Work through PPMG to develop implementation plan. Management of, and reporting on, first- and second-generation *E. globulus* and *E. nitens* pruning and thinning trials. Report results. Develop plan for establishment of third-generation pruning and thinning trials. Prepare establishment report. Complete the Britton Timbers processing and wood products study. Report results. Release of StandWORKS v.1.1 and training of District staff. Support resource characterisation project in cooperation with UTas and NCFFI (see tree improvement above). Rationalise trials. Through Forestry Services International, complete Yong'an III (Genetic Improvement and Silviculture Program) and develop Stage IV.

Productivity - Key research and development projects (continued)

Nutrition and productivity Maximising the production of pruned logs, and associated products, from plantations through nutrition management and fertilisation.	**FT Staff** Paul Adams Kristen Dransfield Crispen Marunda Sean Boucher **Collaborators** CRC Forestry Uni Tas Uni Sydney (ARC funding) Forest Industry Herbicide Research Consortium BASF ServeAg Timberlands Pacific	**2011-12 Activities and outputs** Installed sites for organic nitrogen project (ARC funding). Assisting with field work. Completed herbicide efficacy research for Bayer Environmental Sciences. Cooperated with UTas on biochar research. Installed trial in Derwent district. Continued work with Timberlands Pacific on primary fertiliser research. Installed aerial fertiliser monitoring plots.	**2012-13 Planned program** Ongoing measurement analysis and reporting of long-term nutrition experiments. Complete development of Best Practice guidelines for establishing 2R plantations. Finalise primary fertiliser recommendations (incl. Basacote). Update and improve nutrition decision support tools. Ongoing work with Timberlands Pacific on nutrition and productivity research. Rationalise trials.
Quality standards monitoring and extension Meet stand establishment quality standards, provide best practice guidance on the establishment and management of plantations and native forest regeneration to operational staff, and report annually.	**FT Staff** Dion McKenzie Paul Adams Tim Wardlaw Mark Neyland	**2011-12 Activities and outputs** Facilitated improved productivity of plantations through timely and appropriate fertilising, pruning & thinning operations. Continued auditing of PAT plots to verify data integrity and analysis of PAT data to identify issues and optimise pruning outcomes. Rolled out Thinning Assessment Tool (TAT) to provide timely information on thinning operations and thinned stands. Produced Forest Health Field Guide for staff to increase awareness and enable timely monitoring/correction of forest health issues.	**2012-13 Planned program** Facilitate improved productivity of plantations through timely and appropriate fertilising, pruning & thinning operations. Produce QS and Plantation Performance Indicators reports. Update Plantation Performance Indicators.

3. Sustaining carbon stores, clean air, water and healthy forests

3.4 Ensure availability of clean water from State forests

Hydrology research

Conduct research into water quality and quantity to provide greater understanding of the effects of forest operations and to provide management solutions.

FT Staff

Sandra Roberts
Crispen Marunda

Collaborators

CRC Forestry
FWPA

2011-12 Activities and outputs

Introduced improved rising-stage samplers for operational use to improve timing of routine water-sample collection for pesticide analyses.

Continued monitoring turbidity at Tyenna and compare turbidity from before and after harvesting and roading.

Advise Wood Planning Section on hydrological issues where required.

Participate in Scientific and Technical committee of NRM North.

Finalise collection and analyses of evaporation and vegetation attribute data in Florentine Valley and other Tasmanian plantations.

Submitted final report on results of the Florentine Water Use Study to FWPA.

Ensure telemetered data is collected by Hydro Tasmania and transferred to Bureau of Meteorology.

2012-13 Planned program

Submit paper on the results of water quality analyses in the 15 Warra catchments for CRC.

Prepare journal paper on Plantation water use study.

Ensure telemetered data is collected by Hydro Tasmania and transferred to Bureau of Meteorology.

Analyse streamflow data for three Warra catchments for trends and describe streamflow patterns.

Develop an options paper for harvesting of Swanson and or King catchments at Warra versus retention of existing forest.

Further develop the integration of the water use function in the forest estate model for simultaneously predicting plantation water use and wood production.

TY026C monitoring and report.

3.5. Maintain a diversity of natural habitats and mixed age forests to support biodiversity across the forest estate.

	FT Staff	2011-12 Activities and outputs	2012-13 Planned program
Soil, site selection and productivity estimation Investigate areas proposed for plantation development to define their site productivity and suitability. On areas suitable for plantations: to provide information and advice on site preparation and other treatments required for sustainable development and management of plantations.	Paul Adams	Assisted characterisation of soils at weed research plots (Forestry CRC).	Assist with Australia and New Zealand Soils Conference including hosting the Forest Soils field trip.

5. Sustaining science-based stewardship

5.3 Use science to inform continuous improvement in forest policy and management

	FT Staff	2011-12 Activities and outputs	2012-13 Planned program
Further Operationalise LiDAR technology for tactical planning outcomes and to improve our sustainable yield estimates Investigate techniques for the growth modelling from LiDAR, and develop tools to assist field planning using LiDAR data.	Robert Musk David Mannes Mayo Kajitani Tim Osborn	Investigated imputation techniques for the projection of forest growth for plantations. Commenced development of a simple tool for the deployment of LiDAR derived information to the field (Blue Skys project). Collection of taper data from LiDAR inventory to improve the accuracy of our inventory, provide data to refit existing taper models and to project taper through time.	Deploy a fully operational "Blue Skys" tool to the field. Deploy imputation methods developed in 2011/12 to native forests. Roll out taper data collection for plantation into South east Tasmania and analyse.

Productivity - Key research and development projects (continued)

Communications	**FT Staff**	**2011-12 Activities and outputs**	**2012-13 Planned program**
	All staff	Contribute to lunchtime talks, National Science Week and a large range of science communication outcomes. Ongoing research programs. Assistance / advice to districts, papers, reports, presentations, community engagement. Publication of *Tasforests* journal.	Present a series of Lunchtime Talks. Contribute to National Science Week activities. Science support to Corporate relations.
5.4 Maintain accurate information, effective systems and procedures, and skilled personnal for forest management.			
Technical Bulletins	**FT Staff**	**2011-12 Activities and outputs**	**2012-13 Planned program**
	Mark Neyland Leigh Edwards Robyn Scott Dion McKenzie	Technical Bulletins 11 progressed.	Technical Bulletin 11 published.

Warra Long-Term Ecological Research (LTER) site

Forestry Tasmania Warra Research Co-ordinator: Dr Tim Wardlaw
Tim.Wardlaw@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

The Warra Long-Term Ecological Research Site continued to support a very active research program and is now formally a member of the Australian Supersite Network (ASN). ASN has taken over from Australia's Long Term Ecological Research Network and provides Australia's link to the International Long Term Ecological Research Network (ILTER). It is part of the Terrestrial Ecosystem Research Network (TERN) funded by the Commonwealth government under the National Collaborative Research Infrastructure Scheme (NCRIS).

Progress was made in establishing the flux tower at Warra, although delays in fabrication resulted in the tower erection being put back to spring 2012. A one hectare plot encompassing the flux tower has been established. Complementary monitoring of the forest in this plot will help to interpret fluctuations in fluxes of carbon and water measured by the flux tower.

Monitoring of the Silvicultural Systems Trial is continuing in preparation for the next major review in 2015 when most treatments reach their ten-year post-harvest anniversary. The results of 15 years of hydrology measurements at Warra are being analysed and documented in preparation for a review of the Warra hydrology program. Encouragingly, other Warra partners have become more active at the site. For example, DPIPWE undertook the first decadal remeasurement of the altitudinal monitoring transects last summer. Active collaborations from a diverse group of agencies and institutions is crucial if Warra is to continue to maintain its status as one of the pre-eminent long-term research sites in Australia thus enabling us to attract investment from diverse sources.

branch services to external clients

Research Services

Staff from Research and Development Branch 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 Branch 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 Branch through long experience of native forest management, and specialist skills have been developed in growing plantation pines and eucalypts for solid timber products.

Branch 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 Branch 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 and Development 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.

Forestry Tasmania continued to work with China's Yong'an Forestry Group (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.

Bob Gordon and Mark Kelleher visiting Yong'an Forestry Group nursery as part of a Tasmanian government trade delegation in 2011.

laboratory services

Laboratory
Laboratory Manager: Nita Ramsden

Contact for enquiries:
Tim.Wardlaw@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.

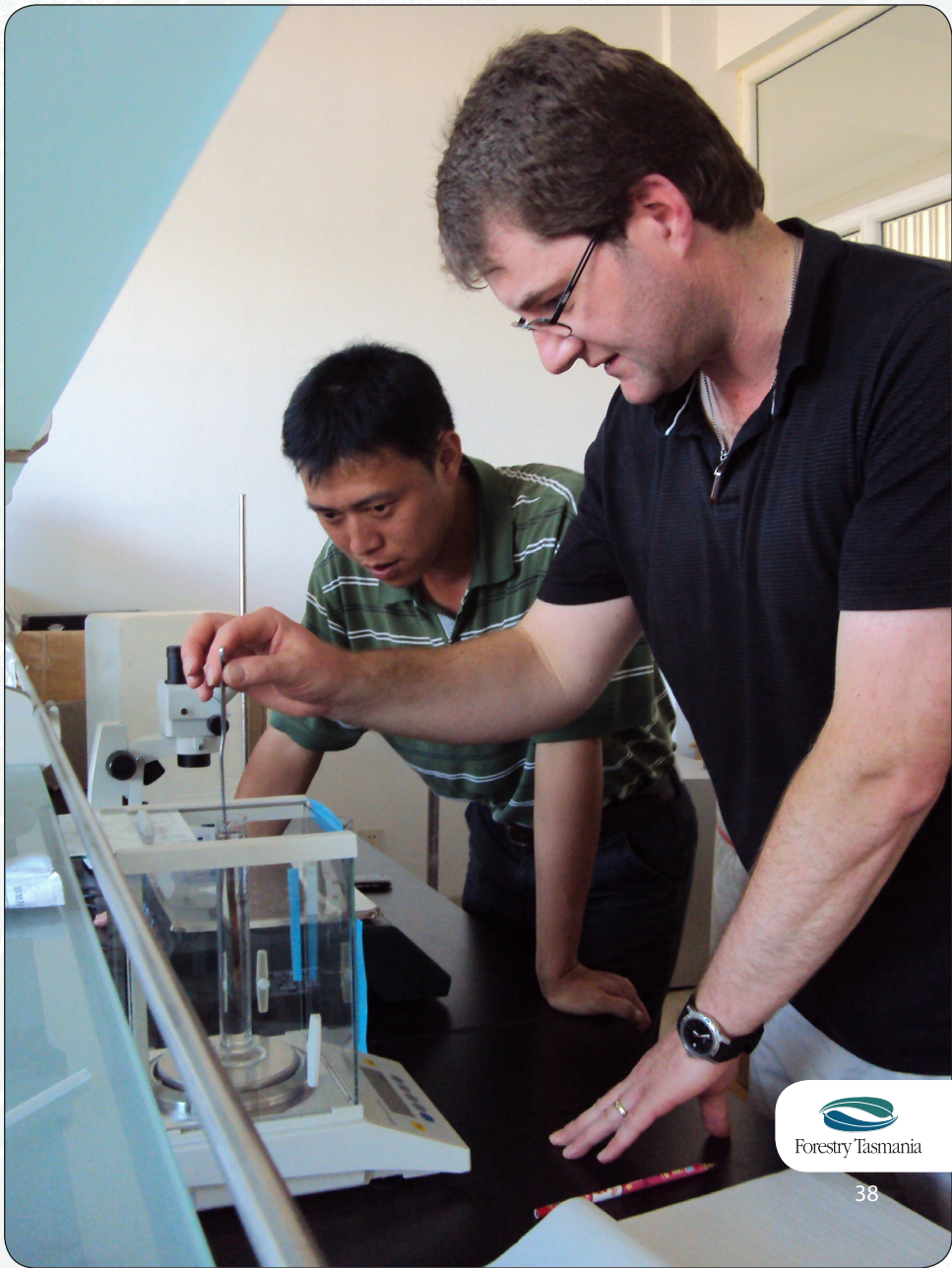
4. **Wood density for wood quality assessment**

- 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.



Collaborations and Linkages

Authors employed by Forestry Tasmania during 2011-12 are shown in boldface.

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
Productivity 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 C data to evaluate CBM-CFS3 and FullCam in Tasmania and Queensland in collaboration with Robert Waterworth, Department of Climate Change and Energy Efficiency.

Dr Martin Moroni remains involved in the Newfoundland Boreal Ecosystem Latitudinal Transect examining the impact of climate change on forest systems.

Charles Sturt University
Dick Bashford is co-supervisor with Professor Geoff Gurr and Dr Angus Carnegie (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 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).

Martin Stone, Dr Paul Adams and **Dr Robert Musk** work 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 Marine and Atmospheric Research
Dr Tim Wardlaw and **Karl Abetz** are collaborating with Dr Helen Leuning in the establishment and operation of the Warra Flux site as part of the Ozflux network (TERN funded).

CSIRO Sustainable Ecosystems:
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*.

Dr Tim Wardlaw, Dr Jane Elek, Karl Wotherspoon and **Leonie McCrossen** are collaborating with Dr Libby Pinkard in a project modelling and validating the impact of leaf beetle defoliation in mid-rotation *E. nitens* plantations.

Dr Tim Wardlaw and **Dr Robert Musk** are collaborating with Dr Libby Pinkard in an FWPA-funded project on the impact of climate change on pest and disease damage in Australian 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 and Jennie Whinam to undertake 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.

collaboration & linkages

Herbarium, Tasmanian Museum and Art Gallery.
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.

Dr Simon Grove and **Dick Bashford** manage the Tasmanian Forest Insect Collection which is a subsidiary collection of the Tasmanian Museum and Art Gallery.

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.

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 2 (Mensuration): Chair **David Mannes,** Membership **Dr. Robert Musk.**

Research Working Group 3 (Water): Membership – **Dr Sandra Roberts.**

Research Working Group 4 (Native Forest Management): Membership - **Dr Simon Grove, Dr Mark Neyland, Robyn Scott.**

Research Working Group 5 (Plantation Management): Membership - **Dr Paul Adams.**

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.

Swedish University of Agricultural Sciences
Dr Mark Neyland and Dr Sue Baker are collaborating with Prof. Lena Gustafsson 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 Arno Kleber to supervise a Masters student Patrick Dietrich, who came to Tasmania in the second half of 2011 to examine soil C stocks in conjunction with Ian Riley's PhD studies at the University of Tasmania.

University of Guelph
Drs Tim Wardlaw and **Simon Grove** are collaborating with University of Guelph 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.

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.

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 ARC Linkage 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 saproxylic insects in the southern forests, and Lynne Forster on population structures of saproxylic beetles in the Experimental Forest Landscape.

collaboration & linkages

Dr Robert Musk is co-supervisor of PhD studies by Luke Wallace on the application of UAV borne LiDAR to plantation inventory.

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 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.

Tim Wardlaw, Paul Adams, Dean Williams, Sandra Roberts, Karl Wotherspoon, Leonie McCrossen, Martin Moroni, David Mannes, Robert Musk, Matthew Wood, Marie Yee and **Mark Neyland** are honorary research associates with the School of Plant Science.

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.

REFEREED JOURNALS

Communications 2011-12

Authors employed by Forestry Tasmania during 2011-12 are shown in boldface.

Papers in refereed journals

Allan, J.D., Yuan, L.L., Black, T., Stockton, P.E., Davies, P.D., Magierowski, R.H. and **Read, S.M.** (2011). Investigating the relationships between environmental stressors and stream condition using Bayesian Belief Networks. *Freshwater Biology*, doi: 10.1111/j.1365-2427.2011.02683.x.

Baker, S.C. and **Read, S.M.** (2011). Variable retention in silviculture in Tasmania's wet forests background and ecological evaluation. *Australian Forestry* 74(3): 218-232.

Blackburn, D.P., Hamilton, M.G., Harwood, C.E., Innes, T.C., Potts, B.M. and **Williams, D.R.** (2011). Genetic variation in traits affecting sawn timber recovery in plantation grown *Eucalyptus nitens. Annals of Forest Science* 68, 1187-1195.

Grove, S.J. (2011). Forest biofuels: messy native forests are healthy forests. Australian Forest Grower 34(3): 38-39.

Grove, S.J. (2011). Review of Lindhe, A., Jeppsson, T. and Ehnström, B. (2011). Longhorn beetles in Sweden – changes in distribution and abundance over the last two hundred years. Special issue of *Entomologisk Tidskrift* 2011, 131(4):241–508, Uppsala, Sweden, Swedish Krone 250 plus postage, ISSN 0013-886x (available from pren@sef.nu). *Journal of Insect Conservation* 15 (5): 755-756.

Gustafsson, L., Baker, S., Bauhus, J., Beese, W., Brodie, A., Kouki, J., Lindenmayer, D.B., Lohmus, A., Martinez Pastur, G.J., Messier, C., **Neyland, M.**, Palik, B., Sverdrup-Thygeson, A., Volney, J., Wayne, A. and Franklin, J.F. (In press). Retention forestry to maintain multifunctional forests: a world perspective. *BioScience* 62, 633-645.

Hamilton, M.G., Tilyard, P., **Williams, D.R**., Vaillancourt, R.E., **Wardlaw, T**. and Potts, B.M. (2011). The genetic variation in the timing of heteroblastic transition in *Eucalyptus globulus* is stable across environments. *Australian Journal of Botany* 59, 170-175.

Hindrum, L., Hovenden, M.J., **Neyland, M.G.** and Baker, S.C. (2012). The effects of mechanical disturbance and burn intensity on the floristic composition of two-year old aggregated retention coupes in Tasmanian wet eucalypt forests. *Forest Ecology and Management* 279, 55-65.

Jennings, S. and **Neyland, M.** (2011). Seedling regeneration of celery-top pine (*Phyllocladus aspleniifolius*) after harvesting of rainforest in north-western Tasmania. *Tasforests* 19, 1-16.

Kantvilas, G. and **Jarman, S.J.** (2012). Lichens and bryophytes in Tasmanian wet eucalypt forest: floristics, conservation and ecology. *Phytotaxa* 59: 1–31.

Keenan, R.J., **Read, S.M.** (2012). Assessment and management of old-growth forests in southeastern Australia. *Plant Biosystems,* 146, 214-222.

Moroni, M.T. (2012). Aspects of forest carbon management in Australia – a discussion paper. *Forest Ecology and Management* 275, 111-116.

Moroni, M.T., Kelley, T.H., McLarin, M.L. and **Read, S.M.** (2012). The wood, the trees or the forest? Carbon in trees in Tasmanian State forest: A response to comments. *International Journal of Forestry Research.* vol. 2012, Article ID 848502, doi:10.1155/2012/848502

Neyland, M. G. and **Jarman, S. J.** (2011). Early impacts of harvesting and burning disturbances on vegetation communities in the Warra silvicultural systems trial, Tasmania, Australia. *Australian Journal of Botany,* 59 (8): 701-712.

Risk, D., Nickerson, N., Phillips, C.L., Kellman, L., and **Moroni, M.** (2012). Drought alters respired δ13CO2 from autotrophic, but not heterotrophic soil respiration. *Soil Biology and Biochemistry* 50: 26-32.

Scott, R.E., Neyland, M.G., McElwee, D.J. and Baker, S.C. (2012). Burning outcomes following aggregated retention harvesting in old-growth wet eucalypt forests. *Forest Ecology and Management* 276: 165-173.

Scott, R.E., Hovenden, M.J., **Neyland, M.G.**, Mitchell, S.J., **Adams, P.R.** and **Wood, M.J.** (2012). Short-term effects of firebreaks on seedling growth, nutrient concentrations and soil strength in southern Australian wet eucalypt forests. *Forest Ecology and Management* 278, 110-117.

Walsh, A.M. and **Wardlaw, T.J.** (2011). Variation in mammal browsing damage between eucalypt plantations in Tasmania, and attempts to associate the variation with environmental factors. *Australian Forestry* 74(3): 197-204.

Wardlaw, T. (2011). A climate analysis of the current and potential future *Eucalyptus nitens* and *E. globulus* plantation estate on Tasmanian State forest. *Tasforests,* 19, 17-27.

Technical Reports

Adams, P.R. and Aurik, D. (2012). Badger Hills P-fertiliser monitoring plots. Establishment report. FTS Report 01/2012. Confidential to Timberlands Pacific.

Adams, P.R. (2012). The use of basacote fertiliser to promote early growth of P. radiata. Growth responses at three sites (LI168A 12 months, SA025G 24 months, SA020C 34 months). FTS Report 06/2011. Confidential to Timberlands Pacific.

Burrows, N., Dell, B., **Neyland, M.** and Ruprecht, J. (2011). Review of silviculture in forests of south-west Western Australia, Report to the Division of Sustainable Forest Management, Department of Environment and Conservation, Western Australia.

Davies, P., Magierowski, **R. Read, S.**, Horrigan, N. (2012). Measuring and modelling the impacts of land use on ecological river condition. In: Landscape Logic: Integrating Science for Landscape Management, Lefroy, T., Curtis, A., Jakeman, T., McKee, L. (eds), CSIRO Publishing, Collingwood, Australia, pp. 23-37.

Dransfield, K. (2011). Basacote fertiliser trial (TG006F) - establishment report. DFRD Technical Report 13/2011. Division of Forest Research and Development. Forestry Tasmania. July 2011.

Elek, J., Patel, V., Allen, G. and **Wardlaw, T.** (2011). Lethal trap tree trials final report 2010 –11: Efficacy of lethal trap trees at protecting *Eucalyptus nitens* from defoliation by the target leaf beetle, *Paropsisterna bimaculata*. Technical Report 16/2011. Forestry Tasmania, Hobart. 41 pp.

Farrell, R., Blum, S., **Williams, D.R** .and Blackburn, D.P. (2011). The potential to recover higher value veneer products from fibre managed plantation eucalypts and broaden market opportunities for this resource: Part A Project No: PNB139-0809. Project Report. Forest and Wood Products Australia Limited, Melbourne, Victoria 3000 Australia.

Moroni, M,, Grove, S., and Riley I. (2012). Coarse woody debris in Tasmanian State forest: 1) A summary of existing studies, and 2) Carbon in woody debris. Division of Forest Research and Development, Technical Report 05/2012, Forestry Tasmania, Hobart.

Moroni, M.T. and Harris, D.D. (2011). Newfoundland balsam fir and black spruce forests described by the Newfoundland Forest Service Permanent Sample Plot and Temporary Sample Plot data sets. Canadian Forest Service Information Report M-X-224.

Musk, R. A. (2011). Calibrating a growth and yield model for *Eucalyptus nitens* and *E. globulus* plantations in southern Australia. CRC for Forestry Technical Report 213, 32pp.

Musk, R. A. (2011). Stand level inventory of eucalypt plantations using small footprint LiDAR in Tasmania, Australia. In: Proceedings of SilviLaser 2011 – 11th International Conference on LiDAR Applications for Assessing Forest Ecosystems, Oct. 16-20, Hobart, Tasmania.

Ramsden, N. and **Bashford, D.** (2012). 2007-2012 *Sirex* Monitoring of Timberland Softwood Plantations in Tasmania. Technical Report 8/2012. Confidential Report to Timberlands Pacific. 22 pp.

Roberts, S. (2011). Water use of *Eucalyptus nitens* plantations in the Florentine Valley, Tasmania. Milestone report to FWPA 15/8/2011.

Roberts, S. (2011). Predicting *Eucalyptus nitens* plantation water use using growth parameters – comparisons of field results with existing models. Report submitted to FWPA April 2011.Plantations Branch, Division of Forest Research and Development, Forestry Tasmania.

Roberts, S. (2011). Water use of *Eucalyptus nitens* plantations in the Florentine Valley, Tasmania. Report submitted to FWPA, August 2011. Plantations Branch, Division of Forest Research and Development, Forestry Tasmania.

Roberts, S. (2012). Huon District Water Sampling Report. Report prepared for Huon District, 9/5/2012.

Roberts, S., Read, S., McLarin, M., and **Adams, P.** (2012). Predicting the water use of *Eucalyptus nitens* plantations in Tasmania using a Forest Estate Model. Report submitted to Forest & Wood Products Australia, April 2012. Plantations Branch, Division of Forest Research and Development, Forestry Tasmania.

Wardlaw, T. (2011). Managing biotic risk. Pages 105-124 in Walker, J. (Editor) "Developing a Eucalypt Resource: Learning from Australia and Elsewhere". Proceedings from workshop 3-4 Nov. 2011, Marlborough Wine Research Centre, Blenheim, New Zealand.

Wardlaw, T., Grove, S., Balmer, J., Hingston, A., Forster, L., Schmuki, L., **Read, S.** (2012). Contribution of CAR reserves to mature-forest biodiversity in production forest landscapes. Project: PNC142-0809. Report to Forest and Wood Products Australia. 103 pp.

Wardlaw, T., Jordan, L. and **Wotherspoon, K**. (2011). A synthesis of the key issues in the current management of leaf beetles and proposed enhancements to the leaf beetle IPM. DFRD Technical Report 12/2011.

Wotherspoon, K. (2012). 2011-2012 Health Surveillance of Timberlands Softwood Joint Venture. Technical Report 1/2012. Confidential report to Timberlands Pacific.

Wotherspoon, K., Jennings, S., Jordan, L. and **Ramsden, N**. (2012). Health Surveillance of Eucalypt Plantations on State Forest for 2011. Technical Report 2/2012. Forestry Tasmania, Hobart.

Presentations

Balmer, J., Hindrum, L. and **Grove, S.J**. (2011). How have wildfires and harvesting impacted wet forest habitats in southern Tasmania? Oral presentation (presented by JB) at annual conference of the Ecological Society of Australia, 21-25 November, Hobart, Tasmania.

Grove, S.J. (2011). FT's coupe-context thinking and a critique of the FPA's mature-forest habitat approach in the context of the IGA and other wood-production issues. Presentation to Forest Practices Advisory Council.

Grove, S.J. (2011). Sustainable forest management in Tasmania. Presentation to group of interstate professionals on study-tour of forests and forestry in Tasmania.

Hingston, A., **Grove, S.J.,** Balmer, J., **Wardlaw, T.**, Forster, L., Schmuki, C. and **Musk, R.** (2011). Birds, forestry and wildfires: the importance of spatial scale in assessing disturbance impacts on bird assemblages across Tasmania's southern forests landscape. Oral presentation (presented

by SG) at annual conference of the Ecological Society of Australia, 21-25 November, Hobart, Tasmania.

Kantvilas, G. and **Jarman, J.** (2012). Using lichens to evaluate Tasmanian forests. 7th International Association of Lichenology Symposium, Lichens: from genome to ecosystems in a changing world, held in Bangkok, Thailand, 9–13 January 2012.

Moroni, M.T., Mannes, D., Kelley, T., McLarin, M., Grove, S., Riley, I. (2011). Carbon in Tasmanian State forest: The role of forestry in greenhouse gas mitigation; Invited presentation to the Royal Society of Tasmania, Winter Lecture Series 2011, Stanley Burbury Theatre, University of Tasmania 21 June 2011, Launceston 16 August; Presented to Forestry Tasmania staff, open to public where indicated by '*'.; June 23, Perth, Scottsdale*, June 24, Devonport, Camdale*, June 27, Smithton; July 14.

Moroni, M.T. (2011). Symposium: Managed regrowth forests in Australia: Reassessing their multiple roles and values in a sustainable future. University of Melbourne, Melbourne; August 2, Business Sustainability Round Table. Hobart, invited presentation; August 29; FT board; September 22 Howrah Rotary Club; 23 September FT Sales division, 6 October, U3A Glenorchy; 26 October, Legislative Council; Parliament of Tasmania; NRM north public meeting and board meeting; 2 November Business Sustainability Round Table. Launceston; 3 November, Environmental Science class FT Education Centre. 10 November Regional Development Australia.

Moroni, M.T. (2011). "The Carbon Economy: A discussion forum" University of Tasmania Cradle Coast Campus. Strategy Enterprise and Regions, Department of Economic Development, Tourism and the Arts lunch time forum 22 Elizabeth Street, 22 February 2012. Hobart Rotary Club, 23 February 2012. Latrobe High School and Latrobe Community forum 21 2012. Devonport High School, St Brendan-Shaw College 22 March 2012. Huonville Council, Huonville Council Chambers, 4 April 2012.

Mannes, D. (2011). Operational LiDAR at Forestry Tasmania, 2 years on. Forest Tech presentation, Albury NSW (Nov 27th), Rotorua NZ (Dec 3rd).

Musk, R.A. (2011). Forest Inventory with Airborne Laser Scanning. FWPA research roadshow presentation Brisbane 7th July and Gympie 8th July.

Musk, R. A. (2011). Stand level inventory of eucalypt plantations using small footprint LiDAR in Tasmania, Australia. Presented to SilviLaser 2011 Oct. 16-20, Hobart, Australia.

Read, S.M. (2011). How adaptive management can connect forest science and practice: a case study using timber harvesting in tall wet forest. Seminar presented to Department of Plant Science, University of Tasmania, 19 August 2011.

Read, S.M. (2012). Variable retention in the southern hemisphere: is managing fire-driven forests an ecological or a social issue? University of Alberta Forest Industry Lecture Series lecture No. 67, Edmonton, Alberta, Canada, 08 Mar 2012. Available at http://www.rr.ualberta.ca/SeminarsandLectures/ForestIndustryLecture/PreviousPresentations.aspx

Roberts, S. (2012). Results of the plantation water use study, Drought and Forest and Water Workshop, 21st February 2012, CRC Forestry, Melbourne University.

Roberts, S. (2011). Presentation on Plantation hydrology and other FT hydrology research to RWG 3, 6 December 2011, Eden, NSW.

Roberts, S., and **Adams, P.R.** (2011). Forest Hydrology research in Tasmania. Presented at the China Eucalypt Conference, 2011 Guangzhou, China.

Scott, R. and Baker, S. (2011). Balancing ecological and silvicultural objectives: variable retention harvesting in Tasmania and globally. Oral presentation (presented by RS) at annual conference of the Ecological Society of Australia, 21-25 November, Hobart, Tasmania.

Trainer, E. (2011). Presentation for Tasmanian water environment merit award on the Floating Rising Stage Sampler. 19th December 2011, Hobart, Tasmania.

Wardlaw, T. (2011). Implications of climate change for the management of pests and diseases of Tasmanian eucalypt plantations. AFPA Workshop on Forest Industry Climate Change Adaptation. 26th September 2011, Hobart.

Wardlaw, T. (2011). Managing biotic risk. Invited presentation. Workshop on "Developing a Eucalypt Resource: Learning from Australia and Elsewhere". 3-4 Nov. 2011, Marlborough Wine Research Centre, Blenheim, New Zealand.

Wardlaw, T.J. (2012). Presentation to AFS Auditors on the outcomes of the FWPA CAR reserves project.

FOREST TOURS AND LUNCHTIME TALK SERIES

Forest tours and lunchtime talk series

Forest Tours

During National Science Week 2011, Forestry Tasmania once again offered tours from the Tahune AirWalk Adventure Forests site to the Warra silvicultural systems trial, where participants saw first-hand and discussed the different approaches to management of wet eucalypt forests that are being developed within the trial. The Warra silvicultural systems trial is embedded within the Warra Long-term ecological research site.

Edwards, L. (2011). Warra and the southern forests. Guided tour for National Science Week. 21st August 2011.

Grove, S. (2012). Warra and the southern forests: Old growth and coarse woody debris. Guided tour for Arboriculture conference. 1 May 2012.

Grove, S., Musk, R., Neyland, M. (2011). Warra and the southern forests. Guided tour for Silvilaser Conference field trip, LiDAR as an operational tool , 20th of October Southern Forests.

Grove, S.J., Neyland, M. and Baker, S. (2011). Warra and the southern forests. Guided tour for >40 delegates from the Ecological Society of Australia conference, 25 November 2011, Hobart, Tasmania.

Neyland, M. (2011). Warra and the southern forests. Guided tour for International Dendrological Association. 6th November 2011.

Lunchtime Talk Series

The Branch 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.

All the recent Forestry Talks are now presented both on-line through the Forestry Tasmania web-site (http://www.forestrytas.com.au/science/forestry-talks), and on YouTube. Follow the links from the Forestry Tasmania web site or put 'forestry talks' into the YouTube search dialog box for a complete listing of available talks.

Forestry Talks 2011/12

August 17

Dr Tim Wardlaw

Measuring carbon exchange in the forests of southern Tasmania

September 14

Aidan Flanagan

Are global biodiversity values threatened by capricious Australian forest policies?

October 12

Dr Paul Adams

Realising the value of forest plantations in Tasmania

November 9

Dr Sandra Roberts

Eucalypt plantations water use in Tasmania

The water balance of eucalypt plantations in the Florentine Valley

December 7

Dr Simon Grove

Sustaining Sustainability

January 18 (2012)

Denise Gaughwin & Dr Dianne Snowdon

Thomas Francis Meagher: a political exile in Van Diemen's Land

February 22

Robyn Scott

Fire and regeneration in wet forests - an evolving story

March 28

Dr Martin Moroni

Carbon substitution, the real carbon value in forest management

April 18

John Hickey

Silviculture, certification and social acceptability in central Europe-comparisons with Tasmania

key contacts

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