



Research and Development Branch
annual report 2013



stewards of the forest



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: Attendees at a variable retention silviculture and landscape-scale management field day held in the Styx Valley in February 2013. Photograph by Leigh Edwards.

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

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Cover Photograph: Robyn Scott, Leigh Edwards and Kristen Dransfield establishing a trial in Tiger block (Florentine Valley) to explore alternative regimes in hardwood plantations. Photograph by Ralph Wessman.

C O N T E N T S

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manager's report

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Over the last three years, the Australian Government has developed a program through the Standing Council on Primary Industries to establish Research, Development and Extension (RD and E) plans across primary industry. The first RD and E strategy for the Forest and Wood Products sector was prepared in 2010 by Ric Sinclair of Forest and Wood Products Australia. More recently (March 2013) the Forest and Wood Products Industry R and D Providers met to consider Draft National Research Priorities.

These priorities can be summarised as: 1. Volume and value, 2. Systems development for estate productivity, 3. Know, grow and diversify the market, 4. Resource risk management, 5. Environmental and social sustainability.

Examination of the current priorities within Research and Development Branch shows that we are addressing many of the national priorities.

Volume and value is clearly a priority for FT. The productivity group is focussed on identifying the most appropriate silvicultural regimes (pruning and thinning) for management of our plantation estate. Site quality is highly variable across the estate, and the preferred product mix can vary regionally. Understanding the growth response of plantation stands to different silvicultural regimes informs the application of the most appropriate regime to stands throughout the State. Research into the stand responses to different regimes is conducted both through research trials and through studies of operationally managed stands.

Veneer production is likely to be of major importance from our plantations in the future. Understanding the wood characteristics; strength, hardness, density and so on, is essential to valuing the resource. A study with the Forestry CRC used logs from southern Tasmania and also mainland Australia, and from both pruned-and-thinned stands and unthinned pulp stands, from low and high productivity sites. Early results indicate acceptable recoveries and properties of the veneer for both species. Further testing of veneer and plywood will be undertaken through the National Centre for Future Forest Industries in 2013/14.

Native forests remain an important part of the production estate. Ensuring that all the harvested forests are regenerated to a high standard through the quality standards process ensures that the productivity of these forests is maintained into the future.

Risk management is managed by the forest health surveillance group. Whilst the leaf beetle program is a high-profile part of the group's work, quarry hazard site surveillance, quarry surveys and *Sirex* management are all ongoing. There is a strong focus within the group at present on better understanding the crown dynamics of mid-rotation *E. nitens* plantations with chronically thin crowns.

Environmental and social sustainability is managed within R and D largely through the Stewardship reporting process, wherein pertinent data is gathered throughout the year and compiled for the Stewardship report. The FWPA-funded

landscape biodiversity project has provided a scientific underpinning to the development of metrics to ensure adequate mature habitat is retained at the local landscape level, which will be further developed in the coming year.

The carbon flux tower has provided a new focal point for research at the Warra supersite, including climate change and carbon programs. The site continues to foster an active research program involving collaborations with state, national and international institutions. Linking the Warra supersite through the national Terrestrial Ecosystem Research Network (www.tern.org.au) has strengthened the national role of the site.

Research without extension and knowledge sharing is a wasted effort. A major focus for the branch in the coming year will be sharing the results of our research efforts through presentations such as our Forestry Talks series, to meetings with interest groups, and with various stakeholders. We will present our research at national and international conferences, and we will publish our work via technical reports, through on-line media, and in the national and international scientific literature. R and D will also support FT's efforts towards certification by the Forest Stewardship Council wherever and however we can.

Monitoring damage of chronically thin crowns in mid-rotation *E. nitens* plantations in the northeast highlands

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In recent years FHS has been tracking the development of chronically thin crowns in mid-rotation, high elevation coupes in the north of the state. Although leaf beetles were playing a key role in the progression to a chronic state of thin crowns it appeared to also be influenced by other factors. Cold, desiccating winds in high elevation areas can contribute to defoliation through mechanical tearing as well as contributing to shoot death. Additionally, extensive defoliation by the fungal pathogen *Kirramyces* occurred in the summer of 2010-2011. As such it has been difficult to ascertain the contribution of each damage type to overall crown defoliation. Chronic defoliation has had a major impact on performance with measured growth reductions of up to 90%.

This summer a project was carried out to monitor the progression of shoot and leaf development and assess the timing of damage symptoms in mid-rotation coupes

in the northeast highlands. Following cluster analysis of environmental variables 8 defoliated and 2 control coupes were selected for monitoring. Photopoints and litter traps were established in each coupe. Five trees were selected in each coupe for monitoring and five shoots on each of these trees were assessed each visit. Coupes were visited and litter traps emptied fortnightly where possible. Parameters assessed at each visit included current season shoot length, newly flushed buds and foliage, missing leaves and defoliation damage.

The first assessment was conducted on 15-17 October 2012. Not a lot of activity was seen and shoots were just starting to expand. However, big adult populations of *Paropsisterna selmani* had started appearing in most areas by the end of October. This resulted in chronic defoliation of newly flushing foliage through to the end of November, so all the defoliation damage recorded up to then (up to 65% of current season foliage without including missing leaves) was due to adult feeding. Egg batches were appearing throughout mid-November but at that stage there was little evidence of larval activity. There was an explosion of the larval population of *P. selmani* in early December. Larvae were common in the litter traps as was foliage damaged by larvae and larval damage was clearly evident in the crowns.

The heaviest loads of damaged new foliage in the litter traps generally coincided with the largest larval catches. Up to this stage chronic feeding by adult beetles and an explosion of the larval population meant that most of the current season's foliage had been removed.

The spray threshold for coupes with chronically thin crowns was set at a very low level at 0.1 OSPT (occupied shoots per tree) this season. There was a sharp drop in defoliation damage following control operations and sprayed coupes generally recovered well from early defoliation. One control coupe (BS118C) was not sprayed because it was below the higher threshold for relatively undamaged coupes of 1.4 OSPT. It actually suffered damage levels over 30% throughout the summer, following a peak of 70% in mid-December, and experienced damage from a late season adult beetle population. It was also the only coupe to have a higher overall crown defoliation score at the end of the summer than at the start. By way of comparison CD113H had very poor crowns at the start of the growing season, was sprayed mid-December and saw good crown recovery throughout the rest of the season (Fig. 1). Defoliation levels on current season foliage dropped from a high of 65% in mid-November to around 20% after spraying and around 10% by the end of the season. Overall average crown

defoliation rating improved from 85% at the start of the season to 56% at the end of the season (Fig. 2).

The huge adult populations of *P. selmani* early in the season were totally unexpected and it is unknown whether this was a one-off or a developing trend. The early season damage caused by these adult populations is not prevented by current management techniques. However, despite huge beetle populations this summer lowering the spray threshold in mid-rotation plantations with chronically thin crowns was very successful in facilitating significant crown recovery. It is essential that these low thresholds are maintained and spray operations conducted to prevent growth stagnation in vulnerable areas.

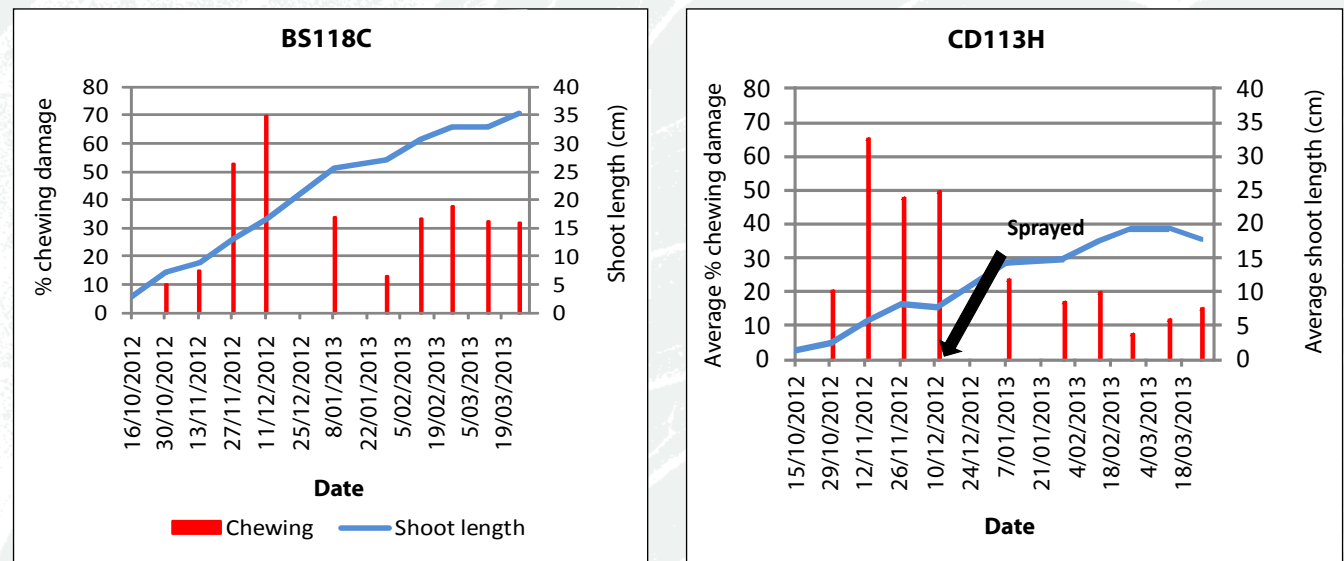


Figure 1. Chewing damage of newly flushed foliage and shoot expansion in two monitored coupes throughout the growing season. BS118C was a control coupe and had reasonable crown density at the start of the season while CD113H had very poor crown density and was sprayed on 11 December. Damage levels had dropped to around 10% late in the season in CD113H while they remained well over 30% in BS118C throughout the whole growing season.

HIGHLIGHTS



*Figure 2. Tree 3 in CD113H showing very poor crown foliage at the start of the season in mid-October (left), little improvement following damage of newly flushed foliage by adult and larval *P. selmani* in early December (centre) and good crown recovery in late March following spray operations on 11 December (right).*

Variable retention silviculture successful in regenerating our forests

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Over the past seven years, Forestry Tasmania has developed variable retention silviculture for managing its oldgrowth wet eucalypt forests. Variable retention aims to maintain biodiversity and ecosystem function in managed forests by retaining patches of forest or individual trees. Retained areas are intended to provide continuity of structure and function, enhance landscape connectivity, and influence the regenerating forest. However, these ecological goals must be balanced against silvicultural considerations such as achieving successful regeneration and avoiding damage to retained trees.

Forestry Tasmania has undertaken an extensive monitoring and research program to evaluate regeneration success and related silvicultural outcomes after operational variable retention harvesting in wet eucalypt forests, and to compare these to outcomes after conventional clearfell, burn and sow harvesting. A total of 38 aggregated retention (ARN) coupes and 31 paired clearfell, burn and sow (CBS) coupes harvested from 2003 – 2009 and regenerated from 2007 – 2010 were monitored for up to three years to address questions concerning forest influence and retention levels, the persistence of aggregates, the effects of site preparation including new 'slow burning' methods, and early regeneration results (Figure 1).



Figure 1. Two examples of paired ARN-CBS coupes monitored for regeneration success.

Regeneration density and height in three-year-old aggregated retention coupes were similar to those in comparable clearfell, burn and sow coupes. This early regeneration success in the ARN coupes is attributed to the

development of successful 'slow burning' techniques that achieved a high proportion of burnt seedbed, the adoption of aerial sowing as a standard operating procedure, and the absence of any increase in browsing pressure or

edge-related growth suppression. Seedling height and density were strongly related to the state of the seedbed, and increased with increasing burn intensity, confirming that the creation of burnt seedbed is essential for good early regeneration in wet eucalypt forests (Figure 2). The higher perimeter-to-area ratio of ARN coupes resulted in a higher proportion of the harvested area being affected by firebreaks, although this decreased in more recently harvested openings due to changes in coupe design.

Windthrow and harvesting damage were not significantly increased by ARN harvesting, but 2.5 times as much unharvested forest was affected by the regeneration burn in ARN coupes compared to CBS coupes, due largely to burning in the retained aggregates. It is recommended that island aggregates be at least 1 ha in size to avoid excessive burn damage and reduce windthrow risk. The longer-term effects of ARN harvesting on eucalypt productivity remain unknown, and more detailed examination of edge effects is required, but these early results indicate that initial silvicultural goals for regeneration can be met after variable retention harvesting in wet eucalypt forests.

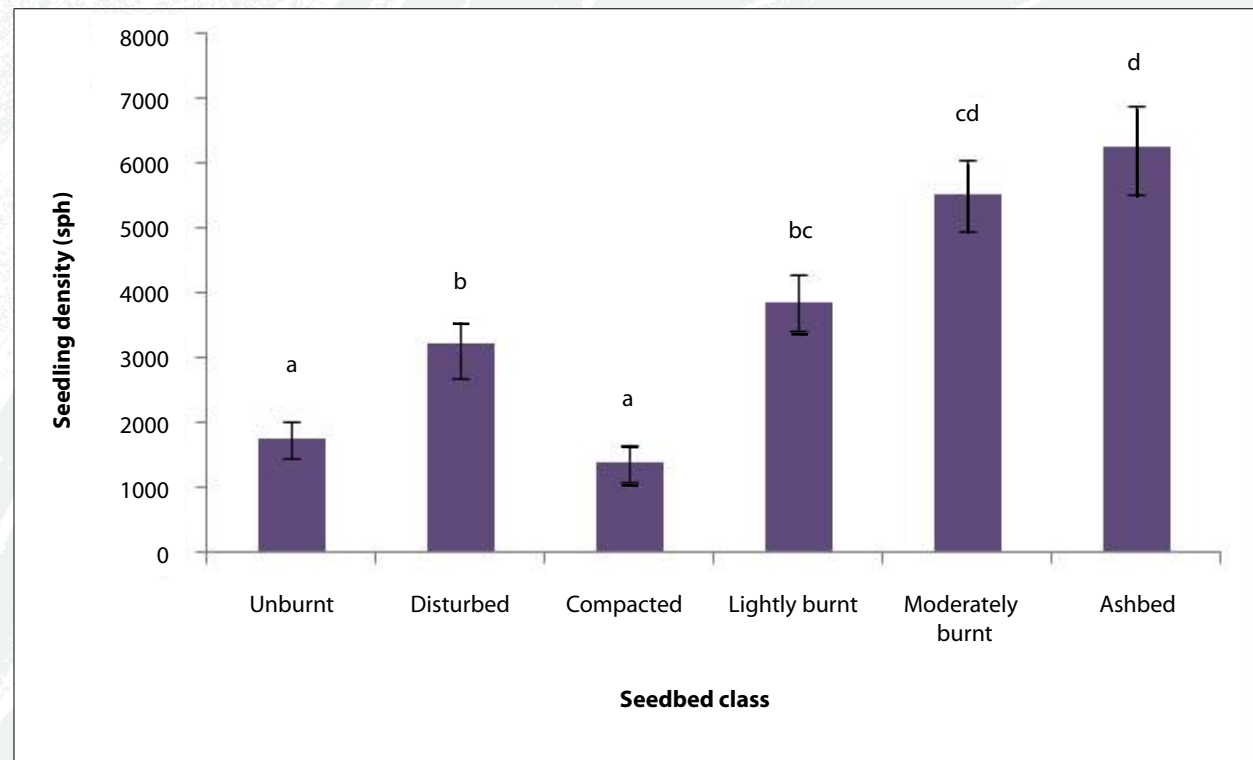


Figure 2. Seedling density at 1 year of age increased with increasing burn intensity and was lowest on compacted and unburnt seedbeds.

Precision forestry using controlled-release fertilisers

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The Basacote® range of controlled-release fertilisers (CRF) has been tested in five field trials (*E. nitens*) over the past six years on State forest in Tasmania. The objective was to quantify growth responses and the operational factors involved with using controlled-release products, compared with the standard primary fertiliser treatment di-ammonium phosphate (DAP) during the first two – three years after planting. DAP has been the main primary fertiliser over the past two decades and is applied at 100 g/seedling, four – six weeks after planting in a hole located 15 – 20 cm on the downhill side of the seedling. This timing and positioning is necessary to reduce problems associated with root burn and possible mortality of the seedlings. Controlled-release fertilisers offer the potential to significantly reduce the amount of primary fertiliser required while at the same time improving the nutrient uptake efficiency of the seedlings. The Basacote range of products was introduced to FT in 2007 by its joint venture partner Dia Paper, who had successfully used the products in their Chilean eucalypt plantations. Trials were initially installed in Bass district and were later extended to other districts. This research was facilitated by Serve-Ag, the national agent/supplier of Basacote products.

Basacote controlled-release products have a polymer coating which enables controlled-release of nutrients from the encapsulated granule according to soil temperature

and moisture conditions. A range of products and blends with different nutrient contents and release rates (3 - 16 months) have been tested. Results show that two products - Basacote Starter (20 g) or Basacote 9M (20 g) - achieved the same or better height growth than DAP across a range of sites. Both products were applied at 20 g/seedling in the planting hole at time of planting using the Pottiputki planting tool. A metered applicator that connects to the Pottiputki has now been developed by Serve-Ag. Figure 1 shows height growth at age 12 months with DAP, Basacote Starter or Basacote 9M. The Basacote products provide 18% to 70% improved height growth over nil fertiliser and 13% to 46% improved height growth over DAP in the first year. These trends have continued through to the second year of growth. The Togari coupe (TG006F) is classed as low – medium productivity due to the low soil nutrient availability while the Florentine and Smiths Plains coupes are classed as high fertility.

The CRF products use 10 - 20% of the standard volume of fertiliser, are applied at the same time as planting in the planting hole using a modified planting tool, and save on labour costs due to one less operation. This targeted application of CRF is very cost effective due to lower product costs and less labour required. These methods are environmentally friendly because less fertiliser is used, with reduced leaching and volatilisation losses and the trees get

ahead of neighbouring weeds and out of the dangerous browsing zone faster. Savings due to reduced browsing monitoring costs have been reported by other growers, along with lower costs associated with refilling seedlings (due to browsing damage and/or variable results from DAP fertilising). In total all these savings can amount to \$120-\$140/ha compared to a standard fertiliser application of DAP at 100 g/seedling. This is equivalent to a 7% saving during the establishment period.

This work represents significant value, demonstrates innovation and is an example of precision silviculture. We are able to reduce chemical inputs in our forests, while at the same time targeting our seedlings and optimising uptake. We have identified a viable alternative to DAP fertiliser and based on these results, the economic benefits and operational efficiencies, Basacote Starter (20 g) is now recommended as the standard primary fertiliser across FT's establishment program. The field trials will continue to be monitored through to age three years and new products will be evaluated as required.

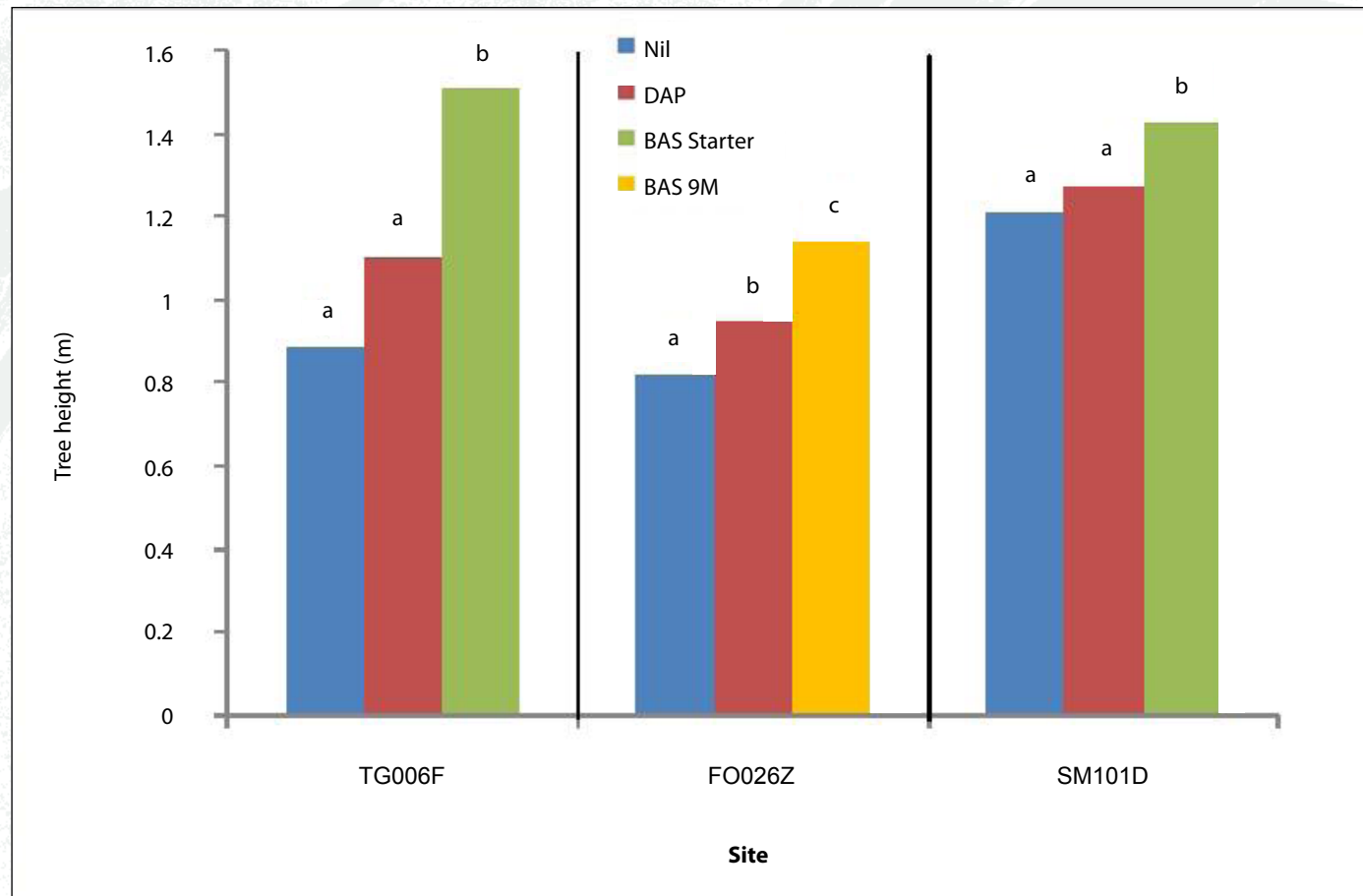


Figure 1. *E. nitens* height growth at age 12 months in response to Nil, DAP, Basacote Starter and Basacote 9M at three coupes. Basacote Starter was not available when the trial at FO026Z was installed so Basacote 9M was applied. For each site, treatments appended by the same letter are not significantly different ($p < 0.05$).

Warra carbon flux site

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Warra became the most recent site of the Ozflux network (funded by the Commonwealth government through the Terrestrial Ecosystem Research Network) with the commissioning of its flux tower in March 2013. The tower, located in Blakes 1A on the floodplains of the Huon River, measures the exchanges of CO₂, water and energy between a tall (55 m) *E. obliqua* forest and the atmosphere using the eddy covariance method (Figure 1). At 80 metres, it is the second tallest flux tower in the world and the southern-most flux tower. The forests around the flux tower (uniformly mature height potential of E1 and 2 with a or b density) are among the most productive and carbon-dense in the world. They are also among the most contested forests in the world. The commissioning of the flux tower will maintain Warra's status as one of Australia's premier long-term ecological research sites.

Importantly, the commissioning of the flux tower will underpin new research to help us understand how these forests function and deliver the ecosystem services that are so highly valued and contested. Even before the tower was erected, the prospect of the tower's eventual establishment attracted researchers from outside Forestry Tasmania to use the site. One of the first was Benedikt Fest, a PhD student from Melbourne University. As part of his studies, automatic soil chambers were installed at the flux site to measure soil fluxes of CO₂ and non-CO₂ greenhouse gasses, particularly methane.

Benedikt recently completed his PhD thesis, which is now being examined. Ben's key finding using data of soil methane fluxes collected at the Warra flux site was that the forest soils there are a strong sink for methane, a potent greenhouse gas. His studies showed that the strength of

that sink was strongly influenced by soil moisture, with the sink strength increasing with decreasing soil moisture. This is because soil moisture directly affects the volume of air-filled pores in the soil (necessary for methane to enter the soil), which increases as soil moisture decreases. A companion study, using the Wildfire Chronosequence Plots, measured soil methane fluxes as a function of time since disturbance. That study found that at all sites the soil was a sink for methane but the strength of that sink varied with

time since disturbance. The sink was strongest in middle-aged forests, declining in very young regeneration and in mature forests. This is consistent with the findings from the measurements at the flux site and reflects a positive relationship between forest water use (peaking in mid-aged forests) and the methane sink strength of the soil. While high forest water use is usually considered a negative, this study shows there are some offsetting environmental benefits of the regrowth stage of forest development.



Figure 1.

research reports

Research program - Ecosystem Services

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The Ecosystem Services group 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 and *Sirex* 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.

Staffing within Ecosystem Services has stabilised after reductions over the past two years. The forest health team, which makes up the bulk of the group, has diversified their work programs with a shift towards a more even split between research and operational activities. Conservation Biology research is largely delivered through collaborations with other institutions, particularly the University of Tasmania. Notably, we have strengthened our relationship with VicForests recognising the synergies between our two organisations in the issues surrounding the management of tall eucalypt forests.

A highlight for the year was the commissioning of the flux tower at Warra after many delays. This is an important initiative, helping to maintain Warra's profile as a premier long-term ecological research site. Despite FTs decline in capacity for conducting research at Warra, the site continues to foster an active research program involving collaborations with state, national and international institutions. This is particularly important because if TERN is to secure ongoing support from the Commonwealth

government they will need to see evidence that their investments in infrastructure have fostered science capacity and generated significant advances in knowledge.

As forecast last year, there was a strong focus within the forest health group of better understanding the crown dynamics of mid-rotation *E. nitens* plantations with chronically thin crowns. This work confirmed that leaf beetles caused most of the leaf damage in those plantations, and that the damage commenced well before we commenced monitoring egg populations. The work also showed that the decision this year to lower population thresholds triggering control operations in those plantations with thin crowns was a good one. Control, once done, curtailed further leaf damage allowing improvement in crown condition by the end of the growing season.

The planned program for 2013-14 for forest health aims to deliver three key outcomes:

1. a better understanding of the importance of high-altitude grasslands as overwintering habitat for leaf beetles;
2. verify anecdotal observations of faster egg-larval development times for *P. selmani* compared with *P. bimaculata*;
3. roll-out coupe-level predictions of site-suitability for planting *E. globulus*.

For the conservation program, important outputs for 2013-14 will be:

1. get papers arising from the landscape biodiversity study progressed to publication in peer-reviewed journals;
2. incorporate science from landscape biodiversity study to verify the coupe-context approach to delivering biodiversity management;
3. bring together the forest influence and landscape context thinking to underpin a new ARC project that will provide the science underpinning claims our biodiversity management meets the standards for FSC certification.

The year ahead will be an important one for Warra. The proposed WHA extension will hopefully be resolved in a way that results in key long-term study sites remaining on State forest. We will commence 10-year post-harvest biodiversity surveys (of beetles) in the ARN treatments in the lead up to a full 10-year post harvest evaluation of SST treatments in 2015. We will refine the science program focussed on the flux site and seek collaborations with other institutions to progress that science plan.

ECOSYSTEM SERVICES

Ecosystem Services - Key research and development projects

1. Sustaining biodiversity and habitat

1.1 Maintain a reserve system in State forests in accordance with the Regional Forest Agreement and Tasmanian Community Forest Agreement.

| Effectiveness of CAR Reserves | FT Staff | 2012-13 Activities and outputs | 2013-14 Planned program |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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. | Tim Wardlaw Marie Yee Martin Moroni Ruiping Gao Collaborators Uni Tas, FPA DSE, Victoria DPI, NSW DEC, WA | Final report to FWPA produced and publicly released. Commenced preparation of papers arising from the study for publication in peer-reviewed journals. Presented findings from study at numerous fora. Liaised with Sustainability Branch and Forest Practices Authority to ensure findings inform biodiversity planning guidelines, particularly the coupe-context metric. | Finalise preparation of papers arising from study and submit to journals for peer-review and eventual publication. Liaise with Sustainability Branch in the development and documentation of coupe-context metric. Integrate scientific findings from landscape study with ARC forest influence study to develop a new ARC Linkage project (in collaboration with Uni Tas, VicForests and Deakin University) that aims to provide the science underpinning the delivery of biodiversity management at all spatial scales in forest landscapes. |

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

| Persistence of saproxylic beetles | FT Staff | 2012-13 Activities and outputs | 2013-14 Planned program |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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. | Tim Wardlaw Lyn Forster Collaborators Uni Tas Monash University Scion | Progress substantially delayed due to illness and personal issues affecting the key Uni Tas staff involved in the study. | Screen <i>Lissotes</i> and <i>Prostomis</i> if additional microsatellites are detected. Complete analysis of genetic x geographic variation of <i>Coripera</i> and <i>Prostomis</i> (and <i>Lissotes</i> 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 | FT Staff | 2012-13 Activities and outputs | 2013-14 Planned program |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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. | Tim Wardlaw Collaborators Uni Tas TMAG | Belinda Yaxley's PhD thesis was submitted. | Finalise corrections to PhD thesis (Belinda Yaxley). |
| 1.7 Retain oldgrowth elements including large trees, stags, understoreys and logs across the forest estate. | | | |
| SST Biodiversity | FT Staff | 2012-13 Activities and outputs | 2013-14 Planned program |
| Document the biodiversity impacts from the range of silvicultural treatments available for harvesting wet eucalypt forests. | Nita Ramsden Andrew Hingston (contract) Tim Wardlaw Collaborators TMAG Uni Tas | Completed annual surveys of birds and ground beetles in the SST control plots. Provided SST bird, beetle and bat data to Sweden University of Agriculture to include in global meta-analysis of biodiversity response to forest retention. | Complete annual bird and ground beetle surveys of the SST control plots; commence 10-year post harvest sampling of beetles in ARN treatments; conduct 6-year post-harvest survey of birds in group-selection treatment. Commence sorting beetle samples from completed 10-year post-harvest treatments. |
| Forest influence | FT Staff | 2012-13 Activities and outputs | 2013-14 Planned program |
| 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. | Tim Wardlaw Andrew Hingston (contract) Collaborators Uni Tas Oregon State Uni Washington State University | Uni Tas Post-doc (Sue Baker) completed beetle surveys in Tasmania and conducted/co-ordinated beetle, plant and spider surveys in USA (on Fulbright Fellowship) as part of a global study to quantify forest influence effect. Uni Tas PhD students (Nick Fountain-Jones and Tom Baker) completed mechanistic studies examining the relative effects of shading and litter on beetles and plants in contributing to forest influence effect. Review paper on forest influence written and accepted for publication after peer-review. | Analyse data collected for the global forest influence study and document results. Complete analysis and write-up of studies by Uni Tas PhD students (Nick Fountain-Jones and Jayne Balmer). |

Ecosystem Services - Key research and development projects (continued)

Forest influence (continued)

Collaborated with Uni Tas in hosting a visit by Jerry Franklin and Tom Spies to review forest influence and landscape biodiversity research. Hosted delegations of foresters and scientists from VicForests and Argentina to coincide with the Franklin-Spies visit.

Completed analysis of bird response to forest influence and commenced preparation of a draft paper.

2. Sustaining jobs for current and future generations

2.4 Ensure an ongoing long term supply of special timbers.

| | | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Stand management of fenced-intensive-blackwood</p> <p>To develop prescriptions for management of blackwood-rich regeneration particularly in the far northwest.</p> | <p>FT Staff</p> <p>Sue Jennings Mark Neyland Rob Musk</p> | <p>2012-13 Activities and outputs</p> <p>Completed remeasurement of TG021A (x 2) and TG021B.</p> | <p>2013-14 Planned program</p> <p>Progress stand management regimes for FIB coupes by writing-up results to date from remeasurements of FIB trials.</p> <p>Input to blackwood resource review (with Planning Branch) (ongoing from 2012/13).</p> <p>Input to blackwood inventory program (pending lead from Resources Branch).</p> |
| <p>Management options for swamp blackwood myrtle forests</p> <p>To develop management prescriptions for swamp blackwood myrtle forests.</p> | <p>FT Staff</p> <p>Sue Jennings Mark Neyland</p> | <p>2012-13 Activities and outputs</p> <p>Provided input into preparation of FPP for selective blackwood harvesting operation (CH037B).</p> | <p>2013-14 Planned program</p> <p>Assist district with selection of areas suitable for treatment recognising there are few opportunities for silvicultural intervention in routine swamp regeneration operations.</p> |
| <p>Silvicultural systems for special timbers</p> <p>To develop and implement safe, practical and economic silvicultural systems for the sustainable production of special timbers.</p> | <p>FT Staff</p> <p>Sue Jennings Robyn Scott Tim Wardlaw Mark Neyland</p> | <p>2012-13 Activities and outputs</p> <p>No rainforest harvesting in 2012-13.</p> <p>Attended IUFRO uneven-aged forest management conference in Christchurch, November 2012.</p> | <p>2013-14 Planned program</p> <p>Monitor harvesting in special timbers zones. Provide training in silvicultural systems and damage assessments to contractors and supervisors as required – no contractor, no activity.</p> <p>Prepare technical note on inoculation of sassafras to produce blackheart timber. Liaise with IST/Uni Tas to develop research agenda for treatment of <i>E. nitens</i> to produce “mock blackheart” of suitable quality to merchandise.</p> |

Ecosystem Services - Key research and development projects (continued)

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 | FT Staff | 2012-13 Activities and outputs | 2013-14 Planned program |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Provide a focal point for intensive studies into carbon dynamics of tall, wet eucalypt forests. Key research objectives include:</p> <p>documenting fluxes of carbon, water and energy from mature/regrowth <i>E. obliqua</i> forest and relate fluctuations in those fluxes with climatic conditions and biotic events.</p> <p>determining the contribution of different components of the forest (soil, CWD, overstorey eucalypts, rainforest understorey) to the carbon fluxes.</p> | <p>Tim Wardlaw Leigh Edwards Alison Phillips</p> <p>Collaborators</p> <p>CSIRO Marine & Atmospheric Research Uni Melb Monash Uni ANU Uni Tech Sydney Uni Tas</p> | <p>Tower erected and instrumented. Commenced collecting data in March 2013. Liaising with Ozflux for a modified program to process Warra flux data to Ozflux specifications.</p> <p>Contracted Ben Fest (Uni Melb) to process and analyse soil CO₂ flux data from automatic soil chambers. Found soil CO₂ fluxes were strongly correlated with soil temperature: soil moisture had little effect on fluxes.</p> <p>Plan official opening of Warra Flux Tower.</p> | <p>Maintain flux tower and data-streams. Install radio communications link to enable 30-minute measurements to be uploaded in real-time.</p> <p>Liaise with potential collaborators to develop science program and funding applications.</p> <p>Maintain active collaborations (ANU – key physiological parameters of main species; UTS – leaf carbon isotopes).</p> |
| Carbon in forests | FT Staff | 2012-13 Activities and outputs | 2013-14 Planned program |
| <p>Engage in the carbon debate in Australia.</p> <p>Progress our understanding of the carbon stocks in different forest types.</p> | <p>Martin Moroni</p> | <p>Paper submitted on domestic harvesting that estimates CWD biomass losses from domestic harvesting, which can be halved to provide a carbon estimate.</p> <p>Masters Thesis (Patrick Dietrich) Technical University of Dresden completed.</p> <p>Active involvement in the National debate.</p> | <p>Ongoing involvement in the National debate.</p> <p>Progress study into the carbon stocks in late stage mixed forest and rainforest.</p> |

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) | FT Staff | 2012-13 Activities and outputs | 2013-14 Planned program |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| <p>Early detection of large-scale influences such as climate change on forest processes.</p> <p>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.</p> <p>Monitor emerging climate change scenarios and trends and adapt forest management practices.</p> | <p>Tim Wardlaw</p> <p>Collaborators</p> <p>DPIPWE TMAG</p> | <p>No activity - waiting on DPIPWE for full report on first decadal remeasurement of plants on altitudinal transect.</p> | <p>Sort and identify beetles (TMAG being contracted for job by DPIPWE).</p> |

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

| Sirex wood wasp | FT Staff | 2012-13 Activities and outputs | 2013-14 Planned program |
|--------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Prevent significant losses from outbreaks of <i>Sirex</i> wood wasp in <i>P. radiata</i> plantations.</p> | <p>Dick Bashford Nita Ramsden</p> <p>Collaborators</p> <p>National Sirex Coordination Committee</p> | <p>Monitored five compartments for <i>Sirex</i> as per Timberlands contract. Introduced nematodes into two <i>Sirex</i>-infested plantations.</p> <p>Supervised post-doc and PhD in ARC-Linkage research project (<i>Ips</i> competition with <i>Sirex</i> in trap-trees).</p> <p>Attended National <i>Sirex</i> Coordination Committee meeting.</p> | <p>Attend National <i>Sirex</i> Coordination Committee annual meeting.</p> <p>Monitor five compartments for <i>Sirex</i> using static traps, evaluate effectiveness of nematode inoculation (Timberlands contract).</p> |

Ecosystem Services - Key research and development projects (continued)

| Leaf beetle management | FT Staff | 2012-13 Activities and outputs | 2013-14 Planned program |
|------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Integrated Pest management (IPM) that is efficient at preventing economic damage by leaf beetles in plantations. | Leonie McCrossen Tim Wardlaw Karl Wotherspoon | Introduced changes to leaf beetle IPM – risk-based targeting of plantations to monitor; roadside occupied-shoots-per-tree monitoring; revised thresholds for control. | Conduct exploratory survey of high altitude plantations to determine role of grass tussocks in providing over-wintering sites for leaf beetles. |
| | Collaborators | Co-ordinated 2012-13 leaf beetle IPM. The program monitored 13,168 ha (a 30% reduction from last year) of which 44% were above-threshold (a 144% increase from last year); and 4,741 ha were sprayed with Dominex (an 87% increase on last year). The higher levels of spraying this year reflect the decision to lower the population threshold for spraying in areas with chronically thin crowns. | Conduct laboratory study to compare temperature x development time for egg-larval stages of <i>P. selmani</i> compared with <i>P. bimaculata</i> . |
| | CSIRO Sustainable Ecosystems | 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. | Co-ordinate 2013-14 IPM, including training contractors in using revised monitoring method. |
| | | | Do another remeasurement of growth plots to measure growth in mid-rotation plantations with chronically thin crowns (to determine if growth is recovering with improvement in crown health following lowering control threshold for leaf beetles). Document (with CSIRO) CABALA Health validation study for the case of mid-rotation defoliation by leaf beetles. |

Ecosystem Services - Key research and development projects (continued)

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|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Hygiene – exotic diseases and weeds (formerly <i>Phytophthora</i> management)</p> <p>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.</p> | <p>FT Staff</p> <p>Sue Jennings Tim Wardlaw Nita Ramsden</p> <p>Collaborators</p> <p>FPA NRM South</p> | <p>2012-13 Activities and outputs</p> <p>Undertook quarry inspections for <i>P. cinnamomi</i>/weed certification.</p> <p>Provided advice to Districts on formulating Forest Practices Plan prescriptions for operations in <i>Phytophthora</i> Management Areas.</p> <p>Draft FT weed strategy completed and submitted to SEG.</p> <p>Attended steering committee meetings of NRM South project to develop and implement hygiene protocols for aquatic pathogens threatening TWWHA.</p> <p>Migrated quarry hygiene survey documents into FT Wiki and quarry survey results onto FOD (to satisfy audit requirements).</p> | <p>2013-14 Planned program</p> <p>Conduct quarry certification surveys as required.</p> <p>Finalise draft weed strategy and seek its adoption.</p> <p>Conduct refresher field days in each District on <i>Phytophthora</i> management.</p> <p>Progress decision for general adoption by Districts of post-harvest monitoring of operations that had <i>Phytophthora</i> prescriptions included in their FPP.</p> <p>Advise on options for adopting findings from NRM South TWWHA hygiene project into FT practices/procedures.</p> |
| <p>Health surveillance of plantations (FT & external)</p> <p>Maximise the health and productivity of plantations by ensuring health problems are detected and managed before significant impacts occur.</p> | <p>FT Staff</p> <p>Karl Wotherspoon Sue Jennings Nita Ramsden Tim Wardlaw Rob Musk</p> <p>Collaborators</p> <p>DPIPWE</p> | <p>2012-13 Activities and outputs</p> <p>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.</p> <p>Intensively monitored the timing of shoot growth, leaf damage and leaf-beetle activity in <i>E. nitens</i> plantations suffering from chronically thin crowns.</p> <p>Results of area-freedom surveys for myrtle rust on State forest were incorporated into a statewide report documenting Tasmania's area-freedom status (report presented to Plant Health Committee).</p> <p>CRCF MODIS tool (satellite imagery analyses by computer) tested and found to be unable to reliably detect severe defoliation (arising from 2011 <i>Kirramyces</i> epidemic).</p> | <p>2013-14 Planned program</p> <p>Conduct aerial and roadside and follow-up surveys of FT and privately-owned plantations (fee-for-service).</p> <p>Prepare and disseminate notification and summary reports to clients, and update datasets (including GIS).</p> <p>Continue seeking opportunities for external customers of FHS services (with FTS Manager).</p> <p>Validate GIS models for cold-air drainage and exposure using FHS surveys and progress towards developing criteria for coupe-level species choice decisions.</p> |

Ecosystem Services - Key research and development projects (continued)

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| <p>FHS: District liaison and quality standards</p> <p>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.</p> | <p>FT Staff</p> <p>Sue Jennings Karl Wotherspoon Nita Ramsden Leonie McCrossen</p> | <p>2012-13 Activities and outputs</p> <p>Meetings were held in all Districts to review the outcomes of actions in response to notifications made in 2010-11 and agree to actions in response to notifications made in 2011-12.</p> <p>Collaborated with FOD Development Team to develop and test FHS summary table in FOD. This will replace FHS database and will track actions arising from FHS notifications.</p> | <p>2013-14 Planned program</p> <p>Integrate FHS into annual programs of Plantations Quality Standards and Plantations Performance Indicators.</p> |
| <p>FHS – policy</p> <p>Ensure flow of information from FHS to inform policy and corporate reporting.</p> | <p>FT Staff</p> <p>Tim Wardlaw Karl Wotherspoon Nita Ramsden Leonie McCrossan Lachie Clark Ruiping Gao</p> | <p>2012-13 Activities and outputs</p> <p>Data and narrative on pest and disease status and pest management was provided for the 2012 Stewardship Report.</p> <p>Annual pest and disease status report for Tasmania was prepared for inclusion in the Sub-committee for National Forest Health's (formerly RWG 7) national pest and disease status report.</p> <p>Contributed to a redrafting of the Plantation Timber Industry Biosecurity Plan (for Plant Health Australia).</p> <p>Represented Sub-committee for National Forest Health at Nov 2012 Plant Health Committee meeting.</p> | <p>2013-14 Planned program</p> <p>Compile tabular and narrative summaries from FHS for inclusion in Stewardship Report.</p> <p>Compile annual pest and disease status report for Plant Health Committee (through Sub-committee for National Forest Health).</p> <p>Provide liaison with Tasmanian Biosecurity Committee (Technical and Stakeholder Committee) and Federal Biosecurity agencies as required.</p> |
| <p>Port surveillance</p> <p>Detect the early introduction of exotic forest pests and diseases.</p> | <p>FT Staff</p> <p>Nita Ramsden Dick Bashford</p> <p>Collaborators</p> <p>DPIPWE Office of the Chief Plant Protection Officer</p> | <p>2012-13 Activities and outputs</p> <p>No activity – deferred to triennial program (due 2013-14 if commonwealth funding is forthcoming).</p> | <p>2013-14 Planned program</p> <p>If commonwealth funding is provided:</p> <ul style="list-style-type: none"> • Assist DPIPWE in selecting monitoring sites; • Screen trap catches to identify suspected incursions; • Complete health surveys of hazard sites. |

Ecosystem Services - Key research and development projects (continued)

| FHS Research & Development | FT Staff | 2012-13 Activities and outputs | 2013-14 Planned program |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Refine methods for the detection of forest pests. | Dick Bashford Karl Wotherspoon Nita Ramsden Tim Wardlaw | Draft paper on relationship between borer trap catches and damage in eucalypt plantations was peer-reviewed. | 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. |
| | Collaborators ACIAR DEEDI, Queensland | | |
| 3.8 Use controlled fire to emulate natural conditions and achieve ecological, silvicultural and forest health benefits. | | | |
| Wildfire Chronosequence | FT Staff | 2012-13 Activities and outputs | 2013-14 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 Dick Bashford | Benedikt Fest submitted PhD thesis exploring the roles of temperature, moisture and disturbance history on soil fluxes of CH ₄ and NO ₂ . Developed theory of succession-driven declines in CH ₄ uptake as the result of increases in soil moisture from a study done using the Wildfire Chronosequence. Sorted beetles collected from the baseline sampling of the Wildfire Chronosequence. 1 ha AusForest plot (TERN) superimposed on the 1934-South Wildfire Chronosequence plot was established and measured. | Complete analysis and write-up of baseline beetle assemblages along the wildfire chronosequence. |
| | Collaborators Uni Tas Uni Melb | | |

Ecosystem Services - Key research and development projects (continued)

4. Sustaining safety, community access and heritage

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

| Occupational health and safety | FT Staff | 2012-13 Activities and outputs | 2013-14 Planned program |
|---------------------------------------------------------------------------------------------|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| Promote safe work practices and safe use of state forests through effective staff training. | All staff | Staff training was 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 | 2012-13 Activities and outputs | 2013-14 Planned program |
|----------------------------------------------------------|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | Leonie McCrossen All staff | 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. | 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. |

Ecosystem Services - Key research and development projects (continued)

| Tasmanian Forest Insect Collection | FT Staff | 2012-13 Activities and outputs | 2013-14 Planned program |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Develop a comprehensive, highly valued and widely used reference collection and database of Tasmanian forest insects. | <p>Nita Ramsden Dick Bashford</p> <p>Collaborators</p> <p>TMAG Australian National Insect Collection Uni Tas University of Guelph Numerous taxonomists</p> | <p>Migration of the TFIC to TMAG commenced. The TFIC was curated.</p> <p>Specimens collected from the CAR reserves project were incorporated into the TFIC.</p> | Continue migrating the TFIC to the Tasmanian Museum and Art Gallery. |
| Warra Supersite | FT Staff | 2012-13 Activities and outputs | 2013-14 Planned program |
| <p>Maintain a high public and scientific profile of the Warra LTER</p> <p>Develop a long-term research strategy based on the Warra Ecological Model. Promote collaborative research at the Warra LTER site.</p> | <p>Tim Wardlaw Leigh Edwards</p> <p>Collaborators</p> <p>James Cook University ANU FPA Uni Tas TERN UWS</p> | <p>Plot data and ancillary water physiology measurements provided to collaborator at University of Western Sydney for a synthesis study using Supersites to explore moisture control of forest maximum forest height.</p> <p>Undertook additional soil bulk density measurements in 1 ha plot.</p> | <p>Continue to support studies in Warra through the summer student scholarship and small projects grant schemes.</p> <p>Continue to maintain acoustic sensor in the 1-ha plot. Develop opportunities for collaboration with relevant experts to develop ways to automate the processing of acoustic data.</p> <p>Conduct winter field campaign to measure physiological attributes of the main tree species in 1-ha plot.</p> <p>Complete full vegetation survey of 1-ha plot.</p> <p>Select site and install piezometer to monitor groundwater beneath 1-ha plot.</p> <p>Migrate Warra beetle and bird datasets to TERN Supersite Portal.</p> |
| Communications | FT Staff | 2012-13 Activities and outputs | 2013-14 Planned program |
| <p>Maintain strong linkages between research and science-based forest management.</p> <p>Maintain a high profile for credible research within the scientific community.</p> <p>Disseminate the results of research to all interested parties.</p> | All research staff | <p>Staff presented at 41 workshops and conferences; produced 18 technical reports and had 14 papers published in peer-reviewed journals or book chapters (see table at rear). Seven lunchtime talks were presented and guides were provided for a number of tours of Warra and the southern forests.</p> | 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. |

Ecosystem Services - Key research and development projects (continued)

| Warra LTER support | FT Staff | 2012-13 Activities and outputs | 2013-14 Planned program |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| <p>Support and promotion for research at the Warra Long Term Ecological Research (LTER) site.</p> <p>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.</p> | <p>Tim Wardlaw Mark Neyland John Hickey</p> | <p>Assistance to external researchers.</p> <p>Safety coordination with Huon District.</p> <p>Guides for 7 Site tours (127 participants). Over 3600 people have now been guided through the Warra LTER site.</p> <p>Maintenance of LTER and SST infrastructure.</p> <p>Input to 'coupe context' and 'tree hollow' discussions with sustainability branch and FPA.</p> <p>Input to consideration of VR in coupes which lack 20% long term retention coupe context.</p> | <p>Paper on relevance of German selection silviculture for Tasmanian wet eucalypt forests.</p> |

research reports

Research program - Productivity

Dr Paul Adams, Principal Research Scientist, Productivity
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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. We also support continuous improvement of forest management through delivery of targeted research and Quality Standards (QS). Our major research activities receive guidance and support via the Plantation Productivity and Management Group (PPMG) and the Tree Breeding Strategy Group (TBSG), which keep it relevant and targeted to the needs of FT. Our objective is to provide targeted research and technical services that are accurate, cost effective and on time.

We also provide services to external clients through the FT consulting arm, Forestry Services International (FSI). Such projects enable us to market our significant technical expertise and bring in much-needed external funds.

Three main outcomes were achieved over the past 12 months:

1. A new 3rd generation silviculture regime trial was established in the Derwent district to enable detailed investigation of alternative regimes (pruning and thinning) for optimising production of high quality pruned logs.
2. A major study on the rotary peeling characteristics of rotation-age *E. nitens* and *E. globulus* was undertaken by Forestry CRC using logs from southern Tasmanian stands and also mainland Australia. This included both pruned/thinned stands and unthinned pulp stands, from low and high productivity sites. Early results indicate acceptable recoveries and properties of the veneer for both species. Further testing of veneer and plywood will be undertaken in 2013/14.

3. We delivered a major consulting project to the Yong'an Forestry Group (YFG) in Fujian, China. This project involved installing the first stage of a Genetic Improvement Program for the two eucalypt species grown by Yong'an (*E. dunnii* and *E. grandis*). In addition, silviculture trials were installed to demonstrate pruning and thinning silviculture for producing medium - large diameter sawlogs over longer rotations. A new project proposal was submitted for the next stage of the project.

The primary aims for 2013/14 are to:

1. Continue work on understanding the links between genetics, silviculture, and wood quality, to characterise FT's eucalypt estate for wood quality (pulp, EWP and SWP). This work is in collaboration with the Product Development group, the National Centre for Future Forest Industries (NCFI) and other industry partners. This work will also include the native forest regrowth resource.
2. Documentation of FT's tree breeding strategy and identification of new initiatives through the Tree Breeding Strategy Group.
3. Complete documentation of the advances made and systems developed for increasing productivity through the nutrition research program.
4. Win a new consultancy contract for Stage 2 of Genetic Improvement and Silviculture project with Yong'an Forestry Group.
5. Install one new 3rd generation regime trial to evaluate alternative regimes and validate models.
6. Establish a backup orchard for Castra *E. nitens* seed orchard.



The 'Number One' tree in the FT *E. nitens* breeding program. Diameter of 63 cm at 24 years old.

PRODUCTIVITY

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 | 2012-13 Activities and outputs | 2013-14 Planned program |
|------------------------------------------------------------------------------------------------|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | Robyn Scott Mark Neyland | Monitoring and maintenance of the Warra silvicultural systems trial. | Monitoring and maintenance of the Warra silvicultural systems trial. |
| Operational development and evaluation of aggregated retention (ARN) in tall oldgrowth forests | FT Staff | 2012-13 Activities and outputs | 2013-14 Planned program |
| | Robyn Scott Mark Neyland | <p>Advice provided to Districts on planned aggregated retention coupes.</p> <p>Database finalised on 2006 to 2011 ARN coupes and comparable CBS coupes.</p> <p>Monitored ARN coupes via FOD.</p> <p>Published journal paper on regeneration in variable retention coupes.</p> <p>PhD thesis submitted and passed.</p> <p>Contributed to coupe context discussions.</p> | <p>Advise on planned aggregated retention coupes.</p> <p>VR for other reasons: Landscape, swift parrot etc.</p> <p>Contribute to coupe context discussions.</p> |

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 | 2012-13 Activities and outputs | 2013-14 Planned program |
|-----------------------------------------------------------------------------|-----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|-------------------------|
| | Dave McElwee Tim Osborn Robyn Scott Mark Neyland | Native forests data sets were entered into corporate databases. Identified gaps in existing knowledge and inventory. | Monitoring. |

Productivity - Key research and development projects (continued)

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|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| <p>Sowing trials</p> <p>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.</p> | <p>FT Staff</p> <p>Mark Neyland Dave McElwee Rob Musk District Staff</p> <p>Collaborators</p> <p>Uni Tas</p> | <p>2012-13 Activities and outputs</p> <p>Measured, analysed and reported on results from the sowing trials. The regeneration survey database is providing useful information on the relationship between sowing rate and seedling density.</p> | <p>2013-14 Planned program</p> <p>Measure, analyse and report on results from the sowing trials.</p> |
| <p>Community evenness trial</p> <p>To determine the effects of plant community evenness on productivity, pest susceptibility and nutrient cycling.</p> | <p>FT Staff</p> <p>Robyn Scott Mark Neyland</p> <p>Collaborators</p> <p>Uni Tas</p> | <p>2012-13 Activities and outputs</p> <p>A replicated randomised block designed trial has been established at one site in southern Tasmania (SX038A), where the blocks have been sown with four local species (2 eucalypts and 2 acacias) in different proportions. Seedling growth and productivity, pest susceptibility and nutrient cycling will be monitored over the next several years.</p> | <p>2013-14 Planned program</p> <p>Coordinate monitoring and provide assistance to Uni Tas staff as needed.</p> |
| <p>Silvicultural advice</p> <p>To provide silvicultural advice and to promote good silvicultural practice in native forests.</p> | <p>FT Staff</p> <p>Robyn Scott Mark Neyland</p> | <p>2012-13 Activities and outputs</p> <p>Advice and training on problematic coupes provided as required.</p> | <p>2013-14 Planned program</p> <p>Provide advice and training on problematic coupes as required.</p> |

Productivity - Key research and development projects (continued)

| Operational standards monitoring and extension - native forests | FT Staff | 2012-13 Activities and outputs | 2013-14 Planned program |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| To ensure 'best practice' standards are developed and met in native forest silviculture. | Leonie McCrossen Mark Neyland | <p>Provided support to Districts with entering data into FOD.</p> <p>State-wide review held in July. Reported to General Management Team in September. Recommended to review internal procedures and formulate a template for section E of FPPs.</p> <p>2013 Quality Standards Manual published.</p> <p>Maintained regeneration survey database.</p> <p>Maintained mammal browsing database and browsing monitoring tool.</p> | <p>Provide advice on QS reporting requirements from FOD.</p> <p>Address native forest QS issues arising from auditing against the Australian Forestry Standard and FTs EMS.</p> <p>QS visits, review and reporting.</p> <p>Support districts with burn program management.</p> <p>Convene meetings of the native forest coordinators group as required.</p> <p>Prepare regeneration success report for 09/10 (three year old) eucalypt coupes and 2007/08 (five year old) special timbers coupes for FTs Annual and SFM reports.</p> <p>Report on carry-over coupes, coupe sizes, regeneration burns.</p> <p>Continue to support regeneration survey database.</p> <p>Continue to manage browsing monitoring tool and browsing management database.</p> <p>Contribute to preparation of Yellow Book.</p> |
| Seed | FT Staff | 2012-13 Activities and outputs | 2013-14 Planned program |
| <p>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.</p> <p>To ensure that optimum seed mixes are used in all FT sowings.</p> | Leonie McCrossen | <p>Provided on-going analysis of seed stock shortfalls and surpluses on an as-needs basis.</p> <p>Supported all districts to use seed management system for 2012/13 seed stock analysis.</p> <p>Supported seed allocation process for 2013 sowing.</p> | Maintain technical support to seed centre and sowing program. |

Productivity - Key research and development projects (continued)

2.5 Establish and manage Forestry Tasmania's plantations to maintain timber supply levels to industry.

| Rationalisation, measurement and maintenance of established thinning trials | FT Staff | 2012-13 Activities and outputs | 2013-14 Planned program |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | Paul Adams Dean Williams Sandra Roberts Crispen Marunda Kristen Dransfield Mark Neyland | Progressed the rationalisation of the research program, and initiated migration of important datasets to FENRIS (corporate database). | Full rationalisation of the productivity research program and integration of systems and efforts with Resources Branch. |
| Tree improvement; genetics | FT Staff | 2012-13 Activities and outputs | 2013-14 Planned program |
| Maximising the production of pruned logs, and associated products, from plantations through genetic improvement, pruning, thinning and fertilising to improve growth and wood quality. | Dean Williams Kristen Dransfield Crispen Marunda Sean Boucher Peter Moore Mitch Fulford | Finished collaborative TREEPLAN analysis of <i>E. nitens</i> breeding program with Gunns and HVP. Wood quality work (including checking, stiffness and pulp yield analysis) in <i>E. nitens</i> as part of H1000 molecular genetics project extended our understanding of the quantitative genetic parameters for these traits. | Documentation of FT's tree breeding strategy and identify new initiatives through the Tree Breeding Strategy Group. Work with collaborators to characterise FT's eucalypt plantation estate for wood quality (pulp, engineered wood products and sawn wood products). This work is to include the native forest regrowth resource. Sow seeds for new H1000 <i>E. nitens</i> and <i>E. globulus</i> association populations and advanced generation trial (200-300 seedlots) in each trial. Selection of elite <i>E. nitens</i> and <i>E. globulus</i> trees to graft for stocking seed orchards. |
| | Collaborators Uni Tas STBA Plantplan Genetics CRC Forestry CSIRO Ta Ann Gunns Ltd HVP Ltd NCCFI | Through Forestry Services International, completed Yong'an III (Genetic Improvement and Silviculture Program) and submitted a new project proposal for the next stage of the project. | |

Productivity - Key research and development projects (continued)

| Tree improvement; seed and seedling supply | FT Staff | 2012-13 Activities and outputs | 2013-14 Planned program |
|--------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Provide research and advice to improve the quality and efficiency of seed and seedling production. | Dean Williams Peter Moore Carlton Cox | <p>Developed a seed orchard management activity responsibility matrix.</p> <p>Provided advice on seed harvesting strategies.</p> <p>Provided advice on procurement of seedlings, seed and seed production facilities.</p> <p>Continued to stock seed orchards with improved genotypes (advancing genetic deployment). Extra tree management protocols put in place.</p> <p>Terminated the redundant Hastings <i>E. nitens</i> seed orchard.</p> | <p>Establishment of back-up orchard for Castra <i>E. nitens</i> seed orchard.</p> <p>Continue to produce trees to stock <i>E. nitens</i> and <i>E. globulus</i> seed orchards, based on most up-to-date genetic evaluations.</p> |
| Eucalypt plantation silviculture | FT Staff | 2012-13 Activities and outputs | 2013-14 Planned program |
| Maximising the production of pruned logs, and associated products, from plantations through improved silviculture. | Paul Adams Robyn Scott Dean Williams Robert Musk David Mannes Crispen Marunda Kristen Dransfield Sean Boucher | <p>Produced technical report summarising modelling work on alternative silviculture for improving production of pruned logs and economics of eucalypt plantations.</p> <p>Ongoing investigations on the relationships between silviculture, processing requirements and wood quality (CRC-F).</p> <p>Established and measured a new third-generation pruning and thinning trial at TI004C. Establishment report written.</p> <p>Started data analysis and report writing summarising results from 2nd generation pruning and thinning trials.</p> <p>Released StandWORKS v.1.1.</p> <p>Provided assistance with planning of silvicultural operations in all Districts.</p> | <p>Continue research to improve understanding of alternative silviculture systems in collaboration with PPMG.</p> <p>Management of, and reporting on, first- and second-generation <i>E. globulus</i> and <i>E. nitens</i> pruning and thinning trials. Complete Tech Report and submit one paper.</p> <p>Support resource characterisation project in cooperation with Uni Tas and NCCFI (see tree improvement above).</p> <p>Complete the Britton Timbers processing and wood products study. Report results.</p> <p>Win a new contract for the next stage of the Genetic Improvement and Silviculture project with Yong'an Forestry Group.</p> |
| | Collaborators | | |
| | CRC Forestry Timberlands Pacific | | |

Productivity - Key research and development projects (continued)

| Nutrition and productivity | FT Staff | 2012-13 Activities and outputs | 2013-14 Planned program |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Maximising the production of pruned logs, and associated products, from plantations through nutrition management and fertilisation.</p> | <p>Paul Adams Kristen Dransfield Crispen Marunda Sean Boucher</p> <p>Collaborators</p> <p>CRC Forestry Uni Tas Uni Sydney (ARC funding) ServeAg Timberlands Pacific</p> | <p>Continued work with University of Sydney on organic nitrogen PhD project.</p> <p>Continued work with Uni Tas on biochar PhD project.</p> <p>Continued work with Timberlands Pacific on primary fertiliser research and cultivation research.</p> <p>Prepared draft paper on the use of controlled-release fertilisers in eucalypt plantations.</p> | <p>Ongoing measurement analysis and reporting of long-term nutrition experiments.</p> <p>Finalise primary fertiliser recommendations (incl. Basacote).</p> <p>Update and improve nutrition decision support tools.</p> <p>Ongoing work with Timberlands Pacific on nutrition and productivity research.</p> |
| Operational standards monitoring and extension - plantations | FT Staff | 2012-13 Activities and outputs | 2013-14 Planned program |
| <p>Meet stand establishment quality standards, provide best practice guidance on the establishment and management of plantations to operational staff, and report annually.</p> | <p>Leonie McCrossen Paul Adams Tim Wardlaw Mark Neyland</p> | <p>Facilitated improved productivity of plantations through timely and appropriate fertilising, pruning & thinning operations.</p> <p>Thorough review of the plantation quality standards (QS) resulting in the development of a QS manual.</p> <p>Updated FOD to allow for changes in QS reporting.</p> | <p>Facilitate improved productivity of plantations through timely and appropriate fertilising, pruning & thinning operations.</p> <p>Support QS visits, review and reporting. Provide advice on QS reporting requirements from FOD.</p> <p>Review Plantation Performance Indicators and estate productivity questions.</p> <p>Review the operational specifications.</p> |

Productivity - Key research and development projects (continued)

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

3.4 Ensure availability of clean water from State forests

| Hydrology research | FT Staff | 2012-13 Activities and outputs | 2013-14 Planned program |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| Conduct research into water quality and quantity to provide greater understanding of the effects of forest operations and to provide management solutions. | Sandra Roberts Crispen Marunda Alison Phillips | Prepared draft paper on the results of water quality analyses in the 15 Warra catchments for CRC. | Submit paper on the results of water quality analyses in the 15 Warra catchments for CRC. |
| | Collaborators CRC Forestry FWPA | Prepared draft paper on Plantation water use study. | Submit journal paper on Plantation water use study. |
| | | Analysed streamflow data for three Warra catchments for trends and describe streamflow patterns. | Ensure telemetered data is collected by Hydro Tasmania and transferred to Bureau of Meteorology. |
| | | Developed an options paper for harvesting of Swanson and/or King catchments at Warra versus retention of existing forest. | |
| | | Ensured telemetered data was collected by Hydro Tasmania and transferred to Bureau of Meteorology. | |

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

| Soil, site selection and productivity estimation | FT Staff | 2012-13 Activities and outputs | 2013-14 Planned program |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|----------------------------------------------------------------------------------------------------------------------------|-------------------------|
| Investigate areas proposed for plantation development to define their site productivity and suitability. | Paul Adam | Participated in the Herbicide Refresher course for FT staff. | No planned activity |
| On areas suitable for plantations provide information and advice on site preparation and other treatments required for sustainable development and management of plantations. | | Participated in a Weed Management field trip (Murchison district). | |
| | | Assisted with Australia and New Zealand Soils Conference including hosting the Forest Soils field trip in the Styx Valley. | |

Productivity - Key research and development projects (continued)

5. Sustaining science-based stewardship

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

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.

FT Staff

Robert Musk
David Mannes
Tim Osborn
Lee Stamm

2012-13 Activities and outputs

Developed tools for the prediction of coupe shape from LiDAR.

Developed timber volume imputation models for regrowth forests.

Prototype developed for the delivery of LiDAR volumes and stand statistics to the field.

2013-14 Planned program

Deploy a fully operational "Blue Skies" tool to the field.

Deploy imputation methods developed in 2011/12 to mature native forests.

Roll out taper data collection for plantation into southeast Tasmania and analyse.

Communications

Maintain strong linkages between research and science-based forest management.

Maintain a high profile for credible research within the scientific community.

Disseminate the results of research to all interested parties.

FT Staff

All staff

2012-13 Activities and outputs

Contributed to lunchtime talks, National Science Week and a large range of science communication outcomes.

Assistance/advice provided to districts, papers, reports, presentations, community engagement.

2013-14 Planned program

Host field days with District staff.

Present a series of Lunchtime Talks.

Contribute to National Science Week activities.

Science support to Public Relations.

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

Technical Bulletins

FT Staff

Mark Neyland
Leigh Edwards
Robyn Scott
Leonie McCrossen

2012-2013 Activities and outputs

Technical Bulletin 11 progressed.

2013-2014 Planned program

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 Long-Term Ecological Research (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 site partners from Tasmanian and national research institutions. Warra LTER is a member site of the Ozflux Network, the Australian Supersite Network (ASN) and hosts two plots in the AusPlots Forests Network. Each of these networks are facilities of the Terrestrial Ecosystem Research Network (TERN) funded by the Commonwealth government under the National Collaborative Research Infrastructure Scheme (NCRIS).

The flux tower at Warra was commissioned in March 2013. It measures the exchanges of carbon, water and energy between the forest and atmosphere. This flux site is the southern-most in the global network of more than 500 sites. The 80-metre tower housing the flux instruments above the 55 metre-tall *E. obliqua* forest canopy is the second tallest in the world. A one hectare plot encompassing the flux tower was established in 2012. Complementary monitoring of the forest in this plot will help to interpret fluctuations in fluxes of carbon and water measured by the flux tower.

The Warra LTER site is continuing to support a very active research program: over the past decade, there has been an annual average of nine new projects (including four post-graduate university studies) initiated and 11 papers published in peer-reviewed journals. Continuing projects are listed at www.warra.com.

Of particular importance are the long-term (Icon) studies. Monitoring of birds, ground-active beetles and vascular plants in the Silvicultural Systems Trial is continuing: most treatments will have had their 10-year post-harvest monitoring completed by summer 2014. Gauged weirs installed in three pristine headwater catchments in 1998 are continuing to take 30-minute measurements of streamflow and other hydrologic parameters. The first decadal resampling of the Altitudinal Monitoring Plots was done by DPIPW last year. Staff from the Tasmanian Museum and Art Gallery completed the sorting of ground-active beetles collected during last year's decadal resampling. Staff from Forestry Tasmania completed the sorting of beetles collected from the baseline sampling of the Wildfire Chronosequence Plots done in 2009.



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.



Dr. Paul Adams providing silvicultural information in trial plantations, China, November 2012.

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.

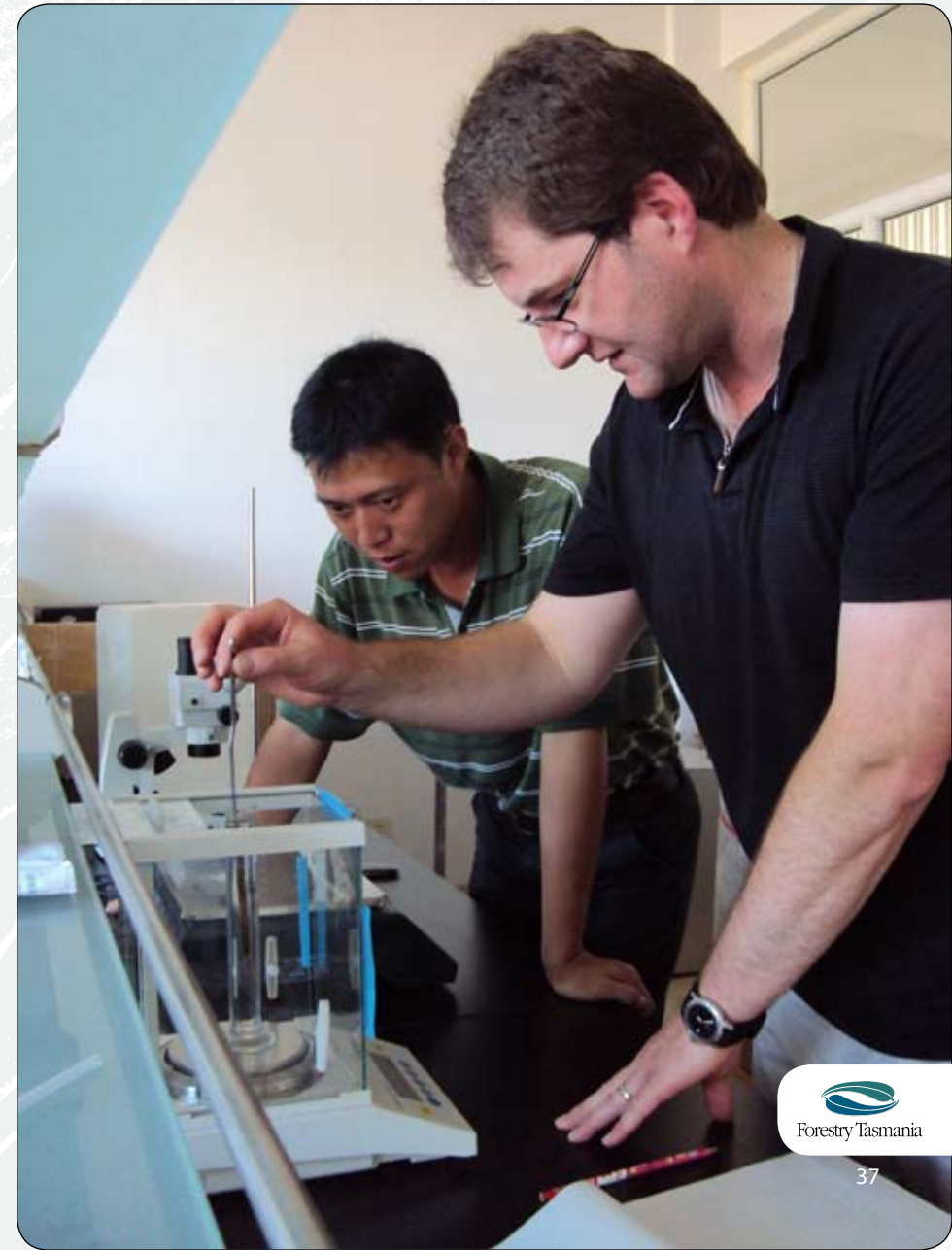
4. Wood density for wood quality assessment

- 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.



collaboration & linkages

Collaborations and Linkages

Authors employed by Forestry Tasmania during 2012-13 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.

Britton Timbers Ltd

Dr Paul Adams and **Gordon Pearn** are collaborating with Britton Timbers on an integrated study of processing and market acceptability of *Eucalyptus nitens* timber derived from the Meunna genetics trial.

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 Prof. Geoff Gurr examining the impact of *Ips grandicollis* on the management of Sirex in *P. radiata* plantations.

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 Plant Industry

Dr Dean Williams is collaborating with Dr Simon Southerton on The Blue Gum Genomics project (or Hottest 1000). This project aims to identify DNA markers in *E. nitens* and *E. globulus* that are linked to wood quality

characteristics including density, pulp yield and stiffness. This project utilises four of FTs *E. nitens* base population trials and data generated will feed directly back into FT's *E. nitens* genetic improvement program to help in the identification of elite trees for operational seed production.

Dr Dean Williams is also collaborating with Dr Simon Southerton on identifying molecular markers for Myrtle Rust. This project aims to identify DNA markers for resistance to Myrtle Rust in a suite of eucalypts, including *E. nitens* and *E. globulus*. FT has contributed seed as part of the initial screening program.

CSIRO Sustainable Ecosystems

Dr Robert Musk is collaborating with Dr Libby Pinkard, Jody Bruce, Dr Stuart Matthews and Dr Michael Battaglia in an FWPA-funded project entitled 'Adaptation strategies to manage risk in Australia's plantations.'

Dr Robert Musk is also collaborating with Dr Don White, Dr Michael Battaglia, Tammi Short, Jody Bruce and Justine Edwards in an FWPA-funded project entitled 'The extent and causes of decline in productivity from first to second rotation blue gum plantations.'

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 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 Industry Herbicide Research Consortium

Dr Paul Adams and **Anthony Wise** are members of this consortium, which discusses matters relating to weed management and herbicide usage.

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.

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.

collaboration & linkages

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 Co-ordination Committee Research Working Groups

Karl Wotherspoon attended Research Working Group 7 and Industry Partner's Meeting, 17-18 August 2012, PHA, Canberra. Development of Timber Industry Biosecurity Plan. Development of the composition of Subcommittee on National Forest Health (formerly RWG 7) and terms of reference.

Southern Tree Breeding Association Inc.

Dr Dean Williams is a member of the STBA Technical Advisory Committee. David Pilbeam (STBA) provides assistance and information for the Forestry Tasmania eucalypt breeding program. *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.

Tasmanian Museum and Art Gallery

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

University of Applied Sciences, Weihenstephan

Professor Andreas Rothe spent a sabbatical in Tasmania, based with R and D, undertaking an assessment of the potential for bioenergy use in Tasmania. Three students from the same university, Rita Satzger, Carmen Kellerman and Julian Schendel undertook three month internships with FT examining the different carbon balances in late stage mixed forest compared to rainforest.

University of Guelph

Drs Tim Wardlaw and **Dr 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 Paul Adams is collaborating with Dr Thomas Baker, Dr Chris Szota and Mr Stephen Elms (Hancock Victorian Plantations) on an FWPA (Forest and Wood Products Australia) funded project to develop predictive relationships to assist fertiliser use decision-making in eucalypt plantations.

Dr Leon Bren provides advice on the Warra Hydrology project.

University of Sydney

Dr Paul Adams is collaborating with Dr Charles Warren and PhD candidate Ms Jacquelyn Simpson on the ARC (Australian Research Council) funded project to understand tree uptake of organic and inorganic nitrogen for optimal fertiliser application in eucalypt plantations.

University of Tasmania

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 Mark Neyland and **Dr Robyn Scott** are collaborating with Assoc. Prof. Mark Hovenden to investigate the influence of different sowing rates on early stand development in native wet eucalypt forests, and on assessing how individual tree growth in the first three years is influenced by the density and size of their immediate neighbours.

Dr Paul Adams is collaborating with Dr Matthew Hamilton, Dr David Blackburn and PhD candidate Mr Mario Vega on a Forestry CRC funded project to improve peeling and veneer production from *E. nitens* and *E. globulus* plantation logs.

Dr Paul Adams is collaborating with Dr Jane Sargison, Dr Mark Boersma and Anna Wrobel-Tobiszewska on a biochar project.

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

Dr Robyn Scott completed her PhD at the School of Plant Science at the University of Tasmania. Her thesis examined 'Effects of variable retention harvesting on productivity and growth in wet eucalypt forests'. Robyn was supervised by Assoc. Prof. Mark Hovenden (University of Tasmania), Dr Steve Mitchell (University of British Columbia) and **Dr Mark Neyland**.

Dr Simon Grove and **Dr 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.

collaboration & linkages

Dr Tim Wardlaw is collaborating with Drs Greg Jordan, Chris Burrige and **Sue Baker** (Post-doctoral researcher) on an ARC Linkage project examining the effect of forest influence on recolonisation of harvested areas.

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 2012-13

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- Blackburn, D., Farrell, R., Hamilton, M., **Volker, P.**, Harwood, C., **Williams, D.** and Potts, B. (2012) Genetic improvement for pulpwood and peeled veneer in *Eucalyptus nitens* *Canadian Journal of Forest Research* 42: 1724-1732.
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- Hamilton, M.G., **Williams, D.R.**, Tilyard, P.A., Pinkard, E.A., **Wardlaw, T.J.**, Glen, M., Vaillancourt, R.E., Potts, B.M. (2013) A latitudinal cline in disease resistance of a host tree. *Heredity* 110: 372-379.
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- Lindenmayer, D.B., Franklin, J.F., Lohmus, A., **Baker, S.**, Bauhus, J., Beese, W., Brodie, A., Kouki, J., Martinez Pastur, G.J., Messier, C., **Neyland, M.**, Palik, B., Sverdrup-Thygeson, A., Volney, J., Wayne, A. and Gustafsson, L. (2012) A major shift to retention forestry can help resolve global forest sustainability issues. *Conservation Letters*. 5: 421-431.
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Theses

- **Scott, R.E.** (2013) Effects of variable retention harvesting on productivity and growth in wet eucalypt forests. PhD thesis, School of Plant Science. University of Tasmania, Hobart.

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 - **Williams, D.J.** (2013) Site 8 *E. dunnii* trial tree selections for grafting. Forest Technical Services Project CR0002. Technical Communication: 01/2013. Confidential report prepared for Yong'an Forestry Group. April 2013.
 - **Williams, D.J. and Adams, P.R.** (2012) Assessment of colour of *E. dunnii* and *E. grandis* wood samples. Forest Technical Services Project CR0002. Technical Communication: 07/2012. Confidential report prepared for Yong'an Forestry Group. November 2012.
 - **Wotherspoon, K.** (2013) 2012 Health Surveillance of New Forests Softwood Plantation Estate. Confidential Client Report. Forestry Tasmania, Hobart. 20 pp.
 - **Wotherspoon, K., Wardlaw, T. and Ramsden, N.** (2013) 2011-12 Forest pest and disease status report for Tasmania. Prepared for the National Sub-committee on Forest Health.
- ### Conference proceedings
- **Musk, R.A., Osborn, T., and Mannes, D.** (2012) 'Forest Inventory and Planning using Airborne LiDAR in Tasmania, Australia' In Proceedings of Silvilaser 2012, 12th International Conference on LiDAR Applications for Assessing Forest Ecosystems, Vancouver, Canada 16-19 September 2012.

Presentations and media releases

- **Moroni M.T.** Key existing and anticipated strategic drivers of carbon management. Bushfire CRC, Melbourne, 29 January 2013.
- Riley, I., **Moroni, M.T., Neyland, M.,** Hovenden, M., and Davidson, N. 2012. Forest Carbon Stock and Flux: The effect of late stage succession on Tasmania's tall-wet Eucalypt forests. Graduate Research Conference – Sharing Excellence in Research (SEiR), University of Tasmania. 6-7 September 2012.
- **Moroni, M.T., Mannes, D., Kelley, T., McLarin, M., Grove, S.** and 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, 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 "The Carbon Economy: A discussion forum University of Tasmania Cradle Coast Campus, 22 February 2012, Strategy Enterprise and Regions (Department of Economic Development, Tourism and the Arts lunch time forum 22 Elizabeth Street. 23 February 2012, Hobart Rotary Club, 21 March 2012, Latrobe High School and Latrobe Community forum, 22 March 2012

published papers, reports & presentations

Devonport High School, St Brendan-Shaw College, 4 April 2012. Huonville Council, Huonville Council Chambers. Glenorchy Civic Centre and Guilford Young College supported by Adriana Taylor MLC 25 June 2012. Glenorchy Rotary, 11 April 2013. Bushfire CRC, Melbourne 6 May 2013.

- **Roberts, S.** (2012) Predicting the water-use of *Eucalyptus nitens* plantations in Tasmania using a Forest Estate Model. Presented to Forest and Wood Products Australia, Melbourne.
- Ryan Burrows presented the final seminar for his project "Structure and Function of headwater streams in southern Tasmania and the impact of clearfell, burn and sow forestry"
- **Scott, R.E.** (2013) "Variable retention harvesting in Tasmania – silvicultural success?" Managing our forests into the 21st century, Institute of Foresters of Australia National Conference. Canberra, April 8, 2013.
- Vega, M., Hamilton, M., Downes, G., Harwood, C., **Adams, P.** and Potts, B. (2013) Near infrared calibrations for wood density, micro fibril angle and modulus of elasticity for *Eucalyptus nitens* from Tasmania (Australia). Poster submitted to International Nondestructive Testing and Evaluation of Wood Symposium in USA.
- **Wardlaw, T.** (2012) Is our management of production forest landscapes conserving mature-forest biodiversity? Lunchtime Talk for National Science Week, 15th August 2012. (This talk was also presented as a Uni Tas Plant Science seminar 17th August).
- **Wardlaw, T.** (2012) Is our management of production forest landscapes conserving mature-forest biodiversity? Presentation to staff of Department of Environment and Conservation, and Forest Products Commission, 6-7th September 2012, Bunbury and Perth.
- **Wardlaw, T.** (2012) Context-class: our journey. Presentation to staff of Department of Environment and Conservation, and Forest Products Commission, 6-7th September 2012, Bunbury and Perth.
- **Wardlaw T.** (2013) Media response to press release on the findings from the landscape biodiversity study: (i) Radio interview with Sally Dakis on ABC Country Hour 20th February 2013; (ii) camera interview with Southern Cross News; (iii) phone interview with Bruce Mounster (*Mercury* Newspaper).
- **Wardlaw, T.** (2013) Managing a production forest landscape to sustain mature forest biodiversity: Is the Regional Forest Agreement working? Oral presentation at the TERN Annual Symposium, 19-20 February 2013, Old Parliament House Canberra.
- **Wardlaw, T.** (2013) Is our management of production forest landscapes conserving mature-forest biodiversity? Oral presentation at a Royal Society Symposium Winter Series: Ecology, Forest Policy and Management. 19th February, Centenary Theatre, University of Tasmania.
- Wrobel-Tobiszewska, A., Boersma, M., Sargison, J., Close, D. and **Adams, P.** (2012) Nitrogen, phosphorus and potassium dynamics in potting mix and plant material under biochar and fertilizer combination amendments in nine-months *Eucalyptus nitens* pot experiment. Submitted for paper presentation at Symposium on Energy from Biomass and Waste in Venice, Nov 2012.

Forest tours and field days

During National Science Week 2012, Forestry Tasmania offered guided tours looking at patterns in the distribution of eucalypts around the foothills of Mt Wellington and the Waterworks reserve. 'Why does that gum tree grow there? Pattern and Process in Eucalypt Species Distribution around Hobart'

Robyn Scott and **Sue Baker** hosted a 2-day variable retention study tour for Ciara McCarthy and Michelle Freeman from VicForests. July 2012.

Robyn Scott, Sue Baker, Mark Neyland and **Tim Wardlaw** hosted a five day visit to Tasmania by five visiting Argentinean scientists, to study forest harvesting and regeneration operations including variable retention. The visit overlapped with tours to Warra by plant science students from Uni Tas, and to the Southern Forests of Tasmania by 5 VicForests staff.

Paul Adams, Mark Neyland, Martin Moroni, Rob Musk, and **David Mannes** hosted a one day field trip on forest soils (Styx Valley) as part of the Australia and New Zealand Soils Conference in December 2012.

Leonie McCrossen conducted leaf beetle monitoring training in preparation for the 2012/2013 season. The training included the theory behind the IPM program, how to collect and interpret the data and how to make control decisions. The sessions were conducted in each District during October 2012.

Leonie McCrossen and **David McElwee** conducted training in the Huon and Derwent districts on regeneration surveys using a GPS in February and May 2013. This involved office based training on how to set up the handheld, how to conduct surveys in the field and how to download the collected data.

FOREST TOURS AND LUNCHTIME TALK SERIES

Lunchtime talks

August 15 2012

Dr Tim Wardlaw

Sustaining biodiversity in forest landscapes

October 17

Daniel Hodge

Tasmania's Forest Giants

January 16 2013

Dr. Chris Harwood

Wood from plantations – Tasmania and the world

February 20

Prof. Jerry Franklin

Ecological forestry - a global view

March 20

Dr Dean Williams

Tree breeding in Australia and China, comparisons and contrasts

April 17

Lee Stamm

Calculating the sustainable wood supply from Tasmania's public forests

June 19

Andreas Rothe

Bioenergy from Tasmania's forests

key contacts

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