



NATIONAL CENTRE FOR FUTURE FOREST INDUSTRIES

13/6/2013

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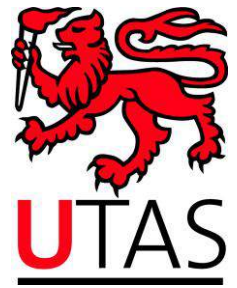
To whom it may concern,

Re: Annual report – National Centre for Future Forest Industries (NCFFI)

On behalf of the University of Tasmania and the Director of NCFFI, Professor Mark Hunt, I would like to thank you for your support of this project. Please do not hesitate to contact me if you have any administration queries about the annual report.

Yours faithfully

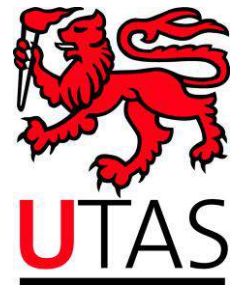
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**National Centre for Future Forest
Industries
First Annual Report
14 June 2013**



Forward

The forestry and forest products sector continues to undergo transformation in response to a range of economic, technological and social factors. There has been a growing acknowledgement, both privately and publicly in the sector, that the context in which forestry is practiced has changed irrevocably and that it is past time that the industry directed its attention to new opportunities rather than lament the loss of the old. Whilst this is a difficult time for many, there is reason for optimism. The future emerging under the constraints of a changing climate brings with it the necessity to improve the resilience of all our production systems as well as drive efficiencies in our use of carbon and energy in the economy. Forestry and forest products must have a central role to play in this future. It is up to us to imagine what that could be and to drive the innovation that will take us there.

It is therefore very timely, particularly with the completion of the CRC for Forestry, that the Commonwealth Government has seen the merit in seeding the establishment of the NCFFI. The sector desperately needs innovation, but in the current economic conditions can least afford to pay for it.

My vision for the centre is that of a distributed and truly national (in participation and impact) research community working in collaboration to address questions relevant to the economic use of forests and their products, both traditional and new. The products will include the boards and chips with which we are familiar, but also increasingly will consider engineered wood products, composites, biosynthetics (including fuels) and ecosystem services including carbon and biodiversity. Through this work NCFFI will provide expertise the length of the innovation pathway from basic research through applied research, development, extension and education to achieve three goals.

1. Greater use of wood products in construction, substituting for concrete and steel, thus achieving lower carbon and energy footprints, increasing the use of renewable materials and providing a valuable sink of carbon

2. Integration of forestry activity explicitly in production landscapes, recognizing that forestry is inextricably linked to agriculture and that partnership with the agricultural sector is not only essential for successful future forest industries also valuable but for improving social, environmental and economic outcomes for farming communities



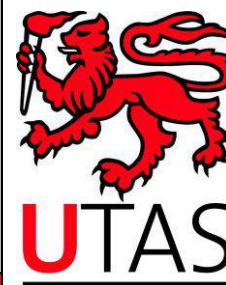
NATIONAL CENTRE FOR FUTURE FOREST INDUSTRIES

3. The development of new energy products from processing residues thus improving economic viability of forestry enterprises and decreasing the use of fossil fuels.

This research community will work with industry to identify questions of importance, design and conduct R,D&E activities to address the identified needs, and implement these to bring about real impact that can be measured in economic terms.

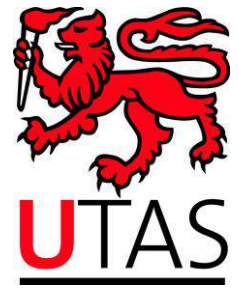
In taking up this challenge I would like to acknowledge the tremendous support that has been provided to me particularly by three people who were instrumental in designing and carrying forward the NCFFI during the period before my arrival in Tasmania - they are Distinguished Professor Jim Reid of University of Tasmania School of Plant Science, Professor Gordon Duff, CEO of the CRC Forestry, and Dr Chris Harwood, Senior Principal Scientist at CSIRO.

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Introduction

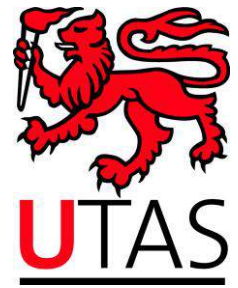
The mission

The goals of the National Centre for Future Forest Industries (NCFFI), as specified in the Commonwealth Agreement, are to (1) drive research, innovation, extension and training in the forestry and forest products sector, (2) maintain and develop national research capacity and achieve coordination of R,D&E efforts nationally, (3) provide leadership, vision and strategic direction to the extent that is appropriate from an R,D&E perspective in order to lead innovation and transformation in the sector resulting in a distributed, diverse and resilient industry. It is the role of NCFFI to undertake both basic and applied industry lead research as well as development, extension and education activities in support of these objectives.

Progress thus far

Following establishment of NCFFI through the grant initial negotiations with industry and other research providers saw the meeting of the Interim Advisory Board on 1 November 2012. Representatives attended from Queensland, Victoria, Tasmania and Western Australia and the organizations CSIRO, University of Melbourne, University of the Sunshine Coast, Forestry Tasmania, Forest and Wood Products Australia, Forestry CRC, DAFF (Queensland) and University of Tasmania were all represented. A key outcome of that meeting was that the Forestry Cooperative Research Centre would provide \$900,000 of matching funds to leverage the NCFFI funding, which saw projects initiated through CSIRO, University of the Sunshine Coast, Forestry Tasmania, DAFF (Queensland) and the University of Tasmania. This co-investment opportunity, combined with demonstrated industry support and alignment with the National Forestry R,D&E Strategy saw three projects commenced in December 2012 following the Interim Advisory Board meeting, one project in each of the three research themes (see below).

Having accepted the position in November 2012, the NCFFI Director commenced duties at the beginning of February 2013. Since that time, the Director has been engaged with (1) overseeing the development and conduct of the three project areas; (2) developing a suite of additional project proposals with industry and research partners for future consideration; (3) working with the Education Theme manager to attract postgraduate students and identify training and education needs; (4) communicating to existing industry members about the aims of NCFFI and developing a strategy to engage industry fully through the Advisory Board, the Collaboration Forum and project steering committees; (5) developing a coordinated national



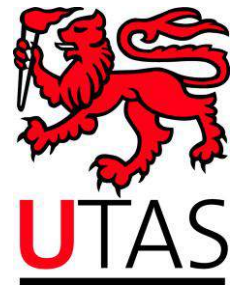
approach with other research providers to ensure best use of resources, improve cross institutional communication and avoid duplication of effort.

These activities included attendance at the National Forestry R,D&E Providers Forum in Melbourne in March, the Annual Institute of Foresters of Australia Conference in Canberra in April, meetings with the incoming CEO of the Australian Forest Products Association, the CEO of Forest and Wood Products Australia, the Secretary of the National Forestry R,D&E Forum, parliamentarians and senior bureaucrats at state and federal level across the political spectrum, CEOs and senior managers in all major Forestry companies in Australia (including state GBEs) and many of the larger processors. In addition to seeking the input and advice of traditional forestry and forest products companies, significant effort was expended in seeking opportunities for new products and industries including carbon farming, novel engineered wood products and bioenergy.

A second meeting of the Interim Advisory Board was held on 21 May 2013. Progress to date was reported and future activities discussed as a basis for preparing this report. Nominees for the position of Chair and members of the Advisory Board were discussed and feedback provided formally to the University of Tasmania executive. Due to the dispersed nature of the industry, political and social diversity about what constitutes future forest industries and the need for NCFFI to be national in impact and membership, the make-up of the Advisory Board has been considered a critical step towards creating a sustainable centre.

At the end of the first year of operation NCFFI has an active research program operating in four states under the auspices of five research institutions and engaging with eight industrial companies. Technical and journal publications have already been generated from the centre activities and NCFFI has participated in several submissions for funding to granting bodies. NCFFI is now working hard to ensure that it will be able to service the research and innovation needs arising from the Tasmanian Forests Agreement through its national collaborative network and furthermore to ensure that R,D&E investment in Tasmania through that process is leveraged, conducted and communicated in such a way as to bring maximum benefit to the broader national forestry and forest products sector.

All initial NCFFI research themes have been initiated and draft budgets have been determined for the three research themes within NCFFI. These show where the funds that will match the Commonwealth funds will be coming from. Three research projects addressing these themes have been established:



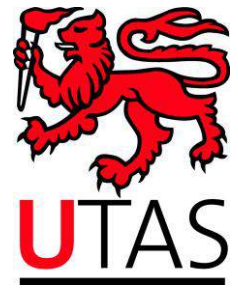
The 'Future Options' project will optimise engineered wood product value chains, including pilot manufacturing runs, using a range of plantation tree species. This will help generate the maximum possible value from Australia's hardwood plantations.

The 'Sustainable plantation systems – closing the value gap' project will assist in improving productivity of existing plantations, and identify the potential productivity of new sites.

The 'Risk mitigation-New forests and opportunities' project will link productivity and risks to environmental and genetic factors to optimize outcomes for plantation investors.

Appointments have been made to these projects and include Dr Matthew Hamilton, Dr David Blackburn and Mr Paul Tilyard.

Project meetings relating to each research theme have been held and projects initiated in conjunction with the Forestry CRC. This meant that projects hit the ground running, allowing key questions regarding innovative uses of the existing hardwood estate and second rotation questions to be addressed within the time-frame necessary for industry. Outputs from this work are already being published and communicated to industry.



National Impact and distributed nature of the collaboration

It is widely recognised that R,D&E capacity in the forestry and forest products sectors has shrunk markedly during the last decade to only a fraction of what it once was. There remains very little duplication of expertise across institutions and resource constraints make collaboration the only sensible model for building an R,D&E activity that is cross-disciplinary and integrated along value chains. Accordingly one of the early challenges has been to identify where key capacity, both in terms of people and infrastructure, sits nationally and to test the mood for that capacity to be brought together under the NCFEI concept.

A core of R&D providers has been identified and is working together on existing projects. The University of Tasmania has key capacity within the School of Plant Science in the areas of forest genetics, tree breeding, plant-animal interactions, biodiversity and forest ecology. The Centre for Sustainable Architecture with Wood based within the University of Tasmania, School of Architecture has a long history of working with the processing sector and brings key skills in timber architecture, design and building systems. The University of the Sunshine Coast hosts the Australian Forestry Operations Research Alliance (AFORA) housing important national capacity in the harvesting, operations and logistics space. The Queensland Department of Agriculture Fisheries and Forestry maintains the only remaining physical product development and processing research infrastructure in the country and works closely with the University of the Sunshine Coast Forest Industries Research Centre addressing breeding and plant health R&D through not only their own explicit cross-institutional arrangements but also through the Collaborative Research Network that is shared with the University of Tasmania. CSIRO remains the premier R&D organisation working in risk and productivity modelling and carbon accounting and retains significant expertise in a number of other important to forestry and forest products research. These four R&D providers presently form the core of the capacity within NCFEI, and, aided by engaging key researchers in University of Melbourne and elsewhere, constitute a functional collaborative research effort distributed across the country (nodes in Queensland, Victoria, Tasmania, Western Australia, ACT) and across institutional types (University, State Government, Federal Government). As NCFEI grows the objective is to be inclusive and find useful ways of engaging a larger group of R&D providers (where that is attractive to them) so that the full national capacity supporting the sector is engaged. Excellent progress is already being made on this front.



Similarly, the projects already initiated have engaged industry colleagues across the country including Forestry Tasmania, Australian Bluegum Plantations and New Forests. Again, as NCFFI activity grows, the breadth of industry participation will increase.

Milestone progress

Milestone 1. Due 28 September 2012

Implementation Plan submitted - An implementation plan was completed and reported in the December 2012 Progress Report.

Governance structure and interim working group membership finalised - Interim Advisory Board met on 1 November 2012 - reported in December 2012 Progress Report.

Milestone 2. Due 3 December 2012

Centre Director recruited - Prof Mark Hunt was recruited in November 2012 and took up the position at the beginning of February 2013. The recruitment was reported in the December 2012 Progress Report.

Partnership agreements signed off - a formal partner agreement has been drafted and distributed to potential core members of NCFFI. This document is currently being considered by legal teams in the various organisations. In the interim a range of project agreements have been put in place that cover specific areas of work - the three research projects that were initiated. This has provided a robust legal and commercial framework for us to proceed with centre activities so that an appropriate form of collaboration agreement that meets everyone's needs can be determined. It is anticipated that the umbrella partnership agreement will be in place early in the new financial year.

Advisory Board established and operating - The Interim Advisory Board has met twice. Finalisation of the Advisory Board has taken longer than anticipated due to the need to engage a very wide range of stakeholders and ensure that the representation was appropriate to their interests. After coming on board early in the year, the Director has kept in close contact with Interim Advisory Board members and when it became apparent that the board would not be finalised within six months of the initial meeting, held a second meeting of the Interim Advisory Board on 21 May to ensure that governance expectations were being addressed. It is anticipated that the Advisory Board will be in place by the end of the financial year (within the next two weeks).

All research projects initiated - three research projects (with sub-projects) have been initiated as described below. They are proceeding well and a second set of projects will be commenced in the second financial year based on co-investment opportunities in the three research themes. These projects are operating across four states, engaging five major research providers and directly engage relevant industrial partners.

First progress report supplied to the Commonwealth - the first progress report was submitted as specified.

Milestone 3. Due 14 June 2013

First annual report produced - this document constitutes the first annual report.

First annual report presented to Partners Forum - the report will be disseminated to stakeholders once appropriate feedback has been received from the Commonwealth representative in DIISRTE. The Collaborators' Forum will be formally constituted once the board is finalised and a workshop held to address a range of needs going forward including the review of the first Annual Report.

Milestone 4. Due 13 December 2013

At least one technical report and industry bulletin per theme - on track.

Refereed publications in press - already achieved (Appendix 2).

Second progress report supplied to Commonwealth - on track.

Milestone 5. Due 31 July 2014

Initial research outputs completed in each thematic area; second annual report prepared and submitted to the Commonwealth - on track

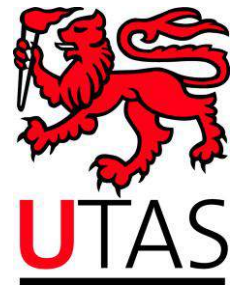
Business plan for sustainability of Centre prepared with evidence of ingoing third party investment - on track.

Milestone 6. Due 15 December 2014

Three national scale industry workshops/roadshows (one per theme) delivered - on track.

Associated project documentation, including final report to the Commonwealth completed and delivered - on track.

Final reporting including financial report and completion of the project - on track.



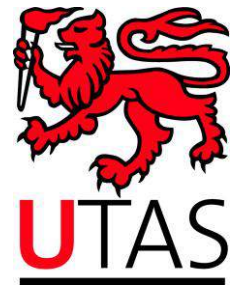
Proposed future activities

The first priority form here is to finalise the governance arrangements. It is appropriate that these arrangements have proceeded cautiously as the NCFFI is being set up with a long term view that extends well beyond the 2.5 year initial funding horizon. Nonetheless, it is critical that the governance arrangements are finalised in the next few weeks and there is no reason why this should not be the case. This will facilitate the formation of the Collaborators' Forum and provide opportunities to determine the nature of the next suite of Centre projects.

The continuing downturn in the industrial forestry sector has meant that companies have little or no capacity to invest in external R&D and indeed Forest and Wood Products Australia does not have funds to which NCFFI can apply between now and the end of the project. Consequently NCFFI will need to be innovative about how the research is co-funded and careful to ensure that key criteria for its research program - industry relevant, distributed, national impact - are met as much as these circumstances permit.

The Tasmanian Forest Agreement has set aside a substantial amount of funding for research and innovation to address the challenges faced by the industry adjusting to the new arrangements. This funding would provide an ideal mechanism for NCFFI to achieve its objectives. Whilst the emphasis of the research and innovation investment under the forest agreement would be on the Tasmanian circumstances, NCFFI would enable the national expertise and capacity to be brought to bear on challenges within the Tasmanian forestry and forest products sectors and provide the best opportunities for the research and development outcomes to be more widely applied and implemented across the national forestry and forest products sector. Questions around the use of the plantation hardwood resource for construction, integration of forestry with agriculture, capturing value from ecosystem services, and deriving value from processing residues have as much relevance nationally as they do for Tasmania. We will be working hard to ensure that this opportunity is not lost.

Over the next few months arrangements will be finalised to support the ongoing work in forest operations (harvesting, transport, logistics) through AFORA (Australian Forest Operations Research Alliance) based at the University of the Sunshine Coast and to optimise the collaboration between the Centre for Sustainable Architecture in Wood (CSAW) in Tasmania and the Forest Products Program at QDAFF in Queensland as well as further formalising the CSIRO/University of Tasmania collaboration in using a deeper understanding of genetics x environment x management interactions to address risk and improve



productivity and resource quality. It is likely that additional expertise in natural resource economics and resource characterisation will need to be recruited into the centre and that skill in the timber engineering and genetics/physiology discipline interface will need to be enhanced.

Research Theme Summaries

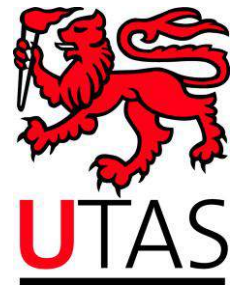
Theme 1: Future options

Industry, society and government recognise the need to replace high-value native forest products with plantation-grown resources, particularly in the context of declining industrial access to native forests and growing demand for timber products. Until recently, much of the focus in Australia was on sawn timber products, and hardwood plantations have been established and managed with this use in mind. More recently, the focus has shifted to using the resource in engineered wood products (EWP) and other applications relying on veneer rather than sawn timber. Engineered wood products have superior strength and can be used in a much greater range of construction applications than sawn timber. Producing engineered wood products using veneers also has several advantages over sawn timber, including greater volume recovery, capacity to use smaller piece sizes, and potentially lower capital costs for processing facilities. In the context of these newly emerging processing opportunities, research is required to characterise the available resource, recalibrate plantation management options and explore processing characteristics of the predominant plantation species.

The objective of this research theme is to optimise engineered wood product value chains, up to and including pilot manufacturing runs, using a range of available resources and thus generate the maximum possible value from Australia's hardwood plantations. To achieve this we are undertaking a collaborative project involving industry, resource managers and the leading forest and wood products scientists in Australia. Project partners include researchers at the University of Tasmania, Forestry Tasmania, the Queensland Department of Agriculture, Fisheries and Forestry and CSIRO, working in collaboration with private sector growers and manufacturers.

Project 1.1 New structural products from the plantation resource (including CRC extension project 2.6)

The project team is addressing three sets of challenges. These include (1) *Characterisation of the plantation resource*. Deliverable: improved understanding of within- and between-tree variation in veneer-critical properties as determined by site, plantation age, silviculture and species/genetics, (2) *Optimisation of primary veneering of plantation eucalypts*. Deliverable: optimised billet pre-treatment, rotary veneer cutting and drying for plantation eucalypts to deliver improved product quality while reducing processing cost and (3) *Strengthening engineered wood products (EWP) value chains for*



plantation eucalypts. Deliverable: in consultation with interested industry partners, demonstrate the EWP value chains from harvest to final product for EWPs and identify opportunities for their improvement. Value chain/market analysis to identify best-bet EWPs matched to main current plantation sources and forecasts of market demand for products.

Participants in the first stage of the project include Dr Matthew Hamilton, Dr David Blackburn, Dr Chris Harwood, Dr Henri Bailleres, Dr Barbara Ozaska and Mr Robbie McGavin. A workshop will be held in late June 2013 to broaden the project participation and in particular to bring on board the expertise in the Centre for Sustainable Architecture with Wood. The experimental component of phase one of the project is complete and data are now being analysed. Phase two has commenced and results will be reported in the December 2013 progress report.

Theme 2: Sustainable plantation systems - closing the value gap

Australia's plantation estate has nearly doubled in size in the last twenty years. This has been supported by government policy and financial incentives for two reasons: (1) the capacity of native forests to meet the demand for wood has been in decline; (2) Australia has a deficit of approximately \$2B in wood and wood products.

This expansion has supported regional infrastructure development and employment and over the past decade and allowed Australia to meet its Kyoto commitments. Plantation forestry plays an important role in regional economies; 50% of GDP in the Mt Gambier region is generated from the 10% of land occupied by plantations. This important industry faces real threats to its viability; changing biophysical and economic circumstances (e.g. the inappropriate site selection for some existing plantations, long-term declines in rainfall in some regions, and the current high exchange rate for the Australian dollar), mean that many Australian plantations do not yield sufficient value to make them an internationally competitive investment prospect for either wood production or carbon sequestration.

In order to make plantation forestry more attractive to investors, the potential for higher productivity and/or greater economic returns through higher value must be demonstrated, and approaches developed to realise this potential. This is a huge challenge that we are well placed to meet using two novel approaches.

Firstly we will quantify potential and actual yield and apply current tools and knowledge to reduce the difference between actual and potential. This approach has been used with great success by agriculture and is known as 'closing the gap'. It differs from the approach most often taken in forestry in one important respect; the management objective is not maximum yield but minimum gap. This avoids wasting resources where yield is already close to potential or where growth is constrained by a factor that is not amenable to management.

We will consider all elements of the supply chain and account for interactions amongst them. Using this approach we will integrate knowledge on harvesting systems, transport and logistics, plantation management and genetic improvement in a systems framework. This will be used to maximise value under a range of climate, policy and regulatory constraints.

This program will support the industry to improve the productivity and value of the existing plantation estate. This is being undertaken through the following projects.

2.1 Systems optimisation for multi-rotation plantation systems

The CRC for Forestry developed tools for predicting productivity of first and second rotation plantations, quantifying the effects of pests on plantation productivity, optimising harvesting and transport, matching genotypes to site and quantifying plantation carbon sequestration and water use. The value of plantations will be determined by all of these components of the supply chain and by a range of regulatory and policy constraints. There is a real need for a whole of system tool to optimise value through supply chain intervention. This project will integrate the best available knowledge on multi-rotation plantation management for sustained growth, with harvesting systems optimisation tools and knowledge, in an economic optimisation tool that can be applied at stand and estate scale, is appropriately constrained and can be adapted for individual companies. In the first instance we will use blue gums as a case study in two sub-projects (already funded). Project 2.1 is being led by CSIRO.

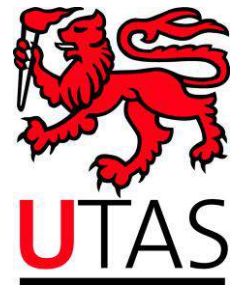
2.2 Supply chain optimisation

Research in the CRC for Forestry demonstrated the opportunity to achieve greater value at reduced cost by optimising product selection at harvest and applying optimisation techniques to schedule transport operations. This was achieved by applying optimisation techniques very late in the rotation (the last 1 to 6 months) and was this constrained by existing markets and product options and by operational decisions made earlier in the rotation. We believe this demonstrates enormous potential to improve the value of our plantations by applying optimisation earlier in the rotation and linking this with plantation silviculture and market knowledge.

In this project we will develop a supply chain planning tool that uses optimisation techniques earlier in the rotation (1 to 5 years) to support decisions on what plantation to harvest and when. This will position forestry companies to match product supply with market demands and values and achieve greater via a better planned supply chain. It will also help plantation owners understand their resource and strengthen strategic planning by managing towards markets best suited to resource potential. Project 2.2 is being led by the Australian Forest Operations Research Alliance at University of the Sunshine Coast.

2.3 Comparing actual and potential yield of the existing plantation estate

In this project we will compare actual and potential productivity of the existing estate and identify key site and climatic attributes affecting productivity and map the extent to which productivity can be improved through application of current knowledge. The environmental (climate and soil) surface will be defined and



the productive potential of plantations quantified for the existing plantation estate in temperate Australia, taking into account effects of successive rotations. Project 2.3 is being led by CSIRO.

2.4 Matching germplasm to site, management and desired products

This project aims to enhance plantation productivity and profitability of Australia's main plantation species by better matching their genotypes to sites, silviculture and products. Improved genotype deployment is a key opportunity to maximise the yield of harvestable biomass and product value, given limits to site productivity. This project will link closely with the national tree breeding cooperative (STBA) and partner organisations involved in tree breeding and seed production. It will determine the extent to which genotype performance changes across different abiotic and biotic environments to better define deployment zones; the sustainability of genotype performance under multi-rotation coppice regimes; and the genetic opportunities and tradeoffs amongst traits affecting industrial (e.g. chip, pulp, timber and veneer and energy production) and risk (drought/pest/disease risk) objectives. Project 2.4 is being led by University of Tasmania.

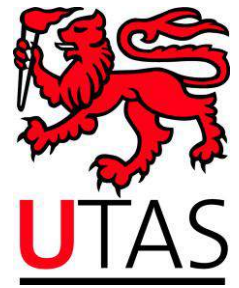
Theme 3: Risk mitigation - New Forests and Opportunities

New commercial and public-benefit opportunities are emerging for tree plantings, including farm forestry, carbon and biodiversity plantings. Australia is now at the threshold of a major expansion of ecosystem restoration and environmental tree plantings due to firstly, the recent establishment of the Australian Government Biodiversity Fund and secondly, the longer-term opportunities to link such activities to carbon sequestration and future commercially-based carbon trading (e.g. the clean energy fund and the carbon farming initiative). For example, the Biodiversity Fund will allocate \$946 million over its first six years to support landholders that establish, restore, protect or manage biodiverse carbon stores. The Fund will also support landholders that establish new environmental plantings to create wildlife corridors and improve landscape connectivity. It is important to maximize benefits from such incentives and opportunities through strong science input and guidance from the outset, as well as the development of the experimental frameworks, knowledge base and systems to guide future investment and plantings.

Using and refining tools developed by the CRC for Forestry in substantially new settings, work in this theme is targeting stakeholders such as Greening Australia and CO2 Australia that have market aspirations and value propositions that differ from those of traditional plantation companies. The challenges of establishing plantings in new areas - including climate variability and integration with existing land uses and values - can't be met simply by applying existing plantation management practices. Different strategies based on sound scientific research are required to inform management decisions and practice.

Project 3.1 Linking productivity and risk to traits, genes and environment (includes CRC extension Project 1.9).

This project aims to provide biological information and models to guide development of new forest estates using species associated with environmental or non-traditional commercial plantings. These plantings are aimed at long rotations or perpetual life-spans and often have multiple objectives including wood production, carbon capture and enhancement of regional biodiversity values. This research will guide the choice of seed sources and management strategies for development of robust long-term tree plantings in order to minimise investment risk associated with current (often degraded or highly modified) environments available for tree plantings and predicted future climate change.



The project will characterise the tree traits and genes which impact on productivity and risk of planting failure. Trees exhibit enormous functional and physiological variation in traits affecting growth and survival. This variation may be due to environmental plasticity, tree genetics or a combination of both (genotype x environment interaction), and is the basis of their adaptation to current and future environmental change. Water availability and temperature are key drivers of productivity and variation in functional traits in trees, and together are key limitations to plant productivity in Australia.

This project will study tree species targeted for planting in water-limited environments in Australia. The project will identify functional traits and genes driving adaptation. It will determine the extent that functional traits are under genetic control, their genetic and plastic response to environmental change and model their relationships with key climate drivers. The work will provide models that will guide species, provenance and genotype choices for new environmental and commercial tree plantings and enhance our understanding of the relationships between functional traits and productivity. Such models will be important in the selection of germplasm for the development of robust long-term plantings and will help us to understand the potential of our native forest systems to adapt to global climate change.

The project will exploit both historic and recently established networks of pedigreed field trials established using native stand seed collections of target eucalypts, as well as extensive genetic, physiological and growth modelling expertise of the NCFI collaborators. This project will link with the resource characterisation work being undertaken in Theme 1 as well as environmental modelling and genotype x environment x management research in Theme 2.

Project participants include Prof Brad Potts, Dr Anthony O'Grady, Dr Jules Freeman, Dr Dorothy Steane, and Mr Paul Tilyard.

Theme 4: Education and Training

The fourth theme in NCFFI is the technology transfer and training theme. This has been commenced with the appointment of a research training coordinator, Dr Julianne O'Reilly-Wapstra (made possible by the provision of matching funds from the UTAS operating grant), and the continuation of Dr Justine Edwards as Industry Liaison Officer at the Forest Industry Research Centre within the University of the Sunshine Coast. Dr Edwards' work ensures the ongoing provision of field training days and other technology transfer activities for industry, particularly in the West and Dr O'Reilly-Wapstra's appointment has provided the impetus to maintain a cohort of enthusiastic early career scientists with interests in forests and forest products.

Already five new PhD projects for future NCFFI students have been developed and suitable candidates are currently being sought:

Minimising mammal damage of pines through plant genetics

The genetics of myrtle rust tolerance in eucalypts

Planting restoration forests: testing new sowing and planting techniques

Genetic by environmental effects on functional tree traits that determine success in current and future climates

*Modeling genomic adaptation to aridity in *Corymbia variegata**

Guidelines have been formulated and advertised for the new NCFFI student grant scheme. A scheme has been developed that provides students with project and travel support costs to assist in the communication of their research to stakeholders and end users..

In addition to her work with postgraduate students, Dr O'Reilly-Wapstra has continued to produce a substantial research output in her field of plant-animal interactions and these have included 4 A1 publications (3 accepted and 1 in review), 2 conference presentations, 1 ARC Linkage Grant, 1 ARC Discovery Grant (administered through Sydney University) and 1 ARC Future Fellowship application, all in review. Dr O'Reilly-Wapstra also supervises 3 NCFFI PhD students (Appendix 1).

Appendix 1: PhD Students affiliated with NCFFI

Adam McKiernan (theme 2.4)

PhD title: The effects of drought on eucalypt plant secondary metabolites and effects on associated herbivores

Supervisors: Julianne O'Reilly-Wapstra, Brad Potts, Mark Hovenden, Tim Brodbrib.

Christina Borzak (theme 2.4)

PhD title: Anti-herbivore strategies in *Eucalyptus globulus*: the effects of genetics and ontogeny on chemical resistance and seedling recovery in response to mammalian browsing

Supervisors: Brad Potts, Julianne O'Reilly-Wapstra, Karen Barry

Ben Gosney (theme 3)

PhD title: Providing a genetic framework to enhance the success and benefits from forest restoration and carbon plantings in rural landscapes

Supervisors: Julianne O'Reilly-Wapstra, Brad Potts

Archana Gauli (theme 3)

PhD title: Genetic diversity and adaptation in *Eucalyptus pauciflora*

Supervisors: Neil Davidson, Brad Potts, Dot Steane, Rene Vaillancourt

Peter Harrison (theme 3)

PhD title: Establishing a genetic framework for resilient woodland restoration: The case of *Eucalyptus ovata*.

Supervisors: Brad Potts, Rene Vaillancourt, Rebecca Jones, Rob Wiltshire



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Matthew Larcombe (theme 2)

PhD title: Managing gene flow from plantation to native eucalypts

Supervisors: Brad Potts, Rene Vaillancourt

Mario Vega (theme 1)

PhD title: Increasing the recovery and quality of peeled veneers from plantation-grown *Eucalyptus nitens*

Supervisors: Matthew Hamilton, Greg Nolan, Brad Potts, Chris Harwood

Appendix 2: NCFFI Research Outputs 2012-2013

Refereed journals

Blackburn DP, Hamilton MG, Harwood CE, Baker TG, Potts BM (2013) Assessing genetic variation to improve stem straightness in *Eucalyptus globulus*. *Annals of Forestry* 70, 461-470.

Larcombe MJ, Silva JS, Vaillancourt RE, Potts BM (2013) Assessing the invasive potential of *Eucalyptus globulus* in Australia: quantification of wildling establishment from plantations. *Biological Invasions*, DOI:10.1007/s10530-013-0492-1.

O'Reilly-Wapstra, J.M., A.M. Miller and B.M. Potts (submitted) Variable patterns of inheritance of plant secondary metabolites in inter-specific eucalypt hybrids. *Tree Genetics and Genomes*.

O'Reilly-Wapstra, J.M., Miller, A.M. Miller., M.G. Hamilton., Williams, D., Glancy-Dean, N. and Potts, B.M. (2013) Chemical variation in a dominant tree species: population divergence, selection and stability. *PLoS ONE*. 8(3): e58416. doi:10.1371/journal.pone.0058416.

O'Reilly-Wapstra, J.M., Freeman, J.S., Barbour, R., Vaillancourt, R.E., and Potts, B.M. (2013) Genetic analysis of the near infrared spectral phenome of a global *Eucalyptus* species. *Tree Genetics and Genomes* DOI 10.1007/s11295-013-0607-y.

Senior JK, Schweitzer JA, O'Reilly-Wapstra J, Chapman SK, Steane D, Langley A, Bailey, JK. (2013) Phylogenetic Responses of Forest Trees to Global Change. *PLoS ONE* 8(4): e60088. doi:10.1371/journal.pone.0060088.

Wentzel-Vietheer M, Washusen R, Downes G, Harwood C, Ebdon N, Ozarska B, Baker T (in press) Prediction of non-recoverable collapse in *Eucalyptus globulus* from near infrared scanning of radial wood samples. *Holsforschung*

Conference presentations and invited seminars

Borzak, C., Potts, B.M., Barry, K., Pinkard, E. and O'Reilly-Wapstra, J.M. (2013) Physiological and defensive chemical responses of a eucalypt to defoliation. Gordon's Research Conference on Plant-Herbivore Interactions. Ventura, California, 24 February – 1st March.

O'Reilly-Wapstra, J.M. (2013) Genetic influences of Australia's iconic eucalypt trees: biotic interactions, extended effects and stability in variable environments. Invited seminar, Department of Zoology, Gothenburg University, Sweden, May 2013.

O'Reilly-Wapstra, J.M. (2013) Eucalypt genetic influences: biotic interactions, stability in variable environments and extended effects. Invited seminar, Department of Zoology, Aberdeen University, U.K, June 2013.

Other communications

Hunt, MA (2013) The National Centre for Future Forest Industries, Australian Forest Grower, Vol 35, No 5.

Grant applications

Minimising pest damage through plant genetics (ARC Linkage)

The ecological consequences of herbivore personality (ARC Discovery)

Building our future forests: tree genetics as drivers of successful forest restoration (ARC Future Fellowship)

Appendix 3: Stakeholders contacted, consulted and collaborated with during the period February - June 2013

University of Tasmania collaborators

Plant Science – Prof Jim Reid; Prof Brad Potts; Dr Dorothy Steane; Dr Jules Freeman; Mr Paul Tilyard; Dr Matthew Hamilton; Dr David Blackburn; Dr Julianne O'Reilly-Wapstra

Computer Science – Assoc Prof Paul Turner; Dr Luke Mirowski

Architecture – Assoc Prof Greg Nolan, Dr Jon Shanks, Mr Bill Leggate, Mr Mick Lee

Others consulted at UTAS

Prof Holger Meinke – Agricultural Science/Tasmanian Institute of Agriculture

Prof Ted Lefroy – Centre for the Environment

Dr Sarah Jennings – School of Economics and Finance

Partner R&D Collaborators

Queensland Department of Agriculture, Fisheries and Forestry – Dr Henri Bailleres; Mr Adam Redman; Mr Robbie McGavin

CSIRO – Dr Phil Polglase; Dr Don White; Dr Tony O'Grady; Dr Chris Harwood; Dr Libby Pinkard

University of the Sunshine Coast – Prof Mark Brown; Assoc Prof David Lee; Dr Mohammad Ghaffariyan; Dr Mauricio Acuna

University of Melbourne – Dr Barbara Oszaska

Research Quality - Geoff Downes

Industry Project Participants

Australian Bluegum Plantations - Ben Bradshaw (R&D Manager); Mark Diedrichs (Regional Manager)

Forestry Tasmania - Mr Bob Gordon (Managing Director); Mr Steve Whiteley (Operations Manager); Mr John Hickey (General Manager - Forest Management); Mr Mark Neyland; Dr Paul Adams; Dr Dean Williams; Dr Martin Moroni

Western Australian Plantation Resources - John Wiedemann

Industry Organisations consulted

Forest and Wood Products Australia (FWPA) - Mr Ric Sinclair (CEO) and Dr Chris Lafferty (R&D Manager)

Australian Forest Products Association (AFPA) - Ross Hampton (CEO)

Tasmanian Farmers and Graziers Association (TFGA) - Ms Jan Davis (CEO)

Forest Industries Association of Tasmania (FIAT) - Mr Terry Edwards (CEO)



Others consulted

Dr Steve Read - ABARES

Mr Evan Rolley - Ta Ann

Mr Dean Vincent - Department of Primary Industries, Parks, Water & Environment (TAS)

Mr Andrew Lyon - Forest Products Commission (WA)

Ms Cassy O'Connor - Minister for Climate Change (Government of Tasmania)

Dr Glen Kile - National Forestry R,D&E Forum

Mr Andrew Morgan - Sustainable Forest Management

Dr James Bulinski - CO2 Australia

Dr Phill Pullinger – Environment Tasmania

Prof Jerry Vanclay – Southern Cross University

Assoc Prof Cris Brack – Australian National University

Prof Gil Garnier – Monash University

Prof Keith Crews – University of Technology Sydney

Dr Ross Peacock – Macquarie University & NSW Government

Dr Paul Grimes - DPSEWPAC (Departmental Secretary)

Prof Gerd Bossinger - University of Melbourne

Mr Geoff Atkinson - AusIndustry