National Centre for Future Forest Industries

Annual Report July 2014

Professor Mark Hunt, Director

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Mr Cameron McDonald, Hancock Victorian Plantations (Industry representative)

Mr Ross Hampton, Australian Forest Products Association (Industry representative)

Professor Mark Brown, University of the Sunshine Coast (Industry Engagement representative)

The Advisory Board met on Thursday 25th June 2014. A draft copy of this report had been provided and was discussed.

Forward

A minor recovery in international terms of trade has seen a modest renewal of confidence for the forest growing sector in Australia – particularly the fibre exporters – but this has been balanced in part by the collapse of the Tasmanian Forest Agreement and changes in policy at a Commonwealth level that have worked against rather than for the adoption of wood as an energy or construction material (repeal of the carbon tax, uncertainty in the renewable energy target etc). Furthermore, the austerity budget delivered by the federal government in May resulted in a collapse of industry investment in R&D and the removal of competitive grant funding opportunities for the sector (details below). State and Federal governments (understandably) have shied away from further investment in forest sector R&D in the absence of a signal from industry that they will co-invest to any significant degree. This is being borne out in the CSIRO decision to withdraw from R&D in the industrial forestry space, additional cuts to R&D funding in most remaining state forestry organisations and a continuation of the retreat of the university sector from being active in the industry.

Against this backdrop, the NCFFI has done remarkably well over the past six months in engaging industry and successfully competing for what meagre grant opportunities do exist. However, at the meeting of the NCFFI Advisory Board in late June it was decided that the outlook for future funding from either industry or government was bleak and given this that the most responsible thing to do would be to wind up the NCFFI on its final grant reporting date of December 13 2014. This recommendation is now being considered by University of Tasmania executive. In the coming final four months of the original NCFFI grant the challenge will be to wrap up the current research program, communicate the outcomes effectively to stakeholders and ensure (as best we can) that the investment of the last two years has as great an impact as possible, both in the immediate future and down the track when (assuredly) the industry will once again find itself moving forward. Some of the NCFFI grant has been used to secure leveraged grant funds beyond 2014 and this legacy will at least maintain important capacity and activity into the immediate future.

This 2013-2014 Annual Report focuses on the reporting of activities from the last six months (since the December 2013 Progress Report) and the commitments and plans for the final four months of the project.

Professor Mark A Hunt

Director

Contents

Activities

Theme 1 - Future Options

1.1 New structural products from the plantation resource

Eucalyptus globulus and E. nitens peeling studies **(QDAFF, UTAS, UMELB, Forestry Tasmania, Australian Bluegum Plantations, New Forests, Forest Quality)**

Data collection and checking through to the veneer sheet stage is complete. One paper on green recovery has been published and the preparation of another is well advanced. Products have been manufactured and performance evaluated. Consultation between QDAFF, the University of Melbourne and others has commenced on market acceptance factors. In more detail:

Silviscan analysis - At UTAS Mario Vega has completed processing discs taken from the top of peeled logs (measured growth rings, basic density, heartwood/sapwood boundary). Radial samples have been dried in preparation for Silviscan analysis.

Grade Analysis – Data analysis and publication preparations are well advanced. A publication is almost complete that will combine the two temperate plantation species with four sub/tropical plantation species to detail at a species level, the visual qualities of the resulting veneer when assessed against industry standards. The publication also includes various scenarios (e.g. standard changes, silviculture) and the potential impact on grade recovery. The publication is a continuation from recently accepted publication on veneer recovery (McGavin RL, Bailleres H, Lane F, Blackburn D, Vega M, Ozarska B (2014) Veneer recovery analysis of plantation eucalypt species using spindleless lathe technology, Bioresources). A third publication is being prepared that will focus on the grade quality variability between sites for both temperate plantation species.

Adhesive Trials – Adhesive trials have been completed on veneer from both temperate plantation species using six different adhesive combinations. A new adhesive system not currently available in Australia demonstrated greatest potential in achieving highly durable structural bonds across both species. Data analysis and reporting is in progress.

Product Manufacture – A range of veneer based products has been manufactured at the Salisbury Research Facility including 12mm structural plywood (both 100% hardwood and hybrid softwood and hardwood mix), 17mm formply, 28.5mm container floor panels and laminated veneer lumber (LVL). Display samples are being prepared and will be issued shortly.

Product Quality – Mechanical properties testing has been completed across the range of products that have been manufactured and data analysis has commenced.

Product/Market Analysis – All available veneers were sorted from both temperate plantation species and veneers selected that represented the variability in visual qualities and mechanical properties (stiffness). The selected veneers were provided to the University of Melbourne for product/market evaluation.

Industry Impacts – Information has been progressively released to stakeholder partners throughout the project. New Forests have been most receptive from the plantation forest growing sector. Generated information in understanding the variability that exists in forest resources and the methodology to measure, analyse and interpret the information from a veneer quality (and value) perspective has been valuable to Ta Ann. In addition, adhesive developments, product definition and selection outputs from the project are guiding Ta Ann's decision making processes.

Additional Activities undertaken by Forest Quality as part of NCFFI

Forest Quality Pty. Ltd. was established as a spin-off company from the CRC Forestry to facilitate industry access to wood quality assessment services and technologies previously provided by the CRC. NCFFI has supported Forest Quality as a researcher povider into the Project 1.1. In addition to the activities outlined above, to that end over the 2013-2014 financial year Forest Quality has

- Provided laboratory NIR predictions of kraft pulp yield and cellulose content for Australian Blue Gum plantations and CSIRO Plant Industry
- Worked with a local tool manufacture to redesign and supply increment corers for use with motorised power units now that the CSIRO-designed Trecor system is no longer available
- Established a non-disclosure agreement to facilitate the access of trans-Tasman kraft pulp mills to the online NIR-based monitoring of the pulping process developed by FPInnovations and supplied by FITNIR Analyzers based in Vancouver.
- Developed a preliminary calibration for the portable NIR for the prediction of nitrogen content in radiata pine foliage
- Provided radiata pine wood density measurements for Timberlands Pacific
- Assisted in the successful completion of the FWPA funded projected developing process-based model (eCambium) for the prediction of radiata wood quality
- Participated in the development of a successful proposal to FWPA to validate the process-based eCambium model in the Murray darling basin region.

1.2 Timber Processing and Engineering

Wood processing residues case study - Tasmania (UTAS, Forestry Tasmania, Private Forests Tasmania, Dorset Renewables Energy Group, various equipment manufacturers)

Project objectives:

- Determine the types, characteristics and quantities of wood processing residues generated in the state.
- Assess current and potential medium-term markets, demand and other relevant factors for different types of wood processing residues.
- Determine the performance requirements for these markets.

A briefing paper has been circulated to Tasmanian industry stakeholders and project participants. A brief literature review has also been completed and key issues discussed in the briefing paper. A project methodology has been developed and work is underway. The methodology involves collecting data directly from wood processing facilities and also existing and potential wood residue end-users. Meetings and interviews have been undertaken with most of the nominated project collaborators and stakeholders.

An interim report will be available by the end of July 2014 (delayed from original expected completion in March) and final report by December 2014. Considerable data has been collected from meetings with industry participants, literature reviews and from other sources. These data will be discussed in the interim report. Additional work will be reported in the final report and this will include: characterisation of residues from 30-year-old unthinned and unpruned *Eucalyptus nitens*; residue product and market research including detailed evaluation of options and simple economic analysis. A briefing paper (with summary of key literature) was circulated in October 2013.

Project Participants/Collaborators

In addition to the project participants listed in the December 2013 Progress Report, there has also been correspondence with Prof Andreas Rothe (German scientist who did sabbatical at Forestry Tasmania) and also some discussions with Jacki Schirmer (University of Canberra) and Tasmanian Department of Infrastructure, Energy and Resources who are coordinating a residues project with the consultants URS.

Desktop hardwood veneering study

Most of the literature review and general writing has been completed and a preliminary report should has been drafted (June 2014). A cash flow analysis is being developed to examine the viability of various business models for residue use in Tasmania and this is being fed into the residues work (above). A first draft of the complete technical and economic feasibility report should be ready by October 2014 with completion of the project on target for December 2014.

Timber engineering solutions using plantation hardwoods in construction

Collaborative R&D relationships have been established with Island Workshop (building designers and constructors), Timber Link and Hyne (softwood producers), Robert Morris-Nunn (Architect)

VOS (contractors), Aldanmark (structural engineers), Professor Karl Zankl (timber architect from Wurzburg University, Germany).

Five student design projects focussing on low-grade mass-timber systems have been undertaken.

A literature review and state-of-the-art review have been completed for mass timber systems.

Proposals have been developed to cover three commonplace flooring systems with different performance requirements: first floor in single house, separating floor in class 2/3 single occupancy units, raised subfloor in bushfire prone area. Three prototype floor systems have been tested with positive results.

A mechanically fixed low-grade cross-laminated timber panel system has been developed and initial testing has been completed.

Timber Engineering/Design Consultancy work completed to date with likely impact noted

Support has been provided to Island Workshop (IW) on various building projects to facilitate the innovative use of timber. A specific example is working with IW to innovate a prefabricated timber 'hut' to be helicoptered to remote locations in Tasmanian National Parks. The first 'hut' is completed and has been reported upon in local media.

Work has been undertaken with a consortium of Tasmanian architects to design a timber solution for 120 units of student accommodation. Industry standard for such a building would be a precast concrete solution. The 120 units are to be constructed from timber – a national first - because of advice and support NCFFI provided.

NCFFI representatives attended a preliminary design workshop with the structural engineers for a nationally significant timber structure proposed at Casey Cultural Precinct. NCFFI support through this project will significantly increase the likelihood of the project being realisable in timber within the Australian supply chain.

Minor support was also provided to AWAWA Hong Kong (see AWAWA.pro) in the development of all-timber, digitally designed and manufactured timber systems. Support is not provided for specific projects but is provided in the strategic development of the AWAWA system. AWAWA do not operate directly in the Australian timber supply chain, but involvement with AWAWA helps keep Australian industry at the leading edge of digital design and fabrication of timber.

1.3 Potential for structural and appearance product recovery from hardwood plantations managed for pulp

This project focuses on wood quality and utilisation potential of logs from a 30-year-old un-thinned and un-pruned *Eucalyptus nitens* plantation at Kamona (UTAS, QDAFF, Ta Ann, Forestry Tasmania, Neville Smith Forest Products).

There are three sub-projects:

(1) Veneer products from plantation *E. nitens*.

(2) Large Section Project – this sub-project examines the behaviour of very large section products (eg whole logs and/or squares ≥75x 75mm) recovered from plantation *E. nitens* logs with minimal production intervention. Most previous studies have focused on small section scantling and appearance board sizes. Little has been done on large section material. The study is in response to requests from architects wanting to use very large section material as internal structural or architectural applications in buildings and also significant previous international work on using large dimension material in agricultural and rough carpentry applications.

(3) Sawing appearance and non-appearance products from plantation *E. nitens*. This sub-project generally examines the potential for using plantation *E.nitens* (unthinned and unpruned) for both appearance and non-appearance products. A particular focus of the study is the suitability of *E.nitens* for mass timber elements such as CLT. Data will also be collected (using both sawn and disc samples) on items such as density, unit shrinkage and stability, strength, workability, sapwood proportion, hardness, collapse, internal checking, grade recoveries and utilization potential. Log grading will also be undertaken in order to assess overall plantation merchantability including the quantities of sawlogs, peeler logs and chip logs. Residues will be quantified and characterized.

After all data is collected economic feasibility and market aspects will be analysed and documented.

Progress

(1) Primary processing was completed at Southwood in the week commencing 7th April 2014 and sample veneers were selected. Sample veneers were delivered to QDAFF Salisbury Research Facility mid May 2014 after which veneer assessment commenced.

(2&3) One hundred and thirty five sawlogs (approximately 120 m^3) were obtained from the Forestry Tasmania *Eucalyptus nitens* genetics trial at Kamona. These logs were transported to Neville-Smith Forest Products Sawmill at Southwood and were stored under sprinklers. Processing of these logs commenced on 30th May and was completed by the 10th June. It is estimated that drying will take between 7 and 12 months depending on thickness. Therefore final project results will not be available until after drying.

Approximately 250 disc samples were also recovered from the logs and these are in coolroom storage in Launceston. These discs will be processed at a later stage and used for various wood property assessments. (No date has been set for this work)

An interim report will be available by the end of August 2014. This report will include discussion on the data collected in the field, log yard and during processing at Neville-Smith Forest Products. Key

aspects will be overall stand merchantability from the log grading and also processing performance. Some preliminary data should also be available from the large section project.

A briefing paper was circulated to project participants in March 2014. A detailed methodology regarding the sawing study at Southwood was circulated in May 2014. An interim report will be available by the end of August 2014.

Theme 2 - Sustainable plantation systems - closing the value gap

2.1 and 2.2 have been completed as per December 2013 report

2.3 Comparing actual and potential yield of the plantation estate

The key activities to date have included (1) synthesising data from the 2nd rotation experiments to better understand the drivers of 2nd rotation decline, (2) developing a prototype 'system optimisation tool' that will help managers address questions around optimising the harvest technique, accounting for direct harvest cost and longer-term site sustainability, (3) working with key industry partners to tee up meetings around understanding system economics, and (4) preparation of manuscripts for publication

The project progress has been delayed, but will be completed by October 2014.

2.4 Matching germplasm to site, management and desired products

Activities and results since the December 2013 report include:

(1) Quantifying and predicting genotype by environment interactions (GxE)

Analysis of GxE for 6 year growth and survival in national network of *E. globulus* diallel trials established by STBA/UTAS with support from FWPA. Assessment of 6 year data from three diallel trials planted in 2008 are planned for late 2014. A contract with University of Lisbon has been finalised to extend analysis of indirect genetic effects in the largest of these trials to the multivariate level. The analysis of GxE in the network of *E. globulus* breeding trials established by the STBA across Australia for growth, survival and wood properties (many of these trials are close to harvest age) has commenced following signing of a contract with PlantPlan Genetics Pty Ltd. The analysis of GxE in two diallel trials of *E. globulus* established in Tasmania in 1999 is underway. Analysis of 13 year data was completed and published (Costa e Silva et al. 2014). The main GxE analysis for *E. globulus* will not be completed by December 2014 but is expected to be finalised by June 2015

(2) Genetic opportunities and tradeoffs for managing abiotic and biotic risk

A key component of this area of work is the identification of traits associated with genetic variation in *E. globulus* drought susceptibility for prediction of correlated responses to selection. Seedlings from populations of known field drought susceptibility have been provided to CSIRO (Dr. L. Pinkard) for physiological studies. A paper addressing the effects of water limitations on defensive chemistry has been accepted (McKiernan et al. in press). Another publication has been submitted showing race differences in susceptibility of *E. globulus* germination to high temperature stress (Rix et al. 2014). As second objective of importance is to determine the genetic variation in resistance of plantation eucalypts to the introduced myrtle rust and its association with resistance to native pathogens, initially focusing on *E. globulus* and *Corymbia* sp. (with USC & QDAFF). Data from original

base population rust screening has been provided to the STBA for incorporation into national data base and genetic evaluations for members. Collaboration has been developed with UMELB researchers screening *E. globulus* as part of their ARC Linkage project. UTAS has provided seed from STBA Cambridge seed orchard plus control seed lots from previous Collaborative Research Network rust screening to provide links between base and breeding populations. Seed has been organised for new screening of *E. globulus* families for detection of rust QTL as part of the collaborative CRN project. We have initiated large rust screening of gene pool collections of two other species being used for restoration (*E. pauciflora* – 1st screening complete; *E. ovata* – seedlings arranged in design and ready to ship to QDAFF in Brisbane). Following availability of rust screening through funding to the University of Sydney and meetings with DPIPWE, Royal Botanic Gardens and FT a new project was developed to screen all the Tasmanian eucalypt species. A large collection of seedlots comprising multiple provenances of each species was compiled. This screening has now been completed and analysis is underway.

2.5 Australian Forestry Operations Research Alliance

The AFORA contract is managed by University of Tasmania under NCFFI but AFORA itself is based at USC and run out of the Forest Industry Research Centre at that institution. A new AFORA agreement under these new arrangements was finalised in 2013 and is structured to run to June 2015 (6-months beyond NCFFI project completion date) with reports to follow as per the AFORA agreement.

Upon finalising the new agreement, potential research activities were defined and reviewed with industry. Industry prioritised the 30 potential activities to reflect their key interests for the application of limited AFORA resources. The top five activities include:

1. Managing moisture content in logs for improved supply chains costs
2. Asses value and volume recovery differences between 3 machine and 2 machine harvest systems for pine harvesting
3. Harvest systems productivity modelling
4. Improved transport efficiency with improved in-supply-chain inventory management
5. Compare volume recovery and harvest system efficiency between in-field chipping, whole tree and cut-to-length systems in high yielding eucalyptus plantations

The following field trials were then commenced

1. Log drying trials
2. Steep terrain forwarder productivity study
3. Transportation weight management data analysis
4. Biomass supply chain scenario modelling
5. Shift length impact on machine productivity data analysis
6. Analysis of genetic trial harvesting data with UTAS genetics team

Specific outputs form the AFORA project are captured elsewhere in this document but a summary of outputs includes:

- 2 industry bulletins published
- 4 industry bulletins in editing process for publication
- 12+ journal articles
- 8 presentations presented at international conference (Precision Forestry + FORMEC)
- Key researcher invited to a 4 week fellowship in Spain to conduct research, training and teaching around optimised transportation planning (FAST Truck)

The AFORA team is working with international collaborators including

- IVALSA –CNR, Italy (Italian national research organisation-forestry section)
- METLA, SLU, BOKU, Munich, UCD through the FP7 funded project INFRES –mobilising forest biomass supply chains to meet renewable energy targets
- UCD – partnered on an ERC application

2.6 Linking genetics and chemistry to decrease bark stripping of *P. radiata*

Project summary

The softwood (conifer) plantation estate forms a major component of Australia's forestry industry, with more than a million hectares of *Pinus radiata* trees. New, emerging opportunities using softwoods as engineered products in residential and commercial building exist in the Australian forestry and construction industries. However, bark stripping (Figure 1) by native mammalian herbivores in *Pinus* forests is a major threat to these opportunities. The damage decreases productivity and is a significant economic burden for forestry companies. In some plantations, up to 80% of the trees are damaged. Bark stripping leads to decreased wood volume and tree death. Lethal culling of native wildlife is the primary management option, but this is expensive and socially and politically controversial. The industry needs a new solution.

One possible solution is to examine natural plant resistance as a strategy to reduce the incidence and severity of bark stripping. In this project UTAS is examining the degree of variation in bark stripping in genetics trials provided by Timberlands Pacific (TPPL). The following questions are being asked:

1) Is variation in bark stripping genetically based?

2) Is variation in bark stripping correlated with variation in bark chemistry?

Summary of results thus far

Significant genetic-based field variation in bark stripping by mammals was detected. Genetic-based variation was largely stable over time. Large GxE effects were seen: treatments (seedlots) were only differentially browsed at some sites and rankings were not consistent across sites. Between-site variation accounted for the majority of variation in stripping. Some variation in stripping was also

related to variation in tree size (height/DBH) and bark texture: smaller trees received more damage than larger ones, and trees with smooth bark received more damage than those with rough bark.

Bark stripping reduced tree growth but had a limited effect on tree form at early stages.

The influence of defensive chemistry on stripping is still to be examined; however, a method to accurately extract and quantify plant secondary metabolites from *P.radiata* bark was developed.

Theme 3 - Risk mitigation and new opportunities

3.1 Linking productivity and risk to traits, genes and environment

The CSIRO component of this project was completed and reported in late 2013 - see Progress report from December 2013. There continues to be work undertaken at UTAS linked closely to Project 2.4 and reported under that heading.

3.2 Understanding and managing climate risk in production forests

Under project 3.2 a joint appointment between CSIRO and UTAS has been made for a period of two years starting from May 2014. Dr Pat Mitchell will be working with his CSIRO and UTAS colleagues on physiological ecology issues of importance to industrial forest management. He is also working with Dr Tim Wardlaw at Forestry Tasmania on the Warra Flux Tower.

To date, experimental studies have been conducted at the University of Tasmania glasshouse facility focussing on the regulation of gas exchange by the phytohormone ABA. This work is testing the relevance of ABA for tree water management strategies and will shed light on the potential to use traits related to ABA production and sensitivity to define drought resistance in forest species. Dr Mitchell has additionally been involved in a drought experiment looking at the role of polyploidy in *Acacia mangium*. This work is considering several traits related to plant water relations such as; leaf hydraulics, osmotic adjustment and leaf anatomy. A climatic analysis of national and global patterns in drought-induced forest mortality is also underway. This project is developing a probabilistic approach to define drought risk and relevant thresholds that are associated with documented die-off events.

Progress over the last four months has been steady and the first phase of the ABA experimental work is wrapping up. Data analysis and writing up of manuscript will get underway in June. Analysis for the drought risk of forest mortality project is well advanced with the majority of analysis completed. Preparation of a manuscript will begin in August. The polyploidy Acacia experiment is complete and results from chemical analysis are being awaited. Two manuscripts are in preparation.

3.3 Optimising water-use efficiency of wood production in plantations

Dr Don White has continued his work on forest hydrology and drought physiology and used the synthesis seed funding from NCFFI to generate projects with Biofiorest SA, FAO and ACIAR.

3.3.1 Manuscript Preparation

Paper 1. Managing water use efficiency in *E. globulus* plantations. This paper has undergone internal review and has been submitted to Forest Ecology and Management.

Paper 2. Water use efficiency of wood production in irrigated and rained *E. globulus* and *E. nitens.* This paper has also been approved and submitted to Forest Ecology and Management.

Synthesis paper 1. Potential production and water productivity of *Eucalyptus* and *Pinus* plantation species in Australia - an optimality approach. The concepts have been developed, data collated. This paper is currently behind schedule due to the need for co-authors to get together to finish the analyses.

Synthesis paper 2. Water use efficient plantations - seeing the wood for the leaves Dr White traveled to Fort Collins, Colorado and spent a week with Dr Mike Ryan analysing data and developing the concepts for an opinion paper that will argue for a systems approach to improving the water use effectiveness of forests. It will highlight the processes that must be represented at different scales to quantify WUE and the issues associated with moving between scale. This has the potential to be a very important paper.

3.3.2 Proposal to Bioforest SA - Dr White spent two weeks in central Chile and presented a research proposal to the Board of Bioforest SA. This proposal was approved by the board last week and Dr White will lead a five year R and D program in the company. One aspect of the proposal was training for local scientists and this will involve Australian post graduate training, potentially at UTAS, for company scientists.

3.3.3 Report for FAO - This project was contracted on May 8th and will be completed on June 10. A report was drafted covering opportunities for managing tension between production and water through a systems approach to plantation water productivity. This report was reviewed by FAO sustainable production committee on June 10th at a meeting in Russia.

3.3.4. ACIAR - The project was contracted early March and Dr White travelled to Vientiane Laos for two weeks commencing March 6th. He then visited Xiangjiang and Nanning in SW China April 8th and 13th 2014 and visited Hanoi, Vietnam April 14th to 18th 2014. A prototype calculator was developed. Planned second visits to China and Laos are scheduled for Late June.

Education and Communication

4.1 Education - Dr Julianne O'Reilly-Wapstra resigned her position as Education Manager for the NCFFI early in the year in order to take up a position in the Office for Research at UTAS. She has not been fully replaced but continues to work in the NCFFI role for 20% of her time.

Efforts to attract PhD students to either UTAS or USC late in 2013 were unsuccessful. A raft of potential projects was advertised and distributed but there were very few enquiries and ultimately no takers. The cadre of PhD candidates at UTAS who are associated with NCFFI has thinned out as students complete their work.

4.1 .1 Adam McKiernan - Additional funds of approximately $11000 were provided to Adam McKiernan to undertake chemical analyses that greatly increased the usefulness of his experimental work on plant:animal interactions from last year. Those data are presently being analysed.

4.1.2 Stuart McDonald is undertaking a PhD jointly supervised between UTAS and Greening Australia, considering revegetation challenges in agricultural landscapes. This work has significant potential application for the plantation sector and $5000 per year over three years ($15000 total) has been allocated to assist with soil analyses. Greening Australia have matched this contribution to the project with cash.

4.1.3 Mario Vega, who is finishing a PhD in Project 1.1, looking at veneer recovery from plantation *Eucalyptus nitens*, has requested an amount of $7000 as a scholarship top-up. Mario is on a Chilean scholarship that lasts for four years. However, his ex-CRC scholarship top-up was only funded for three years. It is intended to formalise that additional support.

4.2 Communication - UTAS has continued to work closely with USC to deliver industry knowledge transfer, particularly to the hardwood plantation growers. As part of these arrangements Justine Edwards has remained employed by USC to work closely with the West Australian industry. As part of the UTAS/USC co-funding arrangements NCFFI is funding Justine for the second half of the present calendar year. No arrangements are in place beyond that date. Justine will continue to be based in WA and will play a significant role in organising the final workshop (see below) and in ensuring that the CRC outputs and NCFFI project outputs will continue to be available to industry and other stakeholders beyond the end of this year.

The key research milestones relating to communication (publications, reports, bulletins) are being exceeded. Please see outputs lists below for details. It is worth noting the important role that AFORA plays in engaging with the industry at a national level and the CSAW group at UTAS at a Tasmanian regional level.

The Commonwealth has agreed that the final communication milestone of three travelling 'roadshow' style workshops would be better replaced with a single workshop in one place. This change was primarily associated with feedback about cost and time impediments to industry stakeholders to attend. We will now hold a 3 day workshop in Hobart in November 2014. The proposed dates are 25th - 27th.

Additional activities

Two small projects in the molecular biology space are being managed within the Centre. Neither of these has required seed funding from NCFFI but their outputs form a useful adjunct to the main focus of centre activities.

5.1 Fingerprinting for quality control and to optimise deployment decisions in *Eucalyptus dunnii* - Project Leader, Prof Rene Vaillencourt - Industry funder seedEnergy

5.2 Development and use of microsatellite markers for clove - Project Leader, Prof Rene Vaillencourt - Industry funder Griffin Tree Improvement

Outputs

Journal papers

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Ghaffariyan, MR, Brown, M. and Spinelli, R. 2013 Evaluating efficiency, chip quality and harvesting residues of a chipping operation with flail and chipper in Western Australia. Croatian Journal of Forest Engineering 34, 189-199.

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Notable Outreach/Collaborative relationships

Supervision of 12 final year School of Engineering student timber research projects covering low-grade mass-timber flooring, all-timber connections in Tasmanian species, embodied energy in timber construction, and AWAWA connection design (see AWAWA.pro). Student projects to be completed by December 2014 with potential for publication (likely two/three journal papers).

Seminar delivered to Hong Kong Architectural Services Department on the use of timber in Hong Kong. Australia is uniquely placed to address the lack of technical timber expertise in HK due to a similar climate and similar design codes.

Development of timber-focussed learning-by-making workshops (to be hosted early 2015) targeting cross-institutional students, building design professionals, and members of the timber industry.

Product testing services provided to Forestry Tasmania product development team through engineering student projects.

Initial development of a UTAS wide working group around a computer controlled robotic manufacturing facility to be installed at the UTAS School of Architecture and Design. Working Group includes members from School of Engineering and Computing (from both disciplines), School of Architecture and Design, School of Geospatial Sciences, School of Plant Sciences, as well as Forestry Tasmania. The working group will meet to develop an activity plan once the robotic facility is commissioned in July 2014.

Ayeska Hubner, PhD student from University of Sao Paolo started working with Daniel Mendham, CSIRO, in August 2013, for a period of 12 months, helping to improve process-level understanding of nutrient cycling and responses in multi-rotation plantations.

Business Development Activities

Tasmanian Intergovernmental Forest Agreement (TIFGA) - Over the past 18 months the Director has engaged with state and federal parliamentarians, bureaucrats and industry associations in order to secure some allocated funding for R&D from the TIFGA. This was **unsuccessful.**

The Plantation Manufacturing Innovation and Investment Fund (PMIIF) was part of the TIFGA and after negotiation with AusIndustry (who had carriage of the fund) NCFFI was permitted to submit an application for an R&D program - as long as the application was led by an industry entity, not a university. Such an application was prepared and submitted under the auspices of Sustainable Forest Management Pty Ltd in November. Forest Industries Association of Tasmania (FIAT) declined to lead the proposal as it was at odds with their own attitude towards R&D funding from the TIFGA - they believed R&D funding should be an allocation, not a contested funding pool. After an announcement being delayed several times over nearly six months, the PMIIF was **cancelled** in the May federal budget.

An application was made to the federal government Dept of Industry Innovation Precincts Program in September for a forestry/forest products/biomaterials precinct in northern Tasmania. This application was led by the engineering consulting firm Pitt and Sherry (who had done most of the Pulp Mill design work). After eight months of delayed announcements, the Innovation Precincts program was **cancelled** in the May Federal budget.

A proposal to the Cooperative Research Centres Program was developed by Forest and Wood Products Australia for submission to Round 17, due July 2, 2014. NCFFI partners played a limited role in the proposal as did most other traditional sources of research expertise in Australia. Round 17 of the CRC program was **cancelled** in response to reduced funding announced in the May Federal budget.

An application was submitted from University of Tasmania to the Australian Research Council Industrial Transformation Program for a research hub. We were advised that there was insufficient industry funding in our application. The amount of in-kind funding we received ($3.8 million over five years) would need to be replaced by cash funding from industry if we were to be competitive against applications from other industries. Thus the proposal was very well reviewed but ultimately **unsuccessful**.

A major collaboration was being developed between Forestry Tasmania and University of Tasmania, with a view to establishing a Tasmanian Institute of Agriculture-type partnership to address regional industry R&D needs. Changes to the funding and strategic direction of Forestry Tasmania being

introduced by the incoming Tasmanian state government have resulted in those plans being **unviable** and discussions have **ceased**.

The Australian Renewable Energy Agency (ARENA) has had its funding for new activities withdrawn completely. NCFFI partners were working on applications considering biofuels to be submitted to ARENA for funding. This option is now **closed**.

There no longer any large applications pending assessment nor any funds to which new applications can be made.

The director has engaged industry through the Centre Advisory Board, Forest and Wood Products Australia and the Australian Forest Products Association; the Commonwealth Government through the Department of Agriculture, Fisheries and Forestry; and the Tasmanian Government through the Minister for Resources and the Department of State Growth and representatives of the Legislative Council. The advice from every one of these sources is that there is not a significant tranche of funding available to the centre (contested or otherwise) in order to support its continuation beyond December 2014. Furthermore, the consistent message from representatives of the forestry and forest products industry is that there is presently insufficient money in their businesses to make a significant investment in R&D. This precludes the Centre from accessing a significant amount of competitive funds that need to be highly leveraged such as through the Australian Research Council Linkage and Industrial Transformation programs.

Finances

The initial grant of $2.5 million has leveraged about $3.1 million in other activity, though once in-kind contributions are full accounted for I expect this figure to exceed $4 million. Cash leverage has been disappointing, even when direct salary contributions to projects are counted as cash rather than in-kind. Fortunately the Commonwealth has been happy to consider both cash and in-kind contributions as acceptable leverage and to consider income into collaborating organisations as permissible where it is clear part of a single cross-institutional activity. For instance, of the CRC Forestry residual funds that were matched against NCFFI funds, only those for CRC Project 2.6 (NCFFI 1.1) went through UTAS accounts. Funds for CRC Projects 1.8 (NCFFI 2.1-2.4) and 1.9 (NCFFI 3.1) went directly through to CSIRO and USC. Nonetheless these can still be counted as leverage for the purposes of the contract. On that basis I have no concerns about us meeting the contract leverage requirements. At an individual project level revenue and expenditure are tracking well and in keeping with the pace of milestones being met and outputs being produced.

Of the $2.5 million NCFFI grant, a little over $500,000 has been disbursed to other organisations within the NCFFI collaboration and these have leveraged about $1.2 million in cash and in-kind, comprising significant CRC residual funding. Of the remaining grant about $1.5 million has been spent internally at UTAS on research activity, itself generating a similar level of leverage. The remaining funds of around $500,000 have maintained the NCFFI directorate - essentially the Director salary for two years and operating primarily for travel. All other administrative costs have been borne by the University of Tasmania and indirect costs have not been applied to the administration of NCFFI projects or projects where the NCFFI has been the major investor.

The Department of Industry has indicated that they are happy for some of the grant to be unspent as at the December 13, 2014 project end date as long as it is formally committed at that time. Such a commitment will need to be in the form of purchase orders or contracts. I am still trying to determine how much they will consider being unspent and how far into the future commitments can be made. Some strategic decisions will need to be made about whether any commitments beyond December 2014 are directed to project outcomes *per se* or the continuation of the NCFFI itself as an entity.

At present the budget is fully allocated, though we are likely to see the normal difficulty of spending the full amount in some projects over the coming months as researchers look to the next job or project. I envisage that up to $100,000 could be made available for alternative investment due to early resignations of research staff and decisions will need to be made about whether this is better reinvested in maintaining capacity, meeting project objectives or other strategic initiatives.

Project Leader	Lead Institution	Project	NCFFI funding	Total Matching
Mark Hunt	UTAS	0.1	$450,000	$160,000
Matt Hamilton	UTAS	1.1	$510,000	$738,000
Greg Nolan	UTAS	1.2	$327,532	$648,000
Henri Bailleres	QDAFF	1.3	$30,000	$30,000
Don White	CSIRO	2.1	$0	$110,000
Mark Brown	USC	2.2	$0	$160,000
Daniel Mendham	CSIRO	2.3	$0	$155,000
Brad Potts	UTAS	2.4	$468,000	$2,000
Mark Brown	USC	2.5	$150,000	$286,250
Julianne O'Reilly-Wapstra	UTAS	2.6	$12,200	$10,000
Paul Turner	UTAS	2.7	$25,000	$210,000
Tony O'Grady	CSIRO	3.1	$130,000	$100,000
Pat Mitchell	CSIRO	3.2	$125,000	$125,000
Don White	Whitegum	3.3	$100,000	$90,000
Julianne O'Reilly-Wapstra	UTAS	4.1	$77,000	$100,000
Mark Hunt	UTAS	4.1.1	$15,000	$15,000
Mark Hunt	UTAS	4.2	$80,000	$135,000
Rene Vaillencourt	UTAS	5.1	$0	$25,380
Rene Vaillencourt	UTAS	5.2	$0	$10,575
			$2,499,732	**$3,110,205**

Milestones due

31 July 2014

- Initial research outputs completed in each thematic area - **Completed**

- Second annual Report prepared and submitted to the Commonwealth - **Completed**

- Business plan for sustainability of Centre prepared with evidence of ongoing third party investment

    - **At risk**

15 December 2014

- Three national scale industry workshops/roadshows (one per theme) delivered - **revised - On track**

- Associated Project documentation, including final Report to the Commonwealth, completed and delivered - **On track**

- Final Report including Financial Report and Completion of the Project - **On track**

Activities going forward

1. Finish project work for most projects - mid November 2014

It is anticipated that Projects 1.1, 1.3, 2.1, 2.2, 2.3, 2.7, 3.1, 3.3, 4.2, 5.1 & 5.2 will be completed.

2. Formalise some ongoing work beyond December 2014 where funds have been allocated and Dept of Industry agrees. These must be bound up in project or employment contracts - to be signed off by mid-September

Project 1.0 will be finalised at the end of January 2015, Projects 1.2, 2.4, 2.5 & 4.1 will have significant contracted activity until the end of 2015 calendar year. Committed funds beyond the December 2014 project end date be in the form of contracted salaries.

3. Hold a workshop to present the outcomes to stakeholders - last week of November

A three day workshop/field tour will take place on the 25th – 27th November in Hobart. This will include presentations by key scientists and industry collaborators. A feature of the workshop will be presentations by industry stating how research outcomes from the NCFFI have been implemented in their businesses.

4. Provide final audited reports - mid December