



ANNUAL REPORT 2009–2010

Established and supported under the
Australian Government's Cooperative Research Centres Program

Annual Report 2009–10

www.crcforestry.com.au

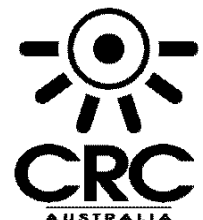


Table of contents

Executive summary	1
Context and major developments during the year	4
National research priorities and CRC research	7
Governance and management	8
Research programs	14
Research collaborations	31
Commercialisation and utilisation	35
Intellectual property management	36
Communication strategy	37
End-user involvement and CRC impact on end users	39
Education and training	46
Abbreviations, acronyms and initialisms	48
Appendix 1: Publications, outreach and technology transfer	51

About this report

The annual report of the Cooperative Research Centre for Forestry has been prepared in accordance with the *Guidelines for annual reporting for the Cooperative Research Centres program* issued in April 2010.

Contact us:

CRC for Forestry
Private Bag 12
Hobart TAS 7001
Australia

Email: crcforestry@crcforestry.com.au
Phone: 03 6226 7947
Fax: 03 6226 7942

ABN 55 115 064 910

© CRC for Forestry 2010

Executive summary

Key achievements and activities

The year under review, 2009–10, was the fifth year of operation for the Cooperative Research Centre for Forestry (CRC). A significant number of CRC projects were completed during this financial year. Many others reached a stage at which research delivery and adoption resulted in demonstrable changes in policy and practice by our industry and government participants.

Recent changes in the operating environment for the forest and wood products industries in Australia have highlighted the need for the CRC's contribution to research, development, innovation and education.

This year saw emerging outcomes from program activities that have been operating for five years. The CRC also began new activities addressing growing areas of significant industry and public concern, including competition for water resources, carbon consequences of different forest management options, second-rotation productivity in the hardwood plantation estate and an array of management responses to concerns around forest biodiversity.

Three new participants joined the CRC at the start of this reporting period. However, two participating companies — Timbercorp and Great Southern Limited (GSL) — collapsed during the year. Many of Timbercorp's forestry assets were acquired by Australian Bluegum Plantations (ABP), and CRC research activities on those sites have continued. Similarly, Gunns has been managing many of the plantations established by GSL, so the CRC has maintained a connection to those assets.

Achievements for the 2009–10 financial year include:

- the significant discovery by CRC researchers and industry participants of the causes of substantial reductions in second-rotation productivity on some sites. This will lead to appropriate management strategies, including stocking density and thinning, scheduling of fertilisation and inter-rotation site management
- completion of work on the application of LiDAR technology for terrain modelling and forest inventory. Industry partners are now using these products in a range of settings
- greater attention focused on decision-support tools for industry participants. The Blue gum Productivity Optimisation System (BPOS) was road-tested and refined in collaboration with a number of industry participants. The CRC appointed an Industry Liaison Officer to increase understanding and adoption of this tool
- completion of the initial phase of model paramaterisation for tropical and sub-tropical plantation species
- completion of processing studies on shining gum (*Eucalyptus nitens*), and the development of processing techniques that substantially reduce value-limiting defects in sawn boards from eucalypt plantations. Recent public and political debate about commercial extraction from native forests is likely to make this work more immediately significant
- incorporation of new findings on genetic control of wood density and pulp yield in blue gum (*Eucalyptus globulus*) into the pulpwood breeding programs of industry partners. *E. globulus* makes up 62 per cent of the Australian hardwood plantation estate, and is the main species driving the \$997 million (in 2009) export woodchip industry
- start of the roll-out of hand-held near-infrared (NIR) spectroscopy scanning techniques developed by the CRC, that significantly improve the efficiency, and reduce the cost, of assessing economically important parameters in hardwood. This has widespread applications in plantations and mills, for both pulp-focused woodchip and sawn timber production from plantations
- the initial roll-out of an operational decision support tool, ALPACA, that has helped industry partners predict, evaluate and optimise machine productivity. A CRC-developed machine evaluation toolbox also has been distributed to industry partners for testing and feedback
- development and deployment of a logistics optimisation planning tool, FastTRUCK, which even in the testing and evaluation phase has generated some significant one-off (of the order of \$1 million) and ongoing (circa 10 per cent) cost savings for one industry partner.

We extended our work focused on water quantity and quality this year. The relevance of CRC work on forest fire impact on water quality and yield has been highlighted in the wake of the Black Saturday bushfires. This project also aims to resolve some of the wider debate on the impact of plantation establishment on other water users and uses in several significant regions such as south-west Western Australia, the Green Triangle (an area of 6 million ha spanning the border between South Australia and Victoria) and Tasmania.

A number of projects completed during the year in review have led to improved guidelines, policies and practices in forest management. Examples include a publication on tree hollow management aimed at forest managers and forest practices officers, input into the review of forest practices codes, and guidelines on the sustainable management of forest pests, including alternatives to chemical use.

The CRC Communities project has continued to deliver policy- and practice-relevant research outputs, including a practical manual for industry on community engagement, and input into the Senate Select Committee on Agriculture and Related Industries inquiry on managed investment schemes.

Risks, opportunities and responses to the above

The CRC is largely on track with milestones and deliverables identified in the Commonwealth Agreement. An external Research Advisory Panel (RAP) regularly benchmarks our progress and quality. The RAP comprises five Australian and international experts who together cover the breadth of the CRC's research, development, innovation and education portfolio.

This year's annual review was conducted as part of the CRC's Annual Science Meeting in May 2010. The panel report included the following summary:

During the 3 year review the panel, in its role of 'critical friends', was asked to evaluate the CRC under five headings. The RAP was pleased to see that its comments from that time against those criteria had been acted upon to a significant degree. These criteria remain just as relevant to the CRC in 2010 and the RAP used them as a guide in its overall assessment.

Is the work of an international high standard?

Here our impression is that generally, the standard is high, although there are one or two areas of concern — and these have been discussed with the relevant program managers.

Is there evidence of collaboration?

Yes and this seems to have improved since 2008; [both] intra and inter program [collaboration] as well as with other relevant researchers and new members. There was a small concern that perhaps not every opportunity had been taken to build on existing experiments versus establishing new field trials.

Are the projects realistically resourced?

No overall comment beyond those made at the third year review which highlighted the issues. There do appear to be specific issues for individual programs to address.

Is there evidence of impact/adoption?

'... the panel was encouraged by how much emphasis has been placed on adoption of the technologies, and the resources put into this area. The "hypothetical exercise" (at the Annual Science Meeting) was a great example of seeking to understand adoption processes, decision making and the barriers to adoption.'

Is the mix of projects appropriate?

The panel noted that since the 3 year review, its suggestions around the mix of projects were implemented — such as the water and new carbon initiatives — but that a careful, staged approach had been taken in these areas.

The CRC has now addressed all of the detailed panel recommendations and reported our responses and strategies to the Board.

Impediments to achievement of the CRC's objectives during the year and strategies adopted to address these

Despite the tumultuous nature of the year and the impacts of the global financial crisis and other market forces on the CRC's industry participants, there were no notable impediments to the achievement of our overall objectives. As part of a planned strategy to examine adoption outcomes, the CRC reviewed different options for decision support and implemented a number of approaches, including the appointment of an additional full-time staff member to facilitate the uptake and adoption of decision-support tool and models.

Awards, special commendations, CRC highlights

Annual Science Meeting

Utilisation and adoption were areas of focus during the CRC's Annual Science Meeting held in May 2010. The ASM included a full-day event for industry participants that showcased 10 decision-support tools developed by the CRC, in an exercise that demonstrated how technology could aid profitability.

IUFRO Scientific Achievement Awards

Dr Michael Battaglia and Professor Jerry Vanclay received International Union of Forest Research Organizations (IUFRO) Scientific Achievement Awards in recognition of their achievements in forestry research. These awards are made only every five years, and Mike and Jerry were among 11 recipients from all over the world.

Science and Innovation Award

Dr Lyndall Bull, CRC Board Member and convenor of Australia's National Forestry Masters Program, received a 2009 Science and Innovation Award for Young People in Agriculture, Fisheries and Forestry. The awards provide grants of up to \$50 000 for people aged 18 to 35 working or studying in rural industries, to pursue original and innovative ideas. Lyndall beat 85 high-quality applicants from across Australia to win the Forest and Wood Products Australia award for her proposal to conduct a series of interviews and surveys to gain a comprehensive understanding of how land-owners feel about using their land for forest carbon offset sinks.

CEO appointed to Forest Practices Authority Board

During the year, the CRC for Forestry CEO, Professor Gordon Duff, was appointed Chair of the Tasmanian Forest Practices Authority (FPA) Board. The FPA is an independent statutory body that administers the forest practices system, which regulates forestry in Tasmania on both public land (mainly State forest) and private land. The FPA is a supporting partner in the CRC, and authority staff are active participants in CRC research, particularly in Project 4.2 'Biodiversity'.

Industry liaison role boosted

A new CRC position was created during the reporting period. The Industry Liaison Officer works with the Industry Engagement Manager and provides additional support to industry participants to implement a variety of CRC-developed decision-support tools in their day-to-day operations.

Context and major developments during the year

Industry context

The early years of the CRC were accompanied by a rapid expansion of the Australian hardwood plantation estate, from a negligible resource in 1990 to approximately 1 million ha in 2009. These plantations are likely to achieve a peak, mature age profile by 2020, producing an estimated 16 million m³ of wood, mostly for pulp and paper production. This is 2.5 times the volume of Australia's peak native forest woodchip harvest in 2002–03. The CRC for Forestry has played an important role in supporting the sustainability and productivity of the hardwood plantation estate. The long-term outlook for the sector, in terms of global and domestic demand, is positive.

Nevertheless, during the reporting period the Australian forest and wood products sector continued to experience a significant downturn due to interrelated factors, including the global financial crisis, rising Australian dollar, reduced demand for export woodchips and forest products more generally, and the collapse of a number of Managed Investment Scheme (MIS) companies involved in the establishment of hardwood plantations. This has resulted in a significant slowing in the rate of new and second-rotation plantation establishment, and a generally more cautious investment environment for the sector.

Three of the MIS companies that collapsed or went into administration in the past 18 months were CRC participants. However, most plantation assets owned or managed by these companies have been acquired by other companies, with which the CRC has maintained or established working relationships. Consequently, field-based trials and other activities have largely continued despite changes in ownership or management responsibility.

Continuing social and political pressure on production forestry in native forests in several Australian jurisdictions has increased private sector and government interest in the CRC's work on high-value wood products from hardwood plantations. Our success this year in identifying processes to reduce value-limiting defects in shining gum (*Eucalyptus nitens*) plantation timber has attracted considerable interest. In other settings, the CRC's recent work on carbon in managed forests, and on modelling water use by plantations, has received additional attention due to growing public policy attention on these issues.

Value of outcomes to date

The CRC conducted a rigorous cost-benefit analysis of current research investments, in collaboration with Agtrans Research and eSYS Development, as part of our third year review in 2008 (reported in our 2008–09 annual report, available on the CRC website). The analysis looked in detail at seven CRC for Forestry projects, and indicated a positive internal rate of return for all. With the exception of a small project evaluating electric/diesel hybrid technology for log transport that is currently suspended, all other CRC investment activities evaluated in that study are on track, and several have now reached the implementation phase.

The table below outlines the expected economic and non-monetary outcomes of the CRC over the long term, many of which are not measurable over the short period that the CRC has been operating during the current funding cycle. For example, considering that the minimum period over which site selection and genetic improvement would result in a measurable economic return is at least one rotation (typically 10 years), no empirical data are available on these economic outcomes. Economic gains and improvement in profitability from improved harvesting and transport practices will be captured over a much shorter period, and case studies conducted during the reporting period have already shown substantial savings in capital expenditure (approximately \$1m) and at least a 10 per cent reduction in transport costs for one participating company. As implementation of research and development findings continues over the next two years, we expect to significantly increase the number of completed case studies of short-term benefits and economic impacts. The table below provides a summary of outcomes to date compared with the value outcomes identified in the Commonwealth Agreement.

Value outcomes: Commonwealth agreement	Summary of progress to date
<p>1. Improved ability to select planting sites and manage for increased profitability of plantation investments, through higher yields and lower costs of production.</p>	<p>There is widespread industry use of CRC decision tools, in site selection, plantation management and performance forecasting (Program One, Projects 1.2 & 1.3).</p> <p>Work on the application of LiDAR technology for terrain modelling and forest inventory has been completed. Industry partners are now using these products in a range of settings (Program One, Project 1.1).</p> <p>Forest health: Operational use of remotely sensed forest health assessment has been implemented by two state forest agencies (Program One, Project 1.1).</p> <p>Strategies to address second-rotation productivity decline in hardwood plantations are under evaluation (Program One, Project 1.2)</p> <p>The Industry Pest Management Group continues to provide direct technology transfer services relating to management of potentially economically significant plantation pests (Program Four, Project 4.4).</p>
<p>2. Increased use of planting stock with improved genetic potential, managed to optimise production of high-value wood for fibre and solid-wood markets.</p>	<p>Research deliverables are on track, and ahead of target with respect to molecular genetics (Program Two, Project 2.1).</p> <p>Findings on genetic control of wood density and pulp yield in <i>E. globulus</i> have been incorporated into the pulpwood breeding programs of industry partners.</p> <p>Processing studies on <i>E. nitens</i> have been completed and the CRC has developed processing techniques that substantially reduce value-limiting defects in sawn boards from eucalypt plantations (Program Two, Project 2.3).</p>
<p>3. Adoption of harvesting and logistical practices that reduce delivered wood costs, contributing to industry profitability, while maintaining conformity with codes of practice and certification standards.</p>	<p>We have conducted training workshops across the country on latest methods and technology for value recovery in harvest operations (Program Three).</p> <p>The agreed Southern Hemisphere framework for machine evaluation and benchmarking has been established, including delivery of machine-evaluation workshops to industry (Program Three).</p> <p>Industry has increased adoption of CRC's transport scheduling (FastTRUCK) and machine productivity (ALPACA) decision support tools (Program Three).</p>
<p>4. Improved security of access to land and forest resources for the forest industry, sustaining levels of investment in the establishment of new plantations, through demonstrated ability to manage in an environmentally and socially sustainable manner.</p>	<p>CRC research outputs have informed changes to policy settings for forest practices (Program Four, Project 4.2).</p> <p>CRC socioeconomic research outputs are regularly cited in Commonwealth and State policy statements and developments in relation to forestry and land use (Program Four, Project 4.3, Project 4.5).</p> <p>The CRC has been an active participant in evidence-based public debate on forestry issues.</p>

Major developments and initiatives

A major development this year was the commencement of Project 1.7 'The forest productivity optimisation system', which is designed to validate models of carbon fluxes in temperate and subtropical native forests, and will complement a Forest and Wood Products Australia (FWPA) funded review of native forest carbon stocks and flows that is due for completion later in 2010. The project will go some way towards balancing the debate on landscape-scale forest carbon stocks. The CRC initiated it in response to industry participants identifying carbon stocks as a major issue and potential source of conflict and adverse policy change relating to forest management.

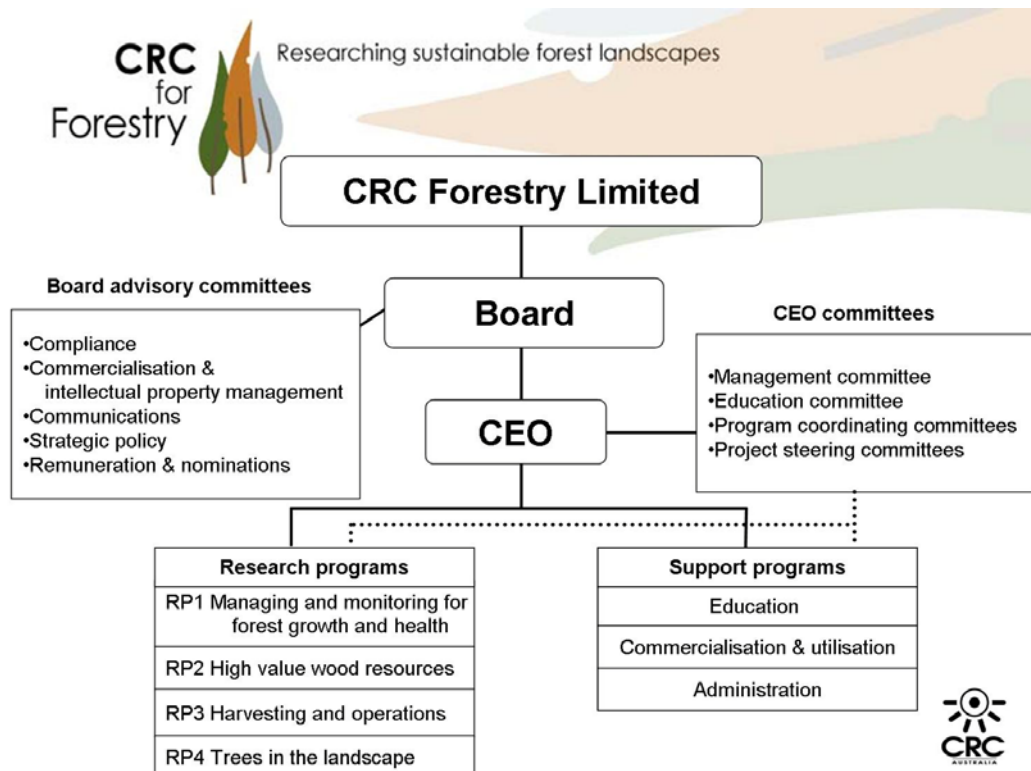
The CRC's Annual Science Meeting in May 2010 included a research review by our independent Research Advisory Panel. The Panel provided a series of comments and recommendations that have helped to fine-tune delivery and adoption of research outcomes, as well as some future research directions.

The CRC continues to canvas interest from potential new industry participants, and where appropriate and necessary, new research providers. We welcomed three more supporting participants in July 2009. The University of the Sunshine Coast will aid the expansion of our research into subtropical and tropical forestry, and brings extra research capability in performance prediction in new environments. New industry partners Timberlands Pacific and the Australian Forest Contractors Association provide additional opportunities for industry engagement.

National research priorities and CRC research

National research priorities	CRC research (%)
AN ENVIRONMENTALLY SUSTAINABLE AUSTRALIA – Transforming the way we use our land, water, mineral and energy resources through a better understanding of environmental systems and using new technologies	
Water – a critical resource Strategies for optimising water use in plantation forestry (see Project 4.1) Prescriptions for improving water quality and or yield from managed forests (see Project 4.1)	6
Transforming existing industries Genetic and silvicultural techniques for maximising value recovery from plantations (see Program Two) Improvements to harvesting and transport productivity (see Program Three)	25
Overcoming soil loss, salinity and acidity Enhancing the role of plantations in mitigating salinity (see Project 4.1)	2
Sustainable use of Australia's biodiversity Developing prescriptions for maintaining biodiversity values in managed native forests and plantations – variable retention silviculture, other inputs into Forest Practices Code (see Project 4.2)	20
Responding to climate change and variability Refining predictive models for forest performance and forest health in the context of a changing climate (see Projects 1.2 and 1.3)	5
PROMOTING AND MAINTAINING GOOD HEALTH – Promoting good health and preventing disease, particularly among young and older Australians	
Strengthening Australia's social and economic fabric Documenting socioeconomic impacts of land-use change in the context of regional economic development and policy development (see Project 4.3)	5
SAFEGUARDING AUSTRALIA – Safeguarding Australia from terrorism, crime, invasive diseases and pests, and securing our infrastructure, particularly with respect to our digital systems	
Protecting Australia from invasive diseases and pests Monitoring and predicting forest health, under current and future climatic scenarios (see Projects 1.2 and 4.4)	4

Governance and management



Governing Board

The CRC for Forestry Board of Directors has eight members, including an independent Chair. Six of the seven Directors are from the private sector. There were no changes to the membership of the Board during 2009–10. The table below outlines the membership of the Board and key skills of Board members.

Name	Organisation	CRC position/role	Particulars
Anne Katherine (Kate) Carnell AO BPharm, FAIM, FAIPM, MAICD	Chief Executive Officer, Australian Food and Grocery Council	Chair of the Board Chair, Remuneration and Nomination Committee Member, Compliance Committee Member, Communications Committee	Joined the Board at incorporation of the company on 30 June 2005 in a non-executive capacity.
Lyndall Bull BForSci(Hons), BSc, PhD, MAICD	Lecturer and National Convenor, National Forestry Masters Program, Australian National University	Member, Compliance Committee	Joined Board in November 2008 in a non-executive capacity.
Johannes (Hans) Hendrick Drielsma BScFor(Hons), MForSci, PhD	Executive General Manager, Forestry Tasmania	Chair, Communications Committee Member, Remuneration and Nomination Committee	Joined the Board at incorporation of the company on 30 June 2005 in a non-executive capacity.
Gary Brian Inions BSc(Hons), PhD	Managing Director, Plantation International Pty Ltd and Hansol PI Pty Ltd	Member, Remuneration and Nomination Committee Member, Commercialisation and IP Committee	Joined the Board on 13 December 2005 in a non-executive capacity.
Robert (Bob) John Pearce	Executive Director, Forest	Member, Communications	Joined the Board in

BA, DipEd, JP	Industries Federation of WA and Chair of the National Association of Forest Industries (NAFI)	Committee	October 2006 in a non-executive capacity.
James (Jim) Balfour Reid BSc(Hons), PhD, DSc, FTSE David Syme Research Medal (1989); Royal Society of Tasmania Medal (2000)	Distinguished Professor, University of Tasmania	Member, Remuneration and Nomination Committee Chair, Commercialisation and IP Committee	Joined the Board at incorporation of the company on 30 June 2005 in a non-executive capacity.
Geoff Wilson AM BSc, MSc, DSc, PhD, FTSE, FAIP FAIM MAICD	Member, Board of the Australian Maritime College (University of Tasmania) and Chairman of the Board of AMC Search	No committee membership at present	Joined the Board on 28 April 2009 in a non-executive capacity.
Robert Geoffrey Woolley Bec, FCA	Chairman of the Forests and Forest Industry Council of Tasmania (FFIC), Chairman of Tasmanian Pure Foods Ltd and Director of Tandou Ltd	Chair, Compliance Committee	Joined the Board on 12 December 2005 in a non-executive capacity.

Chief Executive Officer and Company Secretary

Gordon Anthony Duff BSc(Hons), PhD, FAICD	CEO, CRC Forestry Ltd Member of the Board of the Northern Territory Environment Protection Authority Chairman, Forest Practices Authority Tasmania (FPA)	Chief Executive Officer, CRC Forestry Ltd	Previously CEO of the CRC for Tropical Savannas Management; joined the CRC for Forestry on 2 October 2006.
Mark Sheldon-Stemm CertComm, BSocSc, Grad Dip AgrEcon, MMgt, FPNA	CRC Forestry Ltd	Company Secretary, CRC Forestry Ltd (to 22 June 2010)	Joined the CRC in January 2008; previously Manager of the Burnie campus of the University of Tasmania.
Corinne Elizabeth Jager BSc(Hons), PhD, MPA	CRC Forestry Ltd	Company Secretary, CRC Forestry Ltd (from 23 June 2010)	Joined the CRC in December 2009; previously an accountant at BDO.

Program managers

Name	Organisation	CRC position/role
Dr Mark Hunt	Queensland Department of Employment, Economic Development and Innovation/ University of the Sunshine Coast	Manager, Research Program One
Dr Chris Harwood	CSIRO	Manager, Research Program Two
Mr Mark Brown	University of Melbourne	Manager, Research Program Three Industry Engagement Manager
Professor Brad Potts	University of Tasmania	Manager, Research Program Four
Professor Peter Kanowski	Australian National University	Chair, Education Committee

Committee membership and meetings

During 2009–10 there were four Board meetings, four Compliance Committee meetings, four Communications Committee meetings, and one meeting of the Commercialisation and Intellectual Property Management Committee. The Remuneration and Nomination Committee did not meet during this year.

The following table shows the total number of Directors' meetings (including meetings of committees of Directors) held during the year and the number attended by each Director (while they were a Director or committee member).

	Board of Directors	Compliance Committee	Communications Committee	Commercialisation Committee
Directors	n = 4	n = 4	n = 4	n = 1
Kate Carnell	4	3	2	
Hans Drielsma	4		4	
Lyndall Bull	4	3		
Gary Inions	4			1
Jim Reid	3			1
Robert Woolley	3	4		
Bob Pearce	4		4	
Geoffrey Wilson	4			

Board advisory committees

Compliance Committee

The Compliance Committee meets quarterly, in advance of the Board meetings, to receive the draft financial statements, budget and participants' report package; oversee risk management monitoring and reporting; receive and review reports from the auditors; and address any other major financial impacts of the company's business.

Member	Position
Robert Woolley (Chair)	Board member
Kate Carnell	Chair of the Board
Lyndall Bull	Board member
Gordon Duff	CEO
Mark Sheldon-Stemm	Business Manager and Company Secretary (Secretary)
Shelley Caswell (until October 2009)	Finance and Administration Manager
Corinne Jager (from December 2009)	Finance and Administration Manager

Commercialisation and Intellectual Property (IP) Management Committee

The Commercialisation and IP Management Committee met once during the year. The Committee's purpose is to review company strategies for determining the appropriate 'path to adoption' for each CRC research output, within the context of the CRC's IP portfolio. This includes use of external and in-house expertise; developing commercialisation plans for those outputs identified as having potential beyond own use by

industry participants; and policies and associated training and documentation activities for management of IP generated by CRC for Forestry research.

Member	Position
Jim Reid (Chair)	Board member
Gary Inions	Board member
Charlie Day	University of Melbourne, UM Commercialisation Pty Ltd
Mark Brown (Secretary)	Industry Engagement Manager
Gordon Duff	CEO
Mark Sheldon-Stemm	Business Manager and Company Secretary

Communications Committee

The Communications Committee meets quarterly, in advance of Board meetings, to review the communications strategy in consultation with the CEO and the Communications Manager. The Committee also receives quarterly progress reports against the communications plan, together with the forward program, and considers issues for advice to the Board.

Member	Position
Hans Drielsma (Chair)	Board member
Kate Carnell	Chair of the Board
Bob Pearce	Board member
Gordon Duff	CEO
Prue Loney (Secretary)	Communications Manager

Strategic Policy Committee

The Strategic Policy Committee is responsible for strategic planning and is convened as required. No meetings were held during 2009–10.

Remuneration and Nominations Committee

The Remuneration and Nominations Committee membership is dependent on the type of business which needs to be transacted. The Chair will normally be the Chair of the CRC Board (unless the matter to be addressed relates to the Chair's appointment, performance appraisal or remuneration). The committee is convened, and membership determined, as necessary to address matters in relation to nominations for vacant Board positions and determination of job specifications, advertising, selection, performance appraisal and remuneration of senior company executives. No meetings were held in 2009–10.

Member	Position
Kate Carnell (Chair)	Chair of the Board
Hans Drielsma	Board member
Gary Inions	Board Member
Jim Reid	Board Member

CEO committees

The CEO, with the approval the Board, has established the following committees with relevant interests and expertise to advise on the management of the CRC for Forestry:

Management Committee

The Management Committee assists the CEO in managing the day-to-day activities of the CRC. The committee meets at least six times per year.

Member	Position
Gordon Duff (Chair)	CEO
Mark Hunt	Program Manager, Program One
Chris Harwood	Program Manager, Program Two
Mark Brown	Program Manager, Program Three Industry Engagement Manager
Brad Potts	Program Manager, Program Four
Peter Kanowski	Chair, Education Committee
Mark Sheldon-Stemm	Business Manager
Prue Loney	Communications Manager
Shelley Caswell (until October 2009)	Finance and Administration Manager
Corinne Jager (Secretary) (from December 2009)	Finance and Administration Manager

Education Committee

The Education Committee includes a representative from each of the CRC's participating universities. Meetings are held as necessary to address issues of student recruitment, management and leadership development and development of short courses for industry.

Member	Position
Peter Kanowski (Chair)	Australian National University
Neil Davidson (Secretary)	University of Tasmania
Chris Weston	University of Melbourne
Mervyn Shepherd	Southern Cross University
Treena Burgess	Murdoch University

Program coordinating committees (PCCs)

PCCs are chaired by an industry-based representative, and include representatives of each participant that is active in the relevant program, plus the research program manager (who also acts as secretary). Core participants and multi-core participants (acting as a group) can elect to be on each committee.

The PCCs meet at least twice-yearly to address any major issues arising from research conducted within the relevant research program. In general the role of the PCCs is to assist the CEO in carrying out the CRC program as broadly defined in sections 16–21 of the Participants Agreement, in the best interests of all participants.

Project steering committees (PSCs)

PSCs are chaired by industry-based representatives, and include representatives of each participant active in the relevant project, plus the project leader (who also acts as secretary). The role of each PSC is to oversee implementation of the project as defined in the project agreement, and to ensure that the requirements of clause 18 of the Participants Agreement are met. Meetings are normally held at least quarterly.

Private sector representation on the Board and committees

Under the Participants Agreement, the composition of the Board must include a majority of members who have a background in the forest industry. All other committees (except the CEO's management and education committees) have at least one industry representative. Six of the eight Board members are from the private sector, including one from a government business enterprise.

Changes to participants

The CRC admitted three new members during the 2009–10 year. The University of the Sunshine Coast and Timberlands Pacific Pty Ltd (and its subsidiaries) both joined Program One and Australian Forestry Contractors Association joined Program Three. Great Southern Ltd and Timbercorp Ltd were expelled from the CRC after going into administration in the previous year. In April 2010 Forest Enterprises Australia was placed into administration and receivership. The CRC is monitoring developments and working with all parties to ensure research and participant contributions are maximised.

Participant	Retiring or New	Commonwealth Approval
University of the Sunshine Coast	New	Yes
Australian Forestry Contractors Association	New	Yes
Timberlands Pacific Proprietary Limited	New	Yes
Great Southern Limited	Retiring	Yes
Timbercorp Limited	Retiring	Yes

Variation to the Commonwealth Agreement

In November 2009 the CRC submitted a variation to the Commonwealth Agreement to the Department of Innovation, Industry, Science and Research for approval. The variation to the agreement related to the expulsion of Great Southern Limited and Timbercorp Limited in accordance with Sections 29 of the Participants Agreement, and admission of the University of the Sunshine Coast, Australian Forestry Contractors Association and Timberlands Pacific Proprietary Limited to the CRC. This change in participants also resulted in changes to milestones and budgets. The Department approved the variation in February 2010 and the amended milestones are reported against in this report.

Research programs

Program One Managing and monitoring for growth and health

Manager: Dr Mark Hunt

Summary

Australia's forest industries are on the one hand facing increased pressure to optimise production in the existing forest estate and on the other, embracing new species planted in new environments where experience is limited. Against the background of increased climate variability, this makes for a complex and challenging operating environment.

Additionally, forests are increasingly managed for a range of products and purposes, not only traditional extracted products such as wood fibre and timber but also environmental services including water and carbon.

The modern forest manager needs to understand how to optimally manage forests for the full range of values, and must further understand the effects of different management approaches on the targeted product mix.

One of the key challenges for forest managers today is harnessing the increasing amounts of data and new technologies to improve forest value (physical, social and/or economic). Implicit in this challenge is the need to develop a sophisticated understanding of risk and uncertainty and be able to apply this knowledge to make appropriate decisions that in many cases will have impacts well into the future.

Program One deals with information collection and interpretation, and its inclusion in forest management tools. Such tools are important because they can help evaluate sites, tell us about the influence of biotic (pests and diseases) and abiotic (primarily climate and soils) stressors on forest growth and health, and tell us about the influence on forest management outcomes of changes in the physical environment.

The best tools tell us both what is likely to happen given the status quo, and also how actions today or in the future will affect the eventual outcomes of interest to us.

Program One focuses on investigating questions that help us develop a much deeper understanding of the forest estate, developing models to make predictions and putting these models into decision-support systems to meet the needs of tomorrow's forest managers.

Program One is organised into seven projects. Three of these are large, multi-focused projects that address important thematic areas of investigation.

These and their subprojects are:

- | | |
|--------------------|--|
| Project 1.1 | Monitoring and measuring |
| Subproject 1.1.1 | Site evaluation |
| Subproject 1.1.2 | Monitoring of forest condition with remote sensing |
| Subproject 1.1.3 | Improved forest inventory through high-resolution remote sensing |
| Project 1.2 | Managing and sustaining |
| Subproject 1.2.1 | Sustaining site resources |
| Subproject 1.2.2 | Forest health |
| Project 1.3 | Modelling and information integration |

Program One also has four smaller, targeted projects that have been developed in response to widening stakeholder and participant need, a broadening in the capability of the program team and encouragement through the external review process. These additional projects are:

- | | |
|--------------------|--|
| Project 1.4 | Growth modelling and risk assessment for new environments |
| Project 1.5 | Parameters for describing sustainable landscape carbon stocks |

Project 1.6 Evaluation of models for the estimation of forest carbon

Project 1.7 The forest productivity optimisation system

The CRC has made good progress across the suite of projects and subprojects, although work on projects 1.5, 1.6 and 1.7 has only recently begun and these projects will not achieve reportable outcomes until 2010–2011.

During 2009–2010 a number of projects have moved from the investigative phase into product development, user testing and adoption by industry. Some of the key outputs this year are detailed below.

Key research achievements

Optimising outcomes through soils modelling

An important part of plantation management is understanding the soil properties of potential new sites and existing estates. Historically, this has involved intensive field sampling and required skilled soil scientists to interpret the data and map soil types. These soil maps give little indication of the variation seen across a landscape within a mapping unit.

The CRC for Forestry has developed a model that is able to use readily available soils data, coupled with an understanding of the landscape processes that contribute to site quality. The model provides fine scale data that can be used in forest management in a range of ways — for example, as input into process-based growth models to predict how successful a site will be, to explain the variation in growth seen across existing estates, and to select the best location for new roads within a forest.

The regional soil transport model (Subproject 1.1.1) produces results that allow plantation managers to undertake rapid site evaluation and make informed decisions about where to plant to optimise growth and survival of trees.

The model has performed strongly during initial validation in the field during trials in New South Wales. Because factors such as geography and climate vary markedly across Australia, the model will undergo further field trials in Western Australia, Tasmania, and the Green Triangle region, to confirm its performance under different climatic and geographic circumstances.

The CRC expects to release the model to industry within 18 months.

Forest management from space

The health of growing forests can be impacted by a range of disturbances. On the ground monitoring is essential, but is time-consuming and expensive. Satellite remote-sensing can be used effectively and relatively cheaply as a forest health surveillance tool.

The CRC has developed an algorithm ('BFAST') to help plantation forest managers interpret the health of their forests, and is developing a web interface to provide desktop access to satellite data (Subproject 1.1.2).

The CRC tool uses images transmitted daily from the MODIS (Moderate Resolution Imaging Spectroradiometer) satellite. The BFAST algorithm flags substantial changes in forest health to forest managers and helps them to plan on-ground investigations and intervention activities. The web-interface will also allow access to higher resolution images to aid decision making.

In parallel, an ongoing project with the Department of Sustainability and Environment (Victoria) is evaluating the BFAST algorithm for its usefulness in routine identification of trends and major disturbance events in public native forest. In native forests the satellite data are more difficult to interpret due to increased inherent variability in native forest systems compared to plantations, in part because of the greater contribution of the understorey to the forest mass. This issue is being addressed through combining approaches that provide more information from the field and those that rely on more complex processing of the existing data.

Second-rotation sustainability

Researchers have long suspected that activities undertaken during and between forest rotations affect the productivity of subsequent rotations. Work undertaken by the CRC over the past year has provided the first data confirming the nature of this impact.

Measurement of soil carbon and nitrogen use has been undertaken in experimental sites that are mature enough to allow comparison of the effects on site productivity of soil water and nutrients between rotations.

A key finding of this work is that second-rotation productivity is likely to be more variable across the estate than first rotation productivity, with some sites (typified by low rainfall and deep profiles) unlikely to attain similar levels of productivity in the second rotation until the soil profiles are refilled with water.

In addition, nitrogen (N) management is likely to be a key factor in ensuring that productivity of the second rotation approaches that of the first rotation. Most plantations require more nitrogen fertiliser to achieve similar levels of productivity. Without fertiliser supplementation, lower soil N status in the second rotation is likely to reduce the water use efficiency of wood production, resulting in sites without N fertiliser growing markedly less wood per unit of available water. In addition to fertilisation, on site residue retention at harvest will be an important component of multi rotation nitrogen management.

During the year the CRC established a new network of experiments, in partnership with WAPRES, Australian Bluegum Plantations, Albany Forest Research Centre and Elders Forestry, to explore the response to N fertiliser across a range of second-rotation sites. The first year results are due shortly. Preliminary results are showing that second-rotation plantations are responsive to N fertiliser, and we aim to develop a diagnostic of responsiveness over the next year.

These results and knowledge can be integrated with the CRC's modelling tools to allow predictions about the likely impact on productivity and the extent to which we can ameliorate the problem through the addition of fertiliser to second-rotation sites.

Mapping forests using optical remote sensing technology

In forestry, airborne LiDAR¹ technology is widely used whenever reliable maps or models are needed of the terrain beneath the forest (e.g. for locating water sources, designing drainage, or planning roads or harvesting). Before LiDAR, maps and models of terrain and forest structure were based on information obtained by time-consuming and costly surveys conducted by people on the ground, which provided much less accurate and detailed information. In addition to information about terrain, LiDAR also allows us to capture a huge amount of information on forest structure in one complex and comprehensive data gathering exercise.

LiDAR is helping us better understand the three-dimensional structure of forests by providing highly accurate measurements of canopy height and density of cover at a given point in time. From this information we can derive measures such as biomass and stem volume (volume of harvestable trees).

CRC researchers have developed protocols to optimise LiDAR data capture, and methods to allow forest managers to extract and use the relevant parts of the huge amounts of information obtained via this technology easily and quickly.

Subproject 1.1.3 was finalised during the 2009–10 year within budget, with milestone reporting complete and deliverables now adopted and used by industry partners.

Using technology to optimise blue gum productivity

During 2009–10 the CRC began road-testing the beta version of a new decision-support tool began. The Blue gum Productivity Optimisation System (BPOS) allows models to be run for plantation estates in an intuitive and user-friendly way. Plantation managers are able to enter site-specific information (such as local climate and soil quality) that interacts with a detailed 'behind the scenes' model to produce accurate predictions about productivity over the life of the rotation at the stand level.

BPOS allows managers to run 'what if' scenarios, the outcomes of which will help them make decisions about issues such as site selection, fertiliser regime and harvest timing.

Feedback from industry users is being incorporated into the release version of BPOS, which is expected to be available by the end of 2010.

¹ LiDAR (Light Detection and Ranging) is an optical remote-sensing technology in which a LiDAR instrument attached underneath an aircraft uses high-speed laser pulses to generate three-dimensional data about terrain or landscape features as light bounces back from the ground, understorey and canopy. The equipment also takes into account the orientation and precise location of the aircraft.

Understanding responses to weed competition

A new site in southern Tasmania is being used to study the physiological responses of blue gum (*Eucalyptus globulus*) canopies to weed competition (Project 1.3). The aim of this work is to develop a mechanistic understanding of competition within plantations. The effects of competition are often evident, but understanding how and why competition impacts on tree growth is critical to developing interventions that enhance plantation productivity.

The physiological work extends the understanding being gained from a network of paired plots set up around Tasmania since 2006. To date we have more than 40 plots across a range of environments. This dataset is being explored in detail to tease out the complex interaction of weed growth, tree growth and the environmental drivers of tree/weed competition. Over the next 12 months the CRC is hoping to answer fundamental questions such as 'Under what conditions is weed competition important?', and 'How good are current management practices?'. Already some interesting results are emerging, with differences being observed in biochemical processes governing photosynthesis between weed plots and control plots (weed free). At this stage the results are very preliminary and are under further investigation.

In order to undertake sound research that addresses issues of significance to industry, robust and well-designed field experimentation is critical. This network of sites will also provide a powerful validation dataset for some of the modelling tools being developed or enhanced in Program One, such as Cellular Automata (see below) and CABALA.

Modelling for management of tropical and subtropical forests

Most forest research in Australia has focused on hardwood plantations in the temperate climate of temperate south-eastern Australia. Over the past 10 years, this has expanded to include the Mediterranean climate of Western Australia, but work has remained largely focused on one species, blue gum (*Eucalyptus globulus*).

With a large land base available in northern Australia, interest has recently shifted to subtropical and tropical species.

In order to make various models developed by the CRC applicable to these forest types, we need to fully understand the physiology of these species, and also consider climatic and other variables, so that this knowledge can be built into modelling tools.

Species of particular interest are the large red fruited mahogany (*Eucalyptus pellita*), Dunn's White Gum (*Eucalyptus dunnii*) and Queensland spotted gum (*Corymbia citriodora* subsp. *variegata*). The CRC has largely completed the physiological work needed for CABALA model parameterisation of these species and built draft parameter sets for *E. dunnii* and *Corymbia citriodora* subsp. *variegata* as well as *E. pellita*. We expect to complete the validation stage of the project in 2011 and to roll out a parameterised version of CABALA to industry partners in early 2012.

Seeing the trees in the forest

Modelling tools presently being used to integrate and apply our understanding of tree growth and health provide outputs primarily at the stand level rather than the tree level. However, there are many reasons why it can be important to know the distribution of growth among individual trees within a stand rather than simply the total amount of tree volume or tree biomass per hectare of forest. The distribution of tree sizes within a stand has a very important bearing on patterns of growth at the stand level, and has economic and practical management implications for harvesting, product use and water use.

The CRC is developing the Cellular Automata model of size class distributions to help predict growth at the individual tree level and to better understand the effects on growth of competition between individual trees. We introduced the model to program partners at a workshop in November 2009. It has evolved considerably over the past 12 months, incorporating many of the insights gained from detailed physiological studies conducted on blue gum (*Eucalyptus globulus*). Further industry partner workshops will be held in late 2010 to explain the use and potential of this model.

In addition to the Cellular Automata model, which is physiologically based, Project 1.3 is exploring a range of statistical approaches to size class distribution modelling, including the functional regression tree method. The greater predictive capability that will be generated by this work has significant implications not only for the modelling work within 1.3 but also in the other programs where piece size and stocking are important for understanding harvesting costs, wood quality and site water use.

Determining impact of pests on plantation productivity

CABALA modelling

Pests are present in all forests, and one of the focuses of Program One has been to provide forest managers with tools to help quantify the impacts of pest damage and examine cost-effective management options to reduce pest impact. In previous years the focus has been on understanding how trees respond to defoliation. This understanding is now encapsulated in the latest version of the process-based model CABALA, with the model validated to accommodate effects of water and nutrient stress, pattern of defoliation, and tree age on defoliation responses. Over the past year, our work has focused on gaps in knowledge that will improve the performance of the model, with experiments to capture physiological responses of radiata pine (*Pinus radiata*) to defoliation, and of *E. globulus* and *E. nitens* to bud and tip damage.

Defoliation in the model is defined by the user, based on three horizontal (upper, middle and lower) and two vertical (inner and outer) crown positions. The user indicates the proportion of the crown in each zone that has been defoliated or is suffering from necrosis. This information would generally be entered into CABALA following a field health survey. CABALA includes scope to develop a range of defoliation 'scenarios' to help define threshold levels of defoliation for specific sites, above which productivity will be affected. This could help with risk assessment and in identifying how risk profiles might change in the future.

The CRC presented this model at an industry workshop in December. Flowing from that workshop, a number of case studies were initiated to highlight how the model might assist with operational decision-making.

Essigella damage in P. radiata stands

The CRC's work on the impacts of defoliation on productivity has focused primarily on eucalypts, and there is relatively little understanding of responses of conifers to defoliation. To redress this, we conducted a study to examine the impacts on *P. radiata* growth of defoliation associated with the sapsucking insect *Essigella californica*. The study found that both moisture stress and aphid-induced defoliation constrained the growth response to thinning. However, thinning may have helped damaged trees to maintain growth rates similar to trees with little or no damage. An associated study found that *P. radiata* at least partially compensated for defoliation by increasing photosynthetic rates.

Nature of major consultancies and their contribution to the CRC

No major consultancies have been undertaken within Program One during 2009–10.

Nature of any grants and how they contribute to the CRC

The CRC for Forestry now leads the FWPA-funded project on carbon parameters. The objectives of the project are to review the existing state of knowledge and the present conceptual framework for considering carbon sequestration as a management objective in Australian forests, particularly those currently being managed for fibre and timber production. This project is now designated Project 1.5 within the CRC project portfolio.

The BPOS project (part of Project 1.2.1, see above) has now developed into the FPOS project (Forest Productivity Optimisation System), which will extend the BPOS decision-support system in a number of key areas, including five additional species, future climates, and different product types. This work is being funded by CRC partners and FWPA. FPOS is now CRC Project 1.7 and its objectives include the extension of the BPOS decision-support tool to five additional species and to additional growing environments.

Any changes proposed to future research directions

As part of the CRC for Forestry's broader recognition of the challenges facing Australia's forest-based industries, Program One has begun new work to help develop an understanding of the forest carbon cycle as it relates to the range of products and services likely to form part of future production forest management objectives. This follows the enhanced focus on forest water use jointly undertaken by Program One and Program Four in 2008–09. With the strong research program on forest biodiversity within Program Four, the increased emphasis on water and now carbon underpins an increasing recognition of the future potential role of environmental services in the product mix of commercial forestry organisations.

Program Two

High-value wood resources

Manager: Dr Chris Harwood

Summary

The value and profitability of eucalypt plantations can be increased through improvements in genetics, silviculture and the accurate assessment and prediction of wood quality in standing trees.

The majority of plantations are grown solely for pulpwood, and this section of the industry is primarily interested in improving volume production and increasing wood density and pulp yield. Other forest managers are developing plantations to serve solid and engineered-wood markets, where different log and wood quality criteria are important. The relationships between log and wood traits and performance in processing systems (for example, sawing and drying performance) are critical in defining and improving value. The CRC for Forestry is conducting processing studies and liaising closely with other processing research groups to better understand the wood properties that drive value for different end uses.

Program Two aims to:

- o develop tools and methods to improve the quantitative and molecular breeding of eucalypts used for both pulpwood and solid-wood products
- o develop empirical models of growth and size-class distribution in silviculturally managed stands that will link to the process-based models (such as CABALA) being developed within the CRC's Program One
- o increase understanding of how the scheduling of pruning and thinning affect log and wood traits, processing performance and consequent value
- o improve the assessment methods for key wood traits at the individual tree and stand levels
- o develop decision-support systems that integrate information on germplasm, site, silviculture and stand assessment to enable plantation managers to maximise profitability for defined end uses.

The program is structured around research projects addressing five key themes:

Project 2.1 Breeding for high-value wood products

Project 2.2 Silviculture for high-value solid and engineered wood products

Project 2.3 Impact of silvicultural interventions on wood quality

Project 2.4 Incorporating wood quality into plantation estate management

Project 2.5 High-value wood products from subtropical plantations

Key research achievements

Processing trials for *Eucalyptus nitens*

The CRC completed two major processing studies on plantation-grown logs of shining gum (*Eucalyptus nitens*) this year. CRC Technical Reports 200 and 202 (in press) report that surface checking in sawn boards of *E. nitens*, previously identified as an important value-limiting defect of high-value appearance uses, could be largely eliminated through appropriate sawing, drying and reconditioning strategies. Evaluation of a range of drying treatments showed that internal checking, another important defect for some applications, could be substantially reduced but not eliminated, except in very thin-section boards. A rotary veneering trial on plantation-grown *E. nitens* logs demonstrated higher volume recovery of veneer sheets of acceptable grades from pruned logs, compared to unpruned logs. Veneer recovery was highest from the bottom 1.9m billet (64% of green billet volume from pruned logs), and checking defects from sawn boards are more severe in this lowest part of the log, suggesting the possibility of allocating different log sections to different processing systems to achieve maximum value for this species. A study by Blackburn *et al.* (2010) demonstrated that internal and surface checking were under strong genetic control in *E. nitens*, offering the prospect of eventually reducing these defects through breeding programs.

Breeding for wood density and pulp yield in *Eucalyptus globulus*

Important findings were published this year on the quantitative genetic control of wood density and pulp yield in blue gum (*Eucalyptus globulus*), including substantial differences in pulp yield between geographic races, and improved genetic correlations among growth, density and pulp yield (Stackpole *et al.* 2010a, b). Industry partners are incorporating these findings into their pulpwood breeding programs.

Mapping the genome of *Eucalyptus globulus*

The successful development of the DArT molecular marker system for eucalypts, which will be used in our molecular breeding project, was reported by Sansaloni *et al.* (2010). The DArT technology will help transfer quantitative trait loci (QTL) and gene information across eucalypt species and populations and result in a quantum leap in efficiency of QTL detection and discovery of genes of economic, ecological and evolutionary importance.

The DArT system has already revealed that the order of genes along chromosomes of *E. globulus* is nearly identical to that of flooded gum (*Eucalyptus grandis*), whose genome has been sequenced and made public (Hudson *et al.* 2010). Applying the DArT technology to the analysis of *E. globulus* progeny trials should enable — for the first time — a detailed understanding of which part of the genome contributes to variation in economically important wood traits such as cellulose content and pulp yield. The CRC is working on how to incorporate this molecular knowledge into eucalypt breeding programs to enhance wood properties and ultimately contribute to more profitable industries.

Predicting growth response following thinning

A regression approach was developed for improved empirical modelling to more reliably predict the growth response of individual trees following thinning in plantations of *E. globulus* and *E. nitens* managed for sawlog production (Wang *et al.*, accepted). The models included components for describing the effects of tree size, site quality, thinning, and competition between trees, enabling growth predictions with or without thinning at different intensities.

Predicting pulp yield

Understanding how wood properties vary through the annual growing cycle, and from year to year as the tree grows, is fundamental to the evaluation and prediction of tree and plantation value. Surface scanning of radial wood sections for cellulose and Kraft pulp yield content using Near-infrared (NIR) spectroscopy was developed for *E. nitens* during the year (Downes *et al.* 2010, accepted), and calibrations for *E. globulus* are now being finalised. These, and similar radial calibrations for basic density and cellulose microfibril angle, will enable us to undertake systematic surveys of the occurrence of tension wood in *E. globulus*. This will lead to better understanding of how site conditions, silviculture and genetics jointly determine tension wood occurrence, which has been shown to be the most important factor leading to downgrade of sawn boards from pruned plantation-grown *E. globulus* logs.

Nature of major consultancies and their contribution to the CRC

No consultancies were undertaken during 2009–10.

Nature of any grants and how they contribute to the CRC

No grants were received during the reporting period.

Any changes proposed to future research directions

In late 2008, the Program Coordinating Committee (PCC) determined that available resources would not be sufficient to conduct major processing trials on plantation-grown *E. globulus* that had been scheduled as part of the work program for Project 2.3 (milestone R 2.3.2). Because processing trials undertaken outside of the CRC indicate that tension wood is the primary cause of board degrade in pruned *E. globulus*, effort will instead focus on surveys of *E. globulus* plantations, using radial scanning of wood samples, to better understand and predict the occurrence of tension wood, as affected by site, silviculture and genetics (milestone R 2.3.2).

Program Three

Harvesting and operations

Manager: Mr Mark Brown

Summary

One of the greatest cost components in the production of forest products is the expense of harvesting and transport. These operations must be efficiently planned and implemented to ensure that they are cost-effective and safe.

The primary objective of Program Three is to significantly improve the efficiency, effectiveness and safety of the forest harvesting and transport operations of the CRC's industry partners by applying the findings of quality studies in harvesting and transport operations across a range of Australian industrial forest conditions. Through this research and application of the results, we will achieve a secondary objective: to build capacity in technical expertise in forest harvesting and transport operations in Australia.

Unlike our other core research programs, Program Three does not have any official projects. It is, however, structured around five key themes:

1. developing a better understanding of the performance of different harvesting equipment in different conditions to make harvesting more efficient and cost-effective
2. improving productivity and reducing the cost of applying different harvesting systems across sites and operations in Australia
3. improving value recovery and use of the forest resource
4. testing the application of technology in transportation for improved efficiency
5. developing and testing improved logistics techniques for improved transportation efficiency.

Key research achievements

The CRC has maintained the focus of Program Three on field-based research in collaboration with industry partners. The early and ongoing success of industry-based projects has allowed the CRC to build additional support within the Australian industry and also leverage this support to develop valuable international collaborations that will help deliver future research milestones.

The CRC has also capitalised on increasing industry interest in using forest biomass for energy production, and other uses, to initiate work on developing efficient harvest and haulage systems for biomass in Australia (milestone C&U 3.2.5).

Optimisation and value recovery

Optimising forest operations helps ensure the maximum value can be recovered. Optimisation can be applied across the entire supply chain, including quality of measurement, system calibration and defining relative product values for the required product mix.

For the most part industry believes the use of optimisation can extract higher value products. However the actual value that can be achieved through recovery and sale of these higher value products depends on demand from the market. Anecdotal evidence, following early trials of optimisation technology, has indicated that industry has been able to meet customer demand for a given product using up to 10 per cent less resource. This suggests there is a benefit to be achieved even in a restricted market and we have started trials to document this impact.

It is also clear that with the current optimisation systems, the decision is driven solely by basic external dimensions that can be easily measured by the harvester head. The true value decision is driven by other factors that cannot be directly measured: solid wood dimensions (under bark), internal defects and wood strength. Determining the level and nature of internal defects is currently beyond the reach of available technology but the solid wood dimensions can be effectively predicted with the addition of proper bark function in the optimisation software (an issue we continue to discuss with other countries that want to address the issue for the same species of interest in Australia). In the past year a new opportunity to measure wood strength or stiffness has emerged. The CRC is investigating an acoustic testing attachment

that enables a strength quality measurement to be taken as part of the harvester head optimisation decision.

We have continued to use ground based LiDAR to better predict the mix of products within a given plantation or forest prior to harvest activities. With this level of detailed inventory it is expected that even greater value can be achieved in combination with harvester optimisation as plantation selection can be managed to market demands, marketing can be targeted to those clients that can make the highest value use of the resource and operations can be better targeted to resource conditions. To this end the CRC has continued work with the European developer to adapt their stem predictions to Australian species, introducing functions developed on Australian species and through the use of case based reasoning with an extensive database of real Australian stem profiles. Semi-commercial trials are planned for the coming year.

Onboard computers for effective operations management

The CRC, through Program Three, has continued to make use of different onboard computer systems within machine performance trials, with particular focus on observing accurate long-term performance. This has been done with some of the purpose-built units identified and tested in earlier work, with adjustments made to respond to specific operational tracking needs. Based on the knowledge gained from using these systems the program has also begun a trial of very low-cost (under \$300) generic sensors that can measure one specific performance indicator. Early trials over the past year have shown some promise in addressing very specific industry needs without the purchase price hurdle of the more comprehensive purpose-built systems.

The main focus of the research in this area was establishing three case studies to inform development of guides to selection and implementation of onboard computer systems, funded by Forest and Wood Products Australia. Unfortunately two of the three systems selected for the trial have not delivered the operational information they are designed to provide, in most cases due to technical difficulties (equipment failure). However, the process of troubleshooting and resolving the problems has provided very strong experience to develop the guides. A fourth case study will be established in collaboration with international colleagues. This work will involve pre-production technology being developed by a research organisation in Canada and the establishment of a complementary technology trial in South Africa with the technical support of the CRC for Forestry.

Harvest system productivity and management

The program has continued to conduct field trials based on the defined machine evaluation framework, to build and strengthen the data for machine productivity and performance predictions with a number of field studies that individually address a specific industry question and combined produce a suite of productivity models. The models have been combined into an operational decision-support tool for predicting machine performance in expected forest conditions and a draft version of the tool, ALPACA, (milestone C&U3.2.2) has been delivered to industry partners for use and evaluation through a workshop (milestone C&U3.1.2). Based on industry feedback the tool will be improved over the next year, using field trials to test and refine enhancements.

Success of machine evaluation studies to address industry needs and concerns has led to greater interest and demand for machine evaluation. Recognising that the CRC's small research group will not be able to meet all industry demands for machine evaluation, and many of their demands will be repetitive management evaluations rather than research, we have produced a machine evaluation toolbox for industry. The toolbox provides the user with explanations on how to do effective machine evaluations based on the framework designed by the program, provides them with field forms to easily collect the data and a set of calculation tools to do basic interpretation of the data. A draft has been circulated to industry partners for testing and feedback and will be finalised with full documentation over the next year.

Identifying the different levels of performance of different machines in different forest conditions is generating interest across industry in making better-informed decisions about machine replacement. The replacement of a forestry machine is a complex problem that involves not only the machine in question but how it interacts with other machines in the operation and how that interaction changes when a machine is added or changed. The CRC, working with a math student and in cooperation with forest harvest and haulage contractors, has developed an optimisation function to explore the decision from a whole-of-harvesting-system perspective rather than a single machine. This function will be presented to the industry as a decision-support tool in the next year.

Biomass harvesting

Over the past year there has been growing industry interest in biomass as a new product from plantations. In preparation for expected demand for biomass the CRC has begun trials to look at the costs of different approaches to recovering different levels and types of biomass from the current forest product harvest residue (working towards milestone C&U3.2.5).

Knowing the European forest industry is well advanced in the harvest and transport of forest biomass we started with an extensive review of the technology and methods used in Europe and identified those most likely to be effective in the Australian conditions. Adjacent to the review of European harvest technology the program also participated in a review to see what the value of forest biomass was likely to be in energy production with currently commercial technology and likely Australian policy environments. This review found values that would be attractive for specific areas and resources, provided the harvest and haulage could be done efficiently.

With these reviews in hand we consulted with industry partners and have started trials looking at harvesting smaller stem wood within current harvest systems for biomass use and directly harvesting a low-yielding plantation, not economically viable to harvest as pulp chip, as a biomass crop. Analysis of these trials is ongoing and will be reported to partners in the first half of the year. We have also planned trials using a biomass bundler to collect harvest residue and a forwarder-mounted mobile chipper to conduct a similar task.

Transport efficiency

With industry slowdown related to decreased export demand and the failure of forestry Managed Investment Scheme companies, the expected major growth in transport demand (particularly in western Victoria) has been delayed. As a result, the CRC has postponed work planned to test high-productivity trailers. This is an extension of earlier work by the CRC, which identified the key role of payload to overall transport efficiency. However, a trial of similar transport equipment has begun in the mining industry in western Victoria. We will watch the outcomes of that trial with interest and may apply learnings to the woodchip transport trial when it begins.

Truck scheduling and logistics management

The CRC presented a logistics optimisation planning tool for forest operations running in-field chipping operations, FastTRUCK to industry partners for evaluation (milestone R3.2.11) through a workshop (milestone C&U3.1.2). We also worked with one partner to use the tool as part of a strategic planning exercise for a new area of operation it will open in the coming year. Based on the results the company was able to avoid a very significant capital expenditure in its new receiving facility. The trial also identified that if the company's operations were set up according to the optimised plan, transport costs would be reduced by at least 10 per cent compared to original estimates. We will continue to develop the tool, based on industry feedback, to fit the more complex multiple-log-product operations that are typical in pine plantations and native forests.

Nature of major consultancies and their contribution to the CRC

No consultancies were undertaken during 2009–10.

Nature of any grants and how they contribute to the CRC

The CRC continued work on a project part-funded by a two-year grant from Forests and Wood Products Australia, to develop selection and implementation guides for the use of onboard computer systems. This grant was awarded in March 2009 and work will be finalised in 2010–11.

Any changes proposed to future research directions

There were no major changes to program direction during 2009–10.

Program Four Trees in the landscape

Manager: Professor Brad Potts

Summary

Program Four focuses on developing forestry practices that meet and improve upon agreed environmental certification requirements and foster constructive community engagement. These practices are important as they will provide security for the forest industry's long-term 'licence to operate' in the Australian landscape, and build international recognition of sustainable forest practices for product marketing.

The program is structured around research projects addressing six key themes:

Project 4.1 Water quantity and quality

Changes to forest cover have the potential to alter catchment water balance, and there are community concerns that forestry operations such as harvesting and fertilisation can affect water quality, stream morphology and aquatic habitat. The aim of this project is to improve prediction of water quantity and quality responses to a range of forestry practices.

Project 4.2 Biodiversity

This project provides research to inform the development of strategies, protocols and policies to ensure that biodiversity values are sustained and enhanced in the forest environment and landscapes.

Project 4.3 Communities

It is important to understand the social and economic implications of ongoing change within the forest industry, as well as the impact of changes in rural and regional areas on the forest industry. The CRC is conducting research into the social dimensions of Australia's forest industries to ensure forest and plantation management is socially as well as environmentally sustainable.

Project 4.4 Industry pest management group (IPMG)

This project coordinates regular monitoring of natural enemy and insect herbivore activity in blue gum (*Eucalyptus globulus*) plantations, develops protocols for assessment of insect pests and provides regular technology transfer through field days and training of staff in forest management operations.

Project 4.5 Land-use change

This project concluded at the end of 2008.

Project 4.6 Water use and water-use efficiency of eucalypt plantations: from stand to catchment scale

This project began in December 2008. It aims to improve understanding of the effects of plantation establishment and management on water use and water-use efficiency from the stand to catchment scale. This project will draw on outputs from Program One and Project 4.1.

Project 4.1 'Water quality and quantity' (linked with Project 4.6)

Project Leader: Dr Don White

Key research achievements: Project 4.1 and 4.6

This section reports activities and achievements for Projects 4.1 and 4.6, which are concerned with the effects of forest management on water quality and stream flow (water yield). Work is delivered through six subprojects that collectively aim to develop a process-level understanding of the relationships among forest management, productivity and water outcomes. The subprojects deliver outcomes on (i) water yield, (ii) water quality, and (iii) growth and water use of plantations.

This year has seen a marked increase in outputs from this project, with more than 20 peer-reviewed papers. The potential of wildfire and controlled burns to affect water quality has received a lot of recent media attention. In the wake of the Black Saturday fires, Pat Lane and colleagues at the University of Melbourne contributed to new research and media and scientific presentation of current knowledge and analysis.

Water yield

Several of the subprojects in Project 4.1 are concerned with the effects of forest management (including plantation establishment) on catchment yield or stream flow (4.1.1, 4.1.2, 4.1.3 and 4.6). This work on water yield is augmented by a number of projects in Program One that are quantifying and building models of plantation water use at the stand scale. These projects have demonstrated that soil drying during the first rotation of blue gum (*E. globulus*) has a profound effect on productivity and water balance during the second rotation. This understanding has been captured in stand scale models and will underpin larger scale analysis of impacts on stream flow and opportunities for management in project 4.6.

Work looking at the long-term effects of thinning on vegetation condition and structure and water yield is nearing completion. Along with more standard hydrologic methods this work has successfully used LiDAR to characterise key vegetation parameters required for predicting stand water use. The research indicates that water gains from thinning will be short-lived and after several decades streamflow may be reduced compared to unthinned forest. This work also adds to and benefits from ongoing University of Melbourne research into predicting hydrologic responses to native forest disturbance.

During 2009–10 the CRC produced a technical report on water quality in the Warra LTER. The analysis shows that in the Warra LTER catchment, characteristics such as geology, vegetation type, drainage density and stream morphology may have as great or even a greater influence on water quality than disturbance or management history.

Last year the CRC reported on an important study on the stand-scale growth, water-use efficiency and nutrient cycling of mixed *E. globulus* and *Acacia mearnsii* stands. This work has now been published, one of the first published studies of the water-use efficiency of wood and above-ground biomass production in plantations worldwide. We reported that mixtures were more water use efficient than pure stands of either species.

The Croppers Creek catchment in north-east Victoria that was burnt in the 2006–07 bushfires has given us an opportunity to measure and compare the early response of burnt mixed-species eucalypt forests and second-rotation pine plantations. Modelling of pre-fire radiata pine water use at both plot- and catchment-scales in a parallel project using the 3PG+/CAT modelling framework has proven successful and has been published (milestone R 4.1.2; milestone C&U 4.1.3). This work demonstrates that recent improvements to the 3PG+ model better represent the hydrologic processes in planted forests, and presents a successful test of the model using field data.

Water quality

Research on the impact of controlled burning on water quality aims to provide management guidelines for protection of water quality from prescribed fire. In the past 12 months substantial progress has been made in this area of work, linked to milestone R 4.1.3.

Work on the Long Corner Creek paired catchment experiment is nearly complete and a paper has been published on the water quality impact of prescribed burning. Although this paper reports an increase in sediment and phosphorus inputs to streams following patchy prescribed burns in 2005 and 2006 the absolute amounts are small and of similar order to exports from a range of treated and untreated catchments in the same year. The fire in Croppers Creek provided an opportunity to measure the comparative effect of wildfire on water quality in a pine plantation (burnt then logged) and two mixed-species eucalypt catchments (one also subject to a fuel-reduction burn). All three catchments have long-term datasets for comparison. Considerable work has gone into infrastructure repair, re-instrumenting the catchments, and sediment and nutrient sampling. The CRC has completed a draft Technical Report, submitted a journal paper on the changes to hydrology and to sediment and nutrient loads, and undertaken modelling to inform management practices to minimise the impact of salvage harvesting after fire on water resources (linked to milestone R 4.1.2).

Between 2007 and 2009 a paired catchment study was established at Willow Bend Farm, approximately 50 km south of Hobart, that compares an untreated catchment with a catchment in which the riparian zone is being planted to *Eucalyptus globulus*, *Eucalyptus nitens* and *Acacia melanoxylon* plantations. During 2009–10 measurements have included stream flow at the weirs and water quality there and at piezometers and lysimeters. The plantation is growing well, with average tree height of about 3 m at two years of age, and

expected to reach peak LAI during the next two years. To date, there has been no discernable effect of the trees on soil water content or stream flow.

The Pet catchment near Burnie was selected for a study of the effects of harvesting on water quality. Mature *E. nitens* plantations in the riparian zone along 500 m of a stream reach were harvested in Autumn 2009. Sampling of a stream transect from above to well below the harvest site has continued post-harvest. There was no evidence that harvesting and re-establishment increased sediment delivery to the stream.

Water use and water-use efficiency of eucalypt plantations: from stand to catchment-scale

This project commenced in December 2008 and will deliver outcomes related to milestone R 4.1.2 and milestone R 4.1.3. Existing projects will improve our understanding of the effects of forest management at the plot or compartment scale (Program One) and at the catchment scale (Project 4.1). This project will maximise the impact of these existing projects by bridging these two scales of prediction. We will quantify the relationship between plantation growth, carbon sequestration and water use from the compartment to the catchment scale.

We have made substantial progress selecting and instrumenting two catchments in Tasmania and WA and collating land-use change, stream flow and plantation growth and management data for these catchments. The two catchments will provide the basis for comparing water use and water-use efficiency of different land uses.

In parallel we are developing a new modelling approach to quantify the water balance in a catchment by considering the use and movement of water across a hill slope. We reviewed the literature and tested several models. The main objective is to link a model of distributed flow to the growth and water balance models in the 3-PG spatial forest growth model.

Nature of major consultancies and their contribution to the CRC

No major consultancies were undertaken by the project during the reporting period.

Nature of any grants and how they contribute to the CRC

No direct grants have been awarded during the reporting period to Project 4.1 'Water quantity and quality' however major grants were awarded to CRC for Forestry participants at the University of Melbourne, the Forest Products Commission and CSIRO, which will contribute directly to the CRC's water research outcomes.

Any changes proposed to future research directions

Collectively, projects 4.1 and 4.6 represent a significant and coherent body of work on the effects of forest management on water quality and yield. When considered together with work in Program One (subprojects 1.2.1, 1.1.2 and Project 1.3), the CRC has a portfolio of research on forests and water that is measuring and modelling water impacts from leaf to catchment scales. It is distinguished from other activities on forests and water (National Water Commission projects, e-Water CRC, CSIRO Water for a Healthy Country Flagship) by a focus on the effects of forest management and climatic variability on water yield and quality in the context of other forest values including wood production.

During the past year, the project team developed a three-year plan that maps out the path to delivery of the project research milestones and outputs as defined in the Commonwealth agreement and in the project agreements. This identifies the relationship between all project outputs, including journal papers, and higher level CRC deliverables. This plan emphasises the delivery of:

- process-based understanding of the effects of forest management on water yield and quality and relationship to other values, particularly wood production and carbon sequestration
- translation of this fundamental knowledge into decision support for forest and water resource managers
- publication in high-impact journals as a means of benchmarking our science
- integration and meta-analysis of ecosystem-specific results.

The components of projects 4.1, 4.6 and RP1 concerned with water are studying the effects of forest management on water flow, water quality and biodiversity in natural and planted forests in four Australian states. The complexity of interactions between forest management and water are such that our work is

testing and applying a range of models that represent hydrologic processes within stands and catchments. These include 3PG+, 3PG-FLUSH, Hydrus, FLOTUBE, Kiriross and CABALA. At the same time the forests and communities work in project 4.3 has identified real or perceived water impacts as key determinants of community attitudes to plantations and their management. Given this a clear challenge for the forests and water team is to distil the essence of this complex array of projects, results and models so that project improves clarity for community and industry. Thus, communication, interaction and engagement will be the major focus of our work in the next year.

Project 4.2 'Biodiversity' (linked with Project 4.4)

Project Leader: Professor Brad Potts

Key research achievements

Research in Project 4.2 'Biodiversity' is undertaken in 10 subprojects grouped under three themes. The project also links with Project 4.4 'Industry Pest Management Group', focusing on integrated pest management in blue gum (*Eucalyptus globulus*) plantations in south-west Western Australia and the Green Triangle (see page 28).

Monitoring and management of biodiversity in forestry landscapes

Alternative silvicultural systems to clearfelling in wet eucalypt forests are being explored as a means of providing better biodiversity outcomes in production forest landscapes (leading to milestone C&U 4.2.7).

Student projects have quantified the adverse biological consequences of soil compaction and disturbance associated with the use of machinery in making fire-breaks to protect aggregates as well as adverse effects on eucalypt seedling recruitment. This understanding has helped drive changes to practice to reduce firebreak and disturbance impacts by, for example, using excavators rather than bulldozers. Research and adoption outcomes were highlighted at a CRC and Forestry Tasmania 'Variable Retention (VR) Field Day' in the Styx Valley on 9 December 2009.

Coarse woody debris (CWD) is important habitat for biodiversity and its management in the production forest landscape is required as interest in renewable bio-energy increases. An MSc study found the succession of mosses, liverworts and ferns was largely driven by ageing of the CWD with diversity and cover increasing with age, with at least 110 years needed before the succession reaches maximum species diversity. A study of 10 years of beetle colonisation of mature and regrowth logs of messmate stringybark (*Eucalyptus obliqua*) revealed that the community was dominated by uncommon species, more than half of which were unnamed, and mature logs had higher diversity of species than regrowth logs. The CRC has developed provisional prescriptions for the retention of CWD during harvesting of fuel wood (also leading to milestone C&U 4.2.7) to ensure that sufficient CWD is left onsite to cater for this dependent biodiversity.

The management of forest species of high conservation significance, including species listed in threatened species legislation, is an ongoing challenge for forest managers. Tree hollows are key den or nesting sites for a large number of forest-dwelling birds and marsupials, including several endangered species, and their effective management in the production landscape is important. A major achievement this year was the publication of *Tree hollows in Tasmania*, a guide that helps field-workers and Forest Practices Officers to identify trees most likely to be used by hollow-dependent species. The CRC conducted two training days to familiarise Forest Practices Officers, forest planners and ecological consultants with the guide (leading to milestone C&U 4.2.7).

The CRC is investigating consequences of plantation expansion in agricultural areas on biodiversity of adjacent forest and landscapes (towards milestones R 4.2.7 C&U 4.2.8). Research is examining the effects of plantations on biodiversity as well as strategies to assist regeneration and enhance the biodiversity values of forest remnants degraded by livestock grazing. Degraded forests with agricultural weeds in Western Australia were shown to support different bird communities than those without weeds. There were also differences in soil chemical profiles and the presence of weeds was linked to high soil nitrogen. Research suggests a range of chemical and biological soil measures may be required to achieve effective restoration.

The CRC completed a continent-wide assessment of the likelihood of gene flow from eucalypt plantation into Australia's 74 rare eucalypt species, and monitoring of a high risk spinning gum (*Eucalyptus perriniana*) population in Tasmania is ongoing (milestone R 4.2.3). We developed guidelines for assessing and monitoring the risks of gene flow from shining gum (*Eucalyptus nitens*) plantations in Tasmania. The

guidelines were presented to forest planners and they are now part of the assessment for Forest Practices Plans (milestone C&U 4.2.5).

A PhD study of the genetic diversity in the iconic giant mountain ash tree (*Eucalyptus regnans*) has been completed, and has provide information on the location of centres of genetic diversity and historical refugia. This genetic information is being integrated into a review of seed transfer guidelines being undertaken by the Victorian Department of Sustainability and Environment (towards milestones R 4.2.6 C&U 4.2.7).

Sustainable management of key pests (towards milestones R 4.2.4, C&U 4.2.6)

The CRC is undertaking research on viable alternative strategies to manage browsing marsupial herbivores in forestry as the use of 1080 poison in Tasmanian State forests was banned in 2005. The first results from large-scale pilot trials on operational coupes to test the best combination of non-lethal strategies to reduce browsing impacts have been published and presented at a workshop hosted by the DPIPWE (Tasmania).

Lethal trap trees are being investigated as a more effective and environmentally friendly alternative to control eucalypt leaf beetles than aerial spraying with insecticides. An operational deployment of lethal trap trees was undertaken for the first time.

Traps beneath the trees showed that insecticide infusion was more effective than spraying. During the period that infused trees were effective, they were attracting the target insect at five out of six sites, and were killing significant numbers with little impact detected on non-target organisms.

Project 4.4 Industry Pest Management Group (IPMG) (towards milestones R 4.2.4 C&U 4.2.6)

The IPMG was established as a CRC project in June 2006, co-funded by industry contributions. It has a strong focus on extension work aimed at integrated pest management in *E. globulus* plantations in south-west Western Australia and the Green Triangle. Through this project the CRC coordinates regular monitoring of natural enemy and insect herbivore activity in *E. globulus* plantations, develops protocols for assessment of insect pests for project partners and provides regular technology transfer through field days and training of company personnel. During 2009–10 the CRC developed a major field guide to pests and diseases of *E. globulus*.

Nature of any grants and how they contribute to the CRC

Research in this project is facilitated by close interaction with several Bushfire CRC projects as well as ARC grants held by participating CRC for Forestry scientists. In particular, three recent grants focused on supporting landscape-level biodiversity studies — an ARC Linkage Grant to University of Tasmania, and and ARC Linkage Grant and an FWPA grant to Forestry Tasmania — will contribute to several subprojects that are developing in-coupe prescriptions for maintaining biodiversity.

Two external grants to the Forest Practices Authority involve scientists associated with the CRC and will help with adoption of CRC research. These grants are: a Max Jacobs Award to report on systematic approaches to monitor the effectiveness of forest biodiversity conservation and a Commonwealth-funded project aimed at developing a framework for the management of habitat for RFA-priority species at the landscape scale.

External grants are assisting student projects on gene flow from *E. globulus* plantations (FWPA), bat research (Mohammed Bin Zayed Species Conservation Trust, Bat Conservation International Inc.) and mammal response to silvicultural treatments (WV Scott Charitable Trust, Holsworth Wildlife Research Fund, MA Ingram Trust).

Any changes proposed to future research directions

There are no proposed changes to current subprojects.

Project 4.3 Communities

Project Leader: Dr Jacki Schirmer

Australia's forest industries are undergoing rapid change, as are the perceptions held about forestry by different groups. It is essential to understand the social and economic implications of ongoing change within the forest industry, as well as the impact of changes in rural and regional areas on the forest industry.

The CRC for Forestry is investing in research into the social dimensions of Australia's forest industries to ensure our forest and plantation management is socially, as well as environmentally, sustainable.

Research activities and achievements

Key research achievements of Project 4.3 during 2009–10 included completion of a successful participatory process in Northern NSW, and publication of a report on the socio-economic impacts of plantations in Tasmania.

Social and economic impacts of plantation forestry

The participatory process in Northern NSW involved a range of stakeholders in a joint learning process to assess evidence about a number of issues of community concern about plantation forestry, and to agree on actions needed to address these issues (Subproject 4.3.4). A 12-member Participatory Advisory Committee was established and met until November 2009, discussing local knowledge on issues of controversy, and asking experts to provide information to the group where further information was needed. The participants — including members of the plantation industry, local government, and the local rural community — agreed on a wide range of recommendations for the plantation industry relating to fire management, strategies for maximising social benefits for local communities, improving communication with the community, and pesticide use in plantations. As well as these locally beneficial outcomes, the process created a range of learnings for conducting this type of process in the future, outlined in CRC for Forestry technical report 201, published in March 2010.

The social and economic impact of expansion of hardwood plantations has been a topic of controversy in many Tasmanian rural communities in recent years. The CRC report *Socio-economic impacts of the plantation industry on rural communities in Tasmania* (technical report 199, July 2009) examines the available evidence about impacts of plantation expansion on the number of people living in rural communities, the type and location of jobs, community group membership, land prices and other agricultural industries. This information can help inform debate, which has often been driven by differing perceptions about these impacts, rather than by evidence. For example, the report found that plantation expansion has not been associated with higher than average decline in rural population numbers, that plantation expansion is associated with some rise in land prices, and that there is a significant change in the population living on rural properties when they are established to plantations, with previous residents often shifting away and new residents shifting to live on these properties. This information enables improved communication about the impacts of plantations, and can be used to design strategies to maximise benefits while reducing any social costs associated with plantation expansion.

The CRC convened three public seminars in Tasmania to facilitate discussion about socio-economic impacts of plantations, share our research findings and encourage stakeholders to use the results of CRC research in their day-to-day work and policy development. The seminars, held in Hobart, Launceston, Burnie and Scottsdale, were attended by more than 200 people, including rural residents, government and industry representatives and many members of Tasmanian parliament. The seminars also attracted considerable media attention in Tasmania.

In October 2009 The Senate Select Committee on Agricultural and Related Industries invited Dr Jacki Schirmer, a CRC researcher and leader of Project 4.3, to present evidence to the *Inquiry into food production in Australia: Impact of Managed Investment Schemes*, following her written submission to the Inquiry. Dr Schirmer discussed current knowledge on the impact of plantation expansion on rural communities across Australia, a key area examined in the inquiry. Key findings in the submission were that there is no evidence that Managed Investment Scheme (MIS) expansion has adversely impacted food production in Australia; that while MIS plantations are growing there is a decline in employment in rural communities, but once they reach harvest age plantations generate more jobs per hectare than sheep grazing, beef grazing or cropping, but less than most intensive agricultural land uses; that this employment is often located in regional centres rather than smaller rural towns; that plantation expansion has not exacerbated population decline in rural Australia but has created a lot of change in that population; and that the recent entry of MIS schemes into receivership has been associated with short-term job losses and financial difficulties for many businesses in the industry. The final report of the Inquiry substantially drew on the evidence in Dr Schirmer's submission.

The submission is available at:

http://www.aph.gov.au/senate/committee/agric_ctte/food_production/submissions/sublist.htm;

The Hansard record of witness hearing is available at: <http://www.aph.gov.au/hansard/senate/commttee/S12465.pdf>

The final report of the Inquiry is available at:

http://www.aph.gov.au/Senate/committee/agric_ctte/food_production/report/report.pdf

Nature of major consultancies and their contribution to the CRC

The Victorian Department of Primary Industries provided a grant to the Fenner School of Environment and Society of the Australian National University, to undertake a study of socio-economic characteristics of Victoria's forest industries and the communities dependent on them. This grant, while not administered via the CRC for Forestry, drew on methods developed in Subproject 4.3.1 of the 'Communities' project, and its results and data are now available for use as part of the Communities project. The study found that 23 475 people are employed directly in Victoria's forest industries, generating expenditure of between \$1.34 billion and \$1.64 billion in 2008–09. The majority of jobs generated are based on softwood plantations, followed by native forests and hardwood plantations. The region with the greatest dependence on the industry is Gippsland, where 2.7 per cent of the workforce is employed in the industry. The bushfires of February 2009 impacted the industry in varying ways: 28.8 per cent of forest industry businesses experienced reduced turnover, while 14 per cent had growth in turnover as a result of jobs generated by the fire, for example in salvage logging and road repair. Employment in the forest industry has grown over time, driven largely by growth in some types of wood and paper processing. The full report is available at <http://new.dpi.vic.gov.au/forestry/research/technical-reports>

Nature of any grants and how they contribute to the CRC

None during the reporting period.

Any changes proposed to future research directions

There are no proposed changes to current subprojects.

Research collaborations

The CRC for Forestry is characterised by high levels of collaboration among research providers, and between research groups and end users. We have worked successfully to achieve greater levels of international collaboration during the reporting period.

1. Cross-program collaboration

Collaboration between projects 1.1.2 and 1.2.2. continues through shared field sites (Green Hills State Forest, NSW and Wattle Range, SA) and joint field campaigns. During the past year, two cross-project workshops have been held to review data, present current analyses and plan further work. The workshops included researchers, students and industry representatives.

Project 1.3 has formal collaborations with the forest health program (1.2.2) sharing a postdoctoral fellow (Alieta Eyles) and a field research site (Geeveston, Tasmania). This collaboration is focused on developing a deeper understanding of the physiological processes associated with pests, pathogens and weeds.

Collaboration on experimental field work continues between scientists in projects 1.2, 1.3 and 1.4 and is providing a range of information and skill-sharing opportunities that have significantly boosted capability in the subtropical and tropical CRC nodes.

Collaboration between projects 1.4 and the new project 1.6 is developing well with planned sharing of datasets (particularly litter studies in subtropical eucalypts).

Collaboration between projects 1.4, 2.3.2 and 2.5 continues to link understanding of growth of trees in the field with wood products that can be obtained from subtropical eucalypt species after harvest. This is important in creating a strong connection between research on growing trees and research on production of wood products.

Silvicultural trials evaluating thinning response in subtropical plantations established by the Program Two team at Southern Cross University have provided valuable growth data to researchers in Project 1.4.

Project 1.3 leader Tony O'Grady is collaborating closely with Sandra Roberts (Forestry Tasmania) in a study of the water balance of shining gum (*Eucalyptus nitens*) forests and this is a strong point of intersection with the work being undertaken in Project 4.1 'Water quality and quantity'. This project linkage received a recent boost through FWPA funding of the Forestry Tasmania work linking wood flow modelling with water outcomes. Further linkages with Program Four include the work of Neil Sims (Project 1.1) through co-supervision of PhD student Sandra Hawthorne.

Collaborative linkages between Program Four and other programs and projects are continuing to evolve. Project 4.2 'Biodiversity' has strong linkages with research being undertaken in Programs One and Two across several research providers. This includes links with Program 1 on disease risk, disease genetics and fungal biodiversity on CWD through joint supervision of two students (at Murdoch and UTas); linking the expertise in the biodiversity gene pool management area (4.2) with work being undertaken in Program Two on association genetics (Project 2.1) involving multiple research providers (UTas, UMelb and SCU); and in the development and application of a high throughput DArT marker system for genetic diversity and mapping studies in eucalypts (UTas).

Within Program Four, a student project under Project 4.2 on carbon flows in waterways at Warra is jointly supervised with Project 4.1 staff, and a combined project on stream biodiversity is underway.

2. Linkages with research users and external linkages

The Department of Environment and Resource Management (Qld) and the Terrestrial Ecosystem Research Network (based at the University of Queensland) have expressed interest in collaborating with the CRC in the development of software for processing large-volume hemispherical photography (Project 1.1.2). This project team also has been assisting the Bureau of Meteorology (BoM) with information on mapping leaf area index (LAI) from satellite imagery. There is particular interest from the BoM in the CRC-developed relationships between the leaf area index (LAI) determined through field work over three years and the satellite-derived estimates of LAI for the same period.

Within Project 1.2, the key collaboration is the nutrition network that has been established with a range of industrial partners, including WAPRES, Australian Bluegum Plantations, Elders Forestry and Albany Plantation Research Centre.

Additionally a new project has started, supported by Forest and Wood Products Australia to develop the 'Forest Plantation Productivity Optimisation System' (Project 1.7), which will extend the BPOS decision-support system in a number of key areas, including five additional species, future climates, and different product types. Partners in this project include the Albany Forest Research Centre, Gunns, Forestry SA, Green Triangle Forest Products, Hancock Victoria Plantations, Forest Products Commission of WA, WA Plantation Resources, and Forestry Tasmania.

Project 1.3 continues to maintain close links with Professor Derek Eamus and the climate change cluster at University of Technology Sydney and is building strong collaborative links with Professors David Tissue and David Ellsworth at the National Climate Change Facility at the University of Western Sydney. Informal collaborations with the Mathematics and Statistics Department at University of Melbourne (Professor Andrew Robinson) have developed into formal support for PhD student David Lazaridis through a top-up scholarship under Project 1.3.

Project 1.4 has formal linkages with the University of the Sunshine Coast through a Queensland Department of Employment, Economic Development and Innovation (DEEDI) project investigating below-ground carbon in spotted gum (*Corymbia citriodora* subsp. *variegata*) plantations, including formal support for PhD student Adam Smith through a CRC for Forestry top-up scholarship.

Project 1.4 is formalising linkages with Elders Forestry, and this strengthened collaboration will be important in the coming year for validation of process-based models being parameterised for tropical and subtropical eucalypt plantations.

Ta Ann Tasmania Pty Ltd collaborated with the CRC in Program Two through provision of in-kind resources. A trial to produce rotary-peeled veneer from plantation-grown logs of *E. nitens* was carried out at its mill at Smithton in north-west Tasmania in October 2009.

Southern Cross University researchers involved in Project 2.3 collaborated with managers of subtropical eucalypt plantations to establish additional silvicultural trials in young plantations managed by Forest Enterprises Australia Ltd. These trials will assist in development of optimal silvicultural regimes for subtropical eucalypt plantations.

Project 2.4 implemented a small consultancy to Timberland Pacific Pty Ltd, measuring wood basic density (\$1800).

Bushfire CRC projects studying the effects of fire on forest health and establishing a wildfire chronosequence are linked with CRC for Forestry projects on management of forest remnants and biodiversity impacts of alternatives to clearfelling, respectively.

The CRC's research on water quality and quantity (Project 4.1) has strong linkages with research users in the Victorian Department of Sustainability and Environment (DSE), Forestry Tasmania, and plantation companies such as Hancock Victorian Plantations and Gunns Ltd. Project members have links to the eWater CRC, the CRC for Future Farm Industries and the Bushfire CRC. More recently, and particularly through Project 4.6, the CRC has sought linkages with State water authorities and formalised these through establishment of technical advisory groups that include staff from the WA Department of Water and the Tasmanian Department of Primary Industry and Water. In addition, a number of Project 4.1 partners are engaged in work that will benefit the CRC. Partners' current projects include:

- o University of Melbourne research projects for the Victorian Department of Sustainability and Environment (DSE)
- o a University of Melbourne project funded by Melbourne Water on predicting bushfire risk to water supply
- o a University of Melbourne/CSIRO Flagship Collaboration Fund project on native mixed-species water use
- o CSIRO recently completed two projects funded by the National Water Commission that address the effects of plantations on surface and groundwater systems. These are exclusively about water but are very closely aligned with the CRC for Forestry's Project 4.6. We recently ran a workshop on carbon and water trade-offs in tandem with the final workshops from these projects.
- o in Western Australia CSIRO has a project quantifying water outcomes from thinning native forest that is supported by the State Government.

- Forestry Tasmania has a new FWPA-funded project developing approaches for quantifying plantation water use linked to plantation inventory and existing systems for managing wood flows. Don White (leader of CRC Project 4.1) chairs the steering committee for this project.

In Tasmania, Project 4.1 also has established collaboration with the CERF project 'Landscape Logic' and the Tasmanian Community Forestry Agreement plantation hydrology project.

Several scientists involved with Project 4.2 (Biodiversity) are members of the ARC Environmental Futures Network.

Project 4.2 staff interact with the Threatened Species Unit of the Department of Primary Industries, Parks, Water and Environment to enhance Tasmania's threatened species and risk assessment database, and co-supervise PhD projects.

The project also collaborates on TCFA research into alternatives to the use of 1080, and with Bayer Environmental Sciences on systemic insecticides. Within Project 4.2 the CRC also collaborates with Dr Angus Carnegie (Department of Industry and Investment, NSW) and Geoff Pegg (Tree Pathology Centre, The University of Queensland/Queensland Department of Primary Industries and Fisheries) on molecular taxonomy of eucalyptus pathogens.

Collaboration on biodiversity monitoring for forest biodiversity conservation, as well as CRC PhD project supervision, is being undertaken with staff from NSW Department of Industry and Investment and the Victorian Department of Sustainability and Environment.

Project 4.4 is interacting with the CRC for National Plant Biosecurity in the development of mobile device software for use in routine plantation health surveillance.

Through Project 4.4 the CRC has developed a research collaboration with Dr Rolf Oberprieler from CSIRO Entomology, studying the diversity and distribution of the eucalypt weevil.

3. International collaboration and linkages

The CRC has made our time-series satellite analysis algorithm (BFAST) publicly available (with unanimous support of the Project 1.1.2 Steering Committee) via the Source-forge server: <http://bfast.r-forge.r-project.org/>. The code has been downloaded many times and we have had contacts from international researchers planning to incorporate the algorithm in their work. This has resulted in valuable relationships evidenced by joint publications with international universities (e.g. Somers, Coppin, Verstraeten and Ampe from the Katholieke Universiteit Leuven, Belgium and Achim Zeileis from the Department of Statistics and Mathematics, Wirtschaftsuniversität, Vienna). The algorithm is also being trialled successfully by Ecometrica (UK) to monitor deforestation in the Amazon using MODIS satellite imagery.

The CRC and the University of Tasmania (Associate Professor René Vaillancourt, Dr Dorothy Steane) led an international collaboration that successfully developed the application to eucalypts of the Diversity Array Technology (DART) molecular marker system. This genomic tool (Sansolini *et al.* 2010) is being used by CRC Project 2.1 (Dr Jules Freeman, University of Tasmania) to identify quantitative trait loci (QTL) associations between wood quality traits in *E. globulus* and DART markers with the intention of identifying genes with the most impact on these traits. The collaborators included University of Pretoria, EMBRAPA, Universidade de Brasilia, Universidade Catolica de Brasilia and Diversity Arrays Technology Pty Ltd. The study was supported by funds from the Australian Research Council, CRC for Forestry, and several other participating organisations. CRC partners participating in Project 2.1 have contributed eucalypt DNA samples for this research.

The CRC is collaborating in a trial of an onboard system for forest machine management with Stellenbosch University (South Africa) to expand our case study knowledge. Trial results will inform our development of guides to help industry select and implement these systems in Australia.

Mark Brown, the leader of Program Three, is chair of a new committee on Southern Hemisphere Forest Operations Research Collaborative Group (SHFORC). The group was formed to promote collaboration and coordinate strong nationally-focused forest operations research across the Southern Hemisphere and highlight forest operation issues that are common across the Southern Hemisphere.

Current SHFORC participants are:

- Forest Engineering (South Africa) (FESA)
- Future Forest Research Ltd (New Zealand) (FFR)
- CRC Forestry
- Forest and Wood Products Australia (FWPA).

Mark Brown is also the Australian representative on COST (European Cooperation in Science and Technology) Action FP0902 (forests, their products and services). Development and harmonisation of new operational research and assessment procedures for sustainable forest biomass supply.

Program Three has been collaborating on an onboard system for forest machine management trial with Stellenbosch University (South Africa) to expand our case study knowledge to build industry guides to select and implement these systems in Australia.

The collaborations indicated here maintain the CRC for Forestry's strong linkages with international science networks. In the case of the EUCAGEN (International Eucalyptus Genome Network), scientists have provided 'in kind' assistance in the preparation of an international submission for the USA Department of Energy to undertake a public domain sequence of the *Eucalyptus grandis* genome that has now had a draft sequence released. The involvement of Project 4.2 'Biodiversity' scientists in this network allows information relevant to managing eucalypt genetic resources to flow back to Australia. Specific collaboration is ongoing with Dr Zander Myburg of the University of Pretoria and Dr Dario Grattapaglia on developing genomic resources as well as reviewing *Myrtaceae* genomics.

Our collaboration with the University of Tsukuba, Japan, allowed a large-scale molecular study of pollen dispersal in *E. globulus*.

The CRC is collaborating with the University of Lisbon, Portugal on the quantitative genetics of *E. globulus* and its hybrids.

Professor Marco Restani of St Cloud State University (Minnesota, USA) provided input into a wedge-tailed eagle nest monitoring project.

The disease research group at the Forestry and Agricultural Biotechnology Institute (FABI) of the University of Pretoria (South Africa) are among the leaders in eucalypt fungal taxonomy and genetics, and collaboration with this group is enhancing progress with research on disease spread and fungal communities, particularly involving *Mycosphaerella* species.

Collaboration on eucalypt pest and disease research also occurs with the University of Pretoria, South Africa and the Forest Science Institute of Vietnam.

CRC scientists leading Project 4.2.1 maintain close linkages with scientists involved with variable retention research in Patagonia, Pacific North-western USA, British Columbia and Alberta. Sue Baker, as part of a World Forestry Institute Fellowship in Oregon, is collaborating with scientists from these countries to assemble suitable datasets to conduct a meta-analysis testing the forest influence effect — a key ecological objective of variable retention silviculture. The Warra Long-Term Ecological Research Site, where silvicultural treatment studies are being undertaken, is part of the international long-term ecological research (LTER) network.

Commercialisation and utilisation

As the CRC for Forestry enters the fifth year of our seven-year funding term, we have further increased the emphasis on adoption and utilisation of research outputs, paying particular attention to sustaining and growing already high levels of industry engagement. Utilisation and adoption matters were a significant feature of the CRC Annual Science Meeting held in May 2010, which included a full-day event for industry participants showcasing 10 decision-support tools developed by the CRC to demonstrate how technology could aid profitability.

The CRC's independent Research Advisory Panel commented in their 2010 progress review of the CRC that:

'... the panel was encouraged by how much emphasis has been placed on adoption of the technologies, and the resources put into this area. The "hypothetical exercise" (at the Annual Science Meeting) was a great example of seeking to understand adoption processes, decision making and the barriers to adoption.'

Further staff allocations were made to support utilisation and adoption, including the appointment of a full-time Industry Liaison Officer to assist industry uptake of decision-support tools generated in Program One, and a substantial allocation of staff time to assist companies with uptake of handheld near-infrared (NIR) spectroscopy scans and calibrations from Program Two. Other utilisation and adoption initiatives (e.g. workshops, training days, publication of manuals and industry bulletins) are listed at Appendix A of this report.

The Industry Engagement Manager has continued to work across CRC programs to add value to existing pathways to adoption and to identify and implement new opportunities to achieve research impact.

During the reporting period most commercialisation and utilisation (C&U) milestones were achieved, with the exception of:

- Milestones C2.1.3, 2.3.1, 2.3.3, 2.3.4 and 2.4.3 related to Research Milestone 2.4.2, (Sampling protocols for prediction of solid wood and engineered wood log value from three species). The work has been completed for one species, but slower than expected uptake of solid wood utilisation for *E. globulus* and subtropical species has slowed the work in this area. These milestones will be reached by June 2011.
- Milestone C2.2.2, which has been replaced by a pilot program on *E. nitens* owing to insufficient industry interest in *E. globulus* processing.
- Milestones C2.2.3 and 2.2.4, which have been delayed and timing revised due to staff movements.
- Milestone C2.3.2, which has been revised as the priority of the issue was downgraded.

Within the first year of operation of the CRC it became apparent that project agreements contained insufficient detail to adequately manage projects at an operational level, and did not allow sufficiently for changing circumstances, unforeseen events or shifting priorities. In 2007 we introduced a new project management system centred around project operating plans (POPs). The system came into effect for the 2008–09 financial year. POPs identify annual activities, milestones, deliverables, key responsibilities, pathways to adoption and resource requirements at a subproject level. The CRC Management Group reviews POPs annually, to ensure that adoption strategies are appropriate, that sufficient emphasis is placed on these in the planning process, and that adequate resources have been identified for their implementation.

The CRC Management Group maintains a discretionary fund to support C&U activities and considers applications for funding quarterly. Eight initiatives — including staff appointments, major workshops, conferences, demonstration projects, field days and community information events — were supported in 2009–10.

Industry partner staff are actively involved in one or more field-based research programs and are well-positioned for rapid technology transfer. More structured sharing of information is carried out through field days, seminars and workshops. The C&U plan for 2009–10 included several workshops and pilot projects, during which staff of most industry partners were trained in technologies that are likely to improve various aspects of their businesses (see the 'End user involvement' section of this report).

No patents were filed during the reporting period.

Intellectual property management

The CRC manages its intellectual property (IP) through a set of formal processes, policies and registers and maintains scrutiny on all areas of activity for commercialisation opportunities. IP management within the CRC consists of:

- o IP principles and management policies and procedures
- o a detailed IP register (updated annually)
- o Commercialisation and IP Management Committee.

The Commercialisation and IP Management Committee meets at least once a year to review the IP developed and consider overarching adoption strategies and commercialisation opportunities.

As part of the IP procedures, all research is screened prior to project start-up and during the research phase for the type of IP to be generated; for example, for confidential information/trade secrets, copyrights, tangible research property, and patents. Where IP was identified as potentially able to be commercialised, specific commercialisation assessments were undertaken.

The Commercialisation and IP Management Committee, under the direction of the CEO, is responsible for day-to-day management of IP commercialisation and use. The Industry Engagement Manager also has been closely involved with IP management issues, but with an emphasis on utilisation, and enhancing uptake and overall economic impact. We have refined the CRC's public website, and our intranet and content management system are being further developed to improve delivery of information and services.

In 2009–10, there was no IP generated by projects that was considered suitable for licensing or patenting. Rather, the IP will be incorporated into participants' ongoing commercial operations.

As a general rule, the CRC is creating IP for use by our participants, who represent a very large majority of potential users of the information. The forestry sector in Australia consists of a relatively small number of medium-to-large companies, and a larger number of small contractors — so, outside the CRC's membership, there is a very small potential market for licensing or commercialisation. Because the CRC's research priorities are largely determined by this end-user group, licences or patents are likely to be incidental to the main thrust of the majority of our research programs. There were no developments of this type made during the 2009–10 year.

The CRC for Forestry Board remains firmly of the view that the greatest impact of the CRC will rarely be achieved through direct commercialisation or licensing, but rather through widespread uptake of CRC research outputs leading to innovation by CRC participants. This method of using IP provides maximum benefits to the participants and, at the same time, legal and contractual arrangements ensure that this IP can only be used by the participants and will not be licensed on or used outside their operations without the express permission of the CRC management. The CRC is unaware of any breaches by any participants in regard to IP in 2009–10.

Communication strategy

Effective communication is integral to all areas of the CRC's activities and responsibilities. All CRC participants have a role in our communications functions, which include:

- sharing information between research partners to enhance collaboration and synergy
- exchanging knowledge between research providers and research users to enable uptake of relevant knowledge by various sectors of the industry
- ensuring the CRC's research, education and communication activities are relevant and responsive to stakeholder needs
- making science-based knowledge relating to forests and forestry accessible to the wider community.

An important aspect of CRC communications is developing linkages with industry. The CRC employs an Industry Engagement Manager and an Industry Liaison Officer, who work closely with the Communications Manager to disseminate information to end users and foster uptake of research findings (see more in 'End-user involvement and CRC impact on end users' on page 39).

Report on selected communications initiatives

Annual Science Meeting

Research is only of value if those who can benefit from its findings are able to access it.

One of the ways in which the CRC for Forestry makes the findings of its research known is through the Annual Science Meeting (ASM). The aim of the ASM is to expose developments across the CRC's four research programs to industry and research partners. It is also an important opportunity for professional development for students associated with the CRC.

More than 140 delegates attended the 2010 meeting in Fremantle (WA) in May. CRC partners from around Australia were joined by delegates from South Africa and New Zealand, to learn about our recent activities and achievements, as well as plans for the future. CEO Professor Gordon Duff discussed plans for the bid to extend funding for the CRC until 2017, and highlighted the key industry challenges a refocused CRC will need to address.

Presentations from the ASM are available to the CRC's partner organisations on the member website.

Newsletters

Several electronic newsletters were produced during 2009–10 to update CRC members and other stakeholders on our research activities and achievements:

- Whole-of-CRC newsletter: *CRC for Forestry News* (August 09, December 09, February 2010)
- Program One: *Understorey* (August 09)
- Program Two: *The Wood from the Trees* (August 09)
- Program Three: *The Log* (November 09)
- Program Four: *BioBuzz* (August 09, December 09, May 10), *Community catch-up* (Communities project, May 2010)

Newsletters are distributed electronically to subscribers including our industry partners, research providers, students and interested members of the general public.

Bulletins

In 2009–10 three industry bulletins were produced to rapidly communicate developments and research outcomes of Program Three to industry partners in a short, accessible format. Research bulletins are not intended to replace longer scientific reports but provide a concise summary of major findings in a format we believe busy operational managers will appreciate.

See Appendix A for a full list of CRC publications.

Media

The CRC aims to gain media coverage to ensure that in addition to our research partners and industry members the broader public is able to access science-based knowledge relating to forests and forestry and understand the role of the CRC.

We distributed several media releases this year. Three were related to the Annual Science Meeting, and resulted in local media coverage in Western Australia. There was strong local media interest in contributions made by CRC research and scientists in resolving concerns about reported impacts of plantations on water quality on Tasmania's east coast. There was also significant media and public interest in public seminars discussing the findings of CRC research into the impact on rural communities of plantation forestry. CRC research featured in a special lift-out in *Australia Forest Grower* in April 2010 titled 'Making ends meet: pathways to innovation in Australian forestry' and in multiple articles in the CRC magazine *Success through innovation*.

End-user involvement and CRC impact on end users

During the second half of our current funding term, the CRC's strategy has been to progressively increase the level of emphasis and resourcing to end-user engagement, implementation of adoption strategies and communication with stakeholders. The CRC currently employs an Industry Engagement Manager, a full-time Industry Liaison Officer, a Communications Manager and a Communications Officer.

Our program coordinating committees are chaired by industry representatives, and each project steering committee includes representatives of stakeholder organisations and research end users. Research adoption is assisted by a steady stream of specialist workshops, field days, research bulletins and technical reports, but it is the personal contact between scientists and practitioners and the close involvement of industry people in all stages of a project that ensures CRC research can be translated to policy and practice.

End users are systemically involved in all CRC projects involving field or operational trials. The table below lists end-user participants actively contributing on a project-by-project basis, through involvement of personnel in research and development activities or project oversight, provision of field trial sites and logistic support, or participation in operational trials. Note that at an organisational level, some organisations (e.g. state agencies) participate both as research providers and research users. All acronyms, initialisms and abbreviations are listed in full on page 48.

Project	End users directly involved in project execution and delivery
1.1	DSE, FEA, FPC, FT, Gunns, HVP, Elders, Midway, Norske Skog, DPI NSW, WAPRES
1.2	DSE, ForestrySA, FPC, FT, Gunns, HVP, Elders, Midway, DPI NSW, Timberlands Pacific, WAPRES
1.3	DSE, FEA, FPC, FT, Gunns, Midway, Norske Skog, DPI NSW, WAPRES
1.4	FEA, DPI NSW, QDPIF
2.1	FPC, FT, Gunns, Elders, DPI NSW, STBA
2.2	DSE, FEA, FPC, FT, Gunns, HVP, Elders, Midway, STBA
2.3	FEA, FPC, FT, Gunns, Elders, DPI NSW, STBA
2.4	FPC, FT, Gunns, Elders, Midway, WAPRES
2.5	FEA, Elders, DPI NSW, QDPIF
3.1	FEA, ForestrySA, FPC, FT, Gunns, HVP, Midway, Norske Skog, Oji, SEFE, WAPRES, VicForests
4.1 & 4.6	DSE, ForestrySA, FPA, FPC, FT, Gunns, HVP, WAPRES
4.2	DSE, DPI Vic, ForestrySA, FPA, FPC, FT, Midway, Gunns, DPI NSW, STBA
4.3 & 4.5	FFIC, FPC, FT, Gunns, DPI Vic, Green Triangle Regional Plantation Committee
4.4	APFL, ForestrySA, FPC, Elders, WAPRES

The table on pages 40–45 focuses primarily on end-user involvement in project outputs. The number of activities reported has effectively tripled since the same reporting period last year, a strong indication of the number of project activities reaching completion and being delivered to end users.

End users	Relationship with CRC	Type of activity and end user location	Nature/scale of benefit to end user	Actual or expected benefit to end users
<p>Partners: ABP, HVP, AFRC, WAPRES, Elders, Timberlands, ForestryTas</p> <p>Others: UniMelb, CSIRO, USC, DEEDI, ForestryTas, FNSW</p>	<p>Industry partners</p> <p>Research partners</p>	<p>Modelling/Decision Support System workshop. Hobart, November 2009</p>	<p>Revision of CRCF outputs that can be used to assist with decision-making in forestry operations. Improved communication between tool developers and tool users</p>	<p>An improved understanding of the costs, capabilities, limitations and potential interactions between CRCF outputs. This helps industry partners determine which packages of tools have the potential to meet their needs and where to place further investment.</p>
<p>Partners: Industry partners from across Australia</p> <p>Others: Forestry professionals from non-partner organisations for the Open (non-CRC) sessions</p>	<p>Industry partners</p> <p>Forestry professionals – non members</p>	<p>Two day LiDAR workshop, Hobart, April 2010. Day 1 open to all industry (36 participants). Day 2 open to CRC partners only (25 participants).</p>	<p>Increased knowledge of the application of LiDAR to forest management, particularly for improved measurement of inventory and LiDAR acquisition planning and data processing. Demonstration and delivery of software tools and supporting documentation</p>	<p>Improved capacity to apply LiDAR to a range of forest management tasks, particularly terrain mapping and improved and spatially described assessment of inventory. Project benefits have been estimated by the project's key industry partner and provided as a Project Impact Statement.</p>
<p>Partners: CSIRO, UniMelb, FNSW</p>	<p>Research partners</p>	<p>Green Hills Forest Science Meeting. Melbourne, February 2010</p>	<p>Demonstrated advanced methods of analysis of inventory data, and an improved understanding of sources of error in the types of field data that are typically collected for forest health and inventory assays</p>	<p>Improved methods for collection of field data for forest health and inventory assessments, and hence an improved understanding of the effect of forest health on plantation growth</p>
<p>Partners: FNSW, FSA, WAPRES, ABP, CSIRO</p>	<p>Industry and research partners</p>	<p>Two web seminars: Basics of CABALA HEALTH for industry partners, November 2009</p>	<p>Demonstrated capabilities of CABALA HEALTH as a decision support tool to improve forest health management</p>	<p>Improved forest health management and incorporation of cost-benefit analysis into silvicultural responses to pest attack</p>
<p>Partners: ForestryTas, FNSW, WAPRES, CSIRO</p>	<p>Industry and research partners</p>	<p>Three end user case studies: Use and integration of CABALA HEALTH to assist with decision support. Ongoing</p>	<p>Training, integration and assessment of CABALA HEALTH into real end-user management systems</p>	<p>Improved forest health management and incorporation of cost-benefit analysis into silvicultural responses to pest attack</p>
<p>Partners: HVP, CSIRO</p>	<p>Industry and research partners</p>	<p>Industry participation: Validation of CABALA HEALTH for <i>P. radiata</i></p>	<p>Extension of CABALA HEALTH suitability to the <i>P. radiata</i> estate within southern Australia</p>	<p>Improved forest health management and incorporation of cost-benefit analysis into silvicultural responses to pest attack</p>

End users	Relationship with CRC	Type of activity and end user location	Nature/scale of benefit to end user	Actual or expected benefit to end users
Partners: Elders Forestry	Industry Partner	Strategic planning of a chip receiving facility. Esperance, WA, September 2009	Operational efficiency	Reduced planned capital expenditure on facility through better operational plan, and identified an opportunity to reduce transport budget by 10% through better operational plan
Partners: Forestry Tasmania and various native forest industry partners Others: non-industry stakeholders in public native forests	Industry partners Native forest stakeholders – non members	Variable Retention Field Day – demonstrating the application of Variable Retention Silviculture in Tasmanian native forests. Styx Valley, December 2009	Maintaining social licence to actively manage native forests for commercial purposes	Improved silvicultural practices to achieve a commercial outcome while better preserving the natural habitat and biodiversity will ensure continued access to native regrowth forest for industry
Partners: PCC representatives for Program 3	Industry partners	Decision support tool introduction and evaluation workshop for FAST Truck (logistics planning tool) and ALPACA (machine productivity and cost model). Mt Gambier, SA, October 2009 (approx. 15 participants)	Operational efficiency Improved cost controls	Provided early evaluation access to decision support tools to improve operational planning and control and allowed the tools to be further developed to meet users' specific needs
Partners: Vic Forests	Industry partner	Industry field trial of onboard system data to adapt work patterns of harvest operations to improve productivity. Gippsland, Vic, November 2009	Improved productivity of mechanised operations for reduced unit costs	Approximately \$2/m ³ (\$1 million/year)
Partners: Elders, ABP, Gunns, APFL, AFRC Murdoch University, UTas Others: Forestry professional	Industry partners Research partners Forestry professional - non member	Remnant vegetation workshop. Albany, May 2010 (approx. 12 participants)	Demonstrated tools and provided case studies for the effective management of remnant vegetation	Improved selection of remnant vegetation management options, minimising risks on expenditure
Partners: Elders, ABP, Gunns, APFL, AFRC Murdoch University, UTas Others: Forestry professionals	Industry partners Research partners Non member	Industry trial and field assessment: 'Tree Decline Toolbox'. Albany, May 2010 (approx. 12 participants)	Incorporation of cost-benefit information and decision support into remnant vegetation management practices	Improved selection of remnant vegetation management options, minimising risks on expenditure

End users	Relationship with CRC	Type of activity and end user location	Nature/scale of benefit to end user	Actual or expected benefit to end users
Partners: Tasmanian forest managers	Industry partners	Field day workshops on identification of habitat hollow-bearing trees November 2009	Improved identification of important hollow trees to protect wildlife and biodiversity in line with Forest Practice Code	Improved management practice to preserve the natural habitat and biodiversity while maintaining access for commercial outcome for forest industry
Partners: Tasmanian Forest Planners and Managers Others: non-industry stakeholders in forestry, FPA, DPIPW	Industry partners Government Agencies	Symposium of managing multiple values at a landscape level. Hobart, Tasman Peninsula, 29–30 March 2010	Broader understanding of implications of management practices at the landscape level and how these can be implemented to improve overall outcomes	Improved management practice to preserve the diverse landscape while maintaining commercial native and plantation forestry within other land uses
Partners: Tasmanian Forest Planners, FT, Gunns Others: non-industry stakeholders, FPA, DPIPW, UTas	Industry partners Government Agencies	Revision of the <i>E. globulus</i> distribution in Tasmania for Fauna Strategic Planning Group's Technical Working Group for the development of the Swift Parrot Species Management Plan for Tasmania, late 2009 to April 2010	Development of appropriate management guidelines for a threatened species impacting all forestry operations in Tasmania	Improved management approach to preserving the natural habitat and biodiversity while maintaining access for commercial outcome for forest industry
Partners: FT, Gunns Others: FPA, DPIPW	Industry partners Government Agencies	Development of strategies for management of gene flow from plantations into native species in Tasmania. Technical report (FPA), monitoring of high risk landscapes, report finalised February 2010	Development of appropriate guidelines for management of off-site gene flow effects from plantation forestry in Tasmania with relevance to mainland Australia	Improved management approach to preserving the natural habitat and biodiversity while maintaining access for commercial outcome for forest industry
Partners: FT Others:	Industry partner	Giant Trees Consultation committee meetings and field days advising Forestry Tasmania. Maydena (Tas), November 2009	Promotion of giant trees in Tasmania and development of strategies for their management	Improved social licence to operate
Partners: DSE Others:	Industry partner	Reviewing genetic aspects of the current DSE Victoria guidelines for eucalypt seed collection and usage	Improved eucalypts seed transfer protocols for Victorian native forest managers	Improved biodiversity outcomes, social licence to operate and forest productivity
Partners: FT Others:	Industry partner	Assessment and analysis of industry <i>E. nitens</i> trials for susceptibility to marsupial browsing	Identification of germplasm for planting on sites of high marsupial browsing risk to	Improved social licence to operate and establishment costs

End users	Relationship with CRC	Type of activity and end user location	Nature/scale of benefit to end user	Actual or expected benefit to end users
			reduce lethal control	
Partners: FT, Gunns, Seed Energy, STBA Others:	Industry partners	Assessment and analysis of industry <i>E. globulus</i> trials for <i>Mycosphaarella</i> disease resistance – NW Tasmania and WA	Improved germplasm for planting in high disease risk sites in Australia	Improved plantation productivity with minimal chemical footprint. Improved biodiversity outcomes and social licence to operate
Partners: Others: Tasmanian Government	Government agencies	Submission to the George River Water Quality Panel review. Report released 29 June 2010	Integration of forest science knowledge into report on water quality	Social licence to operate
Partners: FT/FIAT Others: : FPA/PFT	Industry partners Government agencies	Assistance in developing a decision support system relating planned forest management activities to stream ecosystem condition	Use by Tasmanian forest planners and FPA for better water quality management outcomes	Improved biodiversity outcomes, social licence to operate
Partners: Others: FPA	Government agency	Upgrade of the Tasmanian Threatened Fauna Adviser (TFA) maintained by FPA and contribution of results from CRC PhD projects (hydrobiid snails, masked owl and spotted tail quoll) to the current review of species management prescriptions in the TFA	Incorporation of research results directly into prescriptions in the Threatened Fauna Adviser directly impacts on the preparation of all Forest Practices Plans in Tasmania	Improved biodiversity outcomes, social licence to operate
Partners: Industry partners within Tasmania and Western Australia	Industry partners	Six industry seminars: Socio-economic impacts of plantations. Hobart, Launceston, Burnie, Albany, Bunbury and Esperance. June and July 2009 (approx. 70 participants in total)	Licence to operate (empirical information and improved understanding of the impacts and role of plantation development in rural communities)	Improved communications and interaction with community and better understanding of public perceptions, minimising risks on expenditure

End users	Relationship with CRC	Type of activity and end user location	Nature/scale of benefit to end user	Actual or expected benefit to end users
Partners: Industry partners in Tasmania and Western Australia Others: Politicians, regulators, government agencies, farmers, local community members	Industry partners Non members	Seven public seminars: Socio-economic impacts of plantations. Hobart, Launceston, Burnie, Scottsdale, Albany, Bunbury and Esperance, June and July 2009 (approx. 300 participants in total)	Empirical information and improved understanding of the impacts and role of plantation development in rural communities	Improved communications and interaction with community and better understanding of public perceptions, minimising risks on expenditure
Partners: Elders, ABP, ForestrySA, Gunns, APFL, AFRC, Hansol, FPC, WAPRES, Murdoch University	Industry members Research member	Four workshops: 10 Year IPMG Research Summary. Penola, Hamilton, Albany and Bunbury. June and July 2009	Summary of research in the Green Triangle (GT) and Western Australia (WA) and the current state of knowledge regarding pest management and its role in improving plantation productivity	Improved capacity to determine knowledge gaps in GT and WA pest management, leading to more focused, applied and operational pest management research. This will potentially increase the value of outcomes gained versus research dollar spent
Partners: Elders, WAPRES, APFL, ABP, ForestrySA, Gunns Murdoch University	Industry members Research member	Company presentations: Integrated Pest Management and developing tools for pest management. Albany and Penola. February, March and April 2010	Summary of the components of an integrated pest management (IPM) strategy. Development of tools necessary for IPM (e.g. PDAs, databases, use of bio-pesticides)	Improved pest management practices in WA and GT plantations, focussing on prevention and risk management to reduce the economic impact of pest outbreaks. Reduction in reliance on chemical pesticides and improved ability for industry partners to satisfy certification requirements
Partners: ABP, WAPRES, AFRC, APFL, Elders CSIRO, Murdoch University, ForestrySA, ForestryTas, UTas, UMelb Others: DAFWA	Industry member Research member Research non-member	Workshop: Integrated pest management for Eucalypt plantations. Perth, May 2010 (approx. 20 participants)	Summary of current pest problems in southern Australian eucalypt plantations and current and possible future practices in integrated pest management (IPM)	Improved plantation pest management practices leading to a reduction in total use and a more effective and efficient use of pesticides. Improved ability for industry partners to satisfy certification requirements. In dollar terms, IPM can result in a reduction in \$/ha spent on pest control or increases in yield per \$ spent on pest control
Partners: Industry partners across Australia Research partners across Australia Others: FWPA, Visiting scientists, CRC Review panel	Industry partners Research partners Non-members Non-member (international and national) Non-member (international and national)	'Forest Management Hypothetical' interactive management exercise. Fremantle, May 2010 (approx. 120 participants)	Demonstrated existing and CRC outputs that can be used to improve efficiencies of operation, minimise risks and increase profitability. Improved communication between tool developers and tool users through the practical application of these tools	An improved understanding of the costs, capabilities and limitations of CRCF outputs. This will assist industry partners to determine which tools have the potential to meet their needs and therefore where to invest time and money, minimising risks on both expenditure and personnel time

End users	Relationship with CRC	Type of activity and end user location	Nature/scale of benefit to end user	Actual or expected benefit to end users
<p>Partners: Forestry SA, ABP, HVP, FEA, Forestry Tasmania</p> <p>Others: CSIRO, USC, QDPI, Uni of Tasmania, Uni of Melbourne, CRCF, FPA</p>	<p>Industry partners</p> <p>Research partners</p>	<p>Decision support tools and systems workshop. Melbourne, August 2009</p>	<p>Review of recent advances in DSS and the associated benefits to CRCF DSS outputs. Refinement of the Program Two DSS framework. Assessment of cross programme linkages to maximise DSS utility</p>	<p>Delivery of DSS with improved potential to integrate into existing management systems, increased utility for the end user and a greater capacity to integrate outputs from across CRCF programs</p>
<p>Partners: STBA, Oji HVP, Gunns, Forestry Tasmania, Elders</p> <p>Others: CSIRO, SCU, Uni of Tasmania, Uni of Melbourne</p>	<p>Industry partners</p> <p>Research partners</p>	<p>Molecular genetics workshop. Hobart, 9 November 2009</p>	<p>Review of progress in Project 2.1.3 molecular breeding of <i>E. globulus</i>. Planning next stages of research program and associated industry in-kind support</p>	<p>Enhanced application of molecular genetics techniques in tree breeding and their integration with quantitative genetics approaches</p>

Education and training

Chair: Professor Peter Kanowski

Manager: Dr Neil Davidson

Extent to which the CRC is on target in terms of recruiting and supervising PhD and masters students

The CRC's Education and Training Program continued to support more than 50 research students, at various stages of their degrees, representing the major cohort of PhD students working on forestry topics in Australia. The first significant numbers of CRC students (14) graduated in 2009–10. The number of enrolled and completing students satisfied the CRC's milestone requirements.

The value of the CRC's Education and Training role was emphasised in both the Forest and Wood Product Sector's RD&E Strategy² and a review of forestry education commissioned by Forest and Wood Products Australia³.

While overall student numbers were consistent with targets, the CRC continued to experience difficulties in recruiting students for some program and project areas. In many cases, these difficulties reflected the broader challenges facing student recruitment in the sector, which the FWPA report discusses. In some areas, such as Program Three, there has been progress in student recruitment following a strategic and targeted recruitment program.

As the CRC approaches the end of its current funding period, PhD student recruitment is being limited to projects for which supervision and support can be guaranteed beyond the life of the CRC.

Involvement of industry in research supervision

Industry partners continued to be closely involved in research students' projects: through oversight of program and project activities, through membership of students' supervisory panels, and in roles such as formal reviewers of students' progress. Industry partner staff were formally members of the supervisory panels of about one-third of CRC research students, and associated in supporting the research of many others in a variety of ways.

Graduate destinations

Twelve CRC students successfully completed their PhD, and two their MSc, during the reporting period. Of these, five accepted or continued work with CRC for Forestry partners; six took up forestry or environment-related work with other organisations; and three were travelling or seeking employment at the time of writing. Current CRC for Forestry students and their projects are listed on the CRC website.

End-user involvement in developing undergraduate and graduate courses

CRC industry partners continued to be closely involved in the development and delivery of many courses offered by CRC partner universities. Their involvement takes a number of forms: direct roles in development and delivery, for example in the case of the *Plantations and the Environment* course offered by the University of Tasmania to both graduate and undergraduate students; delivery of specialist components, in the classroom and or the field, as in the cases of the *Forest Operations* course offered by the University of Melbourne, or the *Forest Policy and Practices* course offered by the Australian National University; or consultation about and provision of information for courses, such as for the *Australian Joint Course* of the National Forestry Masters Program.

² Anon. 2010. *National primary industries research, development and extension framework – R D & E strategy for the forest and wood products sector*. Forest and Wood Products Australia. <http://www.fpwa.com.au>

³ de Fégely, R. 2010. *Australian forestry education review*. Forest and Wood Products Australia. <http://www.fpwa.com.au>

In addition, staff of the CRC at each of the participating universities teach undergraduate and graduate courses that are informed by their CRC work in association with industry partners; one example among many is the *Participatory Resource Management* course, delivered at the Australian National University with substantial contributions from researchers in the CRC's Communities project (4.3). The CRC and our staff continue to play a fundamental role in supporting the National Forestry Masters Program (<http://www.forestry.org.au/masters>), in which four of our five participating universities are involved.

Nature of seminars/workshops/courses run for industry

Industry staff have participated in many of the modules and courses offered as part of the National Forestry Masters Program. Examples include the professional course *Measuring Forest Value*, offered by the Australian National University twice during the reporting period.

Contribution to skill development in the industry

Twenty-one CRC research students participated in the CRC's 2010 Annual Science Meeting, and in satellite student training programs addressing communication and academic paper writing skills. CRC education funds supported individual students to participate in other targeted generic skills training, such as in scientific writing and statistics, on case-by-case bases agreed with their supervisors.

Abbreviations, acronyms and initialisms

AFG	Australian Forest Growers
AGM	Annual General Meeting
ALS	airborne laser scan
ANU	Australian National University
APFL	Albury Plantation Forest Company
APVMA	Australian Pesticides and Veterinary Medicines Authority
BoM	Bureau of Meteorology
ARC	Australian Research Council
BPOS	Blue gum Productivity Optimisation System
C&U	Commercialisation and utilisation
CA	Commonwealth Agreement
CABALA	A linked carbon, water and nitrogen computer model of forest growth for silvicultural decision-support (from carbon balance)
CASR	Collaboration and Structural Reform Fund
CE	community engagement
CERF	Commonwealth Environment Research Facilities Program
CIPMC	Commercialisation and IP Management Committee
CRC for Forestry	(our working name)
CRC Forestry Limited	(our registered business name)
CRC	The Cooperative Research Centre for Forestry
CRCA	The Cooperative Research Centres Association
CRES	Centre for Resource and Environmental Studies
CSIRO	The Commonwealth Scientific and Industrial Research Organisation (Australia)
CWD	coarse woody debris
DArT	Diversity arrays technology (a generic genotyping technology)
DBH	Diameter over breast height
DED	Department of Economic Development (Tasmania)
DEEDI	Department of Employment, Economic Development and Innovation (Queensland)
DEST	The Australian Government Department of Education Science and Training
DPI NSW	Department of Primary Industries (NSW)
DPIW	Department of Primary Industries and Water (Tasmania)
DSE	Department of Sustainability and Environment (Victoria)
DSS	Decision-support system
ESA	Ecological Society of Australia
FABI	Forestry and Agricultural Biotechnology Institute, University of Pretoria

FEA	Forest Enterprises Australia Ltd
FFIC	Forests and Forest Industry Council of Tasmania
FIAT	Forest Industries Association of Tasmania
FORTHREATS	European network on emerging diseases and invasive species threats to European forest ecosystems. For more information on this project please refer to http://www.ulb.ac.be/sciences/lubies/forthreats.html
FPA	Forest Practices Authority, Tasmania
FPC	Forest Products Commission, WA
FT	Forestry Tasmania
FWPA	Forest and Wood Products Australia
FWPRDC	formerly Forest and Wood Products Research and Development Corporation (now Forest and Wood Products Australia Limited)
GL	Gunns Ltd
GSL	Great Southern Limited
GSP	Great Southern Plantations, a partner to the CRC for Forestry, changed its name to Great Southern Limited in 2006.
GTRPC	Green Triangle Regional Plantations Committee
Gunns	Gunns Limited
Hansol	Hansol P I Pty Ltd
HVP	Hancock Victorian Plantations
IEGN	International <i>Eucalyptus</i> Genome Network
IP	intellectual property
IPMG	Industry Pest Management Group
ISSN	International standard serial number
ITC	ITC Limited
IUFRO	International Union of Forest Research Organisations
LGS	longitudinal growth strain
LiDAR	light detection and ranging
ILTER	Long-term ecological research (There is an LTER site located at Warra in southern Tasmania.)
MC	Management Committee
MIS	Managed Investment Scheme
MLD	<i>Mycosphaerella</i> leaf disease
MODIS	Moderate Resolution Imaging Spectroradiometer
Murdoch	Murdoch University
NIR	near infrared
NIRS	near-infrared scanning
NRM	Natural Resource Management
NS	Norske Skog Paper Mills (Australia) Ltd

NSW DPI	New South Wales Department of Primary Industries
Oji	Oji Paper Co. Ltd
PA	Participants' Agreement
PCC	A CRC for Forestry program coordinating committee
PFT	Private Forests Tasmania
PSC	A CRC for Forestry project steering committee
QDPIF	Queensland Department of Primary Industry and Fisheries
QTL	quantitative trait loci
SCU	Southern Cross University
SED; sedub	small end diameter; small end diameter under bark
SEFE	South East Fibre Exports
SMEs	small to medium enterprises
SPC	Strategic Policy Committee
SST	silvicultural systems trial
StanForD	Standard for Forestry Data
STBA	Southern Tree Breeding Association
TASVEG	Tasmanian Vegetation Map
TC	Timbercorp Ltd
TCFA	Tasmanian Community Forest Agreement
TIAR	Tasmanian Institute of Agricultural Research
UniMelb	University of Melbourne
UTas	University of Tasmania
VR	variable retention
WAPRES	WA Plantation Resources

Appendix A:

Publications, outreach and technology transfer

Publications

Refereed journal articles (in press)

- Berndt LA, Allen GR (2010) Biology and pest status of *Uraba lugens* Walker (Lepidoptera: Nolidae) in Australia and New Zealand. *Australian Journal of Entomology*.
- Costa e Silva J, Harder C and Potts B (2010) Genetic variation and parental performance under inbreeding for growth in *Eucalyptus globulus*. *Annals of Forest Science* **67** (published online).
- Costa e Silva J, Harder C, Tilyard P, Pires A and Potts B (2010) Effects of inbreeding on population mean performance and observational variances in *Eucalyptus globulus*. *Annals of Forest Science* **67** (published online).
- Grosser C, Vaillancourt RE and Potts BM (2010) Microsatellite based paternity analysis in a clonal *Eucalyptus nitens* seed orchard. *Silvae Genetica*.
- Iason GI, O'Reilly-Wapstra JM, Brewer M, Summers RW, Moore BM (2010) Do multiple herbivores maintain chemical diversity of Scots pine monoterpenes? *Philosophical Transactions of the Royal Society B*.
- Leys AJ and Vanclay JK (2010b) Land-use change conflict arising from plantation forestry expansion: Views across Australian fence-lines. *International Forestry Review*.
- New TR, Yen AL, Sands DPA, Greenslade P, Neville PJ, York A, Collett NG (2010) Planned fires and invertebrate conservation in south east Australia. *Journal of Insect Conservation*.
- O'Grady AP, Eyles A, Worledge D and Battaglia M (2010) Seasonal patterns of foliage respiration in dominant and suppressed *Eucalyptus globulus* canopies. *Tree Physiology*
- Othman RJA, Jordan GJ, Worth JRP, Steane DA, Duretto MF (2010) Phylogeny and infrageneric classification of *Correa* Andrews (Rutaceae) based on nuclear and chloroplast DNA. *Plant Systematics and Evolution*.
- Pinkard EA, Beadle CL, Mendham DS, Carter J and Glen M (2010) Determining photosynthetic responses of forest species to elevated [CO₂]: alternatives to FACE. *Forest Ecology and Management*.
- Sanger JC, Davidson NJ, O'Grady AP and Close DC (2010) Are the patterns of regeneration in the endangered *Eucalyptus gunnii* sub sp *divaricata*, shifting in response to climate? *Austral Ecology*.
- Stackpole DJ, Joyce K, Potts BM and Harwood CE (2010) Correlated response of pulpwood profit traits following differential fertilisation of a *Eucalyptus nitens* clonal trial. *New Zealand Journal of Forestry Science*.
- Thavamanikumar S, McManus LJ, Tibbits J and Bossinger G The significance of Single Nucleotide Polymorphisms (SNPs) in *Eucalyptus globulus* breeding programs. Australasian Forest and Genetics Conference Special Issue in Australian Forestry Journal.
- Verbesselt J, Hyndman R, Zeileis A and Culvenor D (2010) Phenological change detection while accounting for abrupt and gradual trends in satellite image time series. *Remote Sensing of Environment*.
- Walker PW, Allen GR (2010) Mating frequency and reproductive success in an income breeding moth: *Mnesampela privata* (Lepidoptera: Geometridae). *Entomologia Experimentalis et Applicata*.

Refereed journal articles (published)

- Acuna M and Kellogg L (2009) Evaluation of alternative cut-to-length harvesting technology for native forest thinning in Australia. *International Journal of Forest Engineering* **20**(2):19-27.
- Almeida AC, Siggins A, Batista TR, Beadle CL, Sebastião Fonseca S and Loos, R (2010) Mapping the effect of spatial and temporal variation in climate and soils on *Eucalyptus* plantation production with 3-PG, a process-based growth model. *Forest Ecology and Management* **259**, 1730–1740.
- Baker SC, Barmuta LA, Richardson AMM (2009) Response of ground dwelling beetles across logging coupe edges into stream side reserves. *Australian Journal of Entomology* **48**, 194–203.

- Baker S, Barmuta L, Grove S, Richardson A (2009) Are streamside buffers edge affected habitat for ground dwelling beetle assemblages? *Biodiversity Conservation* **18**, 3467–3482.
- Barbour RC, Baker SC, O'Reilly-Wapstra JM, Harvest TMA, Potts BM (2009d) A footprint of tree-genetics on the biota of the forest floor. *Oikos* **118**, 1917–1923.
- Barbour RC, Forster LG, Baker SC and Potts BM (2009c) Biodiversity consequences of genetic variation in bark characteristics within a foundation tree species. *Conservation Biology* **23**, 1146–1155.
- Barbour RC, Storer MJ and Potts BM (2009b) Relative importance of tree genetics and microhabitat on macrofungal biodiversity on coarse woody debris. *Oecologia* **160**, 335–342.
- Bethge P, Munks SA, Otley H, Nicol S (2009) Activity patterns and sharing of time and space of platypuses, *Ornithorynchus anatinus*, in a subalpine Tasmanian Lake. *Journal of Mammalogy* **90**, 1350–1356.
- Blackburn D, Hamilton M, Harwood C, Innes T, Potts B and Williams D (2010) Stiffness and checking of *Eucalyptus nitens* sawn boards: Genetic variation and potential for genetic improvement. *Tree Genetics and Genomes* (published online).
- Bradbury GJ, Potts BM and Beadle CL (2010) Quantifying phenotypic variation in wood colour in *Acacia melanoxylon* R.Br. *Forestry* **83** 153–162.
- Burkitt LL, Donaghy DJ and Smethurst PJ (2010) Low rates of phosphorus fertiliser applied strategically throughout the growing season under rain-fed conditions did not affect dry matter production of perennial ryegrass (*Lolium perenne* L.). *Crop & Pasture Science* **61**, 353–362.
- Clapcott JE and Barmuta LA (2010) Metabolic patch dynamics in small headwater streams: exploring spatial and temporal variability in benthic processes. *Freshwater Biology* **55**, 806–824.
- Clapcott JE and Barmuta LA (2010) Forest clearance increases metabolism and organic matter processes in small headwater streams. *J N Am Benthol Soc*, **29**, 546–561.
- Close DC, Davidson NJ, Churchill KC, Corkrey R (2010) Establishment of native *Eucalyptus pauciflora* and exotic *Eucalyptus nitens* on former grazing land. *New Forests* **40**, 143–152.
- Collett NG and Elms S (2009) The control of siren wood wasp using biological control agents in Victoria, Australia. *Agricultural and Forest Entomology* **11**, 283–294.
- Collett NG and Fagg PC (2010) Insect defoliation of mixed-species eucalypts in East Gippsland. *Australian Forestry* **73**, 81–90.
- Downes GM, Catela F and Meder R (2009) Developing and evaluating a multisite and multispecies NIR calibration for the prediction of Kraft pulp yield in eucalypts. *Southern Forests* **71**, 155–164.
- Downes GM, Meder R, Ebdon N, Bond H, Evans R, Joyce K, and Southerton SG (2010) Radial variation in cellulose content and Kraft pulp yield in *Eucalyptus nitens* using NIR spectral analysis of air-dry wood surfaces. *Journal of Near Infra-Red Spectroscopy* **18**, 147–155.
- Drake P, Mendham D, White D, Ogden G (2009) A comparison of growth, photosynthetic capacity and water stress in *Eucalyptus globulus* coppice regrowth and seedlings during early development. *Tree Physiology* **29**, 663–674.
- Drew DM, Downes GM and Battaglia M (2010) CAMBIUM, a process-based model of daily xylem development in *Eucalyptus*. *J. Theor. Biol.* **264**, 395–406.
- Drew DM, Downes GM, O'Grady AP and Read J (2009) High resolution temporal variation in wood density, microfibril angle and wood anatomical properties in irrigated and non-irrigated *Eucalyptus globulus*. *Annals of Forest Science* **66**, 406–415.
- Eyles A, Pinkard E, O'Grady AP, Worledge D, Warren D, Battaglia M and Mohammed CL (2009) Role of cortical photosynthesis in recovery following defoliation in *Eucalyptus globulus*? *Plant Cell and Environment* **32**, 1004–1014.
- Feikema PM, Morris JD, Beverly CR, Collopy JJ, Baker TG, Lane PNJ (2010). Validation of plantation transpiration in south-eastern Australia estimated using the 3PG+forest growth model. *Forest Ecology and Management* **260**, 663–678.
- Feikema PM, Morris JD, Connel LD (2010) The water balance and water sources of a *Eucalyptus* plantation over shallow saline groundwater. *Plant and Soil* **332**, 429–449.
- Forrester DI, Collopy JJ, Morris JD (2010) Transpiration along an age series of *Eucalyptus globulus* plantations in southeastern Australia. *Forest Ecology and Management* **259**, 1754–1760.

- Forrester DI, Theiveyanathan S, Collopy JJ, Marcar NE (2010) Enhanced water use efficiency in a mixed *Eucalyptus globulus* and *Acacia mearnsii* plantation. *Forest Ecology and Management* **259**, 1761–1770.
- Forrester DI, Medhurst JL, Wood M, Beadle CL and Valencia JC (2010) Growth and physiological responses to silviculture for producing solid-wood products from Eucalyptus plantations: An Australian perspective. *Forest Ecology and Management* **259**, 1819–1835.
- Franks PJ, Drake PL, Beerling DJ (2009) Plasticity in maximum stomatal conductance constrained by negative correlation between stomatal size and density: An analysis using *Eucalyptus globulus*. *Plant, Cell and Environment* **32**, 1737–1748.
- Freeman JS, Whittock SP, Potts BM and Vaillancourt RE (2009) QTL influencing growth and wood properties in *Eucalyptus globulus*. *Tree Genetics and Genomes* **5**, 713–722.
- Gates GM, Ratkowsky DA, Grove SJ (2009) Aggregated retention and macrofungi: a case study from the Warra LTER site, Tasmania. *Tasforests* **18**, 33–54.
- Grove S (2009) Beetles and fuelwood harvesting: a retrospective study from Tasmania's southern forests. *Tasforests* **18**, 77–99.
- Grove S (2009). A decade of deadwoodology at Warra. *The Tasmanian Naturalist* **131**, 25–35.
- Grimbacher PS and Stork NE (2009) How do beetle assemblages respond to cyclonic disturbance of a fragmented tropical rainforest landscape? *Oecologia* **161**, 591–599.
- Grove SJ (2009). Beetles and fuelwood harvesting: a retrospective study from Tasmania's southern forests. *Tasforests* **18**, 77–99.
- Hamilton AJ, Basset Y, Benke KK, Grimbacher PS, Miller SE, Novotny V, Samuelson A, Stork NE, Weiblen GD and Yen JDL (2010) Reducing uncertainty in estimating global arthropod species richness. *American Naturalist* **176**, 90–95.
- Hamilton MG, Harwood CE and Potts BM (2009) The Effects of drying temperature and method of assessment on the expression of genetic variation in gross shrinkage of *Eucalyptus globulus* wood samples. *Silvae Genetica* **58**, 252–261.
- Hamilton MG, Potts BM, Greaves BL and Dutkowski GW (2010). Genetic correlations between pulpwood and solid-wood selection and objective traits in *Eucalyptus globulus*. *Annals of Forest Science* **67** (published online).
- Harris S, Allen K, Baker P, Bird T, Bowman D, Connolly A, d'Arville L, Harwood C, Rozefelds A and Wardlaw T (2010) Guidelines for collecting and conserving dendrochronology samples from Tasmanian public reserves. *Tasforests* **18**, 145–157.
- Hingston AB, Grove S (2010) From clearfell coupe to old-growth 1 forest: Succession of bird assemblages in Tasmanian lowland wet eucalypt forests. *Forest Ecology and Management* **259**, 459–468.
- Hubbard R M, Stape J, Ryan MG, Almeida AC, Rojas J (2010) Effects of irrigation on water use and water use efficiency in two fast growing *Eucalyptus* plantations. *Forest Ecology and Management* **259**, 1714–1721.
- Koch A, Munks SA, Spencer C (2009) Bird use of native trees retained in young eucalypt plantations: species richness and use of hollows. *Wildlife Research* **36**, 581–591.
- Lane PNJ, Feikema PM, Sherwin CB, Peel MC, Freebairn AC (2010) Modelling the long term water yield impact of wildfire and other forest disturbance in Eucalypt forests. *Environmental Modelling & Software* **25**, 467–478.
- Lane S, Robinson AP, Baker TG (2010) The functional regression tree method for diameter distribution modelling. *Canadian Journal of Forest Research* **40**, 1870–1877.
- Le S, Nock C, Henson M and Shepherd M (2009) Genetic differentiation among and within three red mahoganies (Series Annulares), *Eucalyptus pellita*, *E. resinifera* and *E. scias* (Myrtaceae). *Aust. J. Sys. Bot.* **22**, 1–12.
- Leys AJ and Vanclay JK (2010a) Stakeholder engagement in social learning to resolve controversies over land-use change to plantation forestry. *Regional Environmental Change*, DOI: 10.1007/s10113-010-0132-6
- Listyanto T, Glencross K, Nichols JD, Schoer L, Harwood C (2010) Performance of eight eucalypt species and interspecific hybrid combinations at three sites in northern New South Wales, Australia. *Australian Forestry* **73**, 48–52.

- McGowen MH, Vaillancourt RE, Pilbeam DJ, Potts BM (2010) Sources of variation in self-incompatibility in the Australian forest tree, *Eucalyptus globulus*. *Annals of Botany* **105**, 737–745.
- Macfarlane C, Bond C, White DA, Grigg AH, Ogden GN, Silberstein R (2010) Transpiration and hydraulic traits of old and regrowth eucalypt forest in southwestern Australia. *Forest Ecology and Management* **260**, 96–105.
- Macgregor JW, Holyoake CS, Munks SA, Robertson ID and Warren KS (2010) Preliminary investigation into the prevalence of mucormycosis in the platypus (*Ornithorhynchus anatinus*) in three catchments in north-west Tasmania. *Australian Veterinary Journal* **88**, 190–196.
- McKinnon G, Smith J, Potts BM (2010) Recurrent nuclear DNA introgression accompanies chloroplast DNA exchange between two eucalypt species. *Molecular Ecology* **19**, 1367–1380.
- Macinnis-Ng CMO, Fuentes S, O'Grady AP, Palmer AR, Taylor D, Whitley RJ, Yunusa I, Zeppel MJB and Eamus D (2010). Root biomass distribution and soil properties of an open woodland on a duplex soil. *Plant and Soil* **327**, 377–388.
- Mendham DS, Kumaraswamy S, Sankaran KV, Smitha John K, Grove TS, O'Connell AM, Rance SJ and Sujatha MP (2009) An assessment of response of soil-based indicators to nitrogen fertilizer across four tropical eucalyptus plantations. *Journal of Forestry Research* **20**, 237–242.
- Miehle P, Battaglia M, Sands PJ, Forrester DI, Feikema PM, Livesley SJ, Morris JD, Arndt SKI (2009) A comparison of four process-based models and a statistical regression model to predict growth of *Eucalyptus globulus* plantations. *Ecological Modelling* **220**, 734–746.
- Miller A, O'Reilly-Wapstra J, Potts B, McArthur C (2009) Non-lethal strategies to reduce browse damage in eucalypt plantations. *Forest Ecology and Management* **259**, 45–55.
- Mimura M, Barbour RC, Potts BM, Vaillancourt RE and Watanabe KN (2009) Comparison of contemporary mating patterns in continuous and fragmented *Eucalyptus globulus* native forests. *Molecular Ecology* **18**, 4180–4192.
- Naghdi R, Moradmand Jalali A, Ghaffariyan MR and Lotfalian M (2009) Soil porosity and soil stress for skidder and mule logging sites. *Journal of Forest Science* **3**, 103–113.
- Neary DG, Smethurst PJ, Baillie BR, Petrone KC, Cotching WE, Baillie CC (2010) Does tree harvesting in streamside management zones adversely affect stream turbidity? Preliminary observations from an Australian case study. *Journal of Soils and Sediments* **10**, 652–670.
- Nevill P, Bossinger G, Ades P (2010) Phylogeography of the world's tallest angiosperm, *Eucalyptus regnans*: evidence for multiple isolated Quaternary refugia. *Journal of Biogeography* **37**, 179–192.
- Neyland MG, Hickey JE and Edwards LG (2009) Safety and productivity at the Warra silvicultural systems trial. *Tasforests* **18**, 1–16.
- Nichols JD, Smith GB, Grant J and Glencross K (2010) Subtropical eucalypt plantations in eastern Australia. *Australian Forestry* **73**, 53–62.
- Noordeloos M, Gates GM (2009) Preliminary studies in the genus *Entoloma* in Tasmania – II. *Cryptogamie, Mycologie* **30**, 107–140.
- Noske PJ, Lane PNJ, Sheridan GJ (2010) Stream exports of coarse matter and phosphorus following wildfire in NE Victoria, Australia. *Hydrological Processes* **24**, 1514–1529.
- O'Grady AP, Cook PG, Eamus D, Duguid A, Wischusen JDH, Fass T and Worledge D (2009) Convergence in water use within an arid-zone woodland. *Oecologia* **160**, 643–655.
- O'Reilly-Wapstra JM, Bailey JK, McArthur C and Potts BM (2010) Genetic and chemical based resistance to two mammalian herbivores varies across the geographic range of *Eucalyptus globulus*. *Evolutionary Ecology Research* **12**, 491–505.
- O'Reilly-Wapstra JM and Cowan P (2010) Native plant/herbivore interactions as determinants of the ecological and evolutionary effects of invasive mammalian herbivores: the case of the common brushtail possum. *Biological Invasions* **12**, 373–387.
- Quentin A, Pinkard EA, Beadle CL, O'Grady AP, Paterson S and Mohammed CL (2010) Do artificial and natural defoliations have similar effects on physiology of *Eucalyptus globulus* Labill. seedlings? *Annals of Forest Science* **67**, 203–212.

- Rapley LP, Potts BM, Battaglia M, Patel VS and Allen GR (2009) Long-term realised and projected growth impacts caused by autumn gum moth defoliation of 2-year-old *Eucalyptus nitens* plantation trees in Tasmania, Australia. *Forest Ecology and Management* **258**, 1896–1903.
- Ratkowsky DA, Gates GM (2009) Macrofungi in early stages of forest regeneration in Tasmania's southern forests. *Tasforests* **18**, 55–66.
- Rice AD, Allen GR (2009) Temperature and developmental interactions in a multitrophic parasitoid guild. *Australian Journal of Entomology* **48**, 282–286.
- Richards AE, Forrester DI, Bauhus J, Scherer-Lorenzen M (2010) The influence of mixed tree plantations on the nutrition of individual species: a review. *Tree Physiology* **30**, 1192–1208.
- Sansaloni CP, Petroli CD, Carlong J, Hudson CJ, Steane DA, Myburg AA, Grattapaglia D, Vaillancourt R and Kilian A (2010) A high-density Diversity Arrays Technology (DArT) microarray for genome-wide genotyping in *Eucalyptus*. *Plant Methods* **6**, 16–27.
- Schirmer J (2009) Ethical issues in the use of multiple survey reminders. *Journal of Academic Ethics* **7**, 125–139.
- Sexton T, Henry R, McManus L, Bowen S, and Shepherd M (2010) Capture of assay template by multiplex PCR of long amplicons for genotyping SNPs and InDels with MALDI-TOF mass spectrometry. *Molecular Breeding* **25**, 471–480.
- Shepherd M, Sexton TR, Thomas D, Henson M and Henry RJ (2010) Geographical and historical determinants of microsatellite variation in *Eucalyptus pilularis*. *Can. J. For. Res.* **40**, 1051–1063.
- Shepherd M and Raymond CA (2010) Species delineation and gene flow in the Blackbutts (genus *Eucalyptus* subgenus *Eucalyptus* section *Pseudophloius*). *Conservation Genetics* **11**, 1965–1978 (published online 18 May 2010).
- Smith BJ, Davies PE, Munks SA (2009) Changes in benthic macroinvertebrate communities in upper catchment streams across a gradient of catchment forest operation history. *Forest Ecology and Management* **257**, 2166–2174.
- Smith HG, Sheridan GJ, Lane PNJ, Sherwin CB (2010) Paired Eucalyptus forest catchment study of prescribed fire effects on suspended sediment and nutrient exports in south-eastern Australia. *International Journal of Wildland Fire* **19**, 624–636.
- Somers B, Verbesselt J, Ampe E, Sims N, Verstraeten WW and Coppin P (2010) Spectral Mixture Analysis to monitor defoliation in mixed aged *Eucalyptus globulus* Labill plantations in southern Australia using Landsat 5-TM and EO-1 Hyperion data. *International Journal of Applied Earth Observation and Geoinformation* **12**, 270–277.
- Stackpole DJ, Vaillancourt RE, de Aguilar M and Potts BM (2010) Age trends in genetic parameters for growth and wood density in *Eucalyptus globulus*. *Tree Genetics and Genomes* **6**, 179–193.
- Stackpole DJ, Vaillancourt RE, Downes GM, Harwood CE and Potts BM (2010) Genetic control of kraft pulp yield in *Eucalyptus globulus*. *Canadian Journal of Forest Research* **40**, 917–927.
- Stone C, Chesnut K, Penman T, Nichols JD (2010) Effects of waterlogging on potted *Eucalyptus dunnii* and the pest psyllid *Creiis lituratus*. *Australian Forestry* **73**, 98–105.
- Strandgard M (2009) Evaluation of manual log measurement errors and its implications on harvester log measurement accuracy. *International Journal of Forest Engineering* **20**, 9–16.
- Suitor S, Brown PH, Gracie AJ, Potts BM, Rix KD, Gore PL (2010) The impact of resource competition on capsule set in *Eucalyptus globulus* seed orchards and its manipulation through irrigation management. [New Forests](#) **39**, 117–127.
- Suitor S, Potts BM, McGowen MH, Pilbeam DJ, Brown PH, Gracie AJ, Gore PL (2009) The relative contribution of the male and female to the variation in reproductive success in *Eucalyptus globulus*. *Silvae Genetica* **58**, 129–138.
- Tedersoo L, Gates G, Dunk CW, Lebel T, May TM, Kõljalg U, Jairus T (2009) Establishment of ectomycorrhizal fungal community on isolated *Nothofagus cunninghamii* seedlings regenerating on dead wood in Australian wet temperate forests: does fruit-body type matter? *Mycorrhiza* **19**, 403–416.
- Tedersoo L, Pärtel K, Jairus T, Gates G, Põldmaa K, Tamm H (2009) Ascomycetes associated with ectomycorrhizas: molecular diversity and ecology with particular reference to the Helotiales. *Environmental Microbiology* **11**, 3166–3178.

- Thumma B, Matheson BA, Zhang D, Meeske C, Meder R, Downes GM and Southerton SG (2009) Identification of a *Cis*-acting Regulatory Polymorphism in Eucalypt Cobra-like Gene Affecting Cellulose Content. *Genetics* **183**, 1153–1164.
- Verbesselt J, Hyndman R, Newnham G and Culvenor D (2010) Detecting trend and seasonal changes in satellite image time series. *Remote Sensing of Environment* **114**, 106–115.
- Verbesselt J, Robinson A, Stone C and Culvenor D (2009) Forecasting tree mortality using change metrics derived from MODIS satellite data. *Forest Ecology and Management* **258**, 1166–1173.
- Walker PW, Allen GR, Davies NW, Smith JA, Molesworth PP, Nilsson A, Anderson F, Hedenstrom E (2010) Identification, synthesis and field testing of (3Z, 6Z, 9Z)-3,6,9-henicosatriene, a second bioactive component of the sex pheromone of the autumn gum moth, *Mnesampela privata* (Lepidoptera: Geometridae). *Journal of Chemical Ecology*. **35**, 1411–1422.
- Wardlaw T, Grove S, Hopkins A, Yee M, Harrison K and Mohammed C (2009) The uniqueness of habitats in old eucalypts: contrasting wood-decay fungi and saproxylic beetles of young and old eucalypts. *Tasforests* **18**, 17–32.
- Watson A, Barmuta LA (2010) Litter retention in Tasmanian headwater streams after clear-fell logging. *Hydrobiologia* **637**, 197–206.
- White D, Battaglia M, Mendham D, Crombie D, Kinal J, McGrath J (2010) Observed and modelled leaf area index in *Eucalyptus globulus* plantations: tests of optimality and equilibrium hypotheses. *Tree Physiology* **30**, 831–844.
- White D, Crombie D, Kinal J, Battaglia M, McGrath J, Mendham D, Walker S (2009) Managing productivity and drought risk in *Eucalyptus globulus* plantations in south-western Australia. *Forest Ecology and Management* **259**, 33–44.
- Wiersma JM and Richardson A (2009) Foraging of white-bellied seaeagles *Haliaeetus leucogaster* in relation to marine fish farms in Tasmania. *Corella* **33**, 71–79.
- Wood MJ, McLarin MW, Volker PW and Syme M (2009) Management of eucalypt plantations for profitable sawlog production in Tasmania, Australia. *Tasforests* **18**, 117–130.
- Wright TE, Kasel S, Tausz M, Bennett LT (2010) Edge microclimate of temperate woodlands as affected by adjoining land use. *Agricultural and Forest Meteorology* **150**, 1138–1146.

Book chapters

- Whitham TG, Gehring CA, Evans LM, LeRoy CJ, Bangert RK, Schweitzer JA, Allan, GJ, Barbour RC, Fischer DG, Potts BM, Bailey JK. A community and ecosystem genetics approach to conservation biology and management. In 'Molecular Approaches in Natural Resource Conservation and Management'. (Eds A DeWoody, JW Bickham, C Michler, KM Nichols, OE Rhodes Jr and K Woeste) pp. 50–62. (Cambridge University Press)

Confidential reports

- Collett NG (2009) Controlling Autumn gum moth (*Mnesampela privata* Guenee) and *Mycosphaerella* leaf spot (*Mycosphaerella* spp.) in *Eucalyptus globulus* (Labill.) seedlings using insecticide tablets and fungicide application'. Report for Department of Primary Industries. (The University of Melbourne: Melbourne, Australia)
- Collett NG (2009) 'Review of key exotic insect pest species, the threats they pose to the plantation industry in Victoria and methods of surveillance and detection'. Report for Department of Primary Industries. (The University of Melbourne: Melbourne, Australia)
- Collett NG and Fagg P (2009) 'Insect defoliation of mixed species eucalypts in East Gippsland 2003–2006'. Report for Department of Sustainability and Environment. (The University of Melbourne: Melbourne, Australia)
- Coote D (2009) 'Identification and review of commercial wood-fuelled electricity and heat generation technologies in the 1MW, 5MW and 25MW ranges'. NFM Forest Internship Project. (The University of Melbourne: Melbourne, Australia)

- Crombie S, O’Gara E, Howard B, Ward B, Harper R, Blake G, Skinner G and Dixon R (2010) ‘Sustainable Production and Landscape Repair in Salinity-Affected Water Supply Catchments’. Final report: Caring for our country – open grants project OG084015.
- Downes GM, Meder R, Ebdon N, Menz D and Hicks C (2009) Quality Assessment of Australian woodchips Project 5: Field-based application of acoustic velocity and NIR as predictors of pulp quality across site and species. FWPA PN07.3027 CSIRO Client Report No. 1895.
- Elek J, Patel V, Allen GR (2009) ‘Lethal trap tree trials 2008–09: Comparison of concentrate and dilute infusions of imidacloprid into trap trees for controlling the leaf beetle *Paropsisterna bimaculata*’. Confidential report for Forestry Tasmania, CRC for Forestry and Bayer CropScience. Forestry Tasmania Technical Report 13/2009.
- Elek J, Patel VS, Allen GR (2009) ‘Lethal trap tree trials 2008–09: Preliminary trial of Pentra-bark® plus imidacloprid as a bark spray for controlling the leaf beetle, *Paropsisterna bimaculata*’. Confidential report for AgriChem, Technical Report 14. (Division of Forest Research and Development, Forestry Tasmania and CRC for Forestry)
- McElwee D and Baker S (2009) ‘Regeneration burn escapes into unharvested forest from aggregated retention and clearfelled coupes 2007–2009’. DFRD Technical Report 15/2009. (Division of Forest Research and Development, Forestry Tasmania)
- Quarrell S, Walker PW, Davies NW, Allen GR (2009) ‘Preliminary analysis of the volatile compounds associated with *Paropsisterna bimaculata* and two host-plant species, *Eucalyptus regnans* and *E. nitens*’. Confidential report for Forestry Tasmania.
- Wapstra M and Doran N (2009) ‘Review of Threatened Fauna Adviser Background Report 1: History of the Threatened Fauna Adviser, Overview of Review Process and Species List’. (Forest Practices Authority: Hobart)

Public reports

- Almeida A, Smethurst P, Harwood C, Battaglia M (2009) ‘Integrated research on catchment management and process-based modelling at Aracruz Guaiba Unit’. CSIRO report no. 1892.
- Baker T, Wiedemann J, Dumbrell I, McGuire D, Acuna M, Knott J (2009) ‘Effect of stocking on growth, yield, tree diameter class distribution, harvesting cost and financial return in *Eucalyptus globulus* pulpwood plantations in Western Australia’. CRC for Forestry Technical Report no. 197.
- Blakemore P, Morrow A, Ngo D, Washusen R, Harwood C, Northway R, Wood M, Volker P and Porada H (2010) ‘Plantation-grown *Eucalyptus nitens*: Solid wood quality and processing performance on linear sawing systems with a range of commercial and experimental drying schedules’. CRC for Forestry Technical Report no. 200.
- Brown M (2009) ‘Best practices for restraining logs and timber for Tasmania’. Report on behalf of Forest Products Transport Committee Load Restraint Subcommittee. Forest Products Transport Committee Tasmania Internal Report.
- Chuter A (2010) Landscape Symposium: 29 and 30 March 2010, Book of Abstracts. (CRC for Forestry: Hobart, Tasmania)
- Forest Practices Authority (2009) ‘Management of gene flow from plantation eucalypt species’. Flora Technical Note No. 12. (Forest Practices Authority: Hobart, Tasmania)
- Gilfedder M, Zhang L, Theiveyanathan T, Marcar N, Roxburgh S, Zhao F, Chen Y, Almeida A (2010) ‘Methods to Assess Water Allocation Impacts of Plantations’. Final report to the National Water Commission.
- Leys A and Vanclay J (2010) ‘Social learning study of plantation forestry in the Upper Clarence catchment of north-eastern NSW’. CRC for Forestry Technical Report 201. (CRC for Forestry: Hobart, Tasmania)
- May B, Smethurst P, Carlyle C, Mendham D, Bruce J, Baillie C (2009) ‘Review of Fertiliser Use in Australian Forestry’. Forest and Wood Products Australia Report PRC072-0708.
- Marcar N, Theiveyanathan T, Roxburgh S, Gilfedder M, Littleboy M, Almeida A, Christy B, Barlow K, Crawford D and Benyon R (2010) ‘Methodology to assess site-specific impacts of plantations on catchment water yields’. Client report to the National Water Commission.
- Schirmer J (2009) ‘Socio-economic impacts of the plantation industry on rural communities in Tasmania’. CRC for Forestry Technical Report 199. (CRC for Forestry: Hobart, Tasmania)

Potts BM and Brooker C (2010) 'Seed germination on filtrates from soil sampled beneath trees of *Eucalyptus globulus*, *E. nitens* and their F₁ hybrid'. CRC for Forestry Technical Report No. 203. (CRC for Forestry: Hobart, Tasmania)

Walsh D (2009) 'Research Summary – Impact on harvesting costs of short logs vs long logs and increasing log sorts'. CRC for Forestry Internal Report.

Theses

Gates GM (2009) Coarse woody debris, macrofungal assemblages, and sustainable forest management in a *Eucalyptus obliqua* forest of southern Tasmania. PhD, University of Tasmania.

Jones R (2009) Molecular evolution and genetic control of flowering in *Eucalyptus globulus* species complex. PhD, University of Tasmania.

Neyland M (2010) Regeneration and growth of *Eucalyptus obliqua* and major rainforest species after a range of silvicultural treatments. PhD, University of Tasmania.

O'Dwyer C (2010) Insect ecology in fragmented Grey Box grassy woodlands in North Central Victoria. PhD, The University of Melbourne.

Parr RM (2010) Host synchrony and development in Tasmania of the proposed New Zealand biological control agent *Cotesia urabae*. BAppSci in Agriculture with Honours, University of Tasmania.

Riley I (2010) Temporal and spatial variation of organic carbon in small head water streams. Honours Thesis, University of Tasmania.

Thavamanikumar S (2009) Using genetic association studies for the improvement of wood and fibre properties in *Eucalyptus globulus* ssp. *globulus* Labill. PhD, The University of Melbourne.

Wright TE (2010) Comparative effects of agricultural land and plantations on woodland edge processes. PhD, The University of Melbourne.

Industry bulletins / Technical notes

Coote D (2010) Review of commercial wood-fuelled electricity and heat generation technologies. *CRC Forestry Bulletin* **7**, April 2010.

Griffin R and Brown M (2010) Forest truck fuel consumption survey. *CRC Forestry Bulletin* **8**, April 2010.

Horton BM (2008) Report of inaugural winner of the Jill Landsberg Scholarship. (2008). *ESA Bulletin* **38**, 15–16.

Scott R and Baker S (2008) Update on variable retention research. *Forest Practices News* **8**, 10–11.

Strandgard M (2009) Comparing harvester productivity in third-row versus fifth-row thinning of a *Eucalyptus nitens* plantation. *CRC Forestry Bulletin* **6**, December 2009.

Conferences and events

Keynote or invited conference presentations

- Acuna M, Strandgard M (2009) Precision Forestry and Value Chain Management: Challenges and Opportunities for the Australian Forest Industry. IUFRO Division 4.01 Conference: Mount Gambier, South Australia, August 2009.
- Barbour R, Vaillancourt R and Potts B (2009) Assessing and managing the risk of gene exchange between planted and native eucalypts in Australia. Invited talk, SER International, 2009 World Conference on Ecological Restoration (Restoration Genetics Symposium): Perth, 24–27 August.
- de Almeida AC, Siggins A, Smethurst P, da Silva CVJ, Baillie C (2010) Establishment of experimental catchments to quantify water use by different vegetation types. Invited paper, 9th Seminar on Remote Sensing and GIS Applications in Forest Engineering: Curitiba, Brazil, October 2010.
- O'Reilly-Wapstra JM, McArthur C and Potts BM (2010) Selection for anti-herbivore PSMs in a *Eucalyptus* system. Invited paper. British Ecological Society 2010 Annual Symposium on 'The integrative role of plant secondary metabolites in ecological systems': University of Sussex, UK, 12–14 April.
- Potts B, Barbour R, Mimura M, Costa e Silva J, Craig Hardner C, Jones RC and Vaillancourt R (2009) Forest restoration genetics: Lessons from *Eucalyptus globulus*. Invited talk, SER International, 2009 World Conference on Ecological Restoration (Restoration Genetics Symposium): Perth, 24–27 August.
- Potts BM (2009) Botany of *Eucalyptus* – a Tasmanian icon. Invited public lecture, '100 years of biology at UTAS': Hobart, 12 November.
- Potts BM, Barbour R, Vaillancourt RE (2010) Assessing and managing the risk of gene flow from forest tree plantings: The case of *Eucalyptus* in Australia. Plenary talk presented at the IUFRO Kuala Lumpur conference, 'Sustainable utilization and conservation of forests in the genomics era': Kuala Lumpur, Malaysia, 7–12 March.
- Sexton TR, Henry RJ, McManus LJ, Thomas D and Shepherd M (2010) Conservation of Single Nucleotide Polymorphisms in 44 Wood Quality Candidate Genes of *Eucalyptus globulus*, *Eucalyptus pyrocarpa* and *Eucalyptus pilularis*. Plant and Animal Genome XVIII Conference: San Diego, California, 9–13 January.
- Steane DA, Myburg AA, Kilian A, Carling J, Huttner E, Sansaloni CP, Petrolli CD, Grattapaglia D and Vaillancourt RE (2010) Application of Diversity Arrays Technology (DArT) in *Eucalyptus* phylogeny reconstruction: from populations to species. Invited presentation to IUFRO Conference, 'Sustainable utilization and conservation of forests in the genomics era': Kuala Lumpur, Malaysia, 7–12 March.
- Vaillancourt RE, Freeman JS, Kilian A and Potts BM (2010). QTL studies in *Eucalyptus*. Plenary presentation to IUFRO Conference, 'Sustainable utilization and conservation of forests in the genomics era': Kuala Lumpur, Malaysia, 7–12 March.
- Vaillancourt RE, Steane DA, Freeman JS, Hudson CJ, Myburg AA, Kilian A, Carling J, Huttner E, Sansaloni CP, Petrolli CD, Grattapaglia D, McKinnon GE and Potts BM (2009) DArT markers for genomic studies in *Eucalyptus*. IUFRO Tree Biotechnology Conference: Whistler, Canada, 28 June to 2 July.
- Vaillancourt RE, McKinnon GE, Freeman J, Jones RC, Steane DA, Hudson CJ, Potts BM (2010) Evolutionary genetic studies in the Tasmanian species of *Eucalyptus*. Invited lecture for the symposium 'Plant genetic insights in the southern hemisphere: from Gondwana till present' at the VI Southern Connection Congress: Bariloche, Argentina, 15–19 February.
- Wardlaw T (2009) Policy, science and operational reality: An evaluation of the cessation in the use of compound 1080 on Tasmania's State forests. Plenary talk, Australasian Wildlife Management Society Conference: Napier, New Zealand, November.
- Washusen R (2009) The influence of plantation silviculture on tension wood formation. In proceedings: *Revisiting Eucalypts 2009*, Apiolaza, L., Chauhan, S., & Walker, J. (Wood Technology Research Centre, University of Canterbury, Christchurch) pp 91-100.
- Washusen R (2009) Sawing patterns and lawing lines for procesing young plantation eucalypts. In proceedings of Sawtech 2009, Sawing technologies for improving mill performance: Melbourne, 1–15 September.

Refereed conference proceedings

- Acuna M, Murphy G and Rombouts J. Determining Radiata pine tree value and log product yields using terrestrial LiDAR and optimal bucking in South Australia. Council of Forest Engineering conference 'Environmentally Sound Forest Operations'. (California, USA) June 2009.
- Baral H, Kasel S, Keenan R, Fox J, and Stork N, (2009) GIS-based classification, mapping and valuation of ecosystem services in production landscapes: A case study of the Green Triangle region of south-eastern Australia. In: 'Forestry: a climate of change.' (Eds R Thistlethwaite, D Lamb and R Haines) pp. 64–71. Proceedings of the IFA Conference (Caloundra, Queensland) 6–10 September 2009.
- Feikema P, Morris J, Beverly C, Lane P, Baker T (2010) Using 3PG+ to simulate long-term growth and transpiration in *Eucalyptus regnans* forests. In 'Modelling for Environment's Sake'. (Eds DA Swayne, A Wanhong Yang, A Voinov, A Rizzoli, T Filatova). International Congress on Environmental Modelling and Software Fifth Biennial Meeting (International Environmental Modelling and Software Society: Ottawa, Canada).
- Feikema PM, Lane PNJ, Beverly CR, Baker TG (2009) Application of Macaque and 3PG+ in CAT catchment-scale hydrological models: limitations and opportunities. In Proceedings of the 18th World IMACS Congress and MODSIM09 International Congress on Modelling and Simulation. (Eds RS Anderssen, RD Braddock and LTH Newham) pp. 3507–3513. (Modelling and Simulation Society of Australia and New Zealand and International Association for Mathematics and Computers in Simulation: Cairns, Australia) 13–17 July 2009.
- Raymond C, Henson M, Shepherd M, Sexton TR and Henson M (2009) Quantitative and Molecular Genetic Control of Wood Properties and Chemistry in *Eucalyptus pilularis*. Revisiting Eucalypts 2009'. (Eds I Apiolaza, S Chauhan and J Walker). (Wood Technology Research Centre: University of Canterbury, Christchurch) February 2009. (Not previously reported in 2008–09 annual report)
- Sexton TR, Henry RJ, McManus LJ, Thomas D, and Shepherd M (2010) Conservation of Single Nucleotide Polymorphisms in 44 Wood Quality Candidate Genes of *Eucalyptus globulus*, *Eucalyptus pyrocarpa* and *Eucalyptus pilularis*. In 'Plant and Animal Genome XVIII Conference'. (San Diego, California) 9–13 January 2010.
- Washusen R, Morrow A, Dung Ngo, Seimon G, Wardlaw T, Ryan M, Linehan M and Tuan D (2009) Processing performance and sawn product recovery from thinned native forest regrowth logs from southern Australia. In 'Forestry: a climate of change' pp. 161–169. (Institute of Foresters of Australia: Caloundra, Queensland) 6–10 September 2009.
- Washusen R (2009) Modelling mill door log prices for plantation eucalypts with CSIRO-MILL. In 'Forestry: a climate of change' pp. 175–184. (Institute of Foresters of Australia: Caloundra, Queensland) 6–10 September 2009.

Unrefereed conference proceedings

- Brown M, Walsh D (2010) Potential economic impact of high productivity vehicles for woodchip transport in the Green Triangle region of Australia. Heavy Vehicle Transport Technology (HVTT11) Symposium (Melbourne, Australia) March 2010.
- Downes GM, Meder R, Harwood CE and Ebdon N (2010) Software tools to aid interpretation of NIR spectra for in-field wood property assessment. Appita Conference Proceedings p. 235. (Melbourne, Australia) 20 April 2010.
- Downes GM, Meder R and Harwood C (2009) A multi-site, multi-species calibration for the prediction of cellulose content in eucalypt woodmeal. Tappi Engineering, Pulping and Environmental Conference: Memphis, Tennessee, 11–14 October 2009.
- Meder R, Downes GM and England N (2010) Understanding within tree variation of KPY to establish protocols for in-field sampling for NIR prediction. Appita Conference Proceedings pp. 123–127. (Melbourne, Australia) 20 April 2010.
- Meder R, Downes GM, Ebdon N, Rodemann T, Stanger T and Ramadevi R (2010) Prediction of Kraft Pulp Yield in Eucalypts: An Inter-lab Study. NIR2009 Conference. (Bangkok, Thailand) 8–10 November 2009.
- Meder R, Downes GM and Ebdon N (2009) Experiences in Field Assessment of Kraft Pulp Yield in Plantation Eucalypts. Tappi Engineering, Pulping and Environmental Conference: Memphis, Tennessee, 11–14 October 2009.

Conference presentations

- Abasolo M, Lee D and Shepherd M (2010) Seasonality of flowering in *Corymbia citriodora* subsp *variegata* (Spotted gum). CRC for Forestry Annual Science Meeting: Freemantle, WA, 18–20 May 2010.
- Acuna M, Acuna M, Murphy G and Rombouts J (2010). Determining Radiata pine tree value and log product yields using terrestrial LiDAR and optimal bucking in South Australia. ForestTECH conference: Albury, Australia and Rotorua, NZ, November 2009.
- Acuna M, Strandgard M, Brown M, and Walsh D (2010). Improving efficiencies in the Australian forestry supply chain: Updates on research projects conducted by the CRC for Forestry Harvesting and Operations Program. Wood supply chain optimisation conference: Melbourne, Australia, May 2010.
- Acuna M and Brown M (2010) Reducing transportation costs through the application of performance based standard and hybrid technology, and optimal truck scheduling systems. Precision Forestry Symposium: Stellenbosch University, South Africa, March 2010.
- Anderson N (2009) The social acceptability of timber plantations: a case of contested rural ideals? Melbourne University School of Land and Environment 7th Annual Postgraduate Conference 'Environment — It's Easy Being Green'. Dookie, Victoria, 5–6 November 2009.
- Bailey T, Davidson NJ, Close DCI (2009) Fire, fencing, fatalities and fuel: recreating the eucalypt regeneration niche in the dry forests of Tasmania Restoration ecology. Oral paper, presented at SERI (Society of Restoration Ecology International): Perth, Western Australia, 23–27 August 2009.
- Baker S (2009) Retención variable in los bosques antiguos de Tasmania. Oral presentation (in Spanish) at Cuarto Seminario de Biometría y Producción de Nothofagus: University of La Plata, Argentina. October 2009.
- Baker S, Deltombe D, Garandel M, Neyland M (2009) Vascular plant seedling responses to burning and aggregated retention silviculture. Poster presented at the 10th INTECOL meeting: Brisbane, Australia, 16-21 August, 2009.
- Baker S, Grove S (2009) Biodiversity responses to alternatives to clearfelling at the Warra Silvicultural Systems Trial, Tasmania, Australia. Poster presented at the 13th World Forestry Congress: Buenos Aires, Argentina, 18-25 October 2009.
- Baker S, Grove S (2009) Biodiversity responses to alternatives to clearfelling at the Warra Silvicultural Systems Trial, Tasmania, Australia. Oral presentation at 10th International Congress of Ecology: Brisbane, Australia, 16–21 August 2009.
- Baral H, Kasel S, Keenan R, Fox J, and Stork NE (2010). Mapping and Valuation of Ecosystem Services in the Lower Glenelg Basin, Victoria, Australia. Poster presentation at the CRC for Forestry Annual Science Meeting: Fremantle, WA, 18–20 May 2010.
- Baral H, Kasel S, Keenan R, Fox J, Stork NE (2009) Mapping and Valuation of Ecosystem Services for Forest Restoration Planning and Assessment: Lessons from the Lower Glenelg Basin, Victoria, Australia. Poster presentation at the SERI 2009 World Conference on Ecological Restoration: Perth, WA, 23–27 August 2009.
- Baral H, Kasel S, Keenan R, Fox J, Stork N (2009). GIS-based classification, mapping and valuation of ecosystem services in production landscapes: a case study of Green Triangle region of south-eastern Australia. Proceedings of the Biennial Conference of the Institute of Foresters of Australia: Caloundra, Queensland, 8 September 2009.
- Bialkowski KM, Archibald R, Hardy G, Burgess T (2010) Using soil respiration to monitor the condition of native remnants within plantations in WA. Poster presentation at the CRC for Forestry Annual Science Meeting: Fremantle, WA, 18–20 May 2010.
- Brown M (2009) Diesel–electric hybrid drive technology for reduced fuel consumption and carbon emissions in forest operations. Biennial Conference of the Institute of Foresters of Australia: Caloundra, September 2009.
- Brown M (2009) Reduced fuel use in forestry transportation through the use of higher productivity vehicles (HPV). Biennial Conference of the Institute of Foresters of Australia: Caloundra, September 2009.
- Dare, L (2009) Adding theory to the practice of community engagement: Are forest managers ready for it? University of Tasmania Cradle Coast Post Graduate Conference 2009: Burnie, Tasmania, 6 August 2009.

- Dare L (2009) Adding theory to the practice of community engagement: Are forest managers ready for it? 15th International Symposium on Society and Resource Management: Vienna, Austria, 5–8 July 2009.
- Davidson NJ, Bailey T, Close DC (2009) The importance of coarse woody debris and a hot fire in the regeneration of dry eucalypt forests. Oral paper, presented at SERI (Society of Restoration Ecology International): Perth, Western Australia, 23–27 August 2009.
- Davies NW, Walker PW, Allen GR, Smith J, Molesworth PP, Nilsson A, Andersson F, Hedenstrom E (2009) The Autumn Gum Moth sex pheromone — an elusive blend of alkatrienes. Proceedings of the 22nd Conference of the Australian and New Zealand Society for Mass Spectrometry: Sydney, Australia, 27–30 January 2009.
- Downes GM, Meder R and Harwood C (2009) A multi-site, multi-species calibration for the prediction of cellulose content in eucalypt woodmeal. Tappi Engineering, Pulping and Environmental Conference: Memphis, Tennessee, 11–14 October 2009.
- Downes GM, Meder R, Harwood CE and Ebdon N (2010) Software tools to aid interpretation of NIR spectra for in-field wood property assessment. Appita Conference Proceedings: Melbourne, Australia, 20 April 2010.
- Hudson CJ, Kumar AR, Freeman JF, Kilian A, Potts BM, Myburg AA and Vaillancourt RE (2010) High genome homology between *Eucalyptus* species. Poster presentation at the CRC for Forestry Annual Science Meeting: Fremantle, WA, 18–20 May 2010.
- Hudson CJ, Freeman JS, Faria DA, Grattapaglia D, Kilian A, Potts BM and Vaillancourt RE (2010) High-density linkage map in *Eucalyptus globulus* constructed with 500+ F2 progenies using Diversity Array Technology (DArT) and microsatellite markers. Plant and Animal Genome (PAG) 18 Conference: San Diego, California, January 9–13 2010.
- Hudson CJ, Kumar KAR, Freeman JS, Faria DA, Grattapaglia D, Kilian A, Potts BM, Myburg AA and Vaillancourt RE (2010) Comparative mapping with high marker density reveals high synteny and colinearity among *Eucalyptus* genomes. Oral presentation at Genetics Society of Australasia (GSA) Conference: Canberra, Australia, 4–8 July 2010.
- Meder R, Downes GM and Ebdon N (2009) Experiences in Field Assessment of Kraft Pulp Yield in Plantation Eucalypts. Tappi Engineering, Pulping and Environmental Conference: Memphis, Tennessee, 11–14 October 2009.
- Elek JA, Patel V and Allen GR (2010) The future IPM for leaf beetles: from lethal trap trees to attract-and-kill traps. Presentation, Integrated pest management in temperate eucalypt plantations workshop: IPMG and CRC for Forestry, Perth, WA, 17 May 2010.
- Gordon M (2010) Quantifying community engagement for sustainable forest management in Australian forest plantations. Sustainability Assessment Symposium: Fremantle, WA, 25–27 May 2010.
- Grove S, Baker S, Yee M, Forster, L (2009) The first decade of beetling at Warra Tasmania. Poster presentation at the Australian Entomological Society annual conference: Darwin, NT, September 2009.
- Grove S, Yee M (2009) Tasmanian forestry, fire and the threatened, log-dwelling giant velvet worm (*Tasmanipatus barretti*). Oral presentation at the Australian Entomological Society annual conference: Darwin, NT, September 2009.
- Horton B, Glen M, Davidson N, Mohammed C and Wardlaw T (2009) Sampling for soil fungi: is there a better way? Poster presentation at 10th International Congress of Ecology: Brisbane, Queensland, 16–21 August 2009.
- Horton B, Gates G, Glen M, Mohammed C, Davidson N and Wardlaw T (2009) Ectomycorrhizal fungal communities of native highland and lowland Tasmanian eucalypt forests. Poster presentation at 10th International Congress of Ecology: Brisbane, Queensland, 16–21 August 2009.

- Horton B, Glen M, Davidson N; Mohammed C, Wardlaw T (2009) The ecology of *Eucalyptus delegatensis* dieback in Tasmania. Poster presentation at 10th International Congress of Ecology: Brisbane, Queensland, 16–21 August 2009.
- Koch A, Baker S (2009) Using aerial photographs to remotely assess tree cavity availability. Poster presented at the 13th World Forestry Congress: Buenos Aires, Argentina, 18-25 October 2009.
- Leys A (2009) Evaluating the effectiveness of participatory modelling for addressing natural resource management issues in Australian forested communities. 15th International Symposium on Society and Resource Management, Vienna, Austria, 5–8 July 2009.
- Leys A, and Vanclay J (2010) Role of social learning in reducing controversy surrounding rapid plantation forestry expansion. 18th Commonwealth Forestry Conference: Edinburgh, Scotland, 28 June – 2 July 2010.
- Meder R, Downes G, Ebdon N and Marston D (2010) Exploring spatial variation in wood properties using fibre optic transport systems. 14th ANISG Conference: Adelaide, Australia, 18–21 April 2010.
- Meder R, Downes GM and England N (2010) Understanding within tree variation of KPY to establish protocols for in-field sampling for NIR prediction. Appita Conference Proceedings: Melbourne, Australia, 20 April 2010.
- Miller AM, O'Reilly-Wapstra JM, Potts BM, McArthur C (2009) Manipulating seedling palatability for non-lethal browsing management. Alternatives to 1080 Program Annual Workshop: Launceston, Tasmania, 6 May 2009.
- Miller AM, O'Reilly-Wapstra JM, Potts BM, McArthur C (2009) Manipulating seedling palatability for non-lethal browsing management. 22nd Australasian Wildlife Management Annual Conference: Napier, New Zealand, 30 November to 2 December 2009.
- Neyland MG (2010) Silvicultural performance of alternatives to clearfelling in lowland wet eucalypt forests: Findings from long-term research at Warra, Tasmania. Presentation to the VI Southern Connections Congress: Bariloche, Argentina, 15–19 February 2010.
- O'Reilly-Wapstra J, Wardlaw T, Miller A, Potts BM (2010) Short and long term strategies for browsing management in Tasmania. CRC for Forestry Annual Science Meeting: Fremantle, WA, 18–20 May 2010.
- O'Reilly-Wapstra J, Hamilton M, Russell J, Potts, B (2009) Genetic based natural plant resistance to mammalian herbivores: a viable management option? Spoken paper. 22nd Australasian Wildlife Management Annual Conference: Napier, New Zealand, 30 November to 2 December 2009.
- Potts BM (2010) Landscape management of genetic values. Invited presentation at FPA/CRC for Forestry Symposium 'People, Forests and Landscapes'. Hobart, 29 and 30 March 2010.
- Read S, Grove S, Baker S (2009) Long-Term Ecological Research at Warra: science to policy, science to land management. Invited paper presented at the 10th INTECOL meeting: Brisbane, Australia, 16-21 August, 2009.
- Schweitzer JA, Bailey JK, Barbour R, O'Reilly-Wapstra JA, Hart SC, Whitham TG, and Potts BM (2009) Population-level genetic differentiation in *Populus* and *Eucalyptus* impacts soil nutrient availability. Soil Ecology Society Meetings. Vermont, USA July 2009.
- Strandgard M (2009) Onboard Systems for Australian Forest Operations. Biennial Conference of the Institute of Foresters of Australia: Caloundra, Queensland, September 2009.
- Strandgard M (2009) User guide for the selection of onboard technology in Australian harvesting operations. Precision Forestry Symposium: Stellenbosch University, South Africa, March 2010.
- Tilyard P, Potts BM and O'Reilly-Wapstra J (2010) Leaf oil chemistry of *Eucalyptus nitens* and the Tasmanian native eucalypts. Poster presented at the CRC for Forestry Annual Science Meeting: Fremantle, WA, 18–20 May 2010.
- Vaillancourt RE, Steane DA, Freeman JS, Hudson CJ, Myburg AA, Kilian A, Carling J, Huttner E, Sansaloni CP, Petroli CD, Grattapaglia D, McKinnon GE, Potts BM (2009) DArT markers for genomic studies in *Eucalyptus*. IUFRO Tree Biotechnology Conference, Whistler, Canada, 28 June to 2 July.
- Vanclay J (2010) Participatory modelling to inform rural development: Case studies from Zimbabwe and Australia. Presented at 1st International Conference on Environmental and Rural Development, 'Strategies for Sustainable Rural Development': Phnom Penh, Cambodia, 4–5 March 2010.

Poster presentations

- Hadjigol S, Jones RC, Potts BM, Steane DA, Thavamanikumar S, McManus LJ, Bossinger G, Vaillancourt RE (2010) Evidence for natural selection on lignin and cellulose biosynthesis genes. Poster presented at CRC for Forestry Annual Science Meeting: Fremantle, WA, 18–20 May 2010.
- Sanger JC, Davidson NJ, Close DC and O'Grady A (2009) Understanding the regeneration niche of an endangered subalpine eucalypt in a changing climate: lessons for restoration. Poster paper, presented at SERI (Society of Restoration Ecology International): Perth, WA, 23–27 August 2009.
- Sexton TR, Henry RJ, McManus LJ, Thomas D and Shepherd M (2010) Trans-specific Single Nucleotide Polymorphisms in Eucalyptus Wood Quality Genes. CRC for Forestry Annual Science Meeting: Fremantle, WA, 18–20 May 2010.
- Smith AL, Bristow M, Osborne D and Hunt MA (2010) Estimation of the belowground carbon pool in plantation spotted gum. CRC for Forestry Annual Science Meeting: Fremantle, WA, 18–20 May 2010.
- Stephens H, O'Reilly-Wapstra J, Baker S, Munks S, Potts B (2009) Aggregated retention and mammal conservation in old-growth forests. Poster abstract presented at the 10th International Mammalogical Conference: Mendoza, Argentina, 9–14 August 2009.
- Thavamanikumar S, McManus LJ, Tibbits JFG, Ades PK and Bossinger G (2010) Association genetics in *Eucalyptus globulus* Labill. CRC for Forestry Annual Science Meeting: Fremantle, WA, 18–20 May 2010.

Other presentations

- Ades P (2010) Seed translocations in ash eucalypts. National Climate Change Adaptation Research Facility Workshop 'Genetic Translocation: insuring against extinction and increasing local adaptation?' Melbourne, Victoria, 28–31 March 2010.
- Archibald R (2009) Biodiversity project update from Murdoch University. Presentation to CRC for Forestry workshop 'Restoring degraded remnants in plantations'. Albany, WA, 26 May 2009.
- Bailkovski C (2009) Soil microbes in remnant rehabilitation. Presentation to CRC for Forestry workshop 'Restoring degraded remnants in plantations'. Albany, WA, 26 May 2009.
- Battaglia M and O'Grady A (2009). Cellular automata. Presentation to CRC for Forestry Program 1 DSS workshop. Hobart, Tasmania, 12 November 2009.
- Beadle C (2010) Journal paper-writing: getting started. CRC for Forestry Annual Science Meeting: Fremantle, WA, 18–20 May 2010.
- Beadle, C (2009) Plantation forestry – theoretical production and constraints on yield. Forestry Masters Course, 26 September 2009.
- Bowman D (2010) Think global change: Research landscape change. Talk presented at the CRC for Forestry/FPA symposium 'Managing multiple values at a landscape scale'. Hobart, Tasmania, 29–30 March 2010.
- Bradshaw B (2010) Pest challenges and research needs in the Green Triangle. Talk presented at the CRC for Forestry IPMG (4.4) / Biodiversity 4.2 joint workshop on 'Integrated pest management in temperate eucalypt plantations workshop'. Perth, WA, 17 May 2010.
- Bristow M and Hunt M (2010) Understanding the drivers for tree growth in the subtropics and tropics: assessing risk associated with eucalypt plantations. CRC for Forestry Annual Science Meeting: Fremantle, WA, 18–20 May 2010.
- Burgess T, Tovar F (2010) The IPMG – the plantation industry working together. Talk presented at the CRC for Forestry IPMG (4.4) and Biodiversity (4.2) joint workshop on 'Integrated pest management in temperate eucalypt plantations'. Perth, WA, 17 May 2010.
- Burrows R, Barmuta L, Magierowski R and Fellman J (2010) Nutrient retention of headwater streams in natural and disturbed catchments. Poster presentation at CRC for Forestry Annual Science Meeting: Fremantle, WA, 18–20 May 2010.
- Collett G (2010) Biosecurity in Victoria – the threat posed by exotic pests to our forest estate. Seminar presented at Melbourne University, Victoria, 21 April 2010.
- Cotching B, Broad S, Lisson S, Smethurst P (2010) Land use and land management impacts on stream nutrients. Presentation to Commonwealth Environment Research Facilities (CERF) Conference: Canberra,

ACT, 24–26 May 2010.

- Davidson NJ (2009) Tree decline toolbox: Presentation and launch: Oatlands, Tasmania, 13 November 2009.
- Davidson NJ (2009) Tree decline toolbox: Science behind the toolbox. Hobart, Tasmania 17 November 2009.
- Davidson NJ (2010) Tree decline toolbox: potential for adaptation to the WA environment. Presentation to Murdoch University, WA, 21 May 2010.
- Davidson NJ (2010) Tree decline toolbox: potential for adaptation to the WA environment. Presentation to Department of Environment and Conservation, Kensington, WA, 25 May 2010.
- Davidson NJ (2010) Presentation and discussion on adapting the remnant management 'toolbox' to WA conditions. Presentation to CRC for Forestry workshop on 'Restoring degraded remnants in plantations': Albany, WA, 26 May 2010.
- Duncan F (2010) The importance of management at the landscape level: A Patagonian case study. Talk presented at the CRC for Forestry/FPA symposium 'Managing multiple values at a landscape scale': Hobart, Tasmania, 29–30 March 2010.
- Dunn C and Williams K (2010) Integrating social and natural science disciplines in forestry. Presentation to Rural Innovation Research Group Symposium: University of Melbourne, Victoria, June 2010.
- Elek JA, Patel V, Allen GR (2010) The future IPM for leaf beetles: from lethal trap trees to attract-and-kill traps. Talk presented at the CRC for Forestry IPMG (4.4) & Biodiversity (4.2) joint workshop on 'Integrated pest management in temperate eucalypt plantations': Perth, WA, 17 May 2010.
- Feikema P, Baker T (2009) Modelling Carbon and Water in Forests. University of Melbourne Department of Forest and Ecosystem Science - Department of Sustainability and Environment: Melbourne, Victoria, 27 November 2009.
- Grimbacher P (2009) Forest insects in changing landscapes. Seminar presented at Creswick Campus, Melbourne University, Victoria, 2 October 2009.
- Grimbacher P (2010) Tropical cyclones: environmental vandals or important facilitators of ecological change? Seminar presented at Burnley Campus, Melbourne University, Victoria, 12 May 2010.
- Grimbacher P (2010) Remnant forest and plantation interactions. Talk presented at the CRC for Forestry IPMG (4.4) & Biodiversity (4.2) joint workshop on 'Integrated pest management in temperate eucalypt plantations': Perth, WA, 17 May 2010.
- Harwood C (2010) Eucalypt silviculture. Presentation to a workshop run by the Office of the Gene Technology Regulator to help prepare an international OECD (Organisation for Economic Cooperation and Development) biology document on eucalypts.
- Harwood C (2009) Some thoughts on the role of forest plantations in Tasmania. Public forum 'Common Ground — is a solution to the forestry conflict possible?': University of Tasmania, Hobart, Tasmania. 4 November 2009.
- Hickey J (2010) An introduction to the complexities of integrated landscape planning. Talk presented at the CRC for Forestry/FPA symposium 'Managing multiple values at a landscape scale': Hobart, Tasmania, 29–30 March 2010.
- Hunt M (2010) Program One: Managing and Monitoring for Growth and Health. CRC for Forestry Annual Science Meeting: Fremantle, WA, 18–20 May 2010.
- Lazaridis D, Verbesselt J and Robinson A (2009) Tree mortality and shrinkage regression. Statistical Society of Victoria: September 2009.
- Lefroy T (2010) Understanding the drivers of landscape change at different scales. Talk presented at the CRC for Forestry/FPA symposium 'Managing multiple values at a landscape scale': Hobart, Tasmania, 29–30 March 2010.
- Matsuki M (2009) IPMG Research summary for Green Triangle. Talk presented to IPMG industry partners: Penola and Hamilton, Green Triangle, 25–26 June 2009 (not previously reported in 08-09 annual report).
- Matsuki M (2009) IPMG Research summary for Western Australia. Talk presented to IPMG industry partners: Albany and Bunbury, Western Australia, 6–7 July 2009.
- Mendham D (2010) Changes in site resources in second and later rotations. Talk presented at the CRC for Forestry IPMG (4.4) & Biodiversity (4.2) joint workshop on 'Integrated pest management in temperate eucalypt plantations': Perth, WA, 17 May 2010.

- Mendham DS (2009) Feedback on BPOS DSS and changes to be made for the release version. Presentation to CRC Program 1 DSS workshop: Hobart, Tasmania, 12 November 2009.
- Mendham DS (2010) Presentation on nutrition network. CRC for Forestry Annual Science Meeting field trip, 21 May 2010.
- Mendham DS (2010) Presentation on BPOS in the hypothetical, CRC for Forestry Annual Science Meeting, 19 May 2010.
- Munks S (2010) Managing the hollow resource across the landscape. Talk presented at the CRC for Forestry/FPA symposium 'Managing multiple values at a landscape scale': Hobart, Tasmania, 29–30 March 2010.
- Neyland M (2010) Variable Retention: adaptive management in practice. 14 April 2010.
- O'Grady AP (2009) Understories: Are we missing something? Forest Hydrology seminar series: Hobart, Tasmania, August 2009.
- O'Grady AP (2010) Understory leaf area dynamics in a *E. nitens* plantation. CRC for Forestry Annual Science Meeting: Fremantle, WA, 18–20 May 2010.
- O'Reilly-Wapstra JM, McArthur C, Potts BM (2010) Selection for anti-herbivore PSMs in a *Eucalyptus* system. Invited seminar: Oxford University, UK, 16 April 2010.
- Pinkard L (2010) Pests and pest management in a changing climate. Talk presented at the CRC for Forestry IPMG (4.4) & Biodiversity (4.2) joint workshop on 'Integrated pest management in temperate eucalypt plantations': Perth, WA, 17 May 2010.
- Potts BM (2009) Advances in eucalypt genetics and breeding. Invited seminar: Hunan Forestry Department, Changsha, China, 23 November 2009.
- Potts BM (2010) Landscape management of genetic values. Talk presented at the CRC for Forestry/FPA symposium 'Managing multiple values at a landscape scale': Hobart, Tasmania, 29–30 March 2010.
- Potts BM, O'Reilly-Wapstra, Hamilton H (2010) Genetic opportunities for pest management. Talk presented at the CRC for Forestry IPMG (4.4) & Biodiversity (4.2) joint workshop on 'Integrated pest management in temperate eucalypt plantations': Perth, WA, 17 May 2010.
- Schirmer J (2010) Expansion of plantations: implications for local government. Invited presentation to National Timber Councils Taskforce General Meeting: Canberra, ACT, 14 June 2010.
- Shepherd M (2009) Geographic variation in Blackbutt (*Eucalyptus pilularis*). Southern Cross University Centre for Plant Conservation Genetics Seminar: Lismore, NSW, 12 August 2009.
- Smethurst P, Almeida A, Neary D, O'Grady A (2009). Hydrology Seminars Series: Hobart, Tasmania, August 2009.
- Thompson V (2010) Long term planning on public land. Talk presented at the CRC for Forestry/FPA symposium 'Managing multiple values at a landscape scale': Hobart, Tasmania, 29–30 March 2010.
- Tovar F (2009) Towards Integrated Pest Management (IPM) in eucalypt plantation forestry. Talk presented to the Industry Pest Management Group (IPMG) executive meeting: Albany, WA, 9 December 2009.
- Tovar F (2010) The IPMG: developing an interactive pest database. Talk presented to the Elders Forestry Operations group: Albany, WA, 3 February 2010.
- Tovar F (2010) The IPMG, IPM and developing tools for pest management. Talk presented to the WAPRES Operations group: Albany, WA, 3 March 2010.
- Tovar F (2010) Western Australian Forest Health in 20 minutes? Invited presentation, IFA Healthy Forests Forum on World Forestry Day: University of WA, Perth, WA, 21 March 2010.
- Tovar F (2010) The IPMG, IPM and developing tools for pest management. Talk presented to the APFL Operations group: Albany, WA, 9 April 2010.
- Tovar F (2010) The IPMG, IPM and developing tools for pest management in the Green Triangle. Talk presented to the IPMG Green Triangle group: Penola, SA, 16 April 2010.
- Tovar F (2010) Moving towards Integrated Pest Management (IPM) in Western Australia. Talk presented at the CRC for Forestry IPMG (4.4) & Biodiversity (4.2) joint workshop on 'Integrated pest management in temperate eucalypt plantations': Perth, WA, 17 May 2010.
- Tovar (2010) The Industry Pest Management Group (IPMG) – a synopsis. Talk presented to the Elders

Forestry Executive group: Albany, WA, 26 May 2010.

- Vaillancourt RE, Worth JRP, McKinnon GE, Freeman JS, Larcombe M, Potts BM, Steane DA, O'Reilly-Wapstra J, Barbour RC, Jones RC, Jordan GJ (2009) The natural history and genome structure of Tasmanian plants species. Invited seminar: School of Biological Sciences, University of Queensland, Brisbane, Queensland, 4 September 2009.
- Verbesselt J (2010) Abrupt, gradual and phenological change detection using satellite image time series, European Geosciences Union General Assembly 2010: Vienna, Austria, 2–7 May 2010.
- Walker PW (2010) Reproductive biology and ecology of a lepidopteran defoliator of eucalypts. Invited seminar speaker: La Trobe University, Melbourne, Vic, 2 June 2010.
- Wardlaw T (2010) Pest management in Tasmania. Talk presented at the CRC for Forestry IPMG (4.4) & Biodiversity (4.2) joint workshop on 'Integrated pest management in temperate eucalypt plantations': Perth, WA, 17 May 2010.
- Wardlaw T (2010) Industry-wide coordination of pest management. Talk presented at the CRC for Forestry IPMG (4.4) & Biodiversity (4.2) joint workshop on 'Integrated pest management in temperate eucalypt plantations': Perth, WA, 17 May 2010.
- Wardlaw T (2010) Management of mammal browsing by Forestry Tasmania: Eucalypt plantations. Oral presentation at DPIPWE Alternatives to 1080 Workshop: Launceston, Tasmania, April 2010.
- Wardlaw T (2010) Appropriate Scales for Biodiversity Management. CRC for Forestry/FPA symposium 'Managing multiple values at a landscape scale': Hobart, Tasmania, 29–30 March 2010.
- Yee M (2010) Tools for landscape planning. CRC for Forestry/FPA symposium 'Managing multiple values at a landscape scale': Hobart, Tasmania, 29–30 March 2010.

Conferences or symposia hosted

- Chuter A (2010) CRC for Forestry and Forest Practices Authority one-day symposium followed by a field day on managing multiple values at a landscape scale: Hobart, 29–30 March 2010.
- O'Reilly-Wapstra J (2009) Organised and chaired a symposium 'Mitigating the impacts of pest species using non-lethal management strategies' at the Australasian Wildlife Management Society Conference: Napier, New Zealand, 30 November to 3 December 2009.

Field days, seminars and workshops hosted

- Archibald N and Davidson N (2009) CRC for Forestry workshop on 'Restoring degraded remnants in plantations': Albany, WA, 26 May 2009.
- Chuter A and Koch A (2009) Two field days run by Tasmania's Forest Practices Authority presenting CRC research to forest planners on the identification of hollow-bearing trees used by fauna and the application of the current *Forest Practices Code* provisions for the management of tree hollows within coupes. Mt Morrison and Cluan Tier, Tasmania, November 2009.
- Matsuki M (2009) 10 Year IPMG Research summary workshop: Penola and Hamilton, Green Triangle, 25–26 June 2009. (Not previously reported.)
- Matsuki M (2009) 10 Year IPMG Research summary workshop: Albany and Bunbury, WA, 6–7 July 2009.
- Neyland M (2009) CRC for Forestry and Forestry Tasmania Variable retention field day: Styx Valley, Tasmania, 9 December 2009.
- Tovar F, Burgess, T, Wardlaw T, Elek, J (2010) CRC for Forestry IPMG (4.4) & Biodiversity (4.2) joint workshop on 'Integrated pest management in temperate eucalypt plantations': Perth, WA, 17 May 2010.
- Tovar, F (2010) Industry Pest Management Group – Research meeting, 3rd May, Perth, WA
- Williams K and Schirmer J (2009) Socio-economic impacts of plantations. Four public seminars presented: Hobart, 20 July; Launceston, 21 July; Burnie, 22 July; Scottsdale, 23 July 2009.
- CRC Project 2.1 Association Genetics Workshop. CRC for Forestry, Hobart, Tasmania: 9 November 2009. Presentations by project research providers CSIRO, University of Tasmania, University of Melbourne and STBA.

Other communication and technology transfer activities

Newsletters

Whole-of-CRC newsletter: *CRC for Forestry News* (August 2009, December 2009, February 2010)

Program One: *Understorey* (August 2009)

Program Two: *The Wood from the Trees* (August 2009)

Program Three: *The Log* (November 2009)

Program Four: *BioBuzz* (August 2009, December 2009, May 2010), *Community catch-up* (Communities project, May 2010)

All CRC for Forestry newsletters are available on our website: <http://crcforestry.com.au/newsletters/>

Media activities: radio, tv, online, newspaper and magazine articles

Acuna M. New truck scheduling system could save the forestry industry big money. *Australian Forests & Timber News*, February 2010.

Acuna M and Brown M. Managing utilisation is a key to profitability. *The Log* (weekly newsletter of the Australian Forest Contractors Association Ltd), November 2009.

Brown M. Size Matters! *The Log* (weekly newsletter of the Australian Forest Contractors Association Ltd), November 2009.

Duff G, Harwood C, O'Reilly-Wapstra J, Potts BM, Reid JB. Forest scientists' response to claims that forestry trees are linked to toxic water in north-eastern Tasmania. *The Tasmanian Mercury*, 25 February 2010.

Harwood C (March 2010) Reducing board checking through natural selection. *Australian Forest Grower* **33**, 33.

Hunt M (2009) Towards Precision Forestry. *Australian Forest Grower Magazine* **32**, 30–40.

Jones R and Potts BM. Tasmania's threatened eucalypts. *ABC TV Stateline* (Reporter: Fiona Breen), 12 February 2010.

Potts BM. Unlocking the secrets of Eucalypts. *ABC TV Stateline* (Reporter: Fiona Breen), 11 September 2009.

Potts BM. Clarke Medal recipient has a long involvement with CRCs. *Success through Innovation* (CRC program newsletter), Autumn 2009.

Potts BM. Chemicals in eucalypt foliage. *ABC Radio – Mornings program*. February 2010.

Strandgard M (2009) A tool to interest everyone at Elmia Wood. *Australian Forest Growers Magazine*, Vol. 32, No. 2, Winter 2009: 37-38

Strandgard M. Thirty percent increase in machine utilisation and productivity? Where do I sign up? *The Log* (weekly newsletter of the Australian Forest Contractors Association Ltd), January 2010.

Strandgard M. Electronic onboard monitoring being put through its paces. *Australian Forests & Timber News*, February 2010.

Wardlaw TJ. Species-choice for eucalypt plantations on State forest. *ABC TV Stateline* (reporter: Lucy Shannon), June 2010.

Williams K. Why do attitudes towards plantations vary between states? *Australian Forest Grower* **32**, 22.

Unwin GL. The challenge of climate change to biodiversity. *Australian Forest Grower* **32**, 42–43. [Book review: Steffen W, Burbidge AA, Hughes L, Kitching R, Lindenmayer D, Musgrave W, Stafford Smith M and Werner PA 'Australia's Biodiversity and Climate Change.' (CSIRO Publ: Collingwood Vic)]

Other

Davidson NJ (2009) Beta Version 1: Tree decline toolbox CD (CRC for Forestry, Bushfire CRC, Greening Australia and University of Tasmania: Hobart)

Koch AJ (2009) 'Tree hollows in Tasmania: a guide.' (CRC for Forestry and the Forest Practices Authority: Hobart)

- Schirmer, J (2009) Submission and invited witness to the Senate Select Committee on Agricultural and Related Industries 'Inquiry into food production in Australia: Impact of Managed Investment Schemes', October 2009.
 [Submission available at http://www.aph.gov.au/senate/committee/agric_ctte/food_production/submissions/sublist.htm; Hansard record of witness hearing at <http://www.aph.gov.au/hansard/senate/committee/S12465.pdf>]
- Wang Y, Wong J, Baker T *et al.* (2009) Farm Forestry Toolbox version 5.0. Incorporating eucalypt plantation growth model

Awards and grants

- Cawthen L (2010) Funding for bat detectors from Mohammed Bin Zayed Species Conservation Trust.
- Cawthen L (2010) Funding for bat detectors from Forest Practices Authority (Tasmania)
- Cawthen L (2010) Funding for bat detectors from Bat Conservation International Inc.
- O'Reilly-Wapstra JM (2010) UTAS Rising Stars Award.
- Potts BM (2009) University of Tasmania's Vice Chancellor's Award for Research Excellence (for level C and above).
- Stephens HC, O'Reilly-Wapstra JM, Potts BM (2010) Does aggregated retention provide suitable habitat for mammal conservation in old growth forests? Holsworth Wildlife Research Fund.
- Stephens HC, O'Reilly-Wapstra JM, Potts BM (2009) Does aggregated retention provide suitable habitat for mammal conservation in old growth forests? WV Scott Charitable Trust.

CRC researchers' membership of relevant committees

Researcher	Committee / Working group
Ades P	Australian Forestry Council, National Research Working Group 1 (Forest genetics and breeding) Technical committee of the Southern Tree Breeding Association
Allen GR	Australian Forestry Council, Research Working Group 7 (Forest Health)
Baker S	Hollows Working Group (established by the Forest Practices Authority Tasmania)
Battaglia M	Organising committee for the 2010 IUFRO Canopy Processes meeting. October 2010
Beadle C	Organising committee for the 2010 IUFRO Canopy Processes meeting. October 2010
Brown M	Founding Chair, Southern Hemisphere Forest Operations Research Collaborative Group (SHFORC) Australian representative on COST (European Cooperation in Science and Technology) Action FP0902: Forests, their products and services
Collett N	Australian Forestry Council, Research Working Group 7 (Forest Health) Victorian Forest Health Advisory Committee (appointed by Victorian Government to provide advice on policy and related forest health issues)
Davidson N	Warra LTR Research Committee
Grove S	Research Working Group 4 (Primary Industries Standing Committee – Forest and Forest Products Subcommittee)
Hardy G	Australian Forestry Council, Research Working Group 7 (Forest Health)
Jordan G	Tasmanian Government Threatened Species Scientific Advisory Committee

Munks S	Threatened species recovery team (threatened fish), Inland Fisheries Service, Tasmanian Government Hollows Working group (established by the Forest Practices Authority Tasmania) Fauna Strategic Planning Group (established by the Forest Practices Authority Tasmania) Research Working Group 4 (Primary Industries Standing Committee – Forest and Forest Products Subcommittee)
Neyland M	Research Working Group 4 (Primary Industries Standing Committee – Forest and Forest Products Subcommittee)
O'Grady AP	Organising committee for the 2010 IUFRO Canopy Processes meeting. October 2010
O'Reilly-Wapstra J	Technical panel advising The Tasmanian Community Forest Agreement Research into Alternatives to the Use of 1080
Potts BM	Australian Forestry Council, National Research Working Group 1 (Forest genetics and breeding) Technical committee of the Southern Tree Breeding Association Giant Trees Consultation Committee advising Forestry Tasmania
Vaillancourt RE	Technical committee of the Southern Tree Breeding Association
Wardlaw TJ	Primary Industry Standing Committee, Research Working Group 7 (Forest Health)