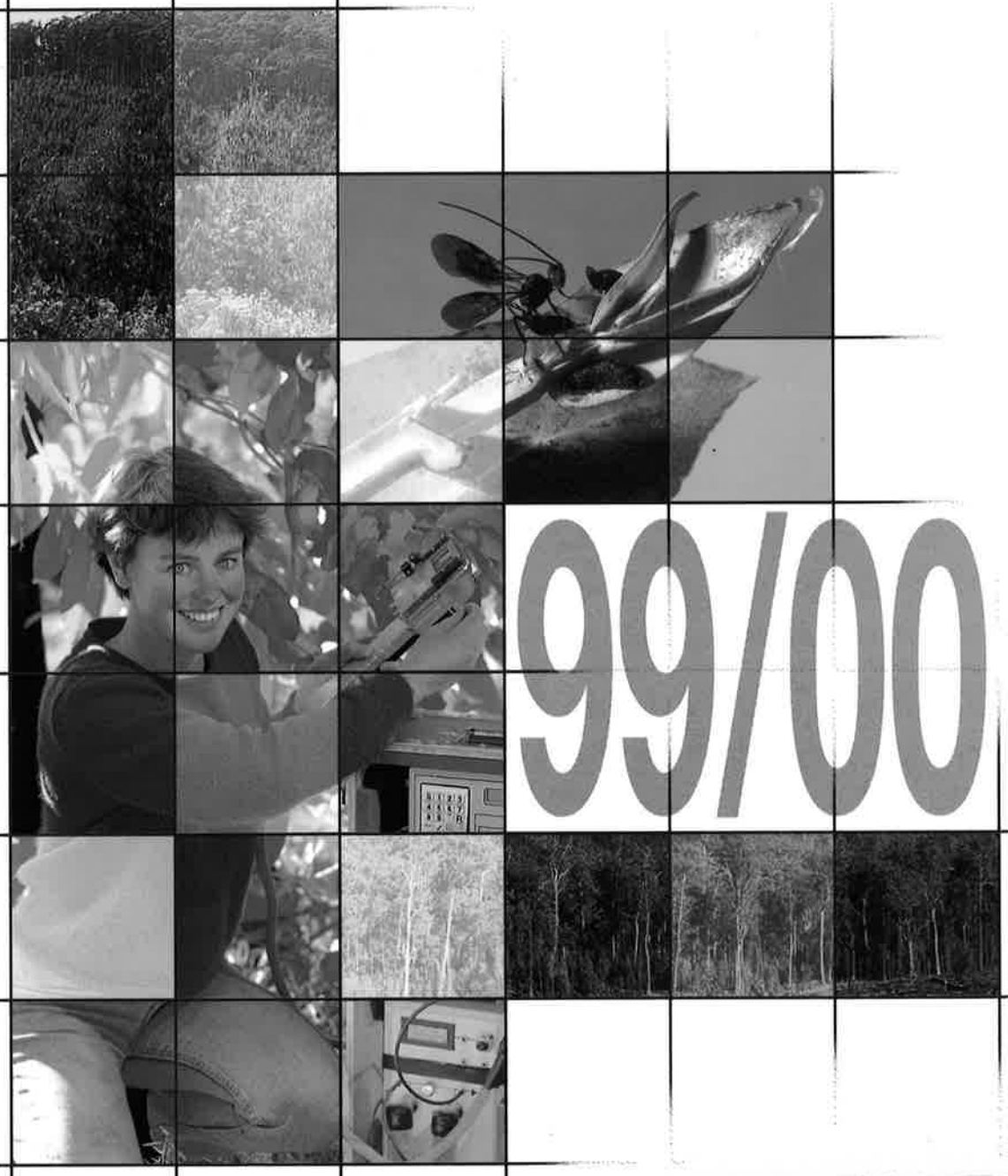
Cooperative Research Centre for Sustainable Production Forestry

ANNUAL REPORT



99/00

Established and supported under the Australian Government's Cooperative Research Centre's program

CRC AUSTRALIA

Mission Statement

The role of the Cooperative Research Centre for Sustainable Production Forestry (CRC-SPF) within the forestry sector is:

To sustain the productivity of and enhance the economic benefit from Australia's forests, through excellence in research, training and technology transfer.

Objectives

The CRC-SPF will provide the following benefits:

- Ensure the long-term viability of Australia's forestry industry through high-quality, relevant research in sustainable plantation forestry.
- Produce research outcomes which improve the competitiveness of industry partners, as well as being of interest to a wider range of stakeholders.
- Improve the efficiency and effectiveness of the applied research and development of industry partners through fostering and facilitating cooperative research.
- Provide an avenue to international science to ensure relevant new approaches and techniques are available in Australia.
- Provide innovative and relevant education and training that meets the skill formation needs of the forestry industry and the national forestry objectives.
- Ensure that all stakeholders capture the benefits of Centre research through effective technology transfer.

COOPERATIVE RESEARCH CENTRE
FOR SUSTAINABLE PRODUCTION FORESTRY

ANNUAL REPORT 99/00

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

Australian Forest Growers

Australian National University

Australian Paper Plantations Pty Ltd

Boral Timber Tasmania Ltd

CSIRO Entomology

CSIRO Forestry and Forest Products

Fletcher Challenge Paper

Forest Enterprises Australia Pty Ltd

Forestry Tasmania

Griffith University

North Forest Products Ltd

Primary Industries Corporation (Qld)

Private Forests Tasmania

Serve-Ag Pty Ltd

Sotico Treefarms Pty Ltd

Southern Cross University

Southern Tree Breeding Association Inc

The University of Queensland

Timbercorp Limited

University of Tasmania

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Chairman's Letter

CRC Secretariat
GPO Box 9839
Canberra City ACT 2601

I am pleased to present you with the Annual Report of the Cooperative Research centre for Sustainable Production Forestry

This year has marked considerable expansion in the CRC, demonstrating the value industry places on the technology the CRC generates. We have three new members, Serve-Ag Pty Ltd, Forest Enterprises Australia Pty Ltd and Private Forests Tasmania, and an Associate member, Silvagene Pty Ltd, has upgraded its membership to Core Party status and changed name to Timbercorp Limited.

The CRC also underwent a review of its research and strategies for technology transfer, education and management, which indicated we were performing well across a wide range of criteria. The staff should be congratulated for their effort, energy and progress in the first two years, which resulted in such a successful review.

This year has also seen two very successful symposia hosted by the CRC and partners, one on 'Hybrid breeding and genetics of forest trees', run in Noosa, and one on 'Insect-eucalypt interactions' run in Canberra. Both made important contributions to research directions and attracted big audiences, and in the case of the Noosa symposium attracted international delegates from 20 countries.

I look forward to the next major gathering of CRC scientists and industrial partners at our Annual Meeting to be held in Hamilton in October, hosted by Timbercorp.

Yours Sincerely

John Kerin
Chairman

Director's Report

The CRC for Sustainable Production Forestry has continued to expand throughout the year. Three new members joined during 1999/2000: Serve-Ag Pty Ltd and Forest Enterprises Australia Pty Ltd (Associate Parties) and Private Forests Tasmania (Supporting Party). A former Associate Party, Silvagene Pty Ltd, upgraded its membership to Core Party status and changed its name to Timbercorp Limited. These changes strengthen the membership of the Centre amongst the major temperate eucalypt plantation growers in southern Australia, and increase the participation by small to medium sized enterprises in our rapidly changing industry.

The research program has continued to produce significant outcomes. This year a detailed map of the *Eucalyptus globulus* genome has been finalised by Dr Karen Thamarus and co-workers based upon 249 distinct molecular markers. Included on the map are 14 genes involved with lignin biosynthesis and cell wall synthesis. These genes may be of crucial importance in determining wood quality characteristics. For the first time we have quantitive data on gene flow between a eucalypt plantation and adjacent native forest. This information is essential for impact assessment and the development of impact minimisation strategies. We have also developed an improved understanding of C and N cycling processes underpinning the productivity and sustainability of sub-tropical plantations.

Two major symposia were held during the year, the first on *Insect-Eucalypt Interactions* in Canberra, and the second on *Hybrid Breeding and Genetics* in Noosa. They were extremely well attended with the second attracting delegates from twenty countries. They made significant progress on defining the way forward in these two key research areas for the industry. The organisers should be congratulated on their success and special thanks go to Drs Martin Steinbauer, Heidi Dungey and Mark Dieters, and Ms Jean Richmond.

Cooperative Research Centres are highly accountable organisations and during the year we went through another major review by the CRC Committee. The first stage of the review concentrated on the research and researchers and was conducted by Professor Margaret Sedgley (Chair), Dr Steven Cork and Mr Alan Brown. The review was favourable and indicated that 'the research performance had been excellent and in some areas had significantly exceeded the stated milestones'. The second stage of the review dealt with the overall program, including objectives of the Centre, strategy for utilisation and application of research outputs, collaborative arrangements, education and training, management structure and arrangements, and performance evaluation. The second stage review panel consisted of Mr Graeme Kelleher (Chair), Dr Michael Carson and Dr Peter Nelson. Again the outcome was strongly supportive of the overall performance of the Centre, indicating that 'there has been very good progress over the two years' and that 'the Centre is now truly national and has built excellent links between all parts of Australia in its field of interest'. Numerous recommendations were made with perhaps the key recommendation focussing on the development of plans for the Centre after the present funding period is completed in mid 2004. The Board of CRC-SPF has commenced this process by completing a new Strategic Plan and identifying strategies that need to be pursued.

The staff of the Centre changed significantly over the year. At Board level, Mr Ian Ravenwood has become the representative of North Forest Products Ltd and Assoc Prof Jane Hughes the representative for Griffith University. We also welcomed onto the Board Mr Ian Bail from our new core partner, Timbercorp. At the end of the year we said goodbye to Dr Peter Nelson who had been our Centre Visitor for the last five years. We have greatly appreciated his invaluable contribution to the Centre and wish him well in his retirement. He has been replaced by Dr Max Whitten, former Chief of the CSIRO Division of Entomology and Professor of Genetics at the University of Melbourne.

We have also had some important visiting scientists at the Centre during 1999/2000, including Assoc Prof Sharon Strauss and Assis Prof Mark Schwartz (University of California), Assoc Prof Sören Nylin (Stockholm University), Dr Caroline Preston (Canadian Forest Service), Dr João Manuel Monteiro da Costa e Silva (Royal Veterinary and Agricultural University, Denmark), Assoc Prof Claire Williams (Texas A&M University), and Dr Yongqi Zheng (Chinese Academy of Forestry).

Prof James B Reid
Director

Management

The Board

The Board of Management of the Centre is comprised of an independent Chairman, Director and Deputy Director of the Centre, Chairman of the Advisory Panel, and the Chief Executive or a nominee from each Core Partner. The Board determines policy and strategic direction, and sets guidelines for the effective operation and management of the Centre. The management structure and links are shown in Figure 1.

Operation of the Centre is facilitated through three committees:

Advisory Panel

The Advisory Panel has the role of providing scientific advice to the Board. The Panel includes Dr David de Little (Chairperson); three external scientific experts: Dr Peter Ades (University of Melbourne), Prof Roger Sands (University of Canterbury, NZ), Dr Tim New (La Trobe University); and the chair-person of each Program Coordinating Committee.

Management Committee

This committee assists the Director in the day-to-day running of the Centre by implementing the policies set by the Board. The Committee includes:

Prof Jim Reid (Director)
Dr Russell Haines (Deputy Director)
Ms Corrine Condie (Business Manager)
Program Managers:
Dr Brad Potts (Genetic Improvement)
Dr Chris Beadle (Sustainable Management)
Dr Clare McArthur (Resource Protection)
Dr Neil Davidson (Education and Technology Transfer)
Ms Jean Richmond (Secretary to the Director and the Board)

CRC Board

Mr John Kerin
Chairman

Prof Jim Reid
Director

Mr Ron Beck
Executive Director Forestry
Department of Primary Industries (Qld)

Prof Andrew Glenn
Pro-Vice-Chancellor (Research)
University of Tasmania

Mr John Cameron
General Manager
Australian Paper Plantations

Mr Ian Ravenwood
Manager Tree Farms
North Forests Burnie

Dr Glen Kile
Chief
CSIRO Forestry and Forest Products

Dr Hans Drielsma
General Manager
(Forest Management)
Forestry Tasmania

Mr Ian Bail
Manager Treefarm Services
Timbercorp Treefarms Pty Ltd

Mr Murray Vitlich
General Manager
Pulpwood Operations
Sotico Treefarms Pty Ltd

Prof Peter Baverstock
Dean, Graduate College and Research
Southern Cross University

Mr Arnold Willems
General Manager
Fletcher Challenge Paper

Assoc Prof Jane Hughes
Head, Australian School of Environmental Studies
Griffith University

Program Coordinating Committees

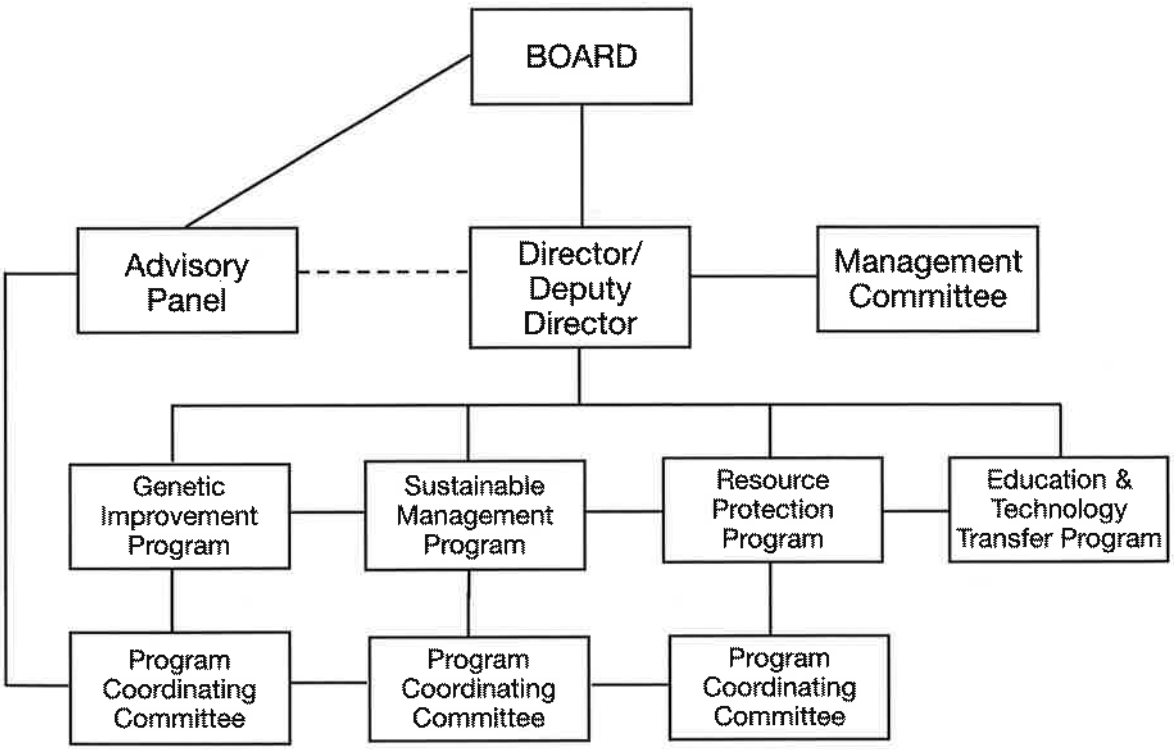
The Program Coordinating Committees meet at least twice a year to review and preview research with regard to its scientific and technological merit, and to set and review research deliverables for each project. Each Committee is chaired by an industry partner representative and consists of the Director, the Program Manager, and at least three industry partner representatives. Project Leaders within the program are included as non-voting members and are therefore not listed below.

Genetic Improvement Program
Mr Peter Volker (Serve-Ag, Chair)
Prof Jim Reid (Director)
Dr Brad Potts (Program Manager)
Ms Helen O'Sullivan (Timbercorp)
Ms Sandra Hetherington (FCP)
Mr Peter Kube (FT)
Mr David Pilbeam (STf)
Dr David de Little (NFP)
Dr Tony McRae (STBA)
Mr Ian Last (PIC)
Mr Maarten Krygsman (APP)
Dr Neil Davidson (Program Manager ETT)

Sustainable Management Program
Ms Sandra Hetherington (FCP, Chair)
Prof Jim Reid (Director)
Dr Chris Beadle (Program Manager)
Mr Ian Last (PIC)
Dr Greg Holz (NFP)
Mr Bill Neilsen (FT)
Dr Chris Shedley (STf)
Mr Phil Whiteman (APP)
Mr Peter Naughton (BTT)
Mr Paul Smale (Timbercorp)
Dr Neil Davidson (Program Manager ETT)

Resource Protection Program
Dr Humphrey Elliott (FT, Chair)
Prof Jim Reid (Director)
Dr Clare McArthur (Program Manager)
Dr David de Little (NFP)
Ms Sandra Hetherington (FCP)
Dr James Bulinski (Timbercorp)
Ms Anne Partridge (APP)
Dr John Madden (Hon CRC Fellow)
Dr Bill Foley (ANU)
Dr Ross Wylie (PIC)
Dr Neil Davidson (Program Manager ETT)

Figure 1 Management Structure



MAJOR DEVELOPMENTS

Eucalyptus globulus genome maps

Molecular genetics is providing unprecedented insights into the structure of forest tree genomes and offers powerful tools for use by tree breeders of the future. Establishment of genome maps based on easily scored molecular markers is important to compare genome structure between species. Such linkage maps are also a first step in locating the position of genes of known function or quantitative trait loci (QTL) which may be used in marker assisted breeding. CRC-SPF molecular geneticist Dr Karen Thamarus and co-workers have now completed a detailed genetic linkage map of *E. globulus* which contains 249 loci including 40 microsatellites, 31 expressed sequence tags and 14 candidate genes (Figure 2). The expressed sequence tags (ESTs) were isolated from *E. globulus* cambium tissue and developed by Dr G Bossinger of the University of Melbourne. Twenty-two of the EST loci have been identified as similar to known genes. The 14 candidate gene loci include genes from the lignin biosynthesis pathway and genes involved in cell wall synthesis. These genes and ESTs were mapped because of their association with wood and fibre growth and development.

Wood properties of individuals from the mapping family have been assessed in collaboration with staff in the Wood Quality (A5) project using technologies developed by the former CRC for Hardwood Fibre and Paper Science. Statistical analyses of trait data have identified putative quantitative trait loci for wood density, per cent pulp yield, per cent cellulose content, fibre length and fibre coarseness. Many of the identified QTLs co-locate with known genes on the linkage map. Pulp and cellulose content QTLs are similar on two linkage groups and co-locate with a lignin biosynthesis gene. One of the fibre length QTLs co-locates with a cell wall synthesis gene. Such co-location of QTL with genes whose function has been determined in other species (e.g. *Arabidopsis*) is an important step in demonstrating functionality and the role of such genes in explaining the variation observed amongst trees in the field. To date the linkage map and QTLs have been derived from only a single full-sib family of *E. globulus*. Data from a second *E. globulus* family is currently being used to validate the QTL. Growth data for both families are available and analysis for growth QTL will begin soon.

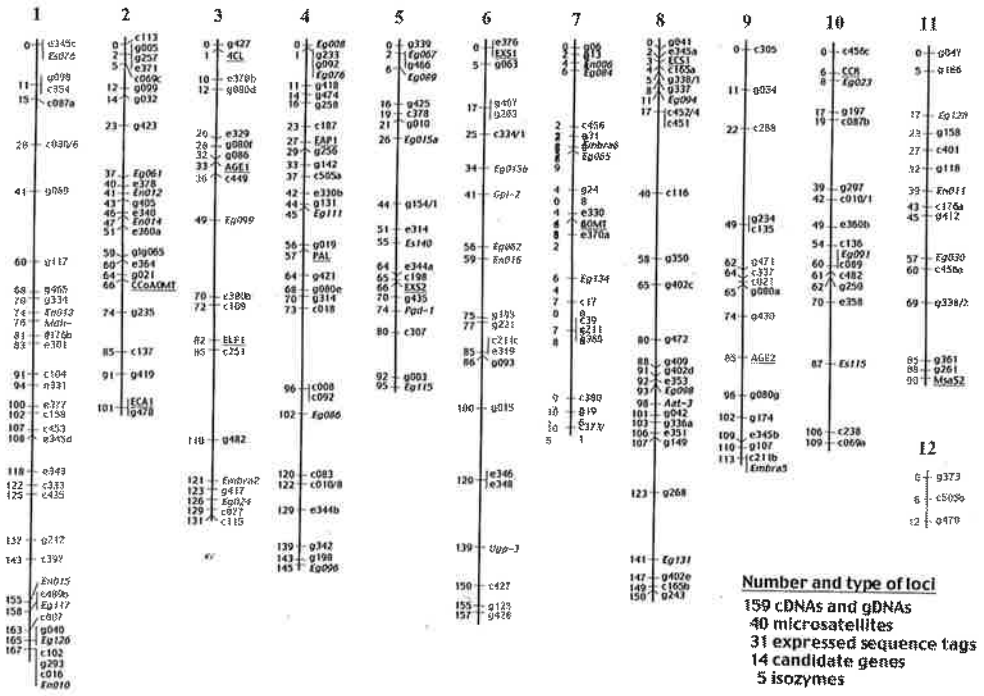


Figure 2
Eucalyptus globulus genome map

MAJOR DEVELOPMENTS

Hybrid Breeding and Genetics Symposium

The first international forestry symposium on Hybrid Breeding and Genetics was held in April 2000, jointly hosted by CRC-SPF and Queensland Forestry Research Institute (QFRI). Most organisations working on forest tree hybrids around the world (including Shell Forestry, UK, and Klabin Riocell, Brazil) were represented with 110 delegates from 20 countries attending the symposium. The symposium focused on the application of quantitative and molecular genetic information in practical forest tree breeding programs. Broader theoretical perspectives were provided by keynote addresses by crop and animal breeders. Of the 81 papers presented, over 20 were by CRC-SPF researchers, clearly establishing Australia's international role in breeding forest tree hybrids, and strong international links including those with the USA (e.g. Dr Bailian Li of North Carolina State University) and China (e.g. Dr Yonqui Zheng of the Chinese Academy of Forestry). The strength of collaboration between the CRC-SPF partners was demonstrated in the structure and organisation of the symposium. Staff from QFRI were the main organisers of the symposium, scientists and post-graduate students from Southern Cross University presented a workshop on Molecular Genetics (16 participants), and scientists from the University of Tasmania organised a workshop on state-of-the-art pollination techniques for eucalypts (53 delegates). The proceedings of the symposium are published and available on CD-ROM from the CRC-SPF.

Delegates at the Hybrid Breeding and Genetics Symposium at Noosa Lakes Resort, Noosa, April 2000

Greg Dutkowski takes notes at a workshop held during the Hybrid Breeding and Genetics Symposium, with Dr Luc Pâques (INRA, France), Dr Stephen Verryn (CSIR, South Africa) and Gustavo Lopez (CRC-SPF, University of Tasmania) in the first aisle.

MAJOR DEVELOPMENTS

Nitrate in soil humic acids revealed by ^{14}N NMR

Both the amount and composition of soil organic matter can influence carbon (C) and nitrogen (N) cycling processes in forest ecosystems. Soil humic acid is an important component of soil organic matter. Application of ^{13}C nuclear magnetic resonance (NMR) has greatly advanced our understanding of soil humic acid composition.

A successful international collaboration between a group of CRC scientists led by Dr Zhihong Xu, Queensland Forestry Research Institute, and the NMR specialists headed by Prof Xi-an Mao, Wuhan Institute of Physics and Mathematics, Chinese Academy of Sciences, China, has resulted in the first application of solution ^{14}N NMR to soil humic acids. Soil samples were collected under different plant residue management regimes in four contrasting forest ecosystems of south-east Queensland. The forest ecosystems included a slash pine (*Pinus elliottii*) x Caribbean pine (*P. caribaea*) hybrid plantation, two hoop pine (*Araucaria cunninghamii*) plantations and a natural wet sclerophyll forest dominated by blackbutt (*Eucalyptus pilularis*) exposed to a range of fire regimes.

Application of ^{14}N NMR spectroscopy to soil humic acid revealed the surprising existence of nitrate-N and ammonia-N in the humic acids. The humic acid nitrate-N was closely related to soil N availability and rather responsive to the plant residue management regimes in the four contrasting forest ecosystems (Figure 3). A plausible mechanism for the presence of nitrate-N in the humic acids was that humic acid nitrate-N was related to soil microbial biomass pools under different residue management regimes. These research findings have major implications for improving the understanding of important C and N cycling processes underpinning the productivity and sustainability of plantation and natural forest ecosystems.

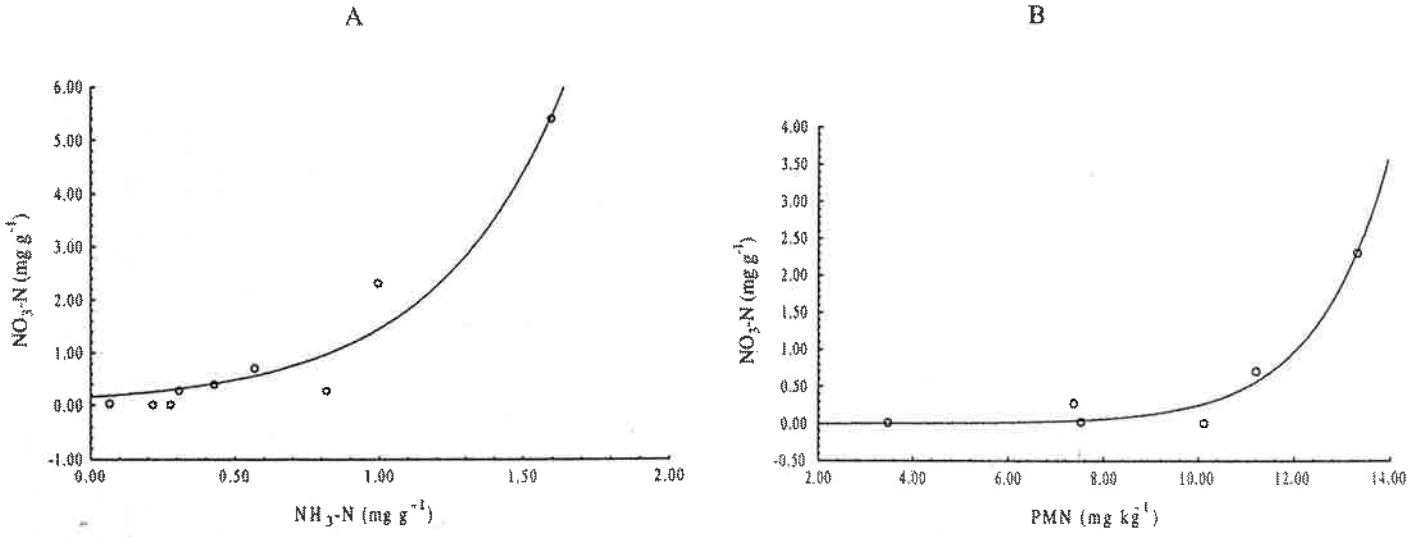


Figure 3
Relationship between (A) NO_3-N (y) and NH_3-N (x) in soil humic acids of the four sites estimated from ^{14}N-NMR spectra: $y = 0.160\ e^{2.21x}$ ($r^2 = 0.945$, $n = 9$, $P < 0.01$); (B) NO_3-N (y) in soil humic acids from plantation forest ecosystems (Sites 1-3) and soil potentially mineralizable N (PMN; x): $y = 0.000301\ e^{0.672x}$ ($r^2 = 0.964$, $n = 6$, $P < 0.01$).

MAJOR DEVELOPMENTS

Experts review insect-eucalypt interactions

The first national meeting of entomologists in 20 years to discuss the interactions of eucalypts and herbivorous insects, the Symposium on Insect-Eucalypt Interactions, was held in Canberra in early February 2000 and hosted by the CRC-SPF. It was attended by 50 delegates and gave unique insights into issues relevant to Australian forestry, including those provided by experts from America, Chile, Sweden and New Zealand.

There were two major outcomes of the meeting. The first was a CRC internal technical report that summarised group discussions concerning *genetic improvement, silviculture* and *knowledge gaps*. The need to diversify research priorities in each of these areas has arisen as a result of the need to reduce reliance upon pesticides to manage insect populations.

The major conclusions were:

- continue identification and deployment of locally resistant, or less preferred, eucalypt provenances;
- specialised insect herbivores are more abundant in monocultures and increased vegetational complexity may provide a means of population management;
- our understanding of key insect herbivores would be enhanced through studies from a wider range of habitats; and
- agreement to hold similar meetings every three years (the next in 2003).

Delegates at the Symposium on Insect-Eucalypt Interactions, Canberra, February 2000.

MAJOR DEVELOPMENTS

Predicting palatability of *Eucalyptus* leaves to chewing insects

CRC research on leaf chewing insect pests of *Eucalyptus* has shown the importance of leaf toughness on tree growth and even survival. Typically, the softer the leaf, the more the insects can eat. Hence, a simple way for foresters to assess the susceptibility to damage by chewing insects would be to provide a measure of leaf palatability relating to toughness.

Specific Leaf Weight (SLW) and water content are two leaf characteristics that can be estimated without the use of specialised equipment and which provide biologically meaningful estimates of leaf palatability. Eucalypts may vary in relation to both parameters, between leaf ages/phenotypes within species and between species and subspecies.

Recent studies of newly hatched autumn gum moth (*Mnesampela privata*) suggest that leaves with SLWs above 0.24mg.mm^{-2} and water contents below 56% prevent larvae from initiating feeding. Previous work on Tasmanian leaf beetle *Chrysophtharta bimaculata* suggested that the most preferred leaves were those with SLWs around 0.18mg.mm^{-2} and water content of 66%. Hence, insects have preferred SLWs and leaf water content for development. Figure 4 illustrates that many of the common plantation eucalypt species have SLWs and water content suitable for autumn gum moth larvae, i.e. SLW less than 0.20mg.mm^{-2} and water content above 56%.

Adoption of SLW and water content as measures of leaf palatability would allow foresters to assess patterns of insect herbivory from comparable reference points.

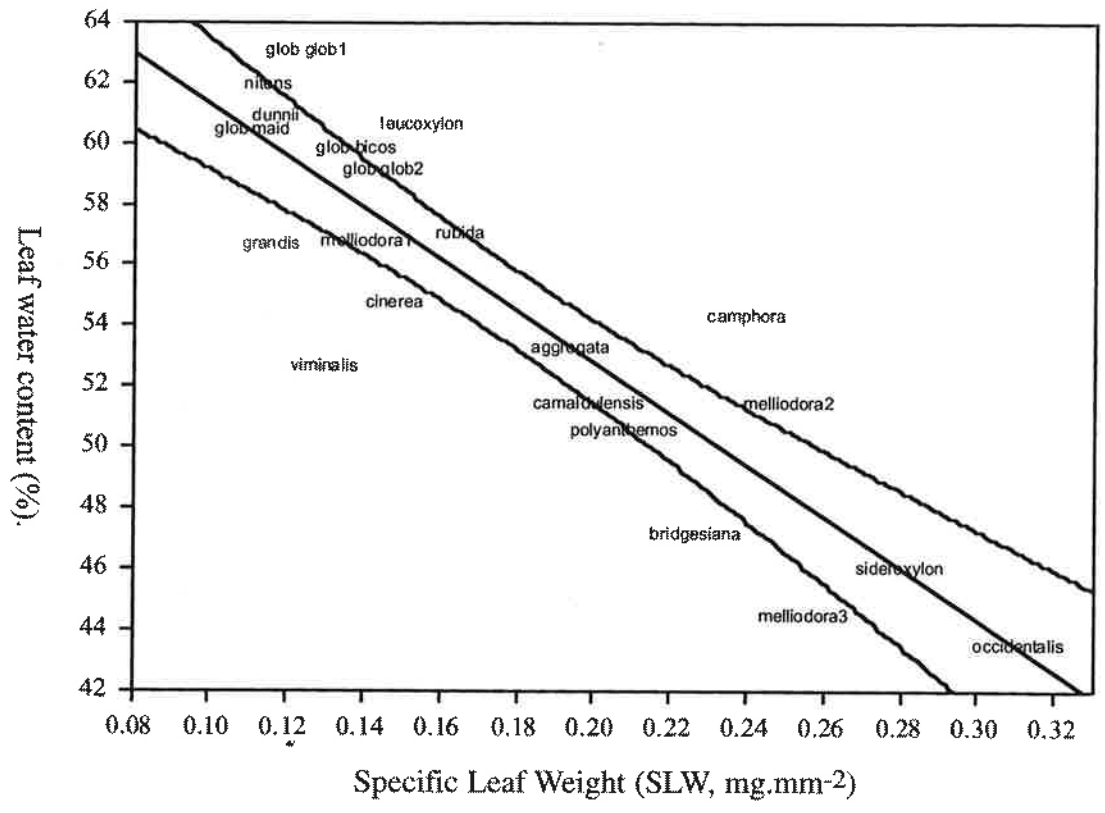


Figure 4
Linear model with 95% confidence intervals of Specific Leaf Weight (SLW, mg.mm^{-2}) *versus* water content (%) for a range of eucalypt species and subspecies (water content = -84.9(SLW) + 69.8; r^2 = 76.7%).

Table 1 Cooperative Linkages

Genetic Improvement Program

International links	CRC Staff	Collaborator	Research
Project A1: Genetics and reproductive biology of eucalypts	Dr B Potts Dr H Dungey	Prof T Whitham (UNA) USA Dr P Minchin (UL) USA	The effect of forest genetics on biodiversity.
	Dr B Potts	Dr C Balocchi Mr P Rojas (Bioforest, Chile)	Hybridisation of temperate eucalypts
Project A2: Breeding strategies	Dr G Dutkowski	Dr J Costa e Silva (Denmark)	Spatial analysis
	Dr G Dutkowski Dr L Apiolaza Dr B Potts Mr G Lopez	INTA (Argentina)	Geographic patterns of variation in *E. globulus* and breeding value prediction
Project A4: Molecular genetics of eucalypts	Dr R Steane Dr R Vaillancourt	Dr D Marshall Dr J Russell (SCRI, UK)	Development of microsatellite markers in *E. globulus*
	Dr D Steane Dr R Vaillancourt Prof J Reid	Dr D Grattapaglia (EMBRAPA, Brazil)	Test microsatellites for repeatability across many species
	Dr R Vaillancourt Dr B Potts Mr H Jackson	Dr C Marques Mr V Carocha Dr N Borralho (RAIZ, Portugal)	Finding the origin of the Portuguese *E. globulus* landraces
	Dr R Vaillancourt	Dr D Verhaegen (CIRAD Forêt, France)	Variation in lignin genes in *E. grandis*, *E. urophylla* and *E. globulus*
Project A6: Hybrid breeding	Dr M Dieters Dr H Dungey Dr K Harding	Prof B Li (NCSU, USA) Prof P Kanowski (ANU)	Estimation of genetic parameters for wood properties in *P. elliotti*, *P. caribaea* var *hondurensis* and their F_1 hybrid
	Dr M Dieters	Dr Y Zheng (Chinese Academy of Forestry)	Variation within natural and domesticated populations of *P. caribaea* var *bahamensis*
	Dr H Dungey Dr G Nikles	Hybrid breeders from countries such as Brazil, India, France, Portugal, Canada, UK, China, South Africa	International survey on the use and performance of forest tree hybrids
Project A7: Molecular genetic improvement for tropical and subtropical production	Prof R Henry Dr M Shepherd	A/Prof C Williams (Texas A&M University, USA)	Genetic mapping in *Pinus* spp
National Links			
Project A1: Genetics and reproductive biology of eucalypts	Dr B Potts Mr P Tilyard	Mr R Brereton (DPIWE)	Flowering patterns in *E. globulus* and their effect on the reproductive success of the swift parrot
	Dr B Potts Dr R Vaillancourt	Prof M Sedgely (UA) Dr M Wallwork (UA) Ms L Pound (UA)	Mechanism of self incompatibility in *E. globulus* and *E. nitens*

	CRC Staff	Collaborator	Research
Project A1: cont	Mr A Hingston Dr B Potts	Dr P McQuillan (UT)	Pollination ecology of *E. globulus* and *E. nitens*
Project A2: Breeding strategies	Mr G Dutkowski	Mr G Dutkowski Dr D Boomsma (STBA) Mr R Breidahl (STf) Ms S Hetherington (FCP) Mr A Gray (ForSA) Mr H Stewart (Treecorp) Mr D Jamieson (ACT Forests) Mr S Penfold (HVP)	Breeding management
	Mr G Dutkowski	Dr A Gilmour (NSW Agriculture)	Improvements in quantitative genetic models
	Mr G Dutkowski Dr T McRae (STBA) Dr L Apiolaza	Dr H Graser Dr R Kerr (UNE) Dr M Dieters (QFRI) Dr C Matheson (CSIRO FFP)	Breeding value prediction software for tree breeding - TREEPLAN™
	Mr G Dutkowski	Dr J Sasse (CFTT)	Spatial analysis for *Dothistroma pinii* damage in *Pinus radiata*
	Mr G Dutkowski	Dr J Sasse (CFTT)	Breeding value prediction
Project A3: Molecular approaches to tree improvement	Dr G Moran Dr K Thamarus Ms K Groom Ms J Murrell	Dr S Read Dr G Bossinger (University of Melbourne)	Mapping cambial specific sequences in *E. globulus*
Project A4: Molecular genetics of eucalypts	Dr R Vaillancourt Dr B Potts Mr C Grosser Dr B Patterson	Prof M Sedgley (UA) Ms L Pound (UA) Mr K Joyce (NET) Ms H O'Sullivan (Timbercorp) Mr D Pilbeam (STf/STBA) Mr P Gore (STBA)	Optimising seed orchards to achieve maximum genetic gain in eucalypt plantations
	Ms R Jones Dr D Steane Dr R Vaillancourt Dr B Potts	Mr M Lavery (Arianda Pty Ltd)	Genetic diversity and affinities of the Jerralang *E. globulus*
	Dr R Vaillancourt Dr B Potts Mr G Dutkowski	Mr P Gore (STBA) Mr D Pilbeam (STf/STBA)	Recovering pedigrees in *E. globulus* using genetic markers
Project A5: Wood quality	Ms C Raymond	SF NSW	Acoustic testing for non-destructive assessment of wood stiffness
	Ms C Raymond	CSIRO FFP	Assessment of microfibril angle and density variation
Project A6: Hybrid breeding	Dr M Dieters Dr H Dungey Dr K Harding	Mr J Knight (QDPI) Mr G Stringer (Hyne & Sons Pty Ltd) Prof P Kanowski (ANU) Dr B Greaves (UT)	Breeding objectives for sawn timber in *P. caribaea* var *hondurensis*, *P. elliottii* and their hybrid

	CRC Staff	Collaborator	Research
Project A6: cont	Dr Z Xu Dr M Dieters Dr H Dungey	QDPI Forestry Griffith University	Use of carbon isotope discrimination to select *P. elliottii* x *P. caribaea* var *hondurensis* clones
	Mr A Joseph Dr M Dieters Dr H Dungey	Dr H Wallace (USC)	Genetics of intra- and inter-provenance hybrids in *P. caribaea* var *hondurensis*
Project A7: Molecular genetic improvement for tropical and subtropical production	Prof R Henry Dr M Shepherd	Mr S Bruskin (SF NSW) Ms M Jones (SCU) Prof A Delves (SCU)	Gene flow and genetic diversity of hardwood plantations in NSW
	Dr M Shepherd Mr R Mellick	Dr A Specht (SCU)	Microsatellite markers in *Eucalyptus* spp
Within Centre Links			
Project A1: Genetics and reproductive biology of eucalypts	Dr B Potts Dr G Jordan Mr G Dutkowski Mr A MacDonald Dr P Chambers	Dr W Tibbits (NET) Mr K Joyce (NET)	Genetic variation, age to age correlations and genotype-environment interactions for base population trials of *E. globulus*
	Dr B Potts	Mr P Gore (STBA) Mr D Pilbeam (STBA)	Genetic control of self incompatibility in *E. globulus* (partly STBA funded)
	Dr L Apiolaza Dr B Potts Mr G Dutkowski	Mr P Gore (STBA) Mr K Joyce (NET) Mr D Pilbeam (STBA) Mr M Krygsman (APP)	Genetic control and estimation of breeding values for flowering time in *E. globulus* (partly STBA funded)
	Dr B Potts Mr G Dutkowski Mr P Tilyard Dr D Williams	Mr P Gore (STBA) Mr P Kube (FT) Ms S Hetherington (FCP)	Genetic variation in new base population trials of *E. nitens*
	Dr D Williams Dr B Potts Prof J Reid	Dr P Smethurst (SM) Dr C Beadle (SM) Mr D Worledge (SM) Mr K Joyce (NET) Mr P Kube (FT)	Environmental and silvicultural factors affecting the flowering of *E. nitens*
	Dr D Williams Dr B Potts	Mr P Kube (FT) Mr N McCormick (FT)	Seed orchard management and optimising seed and seedling quality
	Mr R Barbour Dr B Potts Dr R Vaillancourt	Dr W Tibbits (NET) Dr D de Little (NET) Mr K Joyce (NET)	Gene flow between planted and native eucalypt forests (SIF 1998-99)
	Dr B Potts Mr P Tilyard	Dr C McArthur (RP) Ms J O'Reilly (RP)	Genetic variation in *E. globulus* to marsupial browsing
	Mr T Jones Dr B Potts Dr R Vaillancourt	Dr D de Little (NET)	Genetic basis of susceptibility to insect pests

	CRC Staff	Collaborator	Research
Project A2: Breeding strategies	Mr G Dutkowski Dr L Apiolaza	Mr P Kube (FT) Dr T McRae (STBA) Dr B Potts (A1) Mr G Lopez (A1) Ms C Raymond (A5)	ASREML usage
	Mr G Dutkowski Dr L Apiolaza	Ms S Hetherington (FCP) Dr T McRae (STBA) Mr D Pilbeam (STBA) Mr G Lopez (A1)	Breeding value prediction
	Mr G Dutkowski	Dr T McRae (STBA)	Data modelling for tree breeding
	Mr G Dutkowski	Dr T McRae (STBA) Mr P Gore (STBA) Ms S Hetherington (FCP) Dr C Matheson (CSIRO FFP)	Research management
	Mr G Dutkowski	Mr P Gore (STBA) Mr C O'Connor (Timbercorp)	*E. globulus* geographic variation
	Mr G Dutkowski	Mr P Gore (STBA) Mr P Kube (FT) Ms S Hetherington (FCP)	*E. nitens* geographic variation
	Mr G Dutkowski Dr L Apiolaza	Mr P Gore (STBA) Mr D Pilbeam (STBA) Dr T McRae (STBA)	Breeding strategies
Project A3: Molecular approaches to tree improvement	Dr G Moran Dr K Thamarus Dr E Williams Ms K Groom Ms J Murrell	Ms C Raymond (A5)	QTL analyses for wood and fibre properties in *E. globulus*
Project A4: Molecular genetics of eucalypts	Dr R Vaillancourt Mr A Milgate Dr B Potts	Dr C Mohammed (C5)	The genetic basis of *Mycosphaerella* resistance in *E. globulus*
	Ms R Jones Dr D Steane Dr R Vaillancourt Dr B Potts	Dr M Steinbauer (C1, C2)	Affinities of an AGM resistant variant of *E. pseudoglobulus*
Project A5: Wood quality	Ms C Raymond Ms K Surridge	Dr G Moran (A3) Dr K Thamarus (A3)	QTL analysis of wood and fibre properties in *E. globulus*
	Ms C Raymond Ms K Surridge	Mr P Kube (FT) Ms S Hetherington (FCP)	Genotype by environment interaction for density, fibre length, fibre coarseness, cellulose content, microfibril angle and density variation in *E. nitens*
	Ms C Raymond Mr B Yeo	Dr D de Little (NET) Mr J French (NET)	Genetic control and correlations between wood properties in families of *E. globulus* with different densities

	CRC Staff	Collaborator	Research
Project A6: Hybrid breeding	Dr M Dieters Dr H Dungey Dr G Nikles	Prof R Henry (A7) Dr M Shepherd (A7) Ms R Stokoe (A7) Mr L Scott (A7) Mr R Mellick (A7) Dr D Lee (QFRI)	Molecular genetics of *E. cloeziana*, *Araucaria cunninghamii*, and propagation traits in *P. elliottii* x *P. caribaea* var *hondurensis* hybrids
Project A7: Molecular genetic improvement for tropical and subtropical production	Prof R Henry Dr M Shepherd	Dr H Dungey (A6) Dr M Dieters (A6) Dr G Nikles (A6) Mr P Toon (A6)	Genetic characterisation of commercial traits in hybrid pines
	Prof R Henry Dr M Shepherd	Dr R Vaillancourt (A4)	Development of an enriched microsatellite library for *E. globulus* and *Pinus* spp
	Prof R Henry Dr M Shepherd Ms R Stokoe	Dr B Potts (A1)	Investigation of putative inter-subgeneric *Eucalyptus* hybrid
	Prof R Henry Dr M Shepherd Ms R Stokoe	Dr G Nikles (A6) Dr D Lee (QFRI)	Molecular genetics of *E. cloeziana*
	Dr M Shepherd Mr R Mellick	Dr M Dieters (A6) Dr H Dungey (A6)	Genetic analysis of vegetative propagation traits in hybrid pine
	Prof R Henry Dr M Shepherd Mr L Scott	Dr G Nikles (A6) Dr M Dieters (A6)	Molecular genetics of *Araucaria cunninghamii*
	A/Prof J Hughes Ms R King	Dr B Potts (A1) Dr D Lee (QFRI) Dr G Nikles (QFRI)	Genetic variation in spotted gums and differences in *Ramularia* tolerance

Sustainable Management Program

International Links

Project B2: Management of tropical soils	Dr Z Xu Ms N Mathers A/Prof S Berners-Price A/Prof P Saffigna	Prof Xi-an Mao Mr R Luo (National NMR Laboratory, Wuhan, PR China)	Application of ^{13}C, ^{15}N and ^{14}N NMR to soil organic matter studies
	Ms N Mathers Dr Z Xu A/Prof P Saffigna	Dr C Preston (Natural Resources Canada)	Application of ^{13}C and ^{15}N to soil organic matter studies
	Dr Z Xu Dr N Prasolova A/Prof P Saffigna	A/Prof K Lundkvist (Swedish University of Agricultural Sciences)	Use of carbon isotope composition for selection of pine clones and hoop pine families with improved water use efficiency and tree growth
Project B4: Modelling production and wood quality	Dr M Battaglia	Dr J Majada (University of Oviedos, Spain)	Seed germination modelling
	Dr M Battaglia	Dr N Borralho (RAIZ, Portugal)	Application of ProMod

	CRC Staff	Collaborator	Research
Project B4: cont	Dr P Sands	Dr E Voit (South Carolina Medical University)	Application of S- systems to forest growth modelling
	Dr P Sands	RL Newman and Partners (ACT)	Use of PROMOD to predict potential productivity of *E. nitens* in Ireland
National Links			
Project B1: Site productivity	Dr P Smethurst Dr C Beadle Mr P Adams	Dr N Mendham (UT)	Weed management studies
	Dr P Smethurst	Dr K Paul (CSIRO FFP)	LAI effects on soil temperature
Project B2: Management of tropical soils	A/Prof P Saffigna Ms N Mathers Dr Z Xu Dr G Pu	Dr T O'Connell (CSIRO FFP)	Application of ^{13}C NMR to soil organic matter studies and denitrification studies with soils treated with residue management regimes
	Dr Z Xu Dr N Prasolova A/Prof P Saffigna	Prof G Farquhar (ANU)	Carbon and oxygen isotope compositions and tree water use efficiency
Project B3: Silvicultural systems	Dr C Beadle	Dr L Pinkard (FT) Mr G Britton (Britton Bros) Mr D Stackpole (CFTT) Mr A Warner (PFT) Mr T Bird (FFIC)	Silvicultural management of blackwood
	Dr C Beadle Mr D Worledge	Mr W Lee (Brighton Council)	Effluent irrigation of pines
Project B4: Modelling plantation systems	Dr M Battaglia	Dr C Mohammed (C5)	Analysis of stem decay data
	Dr M Battaglia	Mr P Pennington (CSIRO FFP)	Analysis of native forest productivity
	Dr M Battaglia	Queensland Department of Natural Resources	Landscape modelling spatial analysis
	Dr M Lewty	QDPI Silviculture	Genetic evaluation, breeding studies
	Mr P Ryan	Dr T Thaung (UQ)	Nitrogen nutrition of *E. cloeziana*
	Mr P Ryan	Dr B Burrows (QDPI Rockhampton)	Biomass data
	Mr P Ryan	SF NSW	Biomass data
	Mr P Ryan	Dr P West (SciWest Consulting)	Growth modelling
	Mr P Ryan	Mr K Montagu (SF NSW)	Physiological data for subtropical/tropical eucalypt species
	Dr P Sands	Dr B Rawlins (CSIRO FFP)	Economic effects of irrigation

	CRC Staff	Collaborator	Research
Project B4: cont	Dr P Sands	Mr C Hackett (Plantsoft Services)	Modelling productivity
	Dr P Sands	Dr J Landsberg (Landsberg Consulting)	Modelling productivity
Within Centre Links			
Project B1: Site productivity	Dr P Smethurst	Dr C Mohammed (C5)	Effects of N status on wood decay of pruned and unpruned *E. nitens*
	Dr P Smethurst	Dr M Battaglia (B4)	Predictions of LAI and growth responses to fertilisation
	Dr P Smethurst	Mr G Dutkowski (A2) Dr L Apiolaza (A2)	Genetic interaction with growth response to N fertilization
Project B2: Management of tropical soils	Mr T Leaman Dr Z Xu A/Prof P Saffigna	Dr M Dieters (A6) Dr M Hunt (QFRI)	Improving hoop pine growth potential by selecting for water and nitrogen use efficiency
Project B3: Silvicultural systems	Dr C Beadle Ms J Medhurst	Mr P Naughton (BTT) Ms A LaSala (FT)	Thinning regimes for pulpwood plantations
	Dr C Beadle Mr D Worledge	Ms S Hetherington (FCP) Dr G Holz (NET)	Impacts of irrigation on wood quality
	Dr C Beadle Dr P Smethurst	Dr N Mendham (UT) Mr P Adams (FT)	Vegetation management
	Dr C Beadle Dr C Mohammed	Dr L Pinkard (FT)	Green pruning of *E. globulus*
Project B4: Modelling production and wood quality	Dr M Battaglia	Mr S Candy (FT)	Empirical growth modelling
	Dr M Battaglia	Dr L Pinkard (FT)	Modelling effects of pruning
	Dr M Battaglia	Mr T Smith (Sotico)	Site effects on productivity
	Dr M Battaglia	Mr B Walker (NET)	Productivity modelling
	Ms C Raymond	GI Program	GxE effects on wood quality
	Ms C Raymond	Australian Paper, NET, Sotico	Pulpwood quality in *E. globulus*
	Ms C Raymond	FT, FCP, CSIRO FFP	Pulpwood quality in *E. nitens*
	Ms C Raymond	SF NSW, CSIRO FFP	Assessment of modulus of elasticity
	Ms C Raymond	Mr C Shedley (Sotico) Mr P Kube (FT) Mr W Neilsen (FT)	Site and spacing effects on pulp wood quality in *E. globulus*
	Dr P Sands	Dr C McArthur (RP)	Modelling effects of browsing
	Dr P Sands	Mr A Goodwin (FT)	Software development

Resource Protection Program

International Links

	CRC Staff	Collaborator	Research
Project C1: Biology, ecology and economic impact of insect pests	Dr G Allen	Mr B Murphy (University of Canterbury NZ / NZFRI)	Biocontrol of leaf beetles using egg parasitoids
	Dr M Steinbauer	A/Prof S Strauss (UC Davis)	Tri-tropic interactions between eucalypts, the gum leaf skeletoniser and natural enemies
	Dr M Steinbauer	A/Prof S Nylin (Stockholm University, Sweden)	Life history theory in relation to *M. privata*
	Dr M Steinbauer	Dr T Withers (ForRes NZ)	Insect introductions into NZ
	Dr M Steinbauer	Dr F Schiestl (University of Vienna, Austria)	Electroantennogram assays of eucalypt specific insects
Project C2: Insect control techniques and IPM	Dr M Steinbauer	Prof T Ando (Tokyo University, Japan)	Pheromones of geometrids
Project C3: Resistance of planting stock to vertebrate browsers	Dr C McArthur	Dr M Schwartz (UC Davis)	Modelling methods for sampling damage on plantations
	Dr C McArthur	Dr M Schwartz (UC Davis)	Modelling seedling growth as a function of browsing damage and site quality
Project C5: Strategies to minimise loss due to fungal attack	Dr C Mohammed Ms K Barry	Prof L Hall and colleagues (University of Cambridge, UK)	Better understanding of the passive and active mechanisms of defence against decay in *E. nitens*
	Dr C Mohammed	Dr R Kennedy Dr A Wakeham (Horticulture Research International) Dr M Dewey (University of Oxford, UK)	Immuno-detection of the airborne spores of *Mycosphaerella* species on eucalypt
	Dr C Mohammed	Dr R Kennedy Dr A Wakeham (Horticulture Research International)	Production of the sexual spore form in culture for *Mycosphaerella* species on eucalypt
	Dr C Mohammed Ms E Eyles	Dr D Lonsdale (Alice Holt Research Station Forestry Commission, UK)	Kino formation in eucalypts
	Dr C Mohammed	Dr L Macaskie (University of Birmingham, UK)	Eucalypt defence mechanisms (electron paramagnetic imaging of free radicals)

National Links

	CRC Staff	Collaborator	Research
Project C1: Biology, ecology and economic impact of insect pests	Ms T Simmul Dr G Allen	Dr A Clarke (GU)	Biology of fireblight beetle
	Mr B Howlett Dr J Madden	Dr A Clarke (GU)	Factors influencing *Chrysophtharta bimaculata* oviposition
	Dr M Steinbauer	Prof M Sedgley Dr M Wallwork (UA)	Waxes of *E. globulus* ssp
	Dr M Steinbauer	Mr W Wanjura (CSIRO Ento)	Terpene analyses of eucalypts
	Dr M Steinbauer	Dr A Nicotra Ms V Thomson (ANU)	Plant stress in eucalypts
	Dr M Steinbauer	Dr P McQuillan Ms C Young (UT)	Life history of *M. privata*
	Dr R Floyd Dr M Steinbauer Ms T Wharton	ACT Forests, Auspine, APP, Forestry SA, Green Triangle Forest Products, Hancock Victorian Plantations, SF NSW, QFRI, Dr P Cooper and Dr D Rowell (ANU), Dr M Carver and Dr P de Barro (CSIRO Ento)	Biology of *Essigella californica*
	Dr R Floyd Dr A Loch Mr J Matthiessen	WA Industry Pest Management Group	Ecology and economic impact of insect pests of post-establishment eucalypts in southwestern Australia
	Mr J Matthiessen	WA Industry Pest Management Group	Ecology and economic impact of insect pests of the establishment phase of eucalypts in southwestern Australia
Project C2: Insect control techniques and IPM	Dr A Loch Mr J Matthiessen Dr R Floyd	WA Industry Pest Management Group	Monitoring, surveillance and control of pests of established eucalypts in southwestern Australia
	Mr J Matthiessen	WA Industry Pest Management Group	Management of insect pests of the establishment phase of eucalypts in southwestern Australia
	Dr M Steinbauer	Dr T Bellas (CSIRO Ento) Dr M Lacey (CSIRO Ento)	Sex pheromone of autumn gum moth
	Dr M Steinbauer	Dr I Naumann (Department of Agriculture ACT)	Egg parasitoids of coreids
	Dr M Steinbauer Dr M Short	Dr S Schmidt (CSIRO Ento) Dr J Trueman (ANU) Ms R Schumacher (UQ)	Taxonomy of hymenopteran parasitoids of *M. privata*
	Dr M Steinbauer	Mr P Ebner (Lower Murray Water)	Light trapping of *M. privata*

	CRC Staff	Collaborator	Research
Project C3: Resistance of planting stock to vertebrate browsers	Dr C McArthur Ms J O'Reilly	Dr W Foley (ANU)	NIR analyses of eucalypt leaves in relation to palatability
Project C4: Strategies to reduce vertebrate browsing damage	Ms K le Mar Dr C McArthur	Dr C Southwell (AAD) Dr M Statham (UT)	Use of a plantation and surrounding habitat by mammalian herbivores
Project C5: Strategies to minimise loss due to fungal attack	Dr C Mohammed Ms K Barry	Mr N Davies (UT) Mr E Peacock (UT)	Better understanding of the passive and active mechanisms of defence against decay in *E. nitens*
	Dr C Mohammed	Dr G Hardy (Murdoch University WA) Dr P Keane (La Trobe University Victoria)	*Mycosphaerella* research
Within Centre Links			
Project C1: Biology, ecology and economic impact of insect pests	Ms T Simmul Dr G Allen	Dr D de Little (NET)	Biology of fireblight beetle
	Dr S Candy Dr J Madden	Dr H Elliott (FT)	Mathematical models to support IPM of leaf beetles
	Mr B Howlett Dr J Madden	Dr P McQuillan (UT)	Factors influencing *C. bimaculata* oviposition
	Mr H Redgrove Dr M Hurley	Dr D de Little (NET) Dr P McQuillan (UT)	Biology of Heteronyx beetles interfering with the establishment of *E. nitens* plantations
	Dr M Hurley	Mr P Naughton (BTT) Dr C McArthur (C4)	The impact of Heteronyx beetles on the establishment of *E. nitens* plantations
	Mr J Matthiessen Dr M Hurley Ms T Simmul	Dr D de Little (NET) Mr R Breidahl (Sotico)	Biology and management of insect establishment pests of plantations
	Dr M Steinbauer	Ms R Jones (A4) Dr D Steane (A4) Dr R Vaillancourt (A4) Dr B Potts (A1)	Affinities of an AGM resistant variant of *E. pseudoglobulus*
	Dr M Steinbauer	Dr Z Lukacs (C1)	Biology of *M. privata*
	Dr M Steinbauer	Ms H Nahrung (C1)	Leaf toughness and insect performance
Project C2: Insect control techniques and IPM	Mr L Rapley Dr G Allen	Dr D de Little (NET) Dr B Potts (A1)	Genetic susceptibility of eucalypts to insect attack
	Dr G Allen	Dr B Potts (A1)	Impact and susceptibility of *E. globulus* to sawfly attack

	CRC Staff	Collaborator	Research
Project C2: cont	Dr J Elek Ms N Beveridge	Dr D de Little (NET)	Field trials using Mimic® to control autumn gum moth
	Dr M Steinbauer Dr M Short	Dr Z Lukacs (C1) Mr R Bashford (FT)	Hymenopteran parasitoids of *M. privata*
	Dr M Steinbauer	Mr M Krygsman (APP)	Light trapping *M. privata*
Project C3: Resistance of planting stock to vertebrate browsers	Dr C McArthur Mr H Fitzgerald Mr S Paterson	Mr P Naughton (BTT)	Influence of seedling type and weeds on growth and damage to *E. nitens* seedlings on a plantation
	Dr C McArthur Mr H Fitzgerald Mr S Paterson	Dr M Hurley (C2) Mr P Naughton (BTT)	Comparison of insect versus mammalian herbivore damage to eucalypt seedlings in plantations
	Dr C McArthur Mr S Paterson	Ms N Marsh (FT) Mr A Walsh (FT)	Mammalian preferences for seedlings grown under different nursery conditions
	Ms J O'Reilly Dr C McArthur	Dr B Potts (A1) Mr K Joyce (NET)	Genetic variability in resistance to browsing of *E. globulus* foliage
Project C4: Strategies to reduce vertebrate browsing damage	Ms E Pietrzykowski Dr C McArthur	Ms S Hetherington (PCP)	Influence of small-scale vegetation patches on susceptibility of seedlings to browsing
	Ms K le Mar Dr C McArthur	Dr D de Little (NET)	Use of a plantation and surrounding habitat by mammalian herbivores
Project C5: Strategies to minimise loss due to fungal attack	Dr C Mohammed Ms K Barry Ms A Eyles Ms A Mollon	Dr L Pinkard (FT) Mr W Neilson (FT) Dr C Beadle (B1) Dr P Smethurst (B2)	Better understanding of the passive and active mechanisms of defence against decay in *E. nitens* and *E. globulus*, including a focused investigation of kino defect formation
	Dr C Mohammed Mr A Milgate	Dr D de Little (NET) Dr R Vaillancourt (A4) Dr B Potts (A1)	Determine the infection biology of *Mycosphaerella* and develop a bioassay to test for eucalypt resistance or susceptibility to *Mycosphaerella*
	Dr C Mohammed Dr Y Zi Qing	Dr R Taylor (FT) Mr T Wardlaw (FT) A/Prof A Richardson (UT) Dr D de Little (NET) Mr P Mineely (NET)	Ecologically sustainable forest management: fungal and invertebrate biodiversity

Education and Technology Transfer

National Links	CRC Staff	Collaborator	Activity
	Dr N Davidson	Science Communicators from other CRCs	Interaction and coordination of science communication

	CRC Staff	Collaborator	Activity
	Dr N Davidson Ms C Condie	Mr A Lyons (PFT)	Farm Forestry Fact Sheets and all programs
	Dr N Davidson	Ms J Burrell (Consultant) Mr D Hamilton, Mr D Vickers (Forest Education Foundation) Mr B Yaxley (Tas Ed Dept) Ms J Chambers (Kingston Primary School)	School Kits
	Dr N Davidson	Mr M Castley (PFT)	Agfest displays
	Dr N Davidson	Mr P Volker (Serve-Ag) Mr M Leech (TFGA) Mr A Lyons (PFT)	Production of a book: *Farm Forestry Technical and Business Handbook* (funded by NHT)
	Dr N Davidson	Mr R Philips (Springfield Primary School) Ms K Ancher (Glenorchy City Council) Mr M Castley (PFT)	Production of two arboreta of all 29 Tasmanian native eucalypts (partly funded by NHT)
Within Centre Links	Ms C Condie	All CRC staff	Monthly Report
	Dr N Davidson	All CRC staff	CRC web site

RESEARCH

Genetic Improvement Program

Manager
Dr Brad Potts

Introduction

A major expansion of the plantation estate of eucalypts and pines is occurring throughout Australia. Improved genetic quality of the plantation stock is essential if Australia is to be competitive in international markets when this estate is harvested. Large tree breeding programs being run by CRC partners in both the tropical and temperate regions demonstrate the importance of breeding and aim to reduce the costs of plantation establishment, harvesting and processing, as well as to add value to pulp and timber.

The research undertaken in the Genetic Improvement Program aims to ensure that plantation stock is of the highest possible genetic quality. It aims to improve the efficiency of breeding and ensure the genetic gains are rapidly and efficiently transferred to Australia's increasing plantation estate. In brief, the program aims to:

- define appropriate breeding objectives for individual firms and the sector, from forest growers to industrial processors;
- identify selection criteria and methods for assessing wood quality, growth, pest and disease resistance, and other key traits, and statistical methods for their analysis;
- determine the molecular and quantitative genetic control of important traits, and how this changes with age, site and silviculture;
- improve strategies to select, breed and deploy elite genotypes;
- improve our ability to control and manipulate reproductive characteristics in order to optimise deployment systems;
- ensure rapid uptake of technological advances made in Australia and overseas, particularly in the rapidly changing field of molecular genetics; and
- provide training and education in forest genetics and breeding, and be a forum for discussion in Australia.

The research outcomes will directly assist breeders of pines, eucalypts, and other native species in our member organisations, as well as organisations multiplying and distributing improved seed.

Project A1

Leader
Dr Brad Potts

Staff
Dr Luis Apiolaza
Mr Robert Barbour
Mr Greg Dutkowski
Mr Peter Gore
Mr Andrew Hingston
Mr Tim Jones
Dr Greg Jordan
Mr Kelsey Joyce
Mr Maarten Krygsman
Mr Gustavo Lopez
Mr David Pilbeam
Ms Leanne Pound
Prof Jim Reid
Mr Paul Tilyard
Dr Wayne Tibbits
Dr René Vaillancourt
Mr Peter Volker
Ms Michelle Watson
Dr Dean Williams

Genetics and reproductive biology of eucalypts

Background

This project aims to provide the basic biological information necessary for effective exploitation and management of temperate eucalypt gene pools. It will determine the extent to which traits of economic and biological importance are under genetic control and amenable to artificial selection and breeding. Such traits include growth, wood quality, pest and disease resistance and reproductive characteristics. Further, as cloning is no longer considered an economically viable means of deployment in Australia, the demand for improved seed is currently unprecedented. The project will study factors affecting sexual reproduction in order to optimise the quantity and quality of seed from eucalypt seed orchards. This project is closely linked to Project A4 (Molecular genetics of eucalypts).

Outcomes

- Flowers of *Eucalyptus globulus* were observed to be visited by a variety of native insects and birds, as well as large numbers of introduced honey bees and bumble bees at study sites in Tasmania. In contrast, flowers of *E. nitens* were observed to be visited by a wide variety of native insects, but only rarely by honey bees or bumbles bees, and never by birds.
- The first evidence of pollen flow from plantation to native forest eucalypts was obtained in a study of a boundary between the exotic *E. nitens* and

adjacent native eucalypts in northern Tasmania. Asynchrony in flowering time was shown to be a major barrier to such hybridisation.

- Field susceptibility of *E. globulus* within several full-sib families to autumn gum moth attack was shown to have a genetic basis and was associated with variation in the levels of key leaf chemicals.

- Controlled pollination studies have shown no evidence of major pre-zygotic barriers to advanced generation hybridisation between *E. nitens* and *E. globulus*. However, after 4 years growth and on two contrasting sites, the average performance of the parental outcrosses was greater than that of all hybrid types (F_1, F_2 and backcrosses).

- A factorial application of N and P fertiliser to 1 to 3 year old *E. nitens* revealed that only nitrogen enhanced flower bud abundance. Nitrogen application was shown to enhance the performance and reliability of the flower enhancing chemical Paclobutrazol®.

CRC student Robert Barbour harvesting capsules of *E. ovata* to determine the frequency of F_1 hybrids with the exotic plantation species, *E. nitens*.

Goals

To determine:

- the importance of non-additive genetic effects in *E. globulus* and *E. nitens*;

- the impact of inbreeding depression on growth and wood properties in *E. globulus*;

- the genetic control of flowering time and self-sterility in *E. globulus* and use this information to improve flowering synchrony and outcrossing rates in seed orchards;

- the mechanism of self-sterility in *E. globulus* and *E. nitens*;

- the environmental and genetic factors affecting the quantity and quality (e.g. size and density) of seed produced in *E. nitens* and *E. globulus* seed orchards;

- the pollinators of *E. globulus* and *E. nitens*;

- levels and factors affecting pollen-mediated gene flow between plantation and native forest eucalypts;

- the performance and genetics of F_1 and advanced generation *E. nitens* x *E. globulus* hybrids.

Project A2

Leader
Mr Greg Dutkowski

Staff
Dr Luis Apiolaza
Dr Paul Chambers
Dr Bruce Greaves
Mr Andrew MacDonald
Ms Michelle McGranahan

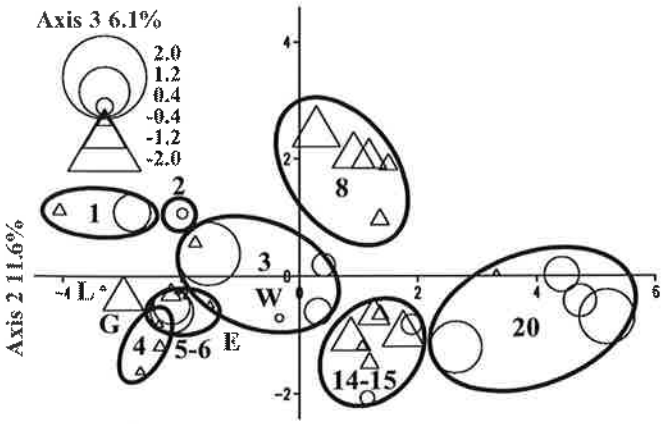
Breeding strategies

Background

The principal aim of this project is to develop 'state-of-the-art' strategies for selection, breeding and deployment which can be integrated into programs run by CRC partners. This involves:

- developing better estimates of breeding values by using improved models which better account for population structure, age, pedigree and site heterogeneity both within and between sites;
- improving selection through the development of economic models that allow the integration of economic information into breeding value prediction;
- improving tree breeding decision making by the evaluation of different breeding strategies; and
- supporting members in the planning and implementation of their breeding and deployment programs.

Figure 5
Multivariate analysis comparing quantitative genetic variation in newly collected localities of *Eucalyptus globulus* with that of known subraces. Note, new localities are positioned close to geographically neighbouring subraces.



KEY
Known subraces
1 West Otways
2 Cape Patton
3 East Otways
4 Strzelecki Ranges
5 Madalya Rd
6 Southern Gippsland
8 Flinders Island
14-15 S & SE Tasmania
20 King Island
New Localities
L Lerderderg Gorge
G Glenmaggie
W West Gippsland
E East Gippsland

Outcomes

- Studies of genetic variation within *Eucalyptus globulus* ssp *globulus* and its intergrade populations in a new base population collection (A E O'Connor and CFTT) have shown geographic patterns of genetic variation very similar to that revealed from previous collections (see Figure 5). New collection areas from East and West Gippsland, Glenmaggie and Lerderderg Gorge have close quantitative genetic affinities to the favoured Strzelecki Ranges race.
- Tools have been developed to assist in prediction of breeding values in spatial analysis.
- A population simulator has been developed to determine how measurement and sampling strategies affect the assessment of gain for a breeding population. Using genetic parameters provided by project A5 (Wood quality), it has shown that a three-stage sampling system for wood quality assessment would improve gain in the STBA national eucalypt breeding program. It has also been shown that the use of cores for basic density determination should replace indirect density determination using pilodyn, and that the evaluation of cores for cellulose content or predicted kraft pulp yield using Near Infrared Analysis (NIRA) was of marginal benefit. However, the genetic correlations used in the simulations require verification.
- Simulation of a partially selfed population has shown that in models used to estimate genetic effects, accounting for selfing in the numerator relationship matrix gives unbiased estimates of heritability.

Goals

- Determine the benefits obtained by accounting for spatial variation in environment and competition when predicting breeding values.
- Identify the best approach to amalgamate information from sites with heterogenous genetic parameters to gain a unified prediction of breeding values.
- Develop models, which incorporate risk traits such as frost resistance, disease resistance and drought tolerance, for use in breeding and deployment systems.
- Modify the 'Rolling Front' strategy in the light of uncertainty in the degree of interaction between genotype and environment.
- Develop alternative wood sampling strategies.
- Determine the extra gain to be achieved from improved genetic models which use more realistic assumptions about the relationships between trees in base population trials.

Project A3

Leader
Dr Gavin Moran

Staff
Ms Kylie Groom
Ms Jan Murrell
Dr Karen Thamarus
Dr Emlyn Williams

Molecular approaches to tree improvement

Background

The aim of this project is to study genes controlling commercial traits in *Eucalyptus globulus* with the focus on wood and fibre properties by:

- determining the number and location of quantitative trail loci (QTL) controlling wood and fibre properties and growth in *E. globulus*; and
- mapping and characterising candidate genes involved in wood and fibre properties.

This work is conducted in collaboration with Project A5 (Wood quality), using two full-sib families from the CSIRO/NET hybrid trial. Data from the first family, the mapping pedigree, are being used to build the genetic linkage map and identify quantitative trait loci. Data from the second family, the validation pedigree, will be used to validate the quantitative trait loci.

Kylie Groom working with the ABI Prism™ 310 Genetic Analyzer made by Perkin-Elmer. It includes the computer which Kylie is sitting at. It is used in this project for fragment size analysis of DNA microsatellites, but it can also be used for DNA sequencing.

Outcomes

- Molecular analyses of DNA samples from the first family are complete, and a genetic linkage map has been developed for *E. globulus* (see Major Development). The linkage map contains 249 loci including 40 microsatellites, 31 expressed sequence tags and 14 candidate genes. The expressed sequence tags (ESTs) at 22 loci have been identified as similar to known genes. The 14 candidate gene loci include genes from the lignin biosynthesis pathway and genes involved in cell wall synthesis.
- Putative quantitative trait loci (QTL) for wood density, percent pulp yield, percent cellulose content, fibre length and fibre coarseness have been identified. Many of the identified QTL co-locate with known genes on the linkage map. Pulp and cellulose content QTL are similar on two linkage groups and co-locate with a lignin biosynthesis gene. One of the fibre length QTL co-locates with a cell wall synthesis gene.

Goals

- Complete collection of molecular data from the second family and use in conjunction with wood and fibre trait data to validate putative quantitative trait loci.
- Complete measurements of microfibril angle in both families by Silviscan II and search for QTL for both microfibril angle and growth.
- Evaluate the role of known genes as potential QTL.
- Recommend strategies to incorporate molecular information for wood density and cellulose content into breeding and deployment programs.

Project A4

Leader
Dr René Vaillancourt

Staff
Mr Peter Bundock
Mr Jules Freeman
Mr Carl Grosser
Ms Rebecca Jones
Ms Marian McGowen
Ms Gay McKinnon
Mr Andrew Milgate
Ms Alexandra Mitchell
Dr Briony Patterson
Dr Brad Potts
Prof Jim Reid
Mr Adam Smolenski
Dr Dorothy Steane
Ms Claire Turner
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Molecular genetics of eucalypts

Background

The rapidly changing field of molecular genetics is providing unprecedented insights into genome and population structure of eucalypts and offers powerful tools for use by tree breeders. Already molecular markers are being used in fingerprinting for quality control, determining relatedness, paternity analysis and gene flow studies, as well as understanding the genetic control of quantitative traits.

This project focuses on eucalypts and aims to use molecular markers to:

- provide a better knowledge of inbreeding, heterosis and the role of genetic diversity in breeding and base populations of eucalypts;
- quantify the factors affecting outcrossing, gene flow, and contamination in seed orchards; and
- characterise the number and location of major genes (QTLs) affecting commercially important traits (e.g. growth, wood density, pest and disease resistance).

Outcomes

- New PCR based markers for chloroplast DNA (cpDNA) have revealed strong spatial structuring to variation in numerous eucalypt species. The fine-scale spatial pattern of chloroplast types has been mapped in *Eucalyptus globulus* and has provided a framework to discover the geographic origin of trees or seed lots of unknown origin.
- Contrary to previous views that the Portuguese landrace of *E. globulus* is derived from a narrow base, cpDNA variation indicates that it is genetically diverse and is probably derived from collections from both southern Tasmania and continental Australia (or Flinders Island).
- New internal transcribed spacer (ITS) sequence data have revealed close phylogenetic relationships between the *Eucalyptus* sections *Transversaria* (e.g. *E. grandis*), *Exsertaria* (e.g. *E. camaldulensis*) and *Maidenaria* (e.g. *E. globulus* and *E. nitens*) which could explain the commercial success of hybrid combinations amongst these sections.
- Natural variation in two important genes affecting lignin, CAD2 and CCR, has been demonstrated in *E. urophylla*, *E. grandis* and *E. globulus* by Dr René Vaillancourt whilst on sabbatical with Dr Daniel Verhaegen at CIRAD Forest (Montpelier, France).
- International collaboration aimed at developing a standard set of microsatellite loci for use in fingerprinting and paternity analysis of commercial species of *Eucalyptus*, found four robust primer pairs that work consistently well in the four commercial species tested.

Goals

- Determine the genetic control of resistance to *Mycosphaerella* infection in *E. globulus*.
- Complete linkage maps of an intraprovenance cross of *E. globulus* using RAPDs and microsatellites developed in temperate and tropical eucalypts. This will help align maps made in different species around the world, locate unlinked microsatellites for fingerprinting and gene flow studies, and be used for QTL detection.
- Use microsatellite and isozyme markers in gene flow studies, calculate outcrossing rates, contamination levels and model seed paternity in seed orchards of *E. globulus* and *E. nitens*.
- Use molecular markers to monitor the efficiency and contamination levels of different pollination techniques in *E. globulus*.
- Determine the genetic composition of open-pollinated progenies and the genetic relatedness among individuals in the base population of *E. globulus*.

Honours student, Rebecca Jones (sitting) assisted by Martyn Lavery (second from right), collects samples of remnant *E. globulus* on farms in Gippsland for fingerprinting with microsatellites.

Project A5

Leader
Ms Carolyn Raymond

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Mr Andrew MacDonald
Ms Laura Nagy
Mr Leon Savage
Ms Kirsty Surridge
Mr Byron Yeo

Wood quality

Background

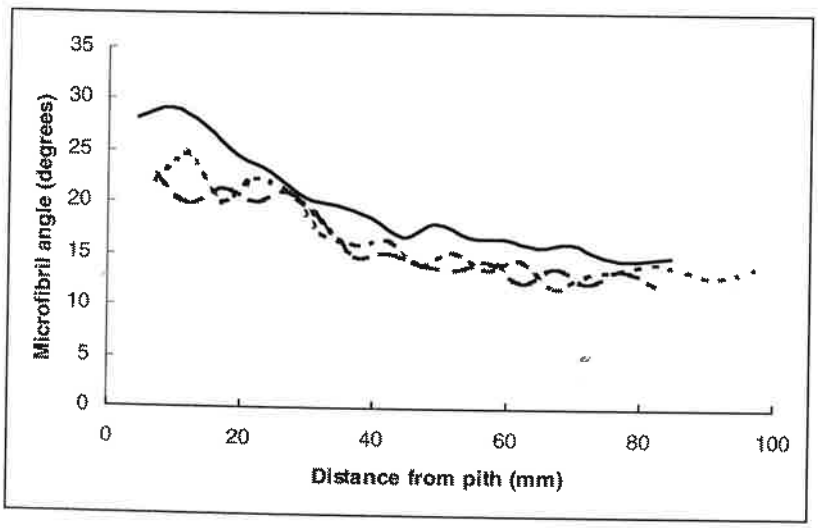
Wood quality is one of the most important determinants of profitability, whether plantations are harvested for pulp, sawn timber or other solid wood products. However, wood property traits are expensive and difficult to measure and there is a poor understanding of their genetic control and relationships with breeding objective. For these traits to be integrated into breeding and deployment programs it is essential to develop cost effective, non-destructive sampling techniques which can be used on a large scale.

Work is concentrating on:

- developing non-destructive sampling strategies for wood and fibre properties;
- defining relationships between wood, pulping and sawn timber properties;
- determining the magnitude and importance of genotype by environment interactions for wood properties; and
- developing breeding objectives for a range of wood products.

This project has strong links with Project A4 (Molecular genetics of eucalypts) and the CSIRO Forest Products Laboratory, where technologies such as Silviscan II, cellulose content analysis and Near Infrared Reflectance Analysis are being applied to genetic material in the current national breeding programs for both *Eucalyptus globulus* and *E. nitens*.

Figure 6
Pith to bark traces for microbril angle in *Eucalyptus nitens*.



Outcomes

- The product requirements and wood properties important for a range of solid and composite wood products have been identified.
- Basic density and cellulose content were found to be under strong genetic control in *E. nitens* with heritability estimates ranging from 0.50 to 0.96 for density and 0.52 to 1.0 for cellulose content. Fibre length was under moderate genetic control (h^2 ranging from 0.25 to 0.80) whilst heritability estimates for fibre coarseness were variable but generally low.
- Genotype by environment interactions were found to be small and of no practical importance for basic density, fibre length and cellulose content in *E. nitens*.
- Data collection for microfibril angle and density variation for 3 sites in *E. nitens* has been completed and is currently being processed with the aim of determining the magnitude of genotype by environment interactions. Ring boundaries are being inserted so age-age correlations may be calculated and optimum age for selection determined.
- Acoustic testing was found to show promise for segregating logs for timber stiffness. However, results from tests on standing trees were less promising.

Goals

- Determine genetic parameters, importance of genotype by environment interactions and age-age correlations for microfibril angle and density variation in *E. nitens*.
- Determine genetic parameters and correlations between basic density, fibre length, cellulose and lignin contents in families of *E. globulus* selected to cover the range of density variation.
- Sample base population trials of *E. nitens* to determine race effects and genetic parameters for basic density and cellulose content from a broad genetic base.
- Develop non-destructive sampling techniques for assessing wood shrinkage and collapse in both *E. globulus* and *E. nitens*.

Project A6

Leader
Dr Mark Dieters

Staff
Dr Heidi Dungey
Dr Kevin Harding
Mr Amal Joseph
Mr Dominic Kain
Dr Garth Nikles

Hybrid breeding

Background

There is an increasing interest in the use of hybrids in forestry in Australia and overseas. However, relatively little is known about the genetics of hybrid populations and the most efficient means of breeding to improve hybrids. Through its partner organisations, the CRC has one of the best genetic bases of artificial forest tree hybrids in the world. Using this resource the project aims to:

- understand the genetics of hybrid populations, focusing on growth and wood properties; and
- develop or introduce into Australia the most advanced strategies for breeding hybrids.

This project focuses on the tropical pines species (*Pinus elliottii* and *P. caribaea* var *hondurensis*) and their hybrids being deployed commercially by QDPI and interacts closely with Project A7 (Molecular genetic improvement for tropical and subtropical production).

Outcomes

- A review of the forestry literature relating to the genetics and deployment of hybrids has been completed.
- A major international symposium on 'Hybrid Breeding and Genetics' (jointly organised and hosted by CRC-SPF and QFRI in April 2000 at Noosa) attracted 110 delegates from over 20 countries. The symposium brought together scientists and tree breeders from a wide range of backgrounds to focus on the development of concepts for the genetic improvement of hybrids in forestry. The proceedings of this symposium is available on CD-Rom from the CRC.
- Estimation of genetic parameters has been completed for *P. elliottii*, *P. caribaea* var *hondurensis* and their hybrids in factorial matings using data to 10 years of age.
- Analyses have been completed on the performance of inter-provenance hybrids within both *P. caribaea* var *hondurensis* and *Araucaria cunninghamii*. In both cases, inter-provenance hybrids appear to yield a growth advantage when compared to intra-provenance hybrids.
- Inter-variety hybrids between var *hondurensis* and var *caribaea* have been shown to have considerable potential for deployment in north Queensland where a fast-growing and wind-firm taxa is required, whereas inter-variety hybrids between var *hondurensis* and var *bahamensis* need further testing before deployment in south-east Queensland.
- A survey of the use of hybrids in forestry involving 42 organisations in 13 countries found that the main use of inter-specific hybrids in forestry was for the pulp and timber markets.

Goals

- Finalise densitometry of wood samples from *P. elliottii*, *P. caribaea* var *hondurensis* and their F_1 hybrid, and the estimation of genetic parameters for wood quality traits (PhD research by Dominic Kain).
- Extend work on the use of finite locus models to determine the most appropriate for the analysis of data from pine hybrids in Queensland.
- Investigate the combined used of data from hybrids and pure species for the prediction of breeding values.

Mr Ken Robson (left) and Ms Susan Jarvis (right) at either end of a 4-tree line plot of an outstanding family in a 2-year old trial of *P. caribaea* var *hondurensis*-*P. caribaea* var *caribaea hybrids* near Cardwell in north Queensland.

Project A7

Leader
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Staff
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Dr Russell Haines
Dr Kevin Harding
A/Prof Jane Hughes
Ms Rachel King
Mr Rohan Mellick
Mr Leon Scott
Dr Mervyn Shepherd
Mr Steven Smith
Ms Rhonda Stokoe
Mr Paul Toon

Molecular genetic improvement for tropical and subtropical production

Background

This project applies molecular techniques to the genetic improvement of tropical forest species, including *Pinus* hybrids, *Araucaria cunninghamii* (hoop pine) and eucalypts. The major focus is the analysis of quantitative trait loci (QTL) and mapping of juvenile wood, growth and vegetative propagation traits in *P. elliottii* x *P. caribaea* hybrids and hoop pine. The project will assist in tree improvement by providing an insight into a) the relationship between quantitative traits and b) the genetic effects of heterosis and epistasis. Exploration of variability and interactions of QTL across genetic backgrounds, sites and cultural regimes will allow evaluation of the feasibility of marker-aided selection and breeding for key commercial traits. Study of the natural diversity, breeding system, taxonomic relationships and hybridisation for species such as *Eucalyptus cloeziana* is being facilitated by the development of new molecular markers. This research supports tree improvement programs for the emerging hardwood plantation industry of Queensland and tropical Australia.

Outcomes

- Genetic maps have been generated for a select PEE (*P. elliottii* var *elliottii*) and PCH (*P. caribaea* var *hondurensis*) individual based on microsatellite and AFLP markers. This required the development of an AFLP system for *Pinus*, which provided an abundance of reliable markers at an average rate of 14 polymorphisms per primer pair in the mapping cross. A further 10 microsatellite loci were also evaluated for mapping in PEE and PCH, bringing the total loci evaluated by our group to 49 from other *Pinus* species and 3 loci developed in PEE or PCH.

- Two molecular assays were developed for verifying interspecific hybridisation in *Pinus*. Both assays, a chloroplast locus and a nuclear microsatellite region showed promise for discrimination amongst the parental taxa. These assays provide a reliable method for verifying hybridity of hybrid pine material used in clonal testing programs.

- A natural inter-subgeneric hybrid (within *Eucalyptus*) between *E. cloeziana* and *E. acmenodies* was verified as unidirectional hybridisation by using molecular markers, morphological and foliar oil characteristics.

Goals

- Complete QTL analysis for early growth and form in hybrid pine.

- Commence genotyping of a *Pinus* family to enable analysis of juvenile wood properties.

- Identify further microsatellite markers for use in *Pinus*.

- Initiate study into the genetics of vegetative propagation traits in hybrid pines.

Dr Mark Dieters (right), Dr Merv Shepherd and Mr Rohan Mellick (left) inspecting *Pinus* hybrid hedge plants in a trial investigating the genetics of vegetative propagation traits.

- Complete mapping and QTL studies in a full-sib and a half-sib hoop pine family.

- Investigate pollen contribution in progeny from a hoop pine clonal seed orchard.

- Report on a study of natural hybridisation of *E. cloeziana*. Complete analysis of population diversity, flowering and taxonomic relationship of *E. cloeziana*.

Sustainable Management Program

Manager
Dr Chris Beadle

Introduction

Plantations, including farm forests, can be considered a sustainable resource only if the factors necessary for production remain favourable over successive crop cycles. This program examines the environmental factors and silvicultural practices that influence forest production and cast these into a quantitative framework with the use of process-based models. We play a critical role in delivering the knowledge needed to ensure that practices implemented by forest managers in Australia are sustainable and subject to ongoing improvement in terms of economic and environmental performance. This provides a valuable adjunct to the work of other research organisations involved in the definition of criteria for sustainability.

Project B1

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Mr Craig Baillie
Mr Chris Barnes
Dr Chris Beadle
Ms Maria Cherry
Mr Keith Churchill
Dr Neil Davidson
Ms Sandra Hetherington
Dr Greg Holz
Mr Andrew Knowles
Dr Martin Line
Mr Arthur Lyons
Dr Bob McCormack
Dr Andrew Mitchell
Mr Martin Moroni
Mr Peter Naughton
Mr Bill Neilsen
Mr Chris O'Hara
Ms Ruth Osborne
Ms Carolyn Ringrose
Mr Tony Smith
Mrs Diane Spurr
Ms Ann Wilkinson

Site productivity

Background

The aims of this project are to:

- determine the extent to which nutrient and water supply can sustain high leaf areas and tree growth rates after canopy closure;
- evaluate the effects of alternative slash management strategies (during the inter-rotation period) on nutrient supply and other soil conditions that affect productivity;
- improve our understanding of water storage and access to it in relation to soil profile characteristics, rainfall, and ground water.

Outcomes

- An increase in leaf area index (LAI) was achieved following nitrogen (N) fertilisation of a 6-year-old *Eucalyptus nitens* plantation at Westfield (on mudstone-derived soil; 1580 mm annual rainfall). An increase in LAI of 1 m^2 leaf area per m^2 ground area was achieved in stands that initially had LAI 5 to 6, but no response was observed in stands with LAI of 7 to 8. This observation is particularly interesting, because LAIs of 5 to 6 are considered moderate to high in *E. nitens* or *E. globulus* plantations in southern Australia.
- Based on the assumption that the observed increased LAI will lead to increased growth, an economic analysis was conducted which indicated that N fertilisation of many stands at 6 years of age would provide a positive return on investment. Research already initiated is testing this assertion on a wider range of sites.
- Evaluation of a 'quick-test' nutrient analysis system indicated that its accuracy and precision were adequate for assessing N and P availability in many plantation soils. Further testing may provide technical groups in the forest industry with their own soil analysis capability.
- High rates of fertilisation with urea and triple-superphosphate increased the concentrations of N and phosphorus (P) in leaf litter of an *E. nitens* plantation. However, early results indicate that high rates of N fertilisation alone will reduce concentrations of exchangeable pools of magnesium and potassium in surface soils.

Goals

- Determine stem volume responses two years after applying N-fertiliser to 4- to 6-year-old plantations of *E. globulus* and *E. nitens*.
- Determine the relationships between LAI and growth in *E. nitens* plantations as affected by N fertilisation.
- Characterise the distribution of N in canopies of *E. nitens* plantations with low to high LAI.
- Determine the effect of N fertilisation on the concentrations of base cations in several soils.

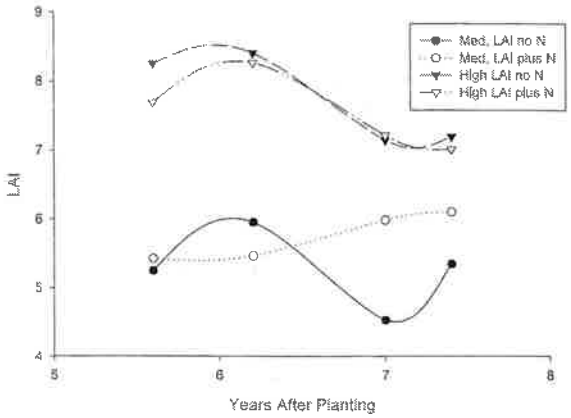

Figure 7
Fertilizing *E. nitens* with 400 kg N ha^{-1} at age 6 years increased LAI by 0.8 to 1.5 m^2 leaf area per m^2 ground area in a medium LAI stand, but there was no response in a high LAI stand. All treatments recieved 100 kg P ha^{-1} at age 6 years.

- Commence an accelerated depletion study to test predictions of base cation uptake and leaching, and the onset of deficiencies of potassium (K) and magnesium (Mg) deficiency in *Pinus radiata*, *E. globulus* and a grass.

- Characterise base cation concentrations in soils and *P. radiata* at several sites of known or suspected K or Mg deficiency.

- Commence using a micro-method of measuring K and Mg uptake by eucalypt and pine roots to determine the effect of concentration and the ratio of these elements on the rate of uptake.

Project B2

Leader
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Mr Trevor Leaman
Ms Nicole Mathers
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Dr Senake Perera
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Dr Nina Prasolova
Dr Guixin Pu
Prof Calvin Rose
A/Prof Paul Saffigna
Mr John Simpson
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Dr Grant Wardle-Johnson
Dr Bofu Yu

Management of tropical soils

Background

The aims of this project are to:

- evaluate the impacts of soil and stand management on both quantity and quality of soil organic matter in subtropical pine plantations of south-east Queensland;

- develop effective soil organic matter management regimes for sustaining the productivity of subtropical pine plantations;

- evaluate the impacts of silvicultural practices on N pools and dynamics in hoop pine plantations of south-east Queensland;

- quantify the effects of both silvicultural practices and environmental conditions on soil N availability and on plantation N demands;

- quantify the effects of harvesting, site preparation practices and seasonal conditions on soil physical processes in subtropical pine plantations;

- quantify the relationships between surface condition, site hydrology, soil physical characteristics and leaching processes during the inter-rotation period of the pine plantations.

Outcomes

- Significantly greater amounts of easily decomposable plant residues such as carbohydrate and alkoxy C (one component of soil organic carbon, C) entered into the top 10 cm of soil in the areas under the 1-year-old windrows compared with the areas between the windrows. However, there were no significant differences in total C. After 3 years, soil organic C composition under the windrows was similar to that between the windrows. However, at this time total C in the top 10 cm of soil was significantly higher under windrows than it was between the windrows.

- A world first in the application of nitrogen-14 NMR to soil humic acids (HAs) (developed in collaboration with the Wuhan Institute of China) has revealed the surprising existence of nitrate-N in the HAs. The HA nitrate-N was closely related to soil N availability and responsive to plant residue management regimes in four contrasting forest ecosystems. This newly discovered HA nitrate-N was biologically active and could be a significant part of total N in the HAs.

- Considerable mineral N may be lost via denitrification during the critical inter-rotation period and early phase of the second rotation in hoop pine plantations. This was demonstrated using estimates of losses of gaseous N (N_2 and N_2O) from microplots in areas just under and between 1-, 2- and 3-year-old windrows of hoop pine harvesting residues (see Figure 8).

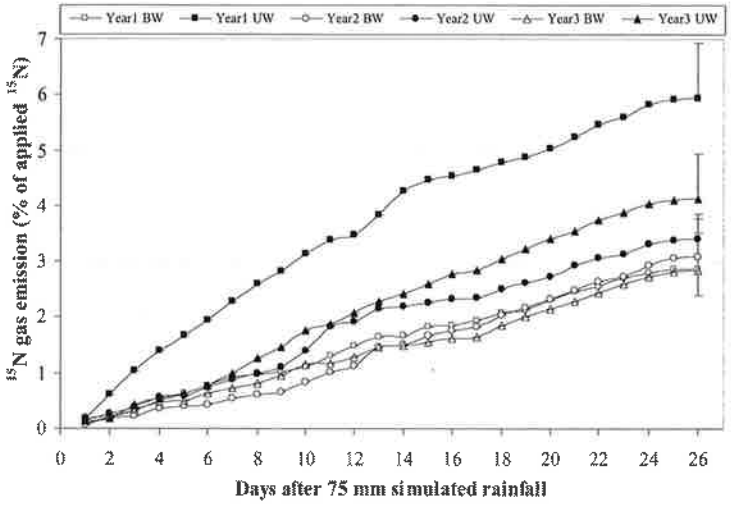

Figure 8 Accumulated daily ^{15}N gases (N_2+N_2O) emitted from microplots under different residue management regimes in the first 25 days after simulated rainfall of 75 mm in 1-year-old (Year 1), 2-year-old (Year 2), and 3-year-old (Year 3) hoop pine plantations. UW–under windrows; BW–between windrows.

Goals

- Further develop and apply ^{13}C, ^{14}N and ^{15}N NMR methodologies to characterising soil organic matter composition and quality in hoop pine and exotic pine plantations.
- Quantify denitrification, immobilisation and leaching of ^{15}N-labelled fertilisers applied to microplots installed under different residue management regimes and environmental conditions in the second-rotation hoop pine plantations.
- Develop and apply soil biological methods, particularly microbial biomass C and N assays, to characterise soil organic C dynamics and N cycling in subtropical pine plantations.
- Assess the suitability of existing data from long-term catchment studies for incorporation into a predictive model of soil loss from subtropical pine plantation catchments.
- Estimate the infiltration parameters using the rainfall-runoff model SRM for the site selected storm events.

Project B3

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Mr Dugald Close
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Ms Amabel Fulton
Ms Sandra Hetherington
Dr Greg Holz
Dr Sarah Jennings
Mr Kelsey Joyce
Prof Peter Kanowski
Mr Sven Ladiges
Dr S Mahendrarajah

Silvicultural systems

Background

The aims of this project are :

- to provide guidelines for the preparation and management of seedling stock during plantation establishment;
- to develop weed management systems which minimise the use of herbicides including the use of non-competing species as cover crops;
- to develop pruning, thinning and spacing systems which are suitable for converting industrial pulpwood plantations to clearwood regimes and for farm forestry;
- to assess the benefits and costs of trees on farms, and the real or perceived barriers to the adoption of commercial forestry on part or all of the farm enterprise and develop an enhanced understanding of the factors which determine regional timber supply.

Outcomes

- Nutrient starvation is a useful risk management tool if seedlings are to be planted into cold environments, where photoinhibition is likely to occur, because these seedlings have high levels of anthocyanin in their leaves and are thus pre-conditioned.

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Ms Jane Medhurst
Prof Robert Menary
Dr Neville Mendham
Ms Alicia Mollon
Mr Peter Naughton
Dr Libby Pinkard
Mr Digby Race
Ms Jacki Schirmer
Dr Chris Shedley
Dr Philip Smethurst
Mr Tim Tabart
Mr Doug Walch
Mr Grant Westphalen
Ms Ann Wilkinson
Mr Dale Worledge

- Tannin (galloylglucoses) and flavonoids are correlated with levels of foliar nutrients, cold-induced photoinhibition and incident light intensity in *Eucalyptus nitens* seedlings, and probably play a role as antioxidants in leaves during establishment.

- Thinning a stand of *E. nitens* does not alter branch angle, branching density or the relationship between branch size and branch leaf area but larger branches develop in the lower crown. Residual stocking has a strong influence on leaf area increase.

- In 5-year-old blackwood plantation grown with a *Pinus radiata* nurse crop, form pruning lowered the incidence of multiple leaders and large branches, while heavy thinning of the nurse crop produced faster diameter growth minimising the negative impact of pruning on growth.

- For *E. globulus* and *E. nitens* in plantations more roots were found: i) in droughted than in irrigated soils, ii) under *E. nitens* than under *E. globulus*, iii) that were of small diameter than of larger diameter, and iv) that were in shallower soils than in deeper soil.

- A study in Victoria and Tasmania found the principal objections to plantation forestry were associated with the placement of plantations, the off-site impacts and the scale of development of plantations, rather than to plantations themselves. Results indicated a need to develop institutional structures to hear objections.

Goals

- Evaluate the roles of the various strategies that seedlings employ to dissipate excess excitation energy during cold-induced photoinhibition.

- Model the effect of physiological responses to thinning.

- Quantify the requirements of blackwood for sidelight suppression to induce good form in plantations.

- Provide a physiological basis for fertiliser-induced micronutrient deficiencies.

- Determine if altered microclimate at the edge of clear-felled areas in wet sclerophyll forest results in changes in the composition of the epiflora

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Project B4

Leader
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Dr David Doley
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Mr Bruce Hogg
Ms Susan House
Dr Mark Hunt
Mr Eric Keady
Dr Mark Lewty
Mr Mike Lofts
Mr Daryl Mummery
Ms Kate Murray
Ms Laura Nagy
Mr Mark Nester
Mr David Osborne

Modelling production and wood quality

Background

The aims of this project are to:

- produce process-based models
  a) which enable the productivity of plantations to be predicted,
  b) which address specific management questions,
  c) which have a transparent structure, and
  d) for which input data can be readily and cheaply obtained by forest managers;

- define the effects of site and climatic factors on wood properties, determine the feasibility of altering wood properties via silvicultural treatments, and develop tools for predicting response of wood properties to environmental factors;

- develop decision support systems for plantation management.

Outcomes

- A stand productivity model, PROMOD, produced by the CRC, has now been parameterised and validated for *Eucalyptus nitens* and *Pinus radiata* in addition to *E. globulus*.

- PROMOD modified to calculate growth of trees in rows of various geometries, using a modified Penman-Monteith equation to calculate evapotranspiration from trees and soil.

Mr Simon Papps
Dr Libby Pinkard
Mr Rob Prydon
Ms Carolyn Raymond
Dr Sigrid Resh
Mr Paul Ryan
Mr Leon Savage
Ms Kirsty Surridge

- The ProMod-NitGro hybrid model has been extended to predict development of stand LAI and crown length, and can be used as a decision support system for silvicultural management.
- Preliminary analysis shows significant savings could have been made if a current process-based model ProMod had been available in the 1990s. Present net value of a plantation was affected little by the cost of a pre-planting survey, but greatly by choosing poor areas for planting.
- Assessment of a growth model (Cabala) indicates realistic prediction of biomass allocation and the distribution of standing biomass and suggests that it can be used to predict stand development and growth prior to canopy closure.
- The performance of ProMod across a landscape was compared at differing scales: 25 x 25 m, 200 x 200 m, and 1 x 1 km, indicating that although simple productivity models are scale dependent they are reasonably robust.
- An expert system (ForMS) has been developed which brings together diverse empirical models used in SE Queensland to analyse or predict aspects of forest growth and stand development.
- Basic density was found to increase with decreasing rainfall in *E. globulus* sampled across rainfall gradients in both Tasmania and Western Australia. Differences in spacing had no effect on basic density.
- Fibre length and cellulose content in *E. globulus* showed little response to changes in altitude or rainfall across 13 sites in northern Tasmania.

Goals

- Obtain data on below-ground carbon allocation in eucalypt plantations.
- Validate and evaluate Cabala using long-term plantation data with observed seasonal and annual climatic data.
- Develop user-friendly implementations of the ProMod-NitGro hybrid model and management-related applications of ProMod.
- Develop allometric relationships, description of canopy architecture and above-and below- ground biomass distribution for 12-year old *E. grandis* and 48-year old *E. cloeziana*.
- Parameterise ProMod and 3-PG for *E. grandis*.
- Determine empirical relationships between site factors and wood properties for *E. globulus* in Western Australia and Tasmania.
- Determine interactions between spacing and rainfall with fibre length and cellulose content in wood samples obtained from 4 spacing trials.

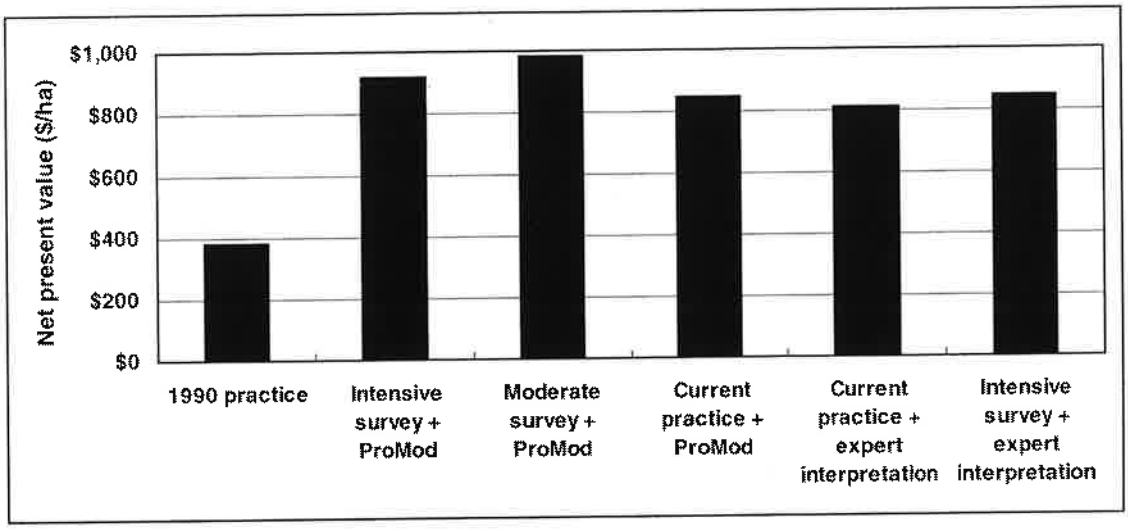

Figure 9
An illustration of the economic advantages that could have been gained if various levels of intensive site survey and productivity modelling had been used to plan a plantation estate.

Resource Protection Program

Manager
Dr Clare McArthur

Introduction

The Resource Protection Program aims to:

- develop a comprehensive understanding of the biology, ecology and impact of a number of key pests (insect and vertebrate) of eucalypt plantations in temperate Australia;
- identify and study the biology, ecology and control of a number of eucalypt fungal pathogens, to provide the basis for future development of integrated pest management (IPM) strategies;
- develop efficient and effective monitoring protocols for some pest and disease species to determine if and when control is necessary;
- develop IPM strategies for a number of key pests such as the Tasmanian leaf beetle (*Chrysophtharta bimaculata*), autumn gum moth (*Mnesampela privata*) and several marsupial herbivores; and
- develop management techniques and products to minimise the effects of pests and diseases on the quantity and quality of forest products, consistent with the principles of sustainable forest management.

Project C1

Leader
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Dr Steven Candy
Ms Michelle Court
Dr David de Little
Mr John Dowse
Dr Jane Elek
Dr Humphrey Elliott
Dr Grant Farrell
Mr Bradley Howlett
Dr Marina Hurley
Dr Andrew Loch
Dr John Madden
Mr John Matthiessen
Ms Helen Nahrung
Mr Vin Patel
Mr Stephen Paterson
Mr Luke Rapley
Mr Hilton Redgrove
Mr Anthony Rice
Dr Mark Short
Ms Tara Simmul
Dr Martin Steinbauer
Mr Rex Sutherland
Ms Trudi Wharton

Biology, ecology and economic impact of insect pests

Background

This project aims to provide a strong foundation of basic research on the biology and ecology of the major insect species across various geographic regions so that integrated pest management (IPM) strategies can be developed. Particular emphasis in the project is centred upon *Mnesampela privata* (autumn gum moth) across all regions of southern Australia, and the leaf beetles *Chrysophtharta agricola* and *C. bimaculata* in Tasmania. Other insect species currently under study include *Acacicola orphana* (fireblight beetle), *Heteronyx* spp (Melolonthine scarab beetles) and *Heteronychus arator* (African black beetle). Areas of research include phenology, host-plant interactions, natural enemies, mating systems, monitoring protocols and impacts on tree growth.

Outcomes

- A survey of newly established plantations across Tasmania during spring located *Heteronyx* species in many areas. Damaging populations of both *Heteronyx crinitis* and *H. dimidata* were found in the north, and *H. crinitus* in the south.
- Work on the natural enemies of *C. agricola* and *C. bimaculata* has revealed significant seasonal partitioning in the activity peaks of the larval parasitoids associated with these species. At least one and possibly two new species of tachinid fly has been discovered.
- Larval and pupal minimum temperature thresholds are some 3°C - 5°C higher in *C. agricola* than in *C. bimaculata*, though day-degree requirements are significantly lower in *C. agricola*. Significant differences in rates of larval development were shown between clutches laid by different females.
- Female autumn gum moth are comparatively indiscriminate of host species and leaf qualtiy when depositing eggs. Females laid an average of 40-272 eggs on the 'soft' juvenile leaves of *Eucalyptus dunnii, E. globulus globulus* and *E. globulus bicostata*, but also laid on the 'tough' adult leaves of the same species even though the latter are less suitable for neonate development.
- During population outbreaks of autumn gum moth, female moths oviposit heavily upon even the most apparently isolated eucalypt. In arrays of trees where acacias significantly outnumbered

eucalypts, the numbers of eggs counted in one minute per individual eucalypt ranged from 8 to 568 eggs.

- *H. elongatus*, a pest of newly establishing seedlings, is present in pastures prior to plantation establishment. In the larval stage it is highly damaging to seedling roots. Operations personnel had assumed that this damage was caused by African black beetle larvae.

- The tendency for African black beetle to accumulate on the planting mounds was confirmed. The effect was greater at wetter sites and those where inter-row vegetation was less.

- Field surveys have revealed that *Gonipterus scutellatus* and chrysomelid beetles (mainly *C. variicollis* and *Cadmus excrementarius*) are the major pests of established WA *E. globulus globulus* plantations between spring and autumn. Surveys have also identified times of greatest defoliation and the seasonal lifecycle of each pest.

Goals

- Determine the impact of larval *C. agricola* and adult *C. bimaculata* feeding in the field.

- Establish the impact of natural enemies on the field survival of *C. agricola*.

- Investigate the host stage preferences of the larval parasitoids of *C. agricola* and *C. bimaculata*.

- Investigate the distribution and biology of *Heteronyx* spp within newly established plantations.

- Study population fluctuations, oviposition behaviour and flight activity of *M. privata* in vegetationally diverse habitats.

- Continue studies of the ecology of *Essigella californica*.

- Undertake studies of the biology, distribution and impact of *H. elongatus* larvae and African black beetle with the aim of devising appropriate prophylactic management practices in at-risk areas.

- Quantify what levels of defoliation of *E. globulus globulus* in WA, by *G. scutellatus*, chrysomelid beetles, *M. privata* and *Phylacteophaga froggatti*, cause economic damage.

A major *Perga affinis* outbreak on *E. globulus*.

Project C2

Leader
Dr Geoff Allen
Dr Rob Floyd

Staff
Mr Dick Bashford
Ms Natasha Beveridge
Dr Steven Candy
Ms Michelle Court
Dr David de Little
Mr John Dowse
Dr Jane Elek
Dr Humphrey Elliott
Dr Grant Farrell
Mr Tim Hingston
Dr Marina Hurley
Dr Andrew Loch
Dr John Madden
Mr John Matthiessen
Dr Richard Milner
Ms Helen Nahrung
Mr Vin Patel
Mr Stephen Paterson
Mr Luke Rapley
Mr Hilton Redgrove
Mr Anthony Rice
Dr Mark Short
Dr Martin Steinbauer
Mr Rex Sutherland
Ms Trudi Wharton

Insect control techniques and IPM

Background

Forest managers are constantly looking for non-chemical options for insect control that are both effective and economically viable. Individual non-chemical control approaches are generally not as efficacious as chemical insecticides and must be used in conjunction with other options in an IPM strategy to achieve adequate control. However, there are very few non-chemical options currently available to managers of eucalypt plantations in temperate Australia. This project is investigating a number of control options, including the better use of chemical insecticides, for incorporation into IPM strategies.

Outcomes

- The biological insecticide, Success® (active ingredient: spinosad), has been found to be very effective against young leaf beetles, not only in the laboratory, but also in an aerial spray trial. A very low rate (50 ml per ha) was needed to kill 100% of young leaf beetle larvae in a plantation of *Eucalyptus nitens* and this rate caused only low levels of mortality of their predators, ladybirds and soldier beetles.

- An aerial spray trial using Novodor® (active ingredient: *Bacillus thuringiensis* var *tenebrionis*) diluted 50% with water, has confirmed that it can be effective in the field: over 90% of young *Chrysophtharta bimaculata* and *C. agricola* larvae were killed. However, Bt formulations are more difficult to use operationally so they are recommended mainly for using along sensitive boundaries.

- An insect growth regulator that is specific to lepidopterans, Mimic® (active ingredient: tebufenozide), was found to be effective against autumn gum moth when sprayed aerially at low volumes in a young *E. globulus* plantation. A 50% dilution in white oil of Dipel SC® (active ingredient: *B. thuringiensis* var *kurstaki* strain HD-1 (Btk), an emulsifiable suspension) was found to be the most effective of several formulations and dilutions of Btk tested against autumn gum moth. However, it was less effective than Mimic® and would be more difficult to use operationally.

- The application of Confidor® (imidacloprid) as a root drench has demonstrated significant phytotoxic effects on *E. nitens* seedlings at high concentrations. When applied as a root drench on two-month-old potted seedlings, very high concentrations (50 ml/litre) resulted in an 18 per cent reduction in growth, while 15 ml/litre caused a loss of 12.8 per cent in growth after six months. Confidor® was found to serve as neither a deterrent nor attractant to mammal browsing.

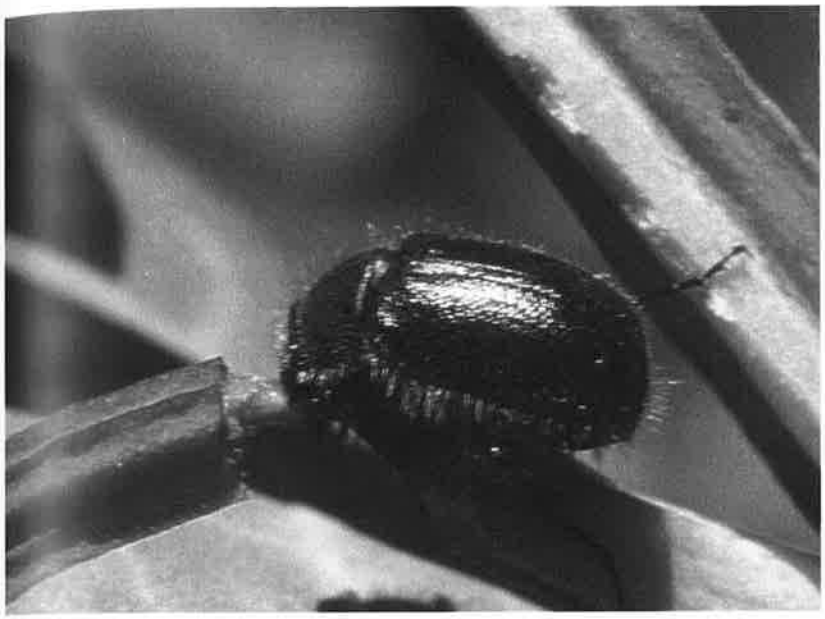
- As a systemic, Confidor® was found to be effective at killing *Heteronyx* spp when applied at 10 ml of 5ml/litre as a root drench, prior to planting. At least three days are necessary to allow the systemic to take effect, then beetles can die after 15 minutes of feeding. When applied in December, Confidor® remained active for approximately six months in the field.

- Investigations into biological control of *Gonipterus scutellatus* in WA during the 1999/2000 season showed that the wasp *Anaphes nitens* parasitised egg masses at low rates during spring (<10%) but by summer parasitism levels were nearly 100%.

- Surveys of insecticidal-sprayed plantations in WA have shown that single applications of alpha-cypermethrin and dimethoate in mid-spring provide effective protection against beetle defoliators over the summer. However, these applications result in almost 100% mortality of beneficial predators such as spiders.

Goals

- To undertake further trials: using Success® to pursue registration for leaf beetles, and test it against autumn gum moth; and using the insect growth regulator Mimic® so that it can be registered for controlling autumn gum moth in



Heteronyx crinitus feeding on *E. globulus*.

eucalypt plantations.

- Commence collaborative experiments on the genetic variability of *E. globulus* to insect attack.
- Extract sex pheromone of autumn gum moth females and identify chemical components.
- Assay responses of male *M. privata* to extracts of sex pheromone.
- Measure the impact of current insecticide control practices on populations of African black beetle, and seedling damage they cause.
- Determine critical times of the year when WA plantation managers should conduct monitoring and surveillance for *G. scutellatus*, chrysomelid beetles, *M. privata* and *Phylacteophaga froggatti*.

Project C3

Leader
Dr Clare McArthur

Staff
Mr Hugh Fitzgerald
Mr Peter Naughton
Ms Julianne O'Reilly
Mr Stephen Paterson

Resistance of planting stock to vertebrate browsers

Background

A key method for reducing browser damage to eucalypts is to produce more resistant trees. This should be possible through genetic and/or phenotypic manipulation of trees. The aims of this project are to:

- quantify the genetic basis of resistance of eucalypts and the effects of environment on this resistance;
- determine whether resistance can be modelled as a function of leaf chemistry, mainly using NIRS (near-infra-red spectroscopy);
- develop a rapid method for estimating resistance as detected by leaf chemistry; and
- develop an overall strategy for predicting and reducing browser damage of eucalypts at plantation establishment.

Outcomes

- In field trials, significant genetic variation at the locality level was observed in damage patterns to foliage. In studies with captive brushtail possums and Tasmanian pademelons, patterns of intake of juvenile *Eucalyptus globulus* foliage from different localities were generally consistent with field results. Two north-eastern Tasmanian localities, Germantown and St Helens, were the most preferred i.e. least resistant.
- Whole leaf NIRS models of the chemistry of foliage used in a feeding trial explained 49% and 42% of the variation in intake of individual plants for possums and pademelons respectively, but this was not sufficient to accurately predict intake in fresh samples leaf samples.
- Large differences in palatability of *E. nitens* seedlings grown with different fertilisers were detected. Intake of seedlings grown with Green Jacket® slow release fertiliser, was much lower than for seedlings grown with either Osmocote®

Pademelon in feeding trial to determine the genetic basis of palatability of *E. globulus* foliage.

(mini) or Nutricote®, by both possums and pademelons. Intake of *E. nitens* seedlings by a group of captive Bennett's wallabies was extremely low.

Goals

- Quantify the genetic basis of palatability of *E. nitens* foliage using bioassays with brushtail possums and Tasmanian pademelons, both at the race and family level (with the Genetic Improvement Program).
- Determine the relationship between leaf chemistry of *E. nitens* and intake by brushtail possums and pademelons.
- Compare NIRS models developed with whole leaves versus ground leaves.

Project C4

Leader
Dr Clare McArthur

Staff
Dr David de Little
Mr Hugh Fitzgerald
Ms Sandra Hetherington
Ms Kirsten le Mar
Mr Peter Naughton
Mr Stephen Paterson
Ms Lizz Pietrzykowski

Strategies to reduce vertebrate browsing damage

Background

This project addresses the problem of reducing browsing damage to seedlings, using physical and vegetation characteristics of the environment (whole plantation and its surrounding habitat) as its framework. These environmental characteristics should have a significant influence on the browsers: how many browsers are present, and how they use plantations and other habitats as refuges and feeding areas. The aims of this project are to:

- understand this interaction between browsers and the environment, and the consequence of it on damage levels to seedings;
- investigate the impact of introduced cover crops on browsing of seedlings;
- develop methods for monitoring damage and predicting risk; and
- design appropriate options to reduce browsing damage through various planting strategies.

Outcomes

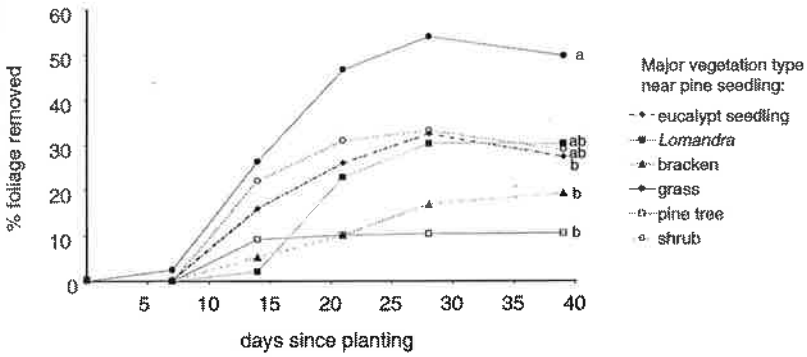
- Modelling of sampling strategies has demonstrated that there is a large error associated with the estimated percentage of seedlings browsed, unless at least 100 seedlings are randomly assessed. The same sampling intensity (i.e. 100 seedlings) on small (10 ha) or large (100 ha) plantations produces similar levels of precision of damage estimates.
- The severity of browsing to *Eucalyptus nitens* seedlings within the first four months following establishment of a plantation in northern Tasmania had a large impact on height trees reached after one year. Mean height at one year was 74 cm, 48 cm and 19 cm for seedlings with low (<30% foliage loss), medium (30%-75% foliage loss) and high (>75% foliage loss) early damage respectively.
- Height of *E. nitens* seedlings varied enormously within a plantation in northern Tasmania 16 months after planting. Seedling height was strongly dependent on the size of the compartment

of plantation in which the seedling was planted, the distance of the seedling from the plantation edge, and to a lesser extent, the type of habitat bordering the edge of the plantation closest to the seedling. Seedlings in small compartments of the plantation (e.g. 2-3 ha) were less than half the height of those in larger compartments (~20 ha) and had a mean height of 56 cm and 137 cm respectively. These differences in height were mainly due to different levels of browsing by mammals.

- In a *Pinus radiata* plantation under relatively low browsing pressure, damage to seedlings by mammalian herbivores was strongly affected by the vegetation within a 0.5 m radius of the seedling. After 40 days, seedlings in bracken were much less damaged than seedlings in grass (average foliage loss 19% and 50% respectively) (Figure 10).

Figure 10
Relationship between damage to *P.radiata* seedlings over time (% of foliage removed) by mammalian herbivores and major vegetation type within 0.5 m radius of the seedling.

Different letters are significantly different (α=0.003)



Goals

- Estimate the long-term economic impact of early browsing damage on growth and final wood volume (at harvest) of *E. nitens* using growth models.
- Determine the effect of vegetation immediately around *E. nitens* seedlings on the extent to which they are damaged by mammalian herbivores in the field.
- Compare the effect of size of vegetation patches around seedlings on damage by mammalian herbivores.

Project C5

Leader
Dr Caroline Mohammed

Staff
Ms Karen Barry
Ms Alieta Eyles
Mr Andrew Milgate
Ms Alicia Mollon
Dr Yuan Zi Qing

Strategies to minimise loss due to fungal attack

Background

Benefits to industry are likely to be significant if decay infection can be better understood and predicted, and management strategies developed to reduce incidence. The objective of this project is to assist forest managers to limit the impact of fungi especially stem decay fungi and the leaf pathogen *Mycosphaerella*. The project also investigates the sustainability of forest management by examining the biodiversity of fungal/invertebrate assemblages in different ecological niches.

Studies that focus on stem defects in pruned and thinned plantation eucalypts include:

- the formation, persistence and effectiveness of preformed and responsive defence mechanisms in restricting the spread of decay, especially in pruned and thinned *Eucalyptus nitens* and *E. globulus* plantations destined for solid wood production;
- the identity and pathogenicity of the decay fungi involved in pruning associated decay;
- the formation of kino veins and pockets, seeking to elucidate the role and mechanisms of kino formation;

- the influence of pruning severity and soil nutrition, established with physiologists and soil scientists within the Sustainable Management Program.

The *Mycosphaerella* project has a strong link with geneticists within the Genetic Improvement Program. Studies aim to develop a bioassay to screen for resistance to the pathogen, a tool for disease resistance breeding whether by classical or molecular techniques.

Outcomes

- Phenolic constituents of reaction zones (tissue of antimicrobial defence) from the sapwood of *E. nitens* with stem decay resulting from pruning wounds were characterised by abundant ellagitannins (particularly pedunculagin).

- Pot grown *E. nitens* were wounded and inoculated with 4 different decay fungi in spring and the components of the reaction zone analysed. More aggressive fungi (causing larger lesions) elicited greater defence responses (as represented by the range of phenolics measured; 2 ellagitannins, 2 galloylglucoses and 1 flavonoid).

- Fungi involved with pruning-associated decay in *E. nitens* have been isolated from two different sites. Identification has involved a molecular technique based on PCR amplification of the ITS region and macro and micro morphology in culture. Pathogenicity tests have been set up by inoculating young trees of *E. nitens* with representative fungi.

- Colleagues at Wellesbourne have induced the sexual form in culture for *Mycosphaerella tasmaniensis*, a pathogenic fungal leaf pathogen of *E. nitens* in Tasmania. Obtaining sexual spores in culture (the infective spore form in the field) will permit the development of a controlled resistance-screening program based on artificial infection. A polyclonal antibody has been developed which detects spores of eucalypt *Mycosphaerella* and will be used as a stepping stone to spore immuno-detection in the field.

- A study of the biodiversity of log beetle fauna, which compared small logs (30-60 cm diameter, representative of 60-80 yr tree) with large logs (>120 cm, representative of >200 yr tree), was conducted in a 34-year-old *E. obliqua* regrowth forest. Results indicate that there could be large differences between large and small logs, and strong patterns between insects and rot types.

Goals

- Promote spore production in culture and develop a screening method to be used on very young plants to test the resistance of eucalypts to *Mycosphaerella*.

- Investigate the process, effectiveness and external factors influencing antimicrobial defence mechanisms in *E. nitens* and *E. globulus*, including both physiological and nutritional considerations.

- Describe the development of kino in the various conditions under which it has been experimentally induced.

- Analyse the molecular profiles and identify the range of fungi involved with high levels of pruning-associated decay. Test the pathogenicity of these fungi to *E. nitens* and *E. globulus*.

- Finish a study of the biodiversity of fungal/invertebrate assemblages in different sized logs.

Assessment of decay and beetle fauna in *Eucalyptus obliqua* log on the forest floor.

Education and Technology Transfer

Manager
Dr Neil Davidson

Staff
Prof Rob Clark
Dr David Doley
Mr Greg Dutkowski
Prof Robert Henry
Ms Gaye Johnson
Dr Greg Jordan
Prof Jim Reid
Dr Robert Wiltshire

Background

The Education and Technology Transfer Program coordinates:

- intake of postgraduate students across the three research programs and five University partners in the CRC, and involvement of CRC staff in education and training;
- transfer of technology from research programs to the industrial partners in the CRC and to small end users of forest technology, particularly farmer groups; and
- activities to raise public awareness of the CRC's research in sustainable forestry, and to develop a CRC ethos.

The principal objectives are to:

- develop a national centre of excellence for postgraduate training with emphasis on training graduates relevant to the industry sector. This includes involving staff from partner organisations in teaching and supervision of university students;
- rapidly transfer the technology arising from research conducted at the Centre to the industrial partners and other end users;
- publish research of international quality so Australia and the CRC are seen as world leaders in plantation forestry; and
- raise community awareness of the CRC's activities and the value to Australia of a sustainably managed forest industry.

Outcomes

Education

- The Centre has 77 PhD, MSc and Honours students currently enrolled. Of the postgraduate students, 14 were attracted from industry, 18 are on scholarships with industry support (APA-I, SPIRT, FFIC, LWRDC, FWPRDC, CSIRO, QDPI, SF NSW and a consortium of industries including CRC partners [designated Industry in the table]), and a further 19 are on competitive national scholarships (APA, ARC, AIDAB). Only 11 are supported solely by CRC PhD scholarships. Eleven students have CRC top-ups to APA or ARC scholarships (see Tables 2 and 3 for details).
- Seven students won awards this year: Mr D Close was awarded $2000 by The Queens Trust for Young Australians to present a paper at the 12th International Congress of the Federation of European Societies of Plant Physiology in Budapest; Ms K Le Mar was awarded $520 to attend an Australian Wildlife Management Meeting; Mr R Barbour received an award for best poster and Ms R Stokoe second best poster at the 'Symposium on Hybrid Breeding and Genetics of Forest Trees' at Noosa; and three Honours students at the University of Tasmania (Ms M McGowen, Mr H Hancock and Ms R Jones) received university scholarships, based on academic performance, to conduct their research.
- Supervision of postgraduate and honours students is widely distributed amongst CRC partner institutions with 39 of the 76 supervisors of Honours, MSc and PhD projects being non university departmental staff (see Table 4 for details).
- Seven CRC scientists, who are not staff of university departments, contributed to university courses in fields allied to their research: Dr N Davidson in Physiological Plant Ecology, Dr P Smethurst in Soil Fertility, Dr B Potts in Genetics, Dr C McArthur in Vertebrate Zoology, Dr Z Xu in Soil Science, Dr M Steinbauer in Insect Management for Forestry and Dr M Hunt in Plantation Silviculture. Dr N Davidson coordinates a four-year undergraduate course, Forest Ecology, designed for students with an interest in forestry at UT.
- Twelve postdoctoral fellows worked with the Centre in 1999/00: Dr K Thamarus in molecular genetics (CSIRO FFP, Canberra); Dr M Steinbauer in entomology (CSIRO Entomology); Dr M Shepherd in molecular biology (SCU); Dr H Dungey in forest genetics (QFRI); Dr N Prasalova in soil nutrition (GU), Dr D Steane and Dr B Patterson both in molecular genetics (UT), Dr F Henskens in canopy nitrogen dynamics (CSIRO FFP, Hobart) Dr A Loch in pest management of Blue Gums (CSIRO Entomology), Dr S Resh in biomass partitioning to roots and root respiration (CSIRO FFP, Hobart), Dr A Mitchell (CSIRO FFP) on availability of base cations and

Ms J Medhurst (CSIRO FFP) on blackwood physiology and silviculture.

- The CRC hosted 10 visiting scientists in 1999/00. The Genetic Improvement Program had visits from A/Prof Claire Williams (Texas Agricultural and Mechanical University) and Dr Luc Pâques (INRA, Orleans, France) who contributed to the Hybrid Breeding and Genetics Symposium in Noosa and to research projects in Gympie. Dr Yongqi Zheng of the Chinese Academy of Forestry visited the CRC-SPF at Gympie as part of a Crawford Fund Training Fellowship. He worked with Dr Mark Dieters on the analysis of data from *P. caribaea* var *bahamensis* genetic tests that were planted in China and Queensland. Dr João Costa e Silva of the Department of Botany, Dendrology and Forest Genetics Arboretum, Royal Veterinary and Agricultural University (Horsholm, Denmark) worked with Mr Greg Dutkowski on predicting breeding values and brought special skills to the CRC in spatial analysis in genetics studies.

  In the Sustainable Management Program Dr Caroline Preston, Dept of Soil and Forest Science, University of British Columbia, Canada, continued her visit (started last financial year) working from 26 September to 10 November 1999 on tropical soils with research groups at Griffith University and QFRI and contributing to research on ^{13}C and ^{15}N NMR spectroscopy in the study of soil organic matter. A/Prof Deping Li (Institute of Soil Sciences, Chinese Academy of Sciences, Nanjing, PRC) visited research groups at Griffith University and QFRI from 28 June to 24 December 2000 to work on soil carbon dynamics and carbon cycling.

  The Resource Protection Program had visits from A/Prof Sharon Strauss and Assis/Prof Mark Schwartz both from University of California, Davis, who visited the Program staff in Canberra for 2 months and contributed to the Symposium on Insect-Eucalypt Interactions hosted by the CRC-SPF. A/Prof Sören Nylin (Stockholm University) visited the Program staff in Canberra and contributed to the Symposium on Insect-Eucalypt Interactions. Mr Brendan Murphy, PhD student from the University of Canterbury, NZ, also worked with Resource Protection Program for three months studying chrysomelids in Tasmania.

Technology transfer

- Mr Greg Dutkowski was appointed as the new Forestry Extension Officer in the Education and Technology Transfer Program. He has been liaising with individual CRC partners to identify their technological needs and is designing an approach to best address these needs. It is hoped that this approach will help us better service our clients.

- In the last year the CRC hosted two symposia:

  the 'Symposium on Insect-Eucalypt Interactions', held in Canberra in February 2000 in association with CSIRO Entomology, focused the attention of industry practitioners and researchers on the current and developing problems of insect pests in eucalypt plantations; and

  the 'Symposium on Hybrid Breeding and Genetics of Forest Trees', held at Noosa, Queensland, in April 2000 in association with QFRI, brought together current results on hybrid breeding previously unavailable in Australia, and attracted considerable national and international interest (see Major Development);

  and a Farm Forestry Colloquium

  'Socio-economic research to Support Successful Farm Forestry' (run by ANU Forestry School with support from CRC) held in Canberra in March 2000, reviewed the success of farm forestry programs and presented research conducted by the CRC to industry practitioners, farmers, scientists and the public;

  and was involved in the launch of Farm Forestry Toolbox 2:

  Farm Forestry Toolbox 2 is a CD to assist farmers in managing farm-based forests; it includes a decision support system for farmers based on ProMod (produced by the CRC) and was launched in February this year in Hobart by Tasmania's Deputy Premier, Hon Paul Lennon. Also present were Mr Des King (CEO PFT), Mr Steve Whitely (FT), Mr Andy Warner (PFT), coordinator of the Toolbox, and the Toolbox developers Dr Michael Battaglia (CRC-SPF), Dr Peter Sands (CRC-SPF), Mr

Table 2: CRC Research Students

CRC Research Students

First Name	Last Name	Degree	Funding	Start	Inst	Topic	Scientific Supervisors	CRC Program
Paul	ADAMS	PhD	LWRDC	1996	UT	Sources of competition from weeds in plantations	Dr N Mendham, Dr C Beadle, Dr P Smethurst	SM
Sue	BAKER	Hons	Ind/CRC	1999	UT	Forest litter beetles and their habitat: wildfire versus clear felling	Ass/Prof A Richardson	RP
Robert	BARBOUR	MSc	ARC/CRC	2000	UT	Gene flow between plantations and native forest	Dr B Potts, Dr R Vaillancourt	GI
Karen	BARRY	PhD	APA-I	1997	UT	Defence mechanisms against decay in *E. nitens*	Dr C Mohammed	RP
Tim	BLUMFIELD	PhD	CRC	1999	GU	Nitrogen dynamics and cycling in hoop pine plantations	Ass Prof P Saffigna, Dr Z Xu, Dr I Philips	SM
Georgina	BROWN	Hons		1999	UT	Preliminary investigations into the biology and ecology of *Heteronyx* spp. (*Scarabaeidae*)	Dr M Hurley, Dr D de Little	RP
Peter	BUNDOCK	PhD	APA	1995	UT	Genetic mapping and QTL analysis in *E. globulus*	Dr R Vaillancourt	GI
Uldis	CAKURS	PhD	APA/CRC	1999	GU	Effect of debris retention on run-off, soil loss and nutrient export in hoop pine plantations	Dr B Yu, Dr K Bubb, Ass Prof P Saffigna	SM
Steven	CANDY	PhD		1993	UT	Mathematical models to support IPM of leaf beetles	Dr J Madden, Dr H Elliott	RP
Paul	CHAMBERS	PhD	APA-I	1995	UT	Quantitative genetics and the economic flow-ons from genetic gains	Dr B Greaves	GI
Dugald	CLOSE	PhD	APA/CRC	1997	UT	Environmental constraints on early growth of seedlings in eucalypt plantations	Dr P Brown, Dr C Beadle, Dr G Holz, Dr M Hovenden	SM
Diane	CONNELL	PhD	CRC	1999	UT	Above-ground nitrogen dynamics in *E. nitens*	Dr P Smethurst	SM
Paul	DARGUSCH	MSc		1997	UT	Physical, social and economic barriers to the adaptation of farm forestry in NE Tasmania	Prof R Clark, Ms A Fulton	SM
Greg	DUTKOWSKI	PhD		1996	UT	Improvement of mixed models for prediction of breeding values in forestry	Dr B Potts, Dr A Gilmour	GI
Alieta	EYLES	PhD	APA/CRC	1999	UT	Role of kino in anti microbial defences of *E. globulus*	Dr C Mohammed	RP
Jules	FREEMAN	Hons		2000	UT	Phylogeography of *Eucalyptus globulus*	Dr R Vaillancourt, Dr D Steane, Dr B Potts	GI
Andrew	GIBBONS	MSc	CSIRO	1998	UT	Effect of intensive forest management on understorey and fauna in *E. delegatensis*	Dr M Battaglia, Dr R Whiltshire	SM
Carl	GROSSER	PhD	SPIRT	1999	UT	Seed orchard molecular biology	Dr R Vaillancourt, Dr B Potts	GI
Hal	HANCOCK	Hons		2000	UT	Below-groung respiration in eucalypt plantations	Dr N Davidson, Dr S Resh, Dr M Battaglia	SM
Craig	HAWKINS	MSc		1998	UT	Response of *Brunonia australis* to forestry practices	Dr R Wiltshire, Dr P Barker	SM
Andrew	HINGSTON	PhD	APA	1998	UT	Pollination ecology of *E. globulus* and *E. nitens*	Dr P McQuillan, Dr B Potts	GI
Bradley	HOWLETT	PhD	FFIC	1993	UT	Host location by *Chrysophtharta bimaculata*	Dr J Madden, Dr P McQuillan	RP
Megan	JONES	PhD	SFNSW	1999	SCU	Gene flow and genetic diversity of hardwood plantations in NSW	Dr M Shepherd, Prof R Henry, Prof A Delves	GI
Rebecca	JONES	Hons		2000	UT	The relationship of the *E. globulus* provenance from the Jeeralangs to the various subspecies	Dr R Vaillancourt, Dr D Steane, Dr B Potts	GI
Amal	JOSEPH	MSc	CRC/QDPI	1998	USC	Performance and genetics of *Pinus caribea* var. *hodurensis* interprovenance hybrids	Dr H Wallace, Dr M Dieters, Dr H Dungey	GI
Dominic	KAIN	PhD	FWPRDC	1998	ANU	Genetics of wood properties of *Pinus elliottii, P. caribea* and their hybrid	Prof P Kanowski, Dr K Harding, Dr M Dieters, Dr B Li	GI
Rachel	KING	PhD	APA	2000	GU	Genetic variation in spotted gums and susceptibility to *Ramularioa* desease	Ass Prof J Hughes, Dr B Potts	GI
Andrew	KNOWLES	MSc	CRC	2000	UT	K and Mg uptake by eucalypts and pines.	Dr S Shabala, Dr P Smethurst, Dr P Brown	SM
Peter	KUBE	PhD		1996	UT	Breeding objectives for the production of sawlogs and pulpwood from plantation grown *E. nitens*	Ms C Raymond, Prof J Reid	GI
Sven	LADIGES	PhD	CRC	1996	UT	Micronutrient deficiencies in eucalypts induced by excess application of N & P	Prof R Menary, Dr C Beadle	SM
Keith	LAMB	MSc		1997	ANU	Modelling environmental characterisitcs for steep country plantations	Prof P Kanowski	SM
Kirsten	LE MAR	PhD	APA/CRC	1996	UT	Use of plantation and surrounding habitat by mammalian herbivores	Dr C McArthur, Dr D de Little, Dr M Statham	RP
Gustav	LOPEZ	PhD	AIDAB	1998	UT	The importance of non-additive genetic effects in *E.globulus*	Dr B Potts, Dr R Vaillancourt	GI
Nicole	MATHERS	PhD	APA	1998	GU	Effective use of C^{13} and N^{15} NMR in C and N dynamics of forest soils	Ass Prof Saffigna, Dr Z Xu, Dr S Berners-Price	SM
Marian	McGOWEN	Hons		2000	UT	Phylogeographic analysis of the Tasmanian yellow gums	Dr R Wiltshire	GI
Michelle	McGRANAHAN	PhD	APA	1996	UT	Genetic control of propagation ability in *Pinus radiata* and its use in breeding programs	Dr B Greaves, Dr B Potts	GI
Gay	McKINNON	PhD	ARC	2000	UT	Molecular evolution of eucalypts	Dr R Vaillancourt, Dr B Potts, Dr D Steane	GI
Jane	MEDHURST	PhD	FFIC	1996	UT	Thinning of *Eucalyptus nitens* stands	Dr C Beadle, Dr N Davidson	SM
Rohan	MELLICK	PhD	CRC	2000	SCU	Genetic analysis of vegetative propagation characteristics in hybrid pine	Dr M Shepherd, Dr H Dungey, Dr M Dieters	GI
Andrew	MILGATE	PhD	SPIRT	1997	UT	The genetic basis of resistance to *Mycosphaerella* in *Eucalyptus globulus*	Dr R Vaillancourt, Dr C Mohammed	GI/RP
Alexandra	MITCHELL	PhD	CRC	1995	UT	Reproductive biology and breeding systems of *E. globulus*	Dr B Potts, Dr R Vaillancourt	GI
Alicia	MOLLON	PhD	SPIRT	1999	UT	Pathology and physiology of pruned *E.globulus*	Dr C Mohammed, Dr L Pinkard, Dr C Beadle	RP/SM
Martin	MORONI	PhD	APA-I	1995	UT	Nitrogen mineralisation	Dr P Smethurst, Prof R Menary	SM
Daryl	MUMMERY	MSc	CSIRO	1999	UT	Using landscape models to enhance plantation yield predictions	Dr E Bruce, Dr M Battaglia, Dr P Ryan	SM

Table 2: CRC Research Students cont.

CRC Research Students

First Name	Last Name	Degree	Funding	Start	Inst	Topic	Scientific Supervisors	CRC Program
Helen	NAHRUNG	PhD	APA	1999	UT	Ecology of *Chrysophtharta agricola*	Dr G Allen	RP
Mark	NEYLAND	MSc		1998	UT	Alternative silvicultural systems for regenerating native forest	Dr N Davidson, Dr C Beadle, Mr J Hickey	SM
Chris	O'HARA	PhD	APA/CRC	1998	ANU	Phosphorus fractions in forest soils	Dr J Bauhus, Dr D Khanna, Dr J Raison, Dr P Smethurst	SM
Julianne	O'REILLY	MSc	APA/CRC	2000	UT	Genetic and chemical variation in browsing resistance of *E. nitens*	Dr C McArthur, Dr B Potts	RP
Ross	PEACOCK	PhD		1994	UT	Regeneration after cable logging	Dr N Davidson, Dr M Brown	SM
Elizabeth	PIETRZYKOWSKI	Hons		2000	UT	Influence of small scale vegetation patches on susceptibility to browsing	Dr C McArthur	RP
Leanne	POUND	PhD	SPIRT	2000	AU	Self-incompatibility in *Eucalyptus globulus* and *E. nitens*	Prof M Sedgley, Dr M Wallwork, Dr B Potts	GI
Digby	RACE	PhD	CRC/ANU	1998	ANU	Economic aspects of farm forestry development in regional Australia	Prof P Kanowski	SM
Luke	RAPLEY	PhD	APA/CRC	2000	UT	Genetic variation in susceptibility of eucalypts to insect attack	Dr G Allen, Dr B Potts	RP/GI
Hilton	REDGROVE	PhD	APA-I/FT	2000	UT	The ecology of *Heteronyx spp.* beetles: establishment pests of eucalypt plantations	Dr M Hurley, Dr P McQuillan, Dr D deLittle	RP
Anthony	RICE	PhD	APA	1999	UT	The ecology and host interactions of the larval parasitoids of *Chrysophtharta agricola*	Dr G Allen	RP
Carolyn	RINGROSE	MSc		1999	UT	N mineralisation in annually N-fertilised plantations	Mr R Doyle, Mr W Neilsen, Dr P Smethurst	SM
Jackie	SCHIRMER	PhD	APA/CRC	2000	ANU	Evaluating the effectiveness of conflict resolution techniches in resource management disputes	Prof P Kanowski, Dr H Ross, Dr S Dovers	SM
Leon	SCOTT	PhD	CRC	1998	SCU	Molecular genetics of hoop pine	Dr M Shepherd, Prof R Henry, Dr M Deiters, Dr G Nikles	GI
Yetti	SETIAWATTI	PhD	AIDAB	1997	UQ	Enhancement of pollen production in *Araucaria cunninghamii* (hoop pine)	Dr D Doley, Dr M Dieters	GI
Mark	SHORT	PhD	APA/CRC	2000	ANU	Taxonomy and biology of hymenopteran larval parasitoids of *Mnesampela privata*	Dr M Steinbauer, Dr R Floyd, Dr J Tueman	RP
Tara	SIMMUL	PhD	APA-I	1996	UT	Biology of the fire blight beetle	Dr G Allen, Dr D deLittle	RP
Steven	SMITH	Hons		1999	GU	Patterns of variation and issues of clonality within and between isolated populations of *E. curttisii*	Ass Prof J Hughes, Dr G Wardell-Johnson	GI
Rhonda	STOKOE	PhD	CRC	1998	SCU	Molecular analysis of *Eucalyptus cloeziana*	Dr M Shepherd, Prof R Henry, Dr G Nikles, Dr D Lee	GI
Tim	TABART	MSc		1998	UT	Achieving sustainable economic development through collaborative community decision-making	Prof R Clarke, Ms A Fulton	SM
Paul	TOON	MSc	ARC/QDPI	1998	USC	Family and provenance variation within *Pinus caribea* var. *bahamensis*.	Dr H Wallace, Dr M Dieters, Dr H Dungey	GI
Greg	UNWIN	PhD		2000	UT	Response of tropical rainforest tree to stress	Dr N Davidson, Prof J Reid, Prof J Kirkpatrick, Dr C Beadle	SM
Peter	VOLKER	PhD		1992	UT	Estimation of genetic parameters for eucalypt hybrids	Dr B Potts	GI
Doug	WALCH	MSc		1997	ANU	Benefits of different designs of shelter belts in farm forestry	Prof P Kanowski	SM
Sally	WARD	Hons		2000	GU	Impacts of site management practices on soil C pools and N availability in hoop pine plantations	Dr Z Xu, Dr I Phillips, Ass Prof P Saffigna	SM
Tim	WARDLAW	PhD		1994	UT	*Armillaria* butt and root rot of eucalypts	Dr C Mohammed, Dr G Kile	RP
Michelle	WATSON	Hons		2000	UT	Factors affecting E. globulus seed quality	Dr B Potts, Dr D Williams	GI
Grant	WESTPHALEN	PhD	CRC	1996	UT	Indicator species for sustainibility in native forest systems	Dr M Brown, Mr J Hickey, Dr N Davidson, Dr C Beadle	SM
Trudi	WHARTON	PhD	Industry	1999	ANU	Biology and ecology of *Essigella californica* (Hemiptera: Aphididae)	Dr M Steinbauer, Dr R Floyd, Dr P Cooper	RP
Simon	WHITTOCK	Hons		2000	UT	The phylogeny of eucalypt chloroplast DNA	Dr R Vaillancourt, Dr D Steane	GI
Dean	WILLIAMS	PhD	CRC	1996	UT	Reproductive biology of *Eucalyptus*	Prof J Reid, Dr B Potts	GI
Marie	YEE	PhD	APA/CRC	1999	UT	Saproxylic insects and their associations with wood decay in wet sclerophyll forests	Dr C Mohammed, Dr A Richardson, Dr R Taylor, Dr G Allen	RP
Byron	YEO	PhD	CRC	2000	UT	Effect of genetic variation in wood properties of *E. globulus* on paper properties	Ms C Raymond, Dr L Apiolaza	GI

Table 3 Student enrolments and funding source

Number of Students			Funding	
Total number of students		77	CRC Scholarship	11
			APA Scholarship	16
			CRC top-up of APA Scholarship	(10)
			ARC	2
Full/PartTime:	Full Time	62	CRC top-up of ARC Scholarship	(1)
	Part Time	15	APA-I	5
			SPIRT	4
			Industry (CRC partners)	1
Degree	Hons	11	QDPI/CRC	1
	MSc	13	FFIC	2
	PhD	53	LWRDC	1
			FWPRDC	1
			SFNSW	1
CRC Programs	Genetic Improvement	31	AIDAB	1
	Sustainable Management	27	CSIRO	2
	Resource Protection	19	Total	48

Adrian Goodwin (FT) and Mr Tim Osborn (FT).

- The CRC also ran a wide range of other technology transfer activities for CRC partners, which included 71 seminars/presentations, 24 workshops, 1 short course, 9 field days, 18 research group meetings involving industry staff and produced 99 technical publications (18 in the CRC-SPF Technical Publication series) and 10 news sheets ('Hot Off the Seed Bed', 'Beyond the Black Stump' and 'Pest Off') (See Technology Transfer Table).

- The CRC published 90 research papers in refereed journals, 99 unrefereed articles and 12 theses.

- Documented visits to individual CRC partners and between nodes of the CRC (Hobart, Canberra, Brisbane, Gympie) totalled 660 person-days for 1999/00.

- The CRC (in association with Serve-Ag, PFT and TFGA) is well advanced on the production of the 'Farm Forestry Technical and Business Handbook', which describes in a simple and attractive way financial, regulatory and technical aspects of managing a farm-based forestry business involving plantation and/or native forest. The project is funded by a grant of $69 900 from the National Heritage Trust. This handbook will provide other end-users of CRC technology access to principles of farm forestry.

- The CRC web page (http://www.forestry.crc.org.au) has received regular review and now offers electronic versions of the research updates (e.g. 'Hot Off The Seedbed') and has a searchable database of all CRC publications.

- In the last year there have been 6 articles in newspapers and industry news sheets, and 6 items in the electronic media relating to Centre Activities (see Public Presentations).

Goals

- Run an Annual Meeting of the CRC-SPF at Hamilton, hosted by Timbercorp, addressing the theme 'Site Selection'. This is a topical issue. With the recent large increase in the rate of plantation establishment across Australia it is important for both producers and investors that the quality of site selection is high so that expected returns are achieved.

- Adjust technology transfer program to include addressing specific technological needs of individual partners.

- Identify important generic technology developed by the CRC that has not yet been fully adopted by industry and, through direct contact with managerial and operational staff, encourage its adoption.

- Complete the 'Farm Forestry Technical and Business Handbook'.

Table 4: Supervisors and the number of CRC students they supervised

Supervisors					
Dr G Allen Ag Sci UT	5	Dr B Greaves* Plant Sci UT	2	Ms C Raymond* CSIRO FFP	2
Dr L Appiolaza* UT	1	Dr K Harding* QFRI	1	Prof J Reid Plant Sci UT	3
Dr P Barker* NPWS	1	Prof R Henry SCU	3	Dr S Resh* CSIRO FFP	1
Dr M Battaglia* CSIRO FFP	3	Mr J Hickey* FT	2	Dr A Richardson UT	2
Dr H Bauhus ANU	1	Dr G Holz* NFP	1	Dr H Ross ANU	1
Dr C Beadle* CSIRO FFP	8	Dr M Hovenden Plant Sci UT	1	Dr P Ryan* CSIRO FFP	1
Dr S Berners-Price GU	1	Ass Prof J Hughes GU	2	Ass Prof P Saffigna GU	4
Dr M Brown* FT	2	Dr M Hurley Ag Sci UT	2	Prof M Sedgley UA	1
Dr P Brown Ag Sci UT	2	Prof P Kanowski ANU	5	Dr S Shabala UT	1
Dr E Bruce Geog Env St UT	1	Dr P Khanna* CSIRO	1	Dr M Shepherd* CRC	4
Dr Bubb* QFRI	1	Dr G Kile* CSIRO FFP	1	Dr P Smethurst* CSIRO FFP	6
Prof R Clark Ag Sci UT	2	Prof J Kirkpatrick UT	1	Dr A Specht SCU	1
Dr P Cooper ANU	1	Dr D Lee* QFRI	1	Dr M Statham* TIAR	1
Dr N Davidson* CRC	6	Dr B Li NCSU (USA)	1	Dr D Steane* UT	4
Prof A Delves SCU	1	Dr J Madden* Ag Sci UT	2	Dr M Steinbauer* CSIRO Ent	2
Dr M Dieters* QFRI	6	Dr C McArthur* CRC	3	Dr R Taylor* FT	1
Dr D de Little* NFP	4	Dr P McQuillan Geography UT	3	Dr J Trueman ANU	1
Dr D Doley UQ	1	Prof R Menary* Ag Sci UT	2	Dr R Vaillancourt Plant Sci UT	10
Dr S Dovers UM (Creswick)	1	Dr N Mendham Ag Sci UT	1	Dr H Wallace USC	2
Mr R Doyle UT	1	Dr C Mohammed Ag Sci UT/CSIRO	6	Dr M Wallwork UA	1
Dr H Dungey* QFRI	3	Mr W Neilsen* FT	1	Dr G Wardell-Johnson GU	1
Dr H Elliott* FT	1	Dr G Nikles* QFRI	2	Dr D Williams UT	1
Dr R Floyd* CSIRO Ento	2	Dr E Pinkard* FT	1	Dr R Wiltshire Plant Sci UT	3
Ms A Fulton Ag Sci UT	2	Dr I Phillips GU	2	Dr Z Xu* QFRI	3
Dr A Gilmour* NSW Ag	1	Dr B Potts* CRC	17	Dr B Yu* GU	1
		Dr J Raison* CSIRO FFP	1		

*Supervisors who are not university departmental staff.	= 39
International supervisors	= 1
University departmental supervisors	= 36
Total	= 76

Utilisation and Application of Research

Strategy for the technology transfer program

The principal objective of the Technology Transfer Program is to transfer technology rapidly to the industrial partners and other end users. This involves the following steps:-

1. *Involvement of industrial partners in planning research projects and running experiments*

Most CRC research is conducted using company trials, or trials established on company land, so companies are involved at the outset with the planning and implementation of research projects and have ownership of them. Research plans for these experiments are lodged with the companies, and these include an agreed protocol for the research. The company partners allocate staff time (in-kind contributions) to CRC research projects so effective interaction can occur. The Program Coordinating Committees of the CRC retain an overview of these research projects. They prioritise research and set 'deliverables' (research outcomes that can be directly used by industry).

2. *Early transfer of results*

The early transfer of results starts with informal interactions (phone, fax, E-mail and visits to company sites). Formal transfer starts with an electronic or faxed summary of the applications of recent research as an A4 page entitled 'Hot Off the Seedbed' (Genetic Improvement Program), 'Beyond the Black Stump' (Sustainable Management Program) or 'Pest Off' (Resource Protection Program). Company responses will then determine whether it is best to organise a seminar, workshop, short course or field day on the topic. Later stages of transfer are through technical reports, unrefereed papers and refereed journal papers.

The Technology Transfer Officer (Mr G Dutkowski) liaises with industrial partners and researchers to develop a better understanding between these groups within the CRC and to facilitate the adoption of the technology most appropriate to each industry partner's needs.

A full list of technology transfer activities conducted by the CRC in 1999/00 is presented in Table 5.

3. *Development of training courses and workshops in modern forestry techniques for company staff and other end users of CRC research*

- Examples of technical training courses run by the CRC this year include: a Symposium on Insect-Eucalypt Interactions, a Symposium on Hybrid Breeding and Genetics of Forest Trees and a Farm Forestry Colloquium 'Socio-economic Research to Support Successful Farm Forestry'. Training courses were conducted, for example an ASREML multivariate course run in Melbourne by Mr G Dutkowski. Many of the 24 workshops run by the CRC also served a training need. It is much easier to get staff to attend a workshop than a course, because of the difference in the implied level of understanding.

- Technology transfer also occurs through the training provided by the CRC to their postgraduates. Recent PhD graduates transfer new technology to their employers. There are 11 company staff enrolled in PhD and MSc courses while still employed: Mr T Wardlaw (Forest Pathologist, FT); Mr S Candy (Statistician, FT); Mr P Kube (Tree Breeder, FT); Mr P Volker (Consultant, Serve-Ag); Mr R Peacock (Research Scientist, Dept Planning, NSW); Mr C Hawkins (Forester, BTT); Mr M Neyland (Research Officer, FT); Mr P Adams (Forest Nutrition, FT); Mr D Mummery (Research Scientist, CSIRO FFP); Mr G Lopez (Forester, INTA, Argentina) and Mr G Unwin (Lecturer in Farm Forestry, UT). Three resigned their positions to conduct research but intend returning to industry: Mr G Dutkowski (Technical Manager, STf), Ms J Medhurst (FT), and Mr A Gibbons (Technician, CSIRO FFP). There are a further 18 of our students on scholarships supported by industry (see Tables 2 and 3).

- The success of our students in obtaining employment in the forest industry was demonstrated by appointments over the last year:

Ms S Scott (Fisheries and Forestry, Canberra), Ms J Sprent (Primate Keeper, London Zoo), Ms N Marsh (Manager, Timbercorp, Hamilton Victoria), Dr J Bulinski (Project Manager, Treefarm Services, Timbercorp, Albany, W.A.), Dr T Garnett (Postdoc, University of Adelaide), Mr P Adams (Forest Nutrition, FT), Dr P Chambers (Postdoc in quantitative genetics, UT), Dr X Wei (Research Scientist, CSIRO), Dr B Greaves and Ms M McGranahan (private consultants in forestry).

CRC Postdoc, Dean Williams (centre) discussing research requirements with Forestry Tasmania's nursery manager Stuart Vance (left) and Peter Kube (right) from Forestry Tasmania.

Martin Moroni explaining his technique for measuring root distribution at the Lewisham plantation to Centre visitors.

Table 5: Technology Transfer Activities

Date	Function	Topic	Reach	Pgm	Time (days)
1999					
July	Workshop Hobart	Forest genetics for bushcare and farm forestry B Potts, G Dutkowski	20	GI	0.5
July	Course Melbourne	ASREML multivariate course and forestry workshop G Dutkowski	15	GI	1
July	Presentation Hobart	Forest genetics for bushcare and farm forestry: how tree breeding works and what it can achieve G Dutkowski	12	GI	0.5
July	Seminar Hobart	Assessing the financial aspects of farm forestry: how do landowners go about it? A Fulton, D Saccardi	19	SM	0.5
July	Research Note	Impact of leaf beetles on growth of eucalypt plantations J Elek, S Candy	50	RP	
July	Presentation Melbourne	Herbivore abundance and habitat selection in a patchy environment in Tasmania K le Mar	150	RP	1
Aug	Seminar Hobart	ANM progress on developing economic breeding objectives P Chambers	15	GI	0.5
July 1999-June 2000	Monthly meetings	Browsing Damage Management Group monthly meetings with research and operations staff from the forest industry and TFGA on browsing damage management C McArthur	10	RP	8
July 1999-June 2000	Bi-monthly meetings	Industry Pest Management Group in Western Australia R Floyd, J Matthiessen, A Loch		RP	
July	School Talk Hobart	Discussion on entomology G Allen		RP	
July	Seminar Hobart	Developing IPM models for *C. bimaculata* S Candy	30	RP	0.5
July	Seminar Hobart	The seasonally challenged gum moth: why the autumn gum moth is not always the autumn gum moth Z Lukacs	30	RP	0.5
July	School Talk Sorell	Science within the workplace: CRC-SPF N Davidson	90	ETT	0.5
July	Field day Southern	Current research in thinning in eucalypt Forests plantations and native forests J Medhurst	45	ETT	1
July	Seminar Hobart	Forest education foundation and the project forest – teacher resource package D Vickers	15	ETT	0.5
July	Seminar Hobart	The role of social sciences in forest management D Field, University of Wisconsin	52	SM	0.5
July	Seminar Hobart	The changing face of resource dependent communities in forested landscapes D Field, University of Wisconsin	41	SM	0.5
July	Seminar Hobart	Assessing the financial aspects of farm forestry: how do landowners go about it? A Fulton, D Saccardi	19	SM	0.5
July	Seminar Hobart	An overview of 12 years experience breeding *E. nitens* W Tibbits	22	GI	0.5

Date	Function	Topic	Reach	Pgm	Time (days)
July	QFRI/CRC Technical Report	No 14 Performance of Pinus taxa on wet sites (Confidential) M Dieters		GI	
July	Pest Off	No 3 SIF funding for research		RP	
Aug	Seminar Hobart	Geographic genetic variation in central Victorian *E. nitens* and a race classification G Dutkowski	10	GI	0.5
Aug	Workshop Lismore	Application of molecular technologies: genetic diversity, population genetics and phylogenetics in plants and animals L Scott	8	GI	15
Aug	Seminar Hobart	Predicting nitrogen deficiency in *E. nitens* plantations M Moroni	25	SM	0.5
Aug	Seminar Hobart	Defining a nursery prescription for *Pinus caribaea* x *P. elliottii* cuttings M Hunt	25	SM	0.5
Aug	Seminar Hobart	Is there a simple way to predict N supply in forest soils? K Paul	22	SM	0.5
Aug	CRC Technical Report	No 17 Biological control of eucalypt defoliators using entomopathogenic fungi – evaluation of the fungi *Metarhizium* and *Beauvaria* spp for the control of eucalypt defoliating beetles J Madden, V Patel, J Elek		RP	
Aug	Seminar Hobart	Forestry Tasmania's entomological research J Elek, D Bashford		RP	
Aug	Seminar Hobart	Hybridisation and inbreeding of *E. globulus* and *E. ovata*: 10 year results G Lopez	22	SM	0.5
Aug	Seminar Hobart	Micronutrient relationships in fertilised plantations S Ladiges	30	SM	0.5
Aug	Seminar Hobart	A new approach to relating growth to wood property variation: the tyranny of time and distance G Downes		GI	0.5
Aug	Seminar Hobart	A racial classification of *E. nitens* G Dutkowski	11	GI	0.5
Sept	Presentation Melbourne	Revised *E. globulus* breeding strategy (STBA Technical Committee, CFTT) G Dutkowski	20	GI	0.3
Sept	Presentation Melbourne	Breeding value prediction for *Dothistroma pinii* damage in *P. radiata* using spatial analysis (STBA Technical Committee, CFTT) G Dutkowski	20	GI	0.3
Sept	Presentation Melbourne	WOOD.FOR – a wood sampling strategy simulator (STBA Technical Committee, CFTT) G Dutkowski	20	GI	0.3
Sept	Beyond the Black Stump	No 16 Weed control and nitrogen release treatments in 3- to 4-year-old eucalypt plantations	100	SM	0.5
Sept	Seminar Hobart	Magnesium fertility and fertilisation of forest soils under *P. radiata* A Mitchell	20	SM	0.5
Sept	Seminar Hobart	Plants behaving badly: weeds that won't die F Henskens	20	SM	0.5
Sept	Seminar Hobart	Evaluating the suppression of tree growth by grass weeds P Adams	41	SM	0.5

Date	Function	Topic	Reach	Pgm	Time (days)
Sept	Seminar Hobart	ForMs – a prototype forest modelling system S Papps	23	SM	0.5
Sept	Seminar Hobart	Environmental and silvicultural effects on wood quality C Raymond	26	SM	0.5
Sept	CRC Technical Report	No 19 Farm forestry in Australia: understanding landholders' decision to adopt D Race, A Fulton		SM	
Sept	Information Sheets	Seven sheets on identifying pests in Tasmanian forests J Elek		RP	
Sept	Seminar Hobart	*Mycosphaerella* species occurring on eucalypts in Tasmania A Milgate	20	RP	0.5
Oct	Seminar Hobart	Geographic genetic variation in central Victorian *E. nitens* and a race classification G Dutkowski, T McRae	15	GI	0.3
Oct	Workshop Melbourne	Applications of Near Infrared Reflectance Analysis C Raymond	10	GI	0.5
Oct	Workshop Gympie	Discussion of breeding objectives in tropical pines and eucalypts between QDPI and Hyne & Sons	6	GI	3
Oct	Seminar Hobart	Photoinhibition of eucalypt seedlings at low temperature D Close	37	SM	0.5
Oct	Seminar Hobart	Eucalypt plantations – which pests get in first? T Simmul	25	RP	
Oct	Field Trip Mt Field	Forest Communities at Mt Field N Davidson		ETT	1
Oct	School Visit Hobart	Tour of Forestry Centre by Hutchins School Agricultural Science class N Davidson		ETT	0.5
Oct	Seminar Hobart	Thinning *E. nitens* – growth response and the processes which drive it J Medhurst	26	SM	0.5
Oct	Seminar Hobart	Impediments to farm forestry in northern Tasmania P Dargusch	30	SM	0.5
Oct	CRC Technical Report	No 18 Growth and yield models for *E. globulus* plantations in south-western Western Australia (Confidential) M Battaglia, T Smith		SM	
Nov	Hot off the Seed Bed	No 20 Inbreeding depression in *E. globulus*: relationship with the inbreeding coefficient B Potts, C Hardner, P Tilyard	50	GI	
Nov	Presentation Sydney	Revised *E. globulus* breeding strategy (STBA meeting with AGBU) G Dutkowski, T McRae	8	GI	0.3
Nov	Workshop Sydney	Breeding value prediction for forestry (STBA meeting with AGBU) G Dutkowski, T McRae	10	GI	1
Nov	Presentation Melbourne	Revised *E. globulus* breeding strategy (STBA annual general meeting) G Dutkowski	25	GI	0.3
Nov	Seminar Melbourne	The STBA cooperative tree improvement strategy for *E. globulus* (STBA annual general meeting) G Dutkowski	20	GI	0.3

Date	Function	Topic	Reach	Pgm	Time (days)
Nov	Workshop Hobart	Applications of Near Infrared Reflectance Analysis C Raymond	10	GI	0.5
Nov	CRC Technical Report	No 22 Interspecific pine hybrids of *P. caribaea*, *P. tecunumanii* and *P. oocarpa*. Genetic parametersestimates and genotype x environment interactions (Confidential) H Dungey, D Gwaze, M Dieters, P Toon, D Nikles		GI	
Nov	CRC Technical Report	No 27 Cloned progeny trial of *P. elliottii* x *P. caribaea* hybrids for genetic mapping experiment (Confidential) C Raddatz, M Dieters		GI	
Nov	CRC Technical Report	No 21 Interspecific hybridisation in forestry – a review H Dungey		GI	
Nov	Workshop	Soil organic matter dynamics under different land uses and environmental conditions	30	SM	1
Nov	Seminar Manjimup	Locating plantations in the landscape: a cost benefit analysis M Battaglia, T Smith, D Mummery	15	SM	0.5
Nov	Presentation	Results of CRC Strategic Initiative Fund project – WA component (to Industry Pest Management Group staff) J Matthiessen		RP	
Nov	Workshop Melbourne	Biology and ecology of Essigella californica T Wharton		RP	
Nov	Workshop Melbourne	Biological control of *E. californica* (Hemiptera: Aphididae: Lachninae: Cinarini) P de Barro, R Floyd		RP	
Nov	Seminar Albany	Managing browsing damage in eucalypt plantations (WA Industry Pest Management Group) C McArthur	15	RP	1
Nov	Seminar Hobart	Leaf area and stem growth responses to fertilisation in young eucalypt plantations P Smethurst	22	SM	0.5
Nov	Seminar Hobart	A small player with a big impact – copper deficiency in fertilised plantation eucalypts S Ladiges	12	SM	0.5
Nov	Pest Off	No 4 Background briefings		RP	
Dec	Hot off the Seed Bed	No 21 Hybrids in forestry H Dungey	50	GI	
Dec	Seminar Hobart	Where are my genes going? Developing microsatellite loci for keeping tabs on *E. globulus* D Steane	20	GI	0.5
Dec	Seminar Hobart	Thinning *E. nitens* – growth response and the processes which drive it J Medhurst	26	SM	0.5
Dec	Workshop Stoney Gully	Field workshop on insect pest monitoring techniques for the WA Pest Management Group R Bashford	20	RP	1
Dec	Field day	Managing insect pests of Western Australian plantations R Bashford, A Loch	10	RP	0.5
Dec	CRC Technical Report	No 23 Nursery phase of cloned progeny trial of *P. elliottii* x *P. caribaea* hybrids for genetic mapping experiment (Confidential) M Dieters		GI	

Date	Function	Topic	Reach	Pgm	Time (days)
Dec	CRC Technical Report	No 25 Root distribution of *E. nitens* and *E. globulus* in irrigated and droughted soil M Moroni, D Worledge, C Beadle		SM	
2000					
Jan	Meeting Gympie	QDPI Stock Production Strategy Group	4	GI	0.5
Jan	Field tour Rockhampton	Performance of hybrids at Byfield, Rockhampton	6	GI	0.5
Jan	Meeting Gympie	Performance of inter-variety hybrids in *P. caribaea* (QDPI)	4	GI	0.5
Jan	Seminar Ridgley	Establishment pests – what and where? T Simmul	12	RP	
Jan	Seminar Hobart	Establishment pests of Tasmanian eucalypt plantations T Simmul	20	RP	
Feb	Seminar Hobart	Application of spatial analysis to forest inventory: spatial analysis in forestry G Dutkowski	15	GI	0.3
Feb	Seminar Melbourne	Geographic variation in the O'Connor/CFTT *E. globulus* collection (STBA technical meeting) G Dutkowski	20	GI	0.3
Feb	CRC Technical Report	No 24 Cloned strategy trial of *P. elliottii* x *P. caribaea* hybrids for genetic mapping experiments: field phase report M Dieters		GI	
Feb	CRC Technical Report	No 26 A strategy for interspecific hybrid verification in *Pinus*: examples of potential molecular assays M Shepherd et al.		GI	
Feb	CRC Technical Report	No 27 Cloned progeny trials of *P. elliottii* x *P. caribaea* hybrids for genetic mapping experiments: commencement report C Raddatz et al.		GI	
Feb	Symposium Canberra	Symposium on Insect-Eucalypt Interactions – hosted by CRC-SPF M Steinbauer	50	RP	2
Feb	Field trip and Workshop ACT	Experimental plantings in the ACT – hosted by CRC-SPF as part of the Symposium on Insect-Eucalypt Interactions M Steinbauer	50	RP	1
Feb	Workshop Canberra	Pest management H Elliott, C McArthur, R Floyd, D de Little	36	RP	2
Feb	Workshop Brisbane	The forest growth model 3_PG	30	SM	0.5
Feb	Research Colloquium Canberra	Socio-economic research to support successful farm forestry (ANU Forestry with support from CRC-SPF and the Joint Venture Agroforestry Program)	85	SM	1
Feb	Seminar Gympie	Impacts of managing exotic pine plantations on soil chemistry and water quality K Bubb, T smith	40	SM	0.5
Mar	Hot off the Seed Bed	No 22 Gene flow between planted and native eucalypt forests R Barbour et al.	50	GI	
Mar	Seminar Hobart	Phylogenetic relationships of Tasmanian Symphyomyrtus chloroplast haplotypes S Whittock	35	GI	0.5

Date	Function	Topic	Reach	Pgm	Time (days)
Mar	Meeting Gympie	QDPI Stock Production Strategy Group	4	GI	0.5
Mar	Presentation Melbourne	Definition of economic objectives (HVP and STBA) P Chambers	10	GI	0.5
Mar	Field day	Hoop pine soils and nutrition field day	22	SM	1
Mar	Field day	Edge effects in clear-felled coupes G Westphalen	15	SM	1
Mar	Seminar/Field day	CRC forestry research in Tasmania, to visiting Chinese delegation G Allen, J Elek	10	RP	1.5
Mar	Seminar Hobart	Linking pollination and herbivory: ecology and evolution within a community context S Strauss	50	RP	
Mar	Seminar Hobart	Biological control of Paropsis charybdis in New Zealand and the fecundity of Tasmanian paropsine beetles B Murphy	25	RP	
Mar	School Talk Hobart	Discussion on entomology G Allen		RP	
Mar	Seminar Hobart	Optimising tree growth and water use in Mediterranean south-western Australia	27	SM	0.5
Mar	Seminar Hobart	*Rotheca* revived: the power of molecular systematics D Steane	30	GI	0.5
Mar	Seminar Hobart	Forest genetics: an overview of CRC-SPF research B Potts	30	GI	0.5
Mar	CRC Technical Report	No 28 Economics of nitrogen fertilising eucalypts for pulpwood P Smethurst et al.		SM	
Mar	CRC Technical Report	No 29 3PGpjs – a user-friendly interface to 3-PG, the Landsberg and Waring model of forest productivity P Sands		SM	
Mar	CRC Technical Report	No 30 Farm forestry in Europe and the United States: synopsis of field research D Race		SM	
April	Workshop	Controlled pollination of eucalypts B Potts, J Harbard	53	GI	0.5
April	Meeting	STBA member briefing: *E. globulus* breeding strategy revision G Dutkowski, D Pilbeam	2	GI	0.5
April	Seminar Hobart	The relationship of the *E. globulus* provenance at Jeeralangs to various subspecies of *E. globulus* R Jones	35	GI	0.5
April	Seminar Hobart	Clinal variation in yellow gums M McGowen	35	GI	0.5
April	Seminar Hobart	Below-ground respiration in eucalypt plantations H Hancock		SM	0.5
April	Symposium Noosa	Hybrid breeding and genetics symposium, workshops and field tours – hosted by CRC-SPF and QFRI	110	GI	6
April	Workshop	*Applications for DNA markers in forestry M Shepherd, L Scott, R Stokoe, R Henry	14	GI	0.5
April	Presentation Mt Gambier	Proposed SPIRT Grant application on development of economic breeding objectives for *E. globulus* for alternative (non-pulpwood) products (STBA) P Chambers	8	GI	0.3

Date	Function	Topic	Reach	Pgm	Time (days)
April	Seminar Gympie	The fate of atrazine and simazine in QDPI plantations (QFRI) K Bubb	40	SM	0.5
April	Field day	Soil erosion studies in hoop pine plantations	80	SM	1
April	Beyond the Black Stump	No 17 Thinning response in *E. nitens* trees J Medhurst	100	SM	
April	CRC Technical Report	No 31 Evaluation of cover crop mixtures in Tasmania K Churchill		SM	
May	Hot off the Seed Bed	No 23 An economic breeding objective for plantation radiata pine grown to produce timber flitch and newsprint P Chambers	50	GI	
May	Seminar Hobart	Australian Low Rainfall Tree Improvement Group: designing and implementing eucalypt breeding strategies for low rainfall southern Australia C Harwood		GI	0.5
May	Seminar Hobart	Phylogeography of *E. globulus* J Freeman	35	GI	0.5
May	Seminar Hobart	Modelling paternity and gene flow in *E. nitens* seed orchards C Grosser	35	GI	0.5
May	Workshop Gympie	Thinning and pruning of eucalypts C Beadle, C Raymond, C Mohammed, J Medhurst, K Barry, A Eyles	30	SM	3
May	CRC Technical Report	No 33 Evaluation of a quick-test meter for measuring nutrient concentrations in soil and plant waters R Osborne, P Smethurst, A Wilkinson		SM	
May	Field days Toolara and Imbil	Softwood Plantations Future Directions – Exotic Pine and Hoop Pine Field Tours (QFRI). Current management and supporting research: how this may impact on future fibre flows and future fibre quality K Harding	20	GI	2
May	Workshop	Molecular marker technologies and plant breeding L Scott	14	GI	5
May	Seminar Morwell	Managing browsing damage in eucalypt plantations – experiences from Tasmania (APP) C McArthur	5	RP	1
June	Hot off the Seed Bed	No 24 The performance and reliability of Paclobutrazol®, in promoting the flowering of *E. nitens* can be enhanced by nitrogen fertilisation D Williams, B Potts, P Smethurst	50	GI	
June	Workshop Hobart	Seed orchard research meeting with STBA, NET and Timbercorp. B Potts, D Steane, C Grosser, L Apiolaza, G Dutkowski, D Williams, M Watson, G Lopez, B Yeo, A Hingston, P Gore	15	GI	0.5
June	Seminar Hobart	Genetic analysis of flowering time (Seed Orchard Meeting) L Apiolaza, P Gore	15	GI	0.3
June	Seminar Hobart	Seed orchard design to take maximum advantage of available information (Seed Orchard Meeting) G Dutkowski	15	GI	0.3

Date	Function	Topic	Reach	Pgm	Time (days)
June	Workshop Hobart	Seed orchard management: development of marker systems for seed orchard research D Steane	15	GI	
June	Workshop Hobart	Seed orchard management: modelling paternity analysis and gene flow in *E. nitens* seed orchards C Grosser	15	GI	
June	Presentation Heidelberg	Genetic control and calculation of breeding values for *Dothistroma* resistance, stem deformity and growth across two sites in north -eastern Victoria, and the implications for breeding and deployment (HVP, STBA, CFTT) P Chambers	8	GI	0.5
June	Seminar	Improving forest productivity and sustainability: recent research findings from ARC, CRC and QDPI forestry projects in tree nutrition, water-use efficiency and soil quality (QFRI)	40	SM	0.5
June	Beyond the Black Stump	No 18 Pre-hardening seedlings in the nursery D Close	100	SM	
June	CRC Technical Report	No 34 Development plan for a forestry decision support system in south-east Queensland S Papps		SM	
June	Workshop Hobart	Scarab beetle identification (FT) P McQuillan, M Hurley	5	RP	0.5
June	Presentation	Results of CRC Strategic Initiative Fund project – WA component (to Insect Study Society) J Matthiessen		RP	
June	Workshop Hobart	Fauna conservation and plantation design Co-convenor: C McArthur	30	RP	2
June	Workshop Hobart	Fauna conservation and plantation design: balancing browsing damage management and fauna conservation in plantation forestry C McArthur	30	RP	1
June	Workshop Hobart	Fauna conservation and plantation design: use of a patchy forest environment by native herbivores K le Mar	30	RP	1
June	Presentation Launceston	Annual research presentation Tasmanian Institute of Agricultural Research: overview of forestry research in resource protection, CRC-SPF		RP	1

Industrial Uptake

The new technologies, developed by the research programs, which have been transferred to industrial partners and other end users, are outlined below:

Genetic Improvement Program

- The CRC has designed and identified genetic material for a new Forestry Tasmania *Eucalyptus globulus* seed orchard and research facility.

- The single visit pollination procedure designed by Dr D Williams and Dr B Potts for *E. globulus* has had increasing usage in the operational breeding program of STBA.

- *E. globulus* flowering time data analysed by the CRC has been used by STBA in decision making about seed collection in a seed orchard.

- Nutrient management prescriptions to enhance flowering developed by Dr D Williams are being adopted by a number of partners with *E. globulus* seed orchards.

- The CRC representation on the STBA Board (Mr G Dutkowski, Ms S Hetherington, Mr R Breidahl), Technical Committee, and Research, Quantitative Genetics and Data Management Sub-committees (Mr G Dutkowski), has assisted in the transfer of technology from the program to this partner.

- CRC staff have contributed to a number of significant STBA projects:
  - TREEPLAN™, breeding value prediction software for trees (Mr G Dutkowski, Dr L Apiolaza)
  - TREEMAN, data management system for tree breeding (Mr G Dutkowski)
  - FORESIGHT, development of breeding objectives for the building, printing and paper industries (Mr G Dutkowski, Dr L Apiolaza, Dr P Chambers)

- Significant components of the revised *E. globulus* breeding strategy for STBA have been written in collaboration with CRC staff:
  - economic models for primary breeding objectives (Mr G Dutkowski, Dr B Greaves)
  - secondary breeding objective strategies (Mr G Dutkowski)
  - genetic parameters for wood quality (Ms C Raymond)
  - quality control using molecular genetics (Dr R Vaillancourt)
  - trial measurement strategies (Mr G Dutkowski, Ms C Raymond)
  - genetic gain calculations (Dr L Apiolaza)
  - assembling a database of *E. globulus* progeny trial data (Mr A MacDonald)

- The racial classifications developed by Mr G Dutkowski and Dr B Potts has been used in breeding value prediction for FCP, FT. NFP, STBA and INTA (Argentina).

- Software which accounts for selfing in the creation and inversion of the additive relationship matrix (developed by the Mr G Dutkowski) has been used in the prediction of breeding values for FCP, STBA, NFP and INTA (Argentina).

- Microsatellite and cpDNA data provide a base framework for quality control, fingerprinting and gene flow studies in partner seed orchards. Several misidentifications have been detected in seed orchards and arboreta, and there is increasing interest in adoption of quality control using molecular markers.

- Marker pollens have been identified which are homozygous for rare alleles at several isozyme loci. These are now being used by STBA to test the efficiency of pollination procedures in *E. globulus*.

Sustainable Management Program

- A number of partners have increased usage of nitrogen fertilisers between 2-6 years, as well as some later age fertilisers, in temperate eucalypt plantations.
- Sotico Treefarms have switched from using ammonium sulphate to urea as a source of nitrogen following recommendation from the CRC.

- The calcium chloride extraction method for phosphorus analysis of soils is increasingly being used by plantation growers.

- Private Forests Tasmania has expanded ProMod (a forest growth model developed by the CRC) as a decision support system in Version 2 of the Farm Forestry Toolbox.

- ProMod has been applied to plantations in Portugal by RAIZ, and used to predict productivity of *E. nitens* grown in Ireland.

- Statistical and modelling assistance provided by the CRC to its partners has been incorporated in various CRC publications.

Resource Protection Program

- The Farm Forestry Toolbox 2, prepared by PFT, incorporates models of the impact of larval leaf beetle, *Chrysoptharta bimaculata*, on growth of *E. nitens*. These models can be used in integrated pest management of *C. bimaculata* to predict the economic impact of defoliation on the plantation value at harvest and so provide the economic threshold level of monitored populations.

- Fact sheets on general biology and control of various Tasmanian forest insect pests have been prepared and made available for industry and public use.

- Results on reinvasion of macropods onto plantations are being considered in relation to browsing damage management practices.

- Major Tasmanian forestry companies have indicated they are willing to incorporate an assessment of mammalian browsing damage at one year since planting into their forestry health surveys, after a field day that will demonstrate methods from CRC-SPF.

- The pruning prescriptions and silvicultural management of Forestry Tasmania had been altered in the light of results concerning tree decay following pruning.

Staffing and Administration

The Board and CRC Committee have approved the membership of four new partners to CRC-SPF. Serve-Ag Pty Ltd (Associate Party), Private Forests Tasmania (Supporting Party), and Forest Enterprises Australia Pty Ltd (Associate Party) all officially joined the Centre on 1 January 2000. Timbercorp Limited (Core Party) joined on 1 April, and Mr Ian Bail (Manager, Treefarm Services) is their representative on the Board. Silvagene Pty Ltd, as part of Timbercorp, now has their membership incorporated under the parent company. Due to company restructuring, Bunnings Treefarms Pty Ltd has changed their name to Sotico Treefarms Pty Ltd, and Fletcher Challenge Paper to Norske Skog Boyer.

Dr Peter Nelson retired from the position of CRC Visitor to our Centre at the end of June. We owe him a debt of gratitude for his interest and support during the last five years, and wish him well in his retirement. Dr Nelson has been succeeded by Dr Max Whitten whose initial term will be from 1 July 2000 until 30 June 2002. Dr Whitten has been Chief of CSIRO Entomology and Professor of Genetics at Melbourne University. We welcome him to the Centre.

Dr Luis Apiolaza started working for CRC-SPF, Hobart, in March 2000 after completing his PhD in forest genetics and tree breeding at Massey University, New Zealand. He has been Project Leader for Project A2 (Breeding Strategies) since 1 August 2000.

Mr Greg Dutkowski commenced as Technology Transfer Officer with the Education and Technology Transfer Program (Hobart) in November 1999.

Staff Movements

Anna Matysek - Economist SM (Hobart), resigned December 1999.
Laura Nagy - Technician GI (Clayton), resigned February 2000.
Kirsty Surridge - Technician GI (Clayton), commenced March 2000.
Simon Papps - Scientist, Decision Support Systems, SM (QFRI), resigned June 2000.
Sigrid Resh - Post-doctoral fellow SM (Hobart), commenced January 2000.
Andrew Mitchell - Post-doctoral fellow SM (Hobart), commenced February 2000.
Paul Chambers - Quantitative Geneticist GI (Hobart), commenced April 2000.
Siobhan Jones - Administrative Officer - finance and personnel (Hobart), commenced April 2000.
Leon Savage - Technician SM (Hobart), commenced May 2000.
Dianne Tambling - part-time Administrative Assistant (Hobart), commenced June 2000.
Ingrid van Putten - Economist (Hobart), commenced July 2000.
Garth Nikles - Principal Tree Breeder GI (QFRI), retired July 2000.

Students

The following CRC-SPF students completed their degrees in 1999/00:

Hons:

Tim Jones (UT), Robert Barbour (UT), Dean Kearney (ANU), Rohan Mellick (SCU), Andrew Rumley (ANU), Jackie Schirmer (ANU), Claire Turner (UT), Jules Freeman (UT), Sue Baker (UT), Steven Smith (GU)

PhD:

Steven Candy (UT), James Bulinski (UT), Paul Chambers (UT), Michelle McGranahan (UT), Martin Moroni (UT), Dean Williams (UT)

The following students commenced with the Centre in 1999/00:

Chris O'Hara - PhD (ANU), Robert Barbour - MSc (UT), Hal Hancock - Hons (UT), Rachel King - PhD (GU), Andrew Knowles - MSc (UT), Marian McGowan - Hons (UT), Gay McKinnon - PhD (UT), Rohan Mellick - PhD (SCU), Julianne O'Reilly - MSc (UT), Elizabeth Pietrzykowski - Hons (UT), Leanne Pound - PhD (UA), Luke Rapley - PhD (UT), Jackie Schirmer - PhD (ANU), Mark Short - PhD (ANU), Greg Unwin - PhD (UT), Michelle Watson - Hons (UT), Simon Whittock - Hons (UT), Byron Yeo - PhD (UT)

Administration

The number of meetings held by the Board and other committees during 1999/00, were as follows:

Board of Mangement	3
Management Committee	12
Advisory Panel	1
Program Coordinating Committees	
Genetic Improvement	2
Sustainable Management	2
Resource Protection	2

SPECIFIED PERSONNEL

Title and Name Role	Contributing Organisation	% time in CRC
Prof James Reid Director	University of Tasmania	50
Dr Russell Haines Deputy Director	Primary Industries Corp (QFRI)	50
Dr David de Little Chair, Advisory Panel	North Forest Products Limited	30
Program Managers		
Dr Chris Beadle Sustainable Mangement	CSIRO Forestry and Forest Products	80
Dr Clare McArthur Resource Protection	University of Tasmania	100
Dr Brad Potts Genetic Improvement	University of Tasmania	100
Dr Neil Davidson Education & Technology Transfer	University of Tasmania	100

Sustainable Production Forestry

Second Year Review of the CRC

The Review of CRCs is a two-stage process:
The first stage of the review concentrated on the research and researchers and was conducted by Professor Margaret Sedgley (Department of Horticilture, Viticulture and Oenology, Waite Campus, The University of Adelaide) (Chair), Dr Steven Cork (CSIRO Wildlife and Ecology) and Mr Alan Brown (CSIRO Forestry and Forest Products).

The second stage of the review dealt with the overall program, including objectives of the Centre, strategy for utilisation and application of research outputs, collaborative arrangements, education and training, management structure and arrangements, and performance evaluation. The second stage review panel consisted of Mr Graeme Kelleher (Co-Chair Life Sciences Expert Panel) (Chair), Dr Michael Carson (Consultant, ex-Forest Research Institute New zealand), Dr Peter Nelson (CRC Visitor), and observer, Dr Goeffrey Vaughan (Chair CRC Committee).

Support was provided by members of the CRC Secretariat, Ms Michelle Stone and Dr Peter Thygesen.

First Stage Review

Executive Summary

Research in the Cooperative Research Centre for Sustainable Production Forestry (CRC-SPF) is focused on three main areas: genetic improvement, sustainable management and resource protection; and on the major plantation species *Eucalyptus nitens* and *E. globulus* in temperate and mediterranean environments, and *Pinus elliottii, P. caribaea* and *Araucaria cunninghamii* in subtropical environments.

The panel found the CRC-SPF to be a good example of cooperative research involving universities, government research providers and industry. Of particular note are mechanisms for discussing, setting and reviewing research priorities with industry, the outstanding environment for postgraduate research and the strong performance by all levels of scientific

management in achieving coordination and cooperation within and among programs across diverse sites and disciplines.

In general, the research performance has been excellent and in some areas has significantly exceeded the stated Milestones The research program addresses key issues in production forestry for major sectors of the Australian industry at both applied and strategic levels. A feature of the Centre has been that its research staff have been active in the areas of technology transfer including publications, industry workshops and forest extension activities, and in obtaining external funding to extend Centre research beyond the core areas set in the Commonwealth Agreement.

Research is aligned with the objectives and strategies detailed in the Centre's Strategic Plan 1997 -2000. The CRC has implemented a comprehensive annual performance management system which monitors, among other things, research performance and quality. The Program Coordinating Committees which meet at least twice a year, play an important role in reviewing and previewing research with regard to its scientific and technological merit and in setting and reviewing the research deliverables for each project.

The quality of the research training is high, with students co-authoring approximately 50% of refereed papers and journal articles of the Centre. Key contributing factors are the broad range of well-qualified supervisors with interest and time to provide assistance to students; adequate operating funds, facilities, services and field sites; and a post-graduate student body of sufficient size to form a motivated and mature critical mass.

The quality of the researchers is high. Many have a well-deserved international reputation and are active in global peer groups.

The CRC-SPF has a sound research management base and the process for setting and monitoring research performance is operating effectively through the Program Coordinating Committees. These committees, which comprise representatives from at least six industry partners, meet at least twice each year to review and preview research with regard to its scientific and technological merit, and to set and review research deliverables.

Second Stage Review

Executive Summary and Recommendations

This CRC addresses an economic area of significant importance to all parts of Australia. Much of the sustainable production forest industry will focus on species of eucalypt, in the growth and utilisation of which Australia should have a strong competitive advantage. However, the deliberate wide distribution of eucalypt species throughout the world, combined with relatively little historical application of science to the Australian hardwood industry, has eliminated this advantage. Australia now has an international trade deficit in forest products amounting to about $2 billion p.a..

This CRC addresses this major problem, which is not significantly addressed by any other CRC. Appropriately, it focuses on sustainability of both hardwood and softwood plantation forests, in part because of the economic constraints in this highly competitive industry.

These strategic directions contribute directly to national objectives including economic, social and environmental benefits to Australia. Users of the research conducted by this Centre are strongly represented on the Board and have had major influence in determining strategic directions and research, education and training priorities.

The Stage I Review Panel concluded that the research and researchers are of very high quality and that research activities contribute directly to the Centre's strategic direction. The Stage 2 Review Panel agrees with these conclusions and with the recommendations in the Stage 1 report, which the Board has supported and agreed to implement. There has been very good progress over the two years and some milestones and targets have been exceeded.

The very strong involvement of research users in the development of the Centre's programs and the regular applications from new organisations to join the CRC clearly indicate that industry strongly supports the work of this Centre and are eager to use or commercialise research results. Commitment of resources significantly exceed in total those in the Commonwealth Agreement and these have been supplemented by very rapid increases in short term consultancies and contract work.

The Centre is now truly national and has built excellent links between all parts of Australia in its field of interest. Indeed it is noteworthy that the extent of the collaboration made it difficult to secure an expert to serve as an independent member on the Stage 2 Panel from within Australia who was not already involved in the Centre. All those interviewed agreed that this integration has enhanced participants' activities in research and education, although there is room for further collaboration between southern and northern nodes. The Centre has established strong international linkages and has a very well structured approach to ensuring that such linkages maximise benefits to Australia. Particularly, it is recognised that scientific progress in other countries, in many aspects of breeding and utilising both hardwood and softwood species, exceeds that of Australia. Concentration on rapid and relatively free exchange of information, both internationally and nationally, in sustainable forestry is therefore logical and the Centre is commended for its achievements in this area.

The Centre has considerably exceeded its targets in postgraduate education and training. Co-supervision of graduate students by industry personnel is encouraged and the strong involvement of industry in all aspects of education is commendable. The success of the Education Program is attested to by the employment in industry of students who have completed studies.

Students are deliberately involved in the research programs of the Centre and conversely, researchers are strongly involved in education and training. Overall, the education and training program is regarded as outstanding.

The Centre has a large Board, which nevertheless appears to operate most effectively, setting policy and overseeing the operations of the Executive in an appropriate way. Despite the geographic spread of the Centre and the number of organisations involved in it, management appears to be most effective with obviously efficient program and financial management.

Within the forestry, pulp and paper, and timber industries, the Centre's communication and information program is very extensive. However, there is room for more attention to publicity of the benefits of sustainable plantation forestry to the wider community and to policy makers specifically.

The Centre has very effective performance evaluation procedures.

Key Achievements

A number of key achievements have resulted from research conducted by the CRC SPF. These include:

(a) The high level of involvement of students in the Centre's research programs and the co supervision of students by industry people.

(b) The large number of scientific research publications.

(c) The very well developed education and training program.

(d) The IP management and commercialisation protocols, strategies and guidelines as developed by the Business Manager.

(e) The very effective communication and administration between the various nodes and programs of the Centre.

(f) The Centre's strategic and research program planning procedures.

(g) The relevance of the Centre's research program as evidenced by the support of industry and its eagerness to take up research results.

(h) The greatly increased contribution of resources from industry and the attraction of new candidates for membership of the Centre.

Recommendations

It is recommended that:

- *The Centre address in post CRC planning the lack of any CRC involvement in the longer-term development of clonal propagation and genetic manipulation methods which is seen as a 'gap in research coverage for the sector;*
- *The Centre address the integration of the Northern and Southern nodes activities in the tree breeding area.*
- *The Centre recognise the relevance of its research to regrowth forests and the value which can accrue to industry from the application of research in that field.*
- *The Centre ensures that the future requirements of the forest products industry are taken carefully into account in the design and formation of its research programs, including the formation of alliances with forest products research organisations.*
- *The Centre take appropriate steps to involve the downstream processing and forest product industry organisations in Centre activities.*
- *Students be given the opportunity to spend some time in the industry before or at the start of their higher degree.*
- *The Centre encourage and assist the students to establish methods of regular communication between all Centre nodes and programs.*
- *All students and staff of the CRC be encouraged to take every opportunity to communicate to the general public the value of the Centre's work and of the CRC Program.*
- *The Centre amplify its program of informing the general public and senior policy makers particularly through its industry participants, about the benefits of its work to Australia.*
- *An exit strategy is developed to provide for a controlled closure of the CRC for the contingency that if at the five year review, sufficient resources have not been identified to replace the Commonwealth funding (which will probably cease at the end of the seven year period).*
- *Commonwealth funding of the Centre continue in accordance with Commonwealth Agreement.*

Publications

Genetic Improvement Program

Refereed Publications

Apiolaza LA, Gilmour AR, Garrick DJ (2000) Variance modelling of longitudinal height data from a *Pinus radiata* progeny test. *Canadian Journal of Forest Research* **30** 645-654.

Chambers PGS, Borralho NMG (1999) A simple model to examine the impact of changes in wood traits on the costs of thermomechanical pulping and high-brightness newsprint production with radiata pine. *Canadian Journal of Forest Research* **29**(10) 1615-1626.

Dungey HS, Dieters MJ, Gwaze DP, Toon PG, Nikles DG (2000) Interspecific pine hybrids II. Genotype by environment interactions across Australia, Swaziland and Zimbabwe. *Forest Genetics* **7**(1) 19-28.

Gwaze DP, Dungey HS, Dieters MJ, Toon PG, Nikles DG (2000) Interspecific pine hybrids I. Genetic parameter estimates in Australia. *Forest Genetics* **7**(1) 9-18.

Homer L, Leach D, Lea D, Lee LS, Henry RJ, Baverstock PR (2000) Natural variation in the essential oil content of *Melaleuca alternifolia* Cheel (Myrtaceae). *Biochemical Systematics and Ecology* **28**(4) 367-382.

Moran GF, Butcher PA, Glaubitz JC (2000) Application of genetic markers in the domestication, conservation and utilisation of genetic resources of Australasian tree species. *Australian Journal of Botany* **48** 313-320.

Raymond C A (2000) Tree breeding issues for solid wood production. In 'The Future of Eucalypts for Solid Wood Products. Proceedings of IUFRO Conference'. Eds Henderson L, Waugh G, Nolan G, and Bennett P. 19-24 March, Launceston, Australia. (IUFRO: Hobart, Tasmania)

Rossetto M, McLauchlan A, Harriss F, Henry RJ, Lee LS, Baverstock PR, Maguire TL, Edwards KJ (1999) Abundance and polymorphism of microsatellite markers in tea tree, (*Melaleuca alternifolia* - Myrtaceae). *Theoretical and Applied Genetics* **98** 1091-1098.

Schimleck LR, Raymond CA, Beadle CL, Downes GM, Kube PD, and French J (2000) Applications of NIR spectroscopy to forest research. In '54th APPITA General Conference'. Melbourne, Victoria. 291-298.

Scott LJ, Cross M, Shepherd M, Maguire TL, Henry RJ (1999) Increasing the efficiency of microsatellite discovery from enriched libraries in coniferous forest species. *Plant Molecular Biology Reporter* **17** 351-354.

Shepherd M, Chaparro JX, Teasdale R (1999) Genetic mapping of monoterpene composition in an interspecific eucalypt hybrid. *Theoretical & Applied Genetics* **99**(7-8) 1207-1215.

Shepherd M, Chaparro JX, Teasdale R (2000) Variation and inheritance of resistance to defoliation by Christmas beetles, *Anoplognathus* sp. (Leach) in eucalypts. *Forest Genetics* **7**(1) 57.

Steane DA, McKinnon GE, Vaillancourt RE, Potts BM (1999) ITS sequence data resolve higher level relationships among the eucalypts. *Molecular Phylogenetics & Evolution* **12**(2) 215-223.

Wei X, Borralho NMG (1999) Objectives and selection criteria for pulp production of *Eucalyptus urophylla* plantations in South East China. *Forest Genetics* **6** 181-190.

Whitham TG, Martinsen GD, Floate KD, Dungey HS, Potts BM, Keim P (1999) Plant hybrid zones affect biodiversity: Tools for a genetic-based understanding of community structure. *Ecology* **80**(2) 416-428.

Williams DR, Potts BM, Black PG (1999) A single visit pollination method for *Eucalyptus globulus*. *Australian Forestry* **62** 346-352.

In Press

Apiolaza LA, Garrick DJ (2000) Analysis of longitudinal data from progeny tests: some multivariate approaches. *Forest Science*.

Dungey HS, Potts BM, Whitham TG, Li H (2000) Plant genetics affects arthropod community richness and composition: Evidence from a synthetic eucalypt hybrid population. *Evolution*.

Jordan GJ, Potts BM, Chalmers P, Wiltshire RJE (2000) Quantitative genetic evidence that the timing of vegetative phase change in *Eucalyptus globulus* ssp. *globulus* is an adaptive trait. *Australian Journal of Botany*.

Lopez GA, Potts BM, Tilyard PA (2000) F_1 hybrid inviability in Eucalyptus: the case of *E. ovata* x *E. globulus*. *Heredity*.

Maguire TL, Edwards KJ, Saenger P, Henry RJ (1999) Characterisation and analysis of microsatellite loci in a mangrove species *Avicennia marina* (Forsk.) Vierh. (Avicenniaceae). *Theoretical and Applied Genetics*.

Muneri A, Raymond CA (2000) Genetic parameters and genotype-by-environment interactions for basic density, pilodyn penetration and diameter in *Eucalyptus globulus*. *Forest Genetics*.

Muneri A, Raymond CA (2000) Non-destructive sampling of *Eucalyptus globulus* and *E. nitens* for wood properties. II. Fibre length and coarseness. *Wood Science and Technology*.

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Mathers NJ, Saffigna PG, Xu ZH, Berners-Price SJ, Perera MCS (1999) Pretreating soils with HF acid to improve the ^{13}C and ^{15}N NMR spectra of forest soils in Australia. In 'Soil Science Society of America Annual Meeting'. October/November, Salt Lake City, Utah, USA.

Mathers NJ, Xu ZH, Saffigna PG, Mao XA, Berners-Price SJ, Perera MCS, Blumfield TJ (2000) Impacts of windrowed tree residues on the residue and soil carbon and nitrogen composition in Australian hoop pine plantations as revealed by NMR spectroscopy. In '2nd European Symposium on NMR in Soil Science'. February/March, Friesling-Weihenstephan, Germany.

Medhurst JL, Pinkard L, Mollon A, Beadle CL (1999) Changes in productivity in response to thinning and pruning in *Eucalyptus* plantations. In: 'Practising forestry today. Proceedings of the 18th Biennial Conference of the Institute of Foresters of Australia'. Hobart Conference (Eds RC Ellis and PJ Smethurst) p 185.

Mendham N, Baker S, Dingle et al. (1999) Impact of competition from weeds on early growth of eucalyts and pines at five sites in Tasmania and Victoria. In 'Practising forestry today. Proceedings of the 18th Biennial Conference of the Institute of Foresters of Australia'. Hobart Conference (Eds Ellis, RC, PJ Smethurst) p 186-187.

Moroni M, Worledge D, Beadle C (1999) Root distribution of *E. nitens* and *E. globulus* in irrigated and droughted soil. CRC-SPF Technical Report No. 25. 22 pp.

Mummery D, Battaglia M (1999) Environmental sensitivity analysis as a method of screening for prospective *Eucalyptus globulus* plantations sites. In 'Practising forestry today. Proceedings of the 18th Biennial Conference of the Institute of Foresters of Australia' Hobart Conference (Eds Ellis RC, PJ Smethurst) pp 189-190.

Osborne R, Smethurst PJ, Wilkinson A (2000) Evaluation of a quick-test meter for measuring nutrient concentrations in soil and plant waters. CRC-SPF Technical Report No. 33. 9 pp.

Papps S (2000) Development plan for a forestry decision support system in south-east Queensland. CRC-SPF Technical Report No. 34. 41 pp.

Prasolova NV, Xu ZH, Dieters M, Saffigna PG (1999) Carbon isotope composition in clones of the F_1 hybrid between slash and Caribbean pines correlates with clonal growth in Queensland. In 'Australian Plant Breeding Conference'. Eds Langridge P, Barr A, Auricht G, Collins G, Granger A, Handford D, Paull J. 19-23 April; Adelaide, South Australia. pp.51-52 (CRC for Molecular Plant Breeding: Adelaide, South Australia)

Prasolova NV, Xu ZH, Dieters M, Saffigna PG (1999) Glasshouse seedling $d^{13}C$ and canopy $d^{13}C$ of 8-year-old hoop pine families grown in south-east Queensland in relation to canopy ^{18}O, nitrogen concentration and tree growth. In 'ComBio 99. Proceedings of Australian Society of Plant Physiology and Australian Society of Biochemistry and Molecular Biology Conference'. 17-20 September, Gold Coast, Queensland.

Pu GX, Saffigna PG, Xu ZH (2000) Impact of tree residues on denitrification in soils from subtropical pine plantations: laboratory studies. In 'Soil Science Society of America Annual Meeting'. October-November, Salt Lake City, Utah, USA.

Race, D.(2000) Farm forestry in Europe and the United States: synopsis of field research. CRC-SPF Technical Report No. 30. 13 pp.

Race, D. and Fulton, A. (1999) Farm forestry in Australia: understanding landholders' decision to adopt. CRC-SPF Technical Report No. 19. 21 pp

Saffigna, PG, Pu GX, Xu ZH (1999) Denitrification under field conditions in subtropical hoop pine plantations. In 'Soil Science Society of America Annual Meeting'. October/November, Salt Lake City, Utah USA.

Sands PJ (2000) 3PGpjs 1.1 – a user-friendly interface to 3-PG, the Landsberg and Waring model of forest productivity. CRC-SPF Technical Report No. 29. 22 pp.

Smethurst P, Jennings S, Matysek A (2000) Economics of nitrogen fertilizing eucalypts for pulpwood. CRC-SPF Technical Report No. 28. 18 pp.

Xu ZH, Kuppu R, Ding WX, Saffigna PG, Mao XA, Perera MCS, Simpson JA, Pu GX (1999) Impacts of site establishment practices on soil fertility in an Australian pine plantation as revealed by chemical and biological methods, and NMR spectroscopy. In 'Soil Science Society of America Annual Meeting'. October-November, Salt Lake City, Utah USA.

Confidential Reports

Battaglia M, Smith T (1999) Growth and yield models for *E. globulus* plantations in south-western Western Australia. CRC-SPF Technical Report No. 18. 8 pp.

These Completed

Rumley AK (1999) Investigation of the influences of environmental factors on leaf area index in *Eucalyptus nitens* plantations in Tasmania. Department of Forestry. BSc Honours, Australian National University. 93p.

Schirmer, J (1998) Socio-economics of commercial farm forestry: developing strategies to assist uptake by landowners in north-east Tasmania. BSc Honours, Australian National University. 224p.

Resource Protection Program

Refereed Publications

Allen GR (2000) Call structure variability and field survival among bushcrickets exposed to phonotactic parasitoids. *Ethology* **105** 409-423.

Allen GR, Kamien K, Berry O, Byrne P, Hunt J (1999) Larviposition, host cues and planidial behavior in the sound locating fly *Homotrixa alleni* (Diptera:Tachinidae). *Journal of Insect Behavior* **12** 67-79.

Bashford R (1999) Predation by ladybird beetles (coccinellids) on immature stages of the Eucalyptus beetle *Chrysophtharta bimaculata* (Olivier). *Tasforests* **11** 77-86.

Bashford R (1999) An adjustable light trap stand for insect monitoring in tree plantations. *Victorian Entomologist* **29** 53-55.

Bulinski J, McArthur C (2000) Spatial distribution of browsing damage and mammalian herbivores in

Tasmanian eucalypt plantations. *Australian Forestry* **63** 27-33.

Bulinski J, McArthur C (2000) Observer error in counts of macropod scats. *Wildlife Research* **27** 277-282.

Day MD, Wilson BW, Nahrung HF (1999) The life history and host range of *Charidotis pygmaea* (Col.: Chrysomelidae), a biological control agent for *Lantana montevidensis* (Verbenaceae). *Biocontrol Science and Technology* **9** 347-354.

Elek JA, Beveridge N (1999) Effect of a *Bacillus thuringiensis* ssp *tenebrionis* insecticidal spray on the mortality, feeding and development rates of larval Tasmanian eucalyptus leaf beetles (Coleoptera: Chrysomelidae). *Journal of Economic Entomology* **92** 1062-1071.

Hurley M (2000) Growth dynamics and leaf quality of the stinging trees *Dendrocnide moroides* and *Dendrocnide cordifolia* (Family Urticaceae) in Australian tropical rainforest: implications for herbivores. *Australian Journal of Botany* **48** 191-201.

Mohammed C, Barry K, Battaglia M, Beadle C, Eyles A, Mollon A, Pinkard L (2000) Pruning-associated stem defects in plantation *E.nitens* and *E.globulus* grown for sawlog and veneer in Tasmania, Australia in 'The Future of Eucalypts for Wood Products'. IUFRO International Conference, March 2000, Launceston, Tasmania, Australia: 357-364.

Nahrung HF, Merritt D (1999) Effects of mate availability on female longevity, fecundity and egg development of *Homichloda barkeri* (Jacoby) (Coleoptera: Chrysomelidae). *The Coleopterists Bulletin* **53** 329-332.

Nahrung HF, Merritt DJ (1999) Moisture is required for the termination of egg diapause in the chrysomelid beetle, *Homichloda barkeri*. *Entomologia Experimentalis et Applicata* **93** 201-207.

O'Reilly J, McArthur C (2000) Damage to and intake of plantation seedlings by captive European rabbits (*Oryctolagus cuniculus*). *Australian Forestry* **63** 1-6.

Seeman OD, Nahrung HF (2000) Mites as fungal vectors? The ectoparasitic fungi of mites and their arthropod associates in Queensland. *Australasian Mycologist* **19** 3-9.

Simmul TL, Clarke AR (1999) Parasitism of *Acacicola orphana* (Erichson) (Coleoptera: Chrysomelidae) in Tasmania. *The Australian Entomologist* **26** 87-90.

Yuan ZQ, Mohammed C (1999) Pathogenicity of fungi associated with stem cankers of eucalypts in Tasmania, Australia. *Plant Disease* **83** 1063-1069.

Yuan ZQ, Mohammed C (2000) The pathogenicity of *Endothia gyrosa* isolates to *Eucalyptus nitens* and *E. globulus*. *Australasian Plant Pathology* **29**(1): 29-35.

Yuan Z.Q, Wardlaw T, Mohammed C (2000) A new species of *Dichomera* (Mitosporic fungus) described on eucalypt leaves from Tasmania, Australia. *Nova Hedwigia* **70** 139-142

Yuan ZQ, Wardlaw T, Mohammed C (2000) First report of *Gloeosporidina* sp isolated from lesions on shoots and leaves of *Eucalyptus nitens* and *E. globulus* in Australia. *Plant Disease* **84** 510-512.

In press

Barry KM, Davies NW, Mohammed CL (2000) Identification of hydrolyzable tannins in the reaction zone of *Eucalyptus nitens* wood, by high performance liquid chromatography / electron ionization mass spectrometry. *Phytochemical Analysis*

Barry KM, Pearce R, Mohammed C (2000) Properties of reaction zones associated with decay from pruning wounds in plantation-grown *Eucalyptus nitens*. *Forest Pathology*

Candy SG (2000) The application of generalised linear mixed models to multi-level sampling for insect population monitoring. *Environmental and Ecological Statistics*, **7**

Hunt J, Allen GR (2000) Larval competition and developmental instability in the acoustically orienting parasitoid *Homotrixa alleni*. *Acta Ethologica*

le Mar K, Southwell C, McArthur C (2000) Evaluation of line transect sampling to estimate nocturnal densities of macropods in open and closed habitats. *Australian Wildlife Research*

McArthur C, Goodwin A, Turner S (2000) Preferences, selection and damage to seedlings under changing availability by two marsupial herbivores. *Forest Ecology and Management*

Milgate A, Vaillacourt R, Powell M, Mohammed C (2000) *Mycosphaerella* species in *Eucalyptus nitens* and *E. globulus* plantations in Tasmania, Australia. *Forest Pathology*

Yuan ZQ, Mohammed, C. (2000) Interactions between bark type, canker fungi infection and lesion development in *Eucalyptus nitens*. *Forest Pathology*

Yuan ZQ, Rudman T, Mohammed C (2000) *Pseudophacidium diselmae* sp. nov. isolated from stem cankers of *Diselma archeri* in Tasmania, Australia. *Australasian Plant Pathology*

Yuan ZQ, Wardlaw T, Mohammed C (2000) *Harknessia* species occurring on eucalypt leaves in Tasmania, Australia. *Mycological Research* **104**

Unrefereed publications

Barry KM, Pearce RB, Mohammed CL (1999) Mechanisms of reaction zone defence in *Eucalyptus nitens*: A non-conformist in our midst? *Abstracts of the 12th biennial Australasian Plant Pathology Society Conference, Canberra, 27-30th September.*

Elek J A (1999) Information sheets on identifying pests in Tasmanian forests; Sheet 1: *C. bimaculata*, Sheet 2: *C. agricola*, Sheet 3: *M. privata*, Sheet 4: *U. lugens*, Sheet 5: Gum tree coreid bugs, Sheet 6: *Perga affinis*, Sheet 7: *Sirex noctilio*.

Elek J A, Candy S (1999) Research Note: Impact of Leaf Beetles on Growth of Eucalypt Plantations.

Hurley M, Matthiessen JM, Simmul TL (2000) Initiating systematic investigation of the biology and management of establishment insect pests in *Eucalyptus* plantations - linking Western Australia and Tasmania. SIF final report.

Madden JL, Patel VS, Elek JA (1999) Biological control of eucalypt defoliators using entomopathogenic fungi - evaluation of the fungi *Metarhizium* and *Beauvaria* spp. for the control of eucalypt defoliating beetles. CRC Technical Report No. 17. 37pp.

Milgate AW, Yuan ZQ, Vaillancourt R, Mohammed C (1999) *Mycosphaerella* species of Tasmania, Australia. IXth International Congress of Mycology, International Union of Microbiological Societies. 16-20 August, Darling Harbour, Sydney.

Mohammed C, Barry K, Battaglia M, Beadle C, Eyles A, de Little D, Milgate A, Mollon A, Smethurst P, Vaillancourt R, Wardlaw T, Yuan Z Q (1999) Research strategies for disease management in eucalypt plantations in Tasmania, Australia. *Abstracts of the 12th Biennial Australasian Plant Pathology Society Conference, Canberra, 27-30th September.*

Mohammed C, Barry K, Battaglia M, Beadle C, Eyles A, Hall M, Milgate A, Mollon A, Smethurst P, Vaillancourt R, Yuan Z (1999) Strategies for disease management in *Eucalyptus* plantations in Tasmania, Australia. *Abstracts of the 18th Biennial Conference of the Institute of Foresters of Australia, Hobart, Tasmania, 3-8th October 1999.*

Nahrung HF (1999) Embryonic diapause of *Homichloda barkeri* (Jacoby) (Coleoptera: Chrysomelidae). Entomological Society of Queensland News Bulletin, 27, 7.

Simmul TL (1999) Establishment pests of *Eucalyptus*. *Network*, North Eucalypt Technologies Newsletter, November.

Yuan ZQ, Wardlaw T, de Little D, Milgate A, Mohammed C (1999) Fungi identified during forest health surveillance of eucalypt plantations in Tasmania. *In The 12th Biennial Australasian Plant Pathology Conference*, pp. 84. Australasian Plant Pathology Society, Canberra, Australia.

Theses completed

Baker S (2000) Forest litter beetles and their habitat: wildfire versus clear felling. Honours thesis. University of Tasmania.

Brown G (1999) Preliminary investigations into the biology, ecology and control of two species of *Heteronyx*. (Coleoptera: Scarabaeidae). Honours thesis, University of Tasmania.

Candy SG (2000) Predictive models for integrated pest management of the leaf beetle *Chrysophtharta agricola* in *Eucalyptus nitens* plantations in Tasmania. PhD thesis, University of Tasmania.

Presentations
(See also Unrefereed Publications)

Genetic Improvement Program

Apiolaza LA, Gore PL (2000) Genetic analysis of flowering time. Seminar at 'Seed Orchard Management Meeting' 22 June 2000. Hobart, Tasmania.

Dutkowski GW (1999) WOOD.FOR - a wood sampling strategy simulator. Presentation at 'STBA Technical Committee Meeting' 23 September 1999. Melbourne, Victoria.

Dutkowski GW (1999) Beeding values prediction for *Dothistroma pinii* damage in *Pinus radiata* using spatial analysis. Presentation at 'STBA Technical Committee Meeting' 23 September 1999. Melbourne, Victoria.

Dutkowski GW (1999) Revised *Eucalyptus globulus* breeding strategy. Presentation at 'STBA Technical Committee Meeting' 23 September 1999. Melbourne, Victoria.

Dutkowski GW (1999) Revised *Eucalyptus globulus* breeding strategy. Presentation at 'STBA General Meeting' 30 November 1999. Melbourne, Victoria.

Dutkowski GW and McRae TA (1999) Breeding value prediction for forestry. Presentation at 'Design of TREEPLAN software Meeting' 17 November 1999. Syndey, NSW.

Dutkowski, G. W. (1999) Geographic genetic variation in Central Victorian *Eucalyptus nitens* and a race classification. Seminar at 'Genetic Improvement Program Coordinating Committee Meeting' 13 October 1999. Hobart, Tasmania.

Dutkowski GW (1999) The STBA Cooperative Tree Improvement Strategy for *Eucalyptus globulus*. Presentation at ' STBA Annual Meeting' 30 November 2000. Melbourne, Victoria.

Dutkowski GW (1999) ASREML Forestry Workshop. Course at 'ASREML for Multivariate Analysis Course' 3 July 1999. Melbourne, Victoria.

Dutkowski GW (1999) How tree breeding works and what it can achieve. Seminar at 'Forest Genetics for Bushcare and Farm Forestry Workshop' 6 July 1999. Hobart, Tasmania.

Dutkowski GW (1999) Geographic genetic variation in Central Victorian *Eucalyptus nitens* and a race classification. Seminar 27 Aug. 1999. Hobart, Tasmania.

Dutkowski GW, McRae TA (1999) Revised *Eucalyptus globulus* breeding strategy. Presentation at 'Design of TREEPLAN software Meeting' 17 Nov. 1999. Sydney, New South Wales.

Dutkowski GW (2000) Spatial Analysis in Forestry. Presentation at 'Application of Spatial Analysis to Forest Inventory' 15 February 2000. Hobart, Tasmania.

Dutkowski GW (2000) Geographic variation in the O'Connor/CFTT *Eucalyptus globulus* collection. Presentation at 'STBA Technical Committee Meeting' 17 February 2000. Melbourne, Victoria.

Dutkowski GW (2000) Seed orchard design to take maximum advantage of available information. Seminar at 'Seed Orchard Management Meeting' 22 June 2000. Hobart, Tasmania.

Dutkowski GW, Pilbeam D (2000) STBA *Eucalyptus globulus* breeding strategy revision. Briefing April 2000. Bridgetown, Western Australia.

Moran GF (1999) QTL for growth in *Eucalyptus nitens*. Oral presentation at Forest Biotechnology Conference, Oxford 11-16 July 1999.

Potts BM, Whitham TG, Lawrence R, Jones TH, Dungey HS, Minchin PR, Vaillancourt RE (2000) Plant genetic and ontogenetic impacts on insect susceptibility and communities. Invited Talk at 'CRC-SPF Symposium on Insect-Eucalypt Interactions' 7-8 February. Canberra, ACT.

Raymond CA (2000) Tree breeding issues for solid wood production. IUFRO Conference on 'The future of eucalypts for solid wood products'. March 2000, Launceston, Australia.

Thamarus KA (2000) QTLs for Wood and Pulp Properties in *Eucalyptus globulus*. Seminar 10 February 2000, for CSIRO FFP. Canberra, ACT.

Vaillancourt RE (1999) Genetic modification of plants. Seminar for Royal Society of Tasmania.

Whitham TG, Potts BM, Dungey HS, Lawrence R, Dickson L, Minchin PR (1999) Genetic and ontogenetic components of community structure and biodiversity. Invited Presentation at 'XVI International Botanical Congress' August 4-7. St. Louis, Missouri, USA.

Sustainable Management Program

Beadle CL (2000) Blackwood – the problem of controlling form in plantation systems. CRC Workshop on Pruning and Thinning. Gympie, May 2000.

Beadle CL, Pinkard L (2000) Pruning temperate eucalypts in industrial plantations – a physiological approach to the management of growth and form through green pruning. CRC Workshop on Pruning and Thinning. Gympie, May 2000.

Close DC, Beadle CL, Brown P, Holz GK (1999) Cold-induced photoinhibition affects establishment of *Eucalyptus nitens* and *E. globulus* seedlings. Combio99. Sym-51-03. Australian Society of Plant Physiology Annual Meeting. Gold Coast, September 1999.

Medhurst J (2000) Thinning strategies for *Eucalyptus nitens* – the effect of site quality on growth and physiological responses. CRC Workshop on Pruning and Thinning. Gympie, May 2000.

Mendham DS, Smethurst PJ, Holz GK, Menary RC, Grove TS Weston C, Baker T (1999) Soil analyses for site-specific management of phosphorus in new *Eucalyptus nitens* and *E. globulus* plantations. Third Workshop on Site Management and Productivity in Tropical Plantation Forests - Impacts on Soils and Options for Management over Successive Rotations. Kerala, India. December 1999. CIFOR.

Papps S (2000) Decision Support Systems for pruning and thinning. CRC Workshop on Pruning and Thinning. Gympie, May 2000.

Pinkard L (2000) Hybrid models for developing prescriptions for green pruning. CRC Workshop on Pruning and Thinning. Gympie, May 2000.

Prasolova NV, Xu ZH, Farquhar GD, Saffigna PG, Dieters MJ (1999) Glasshouse seedling $d^{13}C$ and canopy $d^{13}C$ of 8-year-old hoop pine families grown in south-east Queensland in relation to canopy $d^{18}O$, nitrogen concentration and tree growth. Combio99. Sym-37-04. Australian Society of Plant Physiology Annual Meeting. Gold Coast, September 1999.

Raymond C (2000) Sampling strategies and statistical requirements for determining solid wood quality. CRC Workshop on Pruning and Thinning. Gympie, May 2000.

Simpson JA, Xu ZH, Smith T, Keay P, Osborne DO, Podberscek M (1999) Residue management for maintenance of site productivity in exotic pine plantations in subtropical Queensland, Australia. Third Workshop on Site Management and Productivity in Tropical Plantation Forests - Impacts on Soils and Options for Management over Successive Rotations. Kerala, India. December 1999. CIFOR.

Smethurst PJ, Mendham DS, Moroni MT, Holz GK (1999) Soil nitrogen and phosphorus calibrations. Biennial meeting of Research Working Group 3, Rotorua, New Zealand.

Smith T, Simpson J, Xu ZH (1999) Influence of land-use conversion to *Pinus caribaea*/*Pinus elliottii* on soil properties in northern Australia. Biennial meeting of Research Working Group 3, Rotorua, New Zealand.

Xu ZH, Simpson JA, Saffigna PG, Pu GX, Osborne DO (1999) Impacts of fertilization on tree growth, foliar nutrient concentration and carbon isotope composition and on soil fertility in a full rotation of slash pine in south-east Queensland, Australia. Biennial meeting of Research Working Group 3, Rotorua, New Zealand.

Resource Protection Program

Bashford R (1999) Conducted one day field workshop on insect pest monitoring techniques for the West Australian Pest Management Group at Stoney gully, Western Australia 7 December 1999.

Brown G (1999) Scarab beetles a newly emerged forestry pest. School of Agricultural Science, Hobart 8 October 1999.

Candy SG (1999) Predictive models for integrated pest management of the leaf beetle *Chrysophtharta agricola* in *Eucalyptus nitens* plantations in Tasmania. School of Agricultural Science, Hobart 9 July 1999).

Elek JA, Beveridge N, Candy S, Bashford R, Elliott H (1999) Using trap trees in an IPM monitoring system for chrysomelid leaf beetles in eucalypt plantations. Talk presented at Australian Entomological Society 30th AGM and Scientific Conference, Canberra, September 1999.

Hurley M, McArthur C, de Little D, Brown G, Simmul TL (2000) Herbivores of young eucalypt plantations. Poster presented at the Symposium on Insect-Eucalypt Interactions, Canberra, 7-8 February 2000.

le Mar K (1999) Herbivore abundance and habitat selection in a patchy environment in Tasmania. Australian Mammal Society, July 1999.

le Mar K (2000) Use of a patchy forest environment by native herbivores. Fauna Conservation and Plantation Design Workshop, June 2000.

Loch AD (2000) Insect pests of Tasmanian blue gum, *Eucalyptus globulus* ssp *globulus*, in Western Australia: history of problems, current perspectives and future prospects. Symposium on Insect Eucalypt Interactions, Canberra, 7-8th February 2000.

Lukacs Z (1999) Phenological variability of *Mnesampela privata*: Why the autumn gum moth is not always the autumn gum moth? School of Agricultural Science, Hobart, 23 July 1999.

Lukacs Z (1999) Phenological variability of *Mnesampela privata*: Why the autumn gum moth is not always the autumn gum moth? Talk presented at Australian Entomological Society 30th AGM and Scientific Conference, Canberra, September 1999.

Lukacs Z, Clarke AR, Madden JL, Floyd RB (2000) Life history regulation of *Mnesampela privata*. Poster presented at the Symposium on Insect-Eucalypt Interactions, Canberra, 7-8 February 2000.

McArthur C (1999) Managing browsing damage in eucalypt plantations. WA Industry Pest Management Group, November 1999.

McArthur C (2000) Pest Management Workshop. Co-convenor and chair of session, February 2000.

McArthur C (2000) Managing browsing damage in eucalypt plantations – experiences from Tasmania. Australian Paper Plantations Seminar, May 2000.

McArthur C (2000) Fauna Conservation and Plantation Design Workshop. Co-convenor, June 2000.

McArthur C (2000) Balancing browsing damage management and fauna conservation in plantation forestry. Fauna Conservation and Plantation Design Workshop, June 2000.

Murphy BD (2000) Biological control of *Paropsis charybdis* in New Zealand and the fecundity of Tasmanian paropsine beetles. CRC-SPF, Hobart, 22 March 2000.

Nahrung HF (2000) *Eucalyptus nitens* (Deane & Maiden) foliage consumption by *Chrysophtharta agricola* (Chapuis) (Coleoptera: Chrysomelidae: Paropsini). Poster presented at the Symposium on Insect-Eucalypt Interactions, Canberra, 7-8 February 2000.

Nahrung HF, Merritt DJ (1999) Embryonic diapause of *Homichloda barkeri* (Jacoby) (Coleoptera: Chrysomelidae), a potential biological control agent for prickly acacia? Talk presented at Australian Entomological Society 30th AGM and Scientific Conference, Canberra, September 1999.

Potter KJB, Ireson JE, Allen GR, Holloway RJ (1999) What are the key factors affecting the ragwort flea beetle in its control of Ragwort? Poster presented at Australian Entomological Society 30th AGM and Scientific Conference, Canberra, September 1999.

Potter KJB, Ireson JE, Allen GR, Holloway RJ (1999) What are the key factors affecting the ragwort flea beetle in its control of Ragwort? Poster presented at the 12th Australian Weeds Conference Hobart, August 1999.

Rice AD, Allen GR (1999) Host interactions and impact of tachinid parasitoids upon the eucalypt defoliating beetles *Chrysophtharta agricola* and *C. bimaculata*. Poster presented at Australian Entomological Society 30th AGM and Scientific Conference, Canberra, September 1999.

Rice AD, Rowe R, Dhileepan K (1999) Evidence of local adaptation in the Australian population of *Zygogramma bicolorata* pallister (Coleoptera: Chrysomelidae) - an introduced biocontrol agent for the weed *Parthenium hysterophorus* l. (Asteraceae). Talk presented at Australian Entomological Society 30th AGM and Scientific Conference, Canberra, September 1999.

Simmul TL, Matthiessen JN (1999) Eucalypt plantations – which pests get in first? CRC-SPF seminar, Hobart, 20 October 1999.

Simmul TL, Matthiessen JN, Hurley M (2000) Establishment Pests – What and Where? CRC-SPF – Industry seminar, North Eucalypt Technologies, Ridgley, 21 January 2000.

Simmul TL, Matthiessen JN, Hurley M (2000) Establishment pests of Tasmanian eucalypt plantations. CRC-SPF, Hobart, 27 January 2000.

Simmul TL, Allen GR (1999) Intraspecific variation in *Acacia dealbata* and defoliation by fireblight beetle. Talk presented at Australian Entomological Society 30th AGM and Scientific Conference, Canberra, September 1999.

Steinbauer MJ (2000) Life history theory in relation to outbreak species of Forest Geometridae (Lepidoptera): correlates and inferences for *Mnesampela privata* in Australian eucalypt plantations. Symposium on Insect Eucalypt Interactions, Canberra, 7-8 February 2000.

Strauss SY (2000) Linking pollination and herbivory: ecology and evolution within a community context. University of Tasmania, Hobart, 13 March 2000.

Media Activities

Print

The Examiner, 7 October 1999. 'CRC Reseach'. G Lopez and B Potts.

40 Degrees South, Issue 14, 1999. 'Top-seed'. B Potts and R Vaillancourt.

Agroforestry News, Autumn 2000. 'Tackling blue gum insect pests'. A Loch.

Rural Fringe, NSW, December 1999. 'Landcare in focus: highlighting environmental issues in the local area and in the region'. M Steinbauer

The Mercury, 31 July 1999. 'Tassie's waltz with Gondwana'.

Timber (Asia Pacific) (2000) 'Queensland on show at Asia Pacific forest talks' included a report on the Symposium on Hybrid Breeding and Genetics, held at Noosa in April 2000.

Radio and Television

ABC Television News, 6 October 1999. CRC Research. G Lopez and B Potts.

ABC Radio, 6 October 1999. CRC Research. G Lopez and B Potts.

ABC Radio News, 6 October 1999. 'CRC research'. G Lopez and B Potts.

ABC Radio, 5 April 2000. 'European wasps in Tasmania'. G Allen

ABC Classic FM Radio, 4 May 2000. 'Entomology and Natural Resource Management'. R Floyd.

ABC Radio, 16 November 1999. 'New developments in plant science research'. J Reid.

Committee responsible for the organisation of the Symposium on Hybrid Breeding and Genetics (left to right: Dr Mervyn Shepherd, Ms Jean Richmond, Dr Mark Dieters, Dr Heidi Dungey, Mr Paul Toon, Dr Brad Potts and Dr Garth Nikles).

Mr Jamie Espejo and Dr Wayne Tibbits in discussion during the Controlled Pollination Course at the Noosa Symposium on Hybrid Breeding and Genetics.

Mr Ken Robson of QFRI demonstrates techniques he uses to hybridise eucalypts.

Ass/Prof Jennifer McComb and Dr Chris Harwood discuss new pollination techniques for eucalypts.

Delegates at the Symposium on Hybrid Breeding and Genetics.

Grants and Awards

Genetic Improvement Program

Grant/Award	Awarded for	Duration	Recipient	Amount $
QFRI/CRC-SPF	Best poster at symposium on hybrid breeding and genetics of forest trees		Mr R Barbour et al	
QFRI/CRC-SPF	Second-best poster at symposium on hybrid breeding and genetics of forest trees		Ms R Stokoe	
ARC large grant	The use of molecular markers to assess hybridisation and gene flow in eucalypts	3 years	Dr B Potts Dr R Vaillancourt	246 000
Strategic Initiatives Fund (CRC-SPF)	Maternal tree effects on seed quality	1 year	Dr B Potts Mr P Kube (FT)	15 050
SPIRT Industrial Collaborative Grant	Optimisation of *Eucalyptus nitens* seed and seedling quality for nursery production systems	3 years	Dr B Potts Mr P Kube (FT) Dr D Williams	145 572
QFRI/CRC-SPF	Member organising committee: Symposium on Hybrid Breeding and Genetics		Dr B Potts Dr H Dungey Dr M Dieters	
STBA	Geographic patterns of variation in *E. globulus*	3 months	Mr G Dutkowski	2 000
STBA	Breeding value prediction for tree breeding	3 months	Mr G Dutkowski	3 000
STBA	Attendance at Fortran programming course		Mr G Dutkowski	600
SPIRT APA(I)	Recovering pedigrees in *E. globulus* using genetic markers	3 years	Dr R Vaillancourt Dr B Potts Mr P Gore (STBA) Mr G Dutkowski	62 466
IUFRO Conference	Member organising committee of conference in Launceston: the future of eucalypts for wood products	1 week	Ms C Raymond	
J Malcolm Gillies	Honours scholarship	1 year	Ms R Jones	
HN Barber	Honours scholarship	1 year	Ms M McGowen	
AusAID International Seminar Support Scheme	To support attendance of three delegates at symposium	10 days	Dr H Dungey	8 742
DPIF	Sponsorship of Hybrid Breeding and Genetics Symposium	10 months	Dr H Dungey Dr M Dieters	5 000
Crawford Fund	Attendance at Hybrid Breeding and Genetics Symposium by Yongqi Zheng from China	3 weeks	Dr M Dieters	7 550
French Government	Travel to attend Hybrid Breeding and Genetics Symposium	2 weeks	Dr L Pacque	3 000
Australian Academy of Science	Travel grant to USA	1 month	Dr H Dungey	6 575

Sustainable Management Program

The Queen's Trust for Young Australians	To present a paper at the 12th International Congress of the Federation of European Societies of Plant Physiology in Budapest	1 month	Mr D Close	2 000
HN Barber	Honours scholarship	1 year	Mr H Hancock	
National Heritage Trust	Farm Forestry Technical and Business Handbook	1 year	Dr N Davidson	69 900
Strategic Initiatives Fund (CRC-SPF)	Quick test meter for nutrients	1 year	Dr P Smethurst Dr P Volker	9 250
Strategic Initiatives Fund (CRC-SPF) QDPI cash contribution	Soil water relationships in SE Queensland pine estate	1 year	Dr M Hunt Dr B Yu Dr K Bubb Dr M Mestor Mr D Osborne	9 000
Strategic Initiatives Fund (CRC-SPF) PCP cash contribution	Managing effluent-irrigated plantations	1 year	Dr C Beadle Mr D Worledge Ms S Hetherington	8 500

Resource Protection Program

SPIRT [ARC APA(I)]	Assessing damage to newly established *E. nitens* plantations in Tasmania by Melolonthine beetles (Scarabaeidae: Coleoptera): should browsing mammals get all the blame?	3 years	Dr M Hurley Dr P McQuillan (UT) Dr D de Little (NFP) Dr G Allen	62 466
Strategic Initiatives Fund (CRC-SPF)	Initiating systematic investigation of the biology and management of establishment insect pests in *Eucalyptus* plantations – linking Western Australia and Tasmania	1 year	Mr J Matthiessen Dr M Hurley	25 000
Visiting Scientist (CSIRO)	Host a sabbatical visit by Dr H Brailovsky, Mexico	1 year	Dr M Steinbauer	1 000
Strategic Initiatives Fund (CRC-SPF)	Identification of sex pheromone of *M. privata*	1.5 years	Dr M Steinbauer	15 000
Visiting Scientists (CRC-SPF)	Two-month visit by A/Prof S Strauss and A/Prof M Schwartz (UC Davis)	2 months	Dr M Steinbauer	13 000
CRC-SPF CSIRO	Symposium on Insect-Eucalypt Interactions; Scientific meeting and visit by A/Prof S Nylin (Stockholm University)	2 weeks	Dr M Steinbauer	6 000 1 000
Industry collaboration	PhD on Essigella biology	3.5 years	Dr R Floyd	112 000
Australian Wildlife Management Society Travel Award	Travel to attend conference	1 month	Ms K le Mar	520

Consultancies

Consultancy with	For	Duration	Recipients	Amount $
RIRDC – Joint Venture Agroforestry Program	Commissioned review: Assessing the risk of genetic pollution from farm forestry using hybrids and improved species	1 year	Dr B Potts	5 000
FCP	Prediction of breeding values for diameter and pilodyn penetration for FCP *E. nitens* breeding population families	1 week	Mr G Dutkowski	3 000
STBA	Prediction of DBH breeding values for *E. globulus* EUC422 Tostaree	1 day	Mr G Dutkowski	1 000
STBA	Assembling a data base of *E. globulus* progeny trial data	3 weeks	Mr G Dutkowski	3 000
APP	Statistical analyses and reports	5 days	Dr P Smethurst	3 439
PFT	Data analyses	10 days	Dr P Smethurst	3 000
Timbercorp	Experimental design	1.5 hours	Dr P Smethurst	127
STBA	Site assessment	1.5 days	Dr P Smethurst	1 500
Various	Chemical analyses	30 days	Dr P Smethurst	10 100
STBA	Organising core density assessments of progeny trials	12 weeks	Mr G Dutkowski	12 000
PFT	Develop and implement *E. nitens* version of ProMod for Farm Forestry Toolbox version 2	3 months	Dr M Battaglia	5 000
RL Newman & Partners	Apply ProMod to predict productivity of *E. nitens* at sites in Ireland	2 days	Dr M Battaglia	1 000
RAIZ	Adapt and apply ProMod to *E. globulus* grown in Portugal, and analysis of effects of diverse nutrient regimes	2 weeks	Dr M Battaglia	7 500

Performance Indicators

Cooperative Arrangements

- *Level of participation of contributors in major decisions concerning the research direction of the Centre*

Most CRC research is conducted using company trials, or trials established on company land, so companies are involved at the outset with the planning and implementation of research projects and have ownership of them. Research plans for these experiments are lodged with the companies, and these include an agreed protocol for the research. The company partners allocate staff time (in-kind contributions) to CRC research projects so effective interaction can occur. The Program Coordinating Committees of the CRC retain an overview of these research projects. They priorities research and set 'deliverables' (research outcomes that can be directly used by industry). The Program Coordinating Committees are chaired by industry staff and consist largely of the partner's staff to ensure that they are involved in deciding what research is undertaken.

- *Level of interchange of personnel among different sites and participating institutions*

Documented visits to individual CRC partners and between nodes of the CRC (Hobart, Canberra, Brisbane, Gympie) total 660 person-days for 1999/00.

- *Proportion of joint publications with other research groups*

In the publication list, 80 of the 201 publications (90 refereed + 99 unrefereed + 12 theses = 201) were written with other research groups.

- *Number and duration of stay of visitors to the Centre from Australia and overseas*

There were a large number of visitors to the CRC and to CRC-arranged symposia. The 10 who stayed for periods exceeding a week to work with CRC staff were:-

A/Prof Claire Williams (Texas Agricultural and Mechanical University) - 9 to 21 April, 2000

Dr Luc Pâques (INRA, Orleans, France) - 9 to 21 April, 2000

Dr Yongqi Zheng (Chinese Academy of Forestry) - 2 to 21 April 2000

Dr João Costa e Silva (Department of Botany, Dendrology and Forest Genetics Arboretum, Royal Veterinary and Agricultural University, Horsholm, Denmark) - 3 october to 14 November 1999

Dr Caroline Preston (Dept of Soil and Forest Science, University of British Columbia, Canada) - 26 September to 10 November 1999

A/Prof Deping Li (Institute of Soil Sciences, Chinese Academy of Sciences, Nanjing, PRC) - 28 June to 24 December 2000

A/Prof Sharon Strauss (University of California, Davis) - 31 January to 25 March, 2000

Assis/Prof Mark Schwartz (University of California, Davis) - 31 January to 25 March, 2000

A/Prof Sören Nylin (Stockholm University) - 6 to 11 February 2000

Mr Brendan Murphy (Canterbury University of Canterbury, NZ) - November 1999 to March 2000

- *The degree of interaction among scientific staff at dispersed locations on core activities of the research program, including:*
  - the economic importance and genetic control of growth, stem characteristics and wood properties at the quantitative and molecular levels

The Genetic Improvement Program is structured to ensure close interaction between projects both within and across nodes. The quantitive and molecular genetics projects are paired to ensure synergies between these different fields. For example, the northern node projects A6 and A7 closely interact on work on the tropical hybrid pines, A1 and A4 work closely together on the genetics of temperate eucalypts, and A3 and A5 interact in studying the genetic control and mapping of wood property genes in *Eucalyptus globulus*. There is also regular interaction between the various groups working in the same field across different nodes. In this case they are linked by common technologies, and technological advances made in one project are usually directly relevant to the other projects. For example, the quantitative genetics projects closely interact on the application of genetic models and use of specialised programs (e.g. ASREML) for estimating genetic parameters and breeding values. Mr Greg Dutkowski has worked with scientists from QFRI, NET, STBA,

and FT on introducing them to the use of the ASREML software for the analysis of their data. The molecular genetics research groups in Hobart, Canberra and Lismore have regular phone link ups to update each other on research and discuss common problems and techniques. Project A1 (Genetics and reproductive biology of eucalypts) led by Dr Brad Potts at UT, links with Project A6 led by Mark Dieters at QFRI and A7 lead by Prof Robert Henry on problems associated with eucalypt genetics and hybridisation which are common to temperate and sub-tropical eucalypts. The symposium on hybrid breeding held in April 2000 provided a focus for this interaction. Project A1 is conducting research projects on the genetics of *E. globulus* across Australia, in southern (UT and FCP) and northern Tasmania (NFP), Western Australia (STf and STBA) and in Victoria (with APP). Project A2 is working on research projects with STBA/FT/FCP on geographic genetic variation in *E. nitens*.

Project A5 (Wood quality) led by Ms Carolyn Raymond in Tasmania has strong links with CSIRO scientists in Melbourne in research on Silviscan, cellulose content analysis and Near Infrared Reflectance Analysis, as well as with Project A3 (Molecular approaches to tree breeding) led by Dr Gavin Moran. There are also strong links with FT and NET with joint projects, and with Mr Peter Kube from FT undertaking PhD studies with the centre.

There is a strong link between Projects A6 and A7 with frequent inter-site visits and an annual northern node meeting involving both research groups. Several projects involve collaboration between the Genetic Improvement Program (Projects A1 and A3) and the Sustainable Management Program, and there is increasing linkage between the Genetic Improvement Program and the Resource Protection Program on the genetics of pest and disease resistance.

- Effective mating, selection and deployment strategies in tree improvement programs

Project A2 (Breeding strategies) led by Mr Greg Dutkowski is a major channel by which research results from the southern node projects are flowed into breeding and deployment strategies. It has strong links with most industrial partners and is intimately linked with STBA's *Eucalyptus* Breeding Program. It is enhanced by the co-location of STBA's Eucalypt Deployment Program Manager, Mr Peter Gore, on the University of Tasmania campus. Mr Greg Dutkowski is on the Board, the Technical Committee, and the Quantitative Genetics, Data Management and Research subcommittees of STBA, as well as being involved in strategy reviews for the major STBA breeding programs. There have been 8 presentations made to, or on behalf of, STBA by CRC staff.

- Pruning and thinning

Dr Mark Lewty (QFRI) and Dr Chris Beadle (CSIRO) organised a national workshop to consider issues relating to pruning and thinning with specific strategies for managing plantations for high-value products.

- The dynamics and cycling of organic matter and nitrogen in soils in response to silvicultural treatments

There has been a history of close interaction between Project B1 (Site productivity), led by Dr Philip Smethurst and Project B2 (Management of tropical soils) led by Dr Zihong Xu, as they both cover organic matter and nutrient cycling. National links in these studies were assisted by Dr Philip Smethurst being the chair of the Programme Committee for the 18th biennial conference of the Institute of Foresters of Australia 'Practising forestry today', which had a strong nutritional component.

- Key issues which affect landowners' decision-making

Digby Race (ANU) and Amabel Fulton (UT) organised a Forestry Colloquium 'Socio-economic research to create successful farm forestry' held in Canberra in March 2000. This attracted sponsorship from RIRDC and was supported by farm forestry interests throughout Australia.

- Prediction of productivity in response to environmental factors and management inputs

In association with PFT and FT, the CRC has developed version 2 of the Farm Forestry Toolbox CD

which incorporates PROMOD as a decision support system for farmers. The CD was launched by the Tasmanian Deputy Premier, Hon Paul Lennon. In cooperation with QFRI staff, Dr Peter Sands has assisted in the implementation and application of the site productivity model 3-PG.

- Investigation of pathogens of forest insect pests

This research in Tasmania has essentially concluded following the retirement of John Madden, honorary member of the CRC. Industry was satisfied with the progress that had been made and was keen for other areas to be pursued.

- Studies of the ecology and behaviour of insect herbivores in temperate Australia

A Symposium on Insect–Eucalypt Interactions was held in Canberra in February 2000 which brought together researchers from all CRC-SPF locations as well as about 40 other delegates to discuss the research directions and challenges on this topic. A Technical Report has been produced that summarises the outcomes of the meeting and 14 papers are being edited for the proceedings to be published in *Austral Ecology*.

Links between Dr Martin Steinbauer and Dr Rob Floyd in Canberra and Zoltan Lukacs in Hobart have led to the conclusion of Zoltan's PhD project on the phenology of autumn gum moth. Other cooperation on the biology and ecology of autumn gum moth is taking place between Canberra staff and Dr Andrew Loch in Western Australia.

Dr Andrew Loch is cooperating with staff at Forestry Tasmania and North Forest Products on chrysomelid leaf beetle control and surveillance and monitoring of foliage feeding pests.

- Impact of insect pests at plantation establishment

Mr John Matthiessen (Western Australia) and Dr Marina Hurley (Tasmania) collaborated to develop a project with industry partners to determine the key issues of this establishment pest problem. In June 1999, funding was obtained from the CRC-SPF's Strategic Initiative Fund to initiate systematic investigations into establishment pests of *Eucalyptus* in Western Australia and Tasmania. This work was carried out by Ms Tara Simmul who conducted field work in both locations. The findings were published in a technical report:

Hurley M, Matthiessen J and Simmul T (2000) Initiating systematic investigation of the biology and management of establishment insect pests in *Eucalyptus* plantations - linking Western Australia and *Tasmania*. CRC-SPF Technical Report No 35.

- Genetic and chemical basis of eucalypt resistance to browsing

Strong collaboration between Projects A1 (Dr Brad Potts) and C3 (Dr Clare McArthur, Ms Julianne O'Reilly) within the CRC and with Dr WJ Foley at ANU is continuing in research on the genetic and chemical basis of resistance of eucalypt foliage to browsing by herbivores. As a result of a grant from the CRC-SPF Strategic Initiative Fund, a large CRC Technical Report (No. 32) on the genetic and chemical basis of resistance of *E. globulus* has been completed. Furthermore, Ms Julianne O'Reilly has begun post-graduate research towards a Master of Science degree, co-supervised by Dr Clare McArthur and Dr Brad Potts, investigating the genetic and chemical basis to browsing resistance in *E. nitens*.

Research and Researchers

- *Papers in refereed journals.*

In 1999/00 the Centre produced 90 publications in refereed journals, 99 unrefereed publications and 12 theses.

- *Books and book chapters covering the results of the Centre's research*

Books:

Eds HS Dungey, MJ Dieters, and DG Nikles (2000) Hybrid Breeding and genetics of Forest Trees. Proceedings of QFRI/CRC-SPF Symposium 9-14 April, Noosa, Queensland. (Department of Primary Industries: Brisbane, Queensland)

Book chapters:

Glaubitz JC, Moran GF (2000) Genetic Tools. In 'Forest Conservation Genetics: Principles and Practice'. (Eds A Young, T Boyle, and D Boshier) (CSIRO Publishing: Collingwood)

- *Invitations to present keynote addresses and papers at conferences*

R Vaillancourt (1999). Genetic modifications of plants - the process. Royal Society of Tasmania Public Symposium, 'Your Food and Your Health: Impact of Molecular Genetics', September 7 1999, Hobart.

P Sands (2000). Presentation at '3 PG 2000: A workshop on the forest growth model 3 PG', February 15-16 2000, Brisbane.

H Dungey (2000). Presentation at 'Symposium on Insect-Eucalypt Interactions', February 7-8, 2000, Canberra.

B Potts (2000). Presentation at 'Symposium on Insect-Eucalypt Interactions', February 7-8, 2000, Canberra.

R Haines (2000). Presentation at 'CRC/QFRI Symposium on Hybrid Breeding and Genetics of Forest Trees', 9-14 April 2000, Noosa.

R Henry (2000). Presentation at 'CRC/QFRI Symposium on Hybrid Breeding and Genetics of Forest Trees', 9-14 April 2000, Noosa.

G Moran (2000). Presentation at 'CRC/QFRI Symposium on Hybrid Breeding and Genetics of Forest Trees', 9-14 April 2000, Noosa.

G Nikles (2000). Presentation at 'CRC/QFRI Symposium on Hybrid Breeding and Genetics of Forest Trees', 9-14 April 2000, Noosa.

B Potts (2000). Presentation at 'CRC/QFRI Symposium on Hybrid Breeding and Genetics of Forest Trees', 9-14 April 2000, Noosa.

- *Number and value of competitive grants awarded*

Seven nationally competitive grants were awarded to CRC staff during the last financial year, totalling $646 454

- *Honours and awards*

There were 6 awards to staff or students of the CRC (see Grants and Awards)

Dr H Dungey - Travel grant to USA - Australian Academy of Sciences

Mr D Close - Travel grant to Budapest - Queen's trust for Young Australians

Ms K Le Mar - Travel grant within Australia - Australian Wildlife Management Soc.

Ms R Jones - J Malcolm Giles Honours Scholarship - University of Tasmania

Ms M McGowen - HN Barber Honours Scholarship - University of Tasmania

Mr H Hancock - HN Barber Honours Scholarship - University of Tasmania

Education and Training

- *Time spent by researchers on research training*

We have 77 postgraduate and honours students affiliated with the CRC. It is recognised that each student takes 5-10% of a researcher's time to supervise. This is equivalent to 3.85 to 7.7 person-years on research training.

- *Number of postgraduate students working in the Centre*

The Centre has 66 postgraduate students and 10 honours students (see Table 2).

- *Number of postgraduate students trained in the areas specified*

Genetic Improvement	31
Sustainable Management	27
Resource Protection	19

- *Number of enrolments in special courses*

A special undergraduate course, Forest Ecology, has 9 students enrolled and one was enrolled in Forest Ecology honours this year. In addition there was an ASREML course, run by Mr Greg Dutkowski, and 24 workshops (see Technology Transfer Table).

- *Quality and number of post-doctoral fellows attracted*

Twelve postdoctoral fellows worked with the Centre in 1999/00: Dr K Thamarus in molecular genetics (CSIRO FFP, Canberra); Dr M Steinbauer in entomology (CSIRO Entomology); Dr M Shepherd in

molecular biology (SCU); Dr H Dungey in forest genetics (QFRI); Dr N Prasalova in soil nutrition (GU), Dr D Steane and Dr B Patterson both in molecular genetics (UT), Dr F Henskens in canopy nitrogen dynamics (CSIRO FFP, Hobart), Dr A Loch in pest management of Blue Gums (CSIRO Entomology), Dr S Resh in biomass partitioning to roots and root respiration (CSIRO FFP, Hobart), Dr A Mitchell (CSIRO FFP) on availability of base cations, and Ms J Medhurst (CSIRO FFP) on blackwood physiology and silviculture.

- *Rate and percentage of completion of higher degrees*

16 students completed Honours or PhD this year
Hons: Mr T Jones, Mr R Barbour, Mr D Kearney, Mr R Mellick, Mr A Rumley, Ms J Schirmer, Ms C Turner, Mr J Freeman, Ms S Baker and Mr S Smith.
PhD: Mr S Candy, Mr J Bulinski, Mr P Chambers, Ms M McGranahan, Mr M Moroni, Mr D Williams.

- *Acceptance and employment by the forestry community of students on completion of their studies*

The success of our students in obtaining employment in the forest industry was demonstrated by appointments over the last year: Ms S Scott (Fisheries and Forestry, Canberra), Ms J Sprent (Primate Keeper, London Zoo), Ms N Marsh (Manager, Timbercorp, Hamilton Victoria), Dr J Bulinski (Project Manager, Treefarm Services Timbercorp, Albany, WA), Dr T Garnett (Postdoc, UA), Mr P Adams (Forest Nutrition, FT), Mr P Bundock (Molecular Research, SCU), Dr P Chambers (Postdoc in quantitative genetics, UT), Dr X Wei (Research Scientist, CSIRO), Dr B Greaves and Ms M McGranahan (private consultants in forestry).

Application of Research

- *Degree of adoption of research results by industry*

There were 22 items of CRC technology taken up by industry this year (see Industry Uptake in Utilisation and Application of Research).

- *Quality and relevance of technical publications targeted to user groups.*

There were 18 reports produced in the CRC Technical Report series this year. In addition there were ten technical news sheets released ('Hot off the Seed Bed', 'Beyond the Black Stump' and 'Pest Off') and articles in partner news sheets.

- *Extent of advice and consultancy services provided to industry and government*

Thirteen consultancies were conducted during 1999/00 (see Grants and Awards and Consultancies). Advice is also provided through participation on national committees. For example, Mr G Dutkowski (GI) is on the Technical Committee of STBA and three subcommittees of the STBA Technical Committee; he is also a member of Research Working Group 1 (RWG1, Forest Genetics). Dr Brad Potts (GI) is a member of RGW1, is on the subcommittee on Forest Genetic Resources, on the Biodiversity Advisory Panel for the Tasmanian Government 'State of the Environment' Report, and was invited by RIDC to review the effect of genetic pollution from farm forestry activities in Australia. Dr Philip Smethurst (SM) was chairman of RWG3, Soils and Nutrition. Dr Clare McArthur (RP) has close links with industry through the Browsing Damage Management Group (BDMG) (see Grants and Awards).

- *Number of presentations to companies or user groups*

There were 71 seminars/presentations, 24 workshops, 1 short course, 9 field days, 18 research group meetings specially aimed at our end users (see Table 4, Technology Transfer Activities, Utilisation and Application of Research). There were also major presentations such as the 'Symposium on Insect-Eucalypt Interactions', 'Symposium on Hybrid Breeding and Genetics of Forest Trees' and a Farm Forestry Colloquium 'Socio-economic Research to Support Successful Farm Forestry'. In addition there were 85 presentations to conferences (see Public Presentations) and 4 talks to school groups.

- *Number and financial contribution of potential users*

The CRC-SPF has 19 partners, which includes most of the major wood producing companies in Australia. Each partner commits cash and/or in-kind contributions to the CRC (see financial tables). In addition, partners may provide funds to support particular projects (see table on Grants and Awards). Other end users of our technology, e.g. Greening Australia and Private Forests Tasmania, have given in-kind support in running technology transfer exercises to farmer groups.

- *Number of visitors from user groups*

As the partners in the Centre represent our main user group, many of the 660 person-days involved in within-CRC visits (see Performance Indicator 2 under Cooperative Arrangements) involve users of the technology we are developing.

- *Number of media or trade journal presentations*

There were 6 media and/or trade journal presentations about the CRC this year.

- *Number of seminars, workshops and field days organised to transfer results to industry and the public, including the level of response*

There were two symposia 'Symposium on Insect-Eucalypt Interactions', 'Symposium on Hybrid Breeding and Genetics of Forest Trees' a Farm Forestry Colloquium, 71 seminars/presentations, 24 workshops, 1 short course, 9 field days, 18 research group meetings organised to transfer results to industry and the public this year. An estimated 2700 people attended these activities.

Management and Budget

- *Establish procedures to report on progress and achievements*

There have been plans set in place; Strategic Plan and Business Plan, and a set of 'deliverables' agreed upon to meet industry expectations of progress in research areas. There are also established checks and balances on the quality and quantity of research and its value to industry through Program Coordinating Committees, the Advisory Panel, the Board and the Annual Report.

- *Timely and accurate reporting of progress*

The CRC reports in a timely and accurate manner against the 'deliverables' set for industry and the milestones set by each project and program. These are reported to the Program Coordinating Committees (quarterly report on research 'deliverables'), the Advisory Panel, the Board, and in the Annual Report.

- *Extent of staff turnover*

There were 14 changes to staffing in the CRC (see Staffing and Administration).

- *Proportion of projects completing milestones within the planned time and budget*

All projects have completed milestones within the planned time and budget with the exception of two that were agreed by industry as no longer relevant to their needs because they can be addressed through alternative strategies (deliverables).

- *Accurate recording and reporting of financial transactions*

The Centre has implemented the following management and budgetary systems: triennium budgeting, monthly reporting of financial accounts (to program managers and project leaders), quarterly reporting of in-kind contributions of partner organisations (to the Board), annual external audit of the financial accounts, and an Annual Report.

Budget

Notes to and forming part of the accounts for 1999/00

Summary of significant accounting policies
All funds under the Cooperative Research Centre's control are administered through the University of Tasmania's Financial Management Information System (FMIS).

The principal accounting policies adopted in preparing the accounts of the unincorporated entity are detailed hereunder.

(a) Basis of accounting and principles of consolidation
The cash accounts have been prepared on the basis of historic costs. Cost in respect to the cash contributions and expenditure is the cash sum exchanged in the financial year determined from transactions recorded on the FMIS.

In-kind amounts are the economic values of goods and services declared by each of the joint venture partners and accepted by the entity as being valid.

(b) Interest
Interest is calculated and paid by the University based on the lowest quarterly balance being held on the FMIS on behalf of the entity.

(c) Assets and depreciation
Plant and equipment assets are recorded on the University's asset register in the name of the entity as they are acquired. Their entire cost is expensed in the year of purchase and depreciation is not provided for.

Capital expenditure relates to costs associated with buildings. These costs are also expensed and depreciation is not provided for.

(d) Employee entitlements
Provision has been made for pro-rata entitlements to annual and long service leave.

(e) Partner contributions
Budget estimates of contributions are taken from the original Commonwealth Agreement and actual figures are provided by the partners.

(f) Allocation from Commonwealth Grant
During 1999/00 the CRC received the usual four quarterly grant payments.

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INDEPENDENT AUDIT REPORT TO THE COOPERATIVE RESEARCH CENTRES PROGRAM, DEPARTMENT OF INDUSTRY, SCIENCE AND RESOURCES REPRESENTING THE COMMONWEALTH IN RESPECT OF THE COOPERATIVE RESEARCH CENTRE FOR SUSTAINABLE PRODUCTION FORESTRY

FINANCIAL INFORMATION FOR THE YEAR ENDED 30 JUNE 2000

Scope

We have audited the financial information of the Cooperative Research Centre for Sustainable Production Forestry as set out in Tables 1 to 4 of the Annual Report for the year ended 30 June 2000. The Parties to the Cooperative Research Centre are responsible for the preparation and presentation of the financial information. We have conducted an independent audit of the financial information in order to express an opinion on it to the parties of the Cooperative Research Centre for Sustainable Production Forestry.

The financial information has been prepared for the parties to the Cooperative Research Centre for Sustainable Production Forestry for the purposes of fulfilling their annual reporting obligations under clause 14(1)(f) of the Commonwealth Agreement and for distribution to the Cooperative Research Centres Program, Department of Industry, Science and Resources, representing the Commonwealth of Australia. We disclaim any assumption of responsibility for any reliance on this report or on the financial information to which it relates to any person other than those mentioned above, or for any purpose other than that for which it was prepared.

Our audit has been conducted in accordance with Australian Auditing Standards to provide reasonable assurance as to whether the financial information is free of material misstatement. Our procedures included examination, on a test basis, of evidence supporting the amounts and other disclosures in the financial information, and the evaluation of accounting policies and significant accounting estimates. These procedures have been undertaken to form an opinion whether, in all material respects, the financial information is presented fairly in accordance with Australian accounting concepts and standards and requirements of the Commonwealth Agreement in terms of Clauses 4, 5(1), 5(2), 5(3), 9(1), 9(5) and 12(2), so as to present a view of the sources of funding and the application of funding of the Cooperative Research Centre for Sustainable Production Forestry and the application of which is consistent with our understanding of its financial activities during the year and its financial position.

While we have not performed any audit procedures upon the estimates for the next period and do not express any opinion thereon, we ascertained that they have been formally approved by the Board of Management as required under the Joint Venture Agreement

The audit opinion expressed in this report has been formed on the above basis.

Audit Opinion

1. The multipliers adopted by the Centre to value in-kind contributions other than salary costs have a sound and reasonable basis and each partner's component of the Researcher's Contributions for the year under report has been provided at least to the value for that year committed in the Budget as specified in the Agreement, and the total value of all contributions for the year under report equalled or exceeded the amount of grant paid during the year.

2. The Researcher has used the grant and the Researcher's contributions for the Activities of the Centre and in my professional opinion there appear to be no material reporting irregularities.

3. The Researcher's allocations of the budgetary resources between Heads of Expenditure has not been lower or higher than the allocation in the budget by $100,000 or 20% (whichever is the greater amount) without prior approval by the Commonwealth.

4. Capital Items acquired from the Grant and Researcher's Contributions are vested as provided in the Joint Venture Agreement.

5. Intellectual Property in all Contract Material is vested as provided in the Joint Venture Agreement and no Intellectual Property has been assigned or licensed without the prior approval of the Commonwealth.

6. Proper accounting standards and controls have been exercised in respect of the Grant and Researcher's Contributions and income and expenditure in relation to the Activities of the Centre have been recorded separately from other transactions of the Researcher.

Deloitte Touche Tohmatsu

DELOITTE TOUCHE TOHMATSU

Steven A Hernyk
Partner

Chartered Accountants
Hobart, 6 September 2000

Co-operative Research Center for Sustainable Production Forestry
Summary of Base Grant Funds 1999/2000

Opening Balance at 1/7/99	1,338,121
Add Income	2,882,862
Less Expenditure	
Salaries and associated costs	1,503,437
Consumables	915,389
Equipment	58,957
Total Expenditure	2,477,783
Closing Balance at 30/6/99	1,743,200

IN-KIND CONTRIBUTIONS FROM PARTNERS ($000's)

ATTACHMENT C
TABLE 1
GRAND TOTAL

PARTNER		EXPENDITURE Actual 1997/98 Actual	1998/99 Actual	1999/00 Actual	1999/00 Agr'mt	Cumulative TOTAL TO DATE Actual	Agr'mt	Budget 2000/01 Budget	2000/01 Agr'mt	2001/02 Budget	2001/02 Agr'mt	2002/03 Budget	2002/03 Agr'mt	2003/04 Budget	2003/04 Agr'mt	TOTAL 7 Years	Agreement 7 years	Difference 7 years
AUSTRALIAN PAPER PLANTATIONS PTY LTD																		
	SALARIES	65.8	83.2	58.3	85.0	207.3	255.0	90.3	85.0	92.9	85.0	95.7	85.0	98.6	**85.0**	**584.7**	**595.0**	**-10.3**
	CAPITAL	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	0.0	0.0	0.0
	OTHER	135.5	124.8	108.4	121.0	368.7	363.0	128.4	121.0	132.2	121.0	136.2	121.0	140.3	**121.0**	**905.8**	**847.0**	**58.8**
	TOTAL	201.3	208.0	166.7	206.0	576.0	618.0	218.6	206.0	225.1	206.0	231.9	206.0	238.9	**206.0**	**1,490.5**	**1,442.0**	**48.5**
CSIRO ENTOMOLOGY																		
	SALARIES	163.2	148.6	216.4	152.0	528.2	456.0	330.0	152.0	326.5	152.0	157.1	152.0	137.5	152.0	1,279.1	1,064.0	215.1
	CAPITAL	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	0.0	0.0	0.0
	OTHER	239.7	254.1	260.9	273.0	754.7	819.0	275.5	273.0	369.2	273.0	276.6	273.0	260.4	273.0	1,836.4	1,911.0	-74.6
	TOTAL	402.9	402.7	477.3	425.0	1,282.9	1,275.0	505.5	425.0	495.7	425.0	433.7	425.0	397.7	425.0	3,115.5	2,975.0	140.5
CSIRO FORESTRY and FOREST PRODUCTS																		
	SALARIES	652.6	691.1	679.7	618.0	2,023.4	1,942.0	694.8	618.0	712.1	618.0	729.9	618.0	748.2	618.0	4,908.4	4,414.0	494.4
	CAPITAL	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	0.0	0.0	0.0
	OTHER	1,410.0	1,495.8	1,460.1	1,345.0	4,365.9	4,200.0	1,495.6	1,345.0	1,527.8	1,345.0	1,560.8	1,345.0	1,594.6	1,345.0	10,544.7	9,580.0	964.7
	TOTAL	2,062.6	2,186.9	2,139.8	1,963.0	6,389.3	6,142.0	2,190.4	1,963.0	2,239.9	1,963.0	2,290.7	1,963.0	2,342.8	1,963.0	15,453.1	13,994.0	1,459.1
FLETCHER CHALLENGE PAPER																		
	SALARIES	34.0	21.1	23.7	28.0	78.8	81.0	25.1	28.0	25.1	28.0	25.1	28.0	25.1	28.0	179.2	193.0	-13.8
	CAPITAL	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	0.0	0.0	0.0
	OTHER	186.0	171.0	199.0	161.0	556.0	493.0	184.0	161.0	184.0	161.0	180.0	161.0	180.0	161.0	1,284.0	1,137.0	147.0
	TOTAL	220.0	192.1	222.7	189.0	634.8	574.0	209.1	189.0	209.1	189.0	205.1	189.0	205.1	189.0	1,463.2	1,330.0	133.2
FORESTRY TASMANIA																		
	SALARIES	137.0	157.0	168.0	112.0	462.0	307.0	206.7	124.0	227.3	136.0	250.1	149.0	275.2	164.0	1,441.3	880.0	561.3
	CAPITAL	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	0.0	0.0	0.0
	OTHER	179.1	168.6	239.7	139.0	587.4	380.0	363.7	152.0	290.0	168.0	319.1	185.0	351.0	203.0	1,811.2	1,088.0	723.2
	TOTAL	316.1	325.6	427.7	241.0	1,069.4	687.0	470.4	276.0	517.3	304.0	569.2	334.0	626.2	367.0	3,252.5	1,968.0	1,284.5
GRIFFITH UNIVERSITY																		
	SALARIES	163.7	108.8	109.9	126.5	382.4	389.5	103.0	126.5	104.5	126.5	104.5	126.5	104.5	126.5	798.9	895.5	-96.6
	CAPITAL	0.0	20.0	20.0	0.0	40.0	0.0	20.0	-	20.0	-	20.0	-	20.0	-	120.0	0.0	120.0
	OTHER	150.6	116.5	117.6	116.4	384.7	349.2	110.2	116.4	111.8	116.4	111.8	116.4	111.8	116.4	830.3	814.8	15.5
	TOTAL	314.3	245.3	247.5	242.9	807.1	738.7	233.2	242.9	236.3	242.9	236.3	242.9	236.3	242.9	1,749.2	1,710.3	38.9
NORTH FOREST PRODUCTS																		
	SALARIES	263.0	252.2	154.7	100.0	669.9	300.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	1,069.9	700.0	369.9
	CAPITAL	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	0.0	0.0	0.0
	OTHER	369.0	312.6	158.3	216.0	839.9	648.0	216.0	216.0	216.0	216.0	216.0	216.0	216.0	216.0	1,703.9	1,512.0	191.9
	TOTAL	632.0	564.5	313.0	316.0	1,509.8	948.0	316.0	316.0	316.0	316.0	316.0	316.0	316.0	316.0	2,773.8	2,212.0	561.8
PRIMARY INDUSTRIES CORP'N (QFRI)																		
	SALARIES	449.8	421.5	416.9	322.0	1,288.2	966.0	390.8	322.0	396.8	322.0	390.8	322.0	390.8	322.0	2,851.4	2,254.0	597.4
	CAPITAL	28.4	0.0	0.0	0.0	28.4	0.0	-	-	-	-	-	-	-	-	28.4	0.0	28.4
	OTHER	526.0	384.2	426.8	380.0	910.2	1,140.0	381.3	380.0	381.3	380.0	381.3	380.0	381.3	380.0	2,435.4	2,660.0	-224.5
	TOTAL	1,004.2	805.7	843.7	702.0	2,226.8	2,106.0	772.1	702.0	772.1	702.0	772.1	702.0	772.1	702.0	5,315.2	4,914.0	401.2
SOTICO TREEFARMS PTY LTD																		
	SALARIES	65.9	71.4	62.8	55.0	200.1	165.0	63.8	55.0	63.8	55.0	63.8	55.0	63.8	55.0	455.3	385.0	70.3
	CAPITAL	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	0.0	0.0	0.0
	OTHER	107.3	113.1	113.4	115.0	333.8	345.0	115.0	115.0	115.0	115.0	115.0	115.0	115.0	115.0	793.8	805.0	-11.2
	TOTAL	173.2	184.5	176.2	170.0	533.9	510.0	178.8	170.0	178.8	170.0	178.8	170.0	178.8	170.0	1,249.1	1,190.0	59.1
SOUTHERN CROSS UNIVERSITY																		
	SALARIES	62.9	68.0	70.2	60.0	201.1	180.0	72.3	60.0	75.0	60.0	78.9	60.0	81.5	60.0	508.8	420.0	88.8
	CAPITAL	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	0.0	0.0	0.0
	OTHER	189.7	287.8	300.5	249.0	778.0	747.0	315.5	249.0	328.8	249.0	344.6	249.0	282.7	249.0	2,049.6	1,743.0	306.6
	TOTAL	252.6	355.8	370.7	309.0	979.1	927.0	387.8	309.0	403.8	309.0	423.5	309.0	364.3	309.0	2,558.4	2,163.0	395.4

TABLE 1

EXPENDITURE

PARTNER		Actual 1997/98 Actual	Actual 1998/99 Actual	Actual 1999/00 Actual	1999/00 Agr'mt	Cumulative TOTAL TO DATE Actual	Agr'mt	Budget 2000/01 Budget	2000/01 Agr'mt	2001/02 Budget	2001/02 Agr'mt	2002/03 Budget	2002/03 Agr'mt	2003/04 Budget	2003/04 Agr'mt	GRAND TOTAL TOTAL 7 Years	GRAND TOTAL Agreement 7 years	GRAND TOTAL Difference 7 years
*SILVAGENE **																		
	SALARIES	0.0	0.0	20.6	23.5	20.6	23.5	93.8	93.8	93.8	93.8	93.8	93.8	93.8	93.8	395.8	398.7	-2.9
	CAPITAL	0.0	0.0	2.0	0.0	2.0	0.0	-	-	-	-	-	-	-	-	2.0	0.0	2.0
	OTHER	5.0	5.0	5.0	5.0	15.0	15.0	220.5	220.5	220.5	220.5	220.5	220.5	220.5	220.5	897.0	897.0	0.0
	TOTAL	5.0	5.0	27.6	28.5	37.6	38.5	314.3	314.3	314.3	314.3	314.3	314.3	314.3	314.3	1,294.8	1,295.7	-0.9
UNIVERSITY OF TASMANIA																		
	SALARIES	385.4	402.7	410.5	386.7	1,198.6	1,160.1	433.5	386.7	433.5	386.7	433.5	386.7	433.5	386.7	3,932.6	2,706.9	225.7
	CAPITAL	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	0.0	0.0	0.0
	OTHER	703.1	825.3	792.4	762.0	2,320.8	2,227.0	1,131.2	763.0	1,131.2	763.0	1,131.2	763.0	1,131.3	763.0	6,845.6	5,279.0	1,566.6
	TOTAL	1,088.5	1,228.0	1,202.9	1,149.7	3,519.4	3,387.1	1,564.7	1,149.7	1,564.7	1,149.7	1,564.7	1,149.7	1,564.7	1,149.7	9,778.2	7,985.9	1,792.3
THE AUSTRALIAN NATIONAL UNIVERSITY																		
	SALARIES	59.2	59.2	62.6	63.8	181.0	191.4	62.6	63.8	62.6	63.8	62.6	63.8	62.6	63.8	431.4	446.6	-15.2
	CAPITAL	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	0.0	0.0	0.0
	OTHER	177.7	177.7	187.8	112.0	543.2	336.0	187.8	112.0	187.8	112.0	187.8	112.0	187.8	112.0	1,294.4	784.0	510.4
	TOTAL	236.9	236.9	250.4	175.8	724.2	527.4	250.4	175.8	250.4	175.8	250.4	175.8	250.4	175.8	1,725.8	1,230.6	495.2
BORAL TIMBER TASMANIA																		
	SALARIES	6.4	34.5	28.4	5.0	59.3	15.0	28.0	5.0	2.6	5.0	2.6	5.0	2.6	5.0	95.1	25.0	60.1
	CAPITAL	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	0.0	0.0	0.0
	OTHER	34.6	42.0	13.3	35.0	90.1	105.0	22.0	35.0	33.6	35.0	33.6	35.0	33.6	35.0	212.9	245.0	-32.1
	TOTAL	41.2	66.5	41.7	40.0	149.4	120.0	50.0	40.0	36.2	40.0	36.2	40.0	36.2	40.0	308.0	280.0	28.0
PRIVATE FORESTS TASMANIA PTY LTD																		
	SALARIES	0.0	0.0	10.2	4.1	10.2	4.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	42.7	36.6	6.1
	CAPITAL	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	0.0	0.0	0.0
	OTHER	0.0	0.0	17.2	8.1	17.2	8.1	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	82.2	73.1	9.0
	TOTAL	0.0	0.0	27.4	12.2	27.4	12.2	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	124.9	109.7	15.2
THE UNIVERSITY OF QUEENSLAND																		
	SALARIES	8.6	23.6	24.3	25.0	56.5	75.0	24.6	25.0	24.8	25.0	25.0	25.0	25.0	25.0	155.9	175.0	-19.1
	CAPITAL	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	0.0	0.0	0.0
	OTHER	10.0	47.0	47.0	47.0	104.0	141.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	292.0	329.0	-37.0
	TOTAL	18.6	70.6	71.3	72.0	160.5	216.0	71.6	72.0	71.8	72.0	72.0	72.0	72.0	72.0	447.9	504.0	-56.1
AUSTRALIAN FOREST GROWERS																		
	SALARIES	1.1	1.1	1.3	0.0	3.5	0.0	1.1	0.0	1.1	0.0	1.1	0.0	1.1	0.0	7.9	0.0	7.9
	CAPITAL	0.0		0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	0.0	0.0	0.0
	OTHER	0.3	0.3	0.3	1.0	0.9	3.0	0.3	1.0	0.3	1.0	0.3	1.0	0.3	1.0	2.1	7.0	-4.9
	TOTAL	1.4	1.4	1.6	1.0	4.4	3.0	1.4	1.0	1.4	1.0	1.4	1.0	1.4	1.0	10.0	7.0	3.0
SERVE-AG PTY LTD																		
	SALARIES	0.0	0.0	10.5	3.8	10.5	3.8	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	40.5	33.8	6.8
	CAPITAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	OTHER	0.0	0.0	21.5	5.6	21.5	5.6	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	66.5	50.6	15.9
	TOTAL	0.0	0.0	32.0	9.4	32.0	9.4	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	107.0	84.4	22.6
SOUTHERN TREE BREEDING ASS'N																		
	SALARIES	6.0	6.0	14.8	0.0	26.8	0.0	13.0	0.0	13.0	0.0	13.0	0.0	13.0	0.0	78.8	0.0	78.8
	CAPITAL	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	0.0	0.0	0.0
	OTHER	0.0	37.0	0.0	5.0	37.0	15.0	0.0	5.0	0.0	5.0	0.0	5.0	0.0	5.0	37.0	35.0	2.0
	TOTAL	6.0	43.0	14.8	5.0	63.8	15.0	13.0	5.0	13.0	5.0	13.0	5.0	13.0	5.0	115.8	35.0	80.8
TOTAL IN-KIND CONTRIBUTIONS																		
	SALARIES	2,524.6	2,560.0	2,563.8	2,195.3	7,684.9	6,589.3	2,648.9	2,260.4	2,665.0	2,272.4	2,643.1	2,285.4	2,672.3	2,300.4	18,413.6	15,808.0	2,605.6
	CAPITAL	28.4	20.0	22.0	0.0	70.4	0.0	20.0	0.0	20.0	0.0	20.0	0.0	20.0	0.0	150.4	0.0	150.4
	OTHER	4,423.8	4,562.8	4,469.2	4,097.2	13,029.0	12,340.0	5,121.5	4,339.4	5,204.0	4,355.4	5,289.3	4,372.4	5,281.0	4,390.4	23,924.8	29,797.6	4,127.2
GRAND TOTAL IN-KIND		**6,976.8**	**7,122.8**	**7,055.0**	**6,292.5**	**20,784.3**	**18,929.3**	**7,790.4**	**6,599.8**	**7,889.1**	**6,627.8**	**7,952.4**	**6,657.8**	**7,973.2**	**6,690.8**	**52,488.8**	**45,605.6**	**6,883.2**

* Please note: Budget and Agreement figures from 2000/01 are those of Timbercorp Limited.

CASH CONTRIBUTIONS ($000's)

ATTACHMENT C TABLE 2

	ACTUAL			CUMULATIVE		BUDGET								GRAND TOTAL		
	1997/98	1998/99	1999/2000	Total to date		2000/01	2000/01	2001/02	2001/02	2002/03	2002/03	2003/04	2003/04	Total	Agr'mt	Diff
PARTNERS	Actual	Actual	Actual	Actual	Agr'mt	Budget	Agr'mt	Budget	Agr'mt	Budget	Agr'mt	Budget	Agr'mt	7 yrs	7 yrs	7 yrs
Australian Paper Plantations Pty Ltd	35.0	35.6	35.0	105.6	105.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	245.6	245.0	0.6
CSIRO	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-
Fletcher Challenge Paper	22.4	20.8	20.0	63.2	60.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	143.2	140.0	3.2
Forestry Tasmania	22.5	19.3	15.0	56.8	45.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	116.8	105.0	11.8
Griffith University	25.0	26.2	25.0	76.2	75.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	176.2	175.0	1.2
North Forest Products	65.1	50.0	30.0	145.1	125.0	20.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	240.1	225.0	15.1
Primary Industries Corporation (QFRI)	25.0	50.3	0.0	75.3	75.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	175.3	175.0	0.3
Silvagene *	0.0	0.0	0.0	0.0	0.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	200.0	200.0	-
Sotico Treefarms Pty Ltd	35.0	36.2	35.0	106.2	105.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	246.2	245.0	1.2
Southern Cross University	100.0	100.3	100.0	300.3	300.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	700.3	700.0	0.3
University of Tasmania	0.0	0.3	0.0	0.3	-	-	-	-	-	-	-	-	-	0.3	-	0.3
Australian National University	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-
Boral Timber Tasmania Ltd	0.0	2.2	0.0	2.2	0.0	-	-	-	-	-	-	-	-	2.2	-	2.2
Private Forests Tasmania	0.0	0.0	0.0	0.0	10.0	30.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	90.0	90.0	
The University of Queensland	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-
Australian Forest Growers	1.0	1.0	1.0	3.0	3.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	7.0	7.0	-
Forest Enterprises Australia Pty Ltd	0.0	0.0	0.0	0.0	1.5	4.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	13.5	13.5	
Serve-Ag Pty Ltd	0.0	0.0	0.0	0.0	0.5	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	4.5	4.5	
Southern Tree Breeding Association Incorporated	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-
TOTAL CASH FROM PARTICIPANTS	331.0	342.2	261.0	934.2	905.0	362.0	355.0	355.0	355.0	355.0	355.0	355.0	355.0	2,361.2	2,325.0	36.2
OTHER CASH																
Interest	20.4	67.5	67.9	155.8	0.0	30.0	0.0	30.0	0.0	30.0	0.0	30.0	0.0	275.8	-	275.8
Non-participants	7.8	23.4	11.0	42.2	0.0	-	-	-	-	-	-	-	-	42.2	-	42.2
Other external funds	0.0	0.0	214.6	214.6	0.0	62.8	-	-	-	-	-	-	-	277.4	-	277.4
CRC Grant	1,718.1	2,313.0	2,328.4	6,359.5	6,280.0	2,322.0	2,300.0	2,345.2	2,300.0	2,368.6	2,300.0	2,392.3	2,300.0	595.4	590.0	595.4
TOTAL CRC CASH CONTRIBUTION	2,077.3	2,746.1	2,882.9	7,706.3	7,185.0	2,776.8	2,655.0	2,730.2	2,655.0	2,753.6	2,655.0	2,777.3	2,655.0	3,552.1	2,325.0	1,227.1
Cash carried over from previous year	741.0	1,002.6	1,338.1			1,743.3	14.0	1,487.6	64.0	1,201.5	113.0	953.8	161.0			
Less unspent balance	1,002.6	1,338.1	1,743.3			1,487.6	64.0	1,201.5	113.0	953.8	161.0	1,614.9	213.0			
TOTAL CASH EXPENDITURE	1,815.7	2,410.7	2,477.8	6,704.2	7,750.0	3,032.4	2,605.0	3,016.3	2,606.0	3,001.3	2,607.0	2,116.2	2,603.0	17,870.4	18,171.0	-301
ALLOCATION OF CASH EXPENDITURE BETWEEN HEADS OF EXPENDITURE																
SALARIES	1,288.9	1,686.4	1,503.4	4,478.7	5,135.0	2,070.6	1,700.0	2,125.0	1,701.0	2,100.0	1,702.0	1,409.9	1,703.0	12,184.2	11,941.0	243.2
CAPITAL	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-
OTHER	526.8	724.3	974.3	2,225.4	2,615.0	961.8	905.0	891.3	905.0	901.3	905.0	706.3	900.0	5,686.2	6,230.0	-544

* Please note: Budgeted cash contributions from 2000/01 as those of Timbercorp Ltd.

ALL PROGRAMS ($000's)

TABLE 3

	Actual			Cumulative		Projected								GRAND TOTAL		
	1997/98	1998/99	1999/00	Total to date		2000/01	2000/01	2001/02	2001/02	2002/03	2002/03	2003/04	2003/04			
	Actual	Actual	Actual	Actual	Agr'mt	Budget	Agr'mt	Budget	Agr'mt	Budget	Agr'mt	Budget	Agr'mt	Total	Agr'mt	Diff
CASH																
SALARIES	1,288.9	1,686.4	**1,503.4**	4,478.7	5,135.0	2,070.6	1,700.0	2,125.0	1,701.0	2,100.0	1,702.0	1,409.9	1,703.0	12,184.2	11,941.0	243.2
CAPITAL	0.0	0.0	**0.0**	0.0	0.0	-	-	-	-	-	-	-	-	0.0	0.0	0.0
OTHER	526.8	724.3	**974.3**	2,225.4	2,615.0	961.8	905.0	891.3	905.0	901.3	905.0	706.3	900.0	5,686.2	6,230.0	-543.8
TOTAL	1,815.7	2,410.7	**2,477.8**	6,704.2	7,750.0	3,032.4	2,605.0	3,016.3	2,606.0	3,001.3	2,607.0	2,116.2	2,603.0	17,870.4	18,171.0	-300.6
IN-KIND																
SALARIES	2,524.6	2,540.0	**2,563.8**	5,064.6	4,334.0	2,648.9	2,260.4	2,665.0	2,272.4	2,643.1	2,285.4	2,672.2	2,300.4	15,693.9	13,452.7	2,241.2
CAPITAL	28.4	20.0	**22.0**	48.4	0.0	20.0	0.0	20.0	0.0	20.0	0.0	20.0	0.0	128.4	0.0	128.4
OTHER	4,423.8	4,562.8	**4,469.2**	8,986.6	8,242.8	5,121.5	4,339.4	5,204.0	4,355.4	5,289.3	4,372.4	5,281.0	4,390.4	29,882.4	25,700.4	4,182.0
TOTAL	6,976.8	7,122.8	**7,055.0**	14,099.6	12,576.8	7,790.4	6,599.8	7,889.1	6,627.8	7,952.4	6,657.8	7,973.2	6,690.8	45,704.7	39,153.1	6,551.6

SUMMARY OF RESOURCES APPLIED TO ACTIVITIES OF CENTRE ($000's)

TABLE 3

ALL PROGRAMS

	Actual			Cumulative		Projected								GRAND TOTAL		
	1997/98	1998/99	1999/00	Total to date		2000/01	2000/01	2001/02	2001/02	2002/03	2002/03	2003/04	2003/04			
	Actual	Actual	Actual	Actual	Agr'mt	Budget	Agr'mt	Budget	Agr'mt	Budget	Agr'mt	Budget	Agr'mt	Total	Agr'mt	Diff
GRAND TOTAL (IN-KIND)	6,976.8	7,122.8	**7,055.0**	21,154.6	12,576.8	7,790.4	6,599.8	7,889.1	6,627.8	7,952.4	6,657.8	7,973.2	6,690.8	52,759.7	39,153.1	13,606.6
GRAND TOTAL (CASH EXPENDITURE)	1,815.7	2,410.7	**2,477.8**	6,704.2	7,750.0	3,032.4	2,605.0	3,016.3	2,606.0	3,001.3	2,607.0	2,116.2	2,603.0	17,870.4	18,171.0	-300.6
TOTAL RESOURCES APPLIED TO ACTIVITIES OF CENTRE	8,792.5	9,533.5	**9,532.8**	27,858.8	20,326.8	10,822.8	9,204.8	10,905.4	9,233.8	10,953.7	9,264.8	10,089.4	9,293.8	70,630.1	57,324.1	13,306.0

ALLOCATION OF TOTAL RESOURCES APPLIED TO ACTIVITIES OF CENTRE BETWEEN HEADS OF EXPENDITURE

TOTAL SALARIES (CASH AND IN-KIND)	3,813.5	4,226.4	4,067.2	13,610.6	9,469.0	4,719.5	3,960.4	4,790.0	3,973.4	4,743.1	3,987.4	4,082.1	4,003.4	31,945.4	25,393.7	6,551.7
TOTAL CAPITAL (CASH AND IN-KIND)	28.4	20.0	22.0	70.4	0.0	20.0	0.0	20.0	0.0	20.0	0.0	20.0	0.0	150.4	0.0	150.4
TOTAL OTHER (CASH AND IN-KIND)	4,950.6	5,287.1	5,443.5	16,655.6	10,857.8	6,083.3	5,244.4	6,095.3	5,260.4	6,190.6	5,277.4	5,987.3	5,290.4	41,012.1	31,930.4	9,081.7

TABLE 4

ALLOCATION OF RESOURCES BETWEEN CATEGORIES OF ACTIVITIES 1999/00

PROGRAM	RESOURCE USAGE			
	Cash (1) $000's	In-kind $000's	Contributed Staff (2)	Cash Funded Staff (CRC) (2)
Research	1,963.5	6,238.8	59.3	25.8
Education	193.5	318.3	3.3	1.8
External Communications	0.0	0.0	0	0.0
Commercialisation/ Tech Transfer	0.0	13.4	0.1	0.0
Administration	320.8	484.4	6.4	2.9
TOTAL	2,477.8	7,055.0	69.1	30.4

RESEARCH STAFF RESOURCES (1999/00)

ATTACHMENT B

Organisation	Main activity	Total % time	% spent on Research Program GI	SM	RP	Total on Research	% spent on Education	% Spent on Commercialisation Program	% spent on CRC Administration
Australian Paper Plantations Pty Ltd									
M Krygsman	R	30	18	12		30			
R Appleton	R	29	12	17		29			
H Lieshout	R	7	3	4		7			
J Cameron	R	4	2		2	4			
Total		70	35	33	2	70	0	0	0
CSIRO Entomology									
M Steinbauer	R	100			100	100			
PhD Student	R	100			100	100			
Post Doc WA	R	100			100	100			
J Matthiesen	R	32			32	32			
G Farrell	R	30			30	30			
J Dowse	R	30			30	30			
M Court	R	30			30	30			
R Sutherland	R	30			30	30			
R Floyd	R	25			25	25			
R Milner	R	20			20	20			
Total		497	0	0	497	497	0	0	0
CSIRO Forestry & Forest Products									
C Baillie	R	100		100		100			
M Cherry	R	100		100		100			
D Mummery	R	90		90		90			
M Battaglia	R	90		90		90			
C Beadle	R	80		80		80			
P Sands	R	80		80		80			
P Smethurst	R	72		72		72			
C Raymond	R	64	32	32		64			
K Churchill	R	60		60		60			
J Murrell	R	50	50			50			
D Worledge	R	30		30		30			
G Moran	R	30	30			30			
C Mohammed	R	10			10	10			
J Owen	R	10	10			10			
B McCormack	R	10		10		10			
E Williams	R	10	10			10			
R Evans	R	5	5			5			
A Wallis (July-April 99/00)	R	5	5			5			
Total		896	142	744	10	896	0	0	0
Fletcher Challenge Paper									
S Hetherington	R	20	2	13	3	18	1		1
G Kennedy	R	2		2					
A Willems	A	2							2
Total		24	2	15	3	20	1	0	3
Forestry Tasmania									
J Lesek	R	85	85			85			
N Beveridge	R	50			50	50			
J Elek	R	40			40	40			
N Marsh	R	40			40	40			
A Walsh	R	40			40	40			
S Candy	R	35			35	35			
P Kube	R	30	28.5			28.5			1.5
C Ringrose	R	25		25		25			
L Pinkard	R	20		20		20			
R Bashford	R	10			10	10			
H Elliot	R	10			4	4			6
B Neilsen	R	3				0			3
H Drielsma	A	3				0			3
Total		391	113.5	45	219	377.5	0	0	13.5

Organisation	Main activity	Total % time	% spent on Research Program GI	SM	RP	Total on Research	% spent on Education	% Spent on Commercialisation Program	% spent on CRC Administration
Griffith University									
G Wardell-Johnson	R	25		25		25			
R Bradock	R	15		15		15			
B Yu	R	15		15		15			
R Rickson	R	15		15		15			
J Hughes	R	15	10			10			5
S Berners-Price	R	10		10		10			
I Phillips	R	10		10		10			
Total		105	10	90	0	100	0	0	5
North Forest Products									
D DeLittle	R	56	2		34	36			20
G Holz	R	54		28		28			26
T Hingston	R	49	3		33	36			13
I Hammond	R	25	3	15	1	19			6
K Joyce	R	45	20			20			25
T Williams	R	45	11	12	1	24			21
C Barnes	R	43		31	2	33			10
A Jamieson	A	1				0			1
Total		318	39	86	71	196	0	0	122
Primary Industries Corporation (QFRI)									
P Frayne	R	35		35					
P Toon	R	25	25						
P Pomeroy	R	25	20	5					
C Raddatz	R	22	10	12					
M Podberseck	R	14	10	4					
L Cox	R	20		20					
M Johnson	R	15	15						
J Huth	R	15		15					
L Stephens	R	15		15					
R Haines	A	50	5	5					40
G Nikles	R	10	10						
A Snell	R	3	3						
J Simpson	R	44		44					
M Dieters	R	36	36						
K Bubb	R	40		40					
Z Xu	R	35		35					
D Osborne	R	28		28					
M Hunt	R	25		25					
K Harding	R	20	20						
M Lewty	R	20		10					10
M Nester	R	20		42					
S Walker	R	10	8						2
P Ryan	R	10		10					
A House	R	10		10					
A Single	C	10						10	
P Collins	R	30		30					
M Robinson	A	10							10
T Wemmerslager	A	10							10
Total		607	162	385	0	0	0	10	72
Silvagene									
H O'Sullivan	R	30	30						
Total		30	30	0	0	0	0	0	0
Sotico Treefarms Pty Ltd									
Research Forester	R	28		28		28			
Research Forester (casual)	R	20		20		20			
Technician	R	20	3	17		20			
Technician	R	20	7.3	11.6	1.1	20			
Technician	R	20		17	3	20			
Technician	R	15	5	5	5	15			
Technician	R	12		12		12			
Research Forester	R	10	10			10			
Various	R	5	4	1		5			
Nursery/Research Manager	A	10				0			10
General Manager	A	3				0			3
Commercial Manager	A	2				0			2
Operations Manager	A	2				0			2
Total		135	15.3	110.6	9.1	135	0	0	0

Organisation	Main activity	Total % time	% spent on Research Program GI	SM	RP	Total on Research	% spent on Education	% Spent on Commercialisation Program	% spent on CRC Administration
Southern Cross University									
R Henry	R	30	20			20	10		
T Codrington	R	20		20		20			
D Mcintyre/E Evans	A	10				0	10		
D Scurr	A	10				0	5		5
V Watt	A	10				0			10
P Baverstock	A	5				0			5
Total		85	20	20		40	25	0	20
University of Tasmania									
R Vaillaincourt	R	45	45			45			
I Cummings	R	30	15	15		30			
P Brown	R	30		30		30			
R Wiltshire	R	30	15			15	15		
G Allen	R	25			25	25			
M Hurley	R	25			25	25			
C McArthur	R	25			25	25			
B Potts	R	25	25			25			
M Line	R	20		20		20			
A Smolenski	R	18	18			18			
S Jennings	R	15		15		15			
C Mohammed	R	15			15	15			
G Jordan	R	10	10			10			
L Johnson	R	5	5			5			
N Davidson	E	25				0	25		
R Clark	E	20				0	10		10
M Hovenden	E	5				0	5		
J Reid	A	50	10			10	10		30
G Johnson	A	20				0			20
G Hallegraeff	A	10				0			10
R Swain	A	10				0			10
C Lane	A	5				0			5
B Rumbold	A	5				0			5
Sally Jones	A	5				0			5
A Glenn	A	2				0			2
Total		475	143	80	90	313	65	0	97
Australian National University									
P Kanowski	R	30	10	20		30			
D Race	R	25				0	25		
S Mahendrarajah	R	10		10		10			
R James	R	10		10		10	0		
Total		75	10	40	0	50	25	0	0
Boral Timber Tasmania Ltd									
C Hawkins	R	20		20		20			
P Naughton	R	1		1		1			
Total		21	0	21	0	21	0	0	0
Private Forests Tasmania									
Ms L Anderson	R	9		9		9			
Mr A Lyons	R	4		4		4			
Mr D Bower	R	4		4		4			
Mr A Warner	R	2		2		2			
Mr G Clark	R	2		2		2			
Total		21	0	21		21	0	0	0
The University of Queensland									
D Doley	R	25		10		10	15		
Total		25	0	10	0	10	15	0	0
Australian Forest Growers									
Education Technology Transfer	E	25					25		
Administration	A	25							25
Total		50	0	0	0	0	25	0	25
Serve-Ag Pty Ltd									
P Volker	R	5	5			5			
J Westbrook	R	1	1			1			
D Blaesing	R	1	1			1			
Total		7	7	0	0	7	0	0	0

Organisation		Main activity	Total % time	% spent on Research Program GI	SM	RP	Total on Research	% spent on Education	% Spent on Commercialisation Program	% spent on CRC Administration
STBA										
P Gore		R	13	13						
T McRae		R	7	7						
Total			20	20	0	0	0	0	0	0
CRC funded										
A Mitchell	CSIRO F	R	100		100		100			
A Wilkinson	Utas	R	100		100		100			
R Osborne	Utas	R	100		100		100			
S Papps	QFRI	R	100		100		100			
S Resh	CSIRO F	R	100		100		100			
H Fitzgerald	Utas	R	100			100	100			
M Steinbauer	CSIRO E	R	100			100	100			
S Paterson	Utas	R	100			100	100			
V Patel	Utas	R	100			100	100			
A Bradley / L Savage	Utas	R	100	50	50		100			
L Nagy / K Surridge	CSIRO F	R	100	50	50		100			
A MacDonald	Utas	R	100	100			100			
B Patterson	Utas	R	100	100			100			
H Dungey	QFRI	R	100	100			100			
K Groom	CSIRO F	R	100	100			100			
K Thamarus	CSIRO F	R	100	100			100			
L Apiolaza	Utas	R	100	100			100			
M Cross	SCU	R	100	100			100			
M Shepherd	SCU	R	100	100			100			
P Tilyard	Utas	R	100	100			100			
G. Pu	QFRI	R	100	100			100			
C McArthur	Utas	R	75			75	75			
B Potts	Utas	R	75	75			75			
D Steane	Utas	R	60	60			60			
P Keay	QFRI	R	50		50		50			
G Allen	Utas	R	50			50	50			
M Hurley	Utas	R	50			50	50			
A Matysek	Utas	R	40		40		40			
P Smethurst	Utas	R	28		28		28			
P Safiga	GU	R	100							
A Fulton	Utas	R	25		25		25			
D Race	ANU	R	25		25		25			
G Dutkowski	Utas	E	100					100		
N Davidson	Utas	E	75					75		
S Jones	Utas	A	100							100
C Condie	Utas	A	80							80
S Caswell	Utas	A	80							80
J Richmond	CSIRO F	A	25							25
Total			3138	1235	768	575	2578	175	0	285

SUMMARY OF CONTRIBUTIONS IN PERSON YEARS

	Total person years	Person years spent on Research program GI	SM	RP	Total on Research	Person years spent on Education Program	Person years spent on Commercialisation Program	Person years spent on CRC Administration
Total Contributed	69.1	19.8	24.7	14.8	59.3	3.3	0.1	6.4
Total funded by CRC	30.4	12.4	7.7	5.8	25.8	1.8	0.0	2.9
Grand total	99.5	32.2	32.4	20.5	85.1	5.1	0.1	9.3
Proportion of total professional (%) staff resources in each activity	100.0	32.3	32.5	20.6	85.5	5.1	0.1	9.3

SUPPORT STAFF

Contributed	
Organisation	Number of staff (person years)
CSIRO(FFP & ENTO)	4.60
Forestry Tasmania	2.10
Primary Industries Corporation	1.51
North Forest Products	1.64
Sotico Treefarms	0.92
University of Tasmania	0.68
Australian Paper Plantations	0.66
Fletcher Challenge Paper	0.02
Total	7.53

CRC Funded (by employing organisation)	
Organisation	Number of staff (person years)
University of Tasmania	10.6
CSIRO (FFP & Ento)	3.3
SCU	1.0
PIC (QFRI)	0.5
Total	15.4

Australian Paper Plantations

CRC FOR SUSTAINABLE PRODUCTION FORESTRY 1999/2000 Financial tables

Itemised List of Cash and In-Kind Contributions (in $'000's)

	SALARIES	% time	97/98	98/99	**99/2000**	2000/01	2001/02	2002/03	2003/04	TOTAL
Name	*Designation*	*CRC*	Actual	Actual	**Actual**	Budget	Budget	Budget	Budget	
M Krygsman	Research	30								
R Appleton	Research	29								
H Lieshout	Research	7								
J Cameron	Research	4								
		Total Salary			**48.6**	69.0	71.0	73.2	75.4	337.2
	Direct On-Costs									
		Total On-Costs			**9.7**	21.2	21.9	22.5	23.2	119.5
		Total Salaries & On-Costs	65.8	83.2	**58.3**	90.2	92.9	95.7	98.6	456.7
	CAPITAL									
		Total Capital	0.0	0.0	**0.0**	0.0	0.0	0.0	0.0	0.0
	OTHER	*% of Total Salaries & On -Costs*								
	Overheads		38.6	23.3	**11.1**	36.6	37.7	38.8	40.0	226.1
	Operating		96.9	101.5	**97.3**	91.8	94.6	97.4	100.3	679.8
		Total Other	135.5	124.8	**108.4**	128.4	132.3	136.2	140.3	905.9
TOTAL IN-KIND CONTRIBUTION			**201.3**	**208.0**	**166.7**	**218.6**	**225.2**	**231.9**	**238.9**	**1,362.6**
ALL PROGRAMS CASH CONTRIBUTIONS			**35.0**	**35.0**	**35.0**	**35.0**	**35.0**	**35.0**	**35.0**	**245.0**

CSIRO - Entomology

CRC FOR SUSTAINABLE PRODUCTION FORESTRY 1999/2000 Financial tables

Itemised List of Cash and In-Kind Contributions (in $'000's)

	SALARIES	% time	97/98	98/99	**99/2000**	2000/01	2001/02	2002/03	2003/04	TOTAL
Name	*Designation*	*CRC*	Actual	Actual	**Actual**	Budget	Budget	Budget	Budget	
T Wharton	Research	100			**15.8**	21.0	21.0	15.8	.0	73.5
A Loch	Research	100			**45.0**	47.7	50.0	.0	.0	142.7
J Matthiesen	Research	32			**16.0**	16.5	16.5	16.5	16.5	82.0
G Farrell	Technician	30			**15.1**	15.6	15.6	15.6	15.6	77.5
J Dowse	Technician	30			**15.1**	15.6	10.5	10.5	10.5	62.2
R Sutherland	Technician	30			**15.1**	15.6	15.6	15.6	15.6	77.5
M Court	Technician	30			**10.2**	10.1	10.1	10.1	10.1	50.5
R Floyd	Research	25			**21.2**	21.9	21.9	21.9	21.9	108.7
R Milner	Research	20			**18.6**	19.2	19.2	19.2	19.2	95.3
		Total Salary			**172.3**	183.1	180.4	125.1	109.3	770.1
	Direct On-Costs	*% of total Salary*								
	Superannuation	20.5%			**35.3**	37.5	37.0	25.6	22.4	157.9
	Comcare	1.1%			**1.9**	2.0	2.0	1.4	1.2	8.5
	Leave Loading	1.5%			**2.6**	2.7	2.7	1.9	1.6	11.6
	Long Service Leave	2.5%			**4.3**	4.6	4.5	3.1	2.7	19.3
		Total On-Costs			**44.1**	46.9	46.2	32.0	28.0	197.1
		Total Salaries & On-Costs	163.2	148.6	**216.4**	230.0	226.5	157.1	137.3	967.2
	CAPITAL									
		Total Capital	0.00	0.00	**0.00**	0.00	0.00	0.00	0.00	0.00
	OTHER	*% of Total Salaries & On -Costs*								
	Divnl other support	156	190.8	198.8	**296.7**	314.2	313.2	227.0	202.4	612.0
	Corporate support	32	48.9	55.2	**77.7**	81.6	80.8	63.1	58.0	159.6
	Less Industry Contributions				**113.5**	120.3	124.8	22.5	0.0	233.9
		Total Other	239.7	254.1	**260.9**	275.5	269.2	267.6	260.4	771.6
TOTAL IN-KIND CONTRIBUTION			**402.9**	**402.7**	**477.3**	**505.5**	**495.7**	**424.6**	**397.7**	**1,504.9**
ALL PROGRAMS CASH CONTRIBUTIONS										

CSIRO - Forestry & Forest Products

Itemised List of Cash and In-Kind Contributions (in $'000's)

	SALARIES	% time	97/98	98/99	99/2000	2000/01	2001/02	2002/03	2003/04	TOTAL
Name	*Designation*	*CRC*	Actual	Actual	**Actual**	Budget	Budget	Budget	Budget	
C Baillie	Technical	100			**38.5**					
M Cherry	Technical	100			**43.9**					
D Mummery	Research	90			**45.4**					
M Battaglia	Research	90			**60.5**					
C Beadle	Research	80			**64.1**					
P Sands	Research	80			**64.1**					
P Smethurst	Research	72			**50.3**					
C Raymond	Research	64			**44.7**					
K Churchill	Technical	60			**23.8**					
J Murrel	Technical	50			**25.2**					
D Worledge	Technical	30			**13.5**					
G Moran	Research	30			**27.9**					
C Mohammed	Research	10			**3.2**					
J Owen	Technical	10			**5.2**					
B McCormack	Research	10			**7.3**					
E Williams	Research	10			**9.3**					
R Evans	Research	5			**4.7**					
A Wallis (July-April 99/00)	Research	5			**5.1**					
		Total Salary	515.5	545.9	**536.9**	548.8	562.5	576.6	591.0	3,877.1
	Direct On-Costs	*% of total Salary*								
	Superannuation	18.5	15.5	16.4	**99.3**	101.5	104.1	106.7	109.3	0.0
	Productivity Benefit	3.0	95.4	101.0	**16.1**	16.5	16.9	17.3	17.7	280.8
	Long Service Leave	2.5	5.7	6.0	**13.4**	13.7	14.1	14.4	14.8	82.1
	Leave Loading	1.5	7.7	8.2	**8.1**	8.2	8.4	8.6	8.9	58.2
	Workers Compensation	1.1	12.9	13.6	**5.9**	6.0	6.2	6.3	6.5	57.5
		Total On-Costs	137.1	145.2	**142.8**	146.0	149.6	153.4	157.2	478.6
		Total Salaries & On-Costs	652.6	691.1	**679.7**	694.8	712.1	729.9	748.2	4,355.7
	CAPITAL									
		Total Capital	0.0	0.0	**0.0**	0.0	0.0	0.0	0.0	0.0
	OTHER									
	Divnl other support	153%	1,001.1	1,060.2	**1,042.6**	1,065.8	1,092.4	1,119.7	1,147.7	7,529.5
	Corporate support	32%	208.8	221.2	**217.5**	222.3	227.9	233.6	239.4	1,570.7
	Imputed Rent		200.0	200.0	**200.0**	200.0	200.0	200.0	200.0	1,400.0
	Other operating		0.0	14.5	**0.0**	7.5	7.5	7.5	7.5	44.5
		Total Other	1,410.0	1,495.8	**1,460.1**	1,495.6	1,527.8	1,560.8	1,594.6	10,544.7
TOTAL IN-KIND CONTRIBUTION			**2,062.6**	**2,186.9**	**2,139.8**	**2,190.4**	**2,239.9**	**2,290.7**	**2,342.8**	**14,900.3**
ALL PROGRAMS CASH CONTRIBUTIONS										

Fletcher Challenge Paper

CRC FOR SUSTAINABLE PRODUCTION FORESTRY 1999/2000 Financial tables
Itemised List of Cash and In-Kind Contributions (in $'000's)

	SALARIES	% time	97/98	98/99	**99/2000**	2000/01	2001/02	2002/03	2003/04	TOTAL
Name	*Designation*	*CRC*	Actual	Actual	**Actual**	Budget	Budget	Budget	Budget	
S Hetherington	Research	20								
A Willems	Administration	2								
G Kennedy	Technical	2								
		Total Salary			**18.0**	19.0	19.0	19.0	19.0	94.0
	Direct On-Costs	*% of total Salary*								
	Other-Total	32			**5.7**	6.1	6.1	6.1	6.1	30.0
		Total On-Costs			**5.7**	6.1	6.1	6.1	6.1	30.0
		Total Salaries & On-Costs	34.0	21.1	**23.7**	25.1	25.1	25.1	25.1	124.0
	CAPITAL									
		Total Capital	0.0	0.0	**0.0**	0.0	0.0	0.0	0.0	0.0
	OTHER	*% of Total Salaries & On -Costs*								
	Office Support		10.0	8.0	**8.0**	8.0	8.0	8.0	8.0	58.0
	Land rent		148.5	139.0	**170.0**	150.0	150.0	146.0	146.0	1,049.5
	Trial maintenance		15.0	16.0	**14.0**	16.0	16.0	16.0	16.0	109.0
	Experiments		8.5	6.0	**5.0**	7.0	7.0	7.0	7.0	47.5
	Other(Vehicles)		4.0	2.0	**2.0**	3.0	3.0	3.0	3.0	20.0
		Total Other	186.0	171.0	**199.0**	184.0	184.0	180.0	180.0	1,284.0
TOTAL IN-KIND CONTRIBUTION			**220.0**	**192.1**	**222.7**	**209.1**	**209.1**	**205.1**	**205.1**	**1,408.0**
ALL PROGRAMS CASH CONTRIBUTIONS			**22.4**	**20.0**	**20.0**	**20.0**	**20.0**	**20.0**	**20.0**	**142.4**

Forestry Tasmania

CRC FOR SUSTAINABLE PRODUCTION FORESTRY 1999/2000 Financial tables

Itemised List of Cash and In-Kind Contributions (in $'000's)

Name	Designation	% time CRC	97/98 Actual	98/99 Actual	**99/2000 Actual**	2000/01 Budget	2001/02 Budget	2002/03 Budget	2003/04 Budget	TOTAL
SALARIES										
J Lesek	Technician	85								
N Beveridge	Technician	50								
J Elek	Research	40								
N Marsh	Research	40								
A Jenni	Technician	40								
C Ringrose	Technician	25								
S Candy	Research	21								
P Kube	Research	20								
L Pinkard	Research	20								
H Elliott	Research/Admin	10								
R Bashford	Technician	10								
H Drielsma	Research/Admin	3								
B Neilsen	Research	3								
S Meyer	Technician	2								
		Total Salary			**150.6**	165.7	182.2	200.5	220.5	919.5
	Direct On-Costs	*% of total Salary*								
	Superannuation				**17.9**	19.7	21.7	23.8	26.2	109.3
	Payroll Tax				**10.9**	12.0	13.2	14.5	16.0	66.6
	Workers Compensation				**4.7**	5.2	5.7	6.3	6.9	28.9
	Long Service Leave				**3.8**	4.1	4.5	5.0	5.5	22.9
		Total On-Costs			**37.4**	41.0	45.1	49.6	54.7	227.7
		Total Salaries & On-Costs	137.0	157.0	**188.0**	206.7	227.3	250.1	275.2	1,441.2
CAPITAL										
		Total Capital	0.0	0.0	**0.0**	0.0	0.0	0.0	0.0	0.0
OTHER		*% of Total Salaries & On-Costs*								
	Operational		66.7	58.2	**101.1**	111.2	122.3	134.6	148.0	742.1
	Head office o'heads		57.0	55.4	**75.0**	82.5	90.7	99.8	109.8	570.2
	Corporate Support		24.9	28.6	**34.2**	37.6	41.4	45.5	50.1	262.3
	Office support		30.5	26.4	**29.4**	32.3	35.6	39.1	43.1	236.5
		Total Other	179.1	168.6	**239.7**	263.7	290.0	319.1	351.0	1,811.2
TOTAL IN-KIND CONTRIBUTION			**316.1**	**325.6**	**427.7**	**470.4**	**517.3**	**569.2**	**626.2**	**3,252.4**
ALL PROGRAMS CASH CONTRIBUTIONS			**22.5**	**19.3**	**15.0**	**15.0**	**15.0**	**15.0**	**15.0**	**116.8**

CRC FOR SUSTAINABLE PRODUCTION FORESTRY 1999/2000 Financial tables

Griffith University

Itemised List of Cash and In-Kind Contributions (in $'000's)

Name	SALARIES Designation	% time CRC	97/98 Actual	98/99 Actual	**99/2000 Actual**	2000/01 Budget	2001/02 Budget	2002/03 Budget	2003/04 Budget	TOTAL
G Wardell-Johnson	Research	25			**14.1**					
R Bradock	Research	15			**11.9**					
B Yu	Research	15			**9.8**					
R Rickson	Research	15			**13.9**					
J Hughes	Research/Administration	15			**11.9**					
S Berners-Price	Research	10			**7.2**					
I Phillips	Research	10			**6.4**					
		Total Salary			**75.2**	72.0	73.0	73.0	73.0	366.2
	Direct On-Costs	*% of total Salary*								
	Superanuation	17			**12.8**	10.1	10.2	10.2	10.2	85.5
	Payroll tax	5			**3.8**	3.6	3.7	3.7	3.7	27.7
	Work Cover	1			**0.6**	0.6	0.6	0.6	0.6	4.4
	In-Direct On-Costs									
	Outside Studies Program	19			**14.3**	13.7	13.9	13.9	13.9	83.7
	Long service Leave	3			**2.3**	2.2	2.2	2.2	2.2	13.2
	Leave Loading	1			**1.0**	0.9	0.9	0.9	0.9	7.2
		Total On-Costs			**34.7**	31.0	31.5	31.5	31.5	221.8
		Total Salaries & On-Costs	163.7	108.8	**109.9**	103.0	104.5	104.5	104.5	588.0
	CAPITAL		0.0	20.0	**20.0**	20.0	20.0	20.0	20.0	120.0
		Total Capital	0.0	20.0	**20.0**	20.0	20.0	20.0	20.0	120.0
	OTHER									
	Academic services	28	32.7	30.5	**30.8**	28.8	29.2	29.2	29.2	210.6
	General University Services	49	67.1	53.3	**53.8**	50.5	51.2	51.2	51.2	378.3
	Deptl Other support	10	13.1	10.9	**11.0**	10.3	10.4	10.4	10.4	76.6
	Other Lab & Workshop Space	20	37.7	21.8	**22.0**	20.6	20.9	20.9	20.9	164.7
		Total Other	150.6	116.5	**117.6**	110.2	111.8	111.8	111.8	830.2
TOTAL IN-KIND CONTRIBUTION			**314.3**	**245.3**	**247.4**	**233.3**	**236.3**	**236.3**	**236.3**	**1,538.2**
ALL PROGRAMS CASH CONTRIBUTIONS			**25.0**	**25.0**	**25.0**	**25.0**	**25.0**	**25.0**	**25.0**	**175.0**

North Forest Products

CRC FOR SUSTAINABLE PRODUCTION FORESTRY 1999/2000 Financial tables

Itemised List of Cash and In-Kind Contributions (in $'000's)

SALARIES		% time	97/98	98/99	**99/2000**	2000/01	2001/02	2002/03	2003/04	TOTAL
Name	*Designation*	*CRC*	Actual	Actual	**Actual**	Budget	Budget	Budget	Budget	
D DeLittle	Scientist	56								
G Holz	Scientist	54								
T Hingston	Technician	49								
K Joyce	Technician	45								
T Williams	Technician	45								
C Barnes	Scientist	43								
I Hammond	Technician	25								
A Jamieson	Manager	1								
		Total Salary	198.0	169.0	**103.6**					470.6
	Direct On-Costs	*% of total Salary*								
	Other-Total	33	65.0	83.2	**51.0**					199.2
		Total On-Costs	65.0	83.2	**51.0**					199.2
		Total Salaries & On-Costs	263.0	252.2	**154.7**	100.0	100.0	100.0	100.0	1,069.9
CAPITAL										
		Total Capital	0.0	0.0	**0.0**	0.0	0.0	0.0	0.0	0.0
OTHER		*% of Total Salaries & On -Costs*								
	Other		267.0	217.0	**117.8**					
	Land rent		87.0	87.0	**37.5**					
	Trial maintenance		8.0	9.0	**3.0**					
	Office Support		7.0							
		Total Other	369.0	312.6	**158.3**	216.0	216.0	216.0	216.0	1,703.9
TOTAL IN-KIND CONTRIBUTION			**632.0**	**564.8**	**313.0**	**316.0**	**316.0**	**316.0**	**316.0**	**2,773.7**
ALL PROGRAMS CASH CONTRIBUTIONS			**65.1**	**50.0**	**30.0**	**20.0**	**25.0**	**25.0**	**25.0**	**240.1**

CRC FOR SUSTAINABLE PRODUCTION FORESTRY 1999/2000 Financial tables

QFRI - Primary Industries Corporation

Itemised List of Cash and In-Kind Contributions (in $'000's)

	SALARIES	% time	97/98	98/99	**99/2000**	2000/01	2001/02	2002/03	2003/04	TOTAL
Name	*Designation*	*CRC*	Actual	Actual	**Actual**	Budget	Budget	Budget	Budget	
R Haines	Research/Administration	50			**39.78**					
J Simpson	Research	44			**25.84**					
M Nester	Research	42			**20.88**					
K Bubb	Research	40			**19.41**					
M Dieters	Research	36			**20.07**					
Z Xu	Research	35			**17.40**					
P Frayne	Technician	35			**10.44**					
P Collins	Chemist	30			**13.00**					
D Osborne	Research	28			**11.46**					
M Hunt	Research	25			**11.83**					
P Toon	Technician	25			**10.24**					
P Pomeroy	Technician	25			**9.45**					
C Radddatz	Technician	22			**9.01**					
K Harding	Research	20			**9.94**					
M Lewty	Research	20			**10.90**					
L Cox	Technician	20			**7.56**					
M Johnson	Technician	15			**6.60**					
J Huth	Technician	15			**6.15**					
L Stephens	Technician	15			**4.94**					
M Podberseck	Technician	14			**5.29**					
S Walker	Research	10			**4.85**					
P Ryan	Research	10			**5.58**					
A House	Research	10			**4.97**					
G Nikles	Research	10			**5.98**					
A Single	Publicist	10			**4.09**					
M Robinson	Administration	10			**5.87**					
T Wemmerslager	Administration	10			**3.07**					
A Snell instead of Rod Keenan	Research	3			**1.26**					
		Total Salary	332.7	321.5	**305.9**	297.3	297.3	297.3	297.3	2,149.3
	Direct On-Costs	*% of total Salary*								
	Superannuation	14.55	44.9	46.9	**44.5**	43.4	43.4	43.4	43.4	310.0
	Leave Loading	9.00	27.6	4.8	**27.5**	4.5	4.5	4.5	4.5	77.8
	Payroll Tax	6.15	19.0	19.8	**18.8**	18.4	18.4	18.4	18.4	131.4
	Enterprise Bargaining	2.70	13.3	12.8	**8.3**	11.9	11.9	11.9	11.9	82.0
	Long Service Leave	2.00	6.0	9.6	**6.1**	8.9	8.9	8.9	8.9	57.4
	Salary banding	1.88	5.7	6.1	**5.8**	5.6	5.6	5.6	5.6	39.5
	Workers comp premium		0.7	0.0	**0.0**	0.7	0.7	0.7	0.7	3.5
		Total On-Costs	117.1	100.1	**111.0**	93.5	93.5	93.5	93.5	702.0
		Total Salaries & On-Costs	449.8	421.6	**416.9**	390.8	390.8	390.8	390.8	2,851.3
	CAPITAL									
	Lab Modifications		3.0							3.0
	Gas Chromatograph/Mass Spectrometer x 20%		25.4							25.4
		Total Capital	28.4	0.0	**0.0**	0.0	0.0	0.0	0.0	28.4
	OTHER									
	Dept administrative support	15.0	45.0	63.3	**62.5**	58.6	58.6	58.6	58.6	405.1
	Office space	10.0	45.0	42.2	**41.7**	39.1	39.1	39.1	39.1	285.1
	Depreciation	9.0	39.0	38.0	**37.5**	35.2	35.2	35.2	35.2	255.1
	Other Administrative costs	6.3	0.0	26.6	**26.3**	24.6	24.6	24.6	24.6	151.3
	QFRI Administrative Overheads	5.0	22.5	21.1	**20.8**	19.5	19.5	19.5	19.5	142.5
	QFRI Technical support	3.9	0.0	16.5	**16.3**	15.2	15.2	15.2	15.2	93.6
	Field Trials		303.2	176.7	**201.7**	100.0	100.0	100.0	100.0	1,081.6
	Chemical analysis		26.4	0.0	**20.0**	20.0	20.0	20.0	20.0	126.4
	Laboratory/Glasshouse rent		45.0	0.0	**0.0**	39.1	39.1	39.1	39.1	201.2
	Travel & Accommodation		0.0	0.0	**0.0**	30.0	30.0	30.0	30.0	120.0
		Total Other	526.0	384.2	**426.8**	381.3	381.3	381.3	381.3	2,862.0
TOTAL IN-KIND CONTRIBUTION			**1,004.2**	**805.7**	**843.7**	**772.1**	**772.1**	**772.1**	**772.1**	**5,741.7**
ALL PROGRAMS CASH CONTRIBUTIONS			**25.0**	**50.0**	**53.7**	**25.0**	**25.0**	**25.0**	**25.0**	**228.7**

Sotico Treefarms

Itemised List of Cash and In-Kind Contributions (in $'000's)

Name	SALARIES Designation	% time CRC	97/98 Actual	98/99 Actual	**99/2000 Actual**	2000/01 Budget	2001/02 Budget	2002/03 Budget	2003/04 Budget	TOTAL
T Smith	Research Forester	28								
C Shedley	Research Forester (casual)	20								
J Cox	Technician	20								
M Booth	Technician	20								
V Sims	Technician	20								
Casual Staff	Technician	15								
M Christensen	Technician	12								
S Hunter	Nursery/Research Manager	10								
D Pilbeam	Research Forester	10								
L Maddern	Research Forester	7								
N Staff	Technician	5								
M Vitlich	General Manager	3								
J Tredinnick	Commercial Manager	2								
R Breidahl	Operations Manager	2								
	Total Salary		54.4	58.4	**51.4**	52.2	52.2	52.2	52.2	373.0
	Direct On-Costs	*% of total Salary*								
	Payroll tax	6	3.3	3.5	**3.1**	3.1	3.1	3.1	3.1	22.4
	Superanuation	7	3.3	4.1	**3.6**	3.7	3.7	3.7	3.7	25.6
	Workers Compensation	6	3.3	3.5	**3.1**	3.1	3.1	3.1	3.1	22.4
	Leave Loading	1.5	0.8	0.9	**0.8**	0.8	0.8	0.8	0.8	5.6
	Long Service Leave	1.7	0.9	1.0	**0.9**	0.9	0.9	0.9	0.9	6.3
	Total On-Costs		11.5	13.0	**11.4**	11.6	11.6	11.6	11.6	82.2
	Total Salaries & On-Costs		65.9	71.4	**62.8**	63.8	63.8	63.8	63.8	455.2
	CAPITAL									
	Total Capital		0.0	0.0	**0.0**	0.0	0.0	0.0	0.0	0.0
	OTHER									
	Operational	55	34.8	34.4	**34.4**	36.0	36.0	36.0	36.0	247.7
	Administration	33.9	31.3	21.6	**21.3**	32.0	32.0	32.0	32.0	202.2
	Other-Meetings & visits	29	11.0	18.0	**18.0**	13.0	13.0	13.0	13.0	99.0
	Amortised capital costs	15	8.3	9.5	**9.5**	9.0	9.0	9.0	9.0	63.3
	Trial Maintenance	12	6.7	7.4	**7.4**	7.0	7.0	7.0	7.0	49.4
	Corporate Overheads	10	6.0	6.5	**6.5**	6.5	6.5	6.5	6.5	45.0
	Land rent	6	2.1	4.0	**4.0**	2.5	2.5	2.5	2.5	20.1
	Other- Ferilizers	6	0.0	0.7	**3.7**	2.0	2.0	2.0	2.0	12.4
	Computer Support	5	2.2	2.5	**3.2**	2.5	2.5	2.5	2.5	17.9
	Office Support	4	1.7	2.6	**2.6**	2.0	2.0	2.0	2.0	14.8
	Consumables & Freight	3	1.1	2.0	**2.0**	1.5	1.5	1.5	1.5	11.1
	Library	1	0.8	0.9	**0.9**	1.0	1.0	1.0	1.0	6.5
	WA genetics Workshop	0	1.2	0.0	**0.0**	0.0	0.0	0.0	0.0	0.0
	Other- Wood Coring Trip	0	0.0	3.0	**0.0**	0.0	0.0	0.0	0.0	3.0
	Total Other		107.3	113.0	**113.4**	115.0	115.0	115.0	115.0	792.5
TOTAL IN-KIND CONTRIBUTION			**173.2**	**184.4**	**176.2**	**178.8**	**178.8**	**178.8**	**178.8**	**1,247.7**
ALL PROGRAMS CASH CONTRIBUTIONS			**35.0**	**35.0**	**35.0**	**35.0**	**35.0**	**35.0**	**35.0**	**245.0**

CRC FOR SUSTAINABLE PRODUCTION FORESTRY 1999/2000 Financial tables

Southern Cross University

Itemised List of Cash and In-Kind Contributions (in $'000's)

	SALARIES	% time	97/98	98/99	**99/2000**	2000/01	2001/02	2002/03	2003/04	TOTAL
Name	*Designation*	*CRC*	Actual	Actual	**Actual**	Budget	Budget	Budget	Budget	
R Henry	Research	30								
T Codrington	Research	20								
D McIntyre/E Evans	Administration	10								
V Watt	Administration	10								
D Scurr	Administration	10								
P Baverstock	Research	5								
		Total Salary	47.1	51.0	**52.6**	55.0	57.0	60.0	62.0	384.7
	Direct On-Costs	*% of total salary*								
Jul - Dec 99		Jan - June 00								
16.6	Superannuation	14.6	7.8	8.5	**8.7**	8.0	8.3	8.8	9.1	59.2
7.7	Payroll Tax	7.7	3.6	3.9	**4.1**	4.2	4.4	4.6	4.8	29.6
3	Long Service Leave	3	1.4	1.5	**1.6**	1.7	1.7	1.8	1.9	11.5
3	Tess	3	1.4	1.5	**1.6**	1.7	1.7	1.8	1.9	11.5
1.5	Workers compensation	1.5	0.7	0.8	**0.8**	0.8	0.9	0.9	0.9	5.8
1.3	Leave Loading	1.3	0.6	0.7	**0.7**	0.7	0.7	0.8	0.8	5.0
0.4	Other- Maternity Leave	0.4	0.2	0.2	**0.2**	0.2	0.2	0.2	0.2	1.5
		Total On-Costs	15.8	17.1	**17.6**	17.3	17.9	18.9	19.5	128.5
		Total Salaries & On-Costs	62.9	68.0	**70.2**	72.3	74.9	78.9	81.5	508.8
	CAPITAL									
		Total Capital	0.0	0.0	**0.0**	0.0	0.0	0.0	0.0	0.0
	OTHER									
		% of total salary & oncosts								
	Admin & general	37.6	23.6	25.6	**26.4**	27.4	28.6	30.1	31.2	193.0
	Academic Activities- other	27.7	17.4	18.9	**19.5**	20.2	21.1	22.2	23.0	142.2
	Independent operations	20.4	12.8	13.9	**14.3**	14.9	15.5	16.3	16.9	104.7
	Buildings & grounds	16.8	10.6	11.4	**11.8**	12.3	12.8	13.4	13.9	86.2
	Other academic support services	15.5	9.7	10.6	**10.9**	11.3	11.8	12.4	12.9	79.5
	Libraries	15.4	9.7	10.5	**10.8**	11.2	11.7	12.3	12.8	79.0
	Student support services	12	7.5	8.2	**8.4**	8.8	9.1	9.6	10.0	61.6
	Academic Servs/bldgs, plant. equipt	8.7	5.5	5.9	**6.1**	6.4	6.6	7.0	7.2	44.6
	Public services	1	0.1	0.7	**0.7**	0.7	0.8	0.8	0.8	4.6
	Other(Research)		89.2	177.3	**187.9**	197.0	207.0	215.0	150.0	1,223.4
	Other(Admin)		3.0	3.6	**3.7**	3.8	3.9	4.0	4.0	26.0
	Other		0.0	1.3	**0.0**	1.5	0.0	1.5	0.0	4.3
		Total Other	189.2	287.8	**300.5**	315.5	328.8	344.6	282.7	2,049.1
TOTAL IN-KIND CONTRIBUTION			**252.0**	**355.8**	**370.7**	**387.8**	**403.8**	**423.5**	**364.2**	**2,557.9**
ALL PROGRAMS CASH CONTRIBUTIONS			**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**700.0**

SILVAGENE

CRC FOR SUSTAINABLE PRODUCTION FORESTRY 1999/2000 Financial tables

Itemised List of Cash and In-Kind Contributions (in $'000's)

Name	SALARIES *Designation*	*% time CRC*	97/98 Actual	98/99 Actual	**99/2000 Actual**	2000/01 Budget	2001/02 Budget	2002/03 Budget	2003/04 Budget	TOTAL
H O'Sullivan	Research	30								
		Total Salary	0.0	0.0	**19.0**					19.0
	Direct On-Costs	*% of total Salary*								
	Total On-Costs	8	0.0	0.0	**1.6**					1.6
	Total Salaries & On-Costs		0.0	0.0	**20.6**	93.8	93.8	93.8	93.8	395.8
	CAPITAL									
	Total Capital		0.0	0.0	**2.0**	0.0	0.0	0.0	0.0	0.0
	OTHER									
	Total Other		5.0	5.0	**5.0**	220.5	220.5	220.5	220.5	897.0
TOTAL IN-KIND CONTRIBUTION			**5.0**	**5.0**	**27.6**	**314.3**	**314.3**	**314.3**	**314.3**	**1,292.8**
ALL PROGRAMS CASH CONTRIBUTIONS			**0.0**	**0.0**	**0.0**	**62.5**	**50.0**	**50.0**	**50.0**	**212.5**

Please note: Budgeted contributions from 2000/01 as those of Timbercorp Limited.

University of Tasmania

CRC FOR SUSTAINABLE PRODUCTION FORESTRY 1999/00 Financial tables

Itemised List of Cash and In-Kind Contributions (in $'000's)

	SALARIES	% time	97/98	98/99	99/2000	2000/01	2001/02	2002/03	2003/04	TOTAL
Name	*Designation*	*CRC*	Actual	Actual	Actual	Budget	Budget	Budget	Budget	
J Reid	Administration/Research	50			**45.6**					
R Vaillaincourt	Research	45			**27.3**					
P Brown	Research	30			**16.1**					
R Wiltshire	Research	30			**15.6**					
I Cummings	Technical	30			**11.9**					
G Allen	Research	25			**14.5**					
M Hurley	Research	25			**11.5**					
C McArthur	Research	25			**13.4**					
N Davidson	Research	25			**14.5**					
B Potts	Research	25			**16.9**					
G Johnson	Administration	20			**7.6**					
R Clark	Research	20			**18.3**					
M Line	Research	20			**13.7**					
A Smolenski	Technical	18			**7.9**					
S Jennings	Research	15			**8.7**					
C Mohammed	Research	15			**8.0**					
G Hallegraeff	Administration	10			**7.7**					
R Swain	Administration	10			**7.7**					
G Jordan	Research	10			**0.9**					
C Lane	Administration	5			**1.3**					
B Rumbold	Administration	5			**2.5**					
S Jones	Administration	5			**1.7**					
M Hovenden	Research	5			**2.5**					
L Johnson	Technical	5			**2.2**					
A Glenn *	Research	2			**1.8**					
	Total Salary		259.1	274.7	**279.9**	298	298	298	298	298

* Nominal Allocation of Salary for Academic Level E Step 1

Direct On-Costs	*% of total Salary*								
Payroll Tax	7.72	18.1	21.2	**21.6**	22.8	22.8	22.8	22.8	22.8
Superannuation	17	44.0	46.7	**47.6**	50.7	50.7	50.7	50.7	50.7
Workers Compensation	0.5	2.6	1.4	**1.4**	1.5	1.5	1.5	1.5	1.5
Leave Loading-Academics	1.3	3.2	0.0	**1.0**	1.0	1.0	1.0	1.0	1.0
Long Service Leave	3.2	8.3	8.8	**9.0**	9.5	9.5	9.5	9.5	9.5
Outside Study Academics		20.0	20.0	**20.0**	20.0	20.0	20.0	20.0	20.0
HECS student costs		30.0	30.0	**30.0**	30.0	30.0	30.0	30.0	30.0
Other									
	Total On-Costs	126.3	128.0	**130.6**	135.5	135.5	135.5	135.5	135.5
	Total Salaries & On-Costs	385.4	402.7	**410.5**	433.5	433.5	433.5	433.5	433.5
CAPITAL									
	Total Capital	0.0	0.0	**0.0**	0.0	0.0	0.0	0.0	0.0
OTHER	*% of Total Salaries & On -Costs*								
Academic Services	25	96.3	100.7	**102.6**	108.4	108.4	108.4	108.4	108.4
General Uni Services	41	158.0	165.1	**168.3**	177.7	177.7	177.7	177.7	177.7
Departmental office support	10	38.5	40.3	**41.0**	43.3	43.3	43.3	43.3	43.3
Laboratory rent	32	123.3	128.9	**131.4**	138.7	138.7	138.7	138.7	138.7
Office Space	8	30.8	32.2	**32.8**	346.8	346.8	346.8	346.8	346.8
CSL		84.4	84.4	**84.4**	84.4	84.4	84.4	84.4	84.4
Centre Agency (10% grant)		171.8	231.9	**231.9**	231.9	231.9	231.9	231.9	231.9
Other			41.9						
	Total Other	703.1	825.3	**792.4**	1,131.2	1,131.2	1,131.2	1,131.2	6,845.7
TOTAL IN-KIND CONTRIBUTION		**1,088.5**	**1,228.0**	**1,202.9**	**1,564.7**	**1,564.7**	**1,564.7**	**1,564.7**	**9,778.2**
ALL PROGRAMS CASH CONTRIBUTIONS									

CRC FOR SUSTAINABLE PRODUCTION FORESTRY 1999/2000 Financial tables

The Australian National University

Itemised List of Cash and In-Kind Contributions (in $'000's)

Name	SALARIES *Designation*	*% time* *CRC*	97/98 Actual	98/99 Actual	**99/2000** **Actual**	2000/01 Budget	2001/02 Budget	2002/03 Budget	2003/04 Budget	TOTAL
P Kanowski	Research	30			**30.0**					
D Race	Research	25			**25.0**					
S Mahendrarajah	Research	10			**10.0**					
R James	Research	10			**10.0**					
		Total Salary	48.5	48.6	**49.7**	49.7	49.7	49.7	49.7	345.6
	Direct On-Costs	*% of total Salary*								
	Payroll tax									
	Superanuation									
	Workers Compensation									
	Leave Loading									
	Long Service Leave									
		Total On-Costs	10.7	10.7	**12.9**	12.9	12.9	12.9	12.9	85.9
		Total Salaries & On-Costs	59.2	59.3	**62.6**	62.6	62.6	62.6	62.6	431.5
	CAPITAL									
		Total Capital	0.0	0.0	**0.0**	0.0	0.0	0.0	0.0	0.0
	OTHER									
	Head Office Support	300								
		Total Other	177.7	177.7	**187.8**	187.8	187.8	187.8	187.8	1,294.4
TOTAL IN-KIND CONTRIBUTION			**236.9**	**237.0**	**250.4**	**250.4**	**250.4**	**250.4**	**250.4**	**1,725.9**
ALL PROGRAMS CASH CONTRIBUTIONS										

Boral Timber Tasmania

CRC FOR SUSTAINABLE PRODUCTION FORESTRY 1999/2000 Financial tables

Itemised List of Cash and In-Kind Contributions (in $'000's)

		% time CRC	97/98 Actual	98/99 Actual	**99/2000 Actual**	2000/01 Budget	2001/02 Budget	2002/03 Budget	2003/04 Budget	TOTAL
SALARIES										
Name	*Designation*									
C Hawkins	Research			9.5	**21.2**	20				50.7
P Naughton	Research		5.0	5.4	**1.1**	2	2	2	2	19.5
M Bramich	Administration			0.4	**0**	0				0.4
A White	Administration			3.9	**0**	0				3.9
		Total Salary	5.0	19.2	**22.3**	**22.0**	**2.0**	**2.0**	**2.0**	74.5
	Direct On-Costs	*% of total Salary*								
	Leave Loading	8.0								
	Payroll Tax	7.0								
	Superannuation	5.5								
	Workers Compensation	5.0								
	Long service leave	2.0								
		Total On-Costs	1.4	5.3	**6.1**	6.0	0.6	0.6	0.6	20.5
		Total Salaries & On-Costs	6.4	24.5	**28.4**	28.0	2.6	2.6	2.6	95.0
CAPITAL										
		Total Capital	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OTHER		*% of Total Salaries & On-Costs*								
	Other		28.0	15.2	**12.2**	12.0	26.8	26.8	26.8	147.8
	Office support		1.9	7.4	**1.1**	2.0	1.9	1.9	1.9	18.1
	Head office overheads		0.8	3.0	**0.0**	2.0	0.8	0.8	0.8	8.2
	Operational		1.9	7.4	**0.0**	2.0	1.9	1.9	1.9	17.0
	Amortised vehicle costs		0.3	1.7	**0.0**	0.3	0.3	0.3	0.3	3.2
	Land rent		0.1	0.5	**0.0**	0.5	0.1	0.1	0.1	1.4
	Trial maintenance		0.5	1.9	**0.0**	1.2	0.5	0.5	0.5	5.1
	Experiments		1.3	4.9	**0.0**	2.0	1.3	1.3	1.3	12.1
		Total Other	34.8	42.0	**13.3**	22.0	33.6	33.6	33.6	212.9
TOTAL IN-KIND CONTRIBUTION			**41.2**	**66.5**	**41.7**	**50.0**	**36.2**	**36.2**	**36.2**	**307.9**
ALL PROGRAMS CASH CONTRIBUTIONS										

CRC FOR SUSTAINABLE PRODUCTION FORESTRY 1999/2000 Financial tables

Private Forests Tasmania

Itemised List of Cash and In-Kind Contributions (in $'000's)

	SALARIES	% time	97/98	98/99	**99/2000**	2000/01	2001/02	2002/03	2003/04	TOTAL
Name	*Designation*	*CRC*	Actual	Actual	**Actual**	Budget	Budget	Budget	Budget	
L Anderson		9			**1.0**					
A Lyons		4			**2.5**					
G Clark		4			**1.2**					
A Warner		2			**1.4**					
D Bower		2			**1.9**					
		Total Salary	0.0	0.0	**8.2**	0.0	0.0	0.0	0.0	0.0
	Direct On-Costs	*% of total Salary*								
	Superannuation									
	Workers Compensation									
	Long Service Leave									
	Payroll Tax									
		Total On-Costs	0.0	0.0	**2.0**	0.0	0.0	0.0	0.0	2.0
		Total Salaries & On-Costs	0.0	0.0	**10.2**	8.1	8.1	8.1	8.1	42.7
	CAPITAL									
		Total Capital	0.0	0.0	**0.0**	0.0	0.0	0.0	0.0	0.0
	OTHER									
					17.2					
		Total Other	0.0	0.0	**17.2**	16.3	16.3	16.3	16.3	82.2
TOTAL IN-KIND CONTRIBUTION			**0.0**	**0.0**	**27.4**	**24.4**	**24.4**	**24.4**	**24.4**	**124.9**
ALL PROGRAMS CASH CONTRIBUTIONS			**0.0**	**0.0**	**0.0**	**20.0**	**20.0**	**20.0**	**20.0**	**80.0**

The University of Queensland

CRC FOR SUSTAINABLE PRODUCTION FORESTRY 1999/2000 Financial tables

Itemised List of Cash and In-Kind Contributions (in $'000's)

	SALARIES	% time	97/98	98/99	**99/2000**	2000/01	2001/02	2002/03	2003/04	TOTAL
Name	*Designation*	*CRC*	Actual	Actual	**Actual**	Budget	Budget	Budget	Budget	
D Doley	Research	25								0.0
		Total Salary		19.5	**20.1**	20.3	20.5	20.7	20.7	121.8
	Direct On-Costs	*% of total Salary*								
	Payroll tax	21								
	Superanuation									
	Workers Compensation									
	Leave Loading									
	Long Service Leave									
		Total On-Costs		4.0	**4.2**	**4.3**	**4.3**	**4.3**	**4.3**	**25.6**
		Total Salaries & On-Costs	8.6	23.6	**24.3**	**24.6**	**24.8**	**25.0**	**25.0**	**147.4**
	CAPITAL									
		Total Capital	0.0	0.0	**0.0**	0.0	0.0	0.0	0.0	0.0
	OTHER	*% of Total Salaries & On -Costs*								
		Total Other	10.0	47.0	**47.0**	47.0	47.0	47.0	47.0	292.0
TOTAL IN-KIND CONTRIBUTION			**18.6**	**70.6**	**71.3**	**71.6**	**71.8**	**72.0**	**72.0**	**439.4**
ALL PROGRAMS CASH CONTRIBUTIONS										

Australian Forest Growers

CRC FOR SUSTAINABLE PRODUCTION FORESTRY 1999/2000 Financial tables

Itemised List of Cash and In-Kind Contributions (in $'000's)

	SALARIES	% time	97/98	98/99	**99/2000**	2000/01	2001/02	2002/03	2003/04	TOTAL
Name	*Designation*	*CRC*	Actual	Actual	**Actual**	Budget	Budget	Budget	Budget	
Publicity	Administration	80								
Administration	Administration	40								
		Total Salary	1.0	1.0	**1.2**	1.0	1.0	1.0	1.0	7.2
	Direct On-Costs	*% of total Salary*								
	Productivity benefit									
	Superanuation									
	Workers Compensation	10								
	Leave Loading									
	Long service Leave									
	Other									
		Total On-Costs	0.1	0.1	**0.1**	0.1	0.1	0.1	0.1	0.7
	Total Salaries & On-Costs		1.1	1.1	**1.3**	1.1	1.1	1.1	1.1	8.0
	CAPITAL									
	Total Capital		0.0	0.0	**0.0**	0.0	0.0	0.0	0.0	0.0
	OTHER	*% of Total Salaries & On -Costs*								
	Publicity		0.3	0.3	**0.3**	0.3	0.3	0.3	0.3	2.1
	Total Other		0.3	0.3	**0.3**	0.3	0.3	0.3	0.3	2.1
TOTAL IN-KIND CONTRIBUTION			**1.4**	**1.4**	**1.6**	**1.4**	**1.4**	**1.4**	**1.4**	**10.1**
ALL PROGRAMS CASH CONTRIBUTIONS			**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**7.0**

CRC FOR SUSTAINABLE PRODUCTION FORESTRY 1999/2000 Financial tables

Serve-Ag Pty Ltd

Itemised List of Cash and In-Kind Contributions (in $'000's)

SALARIES	% time	97/98	98/99	**99/2000**	2000/01	2001/02	2002/03	2003/04	TOTAL
Name / *Designation*	*CRC*	Actual	Actual	**Actual**	Budget	Budget	Budget	Budget	
Mr Peter Volker	5								
Ms J Westbrook	1								
Dr D Blaesing	1								
	Total Salary								
Direct On-Costs	*% of total Salary*								
Superannuation									
Workers Compensation									
Long Service Leave									
Payroll Tax									
	Total On-Costs								
Total Salaries & On-Costs		0.0	0.0	**10.5**	7.5	7.5	7.5	7.5	40.5
CAPITAL									
Total Capital		0.0	0.0	**0.0**	0.0	0.0	0.0	0.0	0.0
OTHER									
Total Other		0.0	0.0	**21.5**	11.3	11.3	11.3	11.3	66.5
TOTAL IN-KIND CONTRIBUTION		**0.0**	**0.0**	**32.0**	**18.8**	**18.8**	**18.8**	**18.8**	**107.0**
ALL PROGRAMS CASH CONTRIBUTIONS		**0.0**	**0.0**	**0.0**	**1.0**	**1.0**	**1.0**	**1.0**	**4.0**

CRC FOR SUSTAINABLE PRODUCTION FORESTRY 1999/2000 Financial tables

Southern Tree Breeding Association

Itemised List of Cash and In-Kind Contributions (in $'000's)

	SALARIES	% time	97/98	98/99	**99/2000**	2000/01	2001/02	2002/03	2003/04	TOTAL
Name	*Designation*	*CRC*	Actual	Actual	**Actual**	Budget	Budget	Budget	Budget	
P Gore	Research	13								
T McRae	Research	7								
		Total Salary	0.0	0.0	**10.2**	0.0	0.0	0.0	0.0	10.2
	Direct On-Costs	*% of total Salary*								
		Total On-Costs	0.0	0.0	**4.6**	0.0	0.0	0.0	0.0	4.6
		Total Salaries & On-Costs	6.0	6.0	**14.8**	13.0	13.0	13.0	13.0	78.8
	CAPITAL									
		Total Capital	0.0	0.0	**0.0**	0.0	0.0	0.0	0.0	0.0
	OTHER									
	Data			37.0						
		Total Other	0.0	37.0	**0.0**	0.0	0.0	0.0	0.0	37.0
TOTAL IN-KIND CONTRIBUTION			**6.0**	**43.0**	**14.8**	**13.0**	**13.0**	**13.0**	**13.0**	**115.8**
ALL PROGRAMS CASH CONTRIBUTIONS			**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Abbreviations

AAD	Australian Antarctic Division
AFG	Australian Forest Growers
ANU	Australian National University
APA(I)	Australian Post-graduate Award (Industry)
APP	Australian Paper Plantations Pty Ltd
ARC	Australian Research Council
BTT	Boral Timber Tasmania Ltd
CFTT	Centre for Forest Tree Technology
CRC-SPF	Cooperative Research Centre for Sustainable Production Forestry
CSIRO Ento	CSIRO Entomology
CSIRO FFP	CSIRO Forest and Forest Products
DPIF	Department of Primary Industries, Forestry
DPIWE	Department of Primary Industries, Water and Environment
ETT	Education and Technology Transfer Program
FCP	Fletcher Challenge Paper
FEA	Forest Enterprises Australia Pty Ltd
FFIC	Forests and Forest Industry Council
ForSA	Forestry South Australia
FT	Forestry Tasmania
GI	Genetic Improvement Program
GU	Griffith University
HVP	Hancocks Victoria Plantation
NCSU	North Carolina State University, USA
NET	North Eucalypt Technologies, North Forest Products Ltd
NFP	North Forest Products Ltd
NHT	National Heritage Trust
NPWS	National Parks and Wildlife Service
NZFRI	New Zealand Forestry Research Institute
PFT	Private Forests Tasmania
PIC	Primary Industries Corporation (Qld)
QDPI	Queensland Department of Forest Industries
QFRI	Queensland Forest Research Institute
RIRDC	Rural Industries Research and Development Corporation
RP	Resource Protection Program
SCRI	Scottish Crop Research Institute, UK
SCU	Southern Cross University
Serve-Ag	Serve-Ag Pty Ltd
SF NSW	State Forests of New South Wales
SIF	Strategic Initiatives Fund
SM	Sustainable Management Program
STBA	Southern Tree Breeding Association Inc
STf	Sotico Treefarms Pty Ltd
SPIRT	Strategic Partnerships with Industry Research and Training Scheme
TFGA	Tasmanian Farmers and Graziers Association
TIAR	Tasmanian Institute of Agricultural Research
Timbercorp	Timbercorp Limited
UA	University of Adelaide
UC Davis	University of California, USA
UL	University of Louisiana, USA
UM	University of Melbourne
UNA	University of North Arizona, USA
UNE	University of New England
UQ	The University of Queensland
USC	University of the Sunshine Coast
UT	University of Tasmania

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