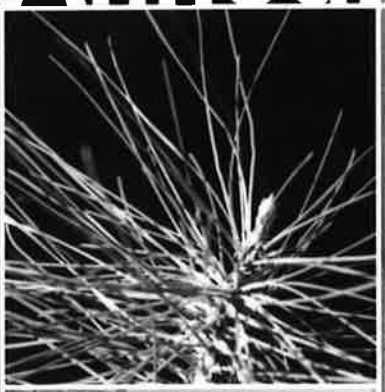
COOPERATIVE RESEARCH CENTRE
FOR SUSTAINABLE PRODUCTION FORESTRY

Annual Report 01/02



CRC

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

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 2001/02

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

Australian Forest Growers

Australian Plantation Timber Limited

CSIRO Entomology

CSIRO Forestry and Forest Products

Department of Primary Industries Queensland

Forest Enterprises Australia Pty Ltd

Forestry Tasmania

Grand Ridge Plantations Pty Ltd

Griffith University

Gunns Limited

Norske Skog Paper Mills (Australia) Limited

Private Forests Tasmania

seedEnergy Pty Ltd

Serve-Ag Pty Ltd

Southern Cross University

Southern Tree Breeding Association Inc

The Australian National University

The University of Queensland

Timbercorp Limited

University of Tasmania

WACAP Treefarms Pty Ltd

Contents

Chairman's Report

Forestry plantations have expanded rapidly since 1995, with the current estate totalling over 1.5 million hectares. The target of the national strategy *Plantations for Australia: The 2020 Vision* is to treble the effective area of Australia's plantations between 1996 and 2020 by planting an average of 80,000 hectares a year. Under this plan a $2 billion trade deficit in wood and wood products will be converted into a surplus.

The CRC's research program is directed to ensuring that plantations are sited and managed to maximise their profitability, thus increasing this significant contribution to the sustainable economic and social development of Australia.

In 2001, the Federal Government's Innovation Statement, *Backing Australia's Ability*, announced additional funding of $227 million over five years to expand the Cooperative Research Centres Program. The expanded program allows for an increased number of CRCs, larger grants, and enhanced opportunities for small and medium enterprises to participate. This is a vote of confidence in the future of the CRC Program in which our CRC and its predecessor Temperate Hardwood Forestry have been prominent participants since 1991.

The eligibility of existing CRCs, like Forestry, to apply for another round of funding was a contentious issue prior to the opening of applications for the 2002 Round. In the event, the Minister's announcement invited strong applications from both new and existing CRCs, with existing CRCs needing to demonstrate a clear record of research leading to commercialisation, technology transfer or utilisation. This CRC's track record positions us advantageously in a very competitive field. With this in mind, the Board decided to mount a bid for a third round 'Plantation Forestry' CRC. Discussions were initiated with several other forestry sector bid groups, in recognition that only one 'forestry' CRC would be likely to be funded. Negotiations to bring the bid groups together were successful and an application for a CRC for Tree Technologies, involving all but one of the current core partners in SPF as well as additional major research and industry players, was lodged on 29 May 2002. The strong forest industry support for continuing CRC research demonstrates the value the industry places on the work done during the life of the current Centre.

Much effort by management and researchers in 2001/02 was devoted to the negotiation and development of the new research and business plans, and the application document.

Another major task was the preparation for the Fifth Year Review scheduled for early 2002/03. As an input to the review process, an independent economic evaluation was commissioned from the Centre for International Economics (CIE). The consultants examined a representative selection of projects and calculated benefit-cost ratios ranging from 5 to 137. Among other things, they concluded that 'the returns on the projects selected for detailed cost benefit analysis far exceed the CRC's expenditure over its seven year term. ... Using these projects as a guide to the pay-offs from the entire portfolio of CRC activities it is clear that the Australian economy is achieving a very high rate of return on funds spent by the CRC.' CIE also commented on the effectiveness of collaboration: 'The partnerships and cooperative links formed between CRC researchers and industry is of major benefit to the forest products industry. It is evident that these partnerships have promoted rapid adoption of research findings by forest companies. In the absence of the CRC, uptake by industry would almost certainly be far less.' The Board is well pleased with the findings of this report and we expect the Commonwealth will also consider its investment in forestry well placed.

Despite the workload associated with the new bid and preparations for the Fifth Year Review, the CRC has continued to show great innovation in its scientific program. Also, it has strengthened its technology transfer and links with industry, and built on the international linkages and collaboration which is becoming an increasingly important component of CRC research.

Two changes in Board membership have occurred during the Year: Dr Sadanandan Nambiar has replaced Dr Glen Kile as the member nominated by CSIRO following Dr Kile's appointment as Executive Director of the Forest and Wood Products Research and Development Corporation; and Prof Roger Kitching has replaced Prof Bill Hogarth as the member nominated by Griffith University, following Prof Hogarth's appointment as Pro Vice-Chancellor Science and Information Technology at the University of Newcastle. I thank all Board members for their contribution during the year.

This report sets out in some detail the significant achievements of the CRC over the past year. On behalf of the Board, I thank all those involved in the work. The Board particularly recognises the contributions of staff in member organisations and the efforts of all CRC researchers, students and support staff. I would also like to acknowledge the positive contributions of our previous Director, Professor J Reid and the present incumbent Professor R Griffin to the successful management of the Centre.

John Kerin
Chairman

Director's Report

In August 2001, my predecessor Professor Jim Reid resigned as Director of CRC-SPF to become Dean of the Faculty of Science and Engineering at the University of Tasmania. It is a credit to the organisation that Jim put in place, and to the current staff of the CRC, that the conduct of research and the timely transfer of new knowledge to users has been remarkably unaffected during the transition process.

Membership of the CRC was relatively stable through this year. Gunns Limited was granted core membership via the acquisition of North Forest Products; Australian Paper Plantations changed ownership and is now Grand Ridge Plantations Pty Ltd; and receivers were appointed to Australian Plantation Timber Limited whose membership of the CRC was subsequently terminated.

Since January 2002, the major challenges have been to progress a new bid for funding beyond the end of CRC-SPF in 2004, and to prepare for the Fifth Year Review process. By the time a CRC has been in existence for five years it should be very obvious whether the objectives are being met, and I am confident that we will be able to demonstrate that CRC-SPF is delivering very well in our mission to sustain the productivity of and enhance the economic benefit from Australia's forests through excellence in research, training and technology transfer.

The three Research Programs have made substantial progress in 2001/02. For example, the TREEPLAN software developed with the Southern Tree Breeding Association has been applied to the latest genetic evaluation of the national *Eucalyptus globulus* breeding program, and molecular studies have demonstrated the important practical conclusion that growth and wood density traits are inherited independently in tropical pines. The Sustainable Management Program has produced a fine example of a simple tool based on a substantial scientific program, with their Visual Guide for Determining Leaf Area Index in eucalypt plantations. The amount of canopy carried by the trees is an important determinant of growth potential and is otherwise slow and costly to measure. In the north, findings that residue retention along the contour in Hoop pine plantations almost halves post-harvest nitrogen loss, is influencing management practice. In the Resource Protection Program advances include identification of the chemical composition of the female sex pheromone of the Autumn gum moth, allowing more effective trapping and management of an insect which can completely defoliate eucalypt plantations. Experiments have shown that, in Tasmania, large reductions in browsing damage may be achieved by sowing a cover crop of bitter lupin.

Since our work is incomplete until the results of research are in the hands of users – particularly our industrial members but also the wider forestry community - I intend that we will further emphasise this aspect of the program during the remaining term of the CRC. The Australian forest industry is undergoing substantial change – through mergers and acquisitions and also in conformity with a world-wide move for reduction of fixed costs and the outsourcing of activities including R&D. Since 1998, the CRC has lost over one third of the research collaborators employed by our industrial partners. In many cases these were the most experienced people who were best able to absorb new knowledge and apply it to management. The challenge is to adapt our technology transfer practices to this new reality. In addition to technical report packages and an increase in scientist visits to companies, the CRC has been developing new methods of presenting research findings. We have initiated the 'Fest', which comprises several short presentations focussed on industrial outcomes from research, followed by discussions and/or field demonstrations. Greater use is also being made of a web-based publication database and calendar of events which have increased partner use of CRC information and communications resources. These measures have been well received by partners.

This year we expanded the strategic scholarship fund to $330,000 and have recruited ten new postgraduate students. Many of these receive Australian Postgraduate Awards or university scholarships so that we have been able to leverage the CRC funds by offering top-ups. Fourteen of our student intake completed their degrees this year and we wish them all well in their new endeavours.

A key reason for my acceptance of this position was that I was confident I would be working with a competent and effective team of people. I have not been disappointed, and I look forward to the continued co-operation of all as during 2002/03 we plan for the windup of CRC-SPF and transition to a new and exciting future, whether within or outside the CRC system. The support of the Chairman and Board is also appreciated and I would like to thank colleagues at all levels for their contribution to an excellent year for the CRC.

Professor Rod Griffin
Director

MANAGEMENT

The Board

The Board of Management of the Centre comprises an independent Chair, a representative of each Core Member organisation, the Director and Deputy Director of the Centre, and the Chair of the Advisory Panel. 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 (Chair), 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 of each Program Coordinating Committee.

Management Committee

The Management Committee assists the Director in the day-to-day running of the Centre by implementing the policies set by the Board. The Committee comprises:

Prof Rod Griffin (Director)
Dr Russell Haines (Deputy Director)
Mr David Lyons (Business Manager)
Ms Jean Richmond (Secretary)
Program Managers:
A/Prof Brad Potts (Genetic Improvement)
Dr Chris Beadle (Sustainable Management)
Dr Clare McArthur (Resource Protection)
Dr Neil Davidson (Education and Technology Transfer)

CRC Board

Mr John Kerin
Chair

Prof Rod Griffin
Director
(Ex officio)

Dr Russell Haines
Deputy Director
(Ex officio)

Dr David de Little
Chair, Advisory Panel
(Ex officio)

Mr Ron Beck
Executive Director Forestry
Department of Primary Industries Queensland

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

Mr John Cameron
General Manager
Grand Ridge Plantations Pty Ltd

Mr Ian Ravenwood
Manager – NW
Plantation Division
Gunns Ltd

Dr Sadanandan Nambiar
Portfolio Manager
CSIRO, Forestry and Forest Products

Dr Hans Drielsma
General Manager
(Forest Management)
Forestry Tasmania

Mr Ian Bail
Project Manager
Timbercorp Technologies
Timbercorp Limited

Prof Peter Baverstock
Dean
Graduate Research College
Southern Cross University

Mr Arnold Willems
Performance Manager-Fibre
Norske Skog Paper Mills (Australia) Limited

Mr Mal Parker
General Manager Operations
Australian Plantation Timber Ltd

Mr Richard Breidahl
General Manager
Plantation Operations
WACAP Treefarms Pty Ltd

Prof Roger Kitching
Chair of Ecology
Griffith University

Program Coordinating Committees

The Program Coordinating Committees 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 program outcomes. The committees are chaired by an industry partner representative, and consist of the Program Manager and at least three industry partner representatives. Project Leaders within the program are included as non-voting members.

Genetic Improvement Program
Mr Peter Volker (Chair)
Prof Rod Griffin (Director)
A/Prof Brad Potts (Program Manager)
Ms Helen O'Sullivan (TC)
Mr Chris Berry (NS)
Mr Peter Kube (FT)
Mr Simon Hunter (WACAP)
Mr Kelsey Joyce (GL)
Dr Tony McRae (STBA)
Mr Ian Last (DPIQ)
Mr Simon Penfold (GRP)
Dr Neil Davidson (Program Manager ETT)

Sustainable Management Program
Ms Sandra Hetherington (Chair)
Prof Rod Griffin (Director)
Dr Chris Beadle (Program Manager)
Mr Ian Ravenwood (GL)
Mr Ian Last (DPIQ)
Mr Bill Neilsen (FT)
Mr Richard Breidahl (WACAP)
Mr Henry Lieshout (GRP)
Mr Paul Smale (TC)
Dr Neil Davidson (Program Manager ETT)

Resource Protection Program
Dr David de Little (Chair)
Prof Rod Griffin (Director)
Dr Clare McArthur (Program Manager)
Mr Chris Berry (NS)
Dr James Bulinski (TC)
Ms Anne Partridge (GRP)
Mr Tim Wardlaw (FT)
Dr John Madden (Hon CRC Fellow)
Dr Bill Foley (ANU)
Dr Ross Wylie (DPIQ)
Dr Neil Davidson (Program Manager ETT)

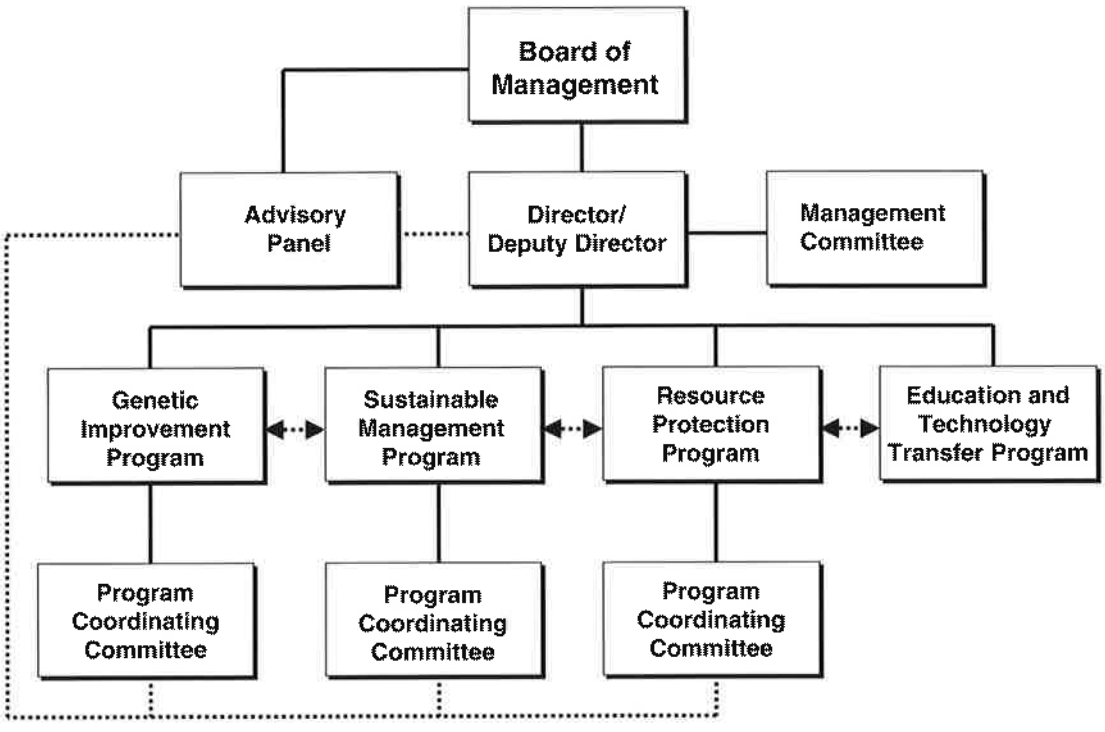


Figure 1. Management Structure

MAJOR DEVELOPMENTS

Maximising the benefits of residue management

Unacceptable losses of nitrogen (N) following burning in Hoop pine plantations after harvesting has led to the retention of post-harvest residues on site. Residues, formed as windrows along the contours of moderate to severely sloping land, should reduce erosion and provide a valuable source of nutrients to the trees of the following rotation. Results from long-term experiments have shown that water in this high rainfall-event environment is the principal agent for the movement of residue-derived nutrients.

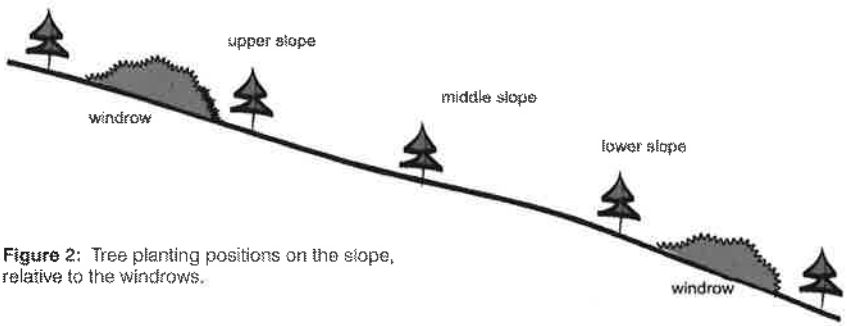


Figure 2: Tree planting positions on the slope, relative to the windrows.

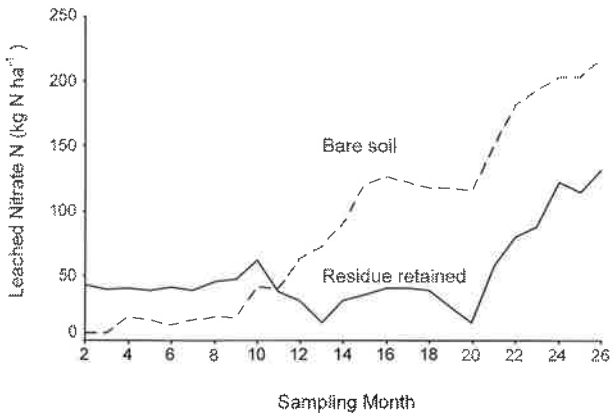


Figure 3: Nitrate leaching following harvesting with bare soil and residue retention.

Windrowed post-harvest residues provided an effective barrier to the down-slope movement of entrained sediments causing deposition of labile carbon (C) and maintaining high soil moisture content at the upper edge of each windrow. The pooling of moisture and labile C carried down the slope also provided an area of microbiological activity on the lower slope, giving trees planted there an advantage over trees planted higher up the slope (Figure 2). During the first three years following harvest, C was more mobile within the system whilst the N was immobilised within the windrows. The nitrification potential in the plantation soils was high and the potential for N loss through leaching was greatest in the areas between the windrows where the residues had been removed. Where residues had been left as a blanket cover, N losses through leaching were reduced from 240 kg N ha^{-1} in bare soil to 140 kg N ha^{-1} with residue retention (Figure 3).

The capacity for residues to immobilise N and prevent off-site losses through leaching and erosion during plantation establishment has important implications for N management. Nitrogen mineralised from the soil and then immobilised in harvest residues will reduce N losses during early plantation establishment when young trees have a low demand for soil N. It is anticipated that the release of the N immobilised in the harvest residues will coincide with the increasing demand for N as the trees grow. Windrowed harvest residues conserve C and N on site and can be used for sustaining the productivity of second and later rotations.

MAJOR DEVELOPMENTS

A new era in insect pest monitoring in forestry arrives

Most species of moth use chemical signals to facilitate mate location and thereby ensure fertilisation of the female. Such chemicals have long been used in the northern hemisphere as tools to assist with population monitoring and even for the management of some forest Lepidoptera. In 1999 a collaborative project supported by the CRC-SPF and involving Austrian, Swedish and Australian experts began to determine the existence, identity and efficacy of the female sex pheromone of the Autumn gum moth (*Mnesampela privata*). This project's ultimate objective was to develop a sex pheromone lure for monitoring populations of Autumn gum moth in plantations. Such a lure would be more cost effective than light trapping for moths because the lures would work for longer, attract only the Autumn gum moth and need less labour to maintain.

The glands of female moths were extracted and the chemical components contained within surveyed using gas chromatography (GC, using a flame ionisation detector, FID). Gas chromatography in combination with simultaneous electroantennographic detection (EAD) was then used to determine which of these compounds the antennae of male moths responded to (see FID and EAD traces in Figure 4). When an 'active peak' was identified, gas chromatography in combination with mass spectroscopy (MS) was used to determine the chemical composition of the active compounds.

When the chemical identity of an active compound had been established, a synthetic analogue from overseas collaborators was obtained for further EAD studies. This synthetic analogue elicited a reaction in male antennae comparable to a compound extracted from female organs (see Figure 4).

Field trapping with synthetic lures, prepared using the synthetic sex pheromone analogue and virgin female moths, began at experimental sites around Canberra in 2002 to determine their relative efficacies in attracting male moths. Male moths were caught in the synthetic sex pheromone lures in similar numbers to the numbers of males caught in traps baited with virgin females. Hence the existence and identity of the sex pheromone of Autumn gum moth has been confirmed under both laboratory and field conditions. Further work with a Swedish collaborator is planned for 2002/03 to refine the use of the lures. When these studies are complete the potential to commercialise the lure will be investigated.

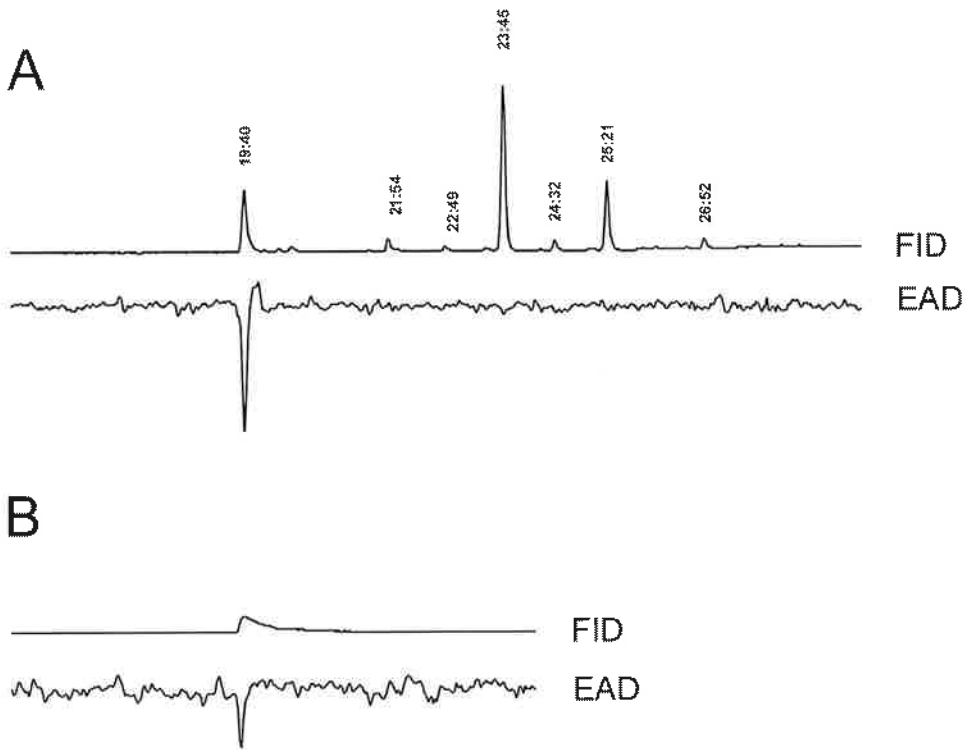


Figure 4: Results of EAD studies with (A) a female pheromone gland extract and (B) a synthetic sex pheromone analogue. The physiologically active component of the sex pheromone extract eluted, in this instance, after 19.40 minutes. An antennal reaction is characterised by a sharp drop in the EAD trace, concomitant with the occurrence of a peak in the FID trace, followed by a 'recovery period' immediately afterwards. Another six compounds in the extract shown in A did not elicit physiological responses in the male antenna.

MAJOR DEVELOPMENTS

A genetic evaluation system for tree breeding (TREEPLAN®)

The effective deployment of improved genetic material in plantations depends on the ability to accurately choose elite genotypes. This involves managing large amounts of information on the attributes for a very large number of potentially valuable parental trees from different generations of breeding. Rapid improvement of genetic stock requires trial assessment, predictions of genetic worth and decisions about which parents will produce the best offspring when mated. Traditionally, this process has been sub optimal, due to resource constraints and inadequate genetic evaluation methods delaying decision-making and hence genetic progress in plantations.

To improve this situation, a new software system has been developed by the Southern Tree Breeding Association (STBA) in collaboration with scientists from the Animal Genetics and Breeding Unit, University of New England (AGBU), and from the Breeding Strategies Project of the CRC-SPF. The CRC-SPF has incorporated theoretical developments in model building and trait mapping. The integrated system consists of two components: a database for maintaining all information from the STBA's national tree improvement programs and a genetic evaluation program (TREEPLAN®).

TREEPLAN® uses the most sophisticated genetic evaluation algorithms available to cope with the diversity of information contained in the national tree improvement programs for *Eucalyptus globulus* and *Pinus radiata*. The TREEPLAN® evaluation system is flexible, allowing for new sources of information and analysis options.

Major obstacles for national evaluations are the sheer number of trees included in the process and site heterogeneity. In addition, evaluations need to be updated regularly as the STBA collects new information, TREEPLAN® overcomes these problems by:

- using reduced individual tree models;
- mapping assessed trials to a small number of key traits that have the biggest impact on profit, thus focusing on the financial impact of decisions;
- allowing for multiple site qualities, ages of measurement and measurement systems;
- using models that are tailored to the measurements and experimental design of each site; and
- grouping similar genetic material to generate comparable information for each different population being assessed.

There are plans for further development of the system, to include molecular information, non additive genetic effects and new statistical methodologies. Equally important will be improvements in usability for tree breeders. The system is currently being used in the latest national evaluations for Blue gum and Radiata pine.

Participants at the TREEPLAN® workshop held in Mount Gambier in June 2002 included, from left to right: David Pilbeam (STBA), Dr Mike Powell (STBA), Dr Luis Apiolaza (CRC-SPF), Greg Dutkowski (CRC-SPF), Dr Bruce Tier (AGBU), Dr Tony McRae (STBA) and Dr Richard Kerr (AGBU).

MAJOR DEVELOPMENTS

Seedling physiology as a tool for risk management

Cold-induced photoinhibition, the absorption of excess light energy by plants, causes 'transplant shock', reduced photosynthetic efficiency and photodamage, leading to death of tissues. This was found to be associated with reduced growth and survival of seedlings after planting on cold, high altitude, sites. Shadecloth tree-shelters are one option for protecting seedlings. Such shelters prevented damage to *E. globulus* seedlings after planting: those not shaded had 25% mortality and the survivors had greatly reduced growth rates. Young seedlings in the nursery were particularly susceptible to cold-induced photoinhibition. Nursery owners now protect young seedlings using shadecloth when air temperature drops below 10°C.

In *E. globulus* and *E. nitens* seedlings, withholding nutrients in the nursery induces formation of the red pigment anthocyanin, reduces chlorophyll and increases carotenoid levels. These changes reduce light absorption and increase energy dissipation, in effect pre-acclimating seedlings to conditions of photoinhibition. Thus, the withholding of nutrients decreases the risk of photodamage after planting. Withholding nutrients in the nursery did not affect the subsequent growth of spring plantings, but did reduce the growth of autumn planted seedlings. However this may be acceptable given the decreased risk of extensive mortality soon after planting.

Withholding nutrients also induced high levels of leaf tannins. Tannins decrease palatability and digestibility of foliage. These seedlings received half the browsing damage of control seedlings when tested in feeding trials with possums and pademelons, and the insect genus *Heteronyx*.

On sites where the risk of photodamage soon after planting is very low, withholding nutrients in the nursery can reduce growth after planting by up to 30% and this growth difference can remain for up to two years after planting. Seedlings require foliar-stored nitrogen for retranslocation for new root growth. Thus, in the absence of risk of photoinhibition, seedlings containing about 1.5% N by dry weight have maximum growth potential and robustness at planting.

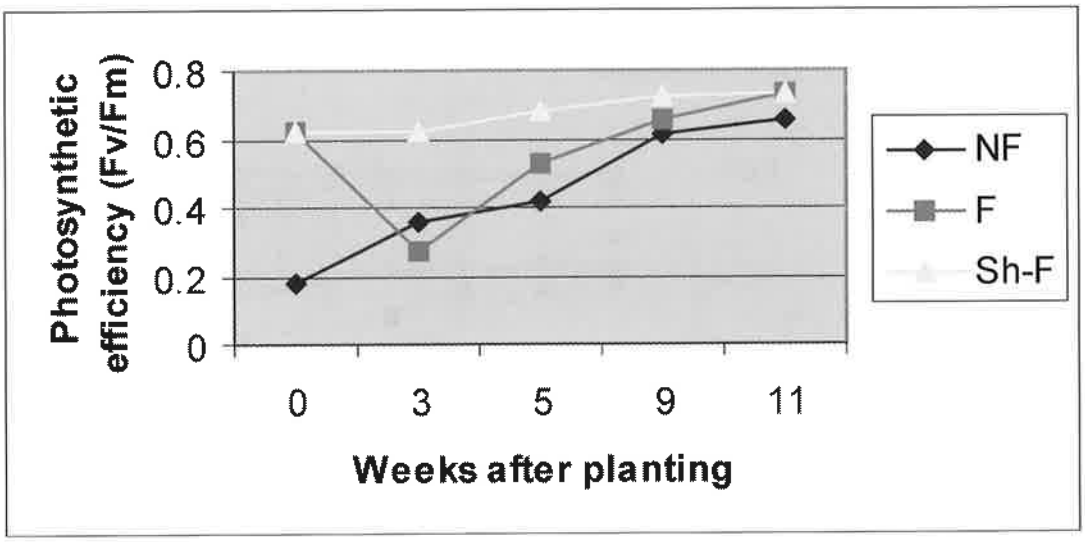
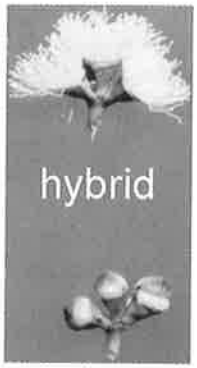
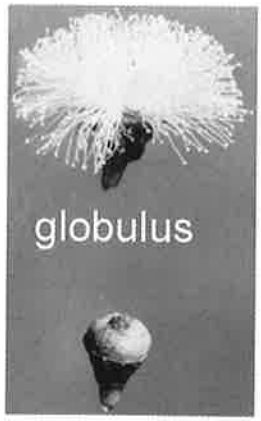


Figure 5:
A measure of photosynthetic efficiency (Fv/Fm) shows that shaded, fertilised seedlings (Sh-F) of *E. nitens* were not affected by photoinhibition (reduced Fv/Fm) after planting. Reduced Fv/Fm of non-shaded, fertilised (F) seedlings three weeks after planting was associated with leaf tissue damage. Through withholding nutrients, non-fertilised (NF) seedlings initially had a low Fv/Fm that rapidly recovered and seedlings sustained no leaf tissue damage after planting.

MAJOR DEVELOPMENTS

Eucalypt hybrids





There is world-wide interest in developing hybrids between the major temperate plantation species, *Eucalyptus globulus* and *E. nitens*, for plantation development in areas too cold for *E. globulus*. A ten-year study of the performance of interspecific and intra-provenance F_1 hybrid populations of *E. globulus* and *E. nitens* has shown that quantitative genetic models used for genetic evaluation of growth in pure species are not appropriate for interspecific hybrid populations. Additive genetic effects expressed in *E. globulus* intra-provenance populations for growth are also expressed in the inter-provenance hybrid population, with levels intermediate between the two parental populations. However, there is no such association in an *E. nitens* x *globulus* hybrid population. Comparable estimates of these additive genetic effects are highly inflated in the hybrid populations, suggesting that different genes or gene interactions are affecting hybrid performance.

The field trial studied was established by CSIRO Forestry and Forest Products and North Forest Products (now Gunns Limited) in 1990 near Ridgley, Tasmania and has been regularly monitored by CRC scientists. It is one of the best hybrid eucalypt trials established and includes crosses within and between provenances of the pure species and interspecific hybrids, with the same parents being used for both within and between species hybridisation.

The interspecific hybrid population was characterised by atypically high levels of seedling abnormalities and high mortality in the nursery and field (Figure 6). The average performance of survivors was below the mid-parent value (i.e. negative heterosis). In contrast, hybrids between the Taranna and King Island provenances of *E. globulus* exhibited high survival and average performance well above the mid-parental value, although they did not perform better than the faster growing King Island crosses. The study showed differences between the Taranna and King Island provenances in their propensity for hybridisation with *E. nitens*, with most of the poorer performing interspecific hybrid families derived from crosses with Taranna *E. globulus*. In contrast to growth, wood density measured indirectly using Pilodyn penetration exhibited more typical quantitative genetic behaviour in the inter-specific F_1 hybrid and was always intermediate or comparable with one or other of the parent species. The inter-specific F_1 hybrid did not show any significant advantage over either of the parental species at this site. They did not show any combination of superior growth or wood density that could not be found within the parental species even though there was one outstanding inter-specific F_1 hybrid family for growth.

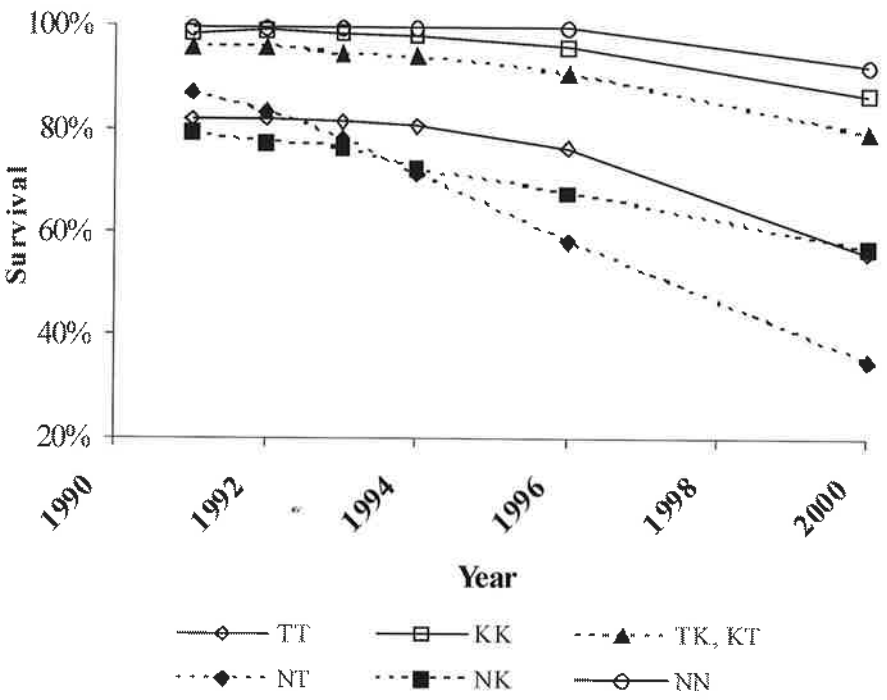


Figure 6: Survival of cross types in the Gunns/CSIRO West Ridgley hybrid trial expressed as percentage of number of trees planted in 1990. Cross types are *E. globulus* intra-provenance (TT, KK), *E. globulus* inter-provenance (TK, KT), *E. nitens x globulus* (NT, NK) and *E. nitens* (NN).

MAJOR DEVELOPMENTS

A cover crop for reducing mammal browsing damage

A bitter lupin plot in late December, about 3 months after sowing

Eucalypt plantations on ex-pasture sites sown with a cover crop of bitter lupins have reduced browsing damage to seedlings from mammalian herbivores. Bitter lupins also enhanced short-term height growth of eucalypt seedlings, whether they were exposed to browsing or not.

In a collaborative project between the Resource Protection Program, Sustainable Management Program and Gunns Limited, Clare McArthur, Philip Smethurst, Elizabeth Pietrzykowski and Chris Barnes found that bitter lupin established successfully in five of six regions of an ex-pasture plantation in southern Tasmania. Sweet lupins were browsed severely on germination and never established. Bitter lupins successfully reduced browsing of *E. nitens* seedlings by mammals compared with both sweet lupin and control (herbicided) plots (Figure 7).

Although overall browsing damage was relatively low in these regions, the reduced damage in bitter lupin plots was still sufficient to improve growth of seedlings over the 12-week period (Figure 8). The mean increase in seedling height from planting to the end of the study 12 weeks later was 12.3cm (42%), 15.4cm (53%) and 18.6cm (64%) for control, sweet lupin and bitter lupin treatments respectively.

In the absence of mammal browsing, height growth was enhanced when seedlings were surrounded by up to 90% bitter lupin cover. This was probably the result of lateral shading of seedlings by lupin. Long-term effects of the cover crop on eucalypt growth will be monitored.

These results demonstrate the potential for using plantation vegetation to manage mammal browsing. If used in combination with other methods, such as reducing seedling palatability in the nursery (reported as a major development in CRC-SPF Annual Report 1999/2000), these techniques may reduce browsing to an acceptable level.

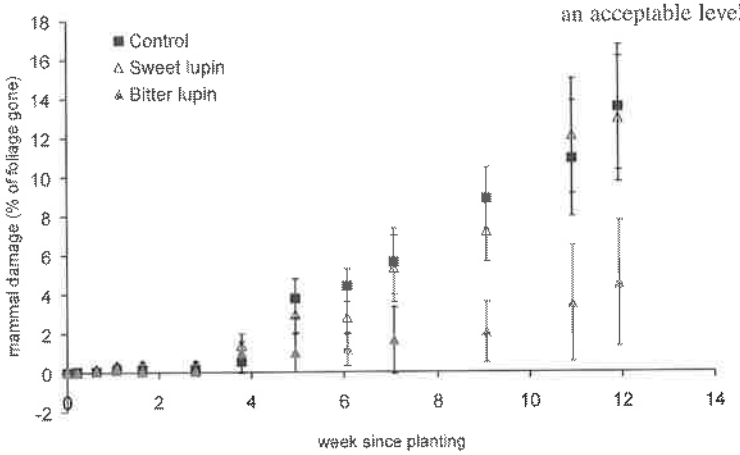


Figure 7: Mammal browsing (% foliage gone) to *E. nitens* seedlings over time since planting, in relation to vegetation type in 0.15 Ha plots on an ex-pasture plantation in southern Tasmania. Values are least squares means ± 1s.e.

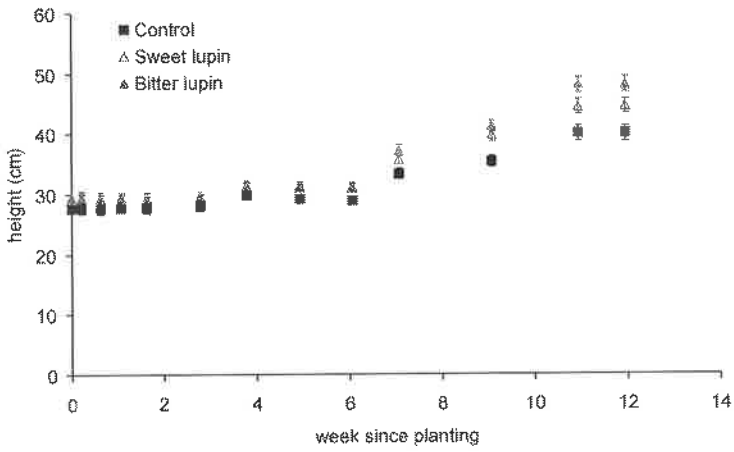
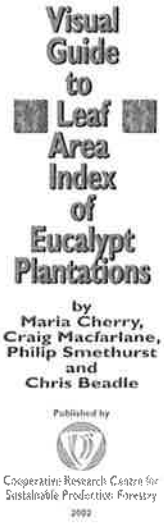


Figure 8: Height (cm) of *E. nitens* seedlings over time since planting in relation to vegetation type. Values are least squares means ± 1s.e.

MAJOR DEVELOPMENTS

A simple method for measuring leaf area index in eucalypt plantations



Canopy size is measured as leaf area index (LAI; m^2 leaf area per m^2 ground area). LAI is a key driver of eucalypt productivity. LAI is used in the new generation of process-based and hybrid models, but there has been no rapid and convenient method of assessing it. In response to this requirement, Maria Cherry, Philip Smethurst and Chris Beadle in cooperation with Craig McFarlane of the University of Western Australia, have developed a 'Visual Guide' for assessing LAI.

The guide uses photographic images taken in three *E. nitens* plantations and was tested in several *E. nitens* and one *E. globulus* plantation in Tasmania. The authors expect the guide to be applicable also to plantations of a wide range of other eucalypt species. The range of LAI covered is 2 to 8, which is expected to cover the range of most eucalypt plantations throughout the world. To use the guide, one simply stands in the plantation and compares an image of the canopy above (reflected in a mirror) with the range of images in the booklet. The value arrived at is then adjusted for subjective bias using a relationship developed with a group of CRC forest researchers and managers. Estimates can be expected to be within one LAI unit of accuracy.

A relationship between growth and LAI (Figure 14, p35) was developed in four *E. nitens* plantations aged between five and eight years. The researchers discovered that current growth was better predicted by LAI than by stem size (basal area), which is commonly used in forest inventory. This result was not unreasonable, because LAI is an indicator of current vigour and basal area is an indicator of past vigour.

Figure 9: *E. nitens* plantation, with an LAI of 4 and a growth rate of 17 t ha^{-1} $year^{-1}$. You can make such assessments and predictions using the visual guide.

MAJOR DEVELOPMENTS

QTL studies confirm genetic independence of growth and wood density in tropical pine hybrids

Studies which map the location and relationships amongst genes in the genomes of tropical pine hybrids are providing more targeted approaches for tree improvement. A recently completed study of the gene effects, or quantitative trait loci (QTL), that control tree growth and wood density in the parents of a Slash pine by Caribbean pine hybrid, has shown that they generally do not occur close together on genetic maps of the parents. While putative QTL that affect trunk ring width, early season and late season components of a ring tended to cluster together, they generally did not occur near those that affected ring density. This suggests that these characters are largely controlled by separate sets of genes that are not located close together in the genome. This means the genes for the different characters tend to be inherited independent of one another, and individuals with favourable combinations of growth and wood density characters should be readily identified in offspring from parents in the existing breeding populations, without recourse to new parents and new genes. These findings are consistent with field measurements of the characters that have also shown a lack of genetic correlation between growth and density in this hybrid. Negative relationships between growth rates and wood density are a key issue for the genetic improvement of some of the world's major plantation species including *Pinus caribaea* and *P. radiata* because they create an impediment to simultaneous gains in both characters. Quantitative trait loci analysis is providing new insight into the relationships between growth and wood density in trees by revealing the distributions and interactions amongst genes that control these characters.

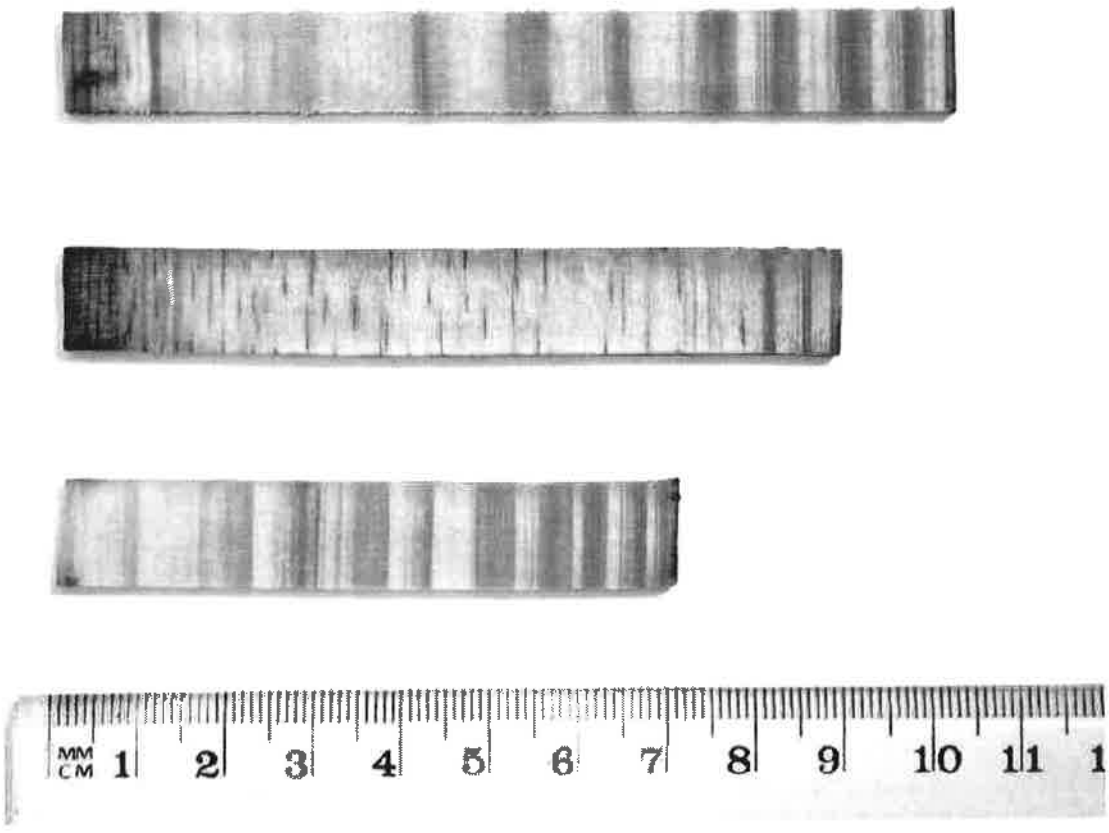


Figure 10: Densitometry trace of an increment core (pith to bark) for a slash X Caribbean pine F1 hybrid. Peaks represent higher density wood formed late in the growth season.

COOPERATIVE LINKAGES

Genetic Improvement Program

	CRC Staff	Collaborator	Activity
INTERNATIONAL LINKS			
Project A1: Genetics and reproductive biology of eucalypts	A/Prof B Potts Dr H Dungey	Prof T Whitham (UNA, USA) Dr P Minchin (UL, USA) Dr H Dungey (FRI, NZ)	The effect of forest genetics on biodiversity
	A/Prof B Potts	Dr C Balocchi, Mr P Rojas (Bioforest, Chile)	Hybridisation of temperate eucalypts
	A/Prof B Potts Mr G Dutkowski Dr L Apiolaza	Mr G Lopez (INTA, Argentina)	Quantitative genetics of *Eucalyptus globulus* grown in Argentina
	A/Prof B Potts Dr L Apiolaza	Prof MH Almeida, Dr JM Monteiro da Costa e Silva (Universidade Técnica de Lisboa, Portugal) Dr N Borralho (RAIZ, Portugal)	Optimising genetic evaluation methods to develop breeding and deployment strategies in *Eucalyptus globulus*
	A/Prof B Potts Dr L Apiolaza Dr B Patterson	Prof Lin Mujiu, Ms Rao Hongxin, Mr Li Bohai (Hunan Forestry, China)	Introduction and breeding of cold tolerant eucalypts in Hunan, China
Project A2: Breeding strategies	Mr G Dutkowski	Dr J Costa e Silva (Denmark)	Spatial analysis
	Dr L Apiolaza Mr G Dutkowski	Mr G Lopez (INTA, Argentina)	Genetic parameters, breeding value prediction and gain calculations for *E. globulus*
	Mr G Dutkowski	Mr J Brown (CMPC, Chile)	Analysis of progeny trials
	Dr L Apiolaza	Dr L Gea (INRA, France)	Analysis of diallel tests
	Dr L Apiolaza	Dr F Isik (NC State, USA)	Analysis of wood properties in diallel tests
Project A4: Molecular genetics of eucalypts	Dr R Vaillancourt A/Prof B Potts	Dr C Marques, Dr N Borralho (RAIZ, Portugal)	Finding the origin of the Portuguese *E. globulus* landraces
	Dr R Vaillancourt Mr J Freeman	Dr A Myburg (University of Pretoria, South Africa)	Aligning linkage maps using microsatellite markers
Project A6: Hybrid breeding	Dr M Dieters	Prof B Li (NCSU, USA) Dr H Dungey (FR, NZ)	Application of finite-locus models in hybrid populations
	Dr M Dieters	Prof B Li (NCSU, USA)	Development of hybrid breeding strategies
	Dr M Dieters	Prof T While, Dr D Huber (UF, USA)	Development of analytical methods for the analysis of clonal data, and investigation of GxE in clonal tests
	Dr M Dieters	Dr Y Zheng (Chinese Academy of Forestry)	Testing of hybrid pines in southern China
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
	Dr M Shepherd	Dr S Carson (Carson Associates Limited, NZ)	QTL detection in *Pinus* spp

	CRC Staff	Collaborator	Activity
NATIONAL LINKS			
Project A1: Genetics and reproductive biology of eucalypts	A/Prof 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
	A/Prof B Potts Dr R Vaillancourt	Ms L Pound (UA)	Mechanism of self incompatibility in *E. globulus* and *E. nitens*
	Mr A Hingston A/Prof B Potts	Dr P McQuillan (UT)	Pollination ecology of *E. globulus* and *E. nitens*
Project A2: Breeding strategies	Mr G Dutkowski	Dr T McRae (STBA) Ms S Hetherington (NS) Mr P Lloyd (Auspine) Mr R Underdown (ForSA) Mr H Stewart (Treecorp) Mr S Penfold (HVP)	Breeding management
	Mr G Dutkowski	Dr A Gilmour (NSW Agriculture)	Improvements in quantitative genetic models
	Dr L Apiolaza	Dr E Williams (CSIRO FFP)	Alternative models for breeding value prediction
	Mr G Dutkowski Dr L Apiolaza	Dr T McRae (STBA) Dr H Graser, Dr R Kerr, Dr B Tier (AGBU, UNE)	Breeding value prediction software for tree breeding
Project A3: Molecular approaches to tree improvement	Dr G Moran Dr R Thumma Ms K Groom Ms J Murrell	Dr G Bossinger (UM)	Mapping cambial specific sequences in *E. globulus* and *E. nitens*
Project A4: Molecular genetics of eucalypts	Dr R Vaillancourt Mr J Freeman	Dr M Rossetto (SCU)	Transferability of *Melaleuca* microsatellites to *Eucalyptus*
	Dr R Vaillancourt Dr D Steane A/Prof B Potts Prof J Reid	Australian Genome Research Facility (AGRF)	Sequencing the chloroplast genome of *E. globulus*
	Dr D Steane Dr R Vaillancourt A/Prof B Potts	Mr M Lavery (Arianda Pty Ltd)	Genetic diversity in *E. globulus*
Project A5: Wood quality	Dr C Raymond	Dr R Evans (CSIRO FFP)	Assessment of microfibril angle and density variation
	Dr C Raymond	Mr J Ilic (CSIRO FFP)	Non-destructive assessment of wood stiffness
Project A6: Hybrid breeding	Dr M Dieters	Dr R Kerr (AGBU, UNE)	Development of program to simulate hybrid breeding strategies, and investigation of finite-locus models
	Dr M Dieters	Dr H Wallace (USC) Dr H Dungey (FR, NZ) Mr A Johnston (UZ, Zurich)	Genetics of intra- and inter-provenance hybrids in *P. caribaea* var *hondurensis*
Project A7: Molecular genetic improvement for tropical and subtropical production	Dr M Shepherd Mr R Mellick	Dr G Dale (Tree Crop Technology)	Genetic mapping of vegetative propagation characteristics in *Pinus* spp
	Prof R Henry Dr M Shepherd Ms M Jones	Dr S MacRae (SF NSW) Prof A Delves (SCU)	Gene flow and genetic diversity of hardwood plantations in NSW

	CRC Staff	Collaborator	Activity
WITHIN CENTRE LINKS			
Project A1: Genetics and reproductive biology of eucalypts	A/Prof B Potts Dr G Jordan Mr G Dutkowski Mr A MacDonald	Mr K Joyce (GL)	Genetic variation, age to age correlations and genotype-environment interactions for base population trials of *E. globulus*
	A/Prof B Potts Dr R Vaillancourt Dr D Williams Ms M McGowen	Mr D Pilbeam (STBA) Mr P Gore (*sE*)	Genetic control of self incompatibility in *E. globulus* (partly STBA funded)
	A/Prof B Potts	Mr P Gore (*sE*) Mr D Pilbeam (STBA)	The early success of inter- and intra-race crosses of *E. globulus* (partly STBA funded)
	A/Prof B Potts	Mr D Pilbeam (STBA)	Inbreeding and SCA effects in inter- and intra-race crosses of *E. globulus* (partly STBA funded)
	Dr L Apiolaza A/Prof B Potts Mr G Dutkowski	Mr K Joyce (GL) Mr D Pilbeam (STBA) Mr P Gore (*sE*) Mr M Krygsman (GRP)	Genetic control and estimation of breeding values for flowering time in *E. globulus* (partly STBA funded)
	Dr D Williams A/Prof B Potts	Mr P Kube (FT) Mr N McCormick (FT)	Seed orchard management and optimising seed and seedling quality
	Mr R Barbour A/Prof B Potts Dr R Vaillancourt	Dr D de Little (GL) Mr K Joyce (GL)	Gene flow between planted and native eucalypt forests (ARC funded)
	A/Prof B Potts Mr P Tilyard	Dr C McArthur (RP) Ms J O'Reilly (RP)	Genetic variation in *E. globulus*, *E. nitens* and their hybrids to marsupial browsing
	A/Prof B Potts Dr R Vaillancourt	Dr D de Little (GL) Dr G Allen (RP) Mr L Rapley (RP)	Genetic basis of susceptibility to insect pests
	A/Prof B Potts	Prof J Hughes (GU) Ms R King (GU) Dr D Lee (QFRI)	Fine-scale molecular and quantitative genetic variation in *Corymbia*
Project A2: Breeding strategies	Dr L Apiolaza	Mr T Jones (A4)	Markers and relatedness calculations
	Dr L Apiolaza Mr G Dutkowski	Mr P Kube (FT) Dr T McRae, Mr D Pilbeam (STBA) A/Prof B Potts, Mr P Volker (A1) Dr C Raymond (A5)	ASREML usage
	Mr G Dutkowski Dr L Apiolaza	Dr T McRae, Mr D Pilbeam (STBA) Mr R Barbour, Mr T Jones (A1)	Breeding value prediction
	Mr G Dutkowski	Dr T McRae (STBA)	Data modeling for tree breeding
	Mr G Dutkowski	Mr P Gore (*sE*)	*E. globulus* geographic variation
	Mr G Dutkowski	Mr P Gore (*sE*) Mr P Kube (FT) Ms S Hetherington (NS)	*E. nitens* geographic variation
	Mr G Dutkowski Dr L Apiolaza	Mr P Gore (*sE*) Mr D Pilbeam, Dr T McRae (STBA)	Breeding strategies

	CRC Staff	Collaborator	Activity
Project A3: Molecular approaches to tree improvement	Dr G Moran Dr R Thumma Ms K Groom Ms J Murrell	Dr C Raymond (A5)	QTL analyses for wood and fibre properties in *E. globulus* and *E. nitens*
Project A4: Molecular genetics of eucalypts	Dr R Vaillancourt Mr A Milgate Mr J Freeman A/Prof B Potts	Dr C Mohammed (C5) Dr D de Little (GL)	The genetic basis of *Mycosphaerella* resistance in *E. globulus*
Project A5: Wood quality	Dr C Raymond Ms K Surridge	Dr G Moran (A3)	QTL analysis of wood and fibre properties in *E. globulus*
	Dr C Raymond Ms K Surridge	Mr P Kube (FT)	GxE interaction for density, fibre length, fibre coarseness, cellulose content, microfibril angle and density variation in *E. nitens*
	Dr C Raymond Mr L Savage	Mr P Kube (FT) Dr E Pinkard (FT) Mr A Bradley (NS)	Growth strain in *E. globulus*
	Dr C Raymond	Dr D de Little (GL) Mr J French (GL)	Genetic control and correlations between wood properties in families of *E. globulus* with different densities
Project A6: Hybrid breeding	Dr M Dieters 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
	Dr M Dieters Dr K Harding	Prof P Kanowski (ANU) Mr D Kain (ANU)	Investigations into the genetic control of wood properties in *P. caribaea*, *P. elliottii*, and the F_1 hybrid
Project A7: Molecular genetic improvement for tropical and subtropical production	Prof R Henry Dr M Shepherd	Dr M Dieters (A6) Dr G Nikles (A6) Mr P Toon (A6)	Genetic characterisation of commercial traits in hybrid pines
	Dr M Shepherd Mr R Mellick	Dr M Dieters (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 *A. cunninghamii*
	Prof R Henry Dr M Shepherd Ms R Stokoe	Ms G McKinnon (A4)	Chloroplast DNA diversity within *Eucalyptus cloeziana* and eastern *Monocalyptus* species

Sustainable Management Program

	CRC Staff	Collaborator	Activity
INTERNATIONAL LINKS			
Project B1: Site productivity	Dr A Mitchell	Dr B Ludwig (Göttingen, Germany)	Modelling soil chemistry
	Dr P Smethurst	Dr N Comerford (Gainsville, USA) Dr N Barros (Vicosa, Brazil)	Modelling nutrient uptake
Project B2: Management of tropical soils	Dr Z Xu Ms N Mathers A/Prof P Healy Dr S Boyd	Prof X Mao, Mr R Luo, Mr Y Zhang (National NMR Laboratory, Wuhan, China)	Application of ^{13}C, ^{15}N and ^{14}N NMR to soil organic matter studies
	Dr Z Xu Ms N Mathers Dr S Boyd A/Prof P Healy	Dr C Preston (Pacific Forestry Centre, Natural Resources Canada)	Application of ^{13}C and ^{15}N to soil organic matter studies
	Dr Z Xu Dr N Prasolova Prof J Hughes Dr M Hunt Dr C Beadle	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
	Dr Z Xu	Prof X Yang, Dr W Ni, Prof Y Yang, Prof J Xu (Zhejiang University, Hangzhou China)	Application of stable isotopes (^{13}C and ^{15}N) to soil chemistry and plant physiology studies
	Dr Z Xu	Prof X Yang, Dr H Shen (South China Agricultural University, Guangzhou, China)	Application of ^{13}C NMR to soil chemical studies
	Dr C Chen Dr Z Xu Ms N Mathers	Dr L Condron (Lincoln University, NZ)	NMR application to soil chemical studies
	Dr Z Xu Prof J Hughes Dr C Chen	Prof T Bruns (University of California, USA)	Soil microbial ecology and function in forest nutrient cycling: approaches with innovative bio-molecular and stable isotope techniques
	Dr Z Xu A/Prof P Healy Dr S Boyd	A/Prof C Johnson (Syracuse University, USA)	Links between carbon and nitrogen cycling processes in forest soils: innovative approaches with both NMR and stable isotopes
Project B4: Modelling production and wood quality	Dr M Battaglia	Dr N Borralho (RAIZ, Portugal)	Application of PROMOD
	Dr P Sands Dr M Battaglia	Mr A Almeida (Aracruz) Mr L Esprey (ICFR, South Africa)	Modelling *E. grandis*
	Dr K Catchpoole Dr M Nester Dr K Harding	Dr J-M Leban (INRA, France)	Conversion software for decision support project
NATIONAL LINKS Project B1: Site productivity	Ms M Cherry Dr P Smethurst Mr G Unwin	Mr C McFarlane (UWA) Dr D White (CSIRO FFP)	LAI estimation technologies
	Dr P Smethurst	Dr K Paul (CSIRO FFP)	N mineralisation modelling

	CRC Staff	Collaborator	Activity
Project B2: Management of tropical soils	Ms N Mathers Dr Z Xu	Dr D Mendham, Dr T O'Connell, Dr T Grove (CSIRO FFP)	Application of ^{13}C NMR to soil organic matter studies with soils treated with residue management regimes
	Dr Z Xu Dr N Prasolova	Prof G Farquhar (ANU)	Carbon and oxygen isotope compositions and tree water use efficiency
	Dr Z Xu Prof J Hughes Dr C Chen	Prof J Cairney (UWS)	Soil microbial ecology and function in forest nutrient cycling: approaches with innovative bio-molecular and stable isotope techniques
	Dr Z Xu A/Prof P Healy Dr S Boyd	Prof M Wilson (UWS) Dr K Kannangara (University of Technology, Sydney)	Links between carbon and nitrogen cycling processes in forest soils: innovative approaches with both NMR and stable isotopes
Project B3: Silvicultural systems	Dr C Beadle	Dr E 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
	Dr D Close Dr C McArthur Dr C Beadle	Mr D Cliff (Narramine Transplants) Mr P Boland (Floriana)	Seedling management
Project B4: Modelling production and wood quality	Dr M Battaglia	Mr P Pennington (CSIRO FFP)	Analysis of native forest productivity
	Dr M Battaglia	Dr D White (CSIRO FFP)	Water use by trees in WA
	Mr P Ryan	Qld Dept Natural Resources	Landscape modelling, spatial analysis
	Mr P Ryan	Dr T Thaung (UQ)	Nitrogen nutrition of *E. cloeziana*
	Mr P Ryan	QFRI Hardwoods	Genetic evaluation, breeding, silviculture studies
	Mr P Ryan	Mr M Ngugi (UQ)	Physiology of *E. cloeziana* and *E. argophloia*
	Mr P Ryan	Dr C Hackett (Plantsoft Services) Dr N Huth (CSIRO SE) Dr J Carter (CRC-CA)	Modelling productivity
	Dr P Sands	Dr C Hackett (Plantsoft Services) Dr J Landsberg (Landsberg Consulting)	Modelling productivity
WITHIN CENTRE LINKS **Project B1: Site productivity**	Dr P Smethurst	Dr M Battaglia (B4)	Predictions of LAI and growth responses to fertilisation
	Dr P Smethurst	Dr S Candy (FT)	Predictions of growth responses to silvicultural options
	Dr P Smethurst	Dr C McArthur (RP)	Use of non-palatable browsing deterrents

	CRC Staff	Collaborator	Activity
Project B2: Management of tropical soils	Dr Z Xu Dr N Prasolova	Dr C Beadle (B3) Dr M Hunt (QFRI)	Hoop pine and eucalypt water use efficiency and nitrogen nutrition studies
	Dr Z Xu Dr N Prasolova	Dr M Dieters (A6)	Genetic variation in foliar carbon isotope composition of hoop pine families and exotic pine clones
Project B3: Silvicultural systems	Dr C Beadle Mr D Worledge	Ms S Hetherington (NS)	Impacts of irrigation on wood quality
	Dr C Beadle Dr P Smethurst	Dr N Mendham (UT) Mr P Adams (FT)	Weed management
	Dr C Beadle Dr C Mohammed	Dr E Pinkard (FT)	Green pruning of *E. globulus*
	Mr D Close	Mr I Bail (TC) Mr I Ravenwood (GL) Mr S Hunter (WACAP) Mr A Cannon (FEA)	Seedling management
	Ms I van Putten Dr S Jennings	Mr P Taylor, Mr A Warner, Mr P Donelly (PFT)	Forest owner intentions survey
	Dr D Race	Mr A Lyons (PFT)	Regional farm forestry strategies
Project B4: Modelling production and wood quality	Dr M Battaglia	Dr P Smethurst	Modelling fertiliser response
	Dr M Battaglia	Dr E Pinkard (FT)	Modelling effects of pruning
	Dr M Battaglia	Dr C Mohammed (CSIRO FFP)	Impact of *Mycosphaerella*; analysis of stem decay data
	Mr D Mummery	Ms R Pryor (UT)	Landscape waterlogging
	Dr C Raymond	GI Program	GxE effects on wood quality
	Dr C Raymond	GRP, FT, WAPRES	Pulpwood quality in *E. globulus*
	Dr C Raymond	FT, NS, CSIRO FFP	Pulpwood quality in *E. nitens*
	Dr P Sands	Mr A Goodwin (FT)	Software development

Resource Protection Program

INTERNATIONAL LINKS Project C1: Biology, ecology and economic impact of insect pests	Dr M Steinbauer	Dr A Carroll (Canadian Forest Service)	Oviposition host preferences of north American forest Geometridae
	Mr M Short	Dr I Gauld (British Museum of Natural History)	Taxonomic revision of *Megacerla* (parasitoids of Autumn gum moth)
	Dr G Allen	Mr B Murphy (University of Canterbury, NZ)	Biocontrol of leaf beetles using egg parasitoids
	Dr A Loch	Dr N dos Anjos (University of Vicosa, Brazil; on sabbatical through Curtin University of Technology, WA) Dr J Majer (Curtin University of Technology, WA) WA Industry Pest Management Group	Biology and ecology of the *Eucalyptus* leaf beetle *Cadmus excrementarius* in Western Australian blue gum plantations

	CRC Staff	Collaborator	Activity
Project C2: Insect control techniques and IPM	Dr M Steinbauer	Dr F Östrand (Lund University, Sweden)	Sex pheromone of *M. privata*
	Dr M Steinbauer	Dr A Carroll (Canadian Forest Service)	Foliar spectral reflectance indices for predicting the susceptibility of *E. globules* and *E. nitens* to oviposition Autumn gum moth
Project C3: Resistance of planting stock to vertebrate browsers	Dr C McArthur	Dr A Duncan (MLURI)	Linking foraging decisions of mammalian herbivores: from plant chemistry to landscape
	Dr C McArthur Dr D Close	A/Prof AE Hagerman (Miami University, USA)	Tannin chemistry
Project C4: Strategies to reduce vertebrate browsing damage	Dr C McArthur	Dr G Iason (MLURI)	Impact of plant secondary chemistry on diet diversity
Project C5: Strategies to minimise loss due to fungal attack	Dr C Mohammed Dr K Barry Ms A Eyles Ms D Wiseman	Ms T Artiningsih (LIPI, Bogor, Indonesia) A/Prof P Bonello (Ohio State Univ, USA) Dr E Hardiyanto (GMU, Indonesia) Dr R Irianto (FNCRDC, Indonesia) Dr S Ito (Mie University, Japan) Dr S Lee (FRIM, Malaysia) Dr D Lonsdale (Forestry Commission, UK) Dr L Macaskie (Univ of Birmingham, UK) Dr T Mitsunaga (Mie University, Japan) Dr A Rimbawanto (RDCBFTI, Indonesia Dr F Schwarze (Univ of Freiburg, Germany) Dr KT Smith (USDA Forest Service) Dr M Taksaki (Kyoto Pharmaceutical University, Japan)	Mechanisms of tree defence Wound tissue formation Kino stem defects
	Dr. C Mohammed	Dr R Kennedy, Ms A Wakeham (Horticulture Research International) Dr E Rodriquez (Bioforest SA, Chile)	*Mycosphaerella* research
	Dr C Mohammed Ms M Yee	Dr K. Klepzig (Forest Insect Research, Pineville, USA)	Ecologically sustainable forest management: fungal and invertebrate biodiversity
NATIONAL LINKS Project C1: Biology, ecology and economic impact of insect pests	Dr M Steinbauer	Dr G Cassis (Australian Museum)	Revision of *Amorbus*
	Dr A Loch Mr J Matthiessen Dr R Floyd	WA Industry Pest Management Group	Ecology and economic impact of insect pests of post-establishment eucalypts in south-western Australia
	Mr J Matthiessen	WA Industry Pest Management Group	Ecology and economic impact of insect pests of the establishment phase of eucalypts in south-western Australia
	Mr A Rice Dr G Allen	Dr D Colless (CSIRO Ento, ANIC, Canberra)	Taxonomy and identity of tachinid parasitoids of leaf beetles

	CRC Staff	Collaborator	Activity
Project C2: Insect control techniques and IPM	Dr M Steinbauer	Dr T Bellas (CSIRO Ento)	Sex pheromone of *M. privata*
	Dr M Steinbauer	Mr P Ebner (Lower Murray Water)	Light trapping of *M. privata*
	Dr A Loch Mr J Matthiessen Dr R Floyd	WA Industry Pest Management Group	Monitoring, surveillance and control of pests of established eucalypts in south-western Australia
	Mr J Matthiessen	WA Industry Pest Management Group	Management of insect pests of the establishment phase of eucalypts in south-western Australia
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
	Dr C McArthur Ms N Wiggins	A/Prof S McLean (UT) Dr R Boyle (UT)	Effect of plant secondary metabolites on feeding behaviour in brushtail possums
	Dr C McArthur Mr Geoff While	Dr W Hennecke (UT)	Effect of landscape features on distribution of browsers on plantations
Project C4: Strategies to reduce vertebrate browsing damage	Dr C McArthur	Mr A Goodwin (FT)	Influence of patch characteristics on browsing of tree seedlings
Project C5: Strategies to minimise loss due to fungal attack	Dr C Mohammed Dr K Barry Ms A Eyles Ms D Wiseman	Dr N Bougher (CSIRO FFP, Perth) Mr N Davies (UT) Dr W Foley (ANU) Dr T Hillis (CSIRO FFP, Clayton) Dr S Lawson (QFRI) Dr M Leitch (UM) Mr E Peacock (UT) Ms R Pilbeam (Dept Agriculture, Manjimup, WA) Dr K Old (CSIRO FFP, Canberra) Dr I Tommerup (CSIRO FFP, Perth)	Mechanisms of tree defence Wound tissue formation Kino stem defects Fungal taxonomy
	Dr C Mohammed	Dr N Coops (CSIRO FFP, Clayton) Dr D Culvenor (CSIRO FFP, Clayton) Dr K Old (CSIRO FFP, Canberra)	*Mycosphaerella* research
	Ms M Yee	Mr T Weir (ANIC/CSIRO Entomology)	Ecologically sustainable forest management: fungal and invertebrate biodiversity
WITHIN CENTRE LINKS Project C1: Biology, ecology and economic impact of insect pests	Mr L Rapley Dr G Allen	A/Prof B Potts (A1)	Genetic susceptibility of eucalypts to insect attack
	Mr H Redgrove Dr G Allen	Dr D de Little (GL) Dr P McQuillan (UT)	Biology of *Heteronyx* beetles interfering with the establishment of *E. nitens* plantations
	Mr M Short	Dr M Matsuki (C1)	Parasitoids of Autumn gum moth
	Dr M Matsuki	Dr J Bullinski (TC)	A study of the spatial variation of eucalypt weevil in south-west WA for developing effective monitoring strategy

	CRC Staff	Collaborator	Activity
Project C2: Insect control techniques and IPM	Dr M Steinbauer	Mr M Krygsman (GRP)	Light trapping *M. privata*
	Dr M Matsuki	Dr J Elek (FT) Mr R Appleton (GRP)	A study of effectiveness of a neem-based insecticide on insect pests
Project C3: Resistance of planting stock to vertebrate browsers	Dr C McArthur Dr D Close Mr H Fitzgerald Mr S Paterson	Mr A Walsh (FT) Ms T Kincade (FT)	Mammalian preferences for seedlings grown under different fertiliser and shade treatments
	Ms J O'Reilly Dr C McArthur	A/Prof B Potts (A1)	Genetic variability in resistance to browsing of *E. globulus* and *E. nitens* foliage
	Dr C McArthur	Mr R Appleton (GRP)	Effect of stem diameter on damage to eucalypt seedlings by rabbits in the field
	Dr C McArthur	Mr R Appleton (GRP)	Differential field damage by swamp wallabies to provenances of *E. globulus*
	Dr C McArthur	Dr G Jordan (UT)	Links between eucalypt seedling characteristics and herbivory
Project C4: Strategies to reduce vertebrate browsing damage	Dr C McArthur Ms E Pietrzykowski	Mr C Barnes (GL) Dr P Smethurst (B3)	Effectiveness of lupins as a cover crop for reducing mammal browsing damage
	Ms K le Mar Dr C McArthur	Dr D de Little (GL)	Use of a plantation and surrounding habitat by mammalian herbivores
	Dr C McArthur	Dr M Matsuki (C1, C2) Mr G Dutkowski (ETT)	Monitoring mammal browsing
	Dr C McArthur Mr S Paterson Mr H Fitzgerald	Mr A Walsh (FT) Ms T Kincade (FT)	Predicting mammal browsing damage in plantations
Project C5: Strategies to minimise loss due to fungal attack	Dr C Mohammed Dr K Barry Dr C Beadle Ms A Eyles Dr P Smethurst Ms D Wiseman	Mr B Neilsen (FT) Dr E Pinkard (FT) Mr T Wardlaw (FT)	Mechanisms of tree defence Wound tissue formation Kino stem defects
	Dr C Mohammed Dr M Battaglia Dr C Beadle A/Prof B Potts Ms A Smith Dr R Vaillancourt	Dr D de Little (GFP) Mr T Wardlaw (FT) Dr J Bulinski (TC)	*Mycosphaerella* research
	Dr C Mohammed Ms M Yee Dr Y Zi Qing	Dr D de Little (GFP) Mr P Mineely (GFP) A/Prof A Richardson (UT) Mr T Wardlaw, Dr S Grove (FT)	Ecologically sustainable forest management: fungal and invertebrate biodiversity

Education and Technology Transfer Program

	CRC Staff	Collaborator	Activity
NATIONAL LINKS			
	Dr N Davidson	Mr P Volker (S-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 Dr D Close	Midlands Tree Committee, PFT, TFGA, Greening Australia, S-Ag and local farmers	Development of a protocol for establishing plantations to combat rural tree decline in the Midlands of Tasmania (funded by NHT)
	Dr N Davidson	Coodinator of Science Week	Presentations during Science Week
	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)
	Dr N Davidson	Science communicators from other CRCs	Interaction and coordination of science communication
	Dr N Davidson Mr A Gibbons	Dr H Locher, Ms J Griggs (Hydro Tasmania)	Assessment of riparian vegetation on the Gordon River
WITHIN CENTRE LINKS			
	Mr G Dutkowski	CRC partners and scientists	Facilitation of adoption of outcomes of CRC research
	Mr G Dutkowski Ms T Bildstein	CRC research scientists	CRC publications database
	Ms T Bildstein Mr G Dutkowski Dr N Davidson	CRC staff and partners	CRC newsletter 'Overstorey'
	Dr N Davidson Mr D Lyons	CRC staff and partners	CRC web site

RESEARCH

Genetic Improvement Program

Manager
A/Prof 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 sub-tropical and temperate regions demonstrate the importance of breeding and aim to increase the returns from wood production.

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
A/Prof Brad Potts

Staff
Dr Luis Apiolaza
Mr Robert Barbour
Mr Peter Gore
Prof Rod Griffin
Mr Andrew Hingston
Dr Greg Jordan
Mr Kelsey Joyce
Mr Peter Buxton
Mr Gustavo Lopez
Mr David Pilbeam
Prof Jim Reid
Dr Wayne Tibbits
Mr Paul Tilyard
Dr René Vaillancourt
Mr Peter Volker
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. There is high demand for improved eucalypts for plantation establishment, and the project will study factors affecting sexual reproduction in order to optimise eucalypt seed production systems. This project is closely linked to project A4 (Molecular genetics of eucalypts), and staff supervise two externally funded ARC SPIRT grants.

Outcomes

- Seed set in *E. nitens* seed orchards in Tasmania was not significantly enhanced by supplementary outcross pollinations, indicating effective insect pollinators were present in all orchards. In contrast, comparable experiments showed that *E. globulus* from remnant native stands and ornamental plantings was chronically pollinator limited.

- A diallel mating amongst trees from two races has provided the first evidence of reciprocal effects (i.e. whether a parent is used as male or female) on early growth in *E. globulus* and that the directionality of a cross may be important. The interaction between males and females from different races increased with age and while not significant in the nursery, was after one year of field growth. In contrast, carry-over effects on growth associated with variation in seed weight

and germination time were transient and not evident after two years field growth.

- Large differences in later age growth and survival of the King Island and Taranna provenances of *E. globulus* have been demonstrated. Inter-provenance F_1 hybrids exhibited mid-parent heterosis but they did not perform as well as the pure King Island crosses (see Major Development Figure 6). In contrast, interspecific hybridisation with *E. nitens* resulted in average performance that was below that of the pure species controls. However, large provenance differences were also reflected in the success of inter-specific hybridisation, with many of the hybrid families involving the Taranna provenance exhibiting high levels of inviability (see Figure 6).

Peter Volker inspecting insect damage to a hybrid eucalypt.

- Differences in the genetic architecture of inter-provenance compared with interspecific hybrid populations have also been demonstrated. Additive genetic effects expressed in *E. globulus* intra-provenance populations for growth are also expressed in the inter-provenance hybrid population, with levels intermediate between the two parental populations. In contrast, there is no such association in an *E. nitens* x *globulus* hybrid population. Comparable estimates of these additive genetic effects are highly inflated in the interspecific hybrid populations, suggesting different genes or gene interactions are affecting hybrid performance.

Goals

To determine:

- the importance of additive and non-additive genetic effects in *E. globulus* and *E. nitens*;
- the impact of inbreeding depression on growth and wood properties in *E. globulus*;
- genetic and environmental control of flowering time and self-sterility in *E. globulus* and the use of this information to improve flowering synchrony and outcrossing rates in seed orchards; and
- the later age performance and genetics of F_1 and advanced generation *E. nitens* x *globulus* hybrids compared with the pure species.

Goals for external grants

- To determine 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.
- To determine the levels of pollen-mediated gene flow between plantation and native forest eucalypts and factors affecting it.

Project A2

Leader
Dr Luis Apiolaza

Staff
Mr Greg Dutkowski
Dr Bruce Greaves
Mr Simon Whittock

Breeding strategies

Background

The Breeding Strategies project aims to maximise the profit derived from breeding programs of CRC partners. This is achieved through the improvement of breeding value predictions by means of more accurate statistical models, integration of economic and risk information into the prediction of total economic merit, and constant evaluation of tree breeding decision-making and its impact on the results of breeding strategies. Most of this work is channelled through the breeding program of the Southern Tree Breeding Association (STBA), which includes most CRC industrial partners as members. The project integrates information on genetic control and geographic information for growth, risk traits, reproductive traits, and wood properties, and closely interacts with projects A1 (Genetics and reproductive biology of eucalypts) and A5 (Wood quality).

Outcomes

- Strategies to deal with heterogeneous environments and genetic expressions were included in TREEPLAN®, STBA's breeding value prediction system.

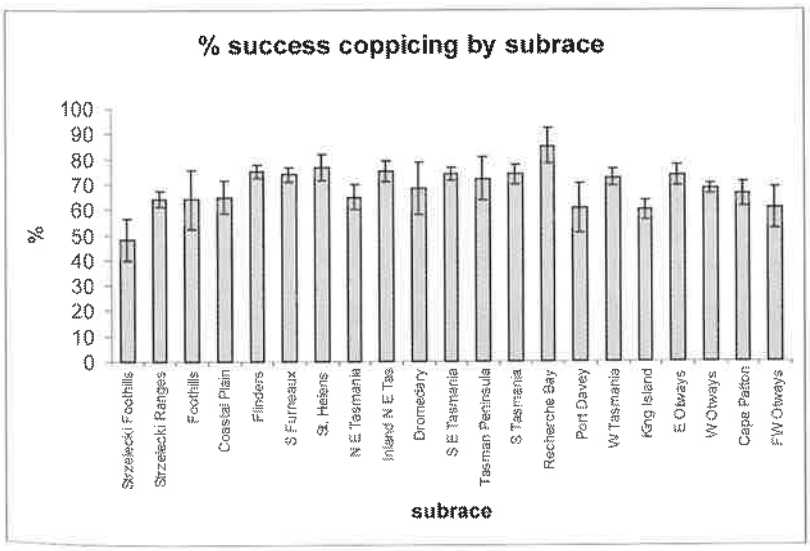


Figure 11: Percentage of trees in each subrace of *E. globulus* coppicing after felling.

- The project has supported the initial national evaluations for *E. globulus* and *P. radiata* by providing variance components to be used in TREEPLAN®. In addition, the project has maintained a strong participation in the process of adding functionality to TREEPLAN® through rationalising the sites and traits used.

- Geographic variation and control of physical and chemical wood properties of *E. globulus* was explored by collaborative work between projects A2 and A5. Results suggest that variation of growth and wood properties between subraces will affect profitability of plantations.

Outcomes from external grants

- The first systematic assessment of genetics of coppicing in *E. globulus* was completed. The heritability of coppicing was small, but there was significant variation in coppicing traits at the subrace level (see Figure 11). There was significant positive correlation between coppicing and growth.

Goals

- Improve accuracy of breeding value prediction through better accounting for environmental variation and population structure.

- Enhance the process of selecting elite trees by developing models that integrate economic and risk information into the prediction of total economic merit.

- Evaluate tree breeding decision-making and its impact on the results of breeding strategies.

- Support CRC partners in the prediction of breeding values, estimation of total tree merit, and design and implementation of breeding strategies.

Goal for external grant

- Develop alternative breeding objectives for *E. globulus* and study the genetic variation of new objective traits (e.g. coppicing ability, solid wood properties).

Project A3

Leader
Dr Gavin Moran

Staff
Ms Kylie Groom
Ms Jan Murrell
Dr Reddy Thumma

Molecular approaches to tree improvement

Background

The aim of this research is to understand the molecular genetic basis of traits with high commercial value, such as those for wood and fibre, and to use this knowledge to more efficiently develop improved breeds for deployment in plantations.

The approach involves characterising quanatitative trait loci (QTL) and candidate genes for wood and fibre traits and growth. The traits include wood density, pulp yield, cellulose levels, fibre length, and microfibril angle. The candidate genes include those involved in lignin and cell wall polysaccharide biosynthesis and cambial specific genes.

Work is focussed on:

- characterising QTL controlling wood and fibre properties in *E. globulus* and *E. nitens*;
- defining the role of candidate genes in expression of wood and fibre traits; and
- developing strategies to utilise QTL data in selection procedures in eucalypt breeding programs.

The project has strong links with Project A5 (wood quality) and utilises technologies developed in the CSIRO Forest Products Laboratory in Clayton. A CSIRO fullsib progeny trial is the source of pedigree material for the QTL work on *E. nitens*. An *E. nitens* progeny trial of collaborator Forestry Tasmania is being used as a source of material to relate candidate gene variation to variation in wood fibre traits.

Dr Reddy Thumma pipetting DNA.

Outcomes

- Twenty microsatellite markers, linked with various wood quality traits in *E. globulus* have been assayed in a pedigree of *E. nitens* containing 300 trees. An additional 17 microsatellites obtained from different sources are also being assayed.
- Seven ESTs and eight candidate genes which were mapped in *E. globulus* have been assayed as RFLP markers in *E. nitens*. For two of these genes (ECS1 and PAL), single strand conformation polymorphism (SSCP) markers have been developed. Also a microsatellite polymorphism has been characterised as part of the ECSI gene and three single nucleotide polymorphisms (SNPs) within the exon of the PAL gene. In addition, nine other candidate genes plus 70 anonymous RFLPs are also being assayed.
- Preliminary results from the QTL analysis conducted with 118 RFLP markers have shown six regions to be significantly associated with wood density in *E. nitens*. Two of these QTLs have been found to be common in both *E. globulus* and *E. nitens* (QTL positions on linkage groups 1 and 11). Five QTLs have been found to be significantly associated with microfibril angle (MFA) in *E. nitens*. None of these positions are common to *E. globulus*. However, these are only preliminary results obtained using a small number of individuals (118). QTL analysis using marker information from 300 trees is in progress, which should provide a better test to compare the QTL positions between the two species.
- DNA samples and wood cores from sample populations of *E. nitens* (about 300 trees) representing the main regions of Australian breeding material are being used to study the sequence variation in candidate genes and to correlate this variation with wood trait variation. Candidate genes, including ECS1, CCR, PAL, have been sequenced and SNP markers, which have been identified, will be assayed on the 300 trees.
- Determination of the genes controlling wood fibre traits in eucalypts will enable better understanding of fibre formation and development of better selection strategies for these traits. Such outcomes will enable Australian industry to establish high value plantations, especially for pulp and paper products based on planting stock for tailored end uses.

Project Goals

- Develop procedures that utilise QTL information for wood and fibre traits in breeding and deployment programs.
- Assay molecular markers in *E. nitens* mapping pedigree, tagging QTL for wood density, microfibril angle and other wood fibre traits (from *E. globulus*).
- Test transference of QTL locations between *E. globulus* and *E. nitens*.
- Assess variation in candidate genes collocating to key QTL for microfibril angle and wood density and relationship to variation in traits.

Project A4

Leader
Dr René Vaillancourt

Staff
Mr Peter Bundock
Ms Susan Foster
Mr Jules Freeman
Mr Carl Grosser
Mr Timothy Jones
Mr Andrew Milgate
Dr Briony Patterson
Ms Fiona Poke
A/Prof Brad Potts
Prof Jim Reid
Mr Adam Smolenski
Dr Dorothy Steane

Molecular genetics of eucalypts

Background

Molecular tools are now being used in fingerprinting for quality control in breeding and deployment programs, in understanding gene flow, conducting paternity and outcrossing studies, as well as understanding the genetic control of quantitative traits. However, these applications are probably just the beginning, since the rapidly expanding field of genomics is providing unprecedented insights into plant genomes leading to the identification of genes of interest (candidate genes).

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

- provide a better knowledge of inbreeding, heterosis and genetic diversity in breeding and base populations of eucalypts;
- quantify factors affecting outcrossing rates and patterns of gene flow, and contamination levels in seed orchards, in close cooperation with project A1 (Genetics and reproductive biology of eucalypts) and externally funded grants; and
- characterise major genes affecting commercially important traits (e.g. growth, wood properties and pest resistance).

Outcomes

- The DNA sequence of two important lignin genes was determined in two provenances of *E. globulus*. These are candidate genes for lignin content because they produce two of the most important enzymes in the lignin biosynthesis pathway. Several single nucleotide polymorphisms were detected in coding parts of the genes, some of which cause changes in parts of the enzymes that are most important to their function.
- Linkage maps were used to detect QTLs in *E. globulus*. Four putative QTLs were found for three traits: growth at age six years, pilodyn penetration at six years (two QTLs) and early flowering. The statistically most significant QTL had a LOD score peak of 4.4 and was estimated to explain 14% of the variance in pilodyn penetration.

As part of her PhD program, Fiona Poke is studying the genetic control of lignin content and composition, the correlated effects of lignin variation on other tree and wood properties, and the potential for developing molecular assays for altered lignin content and composition.

Outcomes from external grants

- Major progress over the last year has been made in using molecular markers to understand the factors affecting outcrossing rates in *E. globulus* seed orchards. The higher the outcrossing rate the better, since self progenies can suffer serious inbreeding effects. We studied factors such as flowering time, self-incompatibility, flower abundance and flower position and found that the degree of self-incompatibility was the most important factor. This is good news since it is a factor that can be measured and controlled by orchard managers.
- Rare isozyme markers were identified which have been used to determine the level of contamination in Mass Supplementary Pollination (MSP). These markers were used to establish that cutting the style, just before pollination, maximised the quantity of uncontaminated seed compared to uncut treatment. This technique has now been adopted by a commercial seed producer.

Goals

- Study resistance to *Mycosphaerella* infection in *E. globulus* using a QTL approach.
- Use microsatellite markers to study the relationships between the different races of *E. globulus* and the degree of inbreeding in each race.
- Establish the potential for incorporating molecular screening methods in *E. globulus* breeding programs in order to change lignin content and composition.

Goals for external grants

- Use microsatellite markers to study genetic diversity and gene flow in breeding and natural populations of *E. globulus*.
- Develop a model to predict seed quality in *E. nitens* seed orchards using simple measurements of reproductive parameters and verify it, using microsatellite markers and paternity analysis. This model will allow prediction of breeding values of seed.

Project A5

Leader
Dr Carolyn Raymond

Staff
Ms Linda Ballard
Mr Peter Kube
Mr Leon Savage
Ms Kirsty Siu

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 objectives. 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 in the Genetic Improvement Program 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 CSIRO Forest Products Laboratory, with some of the technologies developed there (SilviScan 2, cellulose content analysis and Near Infrared Reflectance Analysis) being implemented and applied to genetic material in member breeding programs for both *E. globulus* and *E. nitens*. Research is also conducted in collaboration with the pulping laboratories of the industrial partners.

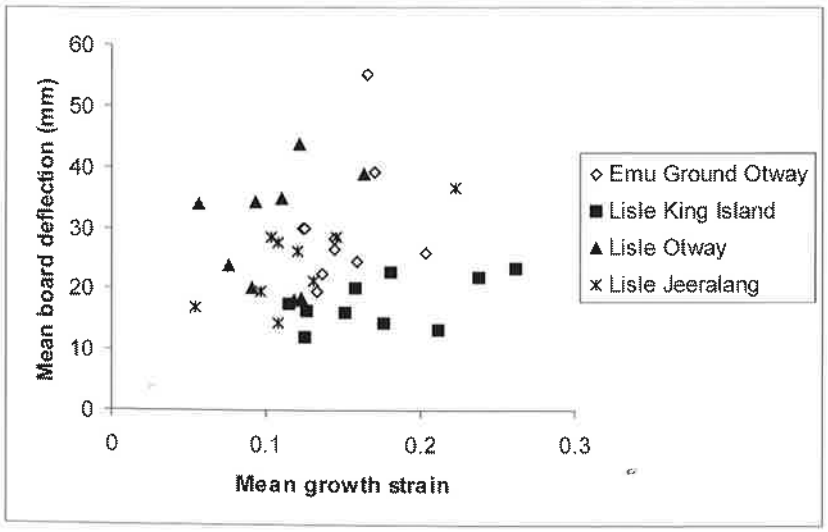


Figure 12:
Mean growth strain plotted against mean board deflection for all trees at two sites (Emu and Lisle) in northern Tasmania.

Outcomes

- Peripheral growth strain was not a reliable indicator for deflection in sawn boards in *E. globulus*. Provenance differences were found for both growth strain and board deflection with King Island having the highest strain levels but the lowest degree of board deflection. In contrast, Otway provenance had the lowest strain readings but the highest degree of board deflection. Jeeralang provenance was intermediate for both strain and board deflection (see Figure 12).
- Screening of breeding populations for problems associated with degrade during drying of sawn timber appears possible. Assessment of degree of shrinkage and collapse in wood core samples taken from low in the tree provides a good predictor for average shrinkage and collapse within the whole stem in both *E. globulus* and *E. nitens*. However, shrinkage and collapse appear to be different traits as they change in different ways up the stem, with collapse decreasing rapidly with increasing height whilst shrinkage remains relatively constant up the stem.
- Subraces of *E. globulus* vary for growth, physical and chemical wood properties, including fibre length, microfibril angle and cellulose content. Genetic control for growth and physical wood properties is moderate to high ($0.2<h^2<0.4$), while control for chemical properties is high ($h^2 > 0.4$). Correlations between growth and wood properties were not statistically significant. However, most of the correlations amongst the wood properties are positive, with the exception of those involving micro fibril angle.

Goals

- Develop Near Infrared Reflectance analysis calibrations for lignin content for *E. globulus* and *E. nitens*.
- Complete processing of SilviScan data to determine changes in heritability with age and the age-age correlations for density and microfibril angle in *E. globulus* and *E. nitens*.
- Complete sampling and processing of base population trials of *E. nitens* to determine race effects and genetic parameters for basic density, cellulose content, shrinkage and collapse.
- Complete processing of stiffness samples to determine optimum non-destructive sampling strategy.

Project A6

Hybrid breeding

Leader
Dr Mark Dieters

Staff
Dr Kevin Harding
Mr Dominic Kain
Dr Garth Nikles

Background

Through its partner organisations, the CRC has one of the best genetic bases of artificial forest tree hybrids in the world.

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 pine species *P. elliottii* and *P. caribaea* var. *hondurensis* and their hybrids being deployed commercially by the Department of Primary Industries (Queensland), and interacts closely with project A7 (Molecular genetic improvement for tropical and subtropical production).

Outcomes

- Genetic parameter estimates obtained for wood density, wood density components, spiral grain, growth and stem form in factorial matings in *Pinus elliottii* var. *elliottii* (PEE), *Pinus caribaea* var. *hondurensis* (PCH) and their F_1 hybrid indicated:
  - wood density and spiral grain were highly heritable in the hybrid and parental species, and highly stable across sites;
  - wood density was uncorrelated with growth traits in PEE and F_1, but negatively correlated with growth in PCH; and
  - there was a strong genetic correlation between wood density measured in the parental and hybrid populations (see Figure 13).
- Early selection and field screening for wood density and spiral grain using bark windows in PEE×PCH and in both parents was found to be highly effective. Genetic gains per year from selection at age three were up to 2.7 times that possible from direct selection on data from increment cores sampled at age 12.

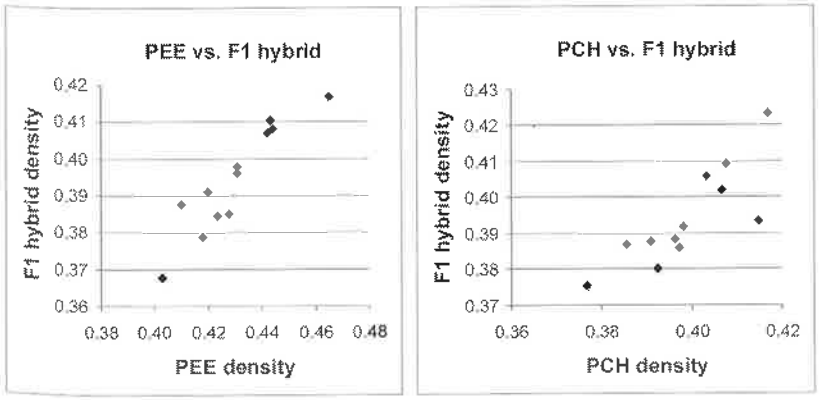


Figure 13:
Relationship between half-sib family means for wood density in both *P. elliottii* (PEE) and *P. caribaea* var. *hondurensis* (PCH) with that in their F_1 hybrid. Results are from Dominic Kain's PhD thesis, for whole core density, sampled at 12 years of age.

- Application of a novel quantitative genetic model for hybrids indicated that additive-related genetic effects were the principle modes of gene action controlling wood density and growth in the PEE×PCH hybrid.
- HYPERSIM (a computer program designed to simulate hybrid breeding strategies in forest trees) was extensively re-written by Dr Richard Kerr of the Animal Genetics Breeding Unit of the University of New England. Enhancements to the program include an ability to account for epistatic gene action, and available breeding strategies now include true Reciprocal Recurrent Selection (RRS) as well as modified RRS. The new program is called XSim.
- Work in collaboration with Prof Bailian Li (North Carolina State University) indicates that the most appropriate breeding strategy for the hybrid between *P. elliottii* and *P. caribaea* var. *hondurensis* in Queensland is likely to be the development of a stable composite hybrid between these two species. Evidence from Dominic Kain's PhD research indicates that (a) there is little change in variance between F_1 and F_2 populations for growth and wood properties, and (b) the growth and wood density in hybrid populations are largely determined by additive and additive × additive epistatic modes of gene action. These and other results, when combined with knowledge of the biological constraints/opportunities, suggest that composite hybrids are likely to be the most appropriate choice. However, the final choice of breeding strategy will be determined following completion of simulations using XSim.

Goals

- Complete analyses and report on genetic parameters from factorial matings in *P. caribaea* var *hondurensis*, *P. elliottii*, *P. elliottii* x *P. caribaea* var *hondurensis* hybrids, and *P. caribaea* var *hondurensis* x *P. oocarpa* and *P. tecunumanii*.
- Complete simulations of breeding strategies using XSim, and report on the most appropriate strategy for adoption in Queensland for the hybrid between *P. elliottii* and *P. caribaea* var. *hondurensis*.
- Refine estimates of the genetic gains that may be achieved by early selection for wood properties.
- Undertake additional studies of the correlation between pure and hybrid populations, to confirm favourable correlations obtained in QFRI Exp. 674.
- Use simulated data to further test the application of finite-locus models in forest tree hybrids and apply the most appropriate finite-locus models to the analysis of data from Queensland pine hybrid trials.

Project A7

Leader
Prof Robert Henry

Staff
Mr Mike Cross
Dr Mark Dieters
Dr Russell Haines
Dr Kevin Harding
Prof Jane Hughes
Ms Megan Jones
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

Genetic improvement and sustainable management of tropical forest species is supported by the application of molecular tools in this project. The species being studied include *Pinus* hybrids (*P. elliottii* var. *elliottii* (PEE) x *P. caribaea* var. *hondurensis* (PCH)), *Araucaria cunninghamii* (Hoop pine) and *Eucalyptus* spp. The project is increasing our understanding of the genetics of complex traits such as wood properties and propagation performance. Techniques for verification of hybridisation in plantations and native populations are being developed and applied in forest management.

Outcomes

- QTL studies of physical wood properties in hybrid pines indicate that breeding for both growth and higher wood densities should be possible as they appear to be largely influenced by separate genomic regions. Six major regions within the genomes of a PEE or a PCH parent were found to influence putative QTL for annual ring density, their early and latewood components, ring widths or the derived variables, and annual dry wood indices. Typically, ring width was influenced by regions separate to ring densities but some genomic regions influenced both, indicating the potential to select to improve growth and density separately. Putative QTL were of small additive effect, most often influencing ring width or early- or late-wood width but also ring density and whole core basic density. Seasonal and annual effects were also identified.
- Molecular verification of interspecific hybridisation of tropical pines is now simpler and more cost effective with the development of a generic assay based on a chloroplast microsatellite marker. A single locus assay has been found which distinguishes a broad sample of PEE from PCH in the Queensland breeding populations. This assay will replace the more complex, case specific, multilocus assays used previously for validating interspecific status of production hedges.
- Revised genetic maps using AFLP and microsatellite markers for select individuals of PEE and PCH were completed based on a larger sample of 140 offspring. These maps will provide more accurate information for QTL detection.

Outcomes from external grants

- Variation in chloroplast DNA revealed that *E. grandis* is a more highly structured species than was previously thought based on protein or morphological markers. The use of single-strand conformation polymorphism (SSCP) provided a cost-effective method for a species-wide survey of the J_{LA} region of the *E. grandis* chloroplast. A clear distinction was found between North Queensland populations and southern populations consistent with their relative isolation (Table 1). Populations from the Coffs Harbour region were highly genetically diverse. Although this is believed to be natural, human intervention has not yet been eliminated as a possible cause. Both findings have implications for the sampling of natural populations for breeding purposes and the policy of plantation establishment in the northern NSW region.
- In the largest study of microsatellite variation in a eucalypt to date, it was found that high levels of genetic differentiation between populations of *E. cloeziana* (F_{ST}=0.133) support evidence from morphological and protein analysis for the recognition of three subspecies. The species was geographically structured with three regions recognised, a southern coastal, southern inland and north Queensland (NQ) group.

Goals

- Develop a consensus microsatellite map for tropical pines.
- Validate QTLs for branching architecture and juvenile wood properties.
- Detect QTL for juvenile wood properties using a large-scale QTL detection study.
- Develop an 'industry ready' assay for hybrid verification.
- Determine self pollination levels in production hybrid pine orchards.

Table 1: Population pair-wise F_{ST}s and within population gene diversity (H_e) for 7 regional populations of *E. grandis*.

Population	n[1]	H_e[2]	1	2	3	4	5	6	7
1. North Queensland	25	0.70	0						
2. Sunshine Coast	20	0.72	0.262 **[3]	0					
3. Sunshine Coast Hinterland	31	0.66	0.253 **	0.026	0				
4. Northern Rivers	22	0.68	0.267 **	0.038	0.066 *	0			
5. Coffs Harbour	45	0.85	0.125 **	0.067	0.079 *	0.142 **	0		
6. Mid North Coast	35	0.64	0.295 **	0.180 **	0.231 **	0.313 **	0.052 *	0	
7. Port Macquarie	12	0.74	0.199 **	0.030	0.076	0.188 *	-0.015	0.020	0

[1] n = number of individuals in the population.
[2] Nei 1987 – Expected heterozygosity
[3] Significance levels tested at an experiment-wise level of $\alpha \leq 0.05$ using a pair-wise threshold of $\alpha \leq 0.002$ as determined by Bonferroni's method.

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 casts 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

Leader
Dr Philip Smethurst

Staff
Mr Paul Adams
Mr Richard Appleton
Mr Craig Baillie
Dr Chris Beadle
Ms Maria Cherry
Mr Keith Churchill
Ms Sandra Hetherington
Dr Greg Holz
Mr Andrew Knowles
Dr Andrew Mitchell
Mr Bill Neilsen
Mr Chris O'Hara
Ms Ruth Osborne
Ms Carolyn Ringrose
Dr Chris Shedley
Dr Erica Shedley
Ms Diane Spurr
Ms Elizabeth Vinall
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; and
- improve our understanding of water storage and access to it in relation to soil profile characteristics, rainfall, and ground water.

Outcomes

- Values of LAI required to achieve a comparable rate of stem growth were consistent across four *E. nitens* plantations (Figure 14), and more of the variation in stem growth was explained by LAI than by basal area because the relationships with basal area were site-specific. There was minimal stem growth at an LAI value of 2, and minimal increase in the rate of stem growth at LAI values greater than about 6.5.
- To facilitate the wider use of LAI for managing eucalypt plantations, a visual guide to estimating LAI was produced (see Major Developments).
- Eucalypt plantations are planted across sites with a wide range of N supply. Soil analyses developed for *E. nitens* plantations indicated the need for N fertilisation on ex-forest sites in Tasmania. Surface soil concentrations of total N less than 5 mg g^{-1} indicate that N deficiency will probably develop.
- Guidelines for N fertilisation were put on a firmer basis by summarising the results of several field experiments. A rate of 200 kg N ha^{-1} maximised growth at a low productivity site, but double that rate was required at more productive, higher rainfall sites. Urea was the preferred form of N and, when applied to trees with small crowns, limiting its spread to the drip line was more effective than totally broadcasting the fertiliser. Although soil N availability was increased for only one to two years by N fertilisation, growth rates were increased for up to six years. Reapplications within this time-frame promoted a more sustained response in growth rate.
- For several months after N fertilisation (400 kg N ha^{-1}) there were increased concentrations of Ca, Mg and K in soil solution and possibly increased availability to tree roots. This effect appeared to be accompanied by leaching of these nutrients down the profile and possibly off-site. N fertilisation practices should take into consideration the need to minimise the potential leaching of base cations.

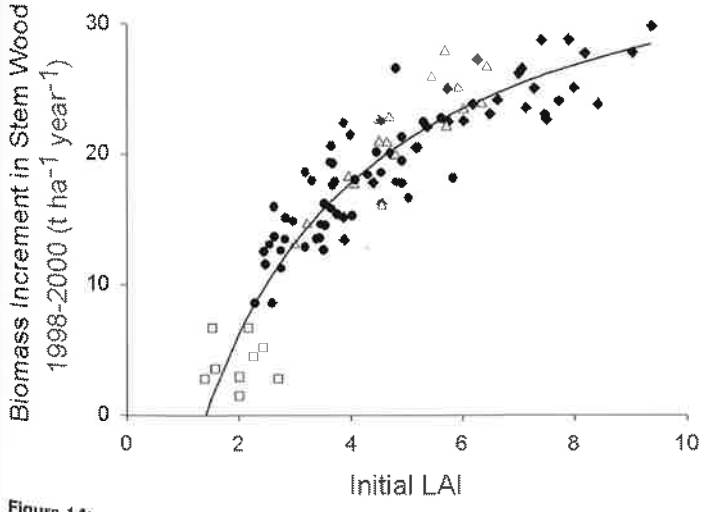


Figure 14:
LAI was closely related to the growth of fertilised and unfertilised *E. nitens* plantations at four sites.

Goals

- Summarise management options for N fertilisation of *E. nitens* plantations.
- Incorporate silvicultural responses into mechanistic and empirical productivity models.
- Model base cation dynamics in response to N fertilisation.

Project B2

Leader
Dr Zhihong Xu

Staff
Mr Tim Blumfield
Dr Sue Boyd
Dr Ken Bubb
Ms Joanne Burton
A/Prof Janet Chaseling
Dr Chenhong Chen
Mr Stuart Fenech
Mr Philip Frayne
Dr Hossein Ghadiri
Mr Jim He
A/Prof Peter Healy
Dr Alan House
Prof Jane Hughes
Mr Paul Keay
Ms Elisha Ladhams
Ms Nicole Mathers
Mr Issa Medraj
Mr David Osborne
Dr Ian Phillips
Dr Nina Prasolova
Dr Heather Proctor
Prof Calvin Rose
Mr John Simpson
Dr Grant Wardle-Johnson
Dr Michael William
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 for sustaining the productivity of subtropical pine plantations in south-east Queensland;
- evaluate the impacts of silvicultural practices on nitrogen (N) pools and dynamics in Hoop pine plantations of south-east Queensland;
- test, develop and apply advanced DNA, stable isotope and nuclear magnetic resonance (NMR) for developing improved biological indicators of soil quality;
- test and identify soil invertebrates as potential indicators of biodiversity in Hoop pine plantations;
- quantify the effects of both silvicultural practices and environmental conditions on soil N availability and on plantation N demands; and
- quantify the effects of harvesting, site preparation practices and seasonal conditions on soil physical processes in subtropical pine plantations.

Outcomes

- The impact on forest productivity of soil compaction (generated by passes from a 40.2 tonnes forwarder) followed by cultivation (using a disc plough) or no cultivation were assessed in a second-rotation (2R) Hoop pine (*Araucaria cunninghamii*) plantation in south-east Queensland. Soil compaction could depress soil microbial activity and promote N immobilisation (for 20 months) or provide conditions suitable for N loss through denitrification. Soil cultivation stimulated N mineralisation, but nitrification promoted N loss through leaching (Figure 15). Significant positive interactions for N mineralisation and nitrification between soil compaction and cultivation indicated that soil cultivation would be effective in restoring or stimulating N processes under severe compaction. However, coordination of ploughing and planting operations would be needed to help minimise N losses.
- Hydrofluoric acid (HF) was a useful pre-treatment for obtaining semi-quantitative ^{13}C CPMAS NMR spectra of subtropical Australian forest soils in south-east Queensland. HF removed more than 86% of Fe and improved the ^{13}C NMR spectral quality. The NMR spectra revealed some changes in C composition and quality due to residue management and decomposition.
- A field study was conducted to investigate the effects of N fertilisation on soil N pools and associated microbial properties in a 13-year-old Hoop pine plantation of south-east Queensland. Five years after application of 600 kg N ha^{-1} (as ammonium nitrate) significantly increased concentrations of ammonium-N and nitrate-N were present at a soil depth of 0-10 cm compared with the control. There was a significant increase in gross N mineralisation and immobilisation rates (0-10 cm soil, determined using ^{15}N dilution techniques) compared with the control. However, N application did not significantly affect the concentrations of soil total C and total N. Nitrogen application appeared to increase microbial biomass C and N and respiration, and to decrease metabolic quotient (qCO_2) in 0-10 cm soil.
- A study was conducted to investigate the soil fungal community under different forest ecosystems by using molecular biological approaches based on 18S rRNA gene. TGGE and SSCP analyses of the PCR products indicated different fungal diversity existed in the soil samples collected from two contrasting forest ecosystems; natural forest and an immediately adjacent 50-year-old Hoop pine plantation. Cloning and sequencing analyses of the 530 bp PCR products produced 26 different sequences, with 12 from the natural forest soil samples and 14 from the Hoop pine plantation soil samples. Comparing the clone sequences with the Genebank database showed that all the sequences were from fungi, mostly wood-decaying fungi.

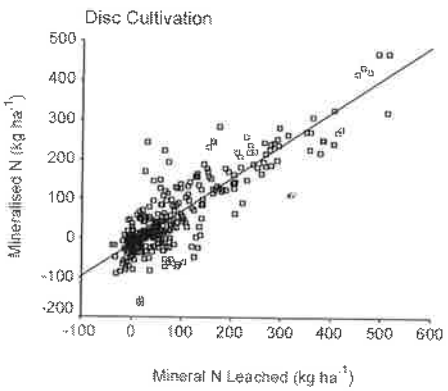


Figure 15: Correlation between cumulative mineralised N and cumulative leached mineral N (r^2= 0.753, n= 646, p <0.001)

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.

A major industry field day stop at a forest catchment study in south-east Queensland, led by Dr Ken Bubb of QFRI.

- Develop improved biological indicators of soil quality by testing, developing and applying advanced DNA, stable isotope and NMR techniques.
- Develop potential soil invertebrates as indicators of biodiversity in Hoop 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 site selected storm events.

Project B3

Leader
Dr Chris Beadle

Staff
Mr Paul Adams
Dr Philip Brown
Ms Maria Cherry
Mr Keith Churchill
Prof Robert Clark
Dr Dugald Close
Dr Neil Davidson
Mr Paul Dargusch
Ms Amabel Fulton
Ms Sandra Hetherington
Dr Greg Holz
Dr Ryde James
Dr Sarah Jennings
Mr Kelsey Joyce
Prof Peter Kanowski
Mr Sven Ladiges
Dr S Mahendrarajah
Prof Robert Menary
Dr Neville Mendham
Dr Libby Pinkard
Dr Digby Race
Ms Jacki Schirmer
Dr Chris Shedley
Dr Philip Smethurst
Ms Anna Smith
Mr Tim Tabart
Ms Ingrid van Putten
Mr Grant Westphalen
Ms Ann Wilkinson
Ms Danielle Wiseman
Mr Dale Worledge

Silvicultural systems

Background

The aims of this project are to:

- provide guidelines for the preparation and management of seedling stock during plantation establishment;
- develop weed management systems that minimise the use of herbicides, including the use of non-competing species as cover crops;
- develop pruning, thinning and spacing systems that are suitable for converting industrial pulpwood plantations to clearwood regimes and for farm forestry; and
- 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

- Rapid induction of cold-induced photoinhibition of *E. nitens* decreased photochemical efficiency and chlorophyll, and increased xanthophyll cycle conversion ratio and xanthophyll cycle pigments. Anthocyanin levels gradually increased except in non-shaded, nutrient-deprived seedlings that had high levels before the induction of photoinhibition. The findings strongly indicated that anthocyanins might provide a photoprotective role (see Major Developments).
- Shadecloth shelters when placed around seedlings in the field to lower light intensity will alleviate cold-induced photoinhibition and maximise growth during winter, but limit growth during warmer periods and therefore overall growth.
- *Eucalyptus nitens* and *E. globulus* seedlings can adjust their leaf angle. Larger leaf angle was associated with decreased levels of incident photon flux density and also with increased levels of photoinhibition induced by nitrogen deficit. Leaf angle may play a role in photoprotection of eucalypt seedlings.
- *Acacia melanoxylon* (blackwood) can compensate for the removal of crown area during green pruning by increasing its photosynthetic capacity in the upper two-thirds of the crown. Form pruning that removes foliage solely from the upper reaches of the crown is likely to reduce this increase in capacity and have a greater effect than lift pruning on the growth of blackwood.
- For commercial nurse-crop species like *E. nitens* and *Pinus radiata*, closer spacing than is used conventionally can produce better blackwood form. However there is a tendency for slower blackwood growth, meaning that management of blackwood under systems such as the five-row nurse treatment must be vigilant to avoid suppression of blackwood growth.
- Lack of post-planting weed control has been a major deficiency leading to the poor success of revegetation programmes in the Midlands of Tasmania. Improved record keeping in these programmes would benefit landowners, extension officers and research scientists working in this area.
- An examination of the 'Drier Tasmanian Demonstration Areas' project indicated that it had been successful in expanding commercial plantation establishment into areas not traditionally or currently involved in the forest industries. Demonstration sites are an important element in fostering the establishment of trees on farms.
- Investment in farm forestry extension should be viewed as a process for building partnerships and seeing forestry's pluralism (i.e. reliance on many and varied stakeholders) as an opportunity to engage more widely amongst communities about forestry's contribution to the social, economic and environmental fabric of society.

Goals

- Quantify the effects of drought and seedling size on seedling growth and mortality following planting.
- Establish four species trials and one demonstration trial in the Midlands of Tasmania using best practice techniques.
- Publish a 'Farm Forestry Technical and Business Handbook'.
- Develop a process-based model of blackwood height.
- Develop a schedule for managing effluent irrigation of plantations managed for solid wood.
- Study the determinants of non-industrial private owners' timber harvest and management decisions.
- Clarify how community anxiety over forestry expansion can be replaced by cooperation between diverse stakeholders.

Project B4

Leader
Dr Peter Sands

Staff
Mr Ian Andrew
Dr Michael Battaglia
Dr Roger Braddock
Mr Alex Bradley
Dr Kerrie Catchpoole
Dr David Doley
Dr Kevin Harding
Dr Frieda Henskens
Dr Mark Hunt
Ms Sharon Koh
Dr Mark Lewty
Mr Daryl Mummery
Dr Marks Nester
Dr Tony O'Grady
Mr David Osborne
Dr Libby Pinkard
Ms Rebecca Pryor
Dr Carolyn Raymond
Mr Paul Ryan
Mr Leon Savage
Ms Kirsty Siu

Modelling production and wood quality

Background

The aims of this project are to:

- produce process-based models which
  a) enable the productivity of plantations to be predicted,
  b) address specific management questions,
  c) have a transparent structure, and
  d) allow input data to 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; and
- develop decision support systems for plantation management.

Outcomes

- A rainfall simulator was developed and incorporated into growth models to enhance their usefulness as drought-risk management tools.
- CABALA was modified to predict predawn water stress and to simulate drought stress response of plantations and was then used to predict levels of water stress, growth and LAI in plantations in Western Australia following various levels of thinning and fertilisation.
- CABALA was adapted to simulate tree growth for wide spacings and row plantings.
- Seasonal and diurnal measures of stand carbon fluxes were made in plantations of *Eucalyptus nitens*. Measures of coarse root, stem and soil respiration, leaf photosynthesis and stand litterfall were made over a day in spring, summer and autumn.
- The Win-EPFIN conversion software was purchased for integration into the decision support project for plantation management. This software will marry stand silviculture conditions with end products allowing simulated sawing of logs and grading of boards.
- Cellulose content was found to increase with increasing rainfall in *E. globulus* sampled across a rainfall gradient in Western Australia, but differences in spacing appear to have no effect on fibre length for *E. globulus* in Western Australia.
- In a study on growth stress and board deflection, no differences were found between sites for degree of board deflection in trees from the Otway provenance of *E. globulus*.

Goals

- Construct a carbon balance for the Westfield plantation and use this data to validate carbon flux predictions by CABALA.
- Use the rainfall simulator to assess sensitivity of drought risk predictions to the way rainfall is represented in process-based, stand growth models.
- Develop a plantation nutrient management toolbox.
- Develop and document branching and predictive grading models for subtropical pines.
- Incorporate the Win-EPFIN software into a prototype decision support system for subtropical softwood species.
- Determine relationships between site climatic factors and wood properties of *E. globulus* in Western Australia and Tasmania.
- Hold a field day on the use of a productivity model for wide spacings and row plantings.
- Hold a workshop on Site Productivity Estimation.
- Hold an International Conference on Determinants of Eucalypt Productivity.

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

Leaders
Dr Geoff Allen
Dr Rob Floyd

Staff
Dr James Bulinski
Dr Steven Candy
Dr David de Little
Dr Jane Elek
Dr Humphrey Elliott
Dr Andrew Loch
Dr Mamoru Matsuki
Mr John Matthiessen
Ms Michelle Michie
Ms Helen Nahrung
Mr Vin Patel
Mr Stephen Paterson
Ms Nita Ramsden
Mr Luke Rapley
Mr Hilton Redgrove
Mr Anthony Rice
Mr Mark Short
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 Strategies (IPM) 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 *Chrysophtharta 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

- In the field, feeding damage caused by adult *C. agricola* was 15% more frequent on adult *E. nitens* foliage than on juvenile foliage, yet egg batches were three times more common on juvenile than on adult foliage. Larval survival, development time and subsequent pupal weight were unaffected by foliage type, suggesting that neither foliage type is nutritionally superior.
- The two tachinid fly species that attack larval *C. agricola* have lower fecundities than the braconid parasitoid but have two generations per year compared to only one in the braconid. Futhermore, one of these two tachinid species prefers to attack early instar beetle larvae and then emerges to kill the damaging last instar, thereby preventing much feeding damage.
- The threshold temperature for *C. bimaculata* emergence from over-wintering and start of egg-laying was found to be close to 5°C, the same as for egg and larval development. Predictions based on laboratory trials closely matched dates that beetles emerged from over-wintering in the field, but egg-laying occurred in the field long before the date predicted by field under-canopy temperatures.
- Leaf-blister sawfly undergoes approximately six annual generations in Western Australia, with most damage to plantations occurring in late summer and early autumn.
- The *Eucalyptus* weevil, *Gonipterus scutellatus*, undergoes one major annual generation in Western Australia but a smaller second generation may occur during summer. This second generation only appears to occur if new expanding foliage is available as a result of significant spring rain.
- A study of the spatial variation of *Eucalyptus* weevil distributions in four plantations in south-west WA was used to construct a table relating sampling intensity (trees visited) to the cost of sampling and the precision of the results.
- In bioassays it has been found that two ichneumonid parasitoids of Autumn gum moth live longer when caged with sprigs of *E. globulus* than when not. Females of one species have been observed feeding from the leaf surface.
- Oviposition by Autumn gum moth is affected by the identities of neighbouring trees. *Eucalyptus globulus* surrounded by *E. globulus* had more Autumn gum moth eggs than did *E. globulus* surrounded by non-*globulus* eucalypts. A few *E. globulus* surrounded by *Acacia* had many more eggs than *E. globulus* surrounded by other *E. globulus*.
- A hybrid individual of *E. globulus* x *E. pseudoglobulus* ('glossy' phenotype) has been shown to be less preferred by Autumn gum moth for oviposition than related 'waxy' half-siblings.

Avoidance of this glossy hybrid is the combined result of less attractive monoterpene odours and reduced epicuticular waxes. These hybrid characteristics could form the basis of future tree-genotype improvement decisions.

Goals

- Undertake studies of the biology, distribution and impact of *Heteronyx elongatus* larvae with the aim of devising appropriate prophylactic management practices in at-risk areas.
- Provide industry with estimates of the economic impact of the major defoliating insect pests in Western Australia based on early results from exclusion trials.
- Determine the benefits that ichneumonid parasitoids of Autumn gum moth gain from the leaves of *E. globulus*. Determine if a similar benefit can be obtained from *E. nitens*.
- Establish a field trial of the 'glossy' hybrid *E. globulus* x *E. pseudoglobulus*, not preferred by Autumn gum moth, to compare its growth rate, fibre properties, and susceptibility to other eucalypt feeding insects with that of *E. globulus* and *E. nitens*.
- Verify field conditions required to predict start and peak egg-laying by *C. bimaculata* and *C. agricola*.
- Estimate long-term effects of defoliation of young *E. nitens* on their growth in Tasmania.
- Assess the distribution and biology of *Heteronyx* spp in newly established plantations in Tasmania.
- Estimate the level of gene flow between populations of *C. agricola* across south-east Australia.
- Investigate the chemical ecology underpinning mate location in *C. agricola*.
- Determine the developmental parameters and reproductive strategies used by the parasitoids of *C. agricola*.
- Establish sampling protocols for key pest species in south-west Western Australia.

Habronyx pammi, an ichneumonid parasitoid, looking for Autumn gum moth larvae inside a leaf shelter (Canberra, April 2002).

Malaise trapping for wasp parasitoids of Autumn gum moth in a newly established *E. nitens* and *E. globulus* field trial (Canberra, March 2002).

Project C2

Leaders
Dr Rob Floyd
Dr Geoff Allen

Staff
Dr James Bulinski
Dr Steven Candy
Dr David de Little
Dr Jane Elek
Dr Humphrey Elliott
Dr Andrew Loch
Dr Mamoru Matsuki
Mr John Matthiessen
Ms Michelle Michie
Dr Richard Milner
Ms Helen Nahrung
Mr Vin Patel
Mr Stephen Paterson
Ms Nita Ramsden
Mr Luke Rapley
Mr Hilton Redgrove
Mr Anthony Rice
Mr 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 use of more environmentally-friendly chemical insecticides, for incorporation into IPM strategies.

Outcomes

- Draft field manuals for the surveillance, monitoring and control of *Eucalyptus* weevil, chrysomelid beetles, *Cadmus excrementarius* and leafblister sawfly have been produced and disseminated to the Blue gum industry in Western Australia.
- An embedded clear casting resin plate containing preserved specimens of the most common beetle pests and predators encountered in Western Australian plantations was produced for plantation managers to enable rapid and accurate identifications of beetles in the field.
- A draft threshold has been developed for the chrysomelid beetle *Cadmus excrementarius*, which enables early control based on counts of adult beetles per tree in January and February.
- An effective synthetic sex pheromone lure for Autumn gum moth has been developed. The lure attracts moths with about the same efficacy as UV light traps, but are better than light traps as they only catch Autumn gum moths, are not labour intensive to set up, and remain effective for in excess of 36 days under field conditions (see Major Developments for details).
- Ultra-violet light trapping has revealed that Autumn gum moths are most active during the night between 0100 and 0430 hours. In addition, catches are likely to be greatest on nights around the crescent moon.
- A variety of *E. globulus* races, subraces and localities from throughout south-east Australia have been ranked for wax composition and susceptibility to *C. agricola* oviposition.
- Aerial field spraying of the biologically-derived insecticide, Success® (active ingredient: spinosad), in *E. nitens* plantations at two concentrations showed that both concentrations (50 and 100 ml Success® in 10 L water/ha) effectively reduced young leaf beetle populations below the economic threshold within seven days without significantly affected the natural enemy population.
- Label registration by the chemical manufacturer of Mimic™ (active ingredient: tebufenozide) has been approved. Mimic™ can be used to control Autumn gum moth in eucalypt plantations by aerial spraying at low volumes.

Aggregation of *Cadmus excrementarius* adults feeding on a young Blue gum shoot.

Goals

- Determine the efficacy of prophylactic insecticide treatments localised at seedlings, and the use of physical barriers, in reducing damage by *Heteronyx elongatus*.
- Carry out assessments of various protective techniques for rendering seedlings unattractive to *Liparetrus* spp.
- Release *Bracon phylacteophagus*, a parasitic wasp of leafblister sawfly to provide higher levels of biological control of the pest in Western Australia.
- Develop foliar spectral reflectance indices to predict the susceptibility of *E. globulus* and *E. nitens* to oviposition by Autumn gum moth, and determine their efficacy for plantation-wide Autumn gum moth surveillance.
- Develop deployment protocols for the synthetic sex pheromone lure of Autumn gum moth. Investigate options for commercialisation.
- Investigate the longer-term effects of insecticide spray on recolonisation of plantations by pest and non-pest insect species, comparing plantations sprayed with Dominex® (broad spectrum) and Success® (targeted to specific insect groups) with unsprayed areas.

Project C3

Leader
Dr Clare McArthur

Staff
Dr Dugald Close
Mr Hugh Fitzgerald
Ms Prue Loney
Ms Julianne O'Reilly
Mr Stephen Paterson
Ms Natasha Wiggins
Ms Andrea Witt

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 achievable by genetic and phenotypic manipulation of those trees. Our research is directed at identifying resistant genotypes, developing a rapid method for estimating susceptibility as detected by leaf chemistry, and predicting susceptibility of seedlings as a function of their environment. These three aspects can be incorporated into an overall strategy for predicting and reducing browser damage of eucalypts at plantation establishment. Specific aims of this project are to:

- determine the relative damage to and preferences for various plant types by browsing herbivores;
- investigate the genetic basis of resistance of eucalypts, and the effects of environment on this resistance; and
- determine whether resistance can be modelled as a function of leaf chemistry using near-infra-red spectroscopy (NIRS). NIRS provides an indirect measure of leaf chemistry.

Outcomes

- Recent NIRS models developed for *E. globulus* leaves provided high correlations with foliage intake by browsing mammals (r^2 = 0.88 for possums, r^2 = 0.89 for pademelons). However, high variation in NIRS between samples (different trees and seasons) indicates that we need to expand the model using a broader range of plant material before we can adequately predict intake of new leaf samples.
- The terpene, cineole, affected feeding behaviour in brushtail possums. With increasing dietary cineole, possums decreased total intake, had smaller feeding bouts, and decreased their rate of feeding.
- Open-rooted 'half-half' seedlings of *E. globulus*, (seedlings grown in pots then transferred to field) with basal diameter of 6 mm, sustained negligible and substantially less browsing damage by rabbits than container stock with basal diameters 1.9-2.5 mm. After four months, survival was 96% for the open-rooted stock, but only ~75% in the container stock.
- Browsing damage by captive pademelons to *E. globulus* seedlings was significantly lower using the Wallaby Repellent No. 1 (WR-1) than for control seedlings. Neem, as a foliar spray or as a systemic soil drench showed promise in reducing damage, but neither were as effective as WR-1. Results were substantiated in a 9-week field trial, though new growth was still browsed from WR-1 seedlings.

Goals

- Compare the relative contribution of genetic and environmental (nursery) effects on palatability of *E. globulus* seedlings to brushtail possums.
- Compare the browsing susceptibility and chemico-physiological responses of eucalypt seedlings differing in size and nursery conditions once planted out into a range of plantations that vary in soil and climate characteristics.

Project C4

Leader
Dr Clare McArthur

Staff
Dr David de Little
Mr Hugh Fitzgerald
Ms Sandra Hetherington
Ms Kirsten le Mar
Mr Stephen Paterson
Ms Elizabeth Pietrzykowski
Mr Andrew Walsh
Mr Geoff While

Strategies to reduce vertebrate browsing damage

Background

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

- understand the interaction between browsers and the environment, and the consequences on damage to seedlings;
- investigate the impact of vegetation immediately around a seedling on its risk of being browsed;
- develop methods for monitoring damage and predicting risk; and
- design appropriate options to reduce browsing damage through various planting strategies.

Outcomes

- On a plantation site in NW Tasmania, mammal browsing to *E. nitens* seedlings planted in November was low until 15 weeks after planting. Damage peaked in winter, six months after planting. This pattern coincided with reduced availability of alternative forage on the plantation during winter, rather than an increase in animal numbers, as local macropod and brushtail possum populations were relatively stable over an 11 month period encompassing this planting and post-planting period.
- Pademelons and Bennett's wallabies ate up to 91% and 87% of available grass and forb biomass respectively, on a spot-herbicided newly established plantation, both before and after planting of *E. nitens* seedlings. Consumption of grasses and forbs increased over summer, with increased availability of these plants. Areas fenced from herbivores became overgrown by grasses during summer months, indicating herbivores contribute substantially to weed control.
- Bitter lupins established effectively in five of six areas on an ex-pasture plantation, and significantly reduced browsing damage to *E. nitens* seedlings over a 12-week period. Fireweed was also very effective at reducing browsing. Sweet lupins did not establish due to heavy browsing. Up to 90% bitter lupin cover enhanced the height growth of both browsed and unbrowsed *E. nitens* seedlings. Increased growth of unbrowsed seedlings was probably due to lateral shading (see Major Development for details).

Goals

- Establish the relative importance of surrounding forest and windrows in affecting distribution of pademelons, Bennett's wallabies and brushtail possums throughout plantations.
- Develop a preliminary model of landscape features influencing browsing on unpoisoned plantations.

Project C5

Leader
Dr Caroline Mohammed

Staff
Dr Karen Barry
Ms Alieta Eyles
Ms Anna Hopkins
Dr Libby Pinkard
Ms Anna Smith
Ms Danielle Wiseman
Ms Marie Yee
Dr Yuan Zi Qing

Strategies to minimise loss due to fungal attack

Background

The objective of this project is to acquire knowledge that will allow the development of management tools to limit the impact of micro organisms, especially fungi, such as stem decay fungi and the leaf spot pathogen *Mycosphaerella*. Benefits to industry are likely to be significant if stem defects in pruned and thinned eucalypts can be better understood and predicted, and management strategies prescribed to reduce incidence in solid wood products.

Research is also in progress to critically assess whether possible future prescriptions relating to the retention of regrowth logs (as opposed to old growth logs) on the forest floor would cater for the conservation of complete fungal and invertebrate biodiversity assemblages associated with the decaying log habitat. Specific objectives are to:

- identify host, pathogen and site parameters influencing the risk of stem defect associated with wounding and decay infection in pruned and thinned *E. nitens* and *E. globulus* plantations destined for solid wood production;
- identify host, pathogen and site parameters influencing the risk and impact on productivity of *Mycosphaerella* infections in plantations of *E. globulus* and *E. nitens*;
- develop a bioassay to screen for resistance to the pathogen *Mycosphaerella*;
- initiate the use of remote sensing technology in eucalypt plantations to determine *Mycosphaerella* disease severity levels; and
- develop a better understanding of the ecology of decomposing coarse woody debris (CWD) and investigate differences in fungal and insect biodiversity between small and large diameter logs.

Outcomes

- The incidence and severity of decay infections associated with pruning were assessed one year prior to pruning (pruning at age four) and six years after pruning (at age ten) on pruned *E. nitens* trees in three Tasmanian plantations. There was little evidence that decay had spread out from the knotty core, although decay had spread longitudinally through the stem so that columns of decay from adjacent branches merged.
- Wound wood developed in stems of *E. nitens* and *E. globulus* is often observed to restrict the outward spread of fungal decay into the normal tissue, and appears to consistently play an important role in the wound repair process, e.g. re-establishing continuity of the vascular cambium. We are the first to report traumatic oil glands induced in wound wood, although the natural occurrence of oil glands in various organs such as bark and leaves is well established as a characteristic of Myrtaceae. Wound wood contains a surprising concoction of tannins, flavonoids and terpenes.
- Disease exclusion plots, established (in conjunction with Sustainable Management) in north-west Tasmania in an eight-month-old plantation of *E. globulus* prone to *Mycosphaerella* infection, are being used to investigate disease epidemiology, disease impact and the remote sensing of disease severity.
- A classification scheme has been devised for rot types occurring in *E. obliqua* logs of small or large diameter. Eight rot types have been found, and approximately 700 basidiomycete isolates identified to morphospecies. In addition, about 104 beetle morphospecies have been hand-collected from the same logs. Of the 15 most commonly found beetles, nine are primarily associated with a red brown blocky rot type that appears to arise through the enzymatic activities of two unidentified basidiomycete species. As this rot type is most consistently found in large, not small logs, the long-term harvesting practices resulting in small logs could potentially have an impact on beetle communities dependent on this rot type.
- Log emergence traps were used to monitor insect emergence from decaying logs over 16 months. At each of ten sites, six traps were erected, three on larger-diameter logs and three on smaller-diameter logs (60 traps in total). Over 7000 beetles from these traps have been sorted into approximately 450 morphospecies of which 25% have been identified to genus level and 25% to species level. Particular logs that have specific beetles emerging can now be cut up to identify the wood rot type from which they emerged, both complimenting and validating the results with those beetles hand-collected from log-sections (see previous dot point).

Mycosphaerella damage in *E. globulus* aged 12 months (left) and 18 months (right) at site in north-west Tasmania

Goals

- Quantify the long-term impact of decay infections established at pruning.
- Continue studies to identify decay fungi (both those associated with decay columns originating from pruning wounds and those isolated from decaying logs) by similarity analysis with the molecular profiles of known decay fungi. Further test the pathogenicity of these fungi to *E. nitens* and *E. globulus*.
- Produce a risk assessment and description of decay defects associated with pruning *E. globulus* and *E. nitens* subject to different fertiliser regimes.
- Produce a description of traumatic tissue induced in stems of *E. globulus* and *E. nitens*.
- Determine environmental conditions dictating spore release, fluctuations in spore inoculum load and leaf infection for the *Mycosphaerella* species present in a Tasmanian plantation site of *E. globulus*.
- Measure physiological and pathological parameters such as growth, leaf and infection phenology, patterns of leaf defoliation and necrosis, changes in the distribution of photosynthesis, stomatal conductance, and biomass allocation in trees with different levels of infection.
- Continue studies to promote spore production in culture and to develop a screening method to be used on very young plants to test the resistance of eucalypts to *Mycosphaerella*. Work on user-friendly methods to detect spores in the field.
- Identify spectra that are useful for the differentiation of plantation sites with different levels of *Mycosphaerella* infection.

Education and Technology Transfer Program

Manager
Dr Neil Davidson

Staff
Dr Rebecca Boyle
Dr Philip Brown
Dr Eleanor Bruce
Ms Jill Butterworth
Dr Dugald Close
Prof Robert Clark
Dr David Doley
Mr Richard Doyle
Mr Greg Dutkowski
Prof Robert Henry
Dr Mark Hovenden
Prof Peter Kanowski
Prof Jamie Kirkpatrick
Dr Sinniah Mahendrarajah
A/Prof Stuart McLean
Dr Peter McQuillan
Dr Neville Mendham
Dr Digby Race
Prof Jim Reid
Dr Alistair Richardson
Dr Sergey Shabala
Dr Robert Wiltshire
Dr Zhihong Xu

Background

The Education and Technology Transfer Program coordinates the:

- intake of postgraduate students across the three research programs and five university partners in the CRC for Sustainable Production Forestry, and the involvement of Centre staff in education and training;
- transfer of technology from research programs to the industrial partners in the Centre and to small end-users of forest technology, particularly farmer groups; and
- activities to raise public awareness of CRC-SPF 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 industrial partners and other end-users;
- publish research of international quality so that through CRC-SPF Australia is seen as a world leader in plantation forestry; and
- raise community awareness of CRC-SPF activities and the value to Australia of a sustainably managed forest industry.

Outcomes

Education

- The Centre has 76 PhD, MSc and Honours students currently enrolled. Of the postgraduate students, 13 were attracted from industry, 14 are on scholarships with industry support (APA-I, SPIRT/ARC, FFIC, LWRDC, FWPRDC, CSIRO, DPIQ, State Forests of New South Wales, a consortium of industries including CRC-SPF partners, and Bioforest, Chile), and a further 27 are on competitive national scholarships (APA, ARC, AIDAB). Four students are on scholarships provided by CRC University partners (UT&GU). Only 12 are supported solely by CRC-SPF PhD scholarships. Eighteen students have CRC-SPF top-ups to APA or ARC scholarships (see Tables 3 and 4 for details).
- Six PhD students received awards this year: Marian McGowen won the prize for best poster at the Joint Conference of the Australasian Evolution Society and the Society of Systematic Biologists July 2001; Luke Rapley was awarded a prize for best talk at the Australian Entomology Society Conference, Sydney September 2001; Rhonda Stokoe and Megan Jones received travel awards of $800 and scholarships of US$400 for high quality abstracts to attend the Stevenson Conference on Tree Technology, July 2001; Tim Blumfield was awarded a travel grant for an oral presentation at the World Congress of Soil Science, Bangkok, August 2002 and Julianne O'Reilly received the 2002 AFFA Science and Innovation Award for Young People. Five students also received prizes for the quality of posters presented at the CRC-SPF Annual meeting: Jules Freeman (first prize), Luke Rapley (second prize), Tim Blumfield and Nicole Mathers (third prize), and Marian McGowen (outstanding poster on native forests).
- Supervision of postgraduate and Honours students was widely distributed amongst CRC-SPF partner institutions, with 43 of the 83 supervisors of Honours, MSc and PhD projects being non university departmental staff (see Table 5 for details).
- Ten CRC-SPF scientists, who are not staff of university departments, contributed to 15 university courses in fields allied to their research, involving 602 students: Dr N Davidson in Plant Ecology (UT, 32 students), Dr C McArthur in Fisheries and Wildlife Management (UT, 55 students) and Vertebrate Zoology (UT, 80 students), Dr P Smethurst in Soil Fertility (UT, 18 students), A/Prof B Potts in Molecular Evolution (UT, 22 students) and Field Botany (UT, 44 students), Dr Z Xu Environmental Chemistry (GU, 102 students) and Land and Water (GU, 51 students), Dr M Steinbauer in Insect Management for Forestry (ANU, 12 students), Dr D Steane in Botany 2 (UT, 90 students) and Molecular Evolution (UT, 20 students), and Dr M Matsuki in Insect Diversity and Function (UT, 47 students) and Insect Ecology and Behaviour (UT, 20 students). A number of CRC-SPF staff (Dr N Davidson, Dr C Beadle, Dr M Battaglia, Dr C McArthur, A/Prof B Potts and Dr D Steane) also supervised a total of 17 undergraduate students enrolled in a third year unit 'Plant Science Research', a one semester research project (Forest Ecology Research) designed to provide an introduction to Honours. Dr N Davidson coordinates a four-year undergraduate course 'Forest Ecology' (12 students) at the University of Tasmania, which was designed for students with an interest in forestry.
- Thirteen postdoctoral fellows worked with the Centre in 2001/02: Dr R Thumma in molecular genetics (CSIRO FFP, Canberra), Dr M Steinbauer in entomology (CSIRO Ento,

Table 2: CRC Research Students

	First Name	Last Name	Degree	Funding	Institution	Start	Topic	Supervisor(s)	Program
1	Paul	ADAMS	PhD	LWRDC	UT	1996	Sources of competition from weeds in plantations	Dr N Mendham, Dr C Beadle, Dr P Smethurst	SM
2	Philip	ALCORN	Hons		ANU	2000	Effect of gap size on physiology and growth of *E. globulus* seedlings	Dr J Bauhus, Mr J Hickey, Dr C Beadle	SM
3	Sue	BAKER	PhD	APA/CRC	UT	2000	Conservation of beetles in managed forests	A/Prof A Richardson	RP
4	Robert	BARBOUR	PhD	CRC	UT	2000	Gene flow between plantations and native forest	A/Prof B Potts, Dr R Vaillancourt	GI
5	Tim	BLUMFIELD	PhD	CRC	GU	1999	Nitrogen dynamics and cycling in hoop pine plantations	Dr Z Xu, A/Prof P Saffigna, Dr I Philips	SM
6	Peter	BUNDOCK	PhD	APA	UT	1995	Genetic mapping and QTL analysis in *Eucalyptus globulus*	Dr R Vaillancourt	GI
7	Joanne	BURTON	PhD	GU/CRC	GU	2002	Links between carbon and nitrogen cycling processes in forest ecosystems	Dr Z Xu, Dr H Ghariđi, Dr S Boyd, Prof J Hughes	SM
8	Paul	DARGUSCH	MSc		UT	1997	Physical, social and economic barriers to the adaptation of farm forestry in NE Tasmania	Prof R Clark, Ms A Fulton	SM
9	Greg	DUTKOWSKI	PhD	Ind staff	UT	1996	Improvement of mixed models for prediction of breeding values in forestry	A/Prof B Potts, Dr A Gilmour	GI
10	Aileta	EYLES	PhD	APA/CRC	UT	1999	Role of kino in anti microbial defences of *Eucalyptus globulus*	Dr C Mohammed	RP
11	Stuart	FENECH	Hons	GU	GU	2002	Impacts of compaction and cultivation on soil mineral and microbial dynamics	Prof J Chaseling, Dr Z Xu	SM
12	Jules	FREEMAN	PhD	UT/CRC	UT	2001	Linkage mapping and QTL analysis of *Mycosphaerella* resistance in *Eucalyptus globulus*	Dr R Vaillancourt, A/Prof B Potts, Dr D Steane	GI
13	Susan	FOSTER	Hons		UT	2001	The genetics of clines in *Eucalyptus globulus*	Dr R Vaillancourt, A/Prof B Potts, Dr D Steane	GI
14	Andrew	GIBBONS	PhD	CSIRO	UT	1998	Effect of intensive forest management on understorey and fauna in *Eucalyptus delegatensis*	Dr M Battaglia, Dr R Wiltshire	SM
15	Carl	GROSSER	PhD	SPIRT/ARC	UT	1996	Seed orchard molecular biology	Dr R Vaillancourt, A/Prof B Potts	GI
16	Craig	HAWKINS	MSc	Ind staff	UT	1998	Response of *Brunonia australis* to forestry practices	Dr R Wiltshire, Dr P Barker	SM
17	Jim	HE	PhD	APA/CRC	GU	2001	Molecular bases of soil biological properties and processes in forest ecosystems	Dr Z Xu, Prof J Hughes, Dr I Phillips	SM
18	Kate	HOORWEG	Hons		ANU	2002	Palatability of tropical and subtropical eucalypts to larvae of autumn gum moth	Dr M Steinbauer, Dr W Foley	RP
19	Andrew	HINGSTON	PhD	APA	UT	1998	Pollination ecology of *Eucalyptus globulus* and *E. nitens*	Dr P McQuillan, A/Prof B Potts	GI
20	Anna	HOPKINS	PHD	APA/CRC	UT	2002	Ecologically sustainable forest management: course woody debris	Dr C Mohammed, Dr S Grove	RP
21	Megan	JONES	PhD	SFNSW	SCU	1999	Gene flow and genetic diversity of hardwood plantations in NSW	Dr M Shepherd, Prof R Henry, Prof A Delves	GI
22	Tim	JONES	PhD	SPIRT/ARC	UT	2000	Genetic relationships in *Eucalyptus globulus*	Dr R Vaillancourt, A/Prof B Potts	GI
23	Dominic	KAIN	PhD	FWRPDC	ANU	1998	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
24	Rachel	KING	PhD	APA	GU	2000	Genetic variation in spotted gums and susceptibility to *Ramularia* disease	Prof J Hughes, A/Prof B Potts	GI
25	Andrew	KNOWLES	PhD	CRC	UT	2000	K and Mg uptake by eucalypts and pines	Dr S Shabala, Dr P Smethurst, Dr P Brown	SM
26	Sharon	KOH	PhD	CRC	UT	2002	Mathematical modelling of tree growth	Dr P Sands, Dr M Battaglia	SM
27	Peter	KUBE	PhD	Ind staff	UT	1996	Breeding objectives for the production of sawlogs and pulpwood from plantation grown *Eucalyptus nitens*	Dr C Raymond, Prof J Reid	GI
28	Elisha	LADHAMS	PhD	APA/CRC	UQ	2001	Testing and identifying soil invertebrates as indicators of biodiversity in hoop pine plantations	Dr G Wardell-Johnson, Dr A House, Dr H Proctor	SM
29	Sven	LADIGES	PhD	CRC	UT	1996	Micronutrient deficiencies in eucalypts induced by excess application of N & P	Prof R Menary, Dr C Beadle	SM
30	Andrew	LAIRD	Hons		UT	2002	Differences in photoinhibition, and protective pigments and waxes amongst eucalypts	Dr N Davidson, Dr D Close	SM
31	Rachel	LAWRENCE	PhD	APA-I	ANU	2002	Eucalypt-insect interactions	Dr W Foley, Dr C Stone, A/Prof B Potts	RP
32	Kirsten	LE MAR	PhD	APA/CRC	UT	1996	Use of plantation and surrounding habitat by mammalian herbivores	Dr C McArthur, Dr D de Little, Dr M Statham	RP
33	Prue	LONEY	PHD	CRC	UT	2002	Plant defences against mammalian browsing	Dr C McArthur, Dr G Jordan	RP
34	Gustavo	LOPEZ	PhD	AIDAB	UT	1998	Quantitative genetics and breeding of *Eucalyptus globulus*	A/Prof B Potts, Dr R Vaillancourt	GI
35	Nicole	MATHERS	PhD	APA	GU	1998	Effective use of C13 and N15 NMR in C and N dynamics of forest soils	Dr Z Xu, A/Prof Saffigna, Dr S Berners-Price, A/Prof P Healy	SM
36	Marian	McGOWEN	PhD	APA/CRC	UT	2000	Reproductive biology of *Eucalyptus globulus*	A/Prof B Potts, Dr R Vaillancourt	GI
37	Michelle	McGRANAHAN	PhD	APA	UT	1995	Genetic control of propagation ability in *Pinus radiata* and its use in breeding programs	Dr B Greaves, A/Prof B Potts	GI
38	Gay	McKINNON	PhD	ARC	UT	2000	Molecular evolution of eucalypts	Dr R Vaillancourt, A/Prof B Potts, Dr D Steane	GI

Table 2: CRC Research Students (cont.)

	First Name	Last Name	Degree	Funding	Institution	Start	Topic	Supervisor(s)	Program
39	Issa	MEDRAJ	PhD	ARC	GU	2002	Molecular nutrition of Hoop Pine: characterisation of ammonium transporter genes	Prof J Hughes, Dr Z Xu, Dr F Smith	SM
40	Rohan	MELLICK	PhD	CRC	SCU	2000	Genetic analysis of vegetative propagation characteristics in hybrid pine	Dr M Shepherd, Dr H Dungey, Dr M Dieters	GI
41	Andrew	MILGATE	PhD	SPIRT/ARC	UT	1997	The genetic basis of resistance to *Mycosphaerella* in *Eucalyptus globulus*	Dr R Vaillancourt, Dr C Mohammed, Dr D de Little	GI/RP
42	Daryl	MUMMERY	MSc	CSIRO	UT	1999	Using landscape models to enhance plantation yield predictions	Dr E Bruce, Dr M Battaglia, Dr P Ryan	SM
43	Helen	NAHRUNG	PhD	APA	UT	1999	Biology and phenology of *Chrysophtharta agricola*	Dr G Allen	RP
44	Mark	NEYLAND	MSc	Ind staff	UT	1998	Alternative silvicultural systems for regenerating native forest	Dr N Davidson, Dr C Beadle, Mr J Hickey	SM
45	Chris	O'HARA	PhD	APA/CRC	ANU	1998	Phosphorus fractions in forest soils	Dr J Bauhus, Dr P Khanna, Dr J Raison, Dr P Smethurst	SM
46	Julianne	O'REILLY	PhD	UT/CRC	UT	2000	Genetic and chemical resistance of *Eucalyptus globulus* and *E. nitens* to mammalian herbivores	Dr C McArthur, A/Prof B Potts	RP
47	Ross	PEACOCK	PhD	Ind staff	UT	1994	Regeneration after cable logging	Dr N Davidson, Dr M Brown	SM
48	Ann	PERRY	PhD	APA/CRC	UQ	2000	Wood quality assessment of plantation-grown *Flindersia brayleyana*	Dr D Doley, Dr A Muneri	SM
49	Fiona	POKE	PhD	APA/CRC	UT	2002	Lignin biosynthesis in *Eucalyptus globulus*	Prof J Reid, Dr R Vaillancourt	GI
50	Rebecca	PRYOR	MSc	CRC	UT	2002	Waterlogging of *Eucalyptus globulus*	Dr N Davidson, Dr M Battaglia, Dr D Close	SM
51	Luke	RAPLEY	PhD	APA/CRC	UT	2000	Genetic variation in susceptibility of eucalypts to insect attack	Dr G Allen, A/Prof B Potts	RP/GI
52	Hilton	REDGROVE	PhD	APA-I	UT	2000	The ecology of *Heteronyx* spp. beetles: establishment pests of eucalypt plantations	Dr G Allen, Dr M Hurley, Dr P McQuillan, Dr D de Little	RP
53	Anthony	RICE	PhD	APA	UT	1999	The ecology and host interactions of the larval parasitoids of *Chrysophtharta agricola*	Dr G Allen	RP
54	Carolyn	RINGROSE	MSc		UT	1999	N mineralisation in annually N-fertilised plantations	Mr R Doyle, Mr W Neilsen, Dr P Smethurst	SM
55	Patricio	ROJAS	PhD	Bioforest	UT	2000	Systems for eucalypt hybrid production	A/Prof B Potts	GI
56	Jackie	SCHIRMER	PhD	APA/CRC	ANU	2000	Evaluating the effectiveness of conflict resolution techniques in resource management disputes	Prof P Kanowski, Dr H Ross, Dr S Dovers	SM
57	Leon	SCOTT	PhD	CRC	SCU	1998	Molecular genetics of hoop pine	Dr M Shepherd, Prof R Henry, Dr M Dieters, Dr G Nikles	GI
58	Yetti	SETIAWATTI	PhD	AIDAB	UQ	1997	Enhancement of pollen production in *Araucaria cunninghamii* (hoop pine)	Dr D Doley, Dr M Dieters	GI
59	Mark	SHORT	PhD	APA/CRC	ANU	2000	Taxonomy and biology of hymenopteran larval parasitoids of *Mnesampela privata*	Dr M Steinbauer, Dr R Floyd, Dr J Trueman	RP
60	Anne	SMITH	PhD	APA/CSIRO	UT	2002	Risk and impact of *Mycosphaerella* in plantations of *Eucalyptus globulus* and *E. nitens*	Dr C Mohammed, Dr C Beadle, Dr M Battaglia	RP
61	Diane	SPURR	PhD	CRC	UT	1999	Above-ground nitrogen dynamics in *Eucalyptus nitens*	Dr P Smethurst, Dr M Hovenden	SM
62	Rhonda	STOKOE	PhD	CRC	SCU	1998	Molecular analysis of *Eucalyptus cloeziana*	Dr M Shepherd, Prof R Henry, Dr G Nikles, Dr D Lee	GI
63	Tim	TABART	MSc		UT	1998	Achieving sustainable economic development through collaborative community decision-making	Prof R Clark, Ms A Fulton	SM
64	Paul	TOON	MSc	ARC	USC	1998	Wood properties of hybrids between *Pinus elliottii* and *P. caribea* var. *hondurensis*	Dr H Wallace, Dr K Harding	GI
65	Greg	UNWIN	PhD	Ind staff	UT	2000	Response of tropical rainforest trees to stress	Dr N Davidson, Prof J Reid, Prof J Kirkpatrick, Dr C Beadle	SM
66	Peter	VOLKER	PhD	Ind staff	UT	1992	Genetics of *Eucalyptus globulus*, *E. nitens* and F_1 hybrid	A/Prof B Potts	GI
67	Tim	WARDLAW	PhD	Ind staff	UT	1994	*Armillaria* butt and root rot of eucalypts	Dr C Mohammed, Dr G Kile	RP
68	Tim	WATSON	Hons		UT	2002	Variation amongst blackwood provenenaces in tolerance to cold, drought and waterlogging	Dr N Davidson, Dr D Close	SM
69	Grant	WESTPHALEN	PhD	CRC	UT	1996	Indicator species for sustainibility in native forest systems	Dr M Brown, Mr J Hickey, Dr N Davidson	SM
70	Trudi	WHARTON	PhD	Industry	ANU	1999	Biology and ecology of *Essigella californica* (Hemiptera: Aphididae)	Dr M Steinbauer, Dr R Floyd, Dr P Cooper	RP
71	Geoff	WHILE	Hons		UT	2002	Spatial use of plantations by herbivores	Dr C McArthur, Dr W Hennecke	RP
72	Simon	WHITTOCK	PhD	SPIRT/ARC	UT	2001	Breeding for sustainability in *Eucalyptus globulus*	Dr L Apiolaza, A/Prof B Potts	GI
73	Natasha	WIGGINS	PhD	UT/CRC	UT	2002	Feeding behaviour in brushtail possums	Dr C McArthur, A/Prof S McLean, Dr R Boyle	RP
74	Danielle	WISEMAN	PhD	APA-I	UT	2001	Pathology and physiology of pruned *Eucalyptus globulus*	Dr C Mohammed, Dr C Beadle, Dr E Pinkard	SM
75	Andrea	WITT	Hons		UT	2002	Use of repellents for reducing browsing by mammals	Dr C McArthur	RP
76	Marie	YEE	PhD	APA/CRC	UT	1999	Saproxylic insects and their associations with wood decay in wet sclerophyll forests	Dr C Mohammed, A/Prof A Richardson, Dr R Taylor, Dr G Allen	RP

Table 3: Student enrolments and funding sources - 2001-02

NUMBER OF STUDENTS			FUNDING	
Full/Part-Time			CRC Scholarship	12
Full-Time		65	APA Scholarship	7
Part-Time		11	CRC top-up of APA Scholarship	14
	Total	76	CSIRO top-up of APA Scholarship	1
			ARC	3
Degree			APA-I	3
			SPIRT/ARC	4
Honours		8	UT/CRC top-up	3
MSc		8	GU/CRC top-up	1
PhD		60	CSIRO	2
	Total	76	CRC Industry partners	1
			LWRDC	1
Research Program			FWPRDC	1
			AIDAB	2
Genetic Improvement		26	SFNSW	1
Sustainable Management		30	Bioforest (Chile)	1
Resource Protection		20	Industry employed postgraduate	8
			Unfunded postgraduate	3
	Total	76	Total	68

Canberra), Dr M Shepherd in molecular biology (SCU, Lismore), Dr D Close in tree physiology (UT and CSIRO FFP, Hobart), Dr N Prasolova on soil nutrition (GU, Brisbane), Dr D Steane and Dr B Patterson in molecular genetics (UT, Hobart), Dr F Henskens on canopy nitrogen dynamics (CSIRO FFP, Hobart), Dr A Loch on pest management of Blue gum (CSIRO Ento, Perth), Dr A O'Grady in root biomass turnover (CSIRO FFP, Hobart), Dr A Mitchell (CSIRO FFP, Hobart) on availability of base cations, Dr K Barry in tree pathology (CSIRO FFP, Hobart), and D M Matsuki in insect ecology (UT, Hobart).

- The Centre's research programs hosted 11 visiting scientists during 2001/02; three in Genetic Improvement, three in Sustainable Management, and five in Resource Protection.
  - Ms Roa Hongxin and Mr Li Bohai (Hunan Forestry Department, China) worked with the Genetic Improvement group in Hobart for 6 months, December 2001 – June 2002.

Ms Roa Hongxin pipetting in the molecular biology laboratory.

  - Prof Bailian Li (North Carolina State University, USA) spent two weeks with Dr M Dieters (GI) at QFRI Gympie during July 2001.
  - Dr Jean-Michel Leban (National Institute for Agricultural Research, France) visited QFRI Brisbane from 4-12 January 2002 to interact with members of the CRC-SPF decision support project, Dr K Catchpoole and Dr M Nester (SM) and Dr K Harding (GI).
  - Dr Kenneth Lundkvist (Department of Forest Genetics, Swedish University of Agricultural Sciences, Uppsala, Sweden) visited from 26 February - 28 March 2002, and worked at QFRI with Dr Z Xu (SM) on analysis of inheritance of water and nutrient use efficiency in Hoop pine families and exotic F_1 hybrid clones.
  - Prof Zhen-Miao Xie (College of Environmental Science and Natural Resources, Zhejiang University, Hangzhou, China) visited from 16-21 December 2001, and worked with Dr Z Xu at QFRI in Brisbane.
  - Dr Christine Stone (State Forests of New South Wales) gave a presentation on 'Plant health surveillance' in Hobart, 15 January 2002. She also interacted with many in the Resource Protection Program during her visit.
  - Dr Alan Carroll (Pacific Forestry Centre, British Columbia, Canada) worked on a three-month project with Dr M Steinbauer (RP) in Canberra, 3 February - 27 April 2002. During

Table 4: Supervisors and the number of CRC students they supervised during 2001/02

Dr G Allen UT	5	Dr B Greaves* CRC Fellow	1	Dr E Pinkard* FT	1
Dr L Apiolaza* CRC-SPF	1	Dr S Grove* FT	1	Dr H Proctor GU	1
Dr P Barker* NPWS	1	Dr K Harding* QFRI	1	A/Prof B Potts* UT/CRC-SPF	17
Dr M Battaglia* CSIRO FFP	5	A/Prof P Healy GU	1	Dr J Raison* CSIRO FFP	1
Dr J Bauhus ANU	2	Prof R Henry SCU	3	Dr C Raymond* CSIRO FFP	1
Dr C Beadle* CSIRO FFP	7	Dr W Hennecke UT	1	Prof J Reid UT	3
Dr S Berners-Price GU	1	Mr J Hickey* FT	3	A/Prof A Richardson UT	2
Dr S Boyd GU	1	Dr A House* QFRI	1	Dr H Ross ANU	1
Dr R Boyle UT	1	Dr M Hovenden UT	1	Dr P Ryan* CSIRO FFP	1
Dr M Brown* FT	2	Prof J Hughes GU	4	A/Prof P Saffigna* GU (Assicuate)	2
Dr P Brown UT	2	Dr M Hurley* UM (Associate)	1	Dr P Sands* CSIRO FFP	1
Dr E Bruce UT	1	Dr G Jordan UT	1	Dr S Shabala UT	1
A/Prof J Chaseling GU	1	Prof P Kanowski ANU	1	Dr M Shepherd* CRC-SPF	4
Prof R Clark UT	2	Dr P Khanna* CSIRO FFP	1	Dr P Smethurst* CRC-SPF/CSIRO FFP	5
Dr D Close* UT (ARC Fellow)	3	Dr G Kile* FWPRDC	1	Dr F Smith* CSIRO PI	1
Dr P Cooper ANU	1	Prof J Kirkpatrick UT	1	Dr M Statham* TIAR	1
Dr N Davidson* CRC-SPF	7	Dr D Lee* QFRI	1	Dr D Steane* CRC-SPF	3
Prof A Delves SCU	1	Dr B Li NCSU	1	Dr M Steinbauer* CSIRO Ento	3
Dr M Dieters* QFRI	3	Dr C McArthur* UT/CRC-SPF	6	Dr C Stone* SFNSW	1
Dr D de Little* CRC Fellow	3	A/Prof S McLean UT	1	Dr R Taylor* NTPWC	1
Dr D Doley UQ	2	Dr P McQuillan UT	3	Dr J Trueman ANU	1
Dr S Dovers UM	1	Prof R Menary* UT (Associate)	1	Dr R Vaillancourt UT	11
Mr R Doyle UT	1	Dr N Mendham UT	1	Dr H Wallace USC	1
Dr H Dungey** FR, NZ	1	Dr C Mohammed* UT/CSIRO FFP	7	Dr G Wardell-Johnson GU	1
Dr R Floyd* CSIRO Ento	2	Dr A Muneri* QFRI	1	Dr R Wiltshire UT	2
Dr W Foley ANU	2	Mr W Neilsen* FT	1	Dr Z Xu* QFRI	6
Ms A Fulton* UT (Associate)	2	Dr G Nikles* QFRI	2		
Dr A Gilmour* NSW Ag	1	Dr I Phillips GU	2		
Dr H Ghadiri GU	1				

* Supervisors who are not university departmental staff = 43

** International supervisors = 2

University departmental supervisors = 38

Total = 83

his stay he also visited ANU, Timbercorp in Victoria and CRC-SPF staff in Hobart.
- Dr Alan York (Forest Science Centre, University of Melbourne) gave a presentation on 'Insect biodiversity and sustainability indicators' in Hobart, 16 May 2002, and had discussions with Dr G Allen, Ms M Yee and Ms S Baker (RP).
- Dr Richard Leschen (New Zealand Landcare Research) gave a presentation on 'Beetle taxonomy' in Hobart, 9 January 2002, and had discussions with Dr M Matsuki, Ms M Yee and Ms S Baker (RP).
- Brendan Murphy (PhD student, University of Canterbury, New Zealand) visited for four weeks in March 2002 to complete his work with the Resource Protection Program for his PhD project.

Technology transfer

- Major events run by CRC-SPF this year included:
  - 'Forests and the Environment', a public symposium hosted by the Royal Society of Tasmania, 9 October 2001. Topics were: *The nature of forests* (Dr M Brown); *Forests, silviculture and the environment* (Dr P Smethurst); *The genetic resources and gene movement in eucalypts* (Prof J Reid); *Browsing management and alternative methods of control* (Dr C McArthur), 300 people.
  - 'Genfest: a slice of life', a workshop discussing genetics and breeding, Genetic Improvement Program, 10 October 2001, 20 people.
  - Workshop on 'TREEPLAN National Genetic Evaluation of *P. radiata* - BV prediction', Creswick, Dr L Apiolaza and Mr G Dutkowski, 12-14 December 2001, 8 people.
  - 'Seedfest', a workshop outlining current technology to enhance seed production, Genetic Improvement Program, Hobart 8 February 2002, 20 people; and Melbourne 11-12 February 2002, 20 people.
  - 'Woodfest' a workshop on breeding for wood properties, Genetic Improvement Program, Gympie, 15 April 2002, 20 people.
  - 'Innovations Night', a workshop which included new developments in plantation forestry, Hobart, 7 May 2002, 40 people.
  - Workshop on 'TREEPLAN progress and planning', Mt Gambier, Mr G Dutkowski and Dr L Apiolaza, 11-14 June 2002, 15 people.
- CRC-SPF ran a wide range of technology transfer activities for partners during 2001/02. There were 145 public presentations (including conference proceedings and abstracts in unrefereed publications), 45 conference and symposium presentations and 88 seminars. In addition the Centre ran 11 workshops, one short course and six field days. The Centre produced 127 refereed and unrefereed publications (including book chapters and theses), 40 confidential reports (24 in the CRC-SPF Technical Publications series), and 27 flash sheets ('Hot Off the Seed Bed', 'Beyond the Black Stump' and 'Pest Off').
- The CRC-SPF published 101 research papers in refereed journals, 93 unrefereed articles and 17 theses.
- In the last year there have been five articles in newspapers and industry news sheets, and four items in the electronic media (see Public Presentations).
- Documented visits to individual CRC-SPF partners and between nodes of the Centre (Hobart, Canberra, Brisbane, Gympie) totalled 659 person-days during 2001/02.

Goals

- Host an 'International Conference on Eucalypt Productivity: a synthesis of the environmental, physiological, genetic and silvicultural factors that affect eucalypt productivity', Eucprod 2002, in September 2002.
- Increase the personal contact between CRC-SPF scientific staff and the management and operational staff of the industrial partners to facilitate technology transfer. [Industrial partners identified this as the most effective means of technology transfer.]
- Continue to develop technology transfer packages (CRC-SPF technology presented in a readily usable form) as an important method of transferring outcomes of Centre research to industry.
- Continue to package generic technology arising from CRC-SPF research in a form that is most useful to other end-users of Centre technology (e.g. farmers, farm foresters, nurserymen, forestry consultants).

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-SPF 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 include an agreed protocol for the research. The company partners allocate staff time (in-kind contributions) to CRC-SPF research projects so effective interaction can occur. The Program Coordinating Committees of CRC-SPF 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, email 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.
   Technology Transfer Officer, Greg Dutkowski, liaises with industrial partners and researchers to develop a better understanding between these groups within CRC-SPF 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 CRC-SPF in 2001/02 is presented in Technology Transfer Activities (p73).

- Increased use and uptake of CRC-SPF research results by industry partners was facilitated by the development of the following technology transfer packages:
  - The completion of the first stage of a eucalypt seed orchard manual. The manual had been identified by industry as a high priority requirement. It provides background information and detailed work instructions on specific forest practices topics and activities, derived directly from CRC-SPF research. The package also includes two videos.
  - Systems are being developed to enable effective, low-cost monitoring of damage caused by mammal browsing to facilitate informed decisions about measures of control.
  - In the area of wood quality, forestry consultants have been engaged to summarise CRC-SPF research results. From this summary, draft work instructions will be developed with a number of CRC-SPF partners to create a plantation wood quality inventory as a pilot project.
  - The Centre has secured National Heritage Trust funding from Private Forests Tasmania to run professional development courses for farm forestry professionals. A training needs analysis has been carried out which will form the basis of professional development courses to be offered in Tasmania and to interested partners in other states.
  - Scientists from CRC-SPF have worked closely with the STBA on the generation of breeding values for *Pinus radiata* and *E. globulus* using the TREEPLAN software (developed by the STBA and AGBU in consultation with CRC-SPF). A number of workshops were held to identify strategies to deal with the large number of traits measured and to provide preliminary analyses to enable standardisation of the data. As a result of these workshops, using the race classification for *E. globulus* developed by the Centre, the first breeding values are now available to STBA members.
  - A comparative analysis of the nutrition management systems of CRC-SPF partners is being undertaken to identify how the research outcomes can be integrated into these systems.

- As well as the specific major projects, a technology transfer plan has been developed for each research project. The plans are stored in an on-line database that allows easy monitoring and updating, and provides information for an on-line calendar of events. The technology transfer team supports

scientists in executing their technology transfer activities by helping with the organisation of events, the design of information resources, and providing funds for travel.

- This year has seen the development of clusters of short seminars on a common theme replacing dispersed single-issue seminars. Dubbed 'fests', the seminars have been held in the areas of genetics, seed production, wood quality and nutrition (GenFest, SeedFest etc.). Presented in this way, the seminars have helped to attract people who would not normally attend a single seminar.

- The technology transfer team has also worked at making existing research information more easily available. As well as the on-line publications database, there are many more full-text documents available, an interactive calendar of events has been developed, and the newsletter now includes extensive links to the on-line resources (see Fig. 16 for partner usage. Videos of events are available on CD for easy distribution and viewing.

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

- Examples of technical training courses run by the CRC-SPF for company staff in 2001/02 include a series of one-day workshops ('fests') in which the outcomes of research in particular discipline areas are discussed with industry partners. These included 'Genfest' (Hobart), two 'Seedfests' (Hobart and Melbourne), and 'Woodfest' (Gympie).

- Technology transfer also occurs through training provided by CRC-SPF to its postgraduates. Recent PhD graduates transfer new technology to their employers. There are currently 13 company staff enrolled in PhD and MSc courses while still employed: Tim Wardlaw (Forest Pathologist, Forestry Tasmania); Peter Kube (Tree Breeder, Forestry Tasmania); Peter Volker (Consultant, Serve-Ag/Total Sylvan Enterprises); Ross Peacock (Research Scientist, Dept. Planning, NSW); Craig Hawkins (Forester, Gunns Limited); Mark Neyland (Research Officer, Forestry Tasmania); Daryl Mummery (Experimental Officer, CSIRO FFP); Andrew Gibbons (Technical Officer, CSIRO FFP); Gustavo Lopez (Forester, INTA, Argentina); Patricio Rojas (Forester, Chile); Greg Unwin (Lecturer in Farm Forestry, UT); Paul Adams (Forest Nutritionist, Forestry Tasmania) and Greg Dutkowski (Technology Transfer Officer, CRC-SPF). A further 14 students are conducting research on scholarships supported by industry (see Tables 3 and 4 - APA-I, SPIRT/ARC, CSIRO, CRC Industry partners, LWRDC, FWPRDC, SFNSW, Bioforests).

- The success of our students in obtaining employment was demonstrated by appointments this year: Dr K Barry (Postdoctoral Fellow, UT), Dr D Close (Postdoctoral Fellow UT), Dr D Williams (Postdoctoral Fellow UT), Ms E Pietrzykowski (Technician, CRC-SPF), Mr A Gibbons (Research Officer, Australian National Museum, NT),

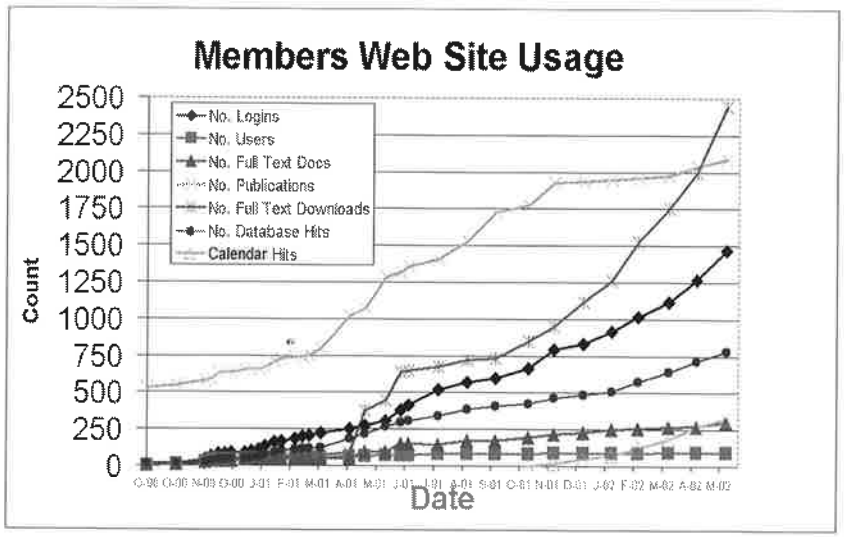


Figure 16: Partner use of the CRC website from October 2000 to May 2002.

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

- Screening of the self-incompatibility level in partner *E. globulus* breeding and deployment populations is increasing following demonstration of the important effect this factor has on outcrossing rates.

- Following results from a CRC-SPF PhD study, partners are now investigating co-application of nitrogen fertiliser to increase the effect of paclobutrazol in enhancing flowering in both *E. globulus* and *E. nitens* seed orchards.

- The demonstration of hybridisation between exotic *E. nitens* plantations and native forest species has resulted in increasing assessment of the risk of such gene flow in environmental impact assessments by partners and government agencies (Forest practices).

- Breeding values for basic density, pulp yield, fibre length, micro-fibre angle and cellulose content of trees in Gunns Limited *E. globulus* base population has been transferred to this industrial partner for breeding purposes.

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

- This year has seen further development in the design of TREEPLAN® and STBA-DMS® breeding value prediction and data management systems. These constitute major innovations at the industry level.

- CRC-SPF has provided specialist support to the STBA in the estimation of genetic parameters for *E. globulus* and *P. radiata*, to be used in the national genetic evaluations of both species.

- A web site has been established to allow rapid diffusion of CRC-SPF experience in the use of complex ASREML models used for genetic evaluation in forest trees. This web site has been accessed by users worldwide.

- Molecular studies have resulted in the adoption of new practices in mass supplementary pollination schemes being developed by CRC-SPF partners (e.g. *seedEnergy*) for *E. globulus* that lower the levels of contamination and increase seed set.

- Increasing use of DNA fingerprinting for quality control in tropical pine breeding and deployment using microsatellites, particularly for F_1 hybrid verification and clonal fidelity.

Sustainable Management Program

- Forestry Tasmania is implementing a major N fertilisation program across their eucalypt plantation estate.

- Adoption of the LAI Visual Guide for estimating canopy size has commenced.

- Recommendations on the use of N fertilisers in second rotation Hoop pine plantations are currently being developed and adopted by QDPI Forestry that will lead to significant improvement in their productivity and profitability.

- New seedling specifications that were developed with Timbercorp have been tested in a range of planting environments.

- Private Forests Tasmania has widely distributed the Farm Forestry Toolbox that includes a decision support tool based on PROMOD.

- Training in the use of PROMOD has been requested by several industry partners and is being used to aid site selection.

- The dynamic site productivity model CABALA is being used to predict stand responses to levels of available water in the second rotation, to fertiliser application, and to climatic and disease risks associated with plantation establishment.

- STEPS software has been used to carry out a large review of silvicultural practices by QDPI Forestry.

- Statistical and modelling advice had been provided to various CRC-SPF partners.

Resource Protection Program

- As a result of FT/CRC-SPF trials with Mimic (registered trade mark), Dow AgroSciences has applied for registration for its use for managing Autumn gum moth on *Eucalyptus* crops in all states. It has just been approved and is now registered for use.

- Based on FT/CRC-SPF trials with Success (registered trade mark), Dow AgroSciences will also be applying for its use for managing Chrysomelid leaf beetles in *Eucalyptus* plantations in all states. We expect to have a Tasmania-wide permit for its use this summer and registration should be approved by summer 2003.

- A Tasmanian state-wide permit for use of Novodor (registered trade mark), the biological insecticide based on Bt, is also expected to be approved by summer 2002 for managing Chrysomelid leaf beetles in *Eucalyptus* plantations, based on FT/CRC-SPF trials.

- The insect pest surveillance and monitoring manual produced for the Western Australian Blue Gum Industry Pest Management Group is being employed to improve current surveillance techniques and efficacy of insecticide applications.

- Western Australian eucalypt plantation companies are successfully employing monitoring techniques and economic thresholds for various insect pests as recommended in field manuals produced for the industry.

- Mesh sleeve technology used to protect seedlings from the plantation establishment pest, African black beetle (reported as a major development in last year's Annual Report) is now being adopted by industry.

- The population assessment and pest control management decision scheme for eucalypt weevil, the major insect pest in WA, developed by the CRC-SPF will be used by Timbercorp starting next spring (2002).

- Based on joint field trials between the CRC-SPF and GRP, showing the effectiveness of large diameter 'half-half' seedlings for reducing browsing damage by rabbits, industry is exploring the possibility of producing seedlings with these characteristics as container stock.

Hugh Fitzgerald and Stephen Paterson erecting shadecloth shelters to prevent mammalian browsing of a Radiata pine plantation at Blue Gum Knob, in the Plenty Valley, on the Norske Skog plantation estate.

Staffing and Administration

Membership

During the year the following changes to CRC-SPF membership arrangements occurred:

- The Board approved two requests from Gunns Limited: (a) to be granted core membership through acquisition of North Forest Products, and (b) to have its supporting membership extinguished.
- Receivers were appointed to Australian Plantation Timber Limited. APT's membership was subsequently terminated for non-payment of contributions. The CRC is listed as a creditor for the unpaid 2001/02 membership contribution.
- Australian Paper Plantations came under new ownership and changed its name to Grand Ridge Plantations Pty Ltd.
- *seedEnergy* Pty Ltd, a spin-off company from the Southern Tree Breeding Association, became an Associate member.
- The Board approved a downgrading of Private Forests Tasmania's membership from Supporting to Associate in 2001/02 for financial reasons with a review at the commencement of 2002/03.

Staff

All research staff of the CRC are listed in attachment B to the budget tables under their member organisations.

Staff movements

Professor Rod Griffin took up duty as Director in January 2002 to replace Professor Jim Reid. Rod has 34 years experience in the government and private sectors in forest research and research management and was most recently employed at Shell Forestry in the UK. Tony O'Grady was appointed as Tree Root Physiologist in Sustainable Management and commenced in Hobart in May 2002. Ian Andrew was appointed as a part-time Biometrician by QFRI to work in Queensland in the Sustainable Management program. Frieda Henskens started as a part-time Junior Research Fellow in Sustainable Management on October 2001 in Hobart. Yongjun Li was appointed as a Quantitative Geneticist and he takes up work in Hobart in July 2002 in the Genetic Improvement Program.

Elizabeth Vinall was appointed a Technician in Site Productivity in November 2001 and Jillian Butterworth commenced work in Hobart in May 2002 as Technology Transfer Assistant.

Postgraduate students

The following CRC-SPF students completed their PhD degrees in 2001/02:

Carolyn Raymond, Andrew Hingston, Sven Ladiges, Kirsten le Mar, Gustavo Lopez, Nicole Mathers, Yetti Setiawatti.

The following CRC students completed their Honours degrees:

Fiona Poke, Rebecca Pryor, Sally Ward, Natasha Wiggins.

The following students commenced postgraduate research with the CRC in 2001/02:

Joanne Burton – PhD - Griffith University
Sharon Koh – PhD – University of Tasmania
Fiona Poke – PhD – University of Tasmania
Anna Hopkins – PhD - University of Tasmania
Natasha Wiggins – PhD - University of Tasmania
Rachel Lawrence – PhD – Australian National University
Rebecca Pryor – MSc - University of Tasmania
Danielle Wiseman – PhD - University of Tasmania
Anna Smith – PhD - University of Tasmania
Prue Loney – PhD - University of Tasmania

Administration

The number of meetings held by the Board and other committees during 2001/02 were as follows:

Board of Management	3
Management Committee	9
Advisory Panel	1
Program Coordinating Committees	
Genetic Improvement	2
Sustainable Management	2
Resource Protection	2

SPECIFIED PERSONNEL

Title, Name and Role	Contributing Organisation	% time in CRC
Prof Rod Griffin, Director	University of Tasmania	80
Dr Russell Haines, Deputy Director	Department of Primary Industries Queensland	40
Dr David de Little, Chair, Advisory Panel	Gunns Limited	48
Program Managers		
Dr Chris Beadle, Sustainable Management	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	University of Tasmania	100
Education & Technology Transfer		

Publications

Genetic Improvement Program

Books and book chapters

Auckland LD, Bui T, Zhou Y, Shepherd M, Williams CG (2002). Transpecific recovery of pine microsatellite. In 'Conifer Microsatellite Handbook'. (Eds CG Williams and LD Auckland) pp. 27-28. (Texas A & M University: College Station, Texas, USA)

Refereed publications

Costa e Silva J, Dutkowski GW, Gilmour AR (2001). Analysis of early tree height in forest genetic trials is enhanced by including a spatially correlated residual. *Canadian Journal of Forest Research* **31,** 1887-1893.

Dungey HS, Potts BM (2002). Susceptibility of some *Eucalyptus* species and their hybrids to possum damage. *Australian Forestry* **65,** 16-23.

Freeman JS, Jackson HD, Steane DA, McKinnon GE, Dutkowski GW, Potts BM, Vaillancourt RE (2001). Chloroplast DNA phylogeography of *Eucalyptus globulus*. *Australian Journal of Botany* **49,** 585-589.

Glaubitz JC, Emebiri L, Moran GF (2002). Dinucleotide microsatellites in *Eucalyptus sieberi*: Inheritance, diversity and improved scoring of single base differences. *Genome* **44,** 1041-1045.

Jones ME, Stokoe RL, Cross MJ, Scott LJ, Maguire TL, Shepherd M (2001). Isolation of microsatellite loci from Spotted Gum (*Corymbia variegata*) and cross-species amplification in *Corymbia* and *Eucalyptus*. *Molecular Ecology Notes* **1,** 276-278.

Jones RC, Steane DA, Potts BM, Vaillancourt RE (2002). Microsatellite and morphological analysis of *Eucalyptus globulus* populations. *Canadian Journal of Forest Research* **32,** 59-66.

Jordan GJ, Potts BM, Clarke AR (2002). Susceptibility of *Eucalyptus globulus* ssp. *globulus* to sawfly (*Perga affinis* ssp. *insularis*) attack and its potential impact on plantation productivity. *Forest Ecology and Management* **160,** 189-199.

Kube PD, Raymond CA, Banham PW (2001). Genetic parameters for diameter, basic density, fibre properties and cellulose content for *Eucalyptus nitens*. *Forest Genetics* **8,** 285-294.

Kube PD, Raymond CA (2002). Prediction of whole tree basic density and pulp yield using wood core samples in *Eucalyptus nitens*. *Appita Journal* **55,** 43-48.

McGowen MH, Wiltshire RJ, Potts BM, Vaillancourt RE (2001). The origin of *Eucalyptus vernicosa*, a unique shrub eucalypt. *Biological Journal of the Linnean Society* **74,** 397-405.

McKinnon GE, Vaillancourt RE, Tilyard PA, Potts BM (2001). Maternal inheritance of the chloroplast genome in *Eucalyptus globulus* and interspecific hybrids. *Genome* **44,** 831-835.

Patterson B, Vaillancourt RE, Potts BM (2001). Eucalypt seed collectors: beware of sampling seedlots from low in the canopy! *Australian Forestry* **64,** 139-142.

Potts BM, Potts WC, Kantvilas G (2001). The Miena cider gum, *Eucalyptus gunnii* subsp. *divaricata* (Myrtaceae): a taxon in rapid decline. *Proceedings of the Royal Society of Tasmania* **135,** 57-61.

Pound LM, Wallwork MAB, Potts BM, Sedgley M (2002). Self-incompatibility in *Eucalyptus globulus* ssp. *globulus* (Myrtaceae). *Australian Journal of Botany* **50,** 365-372.

Pound LM, Wallwork MAB, Potts BM, Sedgley M (2002). Early ovule development following self- and cross-pollinations in *Eucalyptus globulus* Labill. ssp. *globulus*. *Annals of Botany* **89,** 613-620.

Raymond CA, Schimleck LR, Muneri A, Michell AJ (2001). Genetic parameters and genotype by environment interactions for pulp yield predicted using near infrared reflectance analysis and pulp productivity in *Eucalyptus globulus*. *Forest Genetics* **8,** 213-224.

Raymond CA, Schimleck LR (2002). Development of near infrared reflectance analysis calibrations for estimating genetic parameters for cellulose content in *Eucalyptus globulus*. *Canadian Journal of Forest Research* **32,** 170-176.

Raymond CA, Bradley AD (2002). Assessment of wood colour in *Eucalyptus nitens*. *Appita Journal* **55,** 118-122.

Shepherd M, Cross MJ, Maguire TL, Dieters MJ, Williams GC, Henry RJ (2002). Transpecific microsatellites for hard pines. *Theoretical and Applied Genetics* **104,** 819-827.

Steane DA, Vaillancourt RE, Russell J, Powell W, Marshall D, Potts BM (2001). Development and

characterisation of microsatellite loci in *Eucalyptus globulus* (Myrtaceae). *Silvae Genetica* **50,** 89-91.

Steane DA, Nicolle D, McKinnon GE, Vaillancourt RE, Potts BM (2002). Higher-level relationships among the eucalypts are resolved by ITS-sequence data. *Australian Systematic Botany* **15,** 49-62.

Stokoe RL, Shepherd M, Lee D, Nikles G, Henry RJ (2001). Natural inter-subgeneric hybridisation between *Eucalyptus acmenoides* Schauer and *Eucalyptus cloeziana* F. Muell (Myrtaceae) in southeast Queensland. *Annals of Botany* **88,** 563-570.

Thamarus KA, Groom K, Murrell JC, Byrne M, Moran GF (2002). A genetic linkage map for *Eucalyptus globulus* with candidate loci for wood, fibre, and floral traits. *Theoretical and Applied Genetics* **104,** 379-387.

In press

Alzamora RM, Apiolaza LA, Ide S (2002). Evaluación física y económica de pérdidas en volumen debido al daño de *Rhyacionia buoliana* (Shiff.) en plantaciones de *Pinus radiata* D. Don en la IX y X regiones de Chile. *Bosque* **23**.

Barbour RC, Potts BM, Vaillancourt RE, Tibbits WN, Wiltshire RJ (2002). Gene flow between introduced and native *Eucalyptus* species. *New Forests*.

Burczyk J, Adams WT, Moran GF, Griffin AR (2002). Complex patterns of mating revealed in a *Eucalyptus regnans* seed orchard. *Molecular Ecology*.

Dutkowski GW, Costa e Silva J, Gilmour AR, Lopez GA (2002). Spatial analysis methods for forest genetic trials. *Canadian Journal of Forest Research*.

Johnston AJ, Dieters MJ, Dungey HS, Nikles DG (2002). Intraspecific hybridisation in *Pinus caribaea* var. *hondurensis* II. Genetic parameters. *Euphytica*.

Johnston AJ, Dieters MJ, Dungey HS, Wallace HM (2002). Intraspecific hybridisation in *Pinus caribaea* var. *hondurensis* I. Performance and heterosis. *Euphytica*.

Jones TH, Potts BM, Vaillancourt RE, Davies NW (2002). Genetic resistance of *Eucalyptus globulus* to Autumn Gum Moth defoliation and the role of foliar waxes. *Canadian Journal of Forest Research*.

Lawrence R, Potts BM, Whitham, TG (2002). Relative importance of plant ontogeny, host genetic variation, and leaf age for a common herbivore. *Ecology*.

Moran GF, Thamarus KA, Raymond CA, Deyou Q, Uren T, Southerton SG (2002). Genomics of *Eucalyptus* wood traits. *Annals of Forest Science*.

Raymond CA (2002). Genetics of *Eucalyptus* wood properties. *Annals of Forest Science*.

Scott LJ, Shepherd M, Henry RJ (2002). Characterisation of highly conserved microsatellite loci in *Araucaria cunninghamii* and related species. *Plant Systemics and Evolution*.

Shepherd M, Cross MJ, Dieters MJ, Henry RJ (2002). Branch architecture QTL for *Pinus elliottii* var. *elliottii* X *P. caribaea* var. *hondurensis* hybrids. *Annals of Forest Science*.

Stokoe RL, McKinnon GE, Shepherd M, Lee D, Nikles DG, Henry RJ (2002). Chloroplast diversity within *Eucalyptus cloeziana* and eastern *Monocalyptus* species (Myrtaceae). *Australian Journal of Botany*.

Tibbits WN, Hodge GR (2002). Utilising genetic variation for cold hardiness in *Eucalyptus nitens*. *Silvae Genetica*.

Unrefereed publications

Apiolaza LA, Greaves BL (2001). Why are most breeders not using economic breeding objectives? In 'Developing the Eucalypt of the Future'. 10-15 September, Valdivia, Chile. p. 75. (Instituto Forestal: Chile)

Apiolaza LA, Potts BM, Gore PL (2001). Genetic control of peak flowering time of *Eucalyptus globulus*. In 'Developing the Eucalypt of the Future'. 10-15 September, Valdivia, Chile. p. 155. (Instituto Forestal: Chile)

Dieters MJ, Zheng Y (2001). Variation among natural and domesticated populations of *Pinus caribaea* var. *bahamensis* when grown in Queensland and south China. In '26th Biennial Southern Forest Tree Improvement Conference'. 26-29 June, Athens, Georgia, USA. pp. 63-73. (National Information Service: Springfield, Virginia, USA)

Dutkowski GW, Raymond CA (2001). A decision support tool for expensive to measure traits in progeny

trials. In 'Developing the Eucalypt of the Future'. 10-15 September, Valdivia, Chile. p. 72. (Instituto Forestal: Chile)

Dutkowski GW, Gilmour AR (2001). Modification of the additive relationship matrix for open pollinated trials. In 'Developing the Eucalypt of the Future'. 10-15 September, Valdivia, Chile. p. 71. (Instituto Forestal: Chile)

Dutkowski GW, Potts BM, Williams DR, Kube PD, McArthur C (2001). Geographic genetic variation in Central Victorian *Eucalyptus nitens*. In 'Developing the Eucalypt of the Future'. 10-15 September, Valdivia, Chile. p. 39. (Instituto Forestal: Chile)

Dutkowski GW, Costa e Silva J, Gilmour AR (2001). Spatial analysis of forest genetic trials. In 'Developing the Eucalypt of the Future'. 10-15 September, Valdivia, Chile. p. 141. (Instituto Forestal: Chile)

Gelid P, Rodriguez Traverso JM, Lopez GA, Souza R, Pathauer P (2001). Evaluacion clonal de *E. globulus* en la provincia de Buenos Aires, Argentina (Clonal evaluation of *E. globulus* in the Buenos Aires province of Argentina). In 'Developing the Eucalypt of the Future'. 10-15 September, Valdivia, Chile. p. 170. (Instituto Forestal: Chile)

Grosser C, Vaillancourt RE, Potts BM, O'Sullivan H (2001). Paternity analysis in a *Eucalyptus nitens* clonal seed orchard. In 'Developing the Eucalypt of the Future'. 10-15 September, Valdivia, Chile. p. 133. (Instituto Forestal: Chile)

Harding KJ, Copley TR, Smout JJ, Catchpoole KJ (2001). QFRI exotic and hoop pine wood quality research. In '27th Forest Products Conference'. 12-13 November, Melbourne, Victoria.

Jones ME, Shepherd M, Henry R, Bruskin S, Delves A (2001). Intraspecific chloroplast DNA variation and population structure in *Eucalyptus grandis* Hill ex Maiden. In 'Tree Biotechnology: The Next Millennium'. Ed. S Strauss. 22-27 July, Stevenson, Washington USA. (Oregon State University: Corvallis, Oregon)

Jones RC, Steane DA, Vaillancourt RE, Potts BM (2001). Molecular affinities of the Jeeralang population of *Euclyptus globulus*. In 'Developing the Eucalypt of the Future'. 10-15 September, Valdivia, Chile. p. 173. (Instituto Forestal: Chile)

Jones TH, Potts BM, Vaillancourt RE, Davies NW (2001). Using F2 families to search for genetic based pest resistance in *Eucalyptus globulus*. In 'Developing the Eucalypt of the Future'. 10-15 September, Valdivia, Chile. p. 81. (Instituto Forestal: Chile)

Kube PD, Raymond CA, Banham PW (2001). Breeding *Eucalyptus nitens* to improve wood quality and profitability. In 'Developing the Eucalypt of the Future'. 10-15 September, Valdivia, Chile. p. 99. (Instituto Forestal: Chile)

Lopez GA, Potts BM, Rodriguez Traverso JM, Gelid P (2001). The performance of *Eucalyptus maidenii* provences in Argentina. In 'Developing the Eucalypt of the Future'. 10-15 September, Valdivia, Chile. p. 40. (Instituto Forestal: Chile)

Lopez GA, Potts BM, Dutkowski GW, Rodriguez Traverso JM, Gelid P (2001). Quantitative genetic affinities of land races and native stand localities of *Eucalyptus globulus*. In 'Developing the Eucalypt of the Future'. 10-15 September, Valdivia, Chile. p. 144. (Instituto Forestal: Chile)

Lopez GA, Apiolaza LA, Potts BM, Dutkowski GW, Gelid P, Rodriguez Traverso JM (2001). Genetic parameters for growth and pilodyn from *Eucalyptus globulus* in Argentina. In 'Developing the Eucalypt of the Future'. 10-15 September, Valdivia, Chile. p. 143. (Instituto Forestal: Chile)

McGowen MH, Wiltshire RJ, Potts BM, Vaillancourt RE, Jordan GJ, Jackson WD (2001). The origin of the unique shrub eucalypt, *Eucalyptus vernicosa*. In 'Proceedings of the Joint Conference of the Australasian Evolution Society and the Society of Australian Systematic Biologists'. 16-18 July, Melbourne, Victoria.

McKinnon GE, Freeman JS, Whittock SP, Steane DA, Potts BM, Vaillancourt RE (2001). Tasmanian eucalypts: chloroplast phylogeography and glacial refugia. In 'Proceedings of the Joint Conference of the Australasian Evolution Society and the Society of Australian Systematic Biologists'. 16-18 July, Melbourne, Victoria.

McRae TA, Pilbeam DJ, Gore PL, Dutkowski GW, Apiolaza LA (2001). Australian cooperative tree improvement strategy for *Eucalyptus globulus*. In 'Developing the Eucalypt of the Future'. 10-15 September, Valdivia, Chile. p. 179. (Instituto Forestal: Chile)

Patterson B, Potts BM, Vaillancourt RE (2001). Variation in outcrossing rates within the canopy of *Eucalyptus globulus*. In 'Developing the Eucalypt of the Future'. 10-15 September, Valdivia, Chile. p. 132. (Instituto Forestal: Chile)

Potts BM, Dungey HS (2001). Hybridisation of *Eucalyptus*: Key issues for breeders and geneticists. In 'Developing the Eucalypt of the Future'. 10-15 September, Valdivia, Chile. p. 15. (Instituto Forestal: Chile)

Rojas Vergara P, Ramirez de Arellano P, Contardo C, Balocchi C, Potts BM (2001). Desarrollo de una metodologia para la produccion de semilla hibrida intra e interespecifica en un huerto semillero clonal de *Eucalyptus globulus* (Development of a methodology of inter- and intra-specific hybrid seed production in a clonal seed orchard of *E. globulus*). In 'Developing the Eucalypt of the Future'. 10-15 September, Valdivia, Chile. p. 88. (Instituto Forestal: Chile)

Steane DA, Nicolle D, McKinnon GE, Vaillancourt RE, Potts BM (2001). ITS sequence data and the eucalypts: the big picture. In 'Proceedings of the Joint Conference of the Australasian Evolution Society and the Society of Australian Systematic Biologists'. 16-18 July, Melbourne, Victoria.

Stokoe RL, Shepherd M, Lee D, Nikles DG, Henry R (2001). Microsatellite and chloroplast diversity within *Eucalyptus cloeziana*. In 'Tree Biotechnology: The Next Millennium'. Ed. S Strauss. 22 July 2001- 27 July 2001, Stevenson, Washington USA. (Oregon State University: Corvallis, Oregon)

Watson MC, Williams DR, Potts BM, Krygsman M (2001). Seed quality and early seedling growth in *Eucalyptus globulus*. In 'Developing the Eucalypt of the Future'. 10-15 September, Valdivia, Chile. p. 162. (Instituto Forestal: Chile)

Whittock SP, Apiolaza LA, Potts BM (2001). Breeding for sustainability in *Eucalyptus globulus*. In 'Developing the Eucalypt of the Future'. 10-15 September, Valdivia, Chile. p. 177. (Instituto Forestal: Chile)

Williams DR, Potts BM, Smethurst PJ (2001). The effect of fertiliser and paclobutrazol on flowering in *Eucalyptus nitens*. In 'Developing the Eucalypt of the Future'. 10-15 September, Valdivia, Chile. p. 137. (Instituto Forestal: Chile)

Confidential reports

Apiolaza LA (2002). Evaluation of Manifold, Jenkin, Down and Ellis progeny trials: genetic parameters and thinning suggestion for the Kinglake seed orchard. (Timbercorp, Hobart, Tasmania)

Apiolaza LA, Raymond CA (2002). Genetic parameters and breeding values for growth and wood properties of *Eucalyptus globulus* at West Ridgley. Confidential Report 11 pp. (CRC-SPF, Hobart, Tasmania)

Barbour RC, Potts BM, Vaillancourt RE (2001). Establishment report for *Eucalyptus ovata* x *E. nitens* hybrid trials (CRC2000_1) at Arnolds Block, Lilydale, Tasmania. Technical Report No. 75. 29 pp. (CRC-SPF, Hobart, Tasmania)

Cross MJ, Shepherd M (2001). DNA Fingerprinting of putative ramets from QFRI ortet EH49 using microsatellite markers. Technical Report No. 65. 5 pp. (CRC-SPF, Lismore, NSW)

Cross MJ, Shepherd M (2002). Verifying parentage of a large PEE x PCH population for genetic mapping using microsatellite markers: Black Swamp Plantation. Technical Report No. 79. 6 pp. (CRC-SPF, Lismore, NSW)

Dutkowski GW (2001). Compilation of Partners' Seed Orchard Manuals. Technical Report No. 74. 130 pp. (CRC-SPF, Hobart, Tasmania)

Elliot F, Shepherd M (2002). *Pinus elliottii* var. *elliottii* X *P. caribaea* var. *hondurensis* hybrid verification by cpSSR markers. Technical Report No. 86. 13 pp. (CRC-SPF, Lismore, NSW)

Johnston AJ, Dieters MJ, Dungey HS, Nikles DG, Wallace HM (2001). Inter-provenance hybridisation in *Pinus caribaea* var. *hondurensis* – performance and genetic control on two sites in Queensland. Technical Report No. 73. 34 pp. (CRC-SPF, Gympie, Queensland)

Kerr RJ, Dieters MJ, Tier B (2002). XSIM – A simulation program for testing hybrid breeding strategies - Manual. Technical Report No. 85. 28 pp. (CRC-SPF, Gympie, Queensland)

Potts BM, Barbour RC, Hingston AB (2001). The risk of genetic pollution from farm forestry using eucalypt species and hybrids. Rural Industries Research and Development, Joint Venture Agroforestry Program Report 115 pp. (RIRDC, Canberra, ACT)

Potts BM, Dutkowski GW, Smethurst PJ, Vaillancourt RE (2001). Report on the ACACA (AFFA) funded 2001 Eucalypt Mission to China. Technical Report No. 63. 39 pp. (CRC-SPF, Hobart, Tasmania)

Raymond CA, Kube PD, Bradley AD, Savage L, Pinkard EA (2002). Evaluation of non-destructive methods of measuring growth stress in *Eucalyptus globulus*: relationships between strain, wood properties and stress. Technical Report No. 81. 31 pp. (CRC-SPF, Hobart, Tasmania)

Shepherd M, Cross MJ, Dieters MJ, Henry RJ (2001). Verifying interspecific hybrids between *Pinus elliottii* var. *elliottii* and *P. caribaea* var. *hondurensis* using microsatellite or chloroplast markers. Technical Report No. 67. 15 pp. (CRC-SPF, Lismore, NSW)

Shepherd M, Dieters MJ, Carson SD (2001). Proposal for the application of marker-aided selection for tropical hybrid pines in Queensland. Confidential Report 21 pp. (CRC-SPF, Lismore, NSW)

Shepherd M, Cross MJ, Dieters MJ, Henry RJ (2001). Identification of *Pinus* spp. microsatellites polymorphic in *Pinus elliottii* and *P. elliottii* X *P. caribaea* F1 Hybrids. Series II tests. Technical Report No. 64. 13 pp. (CRC-SPF, Lismore, NSW)

Shepherd M, Cross MJ, Dieters MJ, Henry RJ (2001). Paternity testing and DNA fingerprinting in hybrid pines using microsatellite markers. Technical Report No. 66. 15 pp. (CRC-SPF, Lismore, NSW)

Shepherd M, Dieters MJ, Carson S (2001). Proposal for large-scale QTL detection experiments in hybrid pines. Technical Report No. 70. 18 pp. (CRC-SPF, Lismore, NSW)

Williams DR (2001). *Eucalyptus globulus* fertiliser and paclobutrazol treatment trial: Establishment report. Confidential Report 25 pp. (CRC-SPF, Hobart, Tasmania)

Williams DR (2001). Growth and reproductive responses of young *Eucalyptus globulus* trees to pollarding and paclobutrazol treatment. Confidential Report 6 pp. (CRC-SPF, Hobart, Tasmania)

Theses

Hingston AB (2002) Pollination Ecology of *Eucalyptus globulus* Labill. subsp. *globulus* and *Eucalyptus nitens* (Deane & Maiden) Maiden (*Myrtaceae*). PhD, School of Geography and Environmental Studies, University of Tasmania, Hobart, Tasmania.

Johnston AJ (2001) Performance and genetics of provenance hybrids of *Pinus caribaea* var. *hondurensis* in Queensland. Masters, University of the Sunshine Coast, Maroochydore, Queensland.

Lopez GA (2002) Quantitative genetics and breeding of *Eucalyptus globulus*. PhD, School of Plant Science, University of Tasmania, Hobart, Tasmania.

Raymond CA (2001) Wood properties and genetic variation in temperate eucalypts. PhD, University of Tasmania, Hobart, Tasmania.

Setiawati Y (2001) Environmental and biological control of flowering in hoop pine (*Araucaria cunninghamii* Ait. Ex. D.Don). PhD, Department of Botany, University of Queensland, Brisbane, Queensland.

Stokoe RL (2001) Patterns of Genetic Diversity and Hybridisation of *Eucalyptus cloeziana* F. Muell (Myrtaceae). PhD, School of Environmental Science and Management, Southern Cross University, Lismore, New South Wales.

Volker P (2002) Quantitative genetics of *Eucalyptus globulus*, *E. nitens* and their F1 hybrid. PhD, School of Plant Science, University of Tasmania.

Sustainable Management Program

Books and book chapters

Cherry ML, Macfarlane C, Smethurst PJ, Beadle CL (2002). Visual Guide to Leaf Area Index of Eucalypt Plantations. 22 pp. (CRC-SPF, Hobart, Tasmania)

Race D, Reid R (Eds) (2001). Forestry extension: Assisting forest owner, farmer and stakeholder decision-making. Proceedings of IUFRO Extension Working Party (S6.06-03). 472 pp. (Lorne, Victoria.)

Smethurst PJ, Baillie CC, Cherry ML (2001). Nutritional effects on leaf area index and growth of a young *Eucalyptus nitens* plantation. In 'Plant Nutrition - Food Security and Sustainability of Agro-Ecosystems Through Basic and Applied Research'. (Ed. WJ Horst) pp. 928-929. (Kluwer Academic: Dordrecht, Holland)

Refereed publications

Battaglia M, Mummery DC, Smith A (2002). Economic analysis of site survey and productivity modelling for the selection of plantation areas. *Forest Ecology and Management* **162,** 185-195.

Catchpoole KJ, Nester MR (2002). Decision support software tools for pine plantations. *New Zealand Journal of Forestry* **2002,** 15-18.

Chen CR, Condron LM, Davis MR, Sherlock RR (2002). Phosphorus dynamics in the rhizosphere of perennial ryegrass and radiata pine. *Soil Biochemistry and Biology* **34,** 487-499.

Close DC, Beadle CL, Holz GK, Brown PH (2001). Effect of shadecloth treeshelters on cold-induced photoinhibition, foliar anthocyanin and growth of *Eucalyptus globulus* and *E. nitens* seedlings during establishment. *Australian Journal of Botany* **50,** 15-20.

Close DC, Beadle CL, Hovenden MJ (2001). Cold-induced photoinhibition and foliar pigment dynamics of *Eucalyptus nitens* during seedling establishment. *Australian Journal of Plant Physiology* **24,** 1133-1141.

Fulton A, Race D (2001) Farm forestry in Australia: Why do landholders get involved? In 'Developing Policies to Encourage Small-Scale Forestry'. Eds JL Herbohn, SR Harrison, KF Herbohn, and DB Smorfitt. 9-13 January 2000, Kuranda, Australia. 100-108.

Garnett TP, Shabala SN, Smethurst PJ, Newman IA (2001). Simultaneous measurement of ammonium, nitrate and proton fluxes along the length of eucalypt roots. *Plant and Soil* **236,** 55-62.

Guinto DF, House AP, Xu ZH, Saffigna PG (2001). Changes in soil chemical properties and forest floor nutrients under repeated prescribed burning in eucalypt forests of south-east Queensland. *New Zealand Journal of Forest Research* **31,** 170-187.

Henskens FL, Battaglia M, Cherry ML, Beadle CL (2001). Physiological basis of spacing effects on tree growth and form in *Eucalyptus globulus*. *Trees: Structure and Function* **15,** 365-377.

Hunt MA, Davidson NJ, Unwin GL, Close DC (2002). Ecophysiology of the soft tree fern, *Dicksonia antarctica* Labill. *Austral Ecology* **27,** 360-368.

Medhurst JL, Beadle CL (2001). Crown structure and leaf area index development in thinned and unthinned *Eucalyptus nitens* plantations. *Tree Physiology* **21,** 989-999.

Mendham DS, Smethurst PJ, Holz GK, Menary RC, Grove TS, Weston C, Baker T (2002). Soil analyses as indicators of P status in young *Eucalyptus nitens* and *E. globulus* plantations. *Soil Science Society of America Journal* **66,** 959-968.

Pinkard EA, Battaglia M (2001). Using hybrid models to develop silvicultural prescriptions for *Eucalyptus nitens*. *Forest Ecology and Management* **154,** 337-345.
Pinkard EA, Beadle CL (2002). Blackwood plantation silviculture: a review. *Australian Forestry* **65,** 7-13.

Pu GX, Saffigna PG, Xu ZH (2002). Denitrification, leaching and immobilisation of ^{15}N-labelled nitrate in winter under windrowed harvesting residues in 1 to 3-year-old hoop pine plantations of subtropical Australia. *Forest Ecology and Management* **152,** 183-194.

Race D, Buchy M, Fulton A (2001) A dynamic context: Farm forestry extension in Australia. In 'Forestry Extension: Assisting Forest Owner, Farmer, and Stakeholder Decision-Making'. Eds D Race and R Reid. 29 October - 2 November. 352-362. (IUFRO: Lorne, Victoria)

Race D (2001). Forestry Extension: Ideas for a learning and growing sector. *Australian Forest Grower* **24,** 1-6.
Race D (2001) Criteria for assessing regional farm forestry in Australia. In 'Developing Policies to Encourage Small-Scale Forestry'. Eds JL Herbohn, SR Harrison, KF Herbohn, and DB Smorfitt. 9-13 January 2000, Kuranda, Australia. 246-254.

Sands PJ, Landsberg J (2002). Parameterisation of 3-PG for plantation grown *Eucalyptus globulus*. *Forest Ecology and Management* **163,** 273-292.

Shen H, Xu ZH, Yan XL (2002). Effect of fertilisation on oxidizable C, microbial biomass C and mineralizable C under different agroecosystems. *Communications in Soil Science and Plant Analysis* **32,** 1575-1588.

Smethurst PJ, Lyons A, Churchill K (2001). Yellow pines signal potassium deficiency in reforested old pasture land in Tasmania. *Better Crops International* **15,** 11-13.

In press

Chen CR, Condron LM, Davis MR, Sherlock RR (2002). Seasonal changes in soil phosphorus and associated microbial properties under adjacent grassland and forest in New Zealand. *Forest Ecology and Management*.

Close DC, Davidson NJ (2002). Revegetation to combat tree decline in the Midlands of Tasmania and recommendations for best practice. *Ecological Management and Restoration*.

Close DC, Davidson NJ (2002). Survey of a revegetation trial in the Midlands of Tasmania. *Ecological Management and Restoration*.

Close DC, Davidson NJ (2002). Revegetation: a new research initiative in Tasmania. *Ecological Management and Restoration*.

Close DC, Wilson SJ (2002). Provenance effects on pregermination treatments for *Eucalyptus regnans* and *Eucalyptus delegatensis* seed. *Forest Ecology and Management*.

Gibbons AK, Battaglia M (2002). Thinning and plantation establishment affects understorey vegetation in high altitude *Eucalyptus delegatensis* forest of the Central Plateau. *Austral Ecology*.

Guinto DF, Xu ZH, House AP, Saffigna PG (2002). Influence of fuel reduction burning and fertilization on the growth and nutrient uptake of eucalypt seedlings. *Journal of Tropical Forest Science*.

Mao XA, Xu ZH, Luo RS, Mathers NJ, Zhang YH, Saffigna PG (2002). Nitrate in soil humic acids revealed by nitrogen-14 nuclear magnetic resonance spectroscopy. *Australian Journal of Soil Research* **40**.

Mathers NJ, Xu ZH, Blumfield TJ, Berners-Price SJ, Saffigna PG (2002). Composition and quality of harvest residues and soil organic matter under windrow residue management in young hoop pine plantations as revealed by solid-state 13C NMR spectrosopy. *Forest Ecology and Management*.

Mathers NJ, Xu ZH, Berners-Price SJ, Perera MC, Saffigna PG (2002). Hydrofluoric acid pre-treatment for improving 13C CPMAS NMR spectral quality of forest soils in south-east Queensland, Australia. *Australian Journal of Soil Research* **40**.

Medhurst JL, Battaglia M, Beadle CL (2002). Measured and predicted changes in water use of *Eucalyptus nitens* plantations following high-intensity thinning. *Tree Physiology*.

Medhurst JL, Beadle CL (2002). Sapwood hydraulic conductivity and leaf area - sapwood area relationships following thinning of a *Eucaluptus nitens* plantation. *Plant Cell and Environment*.

Moroni MT, Worledge D, Beadle CL (2002). Root distribution of *Eucalyptus nitens* and *E. globulus* in irrigated and droughted soil. *Forest Ecology and Management*.

Mummery DC, Battaglia M (2002). Data input quality and resolution effects on regional and local scale *Eucalyptus globulus* productivity predictions in north-east Tasmania. *Ecological Modelling*.

Paul KI, Polglase PJ, O'Connell AM, Carlyle JC, Smethurst PJ, Khanna PK (2002). Soil nitrogen availability predictor (SNAP): A simple model for predicting mineralisation of nitrogen in forest soils. *Australian Journal of Soil Research*.

Prasolova NV, Xu ZH, Lundkvist K, Farquhar GD, Dieters MJ, Walker SM, Saffigna PG (2002). Genetic variation in foliar carbon isotope composition in relation to tree growth and foliar nitrogen concentration in clones of the F1 hybrid between Slash Pine and Caribbean Pine. *Forest Ecology and Management*.

Pu GX, Xu ZH, Saffigna PG (2002). Fate of 15N-labelled nitrate in a wet summer under different residue management regimes in young Hoop Pine plantations. *Forest Ecology and Management*.

Smethurst PJ, Baillie CC, Cherry ML, Holz GK (2002). Fertilizer effects on LAI and growth of four *Eucalyptus nitens* plantations. *Forest Ecology and Management*.

Xu ZH, Bubb KA, Simpson JA (2002). Improved nitrogen nutrition and growth of *Araucaria cunninghamii* plantation from application of nitrogen fertilizer and weed control to 4-year-old stands in subtropical Australia. *Journal of Tropical Forest Science*.

Unrefereed publications

Battaglia M, White DA, Mummery DC, McGrath J (2002). Modelling drought risk in *Eucalyptus globulus* plantations in a Mediterranean climate. In 'Proceedings

of IUFRO Workshop on Reality, Models and Parameter Estimation - a Forestry Scenario'. June 2002. (IUFRO: Sesimbra, Portugal)

Blumfield TJ, Xu ZH, Saffigna PG (2001). Windrowed tree residues: soil C and N dynamics in Hoop Pine plantations of sub-tropical Australia. In 'Soil Science Society of America Annual Meeting'. 31 September - 4 October, Salt Lake City, Utah, USA.

Close DC (2002) New light on frost damage. *Onwood* **36** p. 2.

Davidson NJ, Gibbons AK (2001) Gordon River riparian vegetation assessment update to the Integrated Impact Assessment Statement. Basslink Integrated Impact Assessment Statement: Supplementary report for the JAP hearings.15 pp. (Hydro Tasmania, Hobart, Tasmania)

Mathers NJ, Xu ZH, Berners-Price SJ (2001). Carbon-13 NMR spectral improvement of HF-treated forest soils in relation to soil chemical and biological properties. In 'Soil Science Society of America Annual Meeting'. 21-25 October, Charlotte, North Carolina, USA.

Mathers NJ, Xu ZH, Boyd SE (2002). Solid-state 13C-NMR investigation of plant residues and soil organic matter in hoop pine plantations of subtropical Australia. In 'ANZMAG 2002'. 17-21 February, Lake Taupo, NZ. p. 101. (Australian and New Zealand Society for Magnetic Resonance: Taupo, New Zealand)

Simpson JA, Xu ZH, Smith T, Keay P, Osborne DO, Podberscek M (2001). Impacts of inter-rotation site management on tree growth and soil properties in the first 5 years of a hybrid pine plantation in subtropical Australia. In '3rd Workshop on Site Management and Productivity in Tropical Plantation Forests'. Eds EKS Nambiar, A Tiark, C Cossalter, and J Ranger. p. 15. (Center for International Forestry Research: Bogor, Indonesia)

Smethurst PJ (2002) Fertilizer management issues for farm forestry. *Australian Forest Grower*.

Confidential reports

Baillie CC, Smethurst PJ (2002). Climate in the Florentine Valley. Technical Report No. 72. 31 pp. (CRC-SPF, Hobart, Tasmania)

Catchpoole KJ, Nester MR (2001). Description of system framework for the silvicultural decision support system in Queensland Forestry. Technical Report No. 78. 18 pp. (CRC-SPF, Gympie, Queensland)

Close DC, Davidson NJ (2001). A synthesis of rural tree decline and revegetation research, vegetation establishment and species selection survey, and description of future research. Technical Report No. 76. 49 pp. (CRC-SPF, Hobart, Tasmania)

Close DC (2002). A study tour of south-west Western Australia and the Armidale Tablelands: Tree decline, revegetation and farm forestry. Technical Report No. 87. (CRC-SPF, Hobart, Tasmania)

Davidson NJ, Gibbons AK (2001) Gordon River riparian vegetation assessment update to the Integrated Impact Assessment Statement. Basslink Integrated Impact Assessment Statement: Supplementary report for the JAP hearings.15 pp. (Hydro Tasmania, Hobart, Tasmania)

Jennings SM, van Putten I (2001). Modelling forest owner behaviour in north-west Tasmania using a binary logit analysis. Technical Report No. 71. (CRC-SPF, Hobart, Tasmania)

Osborne R, Smethurst PJ (2001). Soil Fertility Assessment: Survey and Training Using a Quick-Test Meter. Technical Report No. 61. 67 pp. (CRC-SPF, Hobart, Tasmania)

Raymond CA, Kube PD, Bradley AD, Savage L, Pinkard EA (2002). Evaluation of non-destructive methods of measuring growth stress in *Eucalyptus globulus*: relationships between strain, wood properties and stress. Technical Report No. 81. 31 pp. (CRC-SPF, Hobart, Tasmania)

Saccardi D, Tabart T, Fulton A (2001). Communicating financial aspects of farm forestry. Technical Report No. 77. 36 pp. (CRC-SPF, Hobart, Tasmania)

Sands PJ (2002). A Guide to ProModXL - a Spreadsheet Interface to ProMod. CRC Technical Report No. 88. 26 pp. (CRC-SPF, Hobart, Tasmania)

White DA, Kinal J, Battaglia M, McGrath J, Krockenberger I (2002). Managing productivity and drought risk to blue gum plantations in Mediterranean south-western Australia. Final Report to Industry Partners (CRC-SPF, Hobart, Tasmania)

Theses

Mathers NJ (2002) Effective use of solid-state ^{13}C NMR spectroscopy for studying forest soil organic matter composition and quality. PhD, Griffith University, Nathan, Queensland.

Pryor R (2001) The waterlogging tolerance of *Acacia melanoxylon*. Honours, School of Plant Science, University of Tasmania, Hobart, Tasmania.

Resource Protection Program

Books and book chapters

Candy SG, Zalucki MP (2002). Defoliation. In 'Encyclopedia of Environmetrics'. (Ed. AH El Shaarawi) pp. 479-484. (John Wiley & Sons: Chichester, UK)

Refereed publications

Baker SC, Elek JA, Candy SG (2002). Comparison of feeding efficiency, development time and survival of Tasmanian eucalyptus leaf beetle larvae *Chrysophtharta bimaculata* (Olivier) (Coleoptera: Chrysomelidae) on two hosts. *Australian Journal of Entomology* **41,** 174-181.

Barry KM, Davies NW, Mohammed CL (2002). Effect of season and different fungi on phenolics in response to xylem wounding and inoculation in *Eucalyptus nitens*. *Forest Pathology* **32,** 163-178.

Beveridge N, Elek JA (2001). Insect and host tree species influence the effectiveness of a *Bacillus thuringiensis* subsp. *tenebrionis* based insecticide for controlling chrysomelid leaf beetles. *Australian Journal of Entomology* **40,** 386-390.

Candy SG, Baker SC (2002). Calculating food consumption in the laboratory; a formula to adjust for natural weight loss. *Australian Journal of Entomology* **41,** 174-181.

Davies JT, Allen GR, Williams MA (2001). Dispersal of *Acalitus essigi* to blackberry (*Rubus fructicosus* agg.) fruit. *Entomologia experimentalis et applicata* **101,** 19-23.

Eyles A, Mohammed CL, Lane P (2001). The hidden world of grass endophytes. *The Tasmanian Naturalist* **123,** 12-15.

Loch AD, Floyd RB (2001). Insect pests of Tasmanian Blue Gum, *Eucalyptus globulus globulus*, in south-western Australia: History, current perspectives and future prospects. *Austral Ecology* **26,** 458-466.

Matsuki M, Kay M, Serin J, Floyd RB, Scott JK (2001). Potential risk of accidental introduction of Asian Gypsy Moth (*Lymantria dispar*) to Australasia: effects of climatic conditions and suitability of native plants. *Agricultural and Forest Entomology* **3,** 305-320.

Nahrung HF, Dunstan PK, Allen GR (2001). Larval gregariousness and neonate establishment of the eucalypt-feeding beetle *Chrysophtharta agricola* (Chapuis) (Coleoptera: Chrysomelidae: Paropsini). *Oikos* **94,** 358-364.

O'Reilly-Wapstra JM, McArthur C, Potts BM (2002). Genetic variation in resistance of *Eucalyptus globulus* to marsupial browsers. *Oecologia* **130,** 289-296.

Scott SL, McArthur C, Potts BM, Joyce K (2002). Possum browsing - the downside to a eucalypt hybrid developed for frost tolerance in plantation forestry. *Forest Ecology and Management* **157,** 231-245.

Short MW, Schmidt S, Lukacs ZS (2002). Parasitisation rates of some parasitoids (Hymenoptera: Ichneumonidae) of the Autumn gum moth (Lepidoptera: Geometridae). *Australian Entomologist* **29,** 69-72.

Steinbauer MJ (2001). The ecology, research and management implications of insect-eucalypt interactions: symposium introduction. *Austral Ecology* **26,** 445-446.

Steinbauer MJ, McQuillan PB, Young CJ (2001). Life history and behavioural traits of *Mnesampela privata* that exacerbate population responses to eucalypt plantations: comparisons with Australian and outbreak species of forest geometrid from the northern-hemisphere. *Austral Ecology* **26,** 525-534.

Steinbauer MJ (Ed.) (2001). Thematic issue on insect-eucalypt interactions. *Austral Ecology* **26,** 445-570.

Steinbauer MJ, Malipatil MB, Taylor GS (2002). Book review: Schaefer CW, Panizzi AR (Eds) 2000 Heteroptera of Economic Importance. *Australian Journal of Entomology* **41,** 95-97.

Steinbauer MJ, Yonow T, Reid IA, Cant R (2002). Ecological biogeography of species of *Gelonus*, *Acantholybas* and *Amorbus* in Australia. *Austral Ecology* **27,** 1-25.

Steinbauer MJ, Wanjura WJ (2002). Christmas beetles (*Anoplognathus spp.*, Coleoptera: Scarabaeidae) mistake peppercorn trees for eucalypts. *Journal of Natural History* **36,** 119-125.

Thomson R, Nicotra AB, Steinbauer MJ (2001). The influence of previous frost damage on tree growth and insect herbivory of *Eucalyptus globulus* ssp. *globulus*. *Austral Ecology* **26,** 489-499.

Yee M (2002). Not just waste wood: decaying logs as key habitats in Tasmania's wet sclerophyll *Eucalyptus obliqua* production forests: the ecology of large and small logs compared. *Tasforests* **13,** 119-128.

Yuan ZQ, Mohammed CL (2002). *Ceratocystis moniliformopsis* sp nov., an early coloniser of *Eucalyptus obliqua* logs in Tasmania, Australia. *Australian Systematic Botany* **15,** 125-133.

In press

Barry KM, Davies NW, Mohammed CL, Beadle CL (2002). Post-harvest staining in blackwood (*Acacia melanoxylon* R. Br.). *Holzforschung*.

Close DC, McArthur C (2002). Rethinking the role of many phenolics - protection against photodamage not herbivores? *Oikos* **97**.

Davies JT, Allen GR, Williams MA (2002). Intraplant distribution of *Acalitus essigi* (Acari: Eriphyoidea) on blackberries (*Rubus fruticosus* agg.). *Experimental and Applied Acarology*.

Davies JT, Williams MA, Allen GR (2002). A new method for sampling eriophyoid mites from architecturally complex plant structures. *Journal of Economic Entomology*.

Davies NW, Barry KM (2002). Negative ion electrospray HPLC-MSn of hydrolyzable tannins. *Advances in Mass Spectrometry* **15**.

Eyles A, Mohammed CL (2002). Comparison of CEPA (2-chloroethyl phosphonic acid) induced responses in juvenile *Eucalyptus nitens*, *E. globulus* and *E. obliqua*: a histochemical and anatomical study. *International Association of Wood Anatomists Journal*.

Eyles A, Davies NW, Mohammed CL (2002). Identification of tannins, flavonoids and terpenes detected in the wound wood of *Eucalyptus globulus* and *E. nitens*. *Phytochemistry*.

McArthur C, Marsh NR, Close DC, Walsh A, Paterson S, Fitzgerald H, Davies NW (2002). Nursery conditions affect seedling chemistry, morphology and herbivore preferences for *Eucalyptus nitens*. *Forest Ecology and Management*.

Nahrung HF, Murphy BD (2002). Differences in egg parasitism of *Chrysophtharta agricola* (Chapuis) (Coleoptera: Chrysomelidae) by *Enoggera nassaui* (Girault) (Hymenoptera: Pteromalidae) in relation to host and parasitoid origin. *Australian Journal of Entomology* **41**.

Nahrung HF, Reid CA (2002). Reproductive development of the Tasmanian eucalypt-defoliating beetles *Chrysophtharta agricola* (Chapuis) and *C. bimaculata* (Olivier) (Coleoptera: Chrysomelidae: Paropsini). *The Coleopterists Bulletin* **55,** 84-95.

Sprent J, McArthur C (2002). Diet and diet selection of two species in the macropodid browser-grazer continuum - do they eat what they "should"? *Australian Journal of Zoology*.

Steinbauer MJ (2002). Oviposition preference and neonate performance of *Mnesampela privata* in relation to heterophylly in *Eucalyptus dunni* and *E. globulus*. *Agricultural and Forest Entomology*.

Unrefereed publications

Allen GR, Patel VS (2001). The spatial impact of endemic natural enemies on survival of the southern eucalypt beetle. In '32nd Australian Entomological Society Conference'. 23-28 September, Sydney, NSW.

Bashford R (2001). Invertebrate diversity on the Warra / Mt. Weld altitudinal transect in Southern Tasmania. In '32nd Australian Entomological Society Conference'. 23-28 September, Sydney, NSW.

Elek JA, Beveridge N, Ramsden NG (2001). *Bacillus thuringiensis* spray formulations have potential for environmentally friendly management of insect pests in eucalypt plantations. In '4th Pacific Rim Conference on the Biotechnology of *Bacillus thuringiensis* and its environmental impact'. 11-15 November, Canberra, ACT. p. 88.

Eyles A, Davies NW, Mohammed CL (2002). Traumatic oil glands induced by pruning in the wound-associated phloem of *Eucalyptus globulus*: chemistry and histology. In '7th International Mycological Congress'. 11-17 August, Oslo, Norway.

Matthiessen JN (2001). Challenges and alternatives in managing soil-dwelling scarab pests of plantation eucalypts. In '32nd Australian Entomological Society Conference'. 23-28 September, Sydney, NSW.

Nahrung HF, Matsuki M, Allen GR (2001). Mendel's peas, black beetles, and natural selection: a rare, dominent allele controls melanism in *Chrysophtharta agricola* (Chapuis). In '32nd Australian Entomological Society Conference'. 23-28 September, Sydney, NSW.

Nahrung HF (2001). Phenology of the southern eucalypt beetle *Chrysophtharta agricola* in Tasmania. In '32nd Australian Entomological Society Conference'. 23-28 September, Sydney, NSW.

O'Reilly J, McArthur C, Potts BM, Foley WJ (2001). Genetic variation in browsing resistance of *Eucalyptus globulus*: implications for resistance breeding. In 'Developing the Eucalypt of the Future'. 10-15 September, Valdivia, Chile. p. 152. (Instituto Forestal: Chile)

Rapley L, Allen GR, Potts BM (2001). Rapid screening of *Eucalyptus globulus* genotypes for increased Autumn Gum Moth, *Mnesampela privata*, resistance using a tent bioassay. In '32nd Australian Entomological Society Conference'. 23-28 September, Sydney, NSW.

Rapley L, Allen GR, Potts BM (2001). Identifying Autumn Gum Moth, *Mnesampela privata* behaviour associated with variation in defoliation of *Eucalyptus globulus*. In '32nd Australian Entomological Society Conference'. 23-28 September, Sydney, NSW.

Redgrove HL, Allen GR, Close DC (2001). Some like it soft, some like it hard: Palatability of *Eucalyptus nitens* seedlings to *Heteronyx* spp. In '32nd Australian Entomological Society Conference'. 23-28 September, Sydney, NSW.

Rice AD, Allen GR (2001). Reproductive biology of the parasitoid guild associated with larval *Chrysophtharta agricola* (Coleoptera: Chrysomelidae). In '32nd Australian Entomological Society Conference'. 23-28 September, Sydney, NSW.

Steinbauer MJ, Floyd RB (2001). Risk assessment for autumn gum moth. In 'Site Selection and Productivity Estimation: a CRC-SPF Workshop Technical Report No. 55'. pp. 19-22. (CRC-SPF: Hobart, Tasmania)

Steinbauer MJ, Schiestl FP (2001). Response to a hybrid eucalypt may be mediated by leaf waxes. In '11th International Symposium on Insect-Plant Relationships'. 4-10 August, Helsingor, Denmark.

Yee M, Mohammed CL (2001). Beetles and rot: implications for native forest management in Tasmania. In '32nd Australian Entomological Society Conference'. 23-28 September, Sydney, NSW.

Confidential reports

Barry KM, Hall M, Mohammed CL, Beadle CL (2001). The causes and treatment of post-harvest staining in Blackwood (*Acacia melanoxylon*) wood. Technical Report No. 68. 28 pp. (CRC-SPF, Hobart, Tasmania)

Bulinski J, Matsuki M (2002). Sampling systems for assessing Eucalyptus Weevil (*Gonipterus scutellatus*) density in eucalypt plantations. Technical Report No. 84. 14 pp. (CRC-SPF, Hobart, Tasmania)

McArthur C, Appleton R, Pye C (2002). Effect of seedling characteristics at planting on rabbit browsing in *Eucalyptus globulus* plantations. Technical Report No. 80. 10 pp. (CRC-SPF, Hobart, Tasmania)

Steinbauer MJ, Bellas TE, Schiestl FP, Lacey MJ, Östrand F (2001). Identification and activity of the sex pheromone of Autumn Gum Moth. Technical Report No. 69. 15 pp. (CRC-SPF, Canberra, ACT)

Theses

Wiggins NL (2001) Effects of Plant Secondary Metabolites on Feeding Behaviour in Brushtail Possums. Honours, Department of Zoology, University of Tasmania, Hobart, Tasmania.

Public Presentations

Presentations which also appear as conference proceedings or abstracts are cited in the Publications section of this Annual Report.

Genetic Improvement Program

Apiolaza LA (2001) Why aren't we using economic breeding objectives? Presentation at 'GenFest 2001: A Slice of Life' 10 October. Hobart, Tasmania.

Apiolaza LA (2001) New developments in quantitative genetics. Presentation at 'CRC-SPF Annual Meeting' 29-31 October. Caloundra, Queensland.

Barbour RC (2001) The potential for and risks of genetic pollution. Presentation at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

Davidson NJ (2001) Assessing the risk and management of genetic pollution. Presentation at 'RIRDC and JVAP workshop on 'Species diversity in farm forestry'' 13 August. Canberra, ACT.

Dieters MJ (2001) Hybrids vs pure species: when are hybrids an advantage? Presentation at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

Dieters MJ, Peters WR (2002) Incorporating wood quality assessments into series III clonal tests. Presentation at 'WoodFest' 15 April, for QFRI, DPI-Forestry. Gympie, Queensland.

Dutkowski GW, Costa e Silva J, Gilmour AR (2001) Spatial analysis of forest genetic trials. Presentation at 'GenFest 2001: A Slice of Life' 10 October. Hobart, Tasmania.

Dutkowski GW (2002) Converting breeding values for selection criteria traits to breeding objective traits and applying economic weights to calculate profit index. Workshop at 'TREEPLAN® Genetic Evaluation Workshop' 13 - 14 June, for STBA. Mount Gambier, South Australia.

Freeman JS, Whittock SP, McKinnon GE, Steane DA, Potts BM, Vaillancourt RE (2001) Fingerprinting applications of chloroplast DNA. Poster at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

Gore P (2002) Delivering higher levels of genetic gain to plantation forestry: A new hand pollinated seed production system. Presentation at 'CRC Science Supporting Innovation Research of Antarctic and Forestry CRCs' 7 May. Hobart, Tasmania.

Griffin R (2001) Generic research and development supporting the Eucalypt Breeding Programs in Shell Forestry companies in South America . Seminar at 'CRC-SPF Seminar Series' 6 July. Hobart, Tasmania.

Grosser C, Vaillancourt RE, Potts BM, O'Sullivan H (2001) Paternity analysis in a *Eucalyptus nitens* clonal seed orchard. Poster at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

Grosser C (2002) Paternity analysis in an *Eucalyptus nitens* seed orchard. Seminar at 'SeedFest' 8 February. Hobart, Tasmania.

Grosser C (2002) Paternity analysis in an *Eucalyptus nitens* seed orchard. Seminar at 'SeedFest' 11 February. Melbourne, Victoria.

Harding KJ, Copley TR (2002) Wood properties of series II clones and prospects for a 20-year rotation with F1 clones. Presentation at 'WoodFest' 15 April, for QFRI, DPI-Forestry. Gympie, Queensland.

Harding KJ, Copley TR (2002) Wood properties of the Slash x Caribbean Pine hybrid compared to its parental species. Presentation at 'WoodFest' 15 April, for QFRI, DPI-Forestry. Gympie, Queensland.

Hingston AB, McQuillan PB, Potts BM (2001) What animals are necessary for high seed production in eucalypt seed orchards? Poster at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

Hingston AB (2002) Pollination ecology of *Eucalyptus globulus* and *E. nitens*. Seminar 2 May, for Tasmanian Field Naturalists Association. Hobart, Tasmania.

Hingston AB (2002) Pollination ecology of *Eucalyptus globulus* and *E. nitens*. Seminar at 'SeedFest' 8 February. Hobart, Tasmania.

Hingston AB (2002) Pollination ecology of *Eucalyptus globulus* and *E. nitens*. Seminar at 'SeedFest' 11 February. Melbourne, Victoria.

Jones TH (2001) Genetic variation in resistance of *Eucalyptus globulus* to Autumn Gum Moth and its association with cuticular waxes and foliar oils. Presentation at 'GenFest 2001: A Slice of Life' 10 October. Hobart, Tasmania.

Kain D (2001) Early and indirect selection for wood properties in the *Pinus elliottii* x *P. caribaea* hybrid and parental species. Presentation at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

Kain D, Harding KJ, Dieters MJ, Li B (2002) Wood properties of the Slash x Caribbean Pine hybrid compared to its parental species. Presentation at 'WoodFest' 15 April, for QFRI, DPI-Forestry. Gympie, Queensland.

Kain D (2002) Breeding for wood properties in Slash x Caribbean Pine hybrid. Presentation at 'WoodFest' 15 April, for QFRI, DPI-Forestry. Gympie, Queensland.

King R, Hughes JM, Potts BM, Lee D (2001) The role of selection in maintaining spatial variation within a eucalypt population. Poster at 'Annual Meeting of the Australian Genetics Society' July 2001. Melbourne, Victoria.

King R, Hughes JM, Lee D, Potts BM (2001) Fine-scale molecular and quantitative genetic variation in a *Corymbia* population. Poster at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

Kube PD, Raymond CA (2001) Genetic parameters for *Eucalyptus nitens* solid wood traits and relationships with pulpwood traits. Seminar at 'GenFest 2001: A Slice of Life' 10 October. Hobart, Tasmania.

Li B (2001) Overview of Tree Improvement Programs at North Carolina State University. Seminar at 'QFRI Seminar Serie' 13 July, for QDPI. Gympie, Queensland.

McGowen M (2002) Self-incompatibility in *E. globulus*. Seminar at 'SeedFest' 8 February. Hobart, Tasmania.

McNaught A (2002) Introduction and industry perspective. Presentation at 'WoodFest' 15 April, for QFRI, DPI-Forestry. Gympie, Queensland.

McNaught A (2002) Non-destructive techniques for the assessment of wood properties. Presentation at 'WoodFest' 15 April, for QFRI, DPI-Forestry. Gympie, Queensland.

Mellick R (2001) Genetic control of vegetative propagation traits. Presentation at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

Moran GF (2001) Selecting wood properties in the nursery: how close are we? Presentation at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

Patterson B (2001) Maximising outcrossing rates in *Eucalyptus globulus*. Presentation at 'GenFest 2001: A Slice of Life' 10 October. Hobart, Tasmania.

Patterson B (2002) Factors affecting outcrossing and pollen flow in *E. globulus* seed orchards. Seminar at 'SeedFest' 8 February. Hobart, Tasmania.

Patterson B (2002) Factors affecting outcrossing and pollen flow in *E. globulus* seed orchards. Seminar at 'SeedFest' 11 February. Melbourne, Victoria.

Potts BM (2001) Report on the recent IUFRO international symposium "Developing the Eucalypt of the Future". Presentation at 'GenFest 2001: A Slice of Life' 10 October. Hobart, Tasmania.

Potts BM, Dungey HS, Volker P, Tilyard PA (2001) Hybridisation of *Eucalyptus*. Seminar for Southern Cross University. Lismore, NSW.

Ravenwood IC (2001) Key issues for nurseries and seed producers. Presentation at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

Reid JB (2001) The genetic resource and gene movement in eucalypts. Presentation at 'Royal Society of Tasmania, Public Symposium Forests and the Environment' 9 October. Hobart, Tasmania.

Shepherd M (2001) The role of molecular genetics. Presentation at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

Shepherd M (2002) Molecular genetic studies of wood properties in the Slash X Caribbean Pine F1 hybrid. Presentation at 'WoodFest' 15 April, for QFRI, DPI-Forestry. Gympie, Queensland.

Smethurst PJ, Williams DR (2002) The effect of fertiliser and paclobutrazol on flowering in *E. nitens*. Presentation at 'NutFest' 18 March, for Gunns Ltd; CSIRO Forestry and Forest Products. Nunamara, Tasmania.

Toon P (2002) Variation in wood density among ramets of c545. Presentation at 'WoodFest' 15 April, for QFRI, DPI-Forestry. Gympie, Queensland.

Vaillancourt RE, McKinnon GE, Whittock SP, Freeman J, Steane DA, Potts BM (2001) CpDNA phylogeography of Eucalypts. Presentation 1 November, for Griffith University. Gympie, Queensland.

Vaillancourt RE, McKinnon GE, Whittock SP, Freeman J, Steane DA, Potts BM (2001) CpDNA phylogeography of Eucalypts. Presentation 2 November, for Southern Cross University. Lismore, NSW.

Vaillancourt RE, Patterson B, Grosser C, Potts BM, Gore PL (2001) Optimising seed quality for deployment. Presentation at 'CRC-SPF Annual Meeting' 29-31 October. Caloundra, Queensland.

Vaillancourt RE (2002) Using molecular markers as a diagnostic tool in eucalypt forestry. Lecture 9 May, for INIA and Bioforest. Conception, Chile.

Whittock SP, Apiolaza LA, Potts BM (2001) Breeding for sustainability in *Eucalyptus globulus*. Poster at 'CRC Science Supporting Innovation Research of Antarctic and Forestry CRCs' 7 May. Hobart, Tasmania.

Whittock SP (2001) Breeding for sustainability in *Eucalyptus globulus*. Seminar at 'Introductory PhD Seminar' 17 August, for School of Plant Sciences, University of Tasmania. Hobart, Tasmania.

Whittock SP, Apiolaza LA, Potts BM (2001) Breeding for sustainability in *Eucalyptus globulus*. Poster at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

Williams DR (2002) Enhancing flowering in eucalypts with paclobutrazol. Seminar at 'SeedFest' 8 February. Hobart, Tasmania.

Sustainable Management Program

Bail I (2001) So where is the right place to grow bluegums? Presentation at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

Battaglia M (2001) Anticipating second rotation decline. Presentation at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

Battaglia M (2002) Thinking Like a Tree: process-based modelling of forest growth. Presentation at 'CRC Science Supporting Innovation Research of Antarctic and Forestry CRCs', 7 May. Hobart, Tasmania.

Battaglia M (2002) Sustainable plantations and sustaining landscapes. Presentation at 'El simposio internacional sobre socioeconomia, tecnologia, patologia y sostenibilidad del Eucalypto' 29 May 2002 - 1 June, for Spanish eucalypt researchers and ENCE management. Pontevedra, Spain.

Blumfield TJ (2001) Using 15N-labelled slash to study the decomposition of post-harvest residues. Field Day at 'CRC-SPF Annual Meeting'. Imbil State Forest, Queensland.

Blumfield TJ (2001) Nitrogen dynamics and cycling in hoop pine plantations. Field Day at 'CRC-SPF/QFRI Hoop Pine Soils and Nutrition Field Day' for QFRI, DPI-Forestry. Gympie, Queensland.

Blumfield TJ, Xu ZH (2001) Using ^{15}N-labelled fertilisers and soil to investigate Hoop Pine seedling N uptake in a glasshouse. Poster at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

Blumfield TJ (2001) Nitrogen mineralisation following hoop pine harvest. Presentation at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

Blumfield TJ (2002) The potential for nitrogen loss in the inter-rotation and early establishment phase of Hoop Pine plantations. Field Day at 'CRC-SPF/QFRI Hoop Pine Soils and Nutrition Field Day' for QFRI, DPI-Forestry. Gympie, Queensland.

Bubb KA (2001) Soil management after clearfelling. Presentation at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

Catchpoole KJ, Harding KJ (2001) QFRI Decision support tools. Seminar 25 July. Indooroopilly, Queensland.

Catchpoole KJ (2002) Development of a silvicultural decision support system for exotic pine plantations. Seminar 10 August, for Queensland Forest Research Institute. Gympie, Queensland.

Chen C (2001) Carbon and nutrient dynamics and associated microbiological processes in forest soils: Effects of afforestation and management. Presentation at 'Griffith University Public Seminars' 12 December, for Griffith University. Brisbane, Queensland.

Close DC (2002) Seedling stress physiology and nursery management practice. Poster at 'CRC Science

Supporting Innovation Research of Antarctic and Forestry CRCs' 7 May. Hobart, Tasmania.

Comerford NB, Hua L, Jokela EJ, Barros NF, Adegbidi H, Smethurst PJ (2001) A nutrient uptake model and its usefulness for southern pine management. Presentation at 'Soil Science Society of America Annual Meeting' 25 October. Charlotte, North Carolina, USA.

Davidson NJ (2001) Plantation forestry in Tasmania (soil nutrition, molecular biology and mammalian browsing). Presentation at 'Talk to Hutchins School Matric class' Oct. 2001, 22 October 2000, for The Hutchins School. Hobart, Tasmania.

Davidson NJ, Gibbons AK (2001) Gordon River riparian vegetation assessment update to the Integrated Impact Assessment Statement. Presentation at 'Basslink Project hearings to the Joint Assessment Panel' 16 October 2001, for Department of Primary Industries, Water and Environment. Hadley's Hotel. Hobart, Tasmania.

Hunt MA (2001) Clones or seedlings. Presentation at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

Lee D (2001) Options for tropical and subtropical environments. Presentation at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

Mathers NJ, Xu ZH (2001) Soil organic matter characterisation in a two-year-old exotic pine hybrid plantation using solid-state ^{13}C NMR spectroscopy. Poster at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

Mitchell AD (2001) Effect of nitrogen and phosphorus fertilisation on base cation availability. Presentation at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

Nyvold U (2001) Economics of alternative silvicultural systems in lowland wet euclaypt forest - a study at the Warra Silvicultural Systems Trial. Seminar at 'CRC-SPF Seminar Series' 10 August. Hobart, Tasmania.

Ryan PA (2001) Matching eucalypt species to sites. Presentation at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

Smethurst PJ (2001) Issues and trends in environmental aspects of forestry. Presentation at 'Royal Society of Tasmania, Public Symposium Forests and the Environment' 9 October. Hobart, Tasmania.

van Putten I (2001) Modelling forest owner behaviour in north-west Tasmania. Presentation at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

Xu ZH (2001) CRC/ARC/QDPI Forestry: collaborative research in forest ecosystems - opportunities and challenges. Presentation at 'Griffith University Public Seminars' 12 December. Brisbane, Queensland.

Resource Protection Program

Allen GR (2001) Parasitoids and managing *Chrysoptharta agricola*. Presentation at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

Barry KM (2002) *Acacia mangium* heartrot in Indonesia: Overview of the current ACIAR project. Seminar at 'Invited Lecture' 20 Feb. 2002, for CSIRO Forestry & Forest Products. Yarralumla, ACT.

Barry KM (2002) Many roads lead to innovation: Examples of disease and pest management research in eucalyptus plantations. Presentation at 'CRC Science Supporting Innovation Research of Antarctic and Forestry CRCs' 7 May. Hobart, Tasmania.

Bulinski J, Alexander R, Matthiessen JN (2001) A novel approach to managing African Black Beetle. Presentation at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

Eyles A, Davies NW, Mohammed CL (2001) Anatomy and chemistry of wound tissue in *Eucalyptus nitens* and *E. globulus*. Poster at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

Eyles A (2001) Anatomy and chemistry of wound tissue in *Eucalyptus globulus* and *E. nitens*. Seminar at 'Mie University Seminar Series' 6 November. Tsu, Japan.

Eyles A, Mohammed CL, Davies NW (2001) Eucalypt tree responses to wounding. Presentation at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

Irianto R (2002) Pests, diseases and mycorrhizaes in Indonesian forest plantations. Seminar at 'CRC-SPF Seminar Series' 25 January. Hobart, Tasmania.

le Mar K, McArthur C (2002) Marsupial herbivores in the landscape - do patterns of habitat use by individuals reflect those of the population? Presentation at '8th International Theriological Congress, Sun City, South Africa' 12-17 August 2001. South Africa.

McArthur C (2001) Linking foraging decisions of mammalian herbivores: from plant chemistry to landscape. Presentation at '8th International Theriological Congress, Sun City, South Africa' 12-17 August 2001. South Africa.

McArthur C (2001) Browsing management and alternatives to current methods. Presentation at 'Royal Society of Tasmania, Public Symposium Forests and the Environment' 9 October. Hobart, Tasmania.

McArthur C (2001) Herbivore foraging decisions from leaf to landscape. Seminar at 'Zoology Seminar Series' 17 October. Hobart, Tasmania.

Nahrung HF (2001) Phenology of the southern eucalypt beetle *Chrysophtharta agricola* (Chapuis) (Coleoptera: Chrysomelidae: Paropsini) in Tasmania. Poster at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

O'Reilly J (2001) Potential for breeding browsing resistant stock. Presentation at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

O'Reilly J, McArthur C, Potts BM (2001) Foraging decisions by marsupials: the role of plant genotype. Poster at '8th International Theriological Congress, Sun City, South Africa' 12-17 August 2001. South Africa.

Rapley L, Allen GR, Potts BM (2001) Rapid screening of *Eucalyptus globulus* genotypes for increased Autumn Gum Moth, *Mnesampela privata*, resistance using a tent bioassay. Poster at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

Rapley L, Allen GR, Potts BM (2002) Rapid screening of *Eucalyptus globulus* genotypes for increased Autumn Gum Moth resistance using a tent bioassay. Poster at 'CRC Science Supporting Innovation Research of Antarctic and Forestry CRCs' 7 May. Hobart, Tasmania.

Redgrove HL, Allen GR, Close DC (2001) Some like it soft, some like it hard: Palatability of *Eucalyptus nitens* seedlings to *Heteronyx* spp. Poster at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

Redgrove HL, Allen GR, Close DC (2002) Some like it soft, some like it hard: Palatability of *Eucalyptus nitens* seedlings to *Heteronyx spp*. Poster at 'CRC Science Supporting Innovation Research of Antarctic and Forestry CRCs' 7 May. Hobart, Tasmania.

Rice AD, Allen GR (2001) Phenology and rates of population increase of *Eadya paropsidis* and *Lixophaga* sp. - two of the primary larval parasitoids associated with *Chrysophtharta agricola*. Poster at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

Steinbauer MJ (2001) The life history of Autumn Gum Moth in relation to host utilisation. Presentation for ANU, Division of Botany and Zoology. Canberra, ACT.

Steinbauer MJ (2001) Prospects for managing populations of Autumn gum moth (Geometridae) in eucalypt plantations in southern Australia. Presentation for Pacific Forestry Centre, Canadian Forest Service. Victoria, Canada.

Steinbauer MJ (2001) Summary of CRC-SPF Autumn Gum Moth research in Canberra. Presentation for CSIRO Forestry and Forest Products. Canberra, ACT.

Steinbauer MJ, Short MW, Wharton T, Floyd RB (2001) A multi-faceted approach to reducing reliance upon insecticides to manage Autumn Gum Moth. Poster at 'CRC-SPF Annual Meeting' 28-31 October. Caloundra, Queensland.

Steinbauer MJ (2002) The impact of insect damage to a healthy tree and possible control. Presentation at 'Australian Master TreeGrowers Program: Insects and Farm Forestry' 21 May, for Landholders involved in on-farm revegetation and farm forestry. Wagga Wagga, NSW.

Yee M (2001) Beetles, fungi and rotted wood: Implications for native forest management in Tasmania. Poster at 'CRC-SPF Annual Meeting' 29-31 October. Caloundra, Queensland.

Media Activities

Print

The Mercury, 2001. N Davidson: 'Riverbank fear over Basslink'. 17 October.

Onwood, 2001. M Battaglia: 'Accounting for declining stand productivity'.

Onwood, 2002. D Close: 'New light on frost damage'.

Australian Forest Grower, 2002. P Smethurst: 'Fertiliser management issues for farm forestry'.

Border Watch, 2002. T McRae: 'World-first timber era: Artificial breeding technology to generate growth'. 14 June.

Electronic media

ABC Radio National, J Reid: interview on Genetic pollution. 12 October 2001.

ABC Radio National, M Steinbauer: interview about Like moths to a landing light. March 2002.

ABC Radio 936 Hobart, G Dutkowski & W F Budd: interview about The role of Tasmanian CRC's in innovation. 9 May 2002.

ABC-TV Stateline, D Close: interview on Investigation of effects of future greenhouse scenarios on plant growth and herbivores. 7 June 2002.

Technology Transfer Activities

Date	*Function*	*Topic*	*Reach*	*Program*	*Time*
2001					
Jul	Seminar Hobart, Tasmania	Generic research and development supporting the Eucalypt Breeding Programs in Shell Forestry companies in South America R Griffin	30	GI	90 min
Jul	Seminar Gympie, Queensland	Overview of Tree Improvement Programs at North Carolina State University B Li	30	GI	50 min
Jul	Poster Melbourne, Victoria	The role of selection in maintaining spatial variation within a eucalypt population R King, J Hughes, BM Potts, D Lee		GI	-
Jul	Presentation Victoria, Canada	Prospects for managing populations of Autumn gum moth (Geometridae) in eucalypt plantations in southern Australia MJ Steinbauer	20	RP	60 min
Jul	Seminar Indooroopilly, Queensland	QFRI Decision support tools KJ Catchpoole, KJ Harding	30	SM	60 min
Jul	CRC-SPF Confidential Report	*Eucalyptus globulus* fertiliser and paclobutrazol treatment trial: Establishment report DR Williams		GI	-
Jul	Poster Hobart, Tasmania	Breeding for sustainability in *Eucalyptus globulus* SP Whittock, LA Apiolaza, BM Potts	40	GI	-
Aug	Presentation Sun City, South Africa	Linking foraging decisions of mammalian herbivores: from plant chemistry to landscape C McArthur	50	RP	15 min
Aug	Presentation Sun City, South Africa	Marsupial herbivores in the landscape - do patterns of habitat use by individuals reflect those of the population? K le Mar, C McArthur	50	RP	15 min
Aug	Poster Sun City, South Africa	Foraging decisions by marsupials: the role of plant genotype J O'Reilly, C McArthur, BM Potts	200	RP / GI	-
Aug	CRC-SPF Technical Report	No. 63 Report on the ACACA (AFFA) funded 2001 Eucalypt Mission to China BM Potts, GW Dutkowski, PJ Smethurst, RE Vaillancourt	39	GI	-
Aug	Seminar Hobart, Tasmania	Economics of alternative silvicultural systems in lowland wet euclaypt forest - a study at the Warra Silvicultural Systems Trial U Nyvold	55	SM	120 min
Aug	CRC-SPF Technical Report	No. 64 Identification of *Pinus* spp. microsatellites polymorphic in *Pinus elliottii* and *P. elliottii* X *P. caribaea* F1 Hybrids. Series II tests M Shepherd, MJ Cross, MJ Dieters, RJ Henry	13	GI	-
Aug	Presentation Canberra, ACT	Assessing the risk and management of genetic pollution NJ Davidson	20	GI	-
Aug	Seminar Hobart, Tasmania	Breeding for sustainability in *Eucalyptus globulus* SP Whittock	50	GI	60 min
Aug	CRC-SPF Technical Report	No. 65 DNA Fingerprinting of putative ramets from QFRI ortet EH49 using microsatellite markers MJ Cross, M Shepherd	5	GI	-
Aug	CRC-SPF Technical Report	No. 67 Verifying interspecific hybrids between *Pinus elliottii* var. *elliottii* and *P. caribaea* var. *hondurensis* using microsatellite or chloroplast markers M Shepherd, MJ Cross, MJ Dieters, RJ Henry	13	GI	-

Date	*Function*	*Topic*	*Reach*	*Program*	*Time*
Aug	Hot Off the Seed Bed	No. 38 Peak flowering time of *Eucalyptus globulus* is under strong additive genetic control LA Apiolaza, BM Potts, PL Gore, DJ Pilbeam	50	GI	-
Aug	Seminar Gympie, Queensland	Development of a silvicultural decision support system for exotic pine plantations KJ Catchpoole	30	SM	60 min
Sept	Technology Transfer Project Hobart, Tasmania	Field System – Browsing Monitoring C McArthur, M Matsuki, G Dutkowski		RP / ETT	-
Sept	CRC-SPF Technical Report	No. 68 The causes and treatment of post-harvest staining in Blackwood (*Acacia melanoxylon*) wood K Barry, M Hall, CL Mohammed, CL Beadle	28	RP	-
Oct	Industry Project Victoria & WA	Review of Partners' systems - Health Monitoring M Matsuki, G Dutkowski	16	RP	-
Oct	Presentation Charlotte, North Carolina, USA	A nutrient uptake model and its usefulness for southern pine management NB Comerford, L Hua, EJ Jokela, NF Barros, H Adegbidi, PJ Smethurst	200	SM	60 min
Oct	Workshop Hobart, Tasmania	GenFest 2001: A Slice of Life	20	GI	1 day
		Maximising outcrossing rates in *Eucalyptus globulus* B Patterson			
		Why aren't we using economic breeding objectives? LA Apiolaza			
		Genetic parameters for *Eucalyptus nitens* solid wood trait and relationships with pulpwood traits PD Kube, CA Raymond			
		Genetic variation in resistance of *Eucalyptus globulus* to Autumn gum moth and its association with cuticular waxes and foliar oils TH Jones			
		Spatial analysis of forest genetic trials GW Dutkowski, J Costa e Silva, AR Gilmour			
		Report on the recent IUFRO international symposium "Developing the Eucalypt of the Future" BM Potts			
Oct	Symposium Hobart, Tasmania	Royal Society of Tasmania Public Symposium 2001 'Forests and the Environment'	300		1 day
		The nature of forests M Brown			
		The genetic resource and gene movement in eucalypts J Reid		GI	
		Browsing management and alternatives to current methods C McArthur		RP	
		Issues and trends in environmental aspects of forestry PJ Smethurst		SM	
Oct	Seminar Hobart, Tasmania	Herbivore foraging decisions from leaf to landscape C McArthur	30	RP	60 min
Oct	CRC-SPF Technical Report	No. 74 Compilation of Partners' Seed Orchard Manuals GW Dutkowski	130	GI	-
Oct	CRC-SPF Technical Report	No. 76 A synthesis of rural tree decline and revegetation research, vegetation establishment and species selection survey, and description of future research DC Close, NJ Davidson	75	SM	-

Date	*Function*	*Topic*	*Reach*	*Program*	*Time*
Oct	Field Day Imbil State Forest, Queensland	Using 15N-labelled slash to study the decomposition of post-harvest residues TJ Blumfield	80	SM	25 min
Oct	CRC-SPF Technical Report	No. 70 Proposal for large-scale QTL detection experiments in hybrid pines M Shepherd, MJ Dieters, S Carson	21	GI	-
Oct	Presentation Canberra, ACT	The life history of Autumn Gum Moth in relation to host utilisation MJ Steinbauer	20	RP	60 min
Oct	CRC-SPF Technical Report	No. 69 Identification and activity of the sex pheromone of Autumn Gum Moth MJ Steinbauer, TE Bellas, FP Schiestl, MJ Lacey, F Östrand	16	RP	-
Oct	CRC-SPF Confidential Report	Proposal for the application of marker-aided selection for tropical hybrid pines in Queensland M Shepherd, MJ Dieters, SD Carson		GI	-
Oct	Hot Off the Seed Bed	No. 39 Molecular data shows that the Jeeralang provenance of *Eucalyptus globulus* clearly belongs to subspecies *globulus* RC Jones, DA Steane, BM Potts, RE Vaillancourt	50	GI	-
Oct	Meeting Caloundra, Queensland	CRC-SPF Annual Meeting	110		3 days
	Poster	Using 15N-labelled fertilisers and soil to investigate Hoop pine seedling N uptake in a glasshouse TJ Blumfield, ZH Xu		SM	
	Poster	Some like it soft, some like it hard: Palatability of *Eucalyptus nitens* seedlings to *Heteronyx* spp HL Redgrove, GR Allen, DC Close		RP	
	Poster	Rapid screening of *Eucalyptus globulus* genotypes for increased Autumn gum moth, *Mnesampela privata*, resistance using a tent bioassay L Rapley, GR Allen, BM Potts		RP	
	Poster	Fingerprinting applications of chloroplast DNA JS Freeman, SP Whittock, GE McKinnon, DA Steane, BM BM Potts, RE Vaillancourt		GI	
	Poster	What animals are necessary for high seed production in eucalypt seed orchards? A Hingston, P McQuillan, BM Potts		GI	
	Poster	Fine-scale molecular and quantitative genetic variation in a *Corymbia* population R King, J Hughes, D Lee, BM Potts		GI	
	Poster	Anatomy and chemistry of wound tissue in *Eucalyptus nitens* and *E. globulus* A Eyles, NW Davies, CL Mohammed		RP	
	Poster	Paternity analysis in a *Eucalyptus nitens* clonal seed orchard C Grosser, RE Vaillancourt, BM Potts, H O'Sullivan		GI	
	Poster	A multi-faceted approach to reducing reliance upon insecticides to manage Autumn Gum Moth MJ Steinbauer, M Short, T Wharton, RB Floyd		RP	
	Poster	Phenology of the southern eucalypt beetle *Chrysophtharta agricola* (Chapuis) (Coleoptera: Chrysomelidae: Paropsini) in Tasmania HF Nahrung		RP	
	Poster	Phenology and rates of population increase of *Eadya paropsidis* and *Lixophaga* sp. - two of the primary larval parasitoids associated with *Chrysophtharta agricola* AD Rice, GR Allen		RP	
	Poster	Breeding for sustainability in *Eucalyptus globulus* SP Whittock, LA Apiolaza, BM Potts		GI	

Date	*Function*	*Topic*	*Reach*	*Program*	*Time*
	Poster	Soil organic matter characterisation in a two-year-old exotic pine hybrid plantation using solid-state 13C NMR spectroscopy NJ Mathers, ZH Xu		SM	
	Poster	Beetles, fungi and rotted wood: Implications for native forest management in Tasmania M Yee		RP	
	Presentation	Optimising seed quality for deployment RE Vaillancourt, B Patterson, C Grosser, BM Potts, PL Gore		GI	
	Presentation	Eucalypt tree responses to wounding A Eyles, CL Mohammed, NW Davies		RP	
	Presentation	The role of molecular genetics M Shepherd		GI	
	Presentation	So where is the right place to grow Blue gums? I Bail		SM	
	Presentation	The potential for and risks of genetic pollution RC Barbour		GI	
	Presentation	Matching eucalypt species to sites PA Ryan		SM	
	Presentation	Soil management after clearfelling KA Bubb		SM	
	Presentation	Anticipating second rotation decline M Battaglia		SM	
	Presentation	Clones or seedlings MA Hunt		SM	
	Presentation	Hybrids vs pure species: when are hybrids an advantage? MJ Dieters		GI	
	Presentation	Early and indirect selection for wood properties in the *Pinus elliottii* x *P. caribaea* hybrid and parental species D Kain		GI	
	Presentation	Genetic control of vegetative propagation traits R Mellick		GI	
	Presentation	Options for tropical and subtropical environments D Lee		SM	
	Presentation	Potential for breeding browsing resistant stock J O'Reilly		RP	
	Presentation	Key issues for nurseries and seed producers IC Ravenwood		GI	
	Presentation	Selecting wood properties in the nursery: how close are we? GF Moran		GI	
	Presentation	Nitrogen mineralisation following hoop pine harvest TJ Blumfield		SM	
	Presentation	Effect of nitrogen and phosphorus fertilisation on base cation availability AD Mitchell		SM	
	Presentation	Modelling forest owner behaviour in north-west Tasmania I van Putten		SM	
	Presentation	Parasitoids and managing *Chrysoptharta agricola* GR Allen		RP	
	Presentation	A novel approach to managing African black beetle J Bulinski, R Alexander, JN Matthiessen		RP	
	Presentation	New developments in quantitative genetics LA Apiolaza		GI	
	Game	Forest Fortune T Bildstein, GW Dutkowski		ETT	

Date	*Function*	*Topic*	*Reach*	*Program*	*Time*
Oct	Presentation Hobart, Tasmania	Gordon River riparian vegetation assessment update to the Integrated Impact Assessment Statement NJ Davidson, AK Gibbons	50	SM	40 min
Oct	Presentation Hobart, Tasmania	Plantation forestry in Tasmania (soil nutrition, molecular biology and mammalian browsing) NJ Davidson	12	SM	40 min
Nov	Meeting Creswick, Victoria	STBA Technical Committee L Apiolaza, R Vaillancourt	12	GI	-
Nov	Meeting Melbourne, Victoria	STBA Eucalypt Steering Committee G Dutkowski	8	GI	-
Nov	Meeting Melbourne, Victoria	STBA Pine Steering Committee G Dutkowski	10	GI	-
Nov	Meeting Melbourne, Victoria	STBA Board Meeting G Dutkowski	9	GI	-
Nov	Meeting Melbourne, Victoria	STBA Annual General Meeting G Dutkowski	10	GI	-
Nov	Pest Off!	No. 6 A sex pheromone lure for Autumn gum moth is now closer! MJ Steinbauer	50	RP	-
Nov	CRC-SPF Technical Report	No. 73 Inter-provenance hybridisation in *Pinus caribaea* var. *hondurensis* – performance and genetic control on two sites in Queensland AJ Johnston, MJ Dieters, HS Dungey, DG Nikles, HM Wallace	34	GI	-
Nov	Seminar Tsu, Japan	Anatomy and chemistry of wound tissue in *Eucalyptus globulus* and *E. nitens* A Eyles	20	RP	40 min
Nov	CRC-SPF Technical Report	No. 66 Paternity testing and DNA fingerprinting in hybrid pines using microsatellite markers M Shepherd, MJ Cross, MJ Dieters, RJ Henry	18	GI	-
Nov	CRC-SPF Technical Report	No. 75 Establishment report for *Eucalyptus ovata* x *E. nitens* hybrid trials (CRC2000_1) at Arnolds Block, Lilydale, Tasmania RC Barbour, BM Potts, RE Vaillancourt	29	GI	-
Nov	Hot Off the Seed Bed	No. 40 Genetic variation in freezing tolerance of *Eucalyptus globulus* seedlings WN Tibbits, T White, GR Hodge, NMG Borralho	50	GI	-
Nov	Hot Off the Seed Bed	No. 41 Issues of real cold hardiness in *Eucalyptus nitens* WN Tibbits, GR Hodge	50	GI	-
Nov	Hot Off the Seed Bed	No. 42 Diversity of two lignin genes in *Eucalyptus globulus*, *E. grandis* and *E. urophylla* RE Vaillancourt	50	GI	-
Nov	Pest Off!	No. 7 Plant infochemicals combine with sex pheromones to enlarge beetle mating swarms: another call to focus more research into insect and plant chemical ecology? MJ Steinbauer	50	RP	-
Nov	Seminar Lismore, NSW	Hybridisation of *Eucalyptus* BM Potts, H Dungey, P Volker, P Tilyard	15	GI	40 min
Nov	Presentation Canberra, ACT	Summary of CRC-SPF Autumn gum moth research in Canberra MJ Steinbauer	25	RP	60 min
Nov	Presentation Lismore, NSW	CpDNA phylogeography of Eucalypts RE Vaillancourt, GE McKinnon, SP Whittock, J Freeman, DA Steane, BM Potts	25	GI	30 min
Nov	Presentation Gympie, Queensland	CpDNA phylogeography of Eucalypts RE Vaillancourt, GE McKinnon, SP Whittock, J Freeman, DA Steane, BM Potts	15	GI	30 min

Date	*Function*	*Topic*	*Reach*	*Program*	*Time*
Nov	CRC-SPF Confidential Report	Growth and reproductive responses of young *Eucalyptus globulus* trees to pollarding and paclobutrazol treatment DR Williams		GI	-
Nov	Beyond the Black Stump	No. 23 Changes in soil fertility are reflected in soil carbon and nitrogen pools S Ward, ZH Xu, I Phillips, TJ Blumfield	100	SM	-
Nov	Beyond the Black Stump	No. 24 Silvicultural decision support with process-based forest growth models M Battaglia	100	SM	-
Dec	Technology Transfer Project	Seed Orchard Manual B Potts, D Williams, G Dutkowski, W Tibbits		GI / ETT	-
Dec	Meeting Albany, WA`	Pest Management and Monitoring, Timbercorp A Loch, M Matsuki, G Dutkowski	8	RP	-
Dec	Meeting Perth, Tasmania	Browsing Damage Management Group C McArthur, G Dutkowski, M Matsuki	8	RP / ETT	-
Dec	Workshop Creswick, Victoria	TREEPLAN National Genetic Evaluation of *P. radiata*-BV prediction L Apiolaza, G Dutkowski	8	GI	3 days
Dec	Hot Off the Seed Bed	No. 43 Linking variation in lignin genes to wood quality F Poke, JB Reid, CA Raymond, RE Vaillancourt	50	GI	-
Dec	CRC-SPF Technical Report	No. 77 Communicating financial aspects of farm forestry D Saccardi, T Tabart, A Fulton	36	SM	-
Dec	CRC-SPF Technical Report	No. 78 Description of system framework for the silvicultural decision support system in Queensland Forestry KJ Catchpoole, MR Nester	18	SM	-
Dec	Presentation Brisbane, Queensland	CRC/ARC/QDPI Forestry: collaborative research in forest ecosystems - opportunities and challenges ZH Xu	20	SM	30 min
Dec	Presentation Brisbane, Queensland	Carbon and nutrient dynamics and associated microbiological processes in forest soils: Effects of afforestation and management C Chen	20	SM	30 min
Dec	Beyond the Black Stump	No. 25 How do *E. nitens* seedlings adjust to transplant shock? DC Close, CL Beadle	100	SM	-
2002					
Jan	Web page	Population Genetics L Apiolaza		GI	-
Jan	Seminar Hobart, Tasmania	The role of remote sensing in the management of native forest and plantations C Stone	30	RP	90 min
Jan	Seminar Hobart, Tasmania	Pests, diseases and mycorrhizaes in Indonesian forest plantations R Irianto	20	RP	90 min
Jan	Hot Off the Seed Bed	No. 44 Physical and chemical wood properties of *Eucalyptus globulus*: racial variation and genetic parameters LA Apiolaza, CA Raymond	50	GI	-
Feb	Industry Project Manjimup, WA	Estimating the value of breeding *Eucalyptus globulus* B Greaves, G Dutkowski		GI / ETT	5 days
Feb	Meeting Melbourne, Victoria	STBA Board Meeting G Dutkowski	9	GI	-

Date	*Function*	*Topic*	*Reach*	*Program*	*Time*
Feb	Hot Off the Seed Bed	No. 45 A genetic marker for verification of *P. elliottii* var. *elliottii* X *P. caribaea* var. *hondurensis* hybrids M Shepherd, MJ Cross, MJ Dieters, RJ Henry	50	GI	-
Feb	Pest Off!	No. 8 Simple plantation pest risk model can be useful if calibrated M Matsuki	50	RP	-
Feb	Pest Off!	No. 9 Asian gypsy moth poses low to moderate risk to temperate Australian plantations M Matsuki	50	RP	-
Feb	Hot Off the Seed Bed	No. 46 Intraspecific chloroplast DNA variation and population structure in *Eucalyptus grandis* revealed by single strand conformation polymorphism (SSCP) ME Jones, M Shepherd, RJ Henry, L Schoer, A Delves	50	GI	-
Feb	CRC-SPF Technical Report	No. 72 Climate in the Florentine Valley CC Baillie, PJ Smethurst	14	SM	-
Feb	Workshop Hobart, Tasmania	SeedFest	20	GI	1 day
		Pollination ecology of *Eucalyptus globulus* and *E. nitens* AB Hingston			
		Paternity analysis in an *Eucalyptus nitens* seed orchard C Grosser			
		Enhancing flowering in eucalypts with paclobutrazol DR Williams			
		Factors affecting outcrossing and pollen flow in *E. globulus* seed orchards B Patterson			
		Self-incompatibility in *E. globulus* M McGowen			
		Processing eucalyptus seed M Lavery			
Feb	Workshop Melbourne, Victoria	SeedFest	50	GI	1 day
		Self-incompatibility in *Eucalyptus globulus* and *E. nitens* L Pound			
		Pollination ecology of *Eucalyptus globulus* and *E. nitens* AB Hingston			
		Paternity analysis in an *Eucalyptus nitens* seed orchard C Grosser			
		Factors affecting outcrossing and pollen flow in *E. globulus* seed orchards B Patterson			
		Seed maturation in *E. globulus* J Sasse			
		Seed production systems for dry zone eucalypts C Harwood			
Feb	Field Tour Victoria	SeedFest Industry Visit – Seed Orchard Management B Potts	50	GI	1 day
Feb	Presentation Wagga Wagga, NSW	The impact of insect damage to a healthy tree and possible control MJ Steinbauer	12	RP	30 min
Feb	Seminar Yarralumla, ACT	*Acacia mangium* heartrot in Indonesia: Overview of the current ACIAR project KM Barry	40	RP	40 min

Date	*Function*	*Topic*	*Reach*	*Program*	*Time*
Mar	Meeting Canberra, ACT	Markets for products and services of forests – ANU Forestry Research Colloquium 2 UN Bhati		ETT	-
Mar	Workshop Mt Gambier, SA	*Pinus radiata* breeding value prediction G Dutkowski	2	GI / ETT	3 days
Mar	Seminar Hobart, Tasmania	Manipulating sexual reproduction in eucalypts: doing it with Blue gums M McGowen	50	GI	40 min
Mar	Field Tour Tasmania	NutFest – Fertiliser management of low LAI eucalypts P Smethurst	20	SM	1 day
Mar	CRC-SPF Technical Report	No. 79 Verifying parentage of a large PEE x PCH population for genetic mapping using microsatellite markers: Black Swamp Plantation MJ Cross, M Shepherd	14	GI	-
Mar	Hot Off the Seed Bed	No. 47 Evidence for simple genetic control of rooting in cuttings of the hybrid between *Pinus elliottii* var. *elliottii* and *P. caribaea* var. *hondurensis* R Mellick, M Shepherd, MJ Dieters	50	GI	-
Mar	Pest Off!	No. 10 Bracken reduces browsing C McArthur, E Pietrzykowski, H Fitzgerald, A Goodwin	50	RP	-
Mar	Presentation Gympie, Queensland	The potential for nitrogen loss in the inter-rotation and early establishment phase of Hoop Pine plantations TJ Blumfield	30	SM	30 min
Mar	Presentation Gympie, Queensland	Nitrogen dynamics and cycling in Hoop pine plantations TJ Blumfield	30	SM	20 min
Mar	Presentation Nunamara, Tasmania	The effect of fertiliser and paclobutrazol on flowering in *E. nitens* PJ Smethurst, DR Williams	15	GI	20 min
Mar	Beyond the Black Stump	No. 26 Does nitrogen fertilization improve soil fertility in a Hoop pine plantation? CR Chen, ZH Xu, JM Hughes	100	SM	-
Mar	Beyond the Black Stump	No. 27 The potential for nitrogen loss in the inter-rotation and early establishment phase of hoop pine plantations TJ Blumfield, ZH Xu	100	SM	-
Apr	Field Tour Tasmania	ACACA Chinese Delegation B Potts, P Smethurst	8	GI / SM	7 days
Apr	Seminar Hobart, Tasmania	A death sentence for a forest – the Mountain Pine Beetle in North America A Carroll	25	RP	90 min
Apr	Pest Off!	No. 11 Natural enemies greatly reduce *Chrysophtharta agricola* numbers GR Allen	50	RP	-
Apr	CRC-SPF Technical Report	No. 81 Evaluation of non-destructive methods of measuring growth stress in *Eucalyptus globulus*: relationships between strain, wood properties and stress CA Raymond, PD Kube, AD Bradley, L Savage, EA Pinkard	31	GI/ SM	-
Apr	CRC-SPF Technical Report	No. 80 Effect of seedling characteristics at planting on rabbit browsing in *Eucalyptus globulus* plantations C McArthur, R Appleton, C Pye		RP	-
Apr	Workshop Gympie, Queensland	WoodFest – Wood properties of Slash X Caribbean Pine Hybrids Processing eucalyptus seed M Lavery	40	GI	1 day
		Introduction and industry perspective A McNaught			
		Non-destructive techniques for the assessment of wood properties A McNaught			

Date	*Function*	*Topic*	*Reach*	*Program*	*Time*
		Incorporating wood quality assessments into series III clonal tests MJ Dieters, WR Peters			
		Breeding for wood properties in Slash x Caribbean Pine hybrid D Kain			
		Wood properties of series II clones and prospects for a 20-year rotation with F1 clones KJ Harding, TR Copley			
		Wood properties of the Slash x Caribbean Pine hybrid compared to its parental species KJ Harding, TR Copley			
		Wood properties of the Slash x Caribbean Pine hybrid compared to its parental species D Kain, KJ Harding, MJ Dieters, B Li			
		Variation in wood density among ramets of c545 P Toon			
		Molecular genetic studies of wood properties in the Slash X Caribbean Pine F1 hybrid M Shepherd			
Apr	Beyond the Black Stump	No. 28 Disc cultivation, nitrification and nitrogen leaching in the early establishment phase of a hoop pine plantation TJ Blumfield, ZH Xu, CR Chen	100	SM	-
Apr	Beyond the Black Stump	No. 29 Rags to riches: Estimating leaf area index (LAI) ML Cherry, C Macfarlane, PJ Smethurst, CL Beadle	100	SM	-
May	Technology Transfer Project	Review of Partners Systems – Nutrition Management P Smethurst, G Holz, G Dutkowski		SM / ETT	-
May	Seminar Hobart, Tasmania	Blue gums international – *Eucalyptus globulus* genetic parameters G Lopez	50	GI	60 min
May	Lecture Conception, Chile	Using molecular markers as a diagnostic tool in eucalypt forestry RE Vaillancourt	100	GI	60 min
May	CRC-SPF Technical Report	No. 61 Soil Fertility Assessment: Survey and Training Using a Quick-Test Meter R Osborne, PJ Smethurst	67	SM	-
May	Pest Off!	No. 12 Insect defoliation changes *E. globulus* provenance growth ranking M Matsuki	50	RP	-
May	Pest Off!	No. 13 Ways to increase the effectiveness of Autumn gum moth population monitoring using light traps MJ Steinbauer	50	RP	-
May	Hot Off the Seed Bed	No. 48 How well do inter-specific hybrids perform? P Volker, BM Potts, P Tilyard	50	GI	-
May	Workshop Hobart, Tasmania	CRC Science Supporting Innovation Research of Antarctic and Forestry CRC's	40		1 day
	Presentation	Many roads lead to innovation: Examples of disease and pest management research in eucalyptus plantations K Barry		RP	
	Presentation	Delivering higher levels of genetic gain to plantation forestry: A new hand pollinated seed production system P Gore		GI	
	Presentation	Thinking Like a Tree: process-based modelling of forest growth M Battaglia		SM	
	Poster	Rapid screening of *Eucalyptus globulus* genotypes for increased Autumn gum moth resistance using a tent bioassay L Rapley, GR Allen, BM Potts		RP	
	Poster	Seedling stress physiology and nursery management practice DC Close		SM	

Date	*Function*	*Topic*	*Reach*	*Program*	*Time*
	Poster	Some like it soft, some like it hard: Palatability of *Eucalyptus nitens* seedlings to *Heteronyx spp* HL Redgrove, GR Allen, DC Close		RP	
May	Seminar Hobart, Tasmania	Pollination ecology of *Eucalyptus globulus* and *E. nitens* AB Hingston	20	GI	20 min
May	CRC-SPF Confidential Report	Genetic parameters and breeding values for growth and wood properties of *Eucalyptus globulus* at West Ridgley LA Apiolaza, CA Raymond		GI	-
May	Pest Off!	No. 14 A guide to population assessment of *Eucalyptus* weevil (*Gonipterus scutellatus*) J Bulinski, M Matsuki	50	RP	-
May	CRC-SPF Technical Report	No. 85 XSIM – A simulation program for testing hybrid breeding strategies - MANUAL RJ Kerr, MJ Dieters, B Tier	28	GI	-
May	CRC-SPF Technical Report	No. 84 Sampling systems for assessing *Eucalyptus* weevil (*Gonipterus scutellatus*) density in eucalypt plantations J Bulinski, M Matsuki	14	RP	-
May	CRC-SPF Technical Report	No. 86 *Pinus elliottii* var. *elliottii* X *P. caribaea* var. *hondurensis* hybrid verification by cpSSR markers F Elliot, M Shepherd	20	GI	-
May	Presentation Pontevedra, Spain	Sustainable plantations and sustaining landscapes M Battaglia	100	SM	40 min
Jun	CRC-SPF Technical Report	No. 87 A study tour of south-west Western Australia and the Armidale Tablelands: Tree decline, revegetation and farm forestry DC Close	60	SM	-
Jun	Seminar Hobart, Tasmania	A study tour of south-west Western Australia and the Armidale Tablelands: Tree decline, revegetation and farm forestry DC Close	40	SM	60 min
Jun	Industry Project Mount Gambier, SA	TREEPLAN Progress and Planning L Apiolaza, G Dutkowski		GI / ETT	4 days
Jun	Workshop Mount Gambier, South Australia	Converting breeding values for selection criteria traits to breeding objective traits and applying economic weights to calculate profit index GW Dutkowski	15	GI	40 min
Jun	CRC-SPF Technical Report	No. 88 A guide to ProModXL - a spreadsheet interface to ProMod PJ Sands	50	SM	-
Jun	Seminar Hobart, Tasmania	Fundamentals of Papermaking N Vanderhoek	30	ETT	90 min

Grants and Awards

Grant / Award	Awarded for	Duration	Recipients	Amount $
Genetic Improvement Program				
Post-doctoral Fellowship Grant (collaborative grant from Ministry of Science and Technology, Portugal)	Research project based at the Universidade Técnica de Lisboa, Portugal with a six-month period of research at CRC-SPF, Hobart	3 years	Dr João Manuel Monteiro da Costa e Silva Prof MH Almeida A/Prof B Potts	
Australian Academy of Science Travel Award	Visit USA June-September 2002	3 months	Dr M Dieters	7 850
Strategic Initiatives Fund (CRC-SPF)	Sequencing the chloroplast genome of *Eucalyptus globulus*	1 year	Dr R Vaillancourt Dr D Steane A/Prof B Potts Prof J Reid	55 000
Best poster	Best poster at the International IUFRO Symposium of Eucalypt Genetics and Breeding, held in Valdivia, Chile, 10-14 September 2001		Dr B Patterson	
Best series of posters	Best series of posters at the International IUFRO Symposium of Eucalypt Genetics and Breeding, held in Valdivia, Chile, 10-14 September 2001.		CRC-SPF Genetic Improvement Program	
Most prolific speaker	Most prolific speaker at the International IUFRO Symposium of Eucalypt Genetics and Breeding, held in Valdivia, Chile, 10-14 September 2001.		Mr G Dutkowski	
Golden Microphone Award	The largest number of questions and comments at the International IUFRO Symposium of Eucalypt Genetics and Breeding, held in Valdivia, Chile, 10-14 September 2001.		Dr L Apiolaza	
Sustainable Management Program				
Australian Academy of Science European Union Traveling Grant	Visit EU countries Aug-Sept 2000 to develop collaborative research project: Tree, water and nitrogen use efficiency	4 weeks	Dr Z Xu	7 000
ARC-QDPI Forestry Linkage Grant	Hoop pine nitrogen and water use efficiency: improving the understanding and management with advanced stable isotope, physiological and molecular techniques	3 years	Prof J Hughes Dr Z Xu Dr M Hunt Prof K Lundkvist	320 000
Griffith University Research Grant	C and nutrient cycling processes in forest ecosystems	1 year	Dr Z Xu Dr C Chen Dr I Phillips	62 000
Strategic Initiatives Fund (CRC-SPF)	Testing improved site management practices for improved soil organic matter quality and composition using advanced ^{13}C and ^{31}P NMR spectroscopy	1 year	Ms N Mathers Dr Z Xu Dr S Boyd Mr J Simpson Dr C Chen	27 613

Grant / Award	Awarded for	Duration	Recipients	Amount $
Strategic Initiatives Fund (CRC-SPF)	Is growth a function of water-use efficiency in *E. nitens*?	1 year	Dr C Beadle Dr Z Xu Dr P Smethurst Ms D Spurr Dr N Prasolova	15 244
AFFA	Science Award for Young People	1 year	Dr D Close	4 000
Natural Heritage Trust	Growing Blackwood on farms for high quality timber	1 year	Dr J Medhurst	74 900
RIRDC	Seed and information support for farm forestry	3 years	Dr T Booth	11 400
Strategic Initiatives Fund (CRC-SPF)	Waterlogging in the Greater Green Triangle: quantifying the effects on tree growth	1 year	Dr M Battaglia Dr F Henskens	22 688
Resource Protection Program				
Australian Academy of Science	Scientific visit to Canada and USA to study methods for forest protection using environmentally-friendly insecticides at CFS Great Lakes Forestry Centre, Sault St Marie, Ontario and USDA Savannah River Institute, New Ellenton, South Carolina	6 weeks	Dr J Elek	10 600
Australian Museum, Sydney	Visiting Research Fellowship to prepare a taxonomic revision and web-based interactive key to a species of *Amorbus*	1 month	Dr M Steinbauer	5 083
Hellmuth Hertz Foundation, Royal Physiographic Society of Lund, Sweden	Autumn gum moth sex pheromone research in collaboration with Dr F Ostrand (Lund University)	1 year	Dr M Steinbauer	47 776
Strategic Initiatives Fund (CRC-SPF)	Management and biology of scarab beetle establishment pests	1 year	Mr J Matthiessen	15 000
Natural Heritage Trust	Demonstration and farm surveys of eucalypt seedling tolerance to native animal browsing	1 year	Dr C McArthur Dr D Close	61 800
Strategic Initiatives Fund (CRC-SPF)	Use of lupins in reducing browsing damage to seedlings in plantation forestry	1 year	Dr C McArthur Dr P Smethurst E Pietrzykowski Mr C Barnes	19 000
Australian Research Council Linkage	Understanding and manipulating stress physiology of eucalypt seedlings to improve survival and growth	3 years	Dr D Close Dr C McArthur Dr P Brown Dr M Hovenden Dr C Beadle Dr G Holz Prof A Hagerman	250 500
Australian Research Council Linkage	Risk impact on productivity and control of *Mycosphaerella* infections in Plantations of *E. nitens* and *E. globulus*	3 years	Dr C Mohammed Dr M Battaglia Dr C Beadle Mr T Wardlaw Dr D de Little	190 000

Grant / Award	Awarded for	Duration	Recipients	Amount $
Maxwell Ralph Jacobs Travel Grant	Attendance at Beetle Conference and study visit to the Australian National Insect Collection (CSIRO Entomology)	3 weeks	Ms M Yee	2 000
FWPRDC	Attendance at the International Mycological Conference, Norway	2 weeks	Dr K Barry	5 000
Strategic Initiatives Fund (CRC-SPF)	The use of remote sensing technology to detect severity levels of *Mycosphaerella* attack in *E. globulus*	1 year	Dr C Mohammed Mr T Wardlaw Mr D Culvenor Dr N Coops	25 000
Student exchange to Japan	Association of International Education, Japan – visit to Mie University	6 months	Ms A Eyles	8 500
Australian Academy of Science	Imaging of free radical formation in the reaction zone of young eucalypt challenged with stem decay fungi	6 weeks	Dr C Mohammed	7 700

Consultancies

Consultancy with	For	Duration	Recipients	Amount $
STBA	*Pinus radiata* variance components estimation for national evaluation using TREEPLAN	3 days	Mr G Dutkowski	1 800
PFT	Dry demo site analysis	4 days	Dr P Smethurst	3 000
Various	Chemical analyses	15 days	Dr P Smethurst	14 000
PFT	PROMOD for Farm Forestry Toolbox version 3 upgrade	5 days	Dr P Sands	5 000
RIRDC/JVAP	Information support for Farm Forestry	11 weeks	Dr M Battaglia Dr P Sands Mr D Mummery	11 000
URS	Assessment of Yates Forestry interpretation of soil conditions as PROMOD inputs	1 day	Dr M Battaglia	1 200
URS	Application of process-based model CABALA to examine potential for second growth decline among *E. globulus* plantations in southern Australia	5 days	Dr M Battaglia	5 500
FFIC	Post harvest staining in Blackwood	6 months	Dr K Barry Dr C Mohammed Dr C Beadle	25 000
PFT	Training for professional foresters	6 months	Dr N Davidson Mr G Dutkowski	60 000
Hydro Tasmania	Gordon River riparian vegetation assessment update to the Basslink Integrated Impact Assessment Statement	1 month	Dr N Davidson	10 000

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. 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 (PCCs) 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). The PCCs are chaired by industry representatives and consist largely of the partners' staff to ensure that they are involved setting research priorities.

- *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) totalled 629 person-days for 2001/02.

- *Proportion of joint publications with other research groups*

Ninety five (56%) of the 170 technical publications (refereed, in-press, unrefereed, book chapters, theses) were written with other research groups.

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

There was a large number of visitors to the CRC, and to CRC-arranged seminars. Those who stayed for longer periods and had a particular influence on CRC activities were:

Ms Roa Hongxin and Mr Li Bohai (Hunan Forestry Department) worked with the GI group in Hobart for 6 months, December 2001 to June 2002.

Prof Bailian Li (North Carolina State University, USA) spent two weeks with Dr M Dieters (GI) at QFRI Gympie during July 2001.

Dr Jean-Michel Leban (National Institute for Agricultural Research, France) visited QFRI Brisbane from 4-12 January 2002 to interact with members of the CRC-SPF decision support project, Dr K Catchpoole, Dr M Nester and Dr K Harding (GI).

Dr Kenneth Lundkvist (Department of Forest Genetics, Swedish University of Agricultural Sciences, Uppsala, Sweden) visited from 26 February - 28 March 2002, and worked at QFRI with Dr Zhihong Xu (SM) on analysis of inheritance of water and nutrient use efficiency in Hoop pine families and exotic F_1 hybrid clones.

Prof Zhen-Miao Xie (College of Environmental Science and Natural Resources, Zhejiang University, Hangzhou, PR China) visited from 16-21 December 2001, and worked at QFRI with Dr Zhihong Xu.

Dr Christine Stone (State Forests of New South Wales) gave a presentation on plant health in Hobart, 15 January 2002. She also interacted with many in the Resource Protection Program during her visit.

Dr Alan Carroll (Pacific Forestry Centre, Canadian Forest Service, Victoria, British Columbia) worked on a three month project with Dr M Steinbauer (RP) in Canberra, 3 February to 27 April. During his stay he also visited ANU, Timbercorp in Victoria and CRC-SPF in Hobart.

Dr Alan York (Forest Science Centre, University of Melbourne), gave a presentation on "Insect diversity and sustainable indicators" in Hobart, 16 May 2002, and had discussions with Dr G Allen, Ms M Yee and Ms S Baker (RP).

Dr Richard Leschen (New Zealand Landcare Research, NZ), gave a presentation on Beetle taxonomy, in Hobart on 9 January 2002 and had discusions with Dr M Matsuki, Ms M Yee and Ms S Baker (RP)..

Brendan Murphy (PhD student from University of Canterbury, New Zealand) visited for four weeks in March 2002 to complete his PhD work with the Resource Protection Program.

- *The degree of interaction among scientific staff at dispersed locations on core activities of the research program, included:*

  - the economic importance and genetic control of growth, stem characteristics and wood properties at the quantitative and molecular levels

The genetics program is structured to ensure close interaction between projects both within and across nodes of the CRC. The quantitative 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 tropical hybrid pines, A1 and A4 work closely together on the molecular genetics of temperate eucalypts, and A3 and

A5 interact in studying the genetic control and mapping of wood property genes in *Eucalyptus globulus*. The breeding strategies project A2 integrates research in the other temperate projects for strategy development. There is also regular interaction between the various groups working in the same field across different nodes. 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 interact on the application of genetic models and use of specialised programs (e.g. ASREML) for estimating genetic parameters and breeding values. Project A2 works with scientists from QFRI, GL, STBA, CSIRO and FT on the use of ASREML software for the analysis of their data. Project A1 links with projects A6 and A7 on problems associated with eucalypt genetics and hybridisation, which are common to temperate and sub-tropical eucalypts. Project A1 is conducting research projects on the genetics of *E. globulus* across Australia in southern Tasmania (UT and NS), northern Tasmania (GL), Western Australia (WACAP and STBA), and in Victoria (GRP) Project A2 has been working closely with STBA on the development of data management and analysis systems, as well as breeding and analysis strategies.

Project A5 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 in Canberra. There are also strong links with FT and GL with joint projects, and Peter Kube from FT is undertaking PhD studies with the Centre.

There is a strong link between projects A6 and A7 with frequent inter-site visits and meetings involving both research groups, such as the recent Woodfest seminar series. Several projects involve collaboration between Genetic Improvement Program (GI) projects A1 and A3 and the Sustainable Management Program (SM), and there is increasing linkage between GI, SM and the Resource Protection Program (RP) on the genetics of pest and disease resistance.

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

Project A2 provides research results from the southern node projects for the breeding and deployment strategies of industry. It has strong links with most industrial partners and is closely integrated with STBA's *Eucalyptus* Breeding Program (to which 80% of partners belong) and its spin-off company *seedEnergy*. This link is enhanced by the location of one of the managers, Peter Gore, on the University of Tasmania campus. The CRC has representation on the STBA Board (Greg Dutkowski, Sandra Hetherington, Richard Breidahl), and on the Technical Committee, and Research, Quantitative Genetics and Data Management Sub-Committees (Greg Dutkowski, Dr Luis Apiolaza and Dr René Vaillancourt), which has assisted in the transfer of technology from the program to this and other partners. Project A1 interacts closely with STBA and its members in providing research to back new seed production systems being developed for *E. globulus*. It also collaborates with STBA and its spin-off company *seedEnergy* on research into self-incompatibility and flowering time in arboreta and seed orchards across Australia. Project A2 has been closely involved with scientists in the STBA in the design and implementation of TREEPLAN® and STBA-DMS® breeding value prediction and data management systems. Project A6 is based within and closely interacts with QFRI, the organisation responsible for the breeding and deployment of sub-tropical pines in Queensland.

- pruning and thinning

Dr Chris Beadle (CSIRO) and Andy Warner (PFT) are jointly organising a blackwood workshop and study tour with Forest Research New Zealand. Attendance by Australian delegates, including from CRC partners Forestry Tasmania and Private Forests Tasmania, will be funded by the Joint Venture Agroforestry Program. This workshop in November will provide a major opportunity to learn about the silvicultural techniques that have been specifically developed for managing blackwood on farms in New Zealand.

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

There is close interaction between projects B1 and B2 concerning organic matter and nutrient cycling. Two major activities: (i) the inclusion of Queensland soils in the base cation research of Dr Andrew Mitchell, and (ii) SIF-funded collaboration between these two projects to investigate foliar C, N and water use by *E. nitens*, are in place.

- forestry extension as a tool for assisting forest owner, farmer and stakeholder decision-making

Dr Digby Race (ANU) and other members of the B3 Farm Forestry project organised a conference on Forestry Extension that was held in Victoria in November 2001. The CRC-SPF was a sponsor of this meeting.

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

In association with PFT and FT, the CRC has developed version 3 of the Farm Forestry Toolbox CD. This incorporates a version of PROMOD for *E. nitens*. A dynamic version of PROMOD called CABALA has been developed that can examine the consequences of silviculture on productivity in the current and subsequent rotations. Project B4 staff led a workshop for partners on the use of these models in July 2001.

- measurement of leaf area index in the field

Ms Maria Cherry has trained staff of partners in the use of the Visual Guide for measuring leaf area index both in Tasmania and at Timbercorp in Hamilton, Victoria.

- investigation of pathogens of forest insect pests

This research in Tasmania has essentially concluded following the retirement of Dr John Madden (now honorary CRC Fellow). Industry was satisfied with the progress that had been made.

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

There has been a high degree of collaboration between locations in research on insect herbivores. Dr M Matsuki (Tasmania) and M Short (Canberra) have collaborated in research on parasitoids of Autumn gum moth. Dr M Matsuki and Dr J Bulinksi (Timbercorp, WA) have been studying the spatial variation of eucalypt weevil in south-west WA. Dr M Matsuki (Tasmania) and Dr A Loch (WA) have collaborated on developing efficient insect monitoring schemes for major insect pests in plantations. Research on Autumn gum moth continues with interaction between Dr M Steinbauer (Canberra), Dr A Loch (WA) and Dr G Allen's group (Tasmania). Research on key insect pests in WA forestry involves Timbercorp and WAPRES (WA) with Dr R Floyd (Canberra), J Matthiessen (Perth WA) and Dr A Loch (Manjimup WA). Dr M Matksuki has established an e-group between all researchers in the Resource Protection Program and interested forestry companies for rapid communication of information relating to insect pests and other factors affecting tree health.

- impact of insect pests at plantation establishment

H Redgrove and Dr G Allen (UT) have been investigating the biology of *Heteronyx* beetles and their effect on establishment of *E. nitens* plantations with Dr D de Little (GL). Collaborative research between J Matthiessen (CSIRO, WA) and Dr J Bulinski (Timbercorp) has identified native scarab insect pests (*Liparetrus* and *Heteronyx* spp.) as new threats to successful plantation establishment.

- genetic and chemical basis of eucalypt resistance to browsing

Dr C McArthur has run collaborative trials with R Appleton at GRP in Victoria on provenance variability of *E. globulus* to browsing, and they have completed a project on variation in susceptibility of nursery stock to rabbit browsing. Dr C McArthur has also recently completed a project with Dr J Bulinski at Timbercorp, WA, on predicting browsing damage in eucalypt plantations. Collaboration continues between Dr C McArthur and J O'Reilly (RP) with A/Prof B Potts (GI) on genetic variation of resistance of *E. globulus* and *E. nitens* to browsing. The RP projects in Hobart closely interact with the GI program in research related to resistance breeding, and several PhD students are jointly supervised.

- investigation of pathogens of plantation trees

Research on stem decay, mechanisms of tree defence and wound tissue formation has continued between Dr C Mohammed (CSIRO/UT), and W Neilsen, Dr E Pinkard and T Wardlaw (FT). *Mycosphaerella* research has also progressed with collaboration between Dr C Mohammed and several companies in Tasmania (Dr D de Little, GL; T Wardlaw, FT) and Western Australia (Dr J Bulinksi, Timbercorp).

Research and researchers

- *Papers in refereed journals*

In 2001/02 the Centre produced a total of 210 publications, 101 in refereed journals, 94 unrefereed publications and 14 theses.

- *Book chapters covering the results of the Centre's research*

Auckland LD, Bui T, Zhou Y, Shepherd M, Williams CG (2002). Transpecific recovery of pine microsatellite. In 'Conifer Microsatellite Handbook'. (Eds CG Williams and LD Auckland) pp. 27-28. (Texas A & M University: College Station, Texas, USA)

Smethurst PJ, Baillie CC, Cherry ML (2001). Nutritional effects on leaf area index and growth of a young *Eucalyptus nitens* plantation. In 'Plant Nutrition - Food Security and Sustainability of Agro-Ecosystems Through Basic and Applied Research'. (Ed. WJ Horst) pp. 928-929. (Kluwer Academic: Dordrecht, Holland)

Cherry ML, Macfarlane C, Smethurst PJ, Beadle CL (2002). Visual Guide to Leaf Area Index of Eucalypt Plantations. 22 pp. (CRC-SPF, Hobart, Tasmania)

Race D, Reid R (Eds) (2001). Forestry extension: Assisting forest owner, farmer and stakeholder decision-making. Proceedings of IUFRO Extension Working Party (S6.06-03). 472 pp. (Lorne, Victoria.)

Candy SG, Zalucki MP (2002). Defoliation. In 'Encyclopedia of Environmetrics'. (Ed. AH El Shaarawi) pp. 479-484. (John Wiley & Sons: Chichester, UK)

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

There were 7 invited presentations in 2001/02:

Genetic Improvement

Griffin AR (2001). Deployment decisions – capturing the benefits of tree improvement with clones and seedlings. 'Developing the Eucalypt of the Future'. IUFRO International Symposium Valdivia, Chile. (invited speaker)

Henry R (2002) Invited speaker at 'Plant, Animal & Microbe Genomes X', San Diego 12-16 Jan 2002)

Henry R (2002) Invited speaker at 'Australasian Gene Mapping Workshop' on Comparative Genomics 11-12 July 2002

Potts BM and Dungey HD (2001). Hybridisation of *Eucalyptus*: Key issues for breeders and geneticists. 'Developing the Eucalypt of the Future'. IUFRO International Symposium Valdivia, Chile. (invited speaker)

Sustainable Management

Battaglia M (2002). Modelling drought risk in *Eucalyptus globulus* plantations in a Mediterranean climate. In 'Proceedings of IUFRO Workshop on Reality, models and parameter estimation – a forestry scenario'. June 2002, Sesimbra, Portugal.

Battaglia M (2001). Sustainable plantations in sustainable landscapes. In 'Symposium on Technical, Social and Ecomonical Issues of *Eucalyptus*' May 2002, Pontevedra, Spain.

Resource Protection

R Floyd was an invited speaker at the "Pest Management in *Eucalyptus* Plantations" symposium, International Congress of Entomology, Iguassu Falls, Brazil.

- *Number and value of competitive grants awarded*

Fourteen competitive grants were awarded to CRC staff during the last financial year, totalling $762 874.

- *Honours and awards*

Eleven awards were presented to students of the CRC-SPF.

Marian McGowen won the prize for best poster at the Joint Conference of the Australasian Evolution Society and the Society of Systematic Biologists, July 2001;

Luke Rapley was awarded a prize for the best talk at the Australian Entomology Society Conference, Sydney September 2001;

Rhonda Stokoe and Megan Jones received travel awards of $800 and scholarships of US$400 for high quality abstracts to attend the Stevenson Conference on Tree Technology, July 2001;

Tim Blumfield was awarded a travel grant for his oral presentation at the World Congress of Soil Science, Bangkok, August 2002;

Julianne O'Reilly was awarded the 'AFFA Science and Innovation Award for Young People', sponsored by the Forest and Wood Products Research and Development Corporation, July 2002;

Andrew Laird received the Bill Jackson Honours Scholarship, February 2002;

Briony Patterson was awarded "Best poster" at the International IUFRO Symposium of Eucalypt Genetics and Breeding, held in Valdivia, Chile, 10-14 September 2001;

CRC-SPF Genetic Improvement Program was awarded the "Best series of posters" at the International IUFRO Symposium of Eucalypt Genetics and Breeding, held in Valdivia, Chile, 10-14 September 2001;

Greg Dutkowski was awarded the "Most prolific speaker" at the International IUFRO Symposium of Eucalypt Genetics and Breeding, held in Valdivia, Chile, 10-14 September 2001;

Luis Apiolaza was given the "Golden Microphone Award" for the largest number of questions and comments at the International IUFRO Symposium of Eucalypt Genetics and Breeding, held in Valdivia, Chile, 10-14 September 2001.

Education and training

- *Time spent by researchers on research training*

CRC-SPF has 76 affiliated postgraduate and Honours students. It is recognised that each student takes 5–10%

of a researcher's time to supervise. This is equivalent to 3.75–7.5 person-years on research training.

- *Number of postgraduate students working in the Centre*

The Centre has 68 postgraduate students and 8 Honours students (see Table 3).

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

Genetic Improvement	26
Sustainable Management	30
Resource Protection	20

- *Number of enrolments in special courses*

Forest Ecology, a special undergraduate course in Plant Science at the University of Tasmania, had twelve students enrolled. In addition there a wide range of workshops and field days organised to train industrial staff, including four special training workshops ('fests'):-

'Genfest: a slice of life' a workshop discussing genetics and breeding, Genetic Improvement Program, 10 October 2001.

'Seedfest', a workshop outlining current technology to enhance seed production, Genetic Improvement Program, Hobart, 8 February 2002.

'Seedfest', a workshop outlining current technology to enhance seed production, Genetic Improvement Program, Melbourne, 11-12 February 2002.

'Woodfest' a workshop on breeding for wood properties, Genetic Improvement Program, Gympie, 15 April 2002.

The total number of enrolments for all these courses was 333.

- *Quality and number of postdoctoral fellows attracted*

Thirteen postdoctoral fellows worked with the Centre in 2001/02: Dr R Thumma in molecular genetics (CSIRO FFP, Canberra), Dr M Steinbauer in entomology (CSIRO Ento, Canberra), Dr M Shepherd in molecular biology (SCU, Lismore), Dr D Close in tree physiology (UT and CSIRO FFP, Hobart), Dr N Prasolova on soil nutrition (GU, Brisbane), Dr D Steane and Dr B Patterson in molecular genetics (UT, Hobart), Dr F Henskens on canopy nitrogen dynamics (CSIRO FFP, Hobart), Dr A Loch on pest management of Blue gums (CSIRO Ento, Perth), Dr A O'Grady in root biomass turnover (CSIRO FFP, Hobart), Dr A Mitchell (CSIRO FFP, Hobart) on availability of base cations, Dr K Barry in tree pathology (CSIRO FFP, Hobart), and Dr M Matsuki in insect ecology (UT, Hobart).

- *Rate and percentage of completion of higher degrees*

Twelve students completed this year, 8 PhD and 4 Honours.

PhD: Andrew Hingston, Sven Ladiges, Kirsten le Mar, Gustavo Lopez, Nicole Mathers, Michelle McGranahan, Carolyn Raymond, Yetti Setiawatti.

Honours: Fiona Poke, Rebecca Pryor, Natasha Wiggins, Sally Ward.

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

The success of our students in obtaining employment was demonstrated by appointments this year: K Barry (Research Fellow in RP, CRC-SPF); D Close (Research Fellow in RP/SM, CRC-SPF), Dr D Williams (Postdoctoral Fellow UT), P Volker (Postdoctoral Fellow UT), E Pietrzykowski (Technical Officer, NHT project on mammalian browsing), A Gibbons (Research Officer, Australian National Museum, NT),

Application of research

- *Degree of adoption of research results by industry*

There were twenty-seven discreet areas of CRC research for which technology was transferred to industry this year (see Industry Uptake, in Utilisation and Application of Research).

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

Forty technical reports were produced by the Centre, 24 of which were in the CRC Technical Report series. In addition, 27 technical news sheets were released ('Hot off the Seed Bed', 'Beyond the Black Stump' and 'Pest Off'), and four articles appeared in newsletters of member organisations.

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

Ten consultancies were conducted during 2001/02 (see Grants and Awards and Consultancies). Advice was also provided through participation on national committees. For example, Greg Dutkowski (GI) is a member of the STBA Board, on the Technical

Committee of STBA and three subcommittees of the STBA Technical Committee, and is also a member of Research Working Group 1 (RWG1, Forest Genetics) A/Prof Brad Potts (GI) is a member of RGW1, and is on the subcommittee for Forest Genetic Resources, on the Biodiversity Advisory Panel for the Tasmanian Government 'State of the Environment Report'. Dr Clare McArthur (RP) has close links with industry and government through the Browsing Damage Management Group (BDMG), as well as direct interaction with industry (see Grants and Awards). Dr Neil Davidson gave a presentation to the Joint Assessment Panel (comprised of representatives from the Federal, Victorian and Tasmanian governments) on the impact of the Basslink hydro-electric proposal on riparian vegetation of the Gordon River.

- *Number of presentations to companies or user groups*

The CRC-SPF ran a wide range of technology transfer activities for partners during 2001/02. These included 145 public presentations including 45 conference or symposia presentations and 88 seminars as well as eleven CRC-run workshops, one short course and six field days.

- *Number and financial contribution of potential users*

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

- *Number of visitors from user groups*

The main user group of CRC-SPF technology are the partners of the Centre. Staff of CRC-SPF partners are constantly involved in within-CRC visits, and these visits are included in the 629 person-days documented for 2001/02 (see Cooperative Arrangements, Performance Indicator 2).

- *Number of media or trade journal presentations*

In the last year, five articles relating to Centre activities appeared in newspapers and industry newsletters, and four segments in the electronic media.

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

In 2001/02 CRC-SPF held an Annual Meeting, gave 145 public presentations (45 conference or symposia presentations and 88 seminars), and ran eleven workshops, one short course and six field days, to transfer results to industry and the public. An estimated 4565 people attended these activities (see Technology Transfer Activities p73).

Management and budget

- *Establish procedures to report on progress and achievements*

Plans in place include a Strategic Plan, and a set of 'deliverables' agreed upon to meet industry expectations of progress in research areas. The quality and quantity of research is monitored and reviewed, and its value to industry assessed through Program Coordinating Committees, the Advisory Panel, the Board, and the Annual Report Process.

- *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 for each project. 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 seven staff changes, including a change of CRC Director, during 2001/02 (see Staffing and Administration).

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

All projects completed their milestones within the planned time and budget, with the exception of four that were modified with the agreement of the Program Coordinating Committee and the Commonwealth.

- *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), half yearly reporting to the Board, annual external audit of the financial accounts, and an Annual Report.

Budget

Notes to and forming part of the accounts for 2001/02

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, excluding outstanding debtors at 30 June each year. The closing balance for 2001/02 shown in Table 2 includes provision for a Doubtful Debt of $25,000 from Australian Plantation Timber Limited. The outstanding cash membership contribution for 2001/02 is being pursued through the receiver

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 monthly cash balances 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) Member contributions
Budget estimates of contributions are taken from the original Commonwealth Agreement and actual figures are provided by the members. During 2001/02 receivers were appointed to Australian Plantation Timber Limited and its CRC membership was subsequently terminated. Private Forests Tasmania downgraded its membership and contribution level to Associate in 2001/02. Serve-Ag has advised that during the year it ceased its involvement in forestry and was not able to make an in-kind contribution. The change of ownership in Australian Paper Plantations and the renaming as Grand Ridge Plantations involved a significant reorganisation including contribution to research. The in-kind contribution was reduced because of this. Action is being taken to improve this situation in the future.

(f) Allocation from Commonwealth Grant
During 2001/2002 the CRC received the usual four quarterly grant payments.

Deloitte Touche Tohmatsu
A.B.N. 74 490 121 060
ANZ Centre
Level 9
22 Elizabeth Street
Hobart TAS 7000
GPO Box 777
Hobart TAS 7001 Australia

DX 197
Telephone (03) 6237 7000
Facsimile (03) 6237 7001
www.deloitte.com.au

Deloitte Touche Tohmatsu

AUDITOR'S REPORT TO THE COOPERATIVE RESEARCH CENTRES PROGRAM, DEPARTMENT OF EDUCATION, SCIENCE AND TRAINING REPRESENTING THE COMMONWEALTH IN RESPECT OF COOPERATIVE RESEARCH CENTRE FOR SUSTAINABLE PRODUCTION FORESTRY

FINANCIAL INFORMATION FOR THE YEAR ENDED 30 JUNE 2002

Scope

We have audited the financial information of the Cooperative Research Centre for Sustainable Production Forestry as set out in Tables 1,2,3 and 4 of the Annual Report for the year ended 30 June 2002. 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 to 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 Education, Science and Training, 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 (Contributions), 5(1), 5(2), 5(3) (Application of the Grant and Contributions), 9(1), 9(5) (Intellectual Property) and 12(2) (Financial Provisions), 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, with the following exceptions:

Organisation	Amount Committed $	Amount Provided $
Australian Plantation Timber	250,000	NIL
Norske Skog Paper Mills	209,000	186,900
Griffith University	267,900	229,200
Gunns Limited	341,000	334,300
Timbercorp	364,300	347,400
Private Forests Tasmania	44,400	18,200
The University of Queensland	72,000	71,800
Serve-Ag	19,800	800
Grand Ridge Plantations	241,000	82,300

and the total value of all Contributions for the year under report equalled or exceeded the amount of Commonwealth Government Grant paid during the year (not including advances). [Clause 4]

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. [Clause 5(1)]

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 [Clause 5(2)]

4. Capital Items acquired from the Grant and Researcher's Contributions are vested as provided in the Joint Venture Agreement. [Clause 5(3)]

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. [Clause 9(1), 9(5)]

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. [Clause 12(2)]

Deloitte Touche Tohmatsu

DELOITTE TOUCHE TOHMATSU

L.T Cox
Partner
Chartered Accountants
Hobart, 19 August 2002

ATTACHMENT A

Co-operative Research Centre for Sustainable Production Forestry
Summary of Base Grant Funds 2001/2002

Opening Balance at 1/7/01	1,923,464
Add Income	2,878,674
Outstanding debtors at 1/7/01	26,734
Less Expenditure	
Salaries, scholarships and associated costs	1,899,278
Consumables	1,015,369
Equipment	69,262
Total Expenditure	2,983,909
Balance at 30/6/02	1,844,963
Less outstanding debtors at 30/6/02	56,250
Closing Balance at 30/6/02	**1,788,713**

RESEARCH STAFF RESOURCES (2001/2002)

ATTACHMENT B

Organisation	Main Activity	Total % Time	% Spent on Research Program GI	SM	RP	Total on Research	% Spent on Educn	% Spent on Commln Program	% Spent on CRC Admin
Australian Forest Growers									
M Speedy	E	1					1		
Total		1	0	0	0	0	1	0	0
CSIRO Entomology									
A Loch	R	100			100	100			
A Wharton	R	100			100	100			
J Matthiessen	R	30			30	30			
R Floyd	R	25			25	25			
R Milner	R	20			20	20			
Total		275	0	0	275	275	0	0	0
CSIRO Forestry & Forest Products									
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			
G Moran	R	30	30			30			
B McCormack	R	10		10		10			
E Williams	R	10	10			10			
C Mohammed	R	10			10	10			
R Evans	R	5	5			5			
S Nambiar	A	5							5
G Kile	A	5							5
S Midgley	A	2							2
R Lockwood	A	1							1
Total		554	77	454	10	541	0	0	13
Department Primary Industries Qld									
Z Xu	R	65		65		65			
M Nester	R	58		58		58			
M Dieters	R	51	51			51			
K Bubb	R	50		50		50			
M Hunt	R	38		38		38			
J Simpson	R	31		31		31			
M Lewty	R	30		30		30			
D Osborne	R	25		25		25			
A House	R	16		16		16			
K Harding	R	15	15			15			
P Ryan	R	10		10		10			
I Last	R	5	2	3		5			
R Haines	A	40							40
Total		393	68	325	0	393	0	0	0

RESEARCH STAFF RESOURCES (2001/2002)

ATTACHMENT B

Organisation	Main Activity	Total % Time	% Spent on Research Program GI	SM	RP	Total on Research	% Spent on Educn	% Spent on Commln Program	% Spent on CRC Admin
Forest Enterprises Australia									
L Ficca	R	2					2		
G Ogston	R	2					2		
D Barker	R	1					1		
T Cannon	A	1							1
Total		5	0	0	0	0	4	0	1
Forestry Tasmania									
J Elek	R	40			40	40			
A Walsh	R	40			40	40			
P Kube	R	30	29			29			2
L Pinkard	R	20		20		20			
B Neilsen	R	3							3
S Candy	R	3			3	3			
H Elliott	A	10			4	4			6
M Brown	A	5			2	2			3
H Drielsma	A	3							3
Total		154	29	20	89	138	0	0	17
Grand Ridge Plantations									
R Appleton	R	15	5	5	5	15			
P Buxton	R	12	10	2		12			
M Krygsman	R	5	5			5			
S Elms	A	3							3
Total		35	20	7	5	32	0	0	3
Griffith University									
P Healy	R	10		5		5	5		
J Chaseling	R	10		10		10			
J Hughes	R	10		10		10			
I Phillips	R	10		10		10			
S Boyd	R	10		10		10			
B Yu	R	10		10		10			
H Ghadiri	R	10		5		5	5		
H Proctor	R	5		5		5			
R Kitching	A	5							5
Total		80	0	65	0	65	10	0	5
Gunns Limited									
D de Little	R	48			24	24			24
G Holz	R	59		59		59			
I Ravenwood	A	5							5
Total		112	0	59	24	83	0	0	29
Norske Skog Paper Mills									
S Hetherington	R	4	1	1	1	3			1
C Berry	R	3	1		1	2			1
A Willems	A	2							2
Total		9	2	1	2	5	0	0	4
Private Forests Tasmania									
A Warner	R	4		4		4			
A Lyons	R	1		1		1			
G Clark	R	1		1		1			
G Campbell	R	1		1		1			
Total		7	0	7	0	7	0	0	0
SeedEnergy									
P Gore	R	10	10			10			
D Boomsma	R	2	2			2			
Total		12	12	0	0	12	0	0	0

RESEARCH STAFF RESOURCES (2001/2002) ATTACHMENT B

Organisation	Main Activity	Total % Time	% Spent on Research Program GI	SM	RP	Total on Research	% Spent on Educn	% Spent on Commln Program	% Spent on CRC Admin
Southern Cross University									
R Henry	R	30	20			20	10		
M Elphinstone	R	20	20			20			
P Baverstock	A	5							5
Total		55	40	0	0	40	10	0	5
Southern Tree Breeding Association									
T McRae	R	14	14			14			
D Pilbeam	R	13	13			13			
M Powell	R	3	3			3			
Total		30	30	0	0	30	0	0	0
The Australian National University									
P Kanowski	R	30	10	20		30			
D Race	R	25					25		
S Mahendrarajah	R	10		10		10			
R James	R	10					10		
Total		75	10	30	0	40	35	0	0
The University of Queensland									
D Doley	R	25		25		25			
Total		25	0	25	0	25	0	0	0
Timbercorp									
I Bail	R/A	20		10		10			10
J Bulinski	R	46			46	46			
A Tys	R	8		8		8			
Q Clasen	R	8		8		8			
P Smale	R	8		8		8			
H O'Sullivan	R	8	8			8			
C O'Connor	R	3	2			2			1
Total		101	10	34	46	90	0	0	11
University of Tasmania									
J Reid	A	50	10			10	10		30
R Griffin	A	50							50
B Potts	R	50	50			50			
C McArthur	R	50			50	50			
G Allen	R	50			50	50			
R Vaillancourt	R	45	45			45			
R Wiltshire	R	20	5			5	15		
S Jennings	R	15		15		15			
C Mohammed	R	15			15	15			
D Close	R	15		5		5	10		
G Jordan	R	15					15		
M Hovenden	E	15					15		
A Richardson	E	10					10		
P Brown	E	5					5		
P McQuillan	E	5					5		
S Shabala	E	5					5		
E Bruce	E	5					5		
J Kirkpatrick	E	5					5		
R Doyle	E	5					5		
N Mendham	E	5					5		
S McLean	E	5					5		
R Boyle	E	5					5		
R Clark	A	15					5		10
G Hallegraeff	A	10							10
R Swain	A	10							10
A Glenn	A	2							2
Total		482	110	20	115	245	125	0	112

RESEARCH STAFF RESOURCES (2001/2002) ATTACHMENT B

Organisation		Main Activity	Total % Time	% Spent on Research Program GI	SM	RP	Total on Research	% Spent on Educn	% Spent on Commln Program	% Spent on CRC Admin
WACAP Treefarms										
C Shedley		R	50	10	30	10	50			
M Barness		R	30		4	25	29			1
S Hunter		R	15		2	2	3			11
D Pilbeam		R	10	10			10			
R Breidahl		R	5	1	2		3			2
I Telfer		R	2	1	1		2			
B Humble		R	2	1	1		2			
P Durrell		R	2	1	1		2			
C Palmer		A	2							2
N Itakura/K Oshima		A	2							2
Total			120	24	41	37	101	0	0	18
CRC Funded										
L Apiolaza	Utas	R	100	100			100			
K Catchpoole	QFRI	R	100		100		100			
C Chen	QFRI	R	100		100		100			
M Matsuki	Utas	R	100			100	100			
A Mitchell	CSIRO FFP	R	100		100		100			
A O'Grady	Utas	R	100		100		100			
M Shepherd	SCU	R	100	100			100			
M Steinbauer	CSIRO Ento	R	100			100	100			
R Thumma	CSIRO FFP	R	100	100			100			
D Steane	Utas	R	80	80			80			
B Patterson	Utas	R	55	55			55			
I Andrew	QFRI	R	52		52		52			
B Potts	Utas	R	50	50			50			
C McArthur	Utas	R	50			50	50			
F Henskens	Utas	R	40		40		40			
P Smethurst	CSIRO FFP	R	28		28		28			
A Fulton	Utas	R	25		25		25			
D Race	ANU	R	25		25		25			
G Jordan	Utas	R	10	10			10			
G Dutkowski	Utas	E	100					100		
N Davidson	Utas	E	100		50		50	50		
J Reid/R Griffin	Utas	A	50				0			50
Total			1565	495	620	250	1365	150	0	50

SUMMARY OF CONTRIBUTIONS IN PERSON YEARS

	Total Person Years	Person Years Spent on Research Program GI	SM	RP	Total on Research	Person Yrs Spent on Educn Program	Person Yrs Spent on Commln Program	Person Yrs Spent on CRC Admin
Total Contributed	25.2	4.3	10.9	6.0	21.2	1.8	0.0	2.2
Total funded by CRC	15.7	5.0	6.2	2.5	13.7	1.5	0.0	0.5
Grand total	40.9	9.3	17.1	8.5	34.9	3.3	0.0	2.7
Proportion of total professional (%) staff resources in each activity	100.0	22.7	41.8	20.9	85.3	8.2	0.0	6.5

SUPPORT STAFF

ATTACHMENT B cont'd.

Contributed	
Organisation	Number of Staff (Person Years)
CSIRO (FFP & Ento)	5.65
Department of Primary Industries Qld	2.27
Forestry Tasmania	1.75
Gunns Limited	1.50
University of Tasmania	0.80
Southern Cross University	0.30
Timbercorp	0.04
WACAP Treefarms	0.17
Norske Skog Paper Mills	0.03
Private Forests Tasmania	0.02
Total	12.53

CRC Funded (by Employing Organisation)	
Organisation	Number of Staff (Person Years)
University of Tasmania	12.0
CSIRO (FFP & Ento)	2.8
Southern Cross University	0.8
Department of Primary Industries Qld	0.5
Total	16.1

IN-KIND CONTRIBUTIONS FROM PARTNERS ($'000)

ATTACHMENT C TABLE 1

PARTNER	EXPENDITURE						CUMULATIVE		PROJECTED				GRAND TOTAL		
	1997/98 Actual	1998/99 Actual	1999/00 Actual	2000/01 Actual	2001/02 Actual	2001/02 Agr'mt	Total to Date Actual	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 FOREST GROWERS															
SALARIES	1.1	1.1	1.3	1.2	**1.3**	**0.0**	6.0	0.0	1.1	0.0	1.1	0.0	8.2	0.0	8.2
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
OTHER	0.3	0.3	0.3	0.3	**0.3**	**1.0**	1.5	5.0	0.3	1.0	0.3	1.0	2.1	7.0	-4.9
TOTAL	1.4	1.4	1.6	1.5	**1.6**	**1.0**	7.5	**5.0**	1.4	1.0	1.4	1.0	10.3	7.0	3.3
AUSTRALIAN PLANTATION TIMBER															
SALARIES	0.0	0.0	0.0	83.0	**0.0**	**83.0**	83.0	166.0	0.0	0.0	0.0	0.0	83.0	166.0	-83.0
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
OTHER	0.0	0.0	0.0	117.7	**0.0**	**117.0**	117.7	234.0	0.0	0.0	0.0	0.0	117.7	234.0	-116.3
TOTAL	0.0	0.0	0.0	200.7	**0.0**	**200.0**	200.7	400.0	0.0	0.0	0.0	0.0	200.7	400.0	-199.3
CSIRO ENTOMOLOGY															
SALARIES	163.2	148.6	216.4	212.6	**226.2**	**152.0**	967.0	760.0	181.6	152.0	168.6	152.0	1,317.2	1,064.0	253.2
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
OTHER	239.7	254.1	260.9	250.7	**238.0**	**273.0**	1,243.4	1,365.0	234.2	273.0	188.7	273.0	1,666.3	1,911.0	-244.7
TOTAL	402.9	402.7	477.3	463.3	**464.2**	**425.0**	2,210.4	2,125.0	415.8	425.0	357.3	425.0	2,983.5	2,975.0	8.5
CSIRO FORESTRY and FOREST PRODUCTS															
SALARIES	652.6	691.1	679.8	722.3	**763.1**	**618.0**	3,508.9	3,178.0	730.0	618.0	748.2	618.0	4,987.1	4,414.0	573.1
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
OTHER	1,410.0	1,495.8	1,460.4	1,291.5	**1,616.9**	**1,345.0**	7,274.6	6,890.0	1,560.9	1,345.0	1,594.7	1,345.0	10,430.2	9,580.0	850.2
TOTAL	2,062.6	2,186.9	2,140.2	2,013.8	**2,380.0**	**1,963.0**	10,783.5	10,068.0	2,290.9	1,963.0	2,342.9	1,963.0	15,417.3	13,994.0	1,423.3
DEPARTMENT OF PRIMARY INDUSTRIES QLD															
SALARIES	449.8	421.7	416.9	460.2	**487.3**	**322.0**	2,235.9	1,610.0	390.8	322.0	390.2	322.0	3,016.9	2,254.0	762.9
CAPITAL	28.4	0.0	0.0	0.0	**0.0**	**0.0**	28.4	0.0	0.0	0.0	0.0	0.0	28.4	0.0	28.4
OTHER	526.0	384.2	426.8	382.5	**379.7**	**380.0**	2,099.2	1,900.0	381.3	380.0	381.0	380.0	2,861.5	2,660.0	201.5
TOTAL	1,004.2	805.9	843.7	842.7	**867.0**	**702.0**	4,363.5	3,510.0	772.1	702.0	771.2	702.0	5,906.8	4,914.0	992.8
FOREST ENTERPRISES AUSTRALIA															
SALARIES	0.0	0.0	0.0	5.0	**4.0**	**0.0**	9.0	0.0	0.0	0.0	0.0	0.0	9.0	0.0	9.0
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
OTHER	0.0	0.0	0.0	1.0	**0.0**	**2.0**	1.0	5.0	2.0	2.0	2.0	2.0	5.0	9.0	-4.0
TOTAL	0.0	0.0	0.0	6.0	**4.0**	**2.0**	10.0	5.0	2.0	2.0	2.0	2.0	14.0	9.0	5.0
FORESTRY TASMANIA															
SALARIES	137.0	157.0	188.0	156.2	**158.0**	**136.0**	796.2	567.0	173.6	149.0	191.1	164.0	1,160.9	880.0	280.9
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
OTHER	179.1	168.6	239.7	199.2	**185.1**	**168.0**	971.7	700.0	203.7	185.0	224.1	203.0	1,399.5	1,088.0	311.5
TOTAL	316.1	325.6	427.7	355.4	**343.1**	**304.0**	1,767.9	1,267.0	377.3	334.0	415.2	367.0	2,560.4	1,968.0	592.4
GRAND RIDGE PLANTATIONS															
SALARIES	65.8	83.2	58.3	66.6	**34.4**	**85.0**	308.3	425.0	95.7	85.0	98.6	85.0	502.6	595.0	-92.4
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
OTHER	135.5	124.9	108.4	120.0	**12.9**	**121.0**	501.7	605.0	136.2	121.0	140.3	121.0	778.2	847.0	-68.8
TOTAL	201.3	208.1	166.7	186.6	**47.3**	**206.0**	810.0	1,030.0	231.9	206.0	238.9	206.0	1,280.8	1,442.0	-161.2

IN-KIND CONTRIBUTIONS FROM PARTNERS ($'000) ATTACHMENT C TABLE 1

PARTNER	EXPENDITURE						CUMULATIVE		PROJECTED				GRAND TOTAL		
	1997/98 Actual	1998/99 Actual	1999/00 Actual	2000/01 Actual	**2001/02 Actual**	**2001/02 Agr'mt**	Total to Date Actual	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
GRIFFITH UNIVERSITY															
SALARIES	163.7	108.8	109.8	83.2	**89.0**	**126.5**	554.5	642.5	106.7	126.5	106.7	126.5	767.9	895.5	-127.6
CAPITAL	0.0	20.0	20.0	20.0	**20.0**	**0.0**	80.0	0.0	20.0	0.0	20.0	0.0	120.0	0.0	120.0
OTHER	150.6	116.5	117.5	89.1	**95.2**	**116.4**	568.9	582.0	114.1	116.4	114.1	116.4	797.1	814.8	-17.7
TOTAL	314.3	245.3	247.4	192.3	**204.2**	**242.9**	1,203.5	1,224.5	240.8	242.9	240.8	242.9	1,685.1	1,710.3	-25.2
GUNNS LTD(Formerly GFP)															
SALARIES	263.0	252.2	154.7	217.7	**209.5**	**100.0**	1,097.1	500.0	100.0	100.0	100.0	100.0	1,297.1	700.0	597.1
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
OTHER	369.0	312.6	158.3	127.7	**99.8**	**216.0**	1,067.4	1,080.0	216.0	216.0	216.0	216.0	1,499.4	1,512.0	-12.6
TOTAL	632.0	564.8	313.0	345.4	**309.3**	**316.0**	2,164.5	1,580.0	316.0	316.0	316.0	316.0	2,796.5	2,212.0	584.5
GUNNS LIMITED															
SALARIES	6.4	24.5	28.4	15.1	**0.0**	**0.0**	74.4	25.0	0.0	0.0	0.0	0.0	74.4	25.0	49.4
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
OTHER	34.8	42.0	13.3	11.0	**0.0**	**0.0**	101.1	175.0	0.0	0.0	0.0	0.0	101.1	175.0	-73.9
TOTAL	41.2	66.5	41.7	26.1	**0.0**	**0.0**	175.5	200.0	0.0	0.0	0.0	0.0	175.5	200.0	-24.5
NORSKE SKOG PAPER MILLS															
SALARIES	34.0	21.1	23.7	29.7	**23.9**	**28.0**	132.4	137.0	25.1	28.0	25.1	28.0	182.6	193.0	-10.4
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
OTHER	186.0	171.0	199.0	188.0	**143.0**	**161.0**	887.0	815.0	180.0	161.0	180.0	161.0	1,247.0	1,137.0	110.0
TOTAL	220.0	192.1	222.7	217.7	**166.9**	**189.0**	1,019.4	952.0	205.1	189.0	205.1	189.0	1,429.6	1,330.0	99.6
PRIVATE FORESTS TASMANIA															
SALARIES	0.0	0.0	10.2	5.5	**11.2**	**8.1**	26.9	20.3	12.0	8.1	8.1	8.1	47.0	36.6	10.5
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
OTHER	0.0	0.0	17.2	0.0	**4.0**	**16.3**	21.2	40.7	5.0	16.3	16.3	16.3	42.4	73.2	-30.8
TOTAL	0.0	0.0	27.4	5.5	**15.2**	**24.4**	48.1	61.0	17.0	24.4	24.4	24.4	89.4	109.8	-20.3
SEEDENERGY PTY LTD															
SALARIES	0.0	0.0	0.0	0.0	**11.4**	**9.4**	11.4	9.4	9.4	9.4	9.4	9.4	30.2	28.2	2.0
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
OTHER	0.0	0.0	0.0	0.0	**1.5**	**1.5**	1.5	1.5	1.5	1.5	1.5	1.5	4.5	4.5	0.0
TOTAL	0.0	0.0	0.0	0.0	**12.9**	**10.9**	12.9	10.9	10.9	10.9	10.9	10.9	34.7	32.7	2.0
SERVE-AG															
SALARIES	0.0	0.0	10.5	8.5	**0.0**	**7.5**	19.0	18.7	0.0	7.5	0.0	7.5	19.0	33.7	-14.7
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
OTHER	0.0	0.0	21.5	12.0	**0.0**	**11.3**	33.5	28.1	0.0	11.3	0.0	11.3	33.5	50.6	-17.1
TOTAL	0.0	0.0	32.0	20.5	**0.0**	**18.8**	52.5	46.8	0.0	18.8	0.0	18.8	52.5	84.3	-31.8
SOUTHERN CROSS UNIVERSITY															
SALARIES	62.9	68.0	70.2	71.0	**75.2**	**60.0**	347.3	300.0	79.5	60.0	82.8	60.0	509.6	420.0	89.6
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
OTHER	189.7	287.8	300.5	306.8	**361.3**	**249.0**	1,446.1	1,245.0	378.6	249.0	261.7	249.0	2,086.4	1,743.0	343.4
TOTAL	252.6	355.8	370.7	377.8	**436.5**	**309.0**	1,793.4	1,545.0	458.1	309.0	344.5	309.0	2,596.0	2,163.0	433.0

IN-KIND CONTRIBUTIONS FROM PARTNERS ($'000)

ATTACHMENT C TABLE 1

PARTNER		EXPENDITURE						CUMULATIVE		PROJECTED				GRAND TOTAL		
		1997/98	1998/99	1999/00	2000/01	2001/02	2001/02	Total to Date		2002/03	2002/03	2003/04	2003/04	Total	Agreement	Difference
		Actual	Actual	Actual	Actual	Actual	Agr'mt	Actual	Agr'mt	Budget	Agr'mt	Budget	Agr'mt	7 Years	7 years	7 years
SOUTHERN TREE BREEDING ASS'N																
	SALARIES	6.0	6.0	14.8	25.7	**26.8**	**0.0**	79.3	0.0	23.8	0.0	23.8	0.0	126.9	0.0	126.9
	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
	OTHER	0.0	37.0	0.0	0.0	**0.0**	**5.0**	37.0	25.0	0.0	5.0	0.0	5.0	37.0	35.0	2.0
	TOTAL	6.0	43.0	14.8	25.7	**26.8**	**5.0**	116.3	25.0	23.8	5.0	23.8	5.0	163.9	35.0	128.9
THE AUSTRALIAN NATIONAL UNIVERSITY																
	SALARIES	59.2	59.2	62.6	67.4	**71.6**	**63.8**	320.0	319.0	67.4	63.8	67.4	63.8	454.8	446.6	8.2
	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
	OTHER	177.7	177.7	187.8	202.2	**214.8**	**112.0**	960.2	560.0	202.2	112.0	202.2	112.0	1,364.6	784.0	580.6
	TOTAL	236.9	236.9	250.4	269.6	**286.4**	**175.8**	1,280.2	879.0	269.6	175.8	269.6	175.8	1,819.4	1,230.6	588.8
THE UNIVERSITY OF QUEENSLAND																
	SALARIES	8.6	23.6	24.3	24.6	**24.8**	**25.0**	105.9	125.0	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	0.0	0.0	0.0	0.0	0.0	0.0
	OTHER	10.0	47.0	47.0	47.0	**47.0**	**47.0**	198.0	235.0	47.0	47.0	47.0	47.0	292.0	329.0	-37.0
	TOTAL	18.6	70.6	71.3	71.6	**71.8**	**72.0**	303.9	360.0	72.0	72.0	72.0	72.0	447.9	504.0	-56.1
TIMBERCORP																
	SALARIES	0.0	0.0	20.6	114.8	**89.1**	**93.8**	224.5	211.1	93.8	93.8	93.8	93.8	412.1	398.7	13.4
	CAPITAL	0.0	0.0	2.0	0.0	**0.0**	**0.0**	2.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	2.0
	OTHER	5.0	5.0	5.0	272.8	**195.8**	**220.5**	483.6	517.6	220.5	220.5	220.5	220.5	924.6	958.6	-34.0
	TOTAL	5.0	5.0	27.6	387.6	**284.9**	**314.3**	710.1	728.7	314.3	314.3	314.3	314.3	1,338.7	1,357.3	-18.6
UNIVERSITY OF TASMANIA																
	SALARIES	385.4	402.7	410.5	455.3	**472.2**	**386.7**	2,126.1	1,933.5	479.1	386.7	492.0	386.7	3,097.2	2,706.9	390.3
	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
	OTHER	703.1	825.3	792.4	828.8	**845.3**	**763.0**	3,994.9	3,753.0	854.2	763.0	866.3	763.0	5,715.4	5,279.0	436.4
	TOTAL	1,088.5	1,228.0	1,202.9	1,284.1	**1,317.5**	**1,149.7**	6,121.0	5,686.5	1,333.3	1,149.7	1,358.3	1,149.7	8,812.6	7,985.9	826.7
WACAP TREEFARMS																
	SALARIES	65.9	71.4	62.8	55.7	**61.0**	**55.0**	316.8	275.0	63.8	55.0	63.8	55.0	444.4	385.0	59.4
	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
	OTHER	106.0	113.1	113.4	116.0	**116.0**	**115.0**	564.5	575.0	115.0	115.0	115.0	115.0	794.5	805.0	-10.5
	TOTAL	171.9	184.5	176.2	171.7	**177.0**	**170.0**	881.3	850.0	178.8	170.0	178.8	170.0	1,238.9	1,190.0	48.9
TOTAL IN-KIND CONTRIBUTIONS																
	SALARIES	2,524.6	2,540.2	2,563.8	2,881.3	**2,840.0**	**2,359.8**	13,349.9	11,222.5	2,658.4	2,289.8	2,695.7	2,304.8	18,704.1	15,817.2	2,886.9
	CAPITAL	28.4	20.0	22.0	20.0	**20.0**	**0.0**	110.4	0.0	20.0	0.0	20.0	0.0	150.4	0.0	150.4
	OTHER	4,422.5	4,562.9	4,469.4	4,564.3	**4,556.6**	**4,441.0**	22,575.7	21,336.9	4,852.7	4,340.9	4,771.7	4,358.9	32,200.0	30,036.7	2,163.3
GRAND TOTAL IN-KIND		**6,975.5**	**7,123.1**	**7,055.2**	**7,465.6**	**7,416.6**	**6,800.8**	**36,036.0**	**32,559.4**	**7,531.1**	**6,630.7**	**7,487.4**	**6,663.7**	**51,054.5**	**45,853.9**	**5,200.7**

CASH CONTRIBUTIONS ($'000)

ATTACHMENT C TABLE 2

PARTNERS	ACTUAL 1997/98 Actual	1998/99 Actual	1999/2000 Actual	2000/01 Actual	**2001/02 Actual**	**2001/02 Agr'mt**	CUMULATIVE Total to Date Actual	Agr'mt	PROJECTED 2002/03 Budget	2002/03 Agr'mt	2003/04 Budget	2003/04 Agr'mt	GRAND TOTAL Total 7 yrs	Agr'mt 7 yrs	Diff 7 yrs
Australian Forest Growers	1.0	1.0	1.0	1.0	**1.0**	**1.0**	5.0	5.0	1.0	1.0	1.0	1.0	7.0	7.0	0.0
Australian Plantation Timber	0.0	0.0	0.0	50.0	**0.0**	**50.0**	50.0	100.0	0.0	0.0	0.0	0.0	50.0	100.0	-50.0
Department Primary Industries Qld	25.0	50.3	0.0	25.0	**25.0**	**25.0**	125.3	125.0	25.0	25.0	25.0	25.0	175.3	175.0	0.3
Forest Enterprises Australia	0.0	0.0	0.0	2.3	**3.7**	**3.0**	6.0	7.5	3.0	3.0	3.0	3.0	12.0	13.5	-1.5
Forestry Tasmania	22.5	19.3	15.0	11.6	**18.4**	**15.0**	86.8	75.0	15.0	15.0	15.0	15.0	116.8	105.0	11.8
Grand Ridge Plantations	35.0	35.6	35.0	35.0	**35.0**	**35.0**	175.6	175.0	35.0	35.0	35.0	35.0	245.6	245.0	0.6
Griffith University	25.0	26.2	25.0	18.7	**25.0**	**25.0**	119.9	125.0	31.3	25.0	25.0	25.0	176.2	175.0	1.2
Gunns Ltd (formerly Gunns Forest Products)	65.1	50.0	30.0	20.0	**25.0**	**25.0**	190.1	187.5	25.0	25.0	25.0	25.0	240.1	237.5	2.6
Gunns Limited (former supporting membership)	0.0	2.2	0.0	0.0	**0.0**	**0.0**	2.2	0.0	0.0	0.0	0.0	0.0	2.2	0.0	2.2
Norske Skog Paper Mills	22.4	20.8	20.0	20.0	**20.0**	**20.0**	103.2	100.0	20.0	20.0	20.0	20.0	143.2	140.0	3.2
Private Forests Tasmania	0.0	0.0	0.0	17.5	**3.0**	**20.0**	20.5	33.0	3.0	20.0	3.0	20.0	26.5	73.0	-46.5
Serve-Ag	0.0	0.0	0.0	1.2	**0.8**	**1.0**	2.0	2.5	1.0	1.0	1.0	1.0	4.0	4.5	-0.5
Southern Cross University	100.0	100.3	100.0	100.0	**100.0**	**100.0**	500.3	500.0	100.0	100.0	100.0	100.0	700.3	700.0	0.3
Timbercorp	0.0	0.0	0.0	50.0	**62.5**	**50.0**	112.5	112.5	50.0	50.0	50.0	50.0	212.5	212.5	0.0
University of Tasmania	0.0	0.3	0.0	0.0	**0.0**	**0.0**	0.3	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.3
WACAP Treefarms	35.0	36.2	35.0	35.0	**35.0**	**35.0**	176.2	175.0	35.0	35.0	35.0	35.0	246.2	245.0	1.2
TOTAL CASH FROM PARTICIPANTS	331.0	342.2	261.0	387.3	**354.4**	**405.0**	1,675.9	1,723.0	344.3	355.0	338.0	355.0	2,358.2	2,433.0	-74.8
OTHER CASH															
Interest	20.4	67.5	67.9	121.9	**92.7**	**0.0**	370.4	0.0	60.0	0.0	40.0	0.0	470.4	0.0	470.4
Non-participants	7.8	23.4	11.0	3.2	**0.0**	**0.0**	45.4	0.0	0.0	0.0	0.0	0.0	45.4	0.0	45.4
Other external funds	0.0	0.0	214.6	17.9	**42.5**	**0.0**	275.0	0.0	0.0	0.0	0.0	0.0	275.0	0.0	275.0
CRC Grant	1,718.1	2,313.0	2,328.4	2,346.9	**2,384.5**	**2,300.0**	11,090.9	10,880.0	2,429.8	2,300.0	2,476.0	2,300.0	15,996.7	15,480.0	516.7
TOTAL CRC CASH CONTRIBUTIONS	2,077.3	2,746.1	2,882.9	2,877.2	**2,874.1**	**2,705.0**	13,457.6	12,603.0	2,834.1	2,655.0	2,854.0	2,655.0	19,145.7	17,913.0	1,232.7
Cash carried over from previous year	741.0	1,002.6	1,338.1	1,743.2	**1,923.4**				1,813.6		1,163.9				
Less unspent balance	1,002.6	1,338.1	1,743.2	1,923.4	**1,813.6**				1,163.9		425.6				
TOTAL CASH EXPENDITURE	1,815.7	2,410.7	2,477.8	2,697.0	**2,983.9**	**2,606.0**	12,385.1	12,961.0	3,483.8	2,607.0	3,592.3	2,603.0	19,461.2	18,171.0	1,290.2
ALLOCATION OF CASH EXPENDITURE BETWEEN HEADS OF EXPENDITURE															
SALARIES	1,288.9	1,686.4	1,503.4	1,757.3	**1,899.3**	**1,701.0**	8,135.3	8,536.0	2,434.9	1,702.0	1,440.0	1,703.0	12,010.2	11,941.0	69.2
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
OTHER	526.8	724.3	974.3	939.7	**1,084.6**	**905.0**	4,249.7	4,425.0	1,048.9	905.0	2,152.3	900.0	7,450.9	6,230.0	1,220.9

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

ATTACHMENT C TABLE 3

ALL PROGRAMS

	ACTUAL						CUMULATIVE		PROJECTED				GRAND TOTAL		
	1997/98	1998/99	1999/00	2000/01	**2001/02**	**2001/02**	Total to Date		2002/03	2002/03	2003/04	2003/04	Total	Agr'mt	Diff
	Actual	Actual	Actual	Actual	**Actual**	**Agr'mt**	Actual	Agr'mt	Budget	Agr'mt	Budget	Agr'mt	7 yrs	7 yrs	7 yrs
GRAND TOTAL (IN-KIND)	6,975.5	7,123.1	7,055.1	7,465.7	**7,416.6**	**6,800.8**	36,036.0	32,559.4	7,531.1	6,630.7	7,487.4	6,663.7	51,054.5	45,853.8	5,200.7
GRAND TOTAL (CASH EXPENDITURE)	1,815.7	2,410.7	2,477.8	2,697.0	**2,983.9**	**2,606.0**	12,385.1	12,961.0	3,483.8	2,607.0	3,592.3	2,603.0	19,461.2	18,171.0	1,290.2
TOTAL RESOURCES APPLIED TO ACTIVITIES OF CENTRE	8,791.2	9,533.8	9,532.9	10,162.6	**10,400.5**	**9,406.8**	48,421.0	45,520.4	11,014.9	9,237.7	11,079.7	9,266.7	70,515.6	64,024.8	6,490.8

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

TOTAL SALARIES (CASH AND IN-KIND)	3,813.5	4,226.6	4,067.2	4,638.6	**4,739.3**	**4,060.8**	21,485.2	19,758.5	5,093.3	3,991.8	4,135.7	4,007.8	30,714.2	27,758.1	2,956.1
TOTAL CAPITAL (CASH AND IN-KIND)	28.4	20.0	22.0	20.0	**20.0**	**0.0**	110.4	0.0	20.0	0.0	20.0	0.0	150.4	0.0	150.4
TOTAL OTHER (CASH AND IN-KIND)	4,949.3	5,287.2	5,443.6	5,504.0	**5,641.2**	**5,346.0**	26,825.3	25,761.9	5,901.6	5,245.9	6,924.0	5,258.9	39,650.9	36,266.7	3,384.2

ATTACHMENT C TABLE 4

ALLOCATION OF RESOURCES BETWEEN CATEGORIES OF ACTIVITIES 2001/2002

PROGRAM	RESOURCE USAGE			
	Cash (1) $'000	In-kind $'000	Contributed Staff (2)	Cash Funded Staff (CRC) (2)
Research	2,545.3	6,326.3	21.2	13.7
Education (3)	244.7	608.2	1.8	1.5
Administration	193.9	482.1	2.2	0.5
TOTAL	2,983.9	7,416.6	25.2	15.7

(1) Cash from all sources, including CRC Program
(2) Professional staff in person years
(3) Includes External Communications & Tech Transfer

AUSTRALIAN FOREST GROWERS

CRC FOR SUSTAINABLE PRODUCTION FORESTRY - 2001/2002 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	Actual	**Actual**	Budget	Budget	
R Dyason	Treasurer	0.1								
M Speedy	President	0.1								
G. Wettenhall	Magazine Editor	0.1								
L. Day	Executive Officer	0.1								
G Brooks	Nat Pol Director	0.1								
		Total Salary	1.0	1.0	1.2	1.1	**1.2**	1.0	1.0	7.5
	Direct On-Costs									
		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	1.4	1.2	**1.3**	1.1	1.1	8.3
	CAPITAL									
		Total Capital	0.0	0.0	0.0	0.0	**0.0**	0.0	0.0	0.0
	OTHER									
	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**	**1.5**	**1.6**	**1.4**	**1.4**	**10.4**
ALL PROGRAMS CASH CONTRIBUTIONS			1.0	1.0	1.0	1.0	**1.0**	1.0	1.0	7.0

ATTACHMENT D

CRC FOR SUSTAINABLE PRODUCTION FORESTRY - 2001/2002 Financial Tables

CSIRO - ENTOMOLOGY

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	Actual	**Actual**	Budget	Budget	
T Wharton	Research	100								
A Loch	Research	100								
J Matthiesen	Research	30								
R Floyd	Research	25								
R Milner	Research	20								
G Farrell	Technical	30								
R Sutherland	Technical	30								
M Michie	Technical	30								
		Total Salary	130.5	118.3	172.3	173.6	**189.2**	148.8	134.1	1,066.8
	Direct On-Costs	*% of total Salary*								
	Superannuation	21	26.0	24.3	35.3	31.2	**28.4**	26.3	27.6	199.0
	Comcare	1	1.4	1.3	1.9	1.7	**1.9**	1.4	1.5	11.1
	Leave Loading	2	2.0	1.8	2.6	2.3	**2.5**	1.9	2.0	15.0
	Long Service Leave	3	3.3	3.0	4.3	3.8	**4.2**	3.2	3.4	25.1
		Total On-Costs	32.6	30.3	44.1	39.0	**37.0**	32.8	34.5	250.3
		Total Salaries & On-Costs	163.1	148.6	216.4	212.6	**226.2**	181.6	168.6	1,317.1
	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*								
	Divnl other support	156	190.8	198.8	296.7	292.4	**296.0**	172.6	122.7	1,570.0
	Corporate support	32	48.9	55.2	77.7	78.6	**85.6**	77.6	66.0	489.6
	Less Industry Contributions				113.5	120.3	**143.6**	16		393.4
		Total Other	239.7	254.1	260.9	250.7	**238.0**	234.2	188.7	1,666.3
TOTAL IN-KIND CONTRIBUTION			**402.8**	**402.7**	**477.3**	**463.3**	**464.2**	**415.8**	**357.3**	**2,983.4**
ALL PROGRAMS CASH CONTRIBUTIONS										

ATTACHMENT D

CRC FOR SUSTAINABLE PRODUCTION FORESTRY - 2001/02 Financial Tables

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	Actual	**Actual**	Budget	Budget	
D Mummery	Research	90								
M Battaglia	Research	90								
C Beadle	Research	80								
P Sands	Research	80								
P Smethurst	Research	72								
C Raymond	Research	64								
G Moran	Research	30								
C Mohammed	Research	10								
E Williams	Research	10								
R Evans	Research	5								
C Baillie	Technical	100								
M Cherry	Technical	100								
K Churchill	Technical	60								
J Murrel	Technical	50								
D Worledge	Technical	30								
B Denton	Technical	25								
B McCormack	Research	10								
J Owen	Technical	10								
J Sprent	Admin	50								
P Coles	Admin	25								
G MacGillivray	Admin	25								
G Kile	Admin	5								
S Nambiar	Admin	5								
S Midgley	Admin	2								
R Lockwood	Admin	1								
	Total Salary		515.5	545.9	537.0	570.5	**602.8**	576.6	591.0	3,939.3
	Direct On-Costs	*% of Total Salary*								
	Productivity Benefit	3	15.5	16.4	16.1	17.1	**18.1**	17.3	17.7	118.2
	Superannuation	19	95.4	101.0	99.3	105.5	**111.5**	106.7	109.3	728.8
	Workers Compensation	1	5.7	6.0	5.9	6.3	**6.6**	6.3	6.5	43.4
	Leave Loading	2	7.7	8.2	8.1	8.6	**9.0**	8.6	8.9	59.1
	Long Service Leave	3	12.9	13.6	13.4	14.3	**15.1**	14.4	14.8	98.5
	Total On-Costs		137.1	145.2	142.8	151.8	**160.3**	153.4	157.2	1,047.9
	Total Salaries & On-Costs		652.6	691.1	679.8	722.3	**763.1**	730.0	748.2	4,987.3
	CAPITAL									
	Total Capital									
	OTHER	*% of Total Salaries & On -Costs*								
	Divnl other support	153	1,001.1	1,060.2	1,042.9	877.8	**1,170.5**	1,119.8	1,147.8	7,420.0
	Corporate support	32	208.8	221.2	217.5	179.7	**244.2**	233.6	239.4	1,544.4
	Imputed Rent		200.0	200.0	200.0	200.0	**200.0**	200.0	200.0	1,400.0
	Seed contribution by CSIRO						**2.2**			2.2
	Other operating			14.5				7.5	7.5	29.5
	Adjt for 1999/00					34.0				34.0
	Total Other		1,410.0	1,495.8	1,460.4	1291.5	**1,616.9**	1,560.9	1,594.7	10,430.2
TOTAL IN-KIND CONTRIBUTION			**2,062.6**	**2,186.9**	**2,140.2**	**2013.8**	**2,380.0**	**2,290.9**	**2,342.9**	**15,417.4**
ALL PROGRAMS CASH CONTRIBUTIONS										

ATTACHMENT D

CRC FOR SUSTAINABLE PRODUCTION FORESTRY - 2001/2002 Financial Tables

DEPARTMENT PRIMARY INDUSTRIES QLD

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

Name	**SALARIES** *Designation*	*% time CRC*	97/98 Actual	98/99 Actual	99/2000 Actual	2000/01 Actual	**2001/02 Actual**	2002/03 Budget	2003/04 Budget	TOTAL
Z Xu	Research	65								
M Nester	Research	58								
M Dieters	Research	51								
K Bubb	Research	50								
M Hunt	Research	38								
J Simpson	Research	31								
M Lewty	Research	30								
D Osborne	Research	25								
A House	Research	16								
K Harding	Research	15								
P Ryan	Research	10								
I Last	Research	5								
P Frayne	Technician	80								
P Toon	Technician	33								
M Podberscek	Technician	31								
P Keay	Technician	27								
J Huth	Technician	20								
C Raddatz	Technician	19								
R Haines	Administration	40								
M Robinson	Administration	7								
T Wemmerslager	Administration	5								
A Gardiner	Publicist	5								
		Total Salary	332.7	321.5	305.9	337.8	**371.4**	297.3	297.3	2,263.9
	Direct On-Costs	*% of Total Salaries*								
	Payroll Tax	6	19.0	19.9	18.8	20.8	**23.0**	18.4	18.4	138.4
	Superannuation	15	44.9	46.9	44.5	49.0	**54.2**	43.4	43.4	326.4
	Long Service Leave	2	6.0	9.6	6.1	6.8	**11.1**	8.9	8.9	57.5
	Leave Loading	9	27.6	4.8	27.5	30.4	**5.6**	4.5	4.5	104.9
	Enterprise Bargaining	3	13.3	12.9	8.3	9.1	**14.9**	11.9	11.9	82.2
	Salary Banding	2	5.7	6.1	5.8	6.4	**7.1**	5.6	5.1	41.7
	Workers Comp Premium		0.7	0.0	0.0	0.0	**0.0**	0.7	0.7	2.1
		Total On-Costs	117.1	100.3	111.0	122.4	**115.9**	93.5	92.9	753.0
		Total Salaries & On-Costs	449.8	421.8	416.9	460.2	**487.3**	390.8	390.2	3,016.9
	CAPITAL									
	Lab Modifications		3.0							3.0
	Gas Chromatograph/Mass Spectrometer		25.4							25.4
		Total Capital	28.4	0.0	0.0	0.0	**0.0**	0.0	0.0	28.4
	OTHER	*% of Total Salaries & On-Costs*								
	QFRI Technical Support	4		16.5	16.3	17.9	**19.0**	15.2	15.2	100.1
	QFRI Admin Overheads	5	22.5	21.1	20.8	23.0	**24.4**	19.5	19.5	150.8
	Dept Admin Support	15	45.0	63.3	62.5	69.0	**73.1**	58.6	58.5	430.0
	Office Space	10	45.0	42.2	41.7	46.0	**48.7**	39.1	39.0	301.7
	Lab/Glasshouse Rent		45.0	0.0	0.0	0.0	**0.0**	39.1	39.0	123.1
	Travel & Accommodation			0.0	0.0	0.0	**0.6**	30.0	30.0	60.6
	Other Administrative Costs	6		26.6	26.3	29.0	**30.7**	24.6	24.6	161.7
	Field Trials		303.2	176.7	201.7	156.1	**139.4**	100.0	100.0	1,177.1
	Chemical Analysis		26.4	0.0	20.0	0.0	**0.0**	20.0	20.0	86.4
	Depreciation	9	39.0	36.0	37.5	41.4	**43.9**	35.2	35.1	270.0
		Total Other	526.0	384.2	426.8	382.5	**379.7**	381.3	381.0	2,861.5
TOTAL IN-KIND CONTRIBUTION			1,004.2	805.7	843.7	842.7	**867.0**	772.1	771.2	5,906.9
ALL PROGRAMS CASH CONTRIBUTIONS			25.0	50.3	0.0	25.0	**25.0**	25.0	25.0	175.3

FOREST ENTERPRISES AUSTRALIA

CRC FOR SUSTAINABLE PRODUCTION FORESTRY - 2001/2002 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	Actual	**Actual**	Budget	Budget	
L Ficca	Research	2								
G Ogston	Research	2								
D Barker	Research	1								
T Cannon	Admin	1								
		Total Salary				4.0	**3.2**			
	Direct On-Costs									
		Total On-Costs				1.0	**0.8**			
		Total Salaries & On-Costs				5.0	**4.0**			9.0
	CAPITAL									
		Total Capital	0.0	0.0	0.0	0.0	**0.0**	0.0	0.0	0.0
	OTHER									
	Overheads					1.0				
	Operating									
		Total Other				1.0	**0.0**	2.0	2.0	5.0
TOTAL IN-KIND CONTRIBUTION						**6.0**	**4.0**	**2.0**	**2.0**	**14.0**
ALL PROGRAMS CASH CONTRIBUTIONS						**2.3**	**3.7**	**3.0**	**3.0**	**12.0**

ATTACHMENT D

CRC FOR SUSTAINABLE PRODUCTION FORESTRY - 2001/2002 Financial Tables

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

GRAND RIDGE PLANTATIONS

	SALARIES	% time	97/98	98/99	99/2000	2000/01	**2001/02**	2002/03	2003/04	TOTAL
Name	*Designation*	*CRC*	Actual	Actual	Actual	Actual	**Actual**	Budget	Budget	
R Appleton	Research	15								
P Buxton	Research	12								
M Krygsman	Research	5								
S Elms	Board	3								
		Total Salary	55.6	72.3	48.6	54.1	**28.0**	73.2	75.4	407.2
	Direct On-Costs									
		Total On-Costs	10.1	10.9	9.7	12.5	**6.4**	22.5	23.2	95.3
		Total Salaries & On-Costs	65.7	83.2	58.3	66.6	**34.4**	95.7	98.6	502.5
	CAPITAL									
		Total Capital	0.0	0.0	0.0	0.0	**0.0**	0.0	0.0	0.0
	OTHER									
	Overheads		38.6	23.3	11.1	23.9	**2.4**	38.8	40.0	178.1
	Operating		96.9	101.5	97.3	96.1	**10.5**	97.4	100.3	600.0
		Total Other	135.5	124.8	108.4	120.0	**12.9**	136.2	140.3	778.1
TOTAL IN-KIND CONTRIBUTION			**201.2**	**208.0**	**166.7**	**186.6**	**47.3**	**231.9**	**238.9**	**1,280.6**
ALL PROGRAMS CASH CONTRIBUTIONS			**35.0**	**35.0**	**35.0**	**35.0**	**35.0**	**35.0**	**35.0**	**245.0**

GRIFFITH UNIVERSITY

CRC FOR SUSTAINABLE PRODUCTION FORESTRY - 2001/2002 Financial Tables

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

	SALARIES	*% time*	97/98	98/99	99/2000	2000/01	**2001/02**	2002/03	2003/04	TOTAL
Name	*Designation*	*CRC*	Actual	Actual	Actual	Actual	**Actual**	Budget	Budget	
P Healy	Research	10								
J Hughes	Research	10								
J Chaseling	Research	10								
I Phillips	Research	10								
S Boyd	Research	10								
B Yu	Research	10								
H Ghadiri	Research	10								
H Proctor	Research	5								
R Kitching	Admin	5								
		Total Salary			75.2	57.0	**60.9**			
		% of Total Salaries								
	Direct On-Costs									
	Superannuation	17			12.8	9.7	**10.4**			
	Payroll Tax	5			3.8	2.9	**3.0**			
	Workers Comp	1			0.6	0.4	**0.6**			
	In-Direct On-Costs									
	Outside Studies Program	19			14.3	10.8	**11.6**			
	Long Service Leave	3			2.3	1.7	**1.8**			
	Leave Loading	1			1.0	0.7	**0.6**			
		Total On-Costs			34.7	26.2	**28.0**			
	Total Salaries & On-Costs		163.7	108.8	109.9	83.2	**88.9**	106.7	106.7	767.9
	CAPITAL									
	Total Capital		0.0	20.0	20.0	20.0	**20.0**	20.0	20.0	120.0
	OTHER	*% of Total Salaries & On-Costs*								
	Academic Services	28	32.7	30.5	30.8	23.3	**24.9**			
	General University Services	49	67.1	53.3	53.8	40.8	**43.6**			
	Other support	10	13.1	10.9	11.0	8.3	**8.9**			
	Other Lab & Workshop Space	20	37.7	21.8	22.0	16.7	**17.8**			
	Total Other		150.6	116.5	117.6	89.1	**95.2**	114.1	114.1	797.2
TOTAL IN-KIND CONTRIBUTION			**314.3**	**245.3**	**247.4**	**192.3**	**204.1**	**240.8**	**240.8**	**1,685.0**
ALL PROGRAMS CASH CONTRIBUTIONS			**25.0**	**26.2**	**25.0**	**18.7**	**25.0**	**25.0**	**25.0**	**169.9**

ATTACHMENT D

CRC FOR SUSTAINABLE PRODUCTION FORESTRY - 2001/2002 Financial Tables

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

GUNNS LTD

SALARIES		% time	97/98	98/99	99/2000	2000/01	**2001/02**	2002/03	2003/04	TOTAL
Name	*Designation*	*CRC*	Actual	Actual	Actual	Actual	**Actual**	Budget	Budget	
G Holz	Research	59								
D de Little	Research	48								
T Hingston	Technician	55								
K Joyce	Technician	55								
T Williams	Technician	45								
I Ravenwood	Manager	5								
		Total Salary	198.0	169.0	103.6	145.9	**145.2**			
	Direct On-Costs									
	Other-Total									
		Total On-Costs	65.0	83.2	51.0	71.8	**64.3**			
		Total Salaries & On-Costs	263.0	252.2	154.7	217.7	**209.5**	100.0	100.0	1,297.1
	CAPITAL									
		Total Capital	0.0	0.0	0.0	0.0	**0.0**	0.0	0.0	0.0
	OTHER									
	Office Support		7.0							
	Land Rent		87.0	87.0	37.5	44.3	**57.0**			
	Trial Maintenance		8.0	9.0	3.0	3.7				
	Other		267.0	217.0	117.8	79.7	**42.8**			
		Total Other	369.0	312.6	158.3	127.7	**99.8**	216.0	216.0	1,499.4
TOTAL IN-KIND CONTRIBUTION			**632.0**	**564.8**	**313.0**	**345.4**	**309.3**	**316.0**	**316.0**	**2,796.5**
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 - 2001/2002 Financial Tables

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

NORSKE SKOG PAPER MILLS

	SALARIES	*% time*	97/98	98/99	99/2000	2000/01	**2001/02**	2002/03	2003/04	TOTAL
Name	*Designation*	*CRC*	Actual	Actual	Actual	Actual	**Actual**	Budget	Budget	
S Hetherington	Research	4								
C Berry	Research	3								
A Willems	Administration	2								
M Rush	Technical	2								
G Kennedy	Technical	1								
		Total Salary	26.0	16.0	18.0	22.5	**18.1**	19.0	19.0	138.6
	Direct On-Costs	*% of Total Salaries*								
		32	8.0	5.1	5.7	7.2	**5.8**	6.1	6.1	43.9
		Total On-Costs	8.0	5.1	5.7	7.2	**5.8**	6.1	6.1	43.9
	Total Salaries & On-Costs		34.0	21.1	23.7	29.7	**23.9**	25.1	25.1	182.5
	CAPITAL									
	Total Capital		0.0	0.0	0.0	0.0	**0.0**	0.0	0.0	0.0
	OTHER									
	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	161.0	**115.0**	146.0	146.0	1,025.5
	Trial Maintenance		15.0	16.0	14.0	10.0	**12.0**	16.0	16.0	99.0
	Experiments		8.5	6.0	5.0	6.0	**6.0**	7.0	7.0	45.5
	Other (Vehicles)		4.0	2.0	2.0	3.0	**2.0**	3.0	3.0	19.0
	Total Other		186.0	171.0	199.0	188.0	**143.0**	180.0	180.0	1,247.0
TOTAL IN-KIND CONTRIBUTION			**220.0**	**192.1**	**222.7**	**217.7**	**166.9**	**205.1**	**205.1**	**1,429.5**
ALL PROGRAMS CASH CONTRIBUTIONS			**22.4**	**20.8**	**20.0**	**20.0**	**20.0**	**20.0**	**20.0**	**143.2**

ATTACHMENT D

CRC FOR SUSTAINABLE PRODUCTION FORESTRY - 2001/2002 Financial Tables

PRIVATE FORESTS TASMANIA

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

	SALARIES	*% time*	97/98	98/99	99/2000	2000/01	**2001/02**	2002/03	2003/04	TOTAL
Name	*Designation*	*CRC*	Actual	Actual	Actual	Actual	**Actual**	Budget	Budget	
A Warner	Regional Private Forester	4								
C Wyly	Project Officer	1								
A Lyons	Farm Forestry Coordinator	1								
G Clark	Private Forest Advisor	1								
S Swanson	Planning Officer	1								
G Campbell	Private Forest Advisor	1								
		Total Salary	0.0	0.0	8.2	4.4	**9.3**	10.0	0.0	
	Direct On-Costs									
		Total On-Costs	0.0	0.0	2.0	1.1	**1.9**	2.0	0.0	
		Total Salaries & On-Costs	0.0	0.0	10.2	5.5	**11.2**	12.0	8.1	47.1
	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	17.2	0.0	**4.0**	5.0	16.3	42.5
TOTAL IN-KIND CONTRIBUTION			**0.0**	**0.0**	**27.4**	**5.5**	**15.2**	**17.0**	**24.4**	**89.5**
ALL PROGRAMS CASH CONTRIBUTIONS			**0.0**	**0.0**	**0.0**	**17.5**	**3.0**	**3.0**	**20.0**	**43.5**

CRC FOR SUSTAINABLE PRODUCTION FORESTRY - 2001/2002 Financial Tables

SEEDENERGY 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	Actual	**Actual**	Budget	Budget	
P Gore	Manager Eucalypt seed	10								
D Boomsma	General Manager	2								
	Total Salary						**8.8**			
	Direct On-Costs									
	Total On-Costs						**2.6**			
	Total Salaries & On-Costs						**11.4**	9.4	9.4	30.2
	CAPITAL									
	Total Capital						**0.0**	0.0	0.0	0.0
	OTHER									
	Overheads									0.0
	Equipment & rent						**1.5**	1.5	1.5	4.5
	Total Other						**1.5**	1.5	1.5	4.5
TOTAL IN-KIND CONTRIBUTION							**12.9**	**10.9**	**10.9**	**34.7**
ALL PROGRAMS CASH CONTRIBUTIONS							**5.3**			**5.3**

CRC FOR SUSTAINABLE PRODUCTION FORESTRY - 2001/2002 Financial Tables

SOUTHERN CROSS UNIVERSITY

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

	SALARIES	*% time*	97/98	98/99	99/2000	2000/01	**2001/02**	2002/03	2003/04	TOTAL
Name	*Designation*	*CRC*	Actual	Actual	Actual	Actual	**Actual**	Budget	Budget	
R Henry	Research	30								
T Codrington/M Elphinstone	Research	20								
E Evans	Administration	10								
V Watt	Administration	10								
D Scurr	Administration	10								
P Baverstock	Research	5								
	Total Salary		47.1	51.0	52.6	54.0	**57.2**	59.5	61.8	383.2
	Direct On-Costs	*% of Total Salaries*								
	Payroll Tax	8	3.6	3.9	4.1	4.2	**4.4**	4.6	4.8	29.5
	Superannuation	15	7.8	8.5	8.7	7.9	**8.4**	8.7	9.0	59.0
	Workers Compensation	2	0.7	0.8	0.8	0.8	**0.9**	0.9	0.9	5.7
	Long Service Leave	3	1.4	1.5	1.6	1.6	**1.7**	1.8	1.9	11.5
	Leave Loading	1	0.6	0.7	0.7	0.7	**0.7**	0.8	0.8	5.0
	TESS	3	1.4	1.5	1.6	1.6	**1.7**	1.8	1.9	11.5
	Other- Maternity Leave	0	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	17.0	**18.0**	20.0	21.0	126.5
	Total Salaries & On-Costs		62.9	68.0	70.2	71.0	**75.2**	79.5	82.8	509.6
	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	9	5.5	5.9	6.1	6.2	**6.5**	6.9	7.2	44.3
	Academic Activities - Other	28	17.4	18.8	19.5	19.7	**20.8**	22.0	22.9	141.2
	Libraries	15	9.7	10.5	10.8	10.9	**11.6**	12.2	12.8	78.5
	Other Academic Support Service	16	9.7	10.5	10.9	11.0	**11.7**	12.3	12.8	79.0
	Student Support Services	12	7.5	8.2	8.4	8.5	**9.0**	9.5	9.9	61.2
	Public Services	1	0.1	0.7	0.7	0.7	**0.8**	0.8	0.8	4.5
	Buildings & Grounds	17	10.6	11.4	11.8	11.9	**12.6**	13.4	13.9	85.6
	Admin & General	38	23.6	25.6	26.4	26.7	**28.3**	29.9	31.1	191.6
	Independent Operations	20	12.8	13.9	14.3	14.5	**15.3**	16.2	16.9	104.0
	Other (Research)		89.2	177.3	187.9	193.4	**241.8**	251.5	130.8	1,271.9
	Other (Admin)		3.0	3.6	3.7	2.1	**2.0**	2.5	2.5	19.4
	Other		0.0	1.3	0.0	1.2	**0.8**	1.3		4.6
	Total Other		189.7	287.8	300.5	306.8	**361.3**	378.6	261.7	2,086.4
TOTAL IN-KIND CONTRIBUTION			**252.6**	**355.8**	**370.7**	**377.8**	**436.5**	**458.1**	**344.5**	**2,596.1**
ALL PROGRAMS CASH CONTRIBUTIONS			**100.0**	**100.3**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**700.3**

ATTACHMENT D

CRC FOR SUSTAINABLE PRODUCTION FORESTRY - 2001/2002 Financial Tables

SOUTHERN TREE BREEDING ASSOCIATION

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

	SALARIES	% time	97/98	98/99	99/2000	2000/01	**2001/02**	2002/03	2003/04	TOTAL
Name	*Designation*	*CRC*	Actual	Actual	Actual	Actual	**Actual**	Budget	Budget	
T McRae	Research	14								
D Pilbeam	Research	13								
M Powell	Research	3								
		Total Salary	0.0	0.0	10.2	17.1	**18.4**	14.7	14.5	74.9
	Direct On-Costs									
		Total On-Costs	0.0	0.0	4.6	8.6	**8.4**	9.1	9.3	40.0
		Total Salaries & On-Costs	6.0	6.0	14.8	25.7	**26.8**	23.8	23.8	126.9
	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**	**25.7**	**26.8**	**23.8**	**23.8**	**163.9**
ALL PROGRAMS CASH CONTRIBUTIONS			**0.0**	**0.0**	**0.0**	**0.0**	**6.3**	**5.0**	**5.0**	**16.3**

TIMBERCORP

CRC FOR SUSTAINABLE PRODUCTION FORESTRY - 2001/2002 Financial Tables

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

	SALARIES	*% time*	97/98	98/99	99/2000	2000/01	**2001/02**	2002/03	2003/04	TOTAL
Name	*Designation*	*CRC*	Actual	Actual	Actual	Actual	**Actual**	Budget	Budget	
J Bulinski	Research	46								
A Tys	Research	8								
Q Clasen	Research	8								
P Smale	Research	8								
H O'Sullivan	Research	8								
C Anderson	Operations	2								
A Soanes	Operations	1								
K Mullan	Operations	1								
I Bail	Manager	20								
C O'Connor	Manager	3								
Timbercorp Limited 1999/2000						14.7				
		Total Salary	0.0	0.0	19.0	87.5	**67.9**	71.5	71.5	317.4
	Direct On-Costs	*% of Total Salaries*								
	Total On-Costs	31	0.0	0.0	1.6	27.3	**21.2**	22.3	22.3	94.7
	Total Salaries & On-Costs		0.0	0.0	20.6	114.8	**89.1**	93.8	93.8	412.0
	CAPITAL									
	Total Capital		0.0	0.0	2.0	0.0	**0.0**	0.0	0.0	2.0
	OTHER									
	Admin and Office Support									
	Travel and Accommodation									
	Trial Rent and Maintenance									
	SIF Projects									
	CRC Annual Workshop									
	Industry Pest Management Group									
	Timbercorp Limited 1999/2000									
	Total Other		5.0	5.0	5.0	272.8	**195.8**	220.5	220.5	924.6
TOTAL IN-KIND CONTRIBUTION			**5.0**	**5.0**	**27.6**	**387.6**	**284.8**	**314.3**	**314.3**	**1,338.6**
ALL PROGRAMS CASH CONTRIBUTIONS			**0.0**	**0.0**	**0.0**	**50.0**	**50.0**	**50.0**	**50.0**	**200.0**

NB: Figures provided in 1999/2000 related only to Silvagene. Timbercorp group had part-year Core Partner membership as well.

ATTACHMENT D

CRC FOR SUSTAINABLE PRODUCTION FORESTRY - 2001/2002 Financial Tables

UNIVERSITY OF 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	Actual	**Actual**	Budget	Budget	
J Reid	Administration/Research	50								
R Griffin	Administration/Research	50								
G Allen	Research	50								
C McArthur	Research	50								
B Potts	Research	50								
R Vaillancourt	Research	45								
R Wiltshire	Research	20								
S Jennings	Research	15								
C Mohammed	Research	15								
D Close	Research	15								
G Jordan	Research	15								
M Hovenden	Research	15								
A Richardson	Research	10								
P Brown	Research	5								
P McQuillan	Research	5								
S Shabala	Research	5								
E Bruce	Research	5								
J Kirkpatrick	Research	5								
R Doyle	Research	5								
N Mendham	Research	5								
S McLean	Research	5								
R Boyle	Research	5								
A Smolenski	Technical	25								
G Johnson	Administration	20								
L Johnson	Technical	10								
T Jackson	Technical	10								
R Clark	Administration/Research	15								
G Hallegraeff	Administration	10								
R Swain	Administration	10								
C Phillips	Administration	5								
B Rumbold	Administration	5								
S Jones	Administration	5								
A Glenn	Administration	2								
	Total Salary		259.1	274.7	279.9	323.1	**337.0**	342.7	353.0	2169.5

Direct On-Costs	*% of total Salary*								
Payroll Tax	7	18.1	21.2	21.6	24.7	**24.8**	25.0	25.8	161.2
Superannuation	17	44.0	46.7	47.6	54.9	**57.3**	58.3	60.0	368.8
Workers Compensation	1	2.6	1.4	1.4	2.3	**2.4**	2.4	2.5	14.9
Leave Loading-Academics	0	3.2	0.0	1.0	0.0	**0.0**	0.0	0.0	4.2
Long Service Leave	2	8.3	8.8	9.0	0.3	**0.7**	0.7	0.7	28.4
Outside Study Academics		20.0	20.0	20.0	20.0	**20.0**	20.0	20.0	140.0
HECS student costs		30.0	30.0	30.0	30.0	**30.0**	30.0	30.0	210.0
Other									
	Total On-Costs	126.3	128.0	130.5	132.2	**135.2**	136.4	139.0	927.5
	Total Salaries & On-Costs	385.4	402.7	410.4	455.3	**472.2**	479.1	492.0	3,097.0

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*								
Academic Services	25	96.3	100.7	102.6	113.8	**118.0**	119.8	123.0	774.3
General Uni Services	41	158.0	165.1	168.3	168.3	**168.3**	168.3	168.3	1164.5
Departmental office support	10	38.5	40.3	41.0	45.5	**47.2**	47.9	49.2	309.7
Laboratory rent	32	123.3	128.9	131.3	145.7	**151.1**	153.3	157.4	991.0
Office Space	8	30.8	32.2	32.8	36.4	**37.8**	38.3	39.4	247.8
CSL		84.4	84.4	84.4	84.4	**84.4**	84.4	84.4	590.8
Centre Agency (10% grant)		171.8	231.9	231.9	234.7	**238.5**	242.2	244.6	1595.6
Research Quantum			41.9						41.9
	Total Other	703.1	825.3	792.4	828.9	**845.3**	854.2	866.3	5715.5

TOTAL IN-KIND CONTRIBUTION	**1,088.5**	**1,228.0**	**1,202.9**	**1,284.1**	**1,317.5**	**1,333.2**	**1,358.2**	**8,812.5**
ALL PROGRAMS CASH CONTRIBUTIONS		0.3						

WACAP TREEFARMS

CRC FOR SUSTAINABLE PRODUCTION FORESTRY - 2001/2002 Financial Tables

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

	SALARIES	% time	97/98	98/99	99/2000	2000/01	**2001/02**	2002/03	2003/04	TOTAL
Name	*Designation*	*CRC*	Actual	Actual	Actual	Actual	**Actual**	Budget	Budget	
C Shedley	Research Forester (casual)	50								
M Bamess	Inventory Yield coordinator	30								
S Hunter	Nursery/Research Manager	10								
D Pilbeam	Research Forester	10								
R Breidahl	Gen Manager Operations	5								
N Itakura/K Oshima	General Manager	3								
C Palmer	GM Finance & Admin	2								
I Telfer	GM Woodchips	2								
B Humble	Forest Resource Manager	2								
P Durell	Woodchip Production Manager	2								
J Cox	Technician	15								
V Sims	Technician	2								
	Total Salary		54.4	58.4	51.4	45.6	**49.5**	52.2	52.2	363.7
	Direct On-Costs	*% of Total Salaries*								
	Payroll Tax	6	3.3	3.5	3.1	2.7	**3.0**			
	Superannuation	8	3.3	4.1	3.6	3.2	**4.0**			
	Workers Compensation	6	3.3	3.5	3.1	2.7	**3.0**			
	Leave Loading	2	0.8	0.9	0.8	0.7	**0.7**			
	Long Service Leave	2	0.9	1.0	0.9	0.8	**0.8**			
	Total On-Costs		11.5	13.0	11.4	10.1	**11.5**	11.6	11.6	80.7
	Total Salaries & On-Costs		65.9	71.4	62.8	55.7	**61.0**	63.8	63.8	444.4
	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*								
	Administration	39	31.3	21.6	21.3	23.8	**23.8**	32.0	32.0	185.8
	Office Support	6	1.7	2.6	2.6	3.6	**3.6**	2.0	2.0	18.0
	Corporate Overheads	11	6.0	6.5	6.5	6.5	**6.5**	6.5	6.5	45.0
	Operational	80	34.8	34.4	34.4	48.2	**48.2**	36.0	36.0	272.1
	Amortised Capital Costs	22	8.3	9.5	9.5	13.3	**13.3**	9.0	9.0	71.9
	Land Rent	7	2.1	4.0	4.0	4.0	**4.0**	2.5	2.5	23.1
	Trial Maintenance	1	6.7	7.4	7.4	0.8	**0.8**	7.0	7.0	37.0
	Consumables & Freight	3	1.1	2.0	2.0	2.0	**2.0**	1.5	1.5	12.1
	Library	1	0.8	0.9	0.9	0.5	**0.5**	1.0	1.0	5.5
	Computer Support	5	2.2	2.5	3.2	3.3	**3.3**	2.5	2.5	19.5
	Other - Meetings & Visits	10	11.0	18.0	18.0	6.0	**6.0**	13.0	13.0	85.0
	Other - Fertilizers	7		0.7	3.7	4.0	**4.0**	2.0	2.0	16.4
	Other - Wood Coring Trip			3.0	0.0	0.0				3.0
	Total Other		106.0	113.0	113.4	116.0	**116.0**	115.0	115.0	794.5
TOTAL IN-KIND CONTRIBUTION			**171.9**	**184.4**	**176.2**	**171.7**	**177.0**	**178.8**	**178.8**	**1,238.8**
ALL PROGRAMS CASH CONTRIBUTIONS			**35.0**	**35.0**	**35.0**	**35.0**	**35.0**	**35.0**	**35.0**	**245.0**

Abbreviations

ACACA	Australia/China Agricultural Cooperation Agreement
A/Prof	Associate Professor
AFFA	Commonwealth Department of Agriculture, Fisheries and Forestry Australia
AFG	Australian Forest Growers
AGBU	Animal Genetics and Breeding Unit, University of New England
AGRF	Australian Genome Research Facility
AIDAB	Australian International Development Assistance Bureau
ANIC	Australian National Insect Collection
ANU	The Australian National University
APA-I	Australian Postgraduate Award - Industry
APT	Australian Plantation Timber Limited
ARC	Australian Research Council
ASREML	Quantitative genetics computer program
CALM	Department of Conservation and Land Management
CFTT	Centre for Forest Tree Technology
CMPC	Empresa CMPC, Chile - a paper manufacturer
CRC-SPF	Cooperative Research Centre for Sustainable Production Forestry
CSIRO SE	CSIRO Sustainable Ecosystems
CSIRO Ento	CSIRO Entomology
CSIRO FFP	CSIRO Forestry and Forest Products
CSIRO PI	CSIRO Plant Industry
DELM	Department of Environment and Land Management
DPIQ	Department of Primary Industries Queensland
DPIWE	Department of Primary Industries, Water and Environment
ETT	Education and Technology Transfer Program
FEA	Forest Enterprises Australia Pty Ltd
FFIC	Forests and Forest Industry Council
FFPRDC	Forestry and Forest Products Research and Development Corporation
FNCRDC	Forest and Nature Conservation Research and Development Center, Indonesia
ForSA	Forestry South Australia
FR	Forest Research, New Zealand
FRIM	Forest Research Institute Malaysia
FT	Forestry Tasmania
FWPRDC	Forest & Wood Products R&D Corporation
GI	Genetic Improvement Program
GL	Gunns Limited
GMU	Gadjah Mada University, Indonesia
GRP	Grand Ridge Plantations Pty Ltd
GU	Griffith University
HVP	Hancocks Victoria Plantation
ICFR	Institute for Commercial Forestry Research
INRA	Institut National de la Recherche Agronomique, France
INTA	Instituto Nacional de Tecnologia Agropecuaria, Argentina
IUFRO	International Union of Forest Research Organisations
JVAP	Joint Venture Agroforestry Project
LIPI	Lembaga Ilmu Pengetahuan Indonesia
LWRDC	Land and Water Research and Development Corporation
MLURI	Macauley Land Use Research Institute, Scotland
NCSU	North Carolina State University, USA
NHT	Natural Heritage Trust
NS	Norske Skog Paper Mills (Australia) Limited
NTPWC	Northern Territory Parks and Wildlife Commission
NZ	New Zealand

PFT	Private Forests Tasmania
QFRI	Queensland Forestry Research Institute
RAIZ	Instituto de Investigação de Floresta e Papel, Portugal
RDCBFTI	Research and Development Centre for Biotechnology and Forest Tree Improvement, Indonesia
RIRDC	Rural Industries Research and Development Corporation
RP	Resource Protection Program
S-Ag	Serve-Ag Pty Ltd
SCu	Southern Cross University
sE	*seedEnergy* Pty Ltd
SF NSW	State Forests of New South Wales
Sm	Sustainable Management Program
SPIRT	Strategic Partnership with Industry - Research and Training, ARC
STBA	Southern Tree Breeding Association Incorporated
TC	Timbercorp Limited
TFGA	Tasmanian Farmers and Graziers Association
UA	University of Adelaide
UF	University of Florida
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
USDA	United States Department of Agriculture
UT	University of Tasmania
UWA	University of Western Australia
UWS	University of Western Sydney
UZ	University of Zimbabwe
WACAP	WACAP Treefarms Pty Ltd
WAPRES	WA Plantation Resources

COOPERATIVE RESEARCH CENTRE
FOR SUSTAINABLE PRODUCTION FORESTRY

GPO Box 252-12, Hobart, Tasmania 7001, Australia
Tel (03) 6226 7947 (Internat) +61 3 6226 7947
Fax (03) 6226 7942 (Internat) +61 3 6226 7942
CRCForestry@ffp.csiro.au

Internet http://www.forestry.crc.org.au