



annual report 2005/06

Division of Forest Research and Development

researching



Forestry Tasmania
GROWING OUR FUTURE

Mission

To provide research, development and information services to support Forestry Tasmania and clients

Vision

To be recognised for excellence in forest research and development

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Division of Forest Research and Development



Division of Forest Research
and Development
Forestry Tasmania
GPO Box 207

Hobart, Tasmania – 7001

(03) 6233 8203

www.forestrytas.com.au

forestry.tasmania@forestrytas.com.au

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overview: Forestry Tasmania

Tasmania

Tasmania is an island of 68,331 square kilometres and outstanding natural beauty located 240 kilometres below the south-east corner of the Australian mainland. It is Australia's southernmost state. Tasmania has a population of around 485,000, and benefits from a temperate climate.

Tasmania is rich in natural assets, including forests and a diversity of minerals, and is the most forested state in Australia. Its relatively unspoilt beauty attracts visitors from all over the world.

Forestry Tasmania

Forestry Tasmania is a Tasmanian State Government Business Enterprise. The business manages 1.5 million hectares (ha) of State forest for multiple uses, employs 548 personnel (June 06), and has total assets (including valued forest) of A\$880 million.

Forest operations are managed by dividing Tasmania into five administrative Districts, with offices throughout the State and headquarters in Hobart.

Forest Types

The State Forest managed by Forestry Tasmania includes over 600,000 ha of native forest that is available for wood production. The main categories are tall native eucalypt forest (trees >34 m high), low native eucalypt forest (<34 m) and temperate rainforest.

There are also some 100,000 ha of plantations on State Forest, comprising:

- 53,000 ha of softwood - *Pinus radiata*
- 47,000 ha of hardwood - predominantly *Eucalyptus globulus* and *E. nitens*

A portion of the plantation estate is in joint venture with private investors or customers, including buyers of finished forest products.

Around 2.5 million tonnes of pulp logs and 835,000 m³ of sawlog, veneer and peeler logs were produced in 2005/2006.

Forest Tourism

The business also manages world-class tourist destinations in the forest, such as the Tahune Airwalk and Dismal Swamp.

Further information is available online in the Forestry Tasmania Annual Report 2005/2006, available at www.forestrytas.com.au



overview: Division of Forest Research and Development

Forestry Tasmania has a significant investment in research and development to ensure sustainability, improve productivity and enhance profitability from the native forest and plantation estate. An outlay of some \$2.5 to \$3.0 million of Forestry Tasmania funds per annum is directed to in-house research, out-sourced research and collaborative programs, and is augmented by competitively gained research funds and other state and Commonwealth funding. Some 60 projects are being managed at any one time.

Most of this R & D work is carried out or coordinated by staff in the Division of Forest Research and Development (DFRD). The Division has substantial experience in performing in-house research, in delivering contract research and consultancies to industry both in Tasmania and abroad, and in extending the results of research into forestry operations. The Division is also very experienced in working with other research providers such as Universities and CSIRO. Forestry Tasmania is a core member of the Co-operative Research Centre (CRC) for Forestry, and is also a participant in the Bushfire CRC. Forestry Tasmania also leads long-term ecological research at Warra in Tasmania's southern forests.

This Division has been in existence for over 30 years and is headed by the Chief Scientist, who reports to the Executive General Manager, who in turn reports to the Managing Director. Over 40 staff are employed, who have extensive experience in providing training and operational advice to Forestry Tasmania field operations and external clients in areas such as:

- forest conservation
- native forest silviculture
- plantation establishment and management
- browsing mammal management
- pre-commercial and commercial thinning, pruning and potential sawlog retention
- forest harvesting
- forest health surveillance
- disease and pest diagnosis and management

They have also developed many specialist manuals, standard operating procedures and quality assessment protocols for these operations.

Research and development work is supported by a well-equipped laboratory in Hobart.

The Division of Forest Research and Development is structured as follows:

Three R & D Branches

The Biology and Conservation, Native Forests and Plantations Branches provide the following key services:

- forest conservation and silvicultural research to improve operational performance
- extension of research results into field practice
- development of sustainable management for native forests and plantations

Extension to Districts and other clients takes approximately 30% of Divisional staff time.

Two Trading Units

The Tasmanian Seed Centre supplies locally collected seed for native forest regeneration, and genetically improved seed for plantations, locally and internationally

The Forest Nursery grows millions of tree seedlings for plantations, mainly *E. nitens*, *E. globulus* and *P. radiata*

The Forestry Tasmania Library

The Library is located at Forestry Tasmania's Hobart head office, and provides information services to all Forestry Tasmania staff as well as external clients

A Business Support Group

Three other sections in Forestry Tasmania also carry out research and development work:

Conservation Planning Branch: carries out research to assist with incorporating conservation measures into operational planning

Management Research Branch: develops and implements forest growth and yield models

Fire Management Branch: undertakes research into fire management

Chief Scientist's report

By Dr Steve Read

Steve.Read@forestrytas.com.au

The opening address by Senator Ian Macdonald to the 1500 delegates at the World Congress of the International Organisation of Forest Research Organisations (IUFRO), held in Brisbane in August 2005, noted that Tasmania was Australia's premier forest State with some 45% of its forests in reserves. The diversity of the international research effort in forest science was indicated by the scheduling of no fewer than 22 concurrent research sessions each afternoon and evening of the Congress. Forestry Tasmania's Division of Forest Research and Development (DFRD) sent four staff to participate in the IUFRO Congress and report back on advances in forest science. They concluded that Tasmanian forest research and management is comparable to the best in the world. The brief for Forestry Tasmania researchers includes carrying research outcomes through to operational application, as well as collaboration and wider communication.

Native Forest Research

The Silvicultural Systems Trials at Warra explores alternatives to clear-felling in old-growth forests, and the final trial coupe (the second small-group selection coupe) was harvested this year. The 2005 Tasmanian Forest Community Agreement provided continued funding for research on alternative silvicultures for wet forests. Planning for delivery of this research was undertaken in 2005/06, including appointment of a Data Manager to integrate results from the Silvicultural Systems Trial, and Research Officers to extend variable retention silviculture through wet eucalypt forests across Tasmania and assess the stand-specific biodiversity outcomes from variable retention. Some of the most important additional work to come will be to develop economical and effective burning regimes ensuring forest regeneration in variable retention coupes. Ensuring outcomes from this research are translated into operational practice occurs through a Variable Retention Implementation Group that brings together researchers and field forestry staff, similar to the Integrated Browsing Management Group that has been successful in implementing alternative approaches to management of browsing mammals.

Research on hardwood plantations

A large part of DFRD research addresses the challenge of producing a high-quality pruned resource from Forestry Tasmania's hardwood plantation estate. Highlights of plantation research for 2005/06 include increasingly sophisticated secondary fertilisation regimes, tools to assess the risk of wind-throw, and establishment of four new eucalypt family genetics trials. The increased business focus on plantation status and management led to appointment of a Plantations Quality Standards Officer. The 2005 Tasmanian Forest Community Agreement will also fund DFRD research on plantation hydrology and (through the Tasmanian Water Catchment Initiative) the mobility of pesticides through forest soils.

Conservation biology and forest health

DFRD has continued to make a strategic contribution to forest conservation biology. One example is development of a dynamic model that uses a detailed understanding of log decay processes to predict the level and type of coarse woody debris on the forest floor. The model will allow forest management to take into account the needs of fauna dependent on this dead wood resource, such as invertebrates that play a key role in forest recycling processes, and will also be able to inform future research on forest carbon balance. Our expertise in decaying log habitats was noted through Dr Simon Grove being invited to Sweden as an international reviewer of their national scientific research program on management of habitat for saproxylic (dead-wood-dependent) invertebrates. Forestry Tasmania is fortunate to be the location of the Tasmanian Forest Insect Collection, a comprehensive and widely used reference collection and database of Tasmanian forest insects - tens of thousands of specimens are added annually, specimens sent to experts overseas for taxonomic revision, and substantial grants received for accessing records. Indeed, DFRD's wider health surveillance and forest protection work provides significant income: port surveillance technology (static trapping and sentinel plantings to detect early introduction of exotic forest pests and diseases) developed by Dick Bashford has become part of a nationally funded program, aerial and roadside surveys are carried out for several Tasmanian forestry companies, and an ACIAR-funded project will lead to further advances in cost-effective detection in plantations and at hazard sites.

Our collaborations

Much of DFRD's research is performed in collaboration with others, as this is by far the most cost-effective way to bring into Forestry Tasmania the wide range of relevant expertise and knowledge in other institutions. Examples of these collaborations are participation in the CRC for Forestry, the Bushfire CRC and a number of ARC Linkage grants. This was the first year of the CRC for Forestry, so work was focussed on project establishment. Eucalypt forests are robust and resilient to disturbance, and the Bushfire CRC Wildfire Chronosequence project provides a set of natural disturbance benchmarks against which to assess the structure, biodiversity and productivity of forest regenerating from timber harvesting. One of our ARC Linkage projects seeks to understand the social acceptability of forest operations when visualised at the landscape level: this will be the first of several DFRD projects to use the Mt Weld/Geeveston axis in the southern Tasmanian forests as an Experimental Forest Landscape, extending from the continuous forests of the Warra Long-Term Ecological Research site to the extensively modified but still treed landscape along the Huon estuary.

Wider communications

Research thus informs forest management and operations directly as part of Forestry Tasmania's daily business, but it is also important that this is specifically demonstrated and communicated to the wider community. The scientific and technical staff of DFRD are therefore involved in publicising their research and its implementation. DFRD is a significant player in National Science Week activities in Tasmania, and in 2005 presented a public talk in Hobart every day of National Science Week plus additional talks in northern Tasmania, as well as coach tours of our working forests and other in-forest activities. Altogether 13 lunchtime talks were delivered throughout the year covering the diverse range of scientific activities that underpin the Forestry Tasmania business, from "Calculating the sustainable wood supply from Tasmania's public forests" (Mike McLarin) through "How we know what trees to grow" (Peter Volker) to "A pathologist talking rot" (Tim Wardlaw). In addition, the research work undertaken by DFRD staff was publicised through refereed journal papers, a large number of Technical Reports and Technical Bulletins, presentations at scientific conferences, Forest Education Foundation field days, and guiding visitors through the Warra Silvicultural Systems Trial.

The job of a DFRD researcher thus requires maintaining an awareness of national and international developments in their forest science speciality, performing their own research, and ensuring that results are used to inform Forestry Tasmania's forest management and operations, as well as being involved in publicising their work. The remainder of this Annual Report demonstrates the high standard at which these tasks are carried out. The strength of the research carried out in DFRD is grounded in its close links with both practical forest management and policy setting in a commercial environment.

Research highlight: developing a thinning regime for fenced-intensive-blackwood coupes

By Sue Jennings
Sue.Jennings@forestrytas.com.au

Fenced-intensive-blackwood (FIB) is a regeneration system that makes use of the blackwood seed resource stored in the ground in wet eucalypt forests that have a significant component of blackwood in the understorey. The post-harvest regeneration burn, used to provide seedbed for the crop of eucalypt seedlings, also stimulates germination of the blackwood seed.

Fencing of these coupes after burning protects the palatable blackwood seedlings from browsing by native mammals, and results in a dense stocking of blackwood saplings growing within the eucalypt regeneration. Fenced coupes may carry more than a thousand blackwood saplings/ha at age 15 years, in addition to the eucalypt crop. They may also support more than 20,000 stems of understorey species, predominantly *Pomaderris apetala*. Unfenced coupes are likely to carry less than 100 blackwood stems per ha at the same age.

The older FIB coupes, established in Murchison District in the early 1990s, are reaching an age where competition between the eucalypts, the blackwoods and the understorey species is severe. A release trial in one of the early FIB coupes, where individual blackwood saplings were released from both eucalypt and *Pomaderris* competition, showed that blackwood saplings respond well to increased light, with diameter growth increments up to 2.5 times higher.

Highly stocked young eucalypt stands are routinely pre-commercially thinned (PCT) to concentrate the eucalypt production of the site onto fewer, bigger trees with better stem form. This is usually done by stem injection of unwanted trees with Glyphosate herbicide. Consideration was given to thinning the eucalypt crop in FIB coupes more severely than usual, to provide more light, and hence a growth advantage, to the understorey blackwoods.

A trial established in 1999 compared the growth response of the blackwood saplings under the standard PCT treatment (PCT 50% - removal of 50% of the eucalypt basal area) with a heavier PCT treatment where 75% of the eucalypt basal area was removed (PCT 75%). After 5 years, removal of 50% of the eucalypt basal area had not significantly increased blackwood diameter (Figure 1), while PCT 75% showed an increase in blackwood diameter growth of 42% over that of the controls.

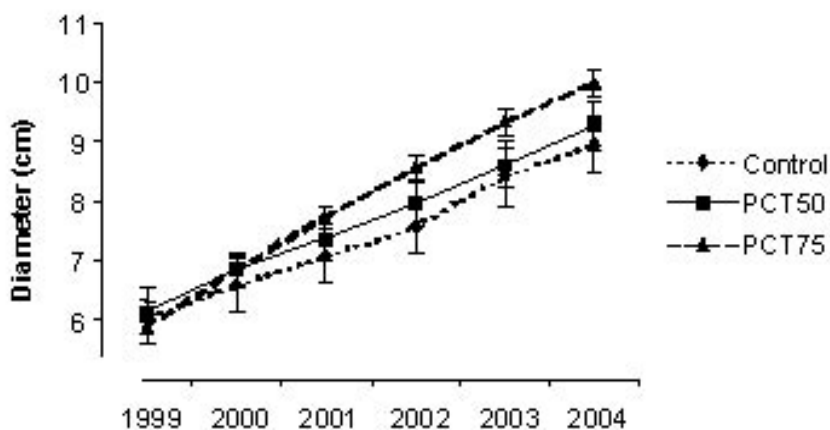


Figure 1. Mean diameter for blackwood saplings under two PCT regimes for the five-year period after thinning. Bars show standard errors of the plot means (n=3)

Removal of 75% of the eucalypt basal area on this highly stocked stand still resulted in a eucalypt density of over 350 stems/ha. This is a stocking level that would benefit from future commercial thinning. However, commercial thinning of the eucalypt overstorey is likely to cause unacceptable damage to the valuable understorey blackwood stems, followed by windthrow or bending of the blackwood stems.

A further trial is underway which will reduce the

eucalypt stocking right down to final crop numbers (100–250 stems/ha) at age 15 years. This should significantly increase blackwood diameter growth immediately, and avoid a damaging mechanical thinning operation in the future.

Research highlight: revision of quality standards system for eucalypt plantations

By Melissa Syme

Melissa.Syme@forestrytas.com.au

Forestry Tasmania's eucalypt plantations are one of its major assets, into which there has been a significant investment of resources. Forestry Tasmania is committed to producing high-value products such as pruned sawlogs and veneer logs at the end of the plantation rotation (or growth cycle). There are a number of operations involved in the establishment and maintenance of plantations throughout their rotation. Achieving a high quality of work throughout each operation is an integral part of achieving these goals.

Over the last 5-10 years Forestry Tasmania has worked with a range of quality control methods, and has been able to evaluate their effectiveness and functionality. We trialed a range of intense sampling techniques, collecting large amounts of data. From this, we are able to evaluate the relative importance of this information and how it impacts on subsequent operations and the performance of the plantations as a whole.

This process has led to development of a simple and effective Quality Standards System to monitor the performance of each operation in the field.

The important concepts of quality control for each operation are to:

- Identify the important aspects that need to be measured or monitored
- Decide on the acceptable standards for those aspects
- Set tolerance limits or levels for each aspect
- Devise suitable sampling methods and sample sizes
- Devise suitable recording and monitoring systems



Evaluating quality standards in the field.

Through identifying the critical aspects of each operation, such as the number of planting spots created during a preparatory cultivation operation, we have been able to minimise the intensity and complexity of the sampling process. We have changed the emphasis of quality standards from a focus on inputs (details of the operation) to a focus on outcomes to be achieved, such as increased plantation performance and improved environmental outcomes. The revised quality standards system will significantly reduce the time and cost involved in monitoring operations whilst still delivering meaningful outcomes.

Research highlight: investigating the suitability of large logs as habitat for broad-toothed stag beetles in Wielangta forest

By Dr Simon Grove and Belinda Yaxley
Simon.Grove@forestrytas.com.au
YaxleyB@utas.edu.au

In January 2006, Forestry Tasmania conducted survey work in Wielangta Forest aimed at ascertaining the extent to which the endangered broad-toothed stag beetle *Lissotes latidens* may make use of large-diameter logs in dry forest. The survey also encompassed wet forest for comparison. *Lissotes latidens* is considered to be primarily an inhabitant of wet forest, and to depend on the interface between rotting logs and soil for breeding habitat. Large logs were the focus of the work because previous surveys involving log-rolling had been confined to smaller logs that could be rolled by hand. In the present survey, an excavator was employed so that larger logs (60 cm average mid-point diameter) could be rolled. Additionally, since views on the effectiveness of pitfall trapping for this species vary, live pitfall trapping was conducted, with the pitfall traps being positioned as close to large logs as possible.

Fifty-four person-days were spent on fieldwork, which involved establishing and checking 162 pitfall traps (totalling 3866 trap-days of sampling), and locating and rolling 121 large logs by excavator (totalling 1114 m of log length, 896 m of which was rolled). The fieldwork was conducted in unharvested forest, at three dry forest sites and three wet forest sites within Wielangta. Survey effort was roughly equally divided between these two forest types.

Six species of stag beetle were found, including four species of *Lissotes*. No *L. latidens* were found through pitfall trapping, but five specimens were found under a total of three logs through excavator rolling. One live male, and identifiable parts of a dead male, were found under a log at one dry forest site, while an adjacent, smaller log at the same site revealed a further dead male. The logs in question were both long (15 m and 10 m respectively), large-diameter (100 cm and 61 cm respectively), and in a late decay stage. They were also both within 50 m of wet forest - much closer than most other dry-forest logs under which the species was not detected. At one wet forest site, a live female and a dead male were found under a 13 m long, 70 cm diameter, mid-decay stage log. Generally, only a small proportion of the length of the large logs that were rolled was found to be in contact with soil, particularly in dry forest (average 32% for logs in wet forest, 24% for logs in dry forest). This may partly explain the scarcity of records of *L. latidens* under these large logs.

Other survey work carried out recently within the study area indicates that large logs comprise a small proportion of the total log resource in unlogged dry forest (e.g. logs over 50 cm diameter comprise 11% of the log volume and only 1% of the log items). Coupled with the findings of the present study, this strongly suggests that large logs cannot be considered a key habitat for *L. latidens*, in either wet or dry forest. It is hypothesised that optimal log size for the species may be smaller than the size of those logs sampled in this study, and that there may be a difference between the characteristics of logs providing optimal breeding habitat and those providing optimal habitat as refugia during dispersal. While wet forest would more readily meet the requirements of *L. latidens*, drier forest may do so on occasion, but chiefly where it abuts wetter forest.



Looking for broad-toothed stag beetles under a log rolled by excavator in WT019D, January 2006. Photo by Karen Richards (Forest Practices Authority)

Research highlight: the use of static traps to detect low levels of the woodwasp, *Sirex noctilio*, in young susceptible plantations

By Dick Bashford

Dick.Bashford@forestrytas.com.au

Exotic wood wasps can cause high levels of mortality in pine plantations. One species, *Sirex noctilio*, was first detected in Tasmania in 1952 and has subsequently spread into softwood plantations throughout southeastern Australia. Plantations aged seven years or older are susceptible to Sirex attack.

For several decades the method of detecting developing populations of Sirex has been through aerial and ground surveillance, and the establishment of trap tree plots following detections. Trap tree plots are sets of ten trees treated with a measured dose of herbicide sufficient to stress the tree and so render it attractive to Sirex. In Australia hundreds of trap tree plots are prepared each year in Sirex-infested plantations and in plantations entering the susceptible age bracket. Sirex attacks approximately half of all prepared plots.

In 2003, a number of Sirex females were captured in static traps that were being run in an experimental urban monitoring program in northern Tasmania. This suggested that we could develop a novel method to detect Sirex in young plantations using static trapping, and a small pilot study was conducted in five Tasmanian plantations during the summer of 2004/05. Three lures containing volatile chemicals released by stressed plants were tested at two release rates in two designs of static trap. The panel trap design was superior in capturing Sirex wasps compared with a funnel trap design, and high volatile release rates were more effective than low release rates.

The National Sirex Co-ordination Committee has funded a trial involving Tasmania, New South Wales and Queensland to test a range of host volatile lures based on antennogram and volatile extraction work conducted in Tasmania in the 1970s by John Madden and Dick Bashford. In collaboration with Advanced Pheromone Technologies (Portland, Oregon), a series of host volatile lures were formulated for use in panel traps. The traps

were set up in the field in December 2005 and ran until the end of March 2006. In Tasmania, traps were placed in two plantations with a known low population of Sirex and in three plantations where Sirex was not known to be present, based on routine forest health surveys. Similar trap placements were made in low-to-moderate Sirex infestations in central NSW. The sites in northern NSW and Queensland were beyond the current known range of Sirex.

In Tasmania, Sirex was recorded in all plantations including the three designated as 'Sirex-free'. In NSW, four out of seven 'Sirex-free' plantations recorded Sirex catches. Sirex was not recorded in northern NSW or Queensland.

The trial has thus enabled the selection of a trap/lure combination that allows very sensitive detection of Sirex at low population levels in young plantations. The introduction of static trapping in parallel with a reduced trap tree program should result in cost reductions in the national Sirex control program of 25-30%. In States such as Queensland and Western Australia, where Sirex is not yet present, the adoption of the static trapping technique in place of trap-tree plots should save 38% in monitoring costs.



Dick Bashford inspecting an intercept panel trap that has been installed in a pine plantation

Research highlight: prediction and management of plantation windthrow

By Dr Matthew Wood

Matthew.Wood@forestrytas.com.au

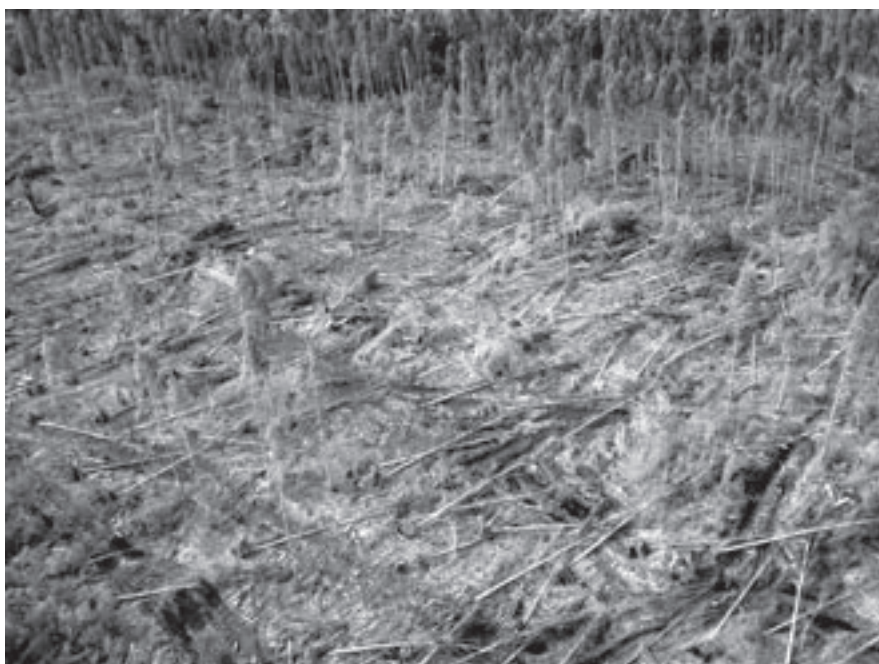
The variables that directly influence the risk of windthrow are well known. These include wind speed, rainfall, elevation, topography, soil properties (physical and hydrological), root development, stem form and other stand attributes (e.g. stocking, crown density), and silvicultural operations (notably thinning). Much has been done overseas to understand wind-tree interactions in spruce and pine species, resulting in complex systems for both the prediction and management of windthrow. However, the extent to which each of these variables influences windthrow in eucalypt species remains unknown. In response, WindRISK, a semi-quantitative windthrow hazard assessment procedure, has been developed for use in Tasmania to provide a framework for more informed decision making.

In Stage 1 of a WindRISK assessment, a site hazard rating is assigned (very low to very high hazard). This includes an assessment of topographical exposure (very sheltered to very exposed) weighted according to additional climate, site and soil variables. In Stage 2, site hazard is weighted according to a range of key silvicultural variables to provide an indication of overall windthrow risk to the stand (insignificant to extreme).

Digital elevation models are used to map topographical exposure. For a given location, the angle to the highest or lowest terrain feature within a pre-determined distance is calculated. This process is carried out for the eight cardinal points of the compass and the sum of the angles then defines exposure for that location; negative values indicate exposure whilst positive values indicate shelter. This process is repeated automatically at a user-defined resolution to produce a contour map of topographical exposure.

The system is being used across the State to assist a range of operations including site selection and plantation design, establishment, and thinning and harvesting operations. To validate WindRISK, retrospective assessment of historic windthrow events using the procedure is under way. Most notable has been windthrow in highly exposed areas, windthrow due to operations in adjacent stands (e.g. removal of shelter due to harvesting), or windthrow after thinning in stands exceeding 20 m in height (a threshold value well documented for

pine and spruce species). Future research efforts aim to understand more fully the relationship between topographical exposure and wind speed in Tasmania, and to quantify the key mechanical forces at work in eucalypts subject to wind loading. Long-term trials will provide further information on the effects of exposure on stem form and wood quality, and on the effectiveness of management regimes, notably stocking and thinning practices, aimed at limiting windthrow on high-risk sites.



Recent windthrow of a eucalypt plantation in Tasmania

Research highlight: harvesting & processing of a long-term plantation silvicultural trial

By Drs Peter Volker and Matthew Wood
Peter.Volker@forestrytas.com.au,
Matthew.Wood@forestrytas.com.au

In native forests, Australia's many eucalypt species are valued for the high quality timbers that they produce. In Tasmania the predominant native forest eucalypts used for timber production are ash species including *Eucalyptus regnans*, *E. delegatensis* and *E. obliqua*. Timber from these three species is collectively sold as Tasmanian Oak.

In the late 1970s the first eucalypt plantations were established in Tasmania on an industrial scale. There was a rapid expansion in eucalypt plantation establishment in the State through the 1980s, primarily aimed at production of wood-fibre resources for pulp and paper. The three ash species were tried, but many difficulties with survival, insect damage and tree form were encountered. In addition the ash species did not have the productive capacity of two species from the blue gum group, *E. globulus* and *E. nitens*. *Eucalyptus globulus* is native to Tasmania and southern Victoria and is a premium species for the production of fibre for chemical pulp production. It is widely planted in pulpwood plantations in Western Australia, the Green Triangle Region, south Gippsland and Tasmania. Its close relative, *E. nitens*, (the shining gum), from the Central Highlands of Victoria, is more frost tolerant and has fibre and timber characteristics more closely matched to ash group species.

Forestry Tasmania embarked on a research program to produce solid timber products from plantations as a result of recommendations of the Helsham Inquiry. Funds were provided through the Intensification of Forest Management (IFM) Program that ran from 1990 to 1997, managed by the Forest and Forest Industries Council.

In 1990, a six-year-old *E. nitens* plantation located at Goulds Country in north-eastern Tasmania was selected for a trial to investigate the potentially beneficial effects of pruning and thinning on the production of solid wood products. Trees were pruned in a single lift to 6.4 metres. Four thinning treatments were imposed in which the initial plantation stocking of 1100 stems per hectare (sph) was reduced to 400, 300, 200 and 100 sph on replicated plots. Unthinned plots were also included for comparison. The trial has since been measured annually for growth and crown development.

At age 22 years, in May 2006, trees from each treatment were harvested and logs sawn into boards for evaluation. Prior to felling, a number of measurements were taken on standing trees including diameter at various heights, bark thickness at various heights, height to first green branch, stem straightness, green crown dimensions and total tree height. A visual assessment of potential log products was also carried out. Immediately prior to felling, growth strain measurements were taken on each tree, and a breast height increment core of 8 mm diameter was extracted for Silviscan analysis. After felling, a few trees from each treatment were sampled for biomass production. Every tree was measured at regular intervals along the stem for diameter and bark thickness. Discs were also collected from regular intervals up the tree for later analysis of growth and stem eccentricity. The 6.0 m pruned logs were taken to a sawmill for processing. An acoustic velocity tool was used as an indirect measure of stiffness in the log prior to sawing.

The final measurements, harvesting and processing studies were coordinated through the Co-operative Research Centre for Forestry. Scientists from Forestry Tasmania, University of Tasmania, University of Melbourne and ensis were involved.

Results from the standing tree and log assessments will be compared with the performance of boards recovered from processing. This evaluation of processed boards will occur in late 2006.



Forestry Tasmania hosts a field day for CRC Forestry members and forest industry members at Goulds Country prior to commencing the processing studies.



Measurement of growth strain in a standing tree is undertaken by Juan Carlos Valencia of the University of Tasmania (UTas)



Dr Bruce Greaves (UTas) collects wood cores.



Juan Carlos Valencia (UTas MSc student) collects growth strain measurements from standing trees.



Collection of detailed tree measurements on tree height, upper stem diameters, branch size, location and direction were made after felling.



Dr Trevor Innes (UTas) measures acoustic velocity in logs.



Logs in the sawmill, ready for cutting.



Juan Carlos Valencia (UTas) and Dr Peter Volker (FT) measure boards for distortion after sawing.

Research Branch report:

Biology and Conservation

Principal Research Officer: Dr Tim Wardlaw
Tim.Wardlaw@forestrytas.com.au

The Biology and Conservation Branch conducts research into the management of pests and diseases and the conservation of natural values. Arising from this research are management prescriptions and monitoring systems to increase forest productivity and ensure ecologically sustainable management practices. The Branch also provides forest health surveillance services to Forestry Tasmania and external clients. At end June 2006, the Branch had nine full-time and six part-time staff.

Main outputs for 2005/06

- Collaborated with Mersey District to provide scientific evidence that the Mersey Box Trap was a humane method for the live capture and shooting of pademelons. This method has since been approved by the Animal Welfare Advisory Committee and a Code of Practice written.
- Completed an analysis of browsing risk data to identify factors associated with the browsing risk of a coupe.
- Installed an automated animal tracking system in coupe EP079A to identify the species responsible for browsing of 12-month-old seedlings, and evaluate the accuracy of the current damage monitoring method.
- Demonstrated that large logs are not preferred habitat for the broad-toothed stag beetle, and reinforced prior understanding that suitable habitat only develops in wet sclerophyll forests and moist ecotones at the junction of wet and dry sclerophyll forests.
- Located suitable sites for 10 of the 12 plots in the Wildfire Chronosequence project and completed the establishment of seven of these.
- Reached 10 years of continuous running of the log decay study, which is now in its third cycle of emergence trapping for beetles and other invertebrates. A notable record was the first emergence of *Toxeutes*, which is considered to be a late successional species.
- Ran a static trapping trial for wood and bark boring insects in an *E. nitens* plantation, and proved that the method could detect all the major coleopteran (beetle) wood-borers and bark-borers known from Tasmania.
- Developed a more sensitive and cost-effective method of detecting *Sirex* wood wasp using static traps.
- Completed an extensive review of research into options for managing leaf beetles, and convened a workshop of experts to identify the areas of research most likely to deliver significant improvements in management. Genetics for improved pest resistance and "attract and kill" technology were the two most highly ranked prospects.
- Developed a survey method for monitoring the condition of wildlife habitat strips. The condition and integrity of WHS in plantation areas was found to be generally good.
- Completed annual health surveillance of all softwood and hardwood plantations on State Forest, prepared 131 notification reports for clients, identified priority health problems, and liaised with Districts to determine responses to detected health problems.
- Provided technical expertise to the Department of Primary Industry and Water to help them set up an urban surveillance program (as the Tasmanian component of a national program) based on the method developed by Forestry Tasmania.
- Undertook destructive sampling of 10 trees in a 26-year-old pruned *E. nitens* plantation, and found that decay from pruning had remained confined to the knotty core, while decay from dead branches above the pruned section had not spread down into the clearwood.
- Appointed a Research Officer (Variable Retention - Biodiversity) to integrate and synthesise the biodiversity findings from the Warra Silvicultural Systems Trial and other variable retention harvest sites across Tasmania.

Biology and Conservation:

key research and development project list

Project Name and Staff	Aim	2005/06 Progress
Forest Health Surveillance program		
Health surveillance of plantations		
FT Staff: K. Wotherspoon S. Jennings N. Ramsden T. Wardlaw J. Elek R. Bashford External clients: Rayonier (Asia-Pacific) Gunns Limited Norske Skog	Maximise the health and productivity of plantations by ensuring health problems are detected and managed before significant impacts occur. Provide a for-profit service to external customers.	Conducted aerial and roadside surveys of all plantations on State Forest. 107 notification reports for problems detected. Conducted aerial and roadside surveys of all Norske Skog pine plantations.
Health surveillance of Wildlife Habitat Strips		
FT Staff: S. Jennings K. Wotherspoon N. Ramsden	Help ensure ongoing function of forest retained as habitat for biodiversity by detecting, documenting and, where appropriate, acting on threats to WHS health and integrity.	Developed a method for evaluating health and integrity of WHS and incorporated in to surveillance program. 146 WHS surveyed. Generally strips were in good condition.
Extension, monitoring and training		
FT Staff: S. Jennings K. Wotherspoon N. Ramsden T. Wardlaw	Provide pro-active responses to the management of detected health problems through effective liaison between Forest Health Surveillance staff (and specialists) and District staff. Increase awareness among field staff of the common health problems in pine and eucalypt plantations.	Conducted annual debriefing of 2004/05 health surveillance program with each District. Produced and implemented an action plan for undertaking agreed responses to health problems detected in 2004/05.
Quality Standards		
FT Staff: S. Jennings K. Wotherspoon N. Ramsden T. Wardlaw	Ensure continuous improvement in managing the health and productivity of the eucalypt plantation estate.	Prepared priority list of insect pests and diseases in plantations for Research Working Group 7 and Australian Forestry Standard. Prepared plantation performance report and health surveillance summary for 2005 Quality Standards program.
Port Surveillance		
FT Staff: R. Bashford T. Wardlaw Collaborators: DPIW Office of the Chief Plant Protection Officer	Provide a service that monitors selected high-risk sites to detect the early introduction of exotic forest pests and diseases, particularly those that attack <i>Pinus</i> and <i>Eucalyptus</i> .	Assisted DPIW staff to establish urban surveillance at all major ports in Tasmania. This is part of a national program that uses the model developed by FT.

Biology and Conservation: key research and development project list (continued)

Project Name and Staff	Aim	2005/06 Progress
ACIAR Pacific FHS		
FT Staff: T. Wardlaw R. Bashford K. Wotherspoon Collaborators: ACIAR Queensland DPI Fiji Forests Department Vanuatu Forestry Department	Assist Pacific Island countries build a capacity for health surveillance of their commercial forest estates. Cost-effective surveillance methods based on scientific studies into the detection efficiency of aerial, roadside and ground surveys.	Sought and received funding from ACIAR for a follow-up project to develop capacity in participating countries for early detection in plantations and at hazard sites using static traps and sentinel plantings
Forest Pathology Program		
Wood decay		
FT Staff: T. Wardlaw Collaborators: <i>ensis</i>	A detailed knowledge of stem decay in regrowth and plantation eucalypts and its effect on management objectives and economic returns. Silvicultural tools and other management strategies to minimise the effect of stem decay identified, tested and introduced operationally.	Undertook destructive sampling to assess rotation-length risk of decay from pruned and dead branches above pruned section of stem in <i>E. nitens</i> . Found <i>E. nitens</i> was able to restrict decay from pruned branches to within the knotty core for the duration of planned current rotations
Management of <i>Mycosphaerella</i> leaf blight (MLB) of <i>Eucalyptus globulus</i>		
FT Staff: T. Wardlaw Collaborators: CSIRO FFP CRC-SPF UTas	An effective and environmentally sound management program to protect <i>E. globulus</i> from economic damage following outbreaks of <i>Mycosphaerella</i> leaf blight (MLB).	All field work completed. Draft manuscripts prepared on: (i) differential growth impacts of MLB in windrow and bay trees; (ii) potential of fertilisation with N & P to reduce growth impacts from MLB; (iii) impact of a severe epidemic of MLB on the growth of <i>E. globulus</i> .
<i>Phytophthora cinnamomi</i> management		
FT staff: T. Wardlaw A. Woolley S. Jennings Collaborators: Forest Practices Authority Gunns Limited	Ensure that susceptible plant species and communities of high conservation value are protected from the adverse effects of <i>P. cinnamomi</i> .	Conducted surveys to determine the <i>Phytophthora</i> -status of strategically important quarries in Bass, Murchison and Huon Districts. Completed draft Flora Technical Note (with Forest Practices Board) for <i>Phytophthora</i> management. Held field day for staff in Bass District on planning and operations for reducing threat of <i>P. cinnamomi</i> .

Biology and Conservation: key research and development project list (continued)

Project Name and Staff	Aim	2005/06 Progress
Diagnosis and advice		
FT Staff: T. Wardlaw R. Bashford	Provide and maintain specialist forest pathology diagnostic support for Forestry Tasmania and as a profit making service for external customers	Diagnosed <i>P. cinnamomi</i> as the cause of extensive early mortality in young <i>E. nitens</i> plantations in Bass District. Isolated suspected <i>Botryosphaeria ribis</i> from upper stem cankers in drought stressed <i>E. nitens</i> .
Insect Pests Program		
Lethal Traps		
FT Staff: J. Elek CRC Staff: Vin Patel Collaborators: Bayer Sumitomo	Develop a novel delivery method for systemic insecticides as an alternative to aerial spraying, which offers the potential for better targeting defoliators and in particular adult beetles that are difficult to manage with current methods.	Evaluated various methods of introducing systemic insecticides into <i>E. nitens</i> , <i>E. regnans</i> and <i>E. delegatensis</i> . Bioassays showed some uptake had occurred within two weeks using stem injection or trunk spray but not ground-applied granular formulation. No treatment proved effective for the required 3 months. The effectiveness of a trial deployment of lethal trees in plantations could not be determined because of low beetle populations. Developed choice experiment method for testing attractiveness of foliage to beetles.
Leaf Beetle Integrated Pest Management (IPM)		
FT Staff: J. Elek	An IPM system that is efficient at preventing economic damage by leaf beetles in plantations, by maximising the effectiveness of natural enemies, biological control and environmentally benign chemicals	Co-ordinated management of 2005/06 leaf beetle program with Districts. Monitoring method was modified in some Districts to reduce costs by sampling amalgamated plantation units. Achieved a high level of substitution of cypermethin with Spinosad in two of the four Districts that undertook spraying.

Biology and Conservation: key research and development project list (continued)

Project Name and Staff	Aim	2005/06 Progress
Extension, monitoring and training		
FT Staff: J. Elek N. Ramsden	Achieve good channels of communication with field staff and Forest Health Officers on all aspects of the operational management of key insect pests, so as to ensure documented prescriptions and standards are adhered to and new issues incorporated into research program as required. Ensure growth of plantations not compromised by damage from insect pests.	Conducted workshops for training in the method for monitoring leaf beetles in three Districts. Liaised with FHS staff to determine priority plantations for leaf beetle management
European Wasp		
FT Staff: R. Bashford Collaborators: DPIW Bayer	Develop and implement a cost-effective method for reducing the impact of European wasp.	Carried out one baiting operation in Huon District.
Sirex monitoring		
FT Staff: R. Bashford Collaborators: NSW DPI Queensland DPI	Prevent significant losses from outbreaks of Sirex wood wasp in <i>P. radiata</i> plantations.	Participated in a tri-State trial to refine static trap method for detecting Sirex. Showed the method was very sensitive and able to detect the wasp much earlier than the current method.
Maintenance and use of the Tasmanian Forest Insect Collection (TFIC)		
FT Staff: S. Grove R. Bashford Collaborators: PHA (Diagnostic Network) ANIC CRC-SPF Numerous taxonomists	Develop a comprehensive, highly valued and widely used reference collection and database of Tasmanian forest insects.	Several thousand further specimens were added to the collection. Formally identified over a hundred additional beetle species in the TFIC. Dedicated workspace now set up to work on the TFIC. Sent many TFIC specimens to overseas experts for taxonomic revision. Received grants totalling \$14,000 for accessing records from the TFIC.

Biology and Conservation: key research and development project list (continued)

Project Name and Staff	Aim	2005/06 Progress
Browsing Mammals Program		
Browsing risk management and monitoring		
<p>FT Staff: A. Walsh L. Stamm D. Burton</p> <p>Collaborators: <i>University of Tasmania</i></p>	<p>Effective methods for predicting browsing risk and monitoring browsing damage to ensure young plantations and regenerating native forests can be protected from unacceptable levels of browsing damage.</p>	<p>Progressed hot-spot analysis and browsing risk assessment through UTAs as part of a Grad. Dip. in Spatial Analysis.</p> <p>Installed and commissioned an automatic animal tracking system in a cable-logged coupe (EP079A). This initial study will (i) relate movement of pademelons and possums with seedling damage, and (ii) evaluate the current damage monitoring method.</p>
Humane trapping method for pademelons		
<p>FT Staff: A. Walsh D. Burton L. Stamm B. Knox G. Crawford D. Horne</p> <p>Collaborators: <i>Tas Wire Products</i> <i>Greg Hocking, DPIW</i></p>	<p>Develop a humane and effective method to reduce browsing damage in plantations and native forests by capture and shooting of pademelons (<i>Thylogale billardierii</i>) and brushtail possums (<i>Trichosurus vulpecula</i>) using specially designed traps.</p>	<p>Collaborated with Mersey District to provide scientific evidence that live capture (using the Mersey Box Trap) and shooting of pademelons was both humane and effective in reducing crop damage.</p> <p>Drafted a Code of Practice for the live capture and shooting of pademelons.</p>
Non-lethal tactics		
<p>FT Staff: A. Walsh D. Burton L. Stamm G. Kennedy B. Garrod C. Cox</p> <p>Collaborators: <i>UNSW</i></p>	<p>Identify and evaluate non-lethal methods useful in reducing browsing risk to seedlings.</p>	<p>Designed and built (Plant Branch) two seedling flexers, which were installed in a tunnel house at Perth Nursery. Conducted an initial trial to determine the maximum plant response that could be achieved from continuous flexing for 3 months.</p> <p>Showed that replaying recorded bioacoustic sounds, particularly distress calls of juvenile wallabies made pademelons and wallabies significantly more vigilant.</p> <p>Post-plant application with Plant-gard® in combination with diversionary feed (sorghum) was ineffective in quelling damage to <i>E. nitens</i> seedlings in a browsing hot-spot.</p>
Tactics for hot spots		
<p>FT Staff: A. Walsh D. Burton L. Stamm</p>	<p>Develop non-lethal options for establishing seedlings in areas that have extreme browsing risk (hot spots).</p>	<p>No work done in this area during the past year.</p>

Biology and Conservation: key research and development project list (continued)

Project Name and Staff	Aim	2005/06 Progress
Extension		
<p>FT Staff: G. Sargison, T. Wardlaw, R. Sharp, A. Walsh, L. Edwards, M. McCormick, B. Knox, C. Butt, N. Foss, G. Bennett, J. Bennett, K. Borland</p> <p><i>Collaborators:</i> Don Aurik (Rayonier) Robin Dixon (Gunns) Chris Berry (Norske Skog)</p>	<p>Effective communication between research and operations staff to ensure rapid translation of research into practical and cost-effective management practices.</p>	<p>Held seven meetings of the IBMG. Shared ideas on tracking for improved access, free-feeding shooting and trapping, fencing, monitoring and data management.</p> <p>Revised necessary documentation for safety and environmental monitoring system (Forest Operational Plan, Standard Operating Procedures, Job Risk Assessments and prescriptions).</p>
Conservation Program		
Coarse woody debris		
<p>FT Staff: S. Grove M. Yee B. Appleby L. Stamm T. Wardlaw</p> <p><i>Collaborators:</i> CRC for Forestry University of Tasmania</p>	<p>Prescriptions to apply to integrated harvesting operations in wet eucalypt forests, which can be demonstrated to sustain coarse woody debris (CWD) habitat and its dependent biota.</p>	<p>CWD dynamics model was substantially re-written to make use of better information about the log decay process. Updated model used to predict the availability of logs for use as habitat by the Broad Toothed Stag Beetle in Wielangta Forest.</p> <p>Analysed a subset of the beetles sampled from two pairs of CBS and fuelwood coupes. Found assemblages of obligate saproxylic beetles differed markedly between treatments compared with facultative saproxylic and non-saproxylic beetles.</p> <p>Final year of collaborative studies (University of Tasmania) investigating invertebrate and fungal communities in ageing trees and their possible role in the production of CWD habitat.</p>
Value of wildlife habitat strips		
<p>FT Staff: S. Grove P. Lefort</p>	<p>Document the value of wildlife habitat strips for fauna conservation in production native forests.</p>	<p>Adjusted data from previous bird surveys at Tarraleah WHS to be compatible with the standard method that has now been adopted by FT for all long-term studies.</p>

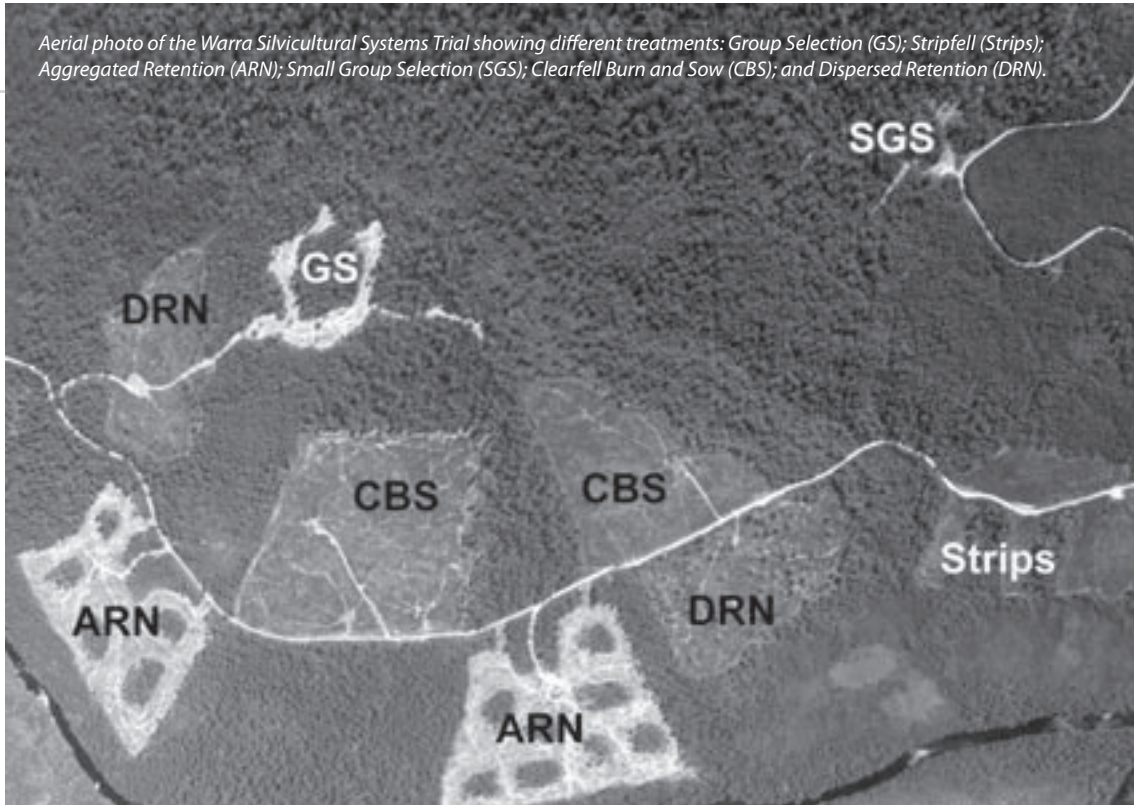
Biology and Conservation: key research and development project list (continued)

Project Name and Staff	Aim	2005/06 Progress
<p>Plantation Biodiversity</p> <p>FT Staff: S. Grove M. Yee L. Stamm</p> <p><i>Collaborators:</i> <i>University of Queensland</i> <i>University of London</i></p>	<p>Find an optimum spatial arrangement of plantations and native forests, at the landscape level, that concurrently minimises the risk of extinction for a spectrum of target species. This provides greater certainty for planning in relation to threatened species. The project also delivers RFA requirements for the plantation program in relation to biodiversity.</p>	<p>Collaborated with Planning Branch and a Masters student in a study looking into the effects of fire intensity and exposure on the suitability of logs as habitat for Giant Velvet Worms. Found that logs on exposed sites or sites experiencing high intensity burns do eventually provide suitable habitat for Giant Velvet Worms, but it takes longer for them to become suitable habitat.</p> <p>Emily Nicholson (University of Queensland) presented key findings from her PhD on optimising conservation outcomes in dynamic landscapes. An action plan was developed to see how FT could use planning tools developed in her study.</p>
<p>Wildfire Chronosequence</p> <p>FT Staff: P. Turner S. Grove B. Appleby B. Yaxley</p> <p><i>Collaborators:</i> <i>Bushfire CRC (P. Turner)</i> <i>University of Tasmania</i> <i>University of Melbourne</i></p>	<p>Establish a set of long-term monitoring sites that will provide natural disturbance benchmarks against which biodiversity and structural changes in the Warra SST can be assessed. These sites fulfil the scientific criteria of an extended "space-for-time" design.</p>	<p>Established permanent plots in seven of the 12 sites for the Wildfire Chronosequence (WFC).</p> <p>PhD student (Genevieve Gates) commenced study on successional patterns in wood decay fungi colonising CWD in wet <i>E. obliqua</i> forests with different fire histories.</p> <p>Honours student commenced study on bryophytes colonising CWD using these sites.</p>
<p>Broad toothed stag beetle</p> <p>FT Staff: S. Grove B. Yaxley</p>	<p>Validate the effectiveness of current prescriptions in retaining viable habitat in the managed forest landscape.</p>	<p>Demonstrated that large logs are not preferred habitat for the beetle and reinforced prior understanding that suitable habitat primarily develops in wet sclerophyll forests and moist ecotones at the junction of wet and dry sclerophyll forests.</p>
<p>East Coast Insects</p> <p>FT Staff: J. Jarman</p>	<p>Document the long-term changes in vegetation and insect diversity following logging and regeneration of a dry sclerophyll forest.</p>	<p>Collated data from all previous floristic surveys (over 30 years), updated taxonomic changes and did preliminary analysis.</p>

Biology and Conservation: key research and development project list (continued)

Project Name and Staff	Aim	2005/06 Progress
Warra Program (Biodiversity)		
Log Decay		
FT Staff: S. Grove R. Bashford A. Phillips B. Burton	Develop ecologically sustainable management practices in relation to biota dependent upon the decaying log and mature timber habitat.	Static trapping to sample flighted wood and bark boring insects recorded many saproxylic species that have not emerged to date from the log decay study. Third 3-year cycle of emergence trapping is progressing. <i>Toxeutes</i> , a late-successional species, was recorded emerging from one of the logs from a mature tree.
Effects of alternative silvicultural systems in wet eucalypt forests on biodiversity		
FT Staff: S. Grove R. Bashford J. Jarman P. Lefort A. Phillips B. Burton	Document the impacts on biodiversity of the range of silvicultural treatments available for harvesting wet eucalypt forests.	Sorted, mounted and identified a sub-sample of beetles from control and CBS. Analysis of this will guide priorities for sorting the remainder of the 9000 samples collected from the SST so key results can be obtained for 2007 review.
Collaborators: <i>Tasmanian Herbarium</i>	Incorporate the resultant knowledge into strategic and operational planning that meets the objectives of sustainable forest management.	Continued surveys of birds, and sampling of (i) lichen and bryophytes and (ii) invertebrates in post-logging in the SST treatments.
Appointed Research Officer (Variable Retention Biodiversity) to help synthesise biodiversity research findings.		
Warra development		
FT Staff: S. Grove	Develop a long-term research strategy based on the Warra Ecological Model. Promote collaborative research at the Warra LTER site.	Seven small project grants approved for the following studies: (i) modelling hydrological processes; (ii) manfern invertebrates and their significance for quarantine; (iii) bryophyte response along wildfire chronosequence; (iv) status of pygmy possums in lowland wet eucalypt forest at Warra; (v) wood decay fungi on eucalypt logs; (vi) taxonomic description of a new spider from Warra; (vii) successional patterns in wood decay fungi on logs.
Collaborators: <i>University of Tasmania</i> <i>CRC for Forestry</i> <i>Goteborg University</i>		
Baseline Altitudinal Monitoring Plots (BAMPS)		
FT Staff: S. Grove R. Bashford	Enable the effect of any large-scale influences such as climate change to be taken into consideration when interpreting small-scale treatment effects on biodiversity.	No activity during the past year.
Collaborators: <i>DPIW</i>		

Aerial photo of the Warra Silvicultural Systems Trial showing different treatments: Group Selection (GS); Stripfell (Strips); Aggregated Retention (ARN); Small Group Selection (SGS); Clearfell Burn and Sow (CBS); and Dispersed Retention (DRN).



Sue Baker assessing retained old trees for hollows as habitat at the Dispersed Retention coupe in the Warra Silvicultural Systems Trial.

Research Branch report:

Native Forests

Principal Research Officer: Mark Neyland

Mark.Neyland@forestrytas.com.au

Native Forests Branch conducts research on the silviculture of native forests to increase productivity and support continuous improvement for sustainable forest management. The branch currently (end June 06) has five full-time and one part-time staff. The Branch works closely with postgraduate and graduate students who are carrying out related research at the Warra Silvicultural Systems Trial.

Research on alternatives to clearfelling (variable retention) at Warra has continued to be the major program for 2005/06. Operational development of variable retention harvesting is increasing steadily and will be a major focus in the future. Quality standards development and extension, eucalypt stand management and blackwood silviculture are the other main Branch programs.

Main outputs for 2005/06

- Completion of harvesting of all the coupes within the Warra Silvicultural Systems Trial, including the tenth and final silvicultural treatment (Tasmanian Group Selection).
- Evaluation of initial eucalypt seedling density and early growth from the treatments at the Silvicultural Systems Trial.
- Silvicultural support and monitoring for operational aggregated retention coupes established throughout the State.
- Provision of silvicultural support and training across all silvicultural systems, and particularly for regrowth thinning and uneven-aged management of high-altitude and dry eucalypt forest.
- Evaluation of growth responses of understorey blackwood to pre-commercial thinning of a eucalypt regrowth overstorey.
- Development of stand management regimes for blackwood in native forests.
- Improved practices for selective logging in rainforest, and tall oldgrowth forest, within Special Timbers Management Units.

Native Forests:

key research and development project list

Project Name and Staff	Aim	2005/06 Progress
Alternatives to clearfelling in lowland wet eucalypt forest		
FT Staff: M. Neyland L. Edwards T. Davis	<p>To establish a replicated silvicultural systems trial (SST) in wet eucalypt forests at Warra and compare the standard clearfell, burn and sow system with potential alternatives.</p> <p>To complete all treatments at the Warra SST and report comparisons of their economic, environmental and social performance after three years in 2007.</p>	<p>Age-two regeneration surveys completed in the two aggregated retention coupes (naturally sown) showed that regeneration had improved markedly, from 34% (WR1E) and 42% (WR8I) at age 1 to 56% and 73% respectively at age 2. Further improvement is anticipated over the next twelve months.</p> <p>Harvesting of the second small group selection trial was completed in WR8G. This treatment prescribed 30% of the forest to be harvested, in strips and patches about 80 m wide, at each of three cutting cycles per 90-year rotation. Ten percent of the forest is to be retained for at least one rotation to provide for late successional species. Slash in gaps will be reduced by burning. The design group reconvened on-site at the completion of the harvesting and expressed their satisfaction with the harvesting, and agreed to retain one fairway and gap unburnt, as a comparison to the rest of the treatment, which will be burnt.</p>
Floristic changes following clearfelling and alternative silvicultural systems		
FT Staff: M. Neyland L. Edwards T. Davis	<p>To determine the effects of clearfelling and alternative silvicultural systems on vascular plant composition.</p>	<p>Paper submitted on efficacy of understorey islands in retaining late successional vascular plants and structures. The 40 m by 20 m islands achieved a modest improvement in species retention but larger islands would be needed to retain a full suite of sensitive species, including vascular epiphytes.</p>
Light environments within the Warra SST		
FT Staff: M. Neyland	<p>To determine the influence of potentially reduced light availability on seedling regeneration following alternative harvesting methods, such as aggregated retention.</p>	<p>The available light levels in the coupes harvested at Warra ranged from less than 20% of full light to 100%. At light levels below 30% seedlings struggled to establish. At levels between 30% and 100% there may be some reduction in growth. Light levels in aggregated retention coupes were 50 - 100% of full light.</p> <p>Field work completed. Data analysis to be completed and paper written.</p>

Native Forests: key research and development project list (continued)

Project Name and Staff	Aim	2005/06 Progress
Effect of simulated fuelwood harvesting on seedbed availability and eucalypt regeneration		
FT Staff: L. Edwards M. Neyland	To determine the effects of removal of fuelwood on burning outcomes, seedbed availability and eucalypt regeneration.	A 2 ha area in each of two Aggregated Retention coupes was subjected to simulated fuelwood harvesting after sawlogs and pulpwood had been removed. The areas were burnt in April 2004 and seedbed outcomes were monitored. The areas subjected to fuelwood harvesting had 75% of the seedbed area classed as unburnt compared to 48% for adjacent non-fuelwood harvested areas. The fuelwood harvesting had removed, and separated, the fuels to the extent that it was difficult to burn under conservative conditions. By comparison, CBS coupes at Warra had 11% of their seedbed classed as unburnt, although these were burnt under less conservative conditions.
Interpretation of alternatives to clearfelling research.		
FT Staff: M. Neyland J. Hickey L. Edwards	To inform visitors to the Warra LTER Site of the costs and benefits of various silvicultural treatments applied to wet eucalypt forests designated for wood production.	About 90 visitors were guided through the Warra silviculture trial (11 trips).
Operational evaluation of aggregated retention (ARN) in tall oldgrowth forests		
FT Staff: L. Edwards J. Hickey Districts VR Champions Peter Coxhell	To develop aggregated retention as a reliable and cost effective silvicultural system.	Preliminary silvicultural prescriptions developed for aggregated retention. Preliminary VR Manual prepared. Five ARN coupes were harvested and scheduled for burning in autumn 2005 (112 ha), another six are scheduled for burning in autumn 2006 (250 ha). Retention rates varied from 10% to 44%. Retained aggregates ranged in size from 0.2 to 8.5 ha, with the majority being less than 1 ha. No safety incidents were recorded and harvest costs appear to be similar to those incurred for clearfelling, apart from the cost of clearing around aggregates.

Native Forests: key research and development project list (continued)

Project Name and Staff	Aim	2005/06 Progress
Social acceptability of forest management options: Landscape level visualisation and evaluation		
<p>FT Staff: J. Hickey</p> <p>Collaborators: University of Melbourne: R. Ford K. Williams J. Bishop A. O'Connell</p> <p>Forest Practices Authority: B. Chetwynd</p> <p>Tourism Tasmania R. Sproule</p>	<p>To extend the social acceptability study (04/05/06) to the landscape level.</p>	<p>A PhD student will prepare animated simulations at the landscape level while Rebecca Ford will conduct the interviews and analysis of people's perceptions. The project commenced in April 2006 and will benefit from FT's expertise in GIS mapping and Visual Nature Studio. A commitment of some specialised resources has been assured by FT to ensure a good outcome from this project.</p>
High-altitude eucalypt forests		
<p>FT Staff: M. Neyland</p>	<p>To provide silvicultural advice and to promote good silvicultural practice in high altitude forests.</p>	<p>The UAT procedure has become widely accepted as a useful tool for planning and monitoring the harvesting of high dry <i>E. delegatensis</i> forest. The area assessed has increased from 1 670 ha in 2001/02 to 4 410 ha in 2004/05.</p> <p>In 2001/02, 1674 ha were treated - 76% met the standard. In 2002/03, 2700 ha were treated - 68% met the standard. In 2003/04, 4000 ha were treated - 90% met the standard. In 2004/05, 4410 ha were treated - 96% met the standard.</p> <p>A meeting was held between FT staff and Victorian DSE/Vic Forests staff to discuss partial harvesting and the implications for modelling sustained yields etc, and to establish the options for a collaborative approach to progress the modelling.</p>
Dry eucalypt forests		
<p>FT Staff: M. Neyland</p>	<p>To develop and improve silvicultural treatments being applied to dry eucalypt forests, particularly in Bass, Derwent and Mersey Districts.</p> <p>Excavator heaping/burning to be applied more widely, where appropriate.</p> <p>Improve dry forest low-intensity burning practices.</p>	<p>Discussions about the issues of leaving some dry forest coupes unburnt, and the general reduction in the amount of fuel reduction burning being undertaken, have recently commenced with Fire Management Branch.</p>

Native Forests: key research and development project list (continued)

Project Name and Staff	Aim	2005/06 Progress
Stand management of fenced-intensive-blackwood forests		
FT Staff: S. Jennings T. Davis	Fenced-intensive-blackwood (FIB) treatments are applied to blackwood-rich wet eucalypt forest. The coupes are clearfelled, burnt, sown with a 0.5 site weighting of eucalypt seed and fenced to promote dense blackwood regeneration. A current priority is the development of a stand management regime for over 1 000 ha of fenced-intensive-blackwood coupes. This should include prescriptions for the target final stocking of eucalypts, and of blackwood, as well as a better understanding of likely rotation age.	Establishment of a stand-level trial to determine the response to pre commercial thinning in the next FIB coupe (TG005A) to be pre-commercially thinned has commenced. The coupe will be pre-commercially thinned in the spring and then monitored over time to assess the response of both the blackwoods and the eucalypts.
Long-term regeneration of celery-top pine after selective logging		
FT Staff: S. Jennings	To report long-term results of a trial, established in 1980 investigating seedfall and establishment and growth of natural regeneration.	Results collated and analysed for reporting later in 2006.
Silviculture for special timbers		
FT Staff: S. Jennings	To provide accessible information on special timbers silviculture and management for forest managers, special timbers processors and users as well as the general public.	Lunchtime talk on the silviculture of special species timbers, available on the FT web site, and available as a DVD-video.
Growth patterns of Celery-top pine, <i>Phyllocladus aspleniifolius</i>, in southern Tasmanian mixed forest		
FT Staff: J. Hickey Collaborators: University of Melbourne V. Tyquin	To examine the regeneration of celery-top pine in different stages of stand development to ask: Is recruitment of new seedlings continual or episodic? How do the growth patterns of saplings differ in different-aged stands? Can saplings be aged by counting the number of nodes along the stem? To develop an age-diameter relationship for mature stems in mature oldgrowth and to estimate how long it takes to grow a sawlog.	This study demonstrated that celery-top pine saplings can be aged using the simple method of counting nodes (branch whorls and nodal scars) along the stem. The density and growth of saplings was greatest in an open small gap (approximately 5 ha) of newly regenerating forest compared to a 1934 wildfire regrowth site and an oldgrowth site > 360 years of age. It was determined that obtaining a sawlog of 30 cm dbh would require a rotation of 145 years; 40 cm, 215 years; 50 cm, 305 years and 60 cm, 470 years.

Native Forests: key research and development project list (continued)

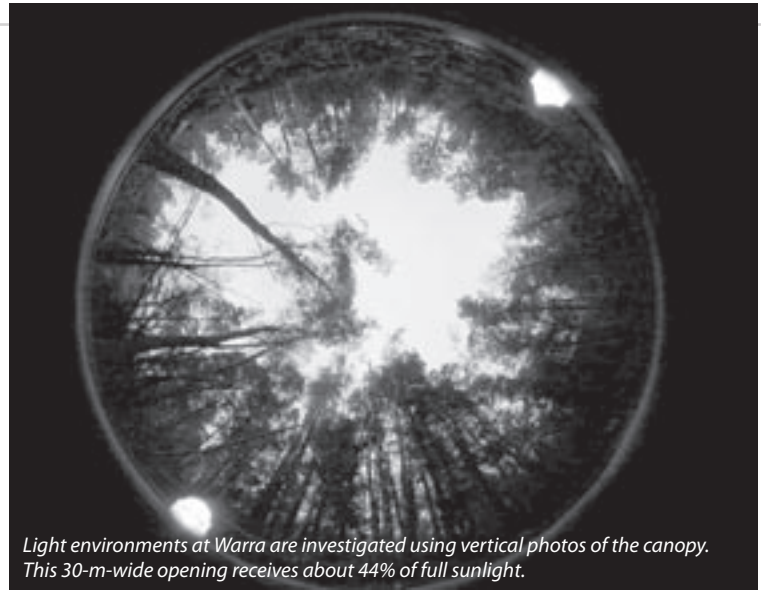
Project Name and Staff	Aim	2005/06 Progress
Silviculture systems for harvesting special timbers from tall oldgrowth forest in STMUs		
FT Staff: T. Davis J. Hickey	To assist Huon District to develop and implement a safe, practical and economic silvicultural system for the sustainable production of low volumes of special species timbers from tall oldgrowth forests.	Five patches, totalling 6 ha, were harvested in 2004 and scheduled for low intensity burning in autumn 2005. Burning was not completed in autumn 2005 – further burning was planned for autumn 2006. A second series of patches was planned for 05/06 for burning in 2006, to be followed by single tree and small group selection within a tree's length of the patches. Subsequent SGS harvesting events at WR017B should take place following patch harvesting at intervals of approximately 50 years.
Growth responses to pre-commercial thinning		
FT Staff: A. LaSala T. Davis L. Edwards	To determine the effects of pre-commercial thinning and fertiliser application on the wood production rates of young regrowth <i>Eucalyptus obliqua</i> stands in southern Tasmania.	This study indicates that pre-commercial thinning of 50% of the basal area is the most appropriate pre-commercial thinning option for <i>E. obliqua</i> stands.
Long-term growth of <i>Eucalyptus regnans</i> in response to three different thinning intensities		
FT Staff: A. LaSala	To quantify the long-term growth response to thinning using the Chestermans Trial thinned in 1970.	The 50% basal area removal experienced negligible attrition, provided adequate thinnings, produced comparable volume to the controls, and increased individual tree sizes and total sawlog volume, thus representing the only treatment which provided improvement for all these parameters over the "do nothing" option.
Choosing rotation lengths for even-aged regrowth to meet structural and commercial objectives		
FT Staff: G. Bradbury	To report on current guidelines and practices for choosing rotation lengths and recommend improvements where necessary.	Draft report prepared.

Native Forests: key research and development project list (continued)

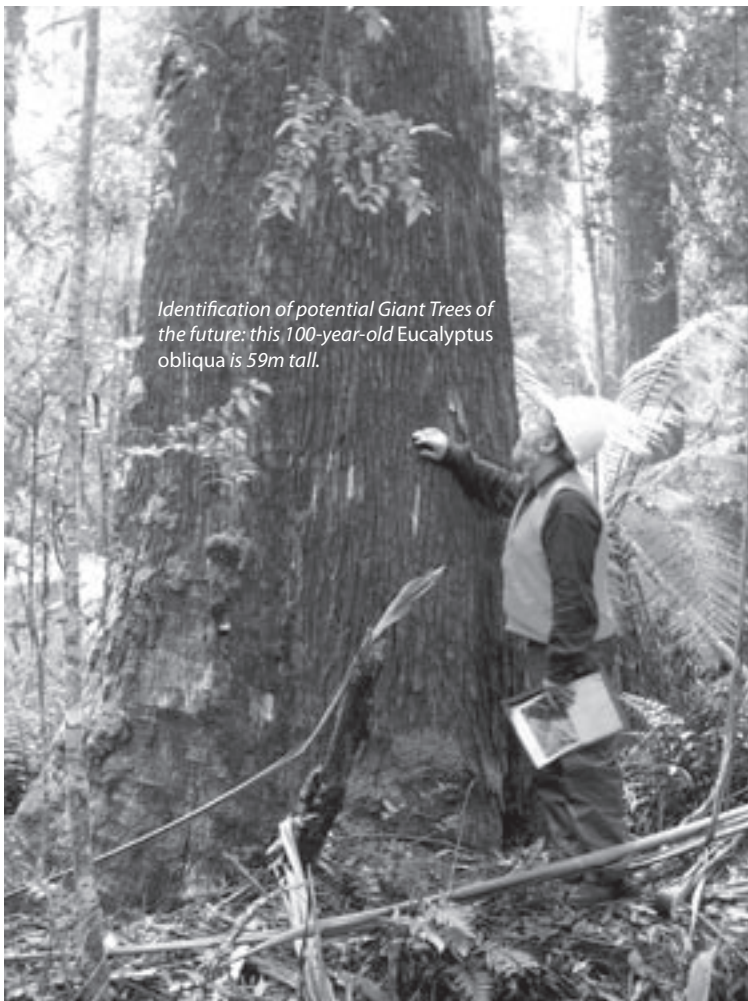
Project Name and Staff	Aim	2005/06 Progress
Quality Standards		
FT Staff: R. Sharp L. Edwards M. Neyland	To ensure that 'best-practice' standards are developed and met in native forest silviculture.	Two formal Quality Standards visits per District for the year, with written feedback on silvicultural issues. Report from 2005 Quality Standards Review for Manager (Field Services) to Executive. Quality Standards supervision and training of thinning operations in Huon District.
Technical Bulletins		
FT Staff: M. Neyland S. Jennings R. Sharp L. Edwards T. Davis	To maintain a comprehensive set of technical bulletins for native forest silviculture.	Revised edition of Technical Bulletin 10 (<i>Blackwood</i>) published. Technical Bulletin 11, <i>Silvicultural use and effects of fire</i> , is under review to identify the work required to revise it.
Silvicultural training		
FT Staff: M. Neyland R. Sharp L. Edwards S. Jennings	To communicate recommended management practices and research results to staff and Technical Forester trainees through training programs, field days and seminars.	Training to Forest Practices Officers and Supervisors Courses. On-ground training for field staff based on needs identified at annual Quality Standards Reviews.
Giant Tree Protection		
FT Staff: L. Edwards T. Davis J. Hickey	To provide science and technical support for FTs protection of Giant Trees.	Participation in 2005 search for Giant Trees in remote areas. Member of Giant Tree Technical Committee (internal) and Giant Tree Consultative Committee (external). Preliminary reconnaissance of ER6 regrowth stands.
Warra LTER support		
FT Staff: L. Edwards T. Davis M. Neyland J. Hickey	Support and promotion for research at the Warra Long-Term Ecological Research site.	Assistance to external researchers. Guides for 11 Site tours (90 participants). Research tracks established for long-term studies. Display for Huon Show.



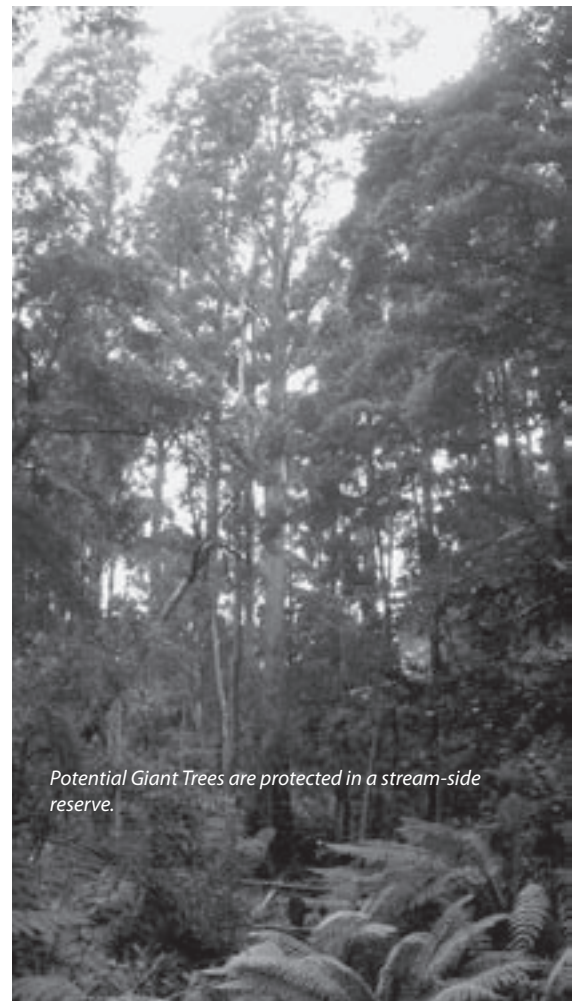
Veronica Tyquin examines a seedling celery-top pine approximately 20 years old in a harvested but unburnt patch of forest.



Light environments at Warra are investigated using vertical photos of the canopy. This 30-m-wide opening receives about 44% of full sunlight.



Identification of potential Giant Trees of the future: this 100-year-old Eucalyptus obliqua is 59m tall.



Potential Giant Trees are protected in a stream-side reserve.

Research Branch Report:

Plantations

Principal Research Officer: Dr Peter Volker

Peter.Volker@forestrytas.com.au

The Plantations Branch undertakes research and development and provides operational advice on the management of Forestry Tasmania plantations. The Branch also provides consulting services to external clients. Collaborative research is undertaken with a number of public and private sector organisations in Australia and elsewhere. At end June 2006 the Branch had ten full-time and 1 part-time staff.

During the year a review of plantation resources information was undertaken in collaboration with Districts and the Division of Management. This project aimed to verify all information associated with the Forestry Tasmania eucalypt plantation estate, including boundary checking, forest condition, silvicultural regimes and information management. This project outcome has resulted in Forestry Tasmania having a clear picture of the intended regime for every plantation, and the current condition of those plantations.

Further refinements to the prediction of wind damage in plantations and native forests have been developed. This has involved the use of exposure mapping which can be input into assessment of wind damage risk on forest sites that are subject to thinning or partial harvest operations.

Wood quality for pulp, timber and veneer production is a research priority. The Branch took a leading role in the development of the ESTR (Eucalypt Sources for Timber Research) database partially funded by the Forest and Wood Products Research and Development Corporation. ESTR provides a listing of eucalypt plantation trials throughout Australia that are suitable for use in wood quality studies for the processing industry.

The Branch made a significant contribution to Research Program 2 (High Value Wood Resources) of the CRC for Forestry through the assessment and harvesting of the Forestry Tasmania Goulds Country Silvicultural Trial established in 1984. The trial consisted of pruned and unpruned treatments thinned to different final stocking levels (from 100 to 400 stems per hectare) plus an unthinned control. Measurements of growth, crown dimensions and wood quality were made prior to harvesting. Trees were harvested from each treatment and then processed at a sawmill. The subsequent boards were assessed for distortion and will be remeasured after drying. Collaborators in the project included ensis, McKays Timber, the University of Melbourne and the University of Tasmania.

Genetic improvement of eucalypts is a high priority for increasing productivity of the plantation estate. A number of trials were established to assess the genetic basis of resistance to *Mycosphaerella* leaf spot fungus and mammal browsing in *E. globulus*. In *E. nitens* a project was established with the Southern Tree Breeding Association (STBA) to enter all Forestry Tasmania pedigree and trial measurements into the Data Management System for subsequent TreePlan analysis. Further improvements to seed orchards for both species will ensure the delivery of the highest quality genetic material to the plantation program.

The Branch also makes a significant contribution to operational plantation management operations through the Quality Standards system. Significant progress was made in achieving efficiencies in the planning and implementation of plantation operations and monitoring of quality standards.

Other Outputs for 2005/06

- Assistance was provided to Districts regarding soil and site suitability for plantations, and to District soil crews with transect surveys and data entry into Soils Database.
- Development of SoilKey v1.1 and EucFERT v1.1 was completed, and WINDRISK v1.0 was developed and released.
- Continuing refinement of fertiliser prescriptions across the estate, and establishment of a nutrition trial evaluating compost as a fertiliser for eucalypt plantations (AR070K).
- Establishment of 2 new *E. nitens* family trials (Mersey) and 2 new *E. globulus* family trials (Murchison), site preparation and sowing of seeds for a further 2 *E. globulus* family trials in Murchison, and establishment of trials to compare early field growth of carried-over and new-season *E. nitens* seedlings.
- Forestry Tasmania was awarded the trophy for STBA Supporter Of The Year 2005.
- A generic basal area/transpiration equation was developed for *E. nitens*, and the first experimental site established for its validation.
- Researchers participated in CRC Forestry Sub-program 4.1 with view to describing the streamflow and quality of streams pre- and post-harvesting, focussing on Warra and Croppers Creek paired catchment studies. Water quality was monitored in streams at potentially contentious forest harvest sites.

Plantations:

key research and development project list

Project Name and Staff	Aim	2005/06 Progress
Quality standards monitoring and extension		
<p>FT Staff:</p> <ul style="list-style-type: none"> D. McKenzie G. Sargison P. Smith P. Volker M. Syme (from Oct 05) 	<p>Work with District staff to implement and refine Quality Standards monitoring of operations.</p> <p>Implement correct management systems and have in place a system to keep field operators abreast of issues in quality management of eucalypt plantations.</p> <p>Communicate recommended management practices and research results to staff through training programs, field days and seminars.</p> <p>Review Standard Operating Procedures and Quality Standards covering the areas of plantation establishment, silviculture and management.</p>	<p>Commenced major review and update of Plantation Quality Assessment (QA) & Monitoring system.</p> <ul style="list-style-type: none"> – Modification of assessment methods – Review of specifications – Rationalisation of data capture <p>Assisted districts in the use of the Forestry Operations Database (FOD) for the annual Quality Standards report & facilitated reports for ongoing district monitoring of Quality Assessment.</p> <p>Continued the development of a Pruning Assessment Tool.</p> <p>Conducted Plantation Resource Information Review and updated corporate systems (FOD and the Plantation Area System (PAS)).</p> <p>Ongoing review, update and rationalisation of all plantations related documentation.</p>
Soil, site selection and productivity estimation		
<p>FT Staff:</p> <ul style="list-style-type: none"> M. Laffan S. Rees J. Leseck <p><i>Collaborators</i></p> <ul style="list-style-type: none"> CRC Forestry CSIRO Division of Forestry and Forest Products 	<p>Investigate areas proposed for RFA plantation development (on State forest, private property proposed for purchase, joint venture and leasehold land) to define their site productivity and suitability.</p> <p>To develop a 'user-friendly' field guide so that District staff are able to undertake their own assessment of site suitability for plantations.</p> <p>On areas suitable for plantations, provide information and advice on site preparation and other treatments required for sustainable development and management of plantations.</p>	<p>Commenced work on verification of site productivity estimates.</p> <p>SoilKey has been developed but is yet to be released. Soils Database has been established and populated with existing data.</p> <p>Site cultivation trials will continue to be monitored.</p>

Plantations: key research and development project list (continued)

Project Name and Staff	Aim	2005/06 Progress
<p>Nutrition and productivity</p> <p>FT Staff: P. Adams, P. Volker D. Robertson</p> <p><i>Collaborators:</i> <i>CRC Forestry</i> <i>ensis</i> <i>CSIRO Division of Forestry</i> <i>and Forest Products</i></p>	<p>Evaluate and predict productivity for plantation sites.</p> <p>Evaluate nutrient limitations to plantation growth and the long-term implications of nitrogen and phosphorus status in eucalypt plantations.</p> <p>Develop systems to maintain or improve plantation productivity through fertilising.</p> <p>Develop a Plantation Nutrient Management System for fertiliser decisions (e.g. product, rate, timing, application) based on soil and site, tree and stand characteristics, weeds, and potential for off-site impacts.</p> <p>Test the feasibility of utilising waste materials from NST Sawmill at Newwood.</p>	<p>Assisted districts to plan and prepare for the 2005/06 secondary fertilising program.</p> <p>Nutrition trials were remeasured and treated.</p> <p>Applied initial fertiliser treatments to post-thinning fertiliser trial at Togari (Murchison District).</p> <p>Established two series of plots to evaluate the impact of weeds on tree responses to fertiliser (Huon District).</p> <p>Continuing development of fertiliser prescriptions across the estate.</p> <p>Completed development of fertiliser decision tool (EucFERT v.1.). Validation underway.</p> <p>Established one nutrition trial to evaluate the use of compost (including biosolids) as a fertiliser for eucalypt plantations (Huon District).</p>

Plantations: key research and development project list (continued)

Project Name and Staff	Aim	2005/06 Progress
Tree improvement and seedling supply		
<p>FT Staff:</p> <p>D. Williams P. Volker D. Robertson N. McCormick</p> <p><i>Collaborators:</i> University of Tasmania seedEnergy Pty Ltd CRC Forestry</p>	<p>Provide genetic material for plantations to maximise profitability and product quality.</p>	<p>Assessed and analysed early-age measurements of Seedlot Comparison trials (<i>E. nitens</i>).</p> <p>Pruned <i>E. globulus</i> and <i>E. nitens</i> seedlot comparison trials for long-term research into solid wood production.</p> <p>Establishment of 2 <i>E. globulus</i> trials in Murchison district to test <i>Mycosphaerella</i> leaf blight and mammal browsing resistance.</p> <p>Establishment of 2 new <i>E. nitens</i> family trials to test performance of new families in the deployment program at different site elevations.</p> <p>Establishment of 2 <i>E. nitens</i> site-specific planting check-plot trials.</p> <p>Establishment of 2 <i>E. nitens</i> trials to compare establishment performance of "carried over" and "new-season's" seedlings.</p> <p>Ongoing preparation for TREEPLAN analysis of <i>E. nitens</i> breeding program.</p> <p>First commercial harvest of seed from <i>E. nitens</i> seed orchard at Oigles Rd.</p>
FT40		
<p>FT Staff:</p> <p>D. Williams P. Volker D. Robertson N. McCormick</p> <p><i>Collaborators</i> Southern Tree Breeding Association seedEnergy Pty Ltd</p>	<p>Project FT40 aims to increase by 40% the production of kraft pulp per ha in <i>E. globulus</i> plantations established from 2007 onwards. This will be done by developing control-pollinated seed orchards. FT40 is a six-year project that commenced in 2001 and will be completed by 2007.</p>	<p>First delivery of 1 million MSP seed from seedEnergy under 3-year contract to supply seed with genetic composition that meets or exceeds FT40 productivity target.</p> <p>Paclobutrazol application in Perth orchard to promote flowering and seed production.</p> <p>Commencement of pollen collection in preparation for MSP seed production program.</p>
Nursery research		
<p>FT Staff:</p> <p>D. Williams P. Moore</p> <p><i>Collaborators</i> University of Tasmania</p>	<p>Provide research and advice to improve the quality and efficiency of seedling production.</p>	<p>Honours Scholarship project was completed – investigated the impact and control of cryptogams pests on <i>E. nitens</i> containerised seedling production.</p> <p>Work on integration of seedlot identification and tracking system into FOD.</p>

Plantations: key research and development project list (continued)

Project Name and Staff	Aim	2005/06 Progress
Eucalypt plantation silviculture		
<p>FT Staff: M. Wood P. Volker D. McKenzie D. Robertson</p> <p>Collaborators: CRC Forestry</p>	<p>To link research outcomes and advances in knowledge, marketing objectives and field operations in order to ensure economically viable production of high quality solid wood from the Forestry Tasmania eucalypt estate.</p>	<p>Management of plantation regime trials.</p> <p>Management of long-term thinning trials at Goulds Country, Castra and Lisle.</p> <p>Final measurement of Goulds Country long-term thinning trial and progress towards inclusion in new CRC program.</p> <p>Formalisation of forest health surveillance procedure to identify and quantify extent of plantation windthrow events for future validation exercise.</p> <p>Development of GIS based topographical exposure mapping to aid silvicultural decision making.</p>
Wood quality		
<p>FT Staff: P. Volker D. Williams M. Wood D. McKenzie D. Robertson</p> <p>Collaborators: Forest and Wood Products R&D Corporation University of Tasmania, Timber Research Unit Ensis State Forests NSW Forest Products Commission, WA University of Melbourne Forestry CRC Tasmanian industry Southern Tree Breeding Association</p>	<p>Evaluate wood properties of plantation grown wood for processing suitability.</p> <p>Determine methods of sampling to assist tree breeding programs.</p>	<p>Completed FWPRDC Project – Eucalypt Trials Database.</p> <p>Developed CRC SFL Program 2 – High Value Wood Resources.</p> <p>Commenced planning for harvesting and processing of Goulds Country silvicultural trial with CRC Forestry.</p> <p>Assisted Dr Bruce Greaves locate plantation material of <i>E. globulus</i> and <i>E. nitens</i> suitable for a processing study to determine economic outcomes at two mills in Tasmania.</p>

Plantations: key research and development project list (continued)

Project Name and Staff	Aim	2005/06 Progress
Hydrology (including plantation and native forest hydrology projects)		
FT Staff: S. Roberts C. Ringrose	Quantify effects of forestry land use on water quality and quantity. Determine the usefulness of the Forest Practices Code in protecting stream water quality.	Participated on steering committee and review panel for TasLUCas – a model to predict the impacts of plantation development and native forest harvesting on streamflow in Tasmanian catchments. Commenced development of basal area/ water use model for <i>E. nitens</i> plantations and field validation. Participation in CRC Forestry to assess water yield and quality impacts of harvesting including development of a postgrad water quality project. Participated in development of more achievable Montreal indicators for soil and water. Advice and support provided to legal section on the impacts of forest operations on hydrology in contentious coupes. Monitoring of turbidity at GC134D completed. Estimated the likely impacts of harvest/ plantations at a number of locations in Bass District.
Soil and site mapping		
FT Staff: Mike Laffan Sam Rees Collaborators: Forest Practices Board: P. McIntosh	To obtain information that will enable sustainable management of soils. Evaluation of effectiveness of the information in improving practices.	Advice was given on soils and site suitability in various areas, based on interpretation of the soils handbook and soils reports. Commenced work on comparison of predicted site quality from soil mapping versus actual yields from plantations. A range of new soils not previously mapped or described have been characterised and sampled in association with the soil specialist from the Forest Practices Board. These have been released as a series of Tasmanian Forest Soil Fact Sheets.

Research report: Warra Long-term Ecological Research (LTER) Site

By Dr Simon Grove (Forestry Tasmania Warra Research Co-ordinator)

Simon.Grove@forestrytas.com.au

The Warra LTER Site of 15,900 ha was designated in 1995 to encourage long-term ecological research and monitoring in wet forests in Tasmania. The site is supported by nine LTER site partners from Tasmanian and national research agencies.

Major activities for 2005/06 were:

- Completion of the tenth and final silvicultural treatment (Tasmanian Group Selection) in the Warra silviculture trial.
- Evaluation of initial eucalypt seedling density and early growth from aggregated retention treatments at the Warra silviculture trial.
- Establishment of permanent plots along a wildfire chronosequence in wet eucalypt forest in and around Warra.
- Development of a model of coarse woody debris (CWD) dynamics for wet eucalypt forest based on sampling CWD at Warra.
- Initiation of the third three-year cycle of emergence trapping for insects in the Warra log decay project.
- Research on streamflow and water quality of Warra and Croppers Creek.
- Appointment of a Warra Data Manager and a Research Officer (Variable Retention Biodiversity).
- Enhancement of links with the International LTER network and promotion of an Australian LTER network.
- Presentation of findings of several Warra research projects at the IUFRO conference in Brisbane.

The following tables list the 9 new projects commenced at the LTER Site during 2005/06, and the 7 projects that were completed during the year. Continuing projects are listed on the Warra web site (www.warra.com). The Division of Forest Research and Development provided Warra small-projects grants to 8 researchers during the year. Some 14 papers, 4 theses and several reports were produced in 2005/06 based on research at the Warra LTER Site.

Projects commenced 2005/06 at the Warra LTER Site

Title	Discipline	Project leader	Affiliation
Monitoring the effectiveness of Forest Practices Code headwater stream provisions in wet dolerite terrain at Warra	Ecology, biodiversity and conservation	Sarah Munks	Forest Practices Authority
Successional patterns and processes along a wildfire chronosequence in Tasmanian wet eucalypt forest	Ecology, biodiversity and conservation	Perpetua Turner	University of Tasmania & Bushfire CRC
Taxonomic description of new spider species from Warra	Ecology, biodiversity and conservation	Lisa Boutin	Queen Victoria Museum and Art Gallery
The value of habitat retained in forestry coupes for hollow dependent fauna	Ecology, biodiversity and conservation	Sarah Munks	Forest Practices Authority

Projects commenced 2005/06 at the Warra LTER Site

Title	Discipline	Project leader	Affiliation
Taxonomic and ecological studies of wood-decaying fungi from Eucalyptus wood	Ecology, biodiversity and conservation	Björn Nordén	University of Göteborg
Status of pygmy-possums in the lowland wet eucalypt forest at Warra	Ecology, biodiversity and conservation	Donald Hird	
Investigating bryophyte response along a wildfire chronosequence in the Southern Forests	Ecology, biodiversity and conservation	Emma Pharo	University of Tasmania
Macrofungal biodiversity as a tool for the sustainable management of coarse woody debris in the forest landscape	Ecology, biodiversity and conservation	Genevieve Gates	University of Tasmania
The role of logs in maintaining bryophyte diversity along a wildfire succession in wet eucalypt forest of Tasmania	Ecology, biodiversity and conservation	Belinda Browning	University of Tasmania

Projects completed in 2005/06 at the Warra LTER Site

Title	Discipline	Project leader	Affiliation
Effects of intraspecific competition on <i>Eucalyptus obliqua</i> sapling stem quality in clearfell and variable retention harvest systems	Ecology, biodiversity and conservation	Andreas Rothe	Bavarian State Forest Service
Secondary succession and nitrogen economy of plants at Warra	Ecology, biodiversity and conservation	Charles Warren	University of Melbourne
Floristic composition of a six year old clearfelled coupe in the Weld/Huon Valley	Ecology, biodiversity and conservation	Tessa Courtney	University of Melbourne
The growth of celery-top pine in Tasmanian mixed wet eucalypt forest	Ecology, biodiversity and conservation	Veronica Tyquin	University of Melbourne
Identifying and modelling hydrological processes within a wet eucalypt forested catchment	Hydrology	Dominik Jaskierniak	University of Tasmania
Southern Forests oral interview project	Socio-economics	Parry Kostoglou	
Effect of cording on soil properties and eucalypt regeneration	Silviculture and harvesting	Alexandra Packer	Australian National University

About 180 people visited the Warra LTER Site in 2005/06 to observe current research activities and outcomes. They included policy makers, forest managers, scientists and students.

Forest Nursery report

By Peter Moore (Forest Nursery Manager)
Peter.Moore@forestrytas.com.au

In 2005/06 the Forest Nursery produced around 9 million eucalypt and pine seedlings for Forestry Tasmania, Forestry Tasmania joint venture partners and private forest growers. This increase constitutes an improvement of 11% over the previous year, and was driven by demand from several external customers. Sales to main customer groups were split between Forestry Tasmania and joint venture partners (37%), and external timber companies (63%). Future seedling demand may be affected by changes to the current taxation environment in regard to Managed Investment Schemes.

On-going seed trials have been undertaken to ensure improved gains are obtained from both pine and eucalypt seed. The introduction of a new fertiliser regime for the production of eucalypts has provided overall improved seedling uniformity.

The nursery continued to provide quality seedlings for a wide variety of situations including streamside reserves and remedial works. As part of the strategy to reduce the incidence of mammal browsing in newly established plantations, a trial was established by DFRD to ascertain the effects of continuous stem flexing on reducing seedling palatability. If successful it will be adopted as a tool to help reduce post-planting palatability.

The Forest Nursery also produced a successful crop of Huon Pine plants for Teepookana on the West Coast of Tasmania.

Forestry Tasmania is undertaking a major upgrade of facilities, including a germination greenhouse coupled with fully integrated growing areas. Upgrades in these areas will increase production efficiency and OHS.

Eucalyptus globulus: The 2006 "Tasmanian Blue Gum" seedling crop was again significantly smaller in size, in line with industry concern about the fungal disease caused by *Mycosphaerella* in young plantations. Areas less susceptible to the disease are still being planted with *E. globulus*, while areas susceptible to the disease are planted with *E. nitens*.

Eucalyptus nitens: Forest Nursery produced increased quantities of "Shining gum" seedlings in line with Forestry Tasmania's needs and external customer demands. The adoption of a pro-active approach to seed germination, to include field testing of seed as well as traditional laboratory germination tests, was aimed at increasing seed productivity. This approach has further optimised production levels.

Pinus radiata: Radiata Pine is grown primarily for joint venture partners, private forest growers and farmers. Seedlings were grown from selected seed chosen for identified productivity gains, improved growth rates and wood density. A trial of 1.5-year-old seedlings produced mixed results: seedlings achieved a better size for early planting needs but higher losses occurred during the colder winter months.

Field visits were conducted to all major customer-planting sites to ensure establishment needs were well understood. Our joint venture partner held a planting contractor field day on site, with input into production of seedlings and nursery dispatch.



Packing eucalypt seedlings for dispatch

- The Forest Nursery Business Summary is presented later in this report.

Tasmanian Seed Centre report

By Neil McCormick (Tasmanian Seed Centre Manager)

Neil.McCormick@forestrytas.com.au

The Seed Centre maintains seed stocks for 3-year requirements for regeneration of Forestry Tasmania's production forests. Aerial sowing during 2005/06 resulted in a total of 931 kg of seed being sown on coupes, of which 46% was on-site seed from the coupe and 100% was in-zone or on-site seed.

Good sales of seed for forest regeneration were made to a major Tasmanian forest company, and an agreement was reached to supply other services including seed extraction, testing, cleaning and storage. Significant quantities of seed were also managed for a pine plantation company. Seed orchard seed was extracted and cleaned for external seed orchard managers. It is pleasing to see that other businesses recognise Forestry Tasmania's staff, equipment and facilities as being first class, and are prepared to pay to utilise these.

Marketing of seed to Australian and international customers continued. The Centre continued its formal business relationship with Austrade, targeting markets in Europe and in South America, and further effort is being made to target other potential markets.

The Seed Centre continued to develop its facilities and equipment to world-class standards. The new "rotating drum" extraction kiln installed at Geeveston has been refined and developed further and is realising significant economic efficiencies as well as addressing and managing OHS considerations. The new vacuum seed cleaner built for the Huon Seed Centre has been calibrated to produce cleaner seed and is ensuring the Centre only pays for the product it requires.

Collections in the *Pinus radiata* seed orchards at Perth Nursery continued, and a significant sale was made to mainland Australia. Ongoing sales have been negotiated, and a good crop of seed was collected in late 2005 with an excellent immature crop in place for the 2007 season.

The Oigles Road and Ben Nevis seed orchards were managed for rapid growth of both *E. globulus* and *E. nitens*, by regular weed control and fertilising. Block 1 of the *E. nitens* orchard established in 1998 was treated with a flower-enhancing agent and fertilised in 2003, and an excellent crop of 1.3 million viable seeds was collected in late 2005. There are very large quantities of immature capsules on the trees on both Blocks 1 and 2, and the Centre expects to collect at least three million seeds late in 2006. Block 3 of this orchard was treated with the flower enhancer during 2005, and a good seed crop can be anticipated in 2007. The Hastings seed orchard produced 1 million seeds from the highest ranked trees.

Good growth and crown management of the "FT40" *E. globulus* seed orchard site at Perth Forest Nursery is continuing. A self-powered slasher has been purchased, which will result in significant savings in grass control. Additional grafted stock has been planted into the orchard, and early survival is excellent. Competing grasses have been treated twice, and all trees have been fertilised. Approximately 300 trees were treated with a flower-enhancing agent in January 2006, and a seed crop should be ready for collection in 2009.



Collecting seed from a seed orchard tree

Tasmanian Seed Centre report (continued)

In an effort to control grass and weeds, reduce chemical use and control the fire risk from long dry grass, sheep have been introduced into the Oigles Road seed orchard. This has been particularly successful and sheep will also be used at Perth in the FT40 orchard when all the trees are large enough to avoid browsing damage. The Seed Centre website continues to attract increasing interest and significant sales are starting to be realised.



E. nitens buds and flowers at Oigles Road Seed Orchard

The second series of small seed packets of major Tasmanian tree and shrub species has been well received by customers, with steady sales, and the series now features 40 species. A third series is being prepared, and it is hoped to have these species on the market during 2007. Displays featuring these packets have been distributed to all Forestry Tasmania customer service areas as well as several external outlets statewide.

The Seed Centre Business Summary is presented later in this Annual Report.



Sheep at Oigles Road controlling grass and weeds



Paclobutrazol application to enhance flowering at the FT40 E. globulus seed orchard

Collaboration and linkages

The Division leverages more research than it can fund directly, through gaining grant funds and working closely with other research providers such as Universities and CSIRO.

Animal Ethics Committee (Tasmania)

- Membership (Dr Jane Elek).

Australian National University, School of Resources, Environment and Society

- Ms Alex Packer from the Forestry Department has been working on an Honours project examining the effectiveness of corded snig tracks under supervision of Matt Wood.
- John Hickey collaborated with John Tabor, now with Forestry Tasmania, and Dr Chris McElhinny from Australian National University to write up a study of colonisation of clearfelled coupes by rainforest tree species from mixed forest edges.
- Discussions have commenced with Dr Chris McElhinny (silviculture lecturer) on development of forest structural elements based around the Wildfire Chronosequence Project.

Bavarian State Forest Service

- Dr Andreas Rothe worked with the Native Forests Branch while on study leave from the Bavarian State Forests Service.

Browsing Damage Management Group

- Membership (Andrew Walsh).

Bushfire CRC

- Dr Simon Grove is a key investigator for subproject B-3.1 (Ecological Processes and Biodiversity) on a project aiming to establish a Wildfire Chronosequence benchmark set in the Southern Forests. Dr Perpetua Turner is the researcher working on this project.

CRC for Forestry

- Dr Peter Volker is Chair of Program 2 (High-Value Wood Resources) Co-ordinating Committee and is joint Project Leader for Project 2.2 Silviculture for High-Value Solid Wood and Engineered Wood Products.
- Dr Steve Read is Chair of Program 4 (Trees in the Landscape) Co-ordinating Committee and sits on Program 3 (Harvesting and Operations) Co-ordinating Committee.
- Dr Tim Wardlaw is Chair of Project Steering Committee for Program 4.2 (Biodiversity).
- DFRD researchers collaborate with the CRC for Forestry and are involved in all the research projects of this CRC.

CSIRO Division of Forestry and Forest Products/ensis

- Dr Chris Beadle co-supervises postgraduate research by Mark Neyland and Gordon Bradbury. Chris also collaborates with the Native Forests Branch on research needs for blackwood.
- CSIRO Land and Water & Information Systems (Dr Ray Corell and Dr Rai Kookana) Pesticide Impact Rating Index (PIRI). Provided input to CSIRO on modification of PIRI model to utilise Soil Dryness Index as an input to the model.
- Collaboration with Drs Chris Beadle and Jane Medhurst on research needs for blackwood.
- Dr Mike Battaglia provided assistance in training staff in the use of CABALA to predict plantation performance.
- The CSIRO FFP Hobart laboratory provides analytical services for nutrient analysis of soils and foliar samples.
- Work with ensis on pruning and thinning, blackwood plantation silviculture, nutrient management and genetics in relation to wood quality (see individual projects in Plantations Branch Project List).

Collaboration and linkages (continued)

CSIRO Division of Land and Water

- The TasLUCAS Project was undertaken by CSIRO Land and Water (Dr Peter Hairsine) and funded by the National Heritage Trust to model the effects of changing land use on small scale catchments. FT provided scientific overview, technical and data input to the project.
- Dr Peter Hairsine is Principal Investigator in the TasLUCAS project and also provided information to Forestry Tasmania on various aspects of forest hydrology.
- Drs Rai Kookana and Ray Corell (CSIRO Maths and Information Sciences) demonstrated the PIRI program and assisted in development of proposals for funding under the Tasmanian Water Quality Initiative.

Department of Primary Industries, Water and Environment

- Dick Bashford and Simon Grove are collaborating with Michael Driessen on a study of invertebrates along an altitudinal transect at Warra.
- Dick Bashford and Tim Wardlaw are collaborating with Danny Reardon and Peter Brown (DPIWE) and Paul Pheloung (DAFF) to develop an urban surveillance program for Tasmania.
- Drs Peter Volker and John Mollison (DPIW) developed a series of proposals to develop the Pesticide Impact Rating Index program for use in Tasmania.
- Water Management Branch staff communicate regularly with Dr Sandra Roberts and provide advice to research and operational programs.
- Dr Peter Volker assisted DPIW (Bill Cotching) and NRM Tasmania in development of a funding proposal to undertake the TasLUCAS project with CSIRO Land and Water, (modelling effects of forestry activities on small catchments). Sandra Roberts was a member of the Steering Committee for the TasLUCAS project.
- Dr Peter Volker is a member of the Inter-Departmental Group on Genetically Modified Organisms.

Forests and Forest Industry Council

- John Hickey, Gordon Bradbury and Sue Jennings contribute to a Blackwood Roundtable subcommittee that considers research needs for blackwood timber supply.

Forest Practices Authority, Tasmania

- Dr Peter McIntosh (FPA) and Dr Mike Laffan work together on soil characterisation for the Forest Soil Fact Sheets posted on Forest Practices Board web site.
- Tim Wardlaw and Fred Duncan (FPA) worked together to produce a Flora Technical Note on *Phytophthora cinnamomi* management.

Forest Science Centre, Victoria

- Drs Tom Baker, Yue Wang and David Forrester and Mr Darren Grant are participants in FWPRDC Project "Sourcing of eucalyptus plantation and regrowth timber with verifiable genetic traits and silvicultural history for solid wood timber research" managed by Forestry Tasmania.

Forest and Wood Products Research and Development Corporation

- Forestry Tasmania is the project manager for FWPRDC Research Project "Sourcing of Eucalyptus plantation and regrowth timber with verifiable genetic traits and silvicultural history for solid wood timber research". Peter Volker is Principal Investigator and Angus MacNeil is Project Manager. Chris Lafferty (FWPRDC) and Peter Volker are members of the Steering Committee.

Queen Victoria Museum

- Dick Bashford and Simon Grove are collaborating with Queen Victoria Museum staff on studies of invertebrates at Warra.

Collaboration and linkages (continued)

Queensland Department of Primary Industries

- Tim Wardlaw and Dick Bashford collaborated with Queensland Department of Primary Industries and CSIRO Division of Entomology on an ACIAR-funded project on developing a health surveillance capability in South Pacific countries.
- Dick Bashford collaborated with Ross Wylie (QDPI) and Jack Simpson (private consultant) to draft a Contingency Plan for Asian Gypsy Moth.
- Ian Last (DPI Forestry) is a member of the Steering Committee for the FWPRDC Project PN05.3008.

Queensland Forest Research Institute

- Dr David Lee (QFRI) was a participant in the FWPRDC Research Project “Sourcing of eucalyptus plantation and regrowth timber with verifiable genetic traits and silvicultural history for solid wood timber research”.

Research Priorities Coordinating Committee

- Membership (Steve Read).
- Research Working Group 1 (Genetic Resources): Membership - Peter Volker, Dean Williams.
- Research Working Group 3 (Land and Water Resources): Membership - Mike Laffan, Carolyn Ringrose.
- Research Working Group 4 (Native Forest Management): Membership (John Hickey, Chair, and Simon Grove, Secretary, to March 2006). Mark Neyland will replace John Hickey as one of Forestry Tasmania’s representatives on this group.
- Research Working Group 5 (Plantation Management): Membership - Paul Adams, Peter Volker.
- Research Working Group 7 (Forest Health): Membership - Tim Wardlaw, Dick Bashford, Steve Read.

seedEnergy Pty Ltd

- Provide contract services for control-pollination of eucalypts under the FT40 project. Collaborative progeny trials have been assessed.

Southern Tree Breeding Association Inc.

- *E. globulus* operational tree breeding and genetic improvement research is done through the STBA, and STBA is undertaking a TreePlan® analysis of FT *E. nitens* breeding populations under contract.
- Peter Volker and Dean Williams are elected members of the STBA Board and Technical Advisory Committee respectively.
- STBA provide technical services for development of the ESTR database for FWPRDC Project “Sourcing of eucalyptus plantation and regrowth timber with verifiable genetic traits and silvicultural history for solid wood timber research” (Dr Tony MacRae, CEO and Mr Peter Cunningham, Business Manager).
- David Pilbeam (STBA) provides assistance and information for the Forestry Tasmania eucalypt breeding program.

State Forests NSW

- Dr Michael Henson (SF NSW) is a participant in FWPRDC Project “Sourcing of eucalyptus plantation and regrowth timber with verifiable genetic traits and silvicultural history for solid wood timber research”.

Tasmania Herbarium

- Jean Jarman is collaborating with Gintaras Kantvilas on surveys of bryophytes and lichens in the Warra Silvicultural Systems Trial.

University of London

- Laura Borrer-Closs from Imperial College collaborated with Dr Simon Grove on habitat requirements for the giant velvet worm.

Collaboration and linkages (continued)

University of Melbourne

- Dr Leon Bren provides guidance on the hydrology program at Warra LTER site.
- John Hickey is collaborating with Dr Kath Williams, Professor Ian Bishop, Rebecca Ford and a PhD student on a new ARC Linkage project to determine the social acceptability of alternatives to clearfelling.
- Dr Leon Bren provides advice on the Warra Hydrology project.
- Dr Charles Warren (University of Melbourne) is conducting research on secondary succession and nitrogen economy of plants in wet forests of SE Australia, including at Warra.
- Drs Tom Baker, Yue Wang and David Forrester collaborate in CRC Forestry Program 2 (High Value Wood Resources), particularly in the area of growth and yield modelling in eucalypt plantations.
- John Hickey co-supervised an Honours project by Veronica Tyquin on the silviculture of celery-top pine in tall oldgrowth forests.

University of Queensland

- Simon Grove is collaborating with Emily Nicholson and Hugh Possingham on a project developing land-use models to find optimal solutions for maintaining viable populations of a range of species with contrasting life histories.

University of Tasmania

- Research by Associate Professor Brad Potts and Dr Robert Barbour is contributing to development of policies relating to genetic pollution.
- Mark Neyland is collaborating with Peter Ades (University of Melbourne), Dot Steane (University of Tasmania) and Brad Potts (University of Tasmania) on a project (4.2.7 Management of Genetic Resources) which is investigating the genetics of *E. regnans* and *E. obliqua*, and may lead to a more genetically based system for seed sourcing.
- Industry partner (Dr Tim Wardlaw-partner investigator) for ARC-SPIRT project on the management of *Mycosphaerella* Leaf Blight.
- Collaborator (Dr Tim Wardlaw) for FWPRDC-funded project on fertilising and forest health.
- ARC Linkage project led by Dr Julianne O'Reilly Wapstra to examine genetic interactions of browsing animals and eucalypts.
- Greg Unwin, agroforestry lecturer is collaborating with Sue Jennings on studies of light regimes on blackwood form at the Togari blackwood release trial, and with Dean Williams on liverwort, moss and algal infestations at the Forest Nursery. Honours research-project on pest cryptogam control in nursery-grown containerised *E. nitens* seedlings by Ms Tanya Bailey successfully completed.
- The Plantations Branch maintains eucalypt genetic trials established by Associate Professor Brad Potts.
- An ARC Linkage Grant on "Unravelling the genetic relationships between growth and wood properties" is supported by Peter Volker, Forestry Tasmania, and Dr Rene Vaillancourt, UTas.
- Tim Wardlaw is co-supervisor of PhD studies by Danielle Wisemann on effects of fertilisation on host responses to decay in *E. globulus* and *E. nitens*, and Anna Hopkins on microbial successions in *E. obliqua* trees and logs.
- Peter Volker is co-supervisor of PhD studies by Des Stackpole on silviculture and genetics of wood properties of cloned eucalypts.
- Mark Neyland is enrolled at the School of Plant Science at the University of Tasmania as a part-time PhD student. His topic is "Regeneration and growth of *E. obliqua* after a range of silvicultural treatments". Mark is supervised by Dr Jürgen Bauhus (University of Freiburg), Dr Chris Beadle (CSIRO FFP), Dr Neil Davidson (University of Tasmania) and John Hickey.

Collaboration and linkages (continued)

- Carolyn Ringrose completed her PhD in Dec 05 in the Department of Agricultural Science. Her topic was “Long-term annual nitrogen fertilisation of *Eucalyptus regnans* and *Pinus radiata*: effects on tree growth, soil chemistry and net nitrogen mineralisation”. Supervisors were Richard Doyle (University of Tasmania), Dr Philip Smethurst (CSIRO FFP) and Bill Neilsen (previously with Forestry Tasmania).
- Simon Grove is co-supervisor of PhD studies by Anna Hopkins and Kate Harrison on invertebrate and microbial successions in *E. obliqua* trees and logs.
- Simon Grove is collaborating with Genevieve Gates and David Ratkowsky on surveys of macrofungi at Warra.
- A comprehensive series of research trials to examine processing characteristics of eucalypt plantation and regrowth timber for funding by FWPRDC was developed. This work was led by Greg Nolan of the Timber Research Unit, University of Tasmania, and Peter Volker.
- Associate Professor Brad Potts and Dr Robert Barbour contributed information to Peter Volker to develop a Policy on Genetic Pollution as part of Forestry Tasmania’s policy development for the Australian Forestry Standard.

Warra Policy and Research Committees

- Membership (John Hickey, Simon Grove, Steve Read).

Western Australia Department of Agriculture

- Dick Bashford collaborated with Mike Grimm to design and establish static traps to delineate the European House borer incursion.

Western Australia Forest Products Commission

- Drs John McGrath and Graeme Siemon are participants in FWPRDC Project “Sourcing of eucalyptus plantation and regrowth timber with verifiable genetic traits and silvicultural history for solid wood timber research”.

Published papers, reports and presentations

Refereed Journals

Authors employed by Forestry Tasmania during 2005/06 are shown in boldface. The list also includes some papers not included in the 2004/2005 Annual Report.

Bashford, R. (2006). The insect complex inhabiting galls formed by *Cecidomyia acaciaelongifoliae* Skuse (Diptera: Cecidomyiidae) on Blackwood (*Acacia melanoxylon*) in Tasmania. *Australian Entomologist*, 33 (1): 1-4.

Bradbury, G.J. (2005). A comparison of timber quality of blackwood grown in young swamp forest, fenced regeneration and a plantation. *Tasforests*, 16, 95-110.

Courtney, T., Clark, S.B. and **Hickey, J.** (2005). Floristic composition of a six-year-old clearfelled coupe in the Weld/Huon Valley. *Tasmanian Naturalist*, 127: 72-85.

Elliott, H.J., Hickey, J.E. and **Jennings, S.M.** (2005). Effects of selective logging and regeneration treatments on mortality of retained trees in Tasmanian cool temperate rainforest. *Australian Forestry*, 68, 274-280.

Gates, G.M., Ratkowsky, D.A., and **Grove, S.J.** (2005). A comparison of macrofungi in young silvicultural regeneration and mature forest at the Warra LTER site in the Southern Forests of Tasmania. *Tasforests* 16: 127-152.

Grove, S.J. (2005). Winkles, whelks and warreners: a year of shelling at Taroona. *The Tasmanian Naturalist* 127: 57-71.

Grove, S.J. (2005). How well can current planning measures maintain ecological integrity in the Tasmanian production forest landscape? *International Forestry Review* 7: 39.

Grove, S.J. and **Yaxley, B.** (2004). A species of jewel beetle (*Coleoptera: Buprestidae*) new to Tasmania. *The Tasmanian Naturalist* 126: 29-30.

Grove, S.J. and **Neyland, M.G.** (2005). How 'natural' is the response of biodiversity to clearfelling and to alternative silvicultural systems in Tasmanian wet eucalypt forest? *International Forestry Review* 7: 325.

Grove, S.J. and **Yaxley, B.** (2005). Wildlife habitat strips and native forest ground-active beetle assemblages in plantation nodes in northeast Tasmania. *Australian Journal of Entomology* 44: 331-343.

Hickey, J.E., Neyland, M.G., and **Grove, S.J.** (2005). From little things big things grow: The Warra Silvicultural Systems Trial in Tasmanian tall *Eucalyptus obliqua* forest. *International Forestry Review* 7: 47.

Hopkins, A.J.M., Harrison, K.S., **Grove, S.J., Wardlaw, T.J.** and Mohammed, C.L. (2005). Wood decay fungi and beetle assemblages associated with living *Eucalyptus obliqua* trees: early results from studies at the Warra Long Term Ecological Research Site, Tasmania. *Tasforests* 16: 111-126.

Jennings, S.M., Edwards, L.G. and **Hickey, J.E.** (2005). Natural and planted regeneration after harvesting of Huon pine at Traveller Creek, western Tasmania. *Tasforests*, 16, 61-70.

LaSala, A.V. (2006). Pre-commercial thinning and fertiliser enhance growth in young native *Eucalyptus obliqua* (L'Hérit.) stands in Tasmania. *Australian Forestry* 69, 16-24.

Lauck, B., Swain, R. and **Bashford, R.** (2005). Seasonal activity patterns of the frog, *Crinia signifera* (Anura: Myobatrachidae), in southern Tasmania, Australia. *Papers and Proceedings of the Royal Society of Tasmania*, 139: 29-32.

Macdonald, M.A., Apiolaza, L.A., and **Grove, S.J.** (2005). The birds of retained vegetation corridors: a pre- and post-logging comparison in dry sclerophyll forest in Tasmania. *Forest Ecology and Management* 218: 277-290.

McIntosh, P.D., **Laffan, M.D.** and Hewitt, A. (2005). The role of fire and nutrient loss in the genesis of the forest soils of Tasmania and southern New Zealand. *Forest Ecology and Management* 220: 185-215

McIntosh, P.D. and **Laffan, M.D.** (2005). Soil erodibility and erosion hazard: extending these cornerstone soil conservation concepts to headwater streams in the forestry estate in Tasmania. *Forest Ecology and Management* 220: 128-139

Neyland, M.G. and **LaSala, A.V.** (2005). Response of understorey floristics to pre-commercial thinning and

Published papers, reports and presentations (continued)

fertilising in even-aged eucalypt regeneration. *Tasforests*, 16, 71-82.

Nyvold, U., **Dawson, J.K.** and **Hickey, J.E.** (2005). An assessment of timber values from alternative silvicultural systems tested in wet *Eucalyptus obliqua* forests in Tasmania. *Tasforests* 16, 19-34

Walters, J.R., Bell, T.L and **Read, S.** (2005). Intra-specific variation in carbohydrate reserves and sprouting ability in *Eucalyptus obliqua* seedlings. *Australian Journal of Botany* 53: 195-203

Wiseman, D, Smethurst, P.J., Beadle, C.L., **Wardlaw, T.J.**, Hall, M.F., Baillie, C.C., and Mohammed, C.L. (2006). Pruning and fertiliser effects on branch size and decay in two *Eucalyptus nitens* plantations. *Forest Ecology and Management*; 225 (1-3): 123-133

Conference Proceedings and Posters

Adams, P.R. (2005). Tree responses to fertiliser are reduced by weed interference. Paper presented at 1st Tasmanian Weeds Conference, Launceston, October 13 – 14, 2005.

Barbour, R.C., Otahal, Y., Jones, R.C., Potts, B.M., Vaillancourt, R.E. and **Volker, P.W.** (2005). Assessing and managing the risk of gene flow from plantations into native eucalypts in Australia. Poster presented at Symposium 'Advances in Plant Conservation Biology: Implications for Flora Management and Restoration', Perth, October 25-27.

Bashford, R. (2005). Monitoring for exotic forest *Coleoptera* in urban and commercial forest areas using static traps. Oral presentation to National Workshop on Plant Pest Surveillance in Urban Areas, Canberra, June 2005.

Bashford, R. (2006). The use of static traps to monitor for exotic and native woodborer insects in plantation forestry. Oral presentation to Plantation Timber Industry Biosecurity Group, Melbourne, February 2006.

Bashford, R. (2005). Effectiveness of insecticidal baits in the control of exotic vespid wasps in Tasmanian forestry areas. Poster presentation to Australian Entomological Society 36th Scientific Conference, ANU Canberra 4-9 December 2005.

Bashford, R. (2005). The impact of two species of vespid wasps (*Vespula vulgaris* and *V. germanica*) on some species of Diptera at the Warra LTER site in southern Tasmania. Poster presentation to Australian Entomological Society 36th Scientific Conference, ANU Canberra 4-9 December 2005.

Elek, J. (2005). Challenges in Capturing the Social Benefits of Softer Insecticides. Oral presentation to 4th Plantation Pest Management Workshop, Mt Gambier, March 2006.

Fox, J.C., Regan, T.J., Berkessy, S.A., Wintle, B.A., **Brown, M.J.**, **Meggs, J.M.**, Bonham, K., Mesibov, R., McCarthy, M.A., Munks, S.A., Wells, P., Brereton, R., Graham, K., **Hickey, J.**, **Turner, P.**, Jones, M., Brown, W.E., Mooney, N., **Grove, S.**, Yamada, K., and Burgman, M.A. (2005). Forest-dependent species persistence in the production forestry landscapes of NE Tasmania: findings from population viability analyses. Poster presentation at the 7th Invertebrate Biodiversity and Conservation conference, Canberra, ACT, 5-9 December 2005.

Grove, S.J. (2006). The Warra LTER site in southern Tasmania. Poster presentation at Sixth conference of the East Asia - Pacific regional network of the International Long-Term Ecological Research network, Kyoto, Japan, 20-23 March 2006.

Grove, S.J., Jennings, J.T., and Keenan, R. (2006). The Australian LTER network. Oral presentation at Sixth conference of the East Asia - Pacific regional network of the International Long-Term Ecological Research network, Kyoto, Japan, 20-23 March 2006.

Grove, S.J. (2005). How well can current planning measures maintain ecological integrity in the Tasmanian production forest landscape? Oral presentation at XXII IUFRO World Congress, Brisbane, Queensland, 8-13 August 2005.

Grove, S.J. (2005). How well can current planning measures maintain terrestrial invertebrate assemblages in the Tasmanian production forest landscape? Oral presentation at the 7th Invertebrate Biodiversity and Conservation conference, Canberra, ACT, 5-9 December 2005.

Grove, S.J. (2005). Deadwoodology Down Under. Oral presentation for Forestry Commission Alice Holt Research

Published papers, reports and presentations (continued)

Station occasional seminars, Wrecclisham, UK, 3 November 2005.

- Grove, S.J.** (2005). Deadwoodology Down Under. Oral presentation at the Review of the Swedish Research Programme on Coarse Woody Debris and saproxylic Insects, Uppsala, Sweden, 8-9 November 2005.
- Grove, S.J.** (2005). Deadwoodology report card: Sweden and Tasmania compared. Oral presentation at the Review of the Swedish Research Programme on Coarse Woody Debris and saproxylic Insects, Uppsala, Sweden, 8-9 November 2005.
- Grove, S., Bashford, R., Yaxley, B. and Appleby, B.** (2005). The Warra log decay project: saproxylic beetles from the first three-year sampling cycle. Poster presentation at the 7th Invertebrate Biodiversity and Conservation conference, Canberra, ACT, 5-9 December 2005.
- Grove, S., Bashford, R., Yaxley, B., and Appleby, B.** (2005). The Tasmanian Forest Insect Collection. Poster presentation at the 7th Invertebrate Biodiversity and Conservation conference, Canberra, ACT, 5-9 December 2005.
- Grove, S.J.** and Keenan, R. (2005). The Australian LTER Network. Oral presentation at the International Workshop on Information Management of Ecological Networks, Beijing, 19-22 July 2005.
- Grove, S.J. and Neyland, M.G.** (2005). How 'natural' is the response of biodiversity to clearfelling and to alternative silvicultural systems in Tasmanian wet eucalypt forest? Oral presentation at XXII IUFRO World Congress, Brisbane, Queensland, 8-13 August 2005.
- Grove, S. and Yaxley, B.** (2005). How effective are wildlife habitat strips in the conservation of Tasmania's native forest invertebrates? Poster presentation at the 7th Invertebrate Biodiversity and Conservation conference, Canberra, ACT, 5-9 December 2005.
- Grove, S.J.** and Hanula, J.L. (Editors) (2006). Insect biodiversity and dead wood. Proceedings of a symposium at the International Congress of Entomology, Brisbane, Australia, August 2004. USDA Forest Service Southern Research Station General Technical Report SRS-93, Athens.
- Grove, S.** (2006). A research agenda for insects and dead wood. In Grove, S.J. & Hanula, J.L. (Ed.), Insect biodiversity and dead wood. Proceedings of a symposium at the International Congress of Entomology, Brisbane, Australia, August 2004. USDA Forest Service Southern Research Station General Technical Report SRS-93, Athens.
- Grove, S.J.** (2006). The Warra LTER site in southern Tasmania. In Sixth conference of the East Asia - Pacific regional network of the International Long-Term Ecological Research network (ed Tagaki, M.), p 34. Japanese Ecosystem Research Network, Kyoto, Japan.
- Grove, S.J., Jennings, J.T., and Keenan, R.** (2006). The Australian LTER network. In Sixth conference of the East Asia - Pacific regional network of the International Long-Term Ecological Research network (ed Tagaki, M.), p 15. Japanese Ecosystem Research Network, Kyoto, Japan.
- Grove, S.J., Neyland, M.G. and Lefort, P.** (2005) How 'natural' is the response of biodiversity to clearfelling and to alternative silvicultural systems in Tasmanian wet eucalypt forest? Paper presented at the XXIII IUFRO conference, Forests in the Balance: Linking Tradition and Technology, 8 – 13 August 2005, Brisbane, Australia.
- Harrison, K., Hopkins, A., **Grove, S.** and Mohammed, C. (2005). Saproxylic beetles associated with mature living *Eucalyptus obliqua* trees in southern Tasmania. Poster presentation at the 7th Invertebrate Biodiversity and Conservation conference, Canberra, ACT, 5-9 December 2005.
- Hickey, J.E.** (2005). Alternatives to clearfell silviculture in tall old-growth forests in Tasmania. *The International Forestry Review*, 7(5)
- Hickey, J.E., Neyland, M.G. and Grove, S.J.** (2005). From little things big things grow: The Warra Silvicultural Systems Trial in Tasmanian tall *Eucalyptus obliqua* forest. Paper presented at the XXIII IUFRO conference, Forests in the Balance: Linking Tradition and Technology, 8 – 13 August 2005, Brisbane, Australia.
- Neyland, M.G.** (2005). Seedling regeneration, growth and density of *Eucalyptus obliqua* following variable retention harvesting in wet eucalypt forests in Tasmania, Australia. Poster paper presented at the XXIII

Published papers, reports and presentations (continued)

- IUFRO conference, Forests in the Balance: Linking Tradition and Technology, 8 – 13 August 2005, Brisbane, Australia.
- Neyland, M.G.** (2005). Understorey islands as a means of conserving structural and plant diversity within harvested wet eucalypt forests in Tasmania. Paper presented at the XXIII IUFRO conference, Forests in the Balance: Linking Tradition and Technology, 8 – 13 August 2005, Brisbane, Australia.
- Stamm, L., Yee, M., Grove, S.** and Mohammed, C. (2005). Talking rot! Poster presentation at the 7th Invertebrate Biodiversity and Conservation conference, Canberra, ACT, 5-9 December 2005.
- Volker, P.W.** (2005). Eucalypt plantations – creating a new solid wood resource for Tasmania. CRC Sustainable Production Forestry – Solid Wood from Plantations Workshop, Hobart, 12 May 2005.
- Volker, P.W.,** Greaves, B. and **Wood, M.J.** (2005). Silvicultural management of eucalypt plantations for solid wood and engineered wood products – experience from Tasmania, Australia. In Proceedings of ITTO International Conference on Plantation Eucalyptus: Challenge in Product Development. Zhanjiang, Guandong, China, 28 November – 1 December 2005. (China Research Institute of Wood Industry, China Eucalypt Research Centre). 3-12.
- Walsh, A.** (2005). A strategy for integrated management of browsers on State forest in Tasmania. Paper presented at the Vertebrate Pest Conference, Christchurch, New Zealand. August 2005.
- Wardlaw, T.** (2005). The evolution of forest health surveillance in Tasmania. Presentation at the 9th National Conference of the International Society of Arborists - Australian Chapter. 2-4 October 2005, Launceston.
- Wardlaw, T.,** Pinkard, L., & Mohammed, C. (2005). Can fertilisation with nitrogen and phosphorus limit growth impacts from *Mycosphaerella* leaf blight? Presentation at a Workshop on *Mycosphaerella* leaf diseases of eucalypts. Australasian Plant Pathology Society Biennial Conference. September 2005, Geelong.
- Wardlaw, T., Bashford, R.,** Wylie, R, **Wotherspoon, K.,** MacDonald, J.M., **Ramsden, N., Jennings, S., Elek, J.** and **Elliott, H.** (2005). The efficiency of routine forest health surveillance in detecting pest and disease damage in eucalypt plantations. Presentation at the Australasian Plant Pathology Society Biennial Conference. September 2005, Geelong.
- Wood, M.** (2005). ITTO Conference on Plantation Eucalypts, Zhanjiang, China. Silvicultural management of Eucalyptus plantations for solid wood and engineered wood products – Experience from Tasmania, Australia.
- Wood, M.** (2005). ITTO Conference on Plantation Eucalypts, Zhanjiang, China. Towards the prediction and management of windthrow in Eucalyptus plantations across Tasmania, Australia.
- Wood, M.J., Ellis, L.** and **Volker, P.W.** (2005). Towards the prediction and management of windthrow in Eucalyptus plantations across Tasmania, Australia. In Proceedings of ITTO International Conference on Plantation Eucalyptus: Challenge in Product Development. Zhanjiang, Guandong, China, 28 November – 1 December 2005. (China Research Institute of Wood Industry, China Eucalypt Research Centre). 13-27.
- Yee, M., Grove, S.J.,** Richardson, A., and Mohammed, C. (2006). Brown rot in inner heartwood: why large logs support characteristic saproxylic beetle assemblages of conservation concern. In: Grove, S.J. & Hanula, J.L. (Ed.), Insect biodiversity and dead wood. Proceedings of a symposium at the International Congress of Entomology, Brisbane, Australia, August 2004. USDA Forest Service Southern Research Station General Technical Report SRS-93, Athens.
- Yee, M., Borrer-Closs, L., Grove, S.** and **Stamm, L.** (2005). Giant velvet worms and Tasmanian forestry: can they coexist? Poster presentation at the 7th Invertebrate Biodiversity and Conservation conference, Canberra, ACT, 5-9 December 2005.

Theses

- Ringrose, C.R.,** (2006). Long-term N fertilisation of *Eucalyptus regnans* and *Pinus radiata*: effects on tree growth, soil, chemistry and net N mineralisation. School of Agricultural Science. University of Tasmania. PhD Thesis.

Published papers, reports and presentations (continued)

Reports and other Publications

- Adams, P., Wardlaw, T. and Robertson, D.** (2005). Establishment report: Eucalypt compost trials in Huon 2005. DFRD Technical Report 26/2005.
- Barker, R. and **Bashford, R.** (2006). National Urban Hazard Site Surveillance for Exotic Pests. First Phase Activity Report. April 2006. Prepared for Office of the Chief Plant Protection Officer. Canberra. 13pp.
- Bashford, R. and Wardlaw, T.** (2005). Annual Pest and Disease Status Report for Australia and New Zealand: Tasmania. Report compiled by Research Working Group 7 for Primary Industries Standing Committee. 7pp.
- Brown, P. and **Bashford, R.** (2006.) National Urban Hazard Site Surveillance for Exotic Pests. Stage 1 Tasmania Activity Performance Report. February 2006. Prepared for Office of the Chief Plant Protection Officer. Canberra. 19pp.
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- Grove, S.J.** (2006). Forestry Tasmania surveys for broad-toothed stag beetle *Lissotes latidens* in Wielangta State Forest, January/February 2006, Technical Report no. 02/2006. Forestry Tasmania, Hobart.
- Laffan, M.** and McIntosh, P. (2005). Forest soils formed on Jurassic dolerite in Tasmania: A summary of properties, distribution and management requirements. DFRD Technical Report 25/2005.
- Lucieer, A. and **Walsh, A.** (2006). An experimental approach for a browsing hot-spot analysis using Forestry Tasmania's browsing risk assessment data. Report to Forestry Tasmania.
- Rees, S.J.** (2005). Soils of Taswood Growers Softwood Forests: Tower Hill sheet. 2005. DFRD Technical Report 23/2005.
- Walsh, A.** (2005). Evaluation of the Mersey Box Trap for live capturing Tasmanian pademelons. A report to the Animal Welfare Advisory Committee. Forestry Tasmania, Hobart. 29pp.
- Wardlaw, T.** (2006). Redevelopment of Dempster Plains Lookout: Managing the threat from *Phytophthora cinnamomi*. Forestry Tasmania, Hobart. 10 pp.
- Wotherspoon, K. and Jennings, S.** (2005.) 2004-2005 Health Surveillance of Rayonier Joint Venture.
- Wotherspoon, K., Jennings, S. and Ramsden, N.** (2005). 2004-2005 Health Surveillance of GLP Plantations on State Forest.
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- Wotherspoon, K. and Ramsden, N.** (2005). Health Surveillance of Norske Skog Pine Plantation Estate.
- Wotherspoon, K., Jennings, S. and Ramsden, N.** (2005). Health and Performance of Eucalypt Plantations on State Forest for 2004-05
- Wylie, R., Simpson, J. and **Bashford, R.** (2005). A response plan and strategy for Gypsy moth. *Lymantria dispar dispar*, in Australia. Prepared for the Department of Agriculture, Fisheries and Forestry, Canberra. 65pp.
- Williams, D. and McCormick, N.** (2005). Forestry Tasmania's *Eucalyptus nitens* and *E. globulus* seed orchards: History, current status and future direction. DFRD Technical Report 12/2005.
- Williams, D.** (2005). *E. nitens* altitude specific genotype validation trials Autumn 2005. DFRD Technical Report 19/2005.

Published papers, reports and presentations (continued)

Williams, D. (2005). Comparing the field performance of carried over and new season's seedlings in *E. nitens*. 2005. DFRD Technical Report 20/2005.

Lunchtime Talk Series

Staff from the Division hold regular lunchtime talks at Forestry Tasmania's Hobart head office, on the theme of "Applying Science to Modern Forest Management". These short presentations on topical issues are intended to inform a wide audience, from scientists, industry workers and students through to interested members of the general public. Video recordings of many of the talks are available from the Division in VCR or DVD format (Tel: 03 6233 8219 or e-mail research@forestrytas.com.au).

The following talks were held in 2005/2006:

- 27th Jul 05 Sue Jennings
Increasing the sustainable blackwood supply for high value timber
- 15th Aug 05 Tim Wardlaw
A pathologist talking rot
- 16th Aug 05 Steve Read
Sustainable Forest Landscapes – new research approaches
- 17th Aug 05 Peter Volker
How we know what trees to grow
- 18th Aug 05 Perpetua Turner
Tasmania's wet forests – teeming with bryophytes
- 19th Aug 05 Mark Neyland
Forests regenerate!
- 28th Sep 05 Gary King
Conservation of threatened species in State Forest
- 26th Oct 05 Brad Potts
Eucalyptus globulus: a tree for the world
- 30th Nov 05 Sandra Roberts
Water quality in Tasmanian forests
- 25th Jan 06 Mike McLarin
Calculating the sustainable wood supply from Tasmania's public forests
- 22nd Feb 06 John Hickey
Silviculture for ongoing supply of Tasmania's Special Species Timbers
- 29th Mar 06 Mick Brown
The Warra Long term Ecological Research site – 10 years (and more) of research

Published papers, reports and presentations (continued)

26th Apr 06 Simon Grove

Beetling around the bush: forestry, research and the Tasmanian Forest Insect Collection

Other Talks

Grove, S.J. (2005). The Warra Long Term Ecological Research Site. Oral presentation at the Tasmanian Field Naturalists Club monthly meeting, Hobart, Tasmania, 6 October 2005.

Roberts, S. (2005). Water Quality Management in Forests. Australian Water Association, Launceston.

Roberts, S. (2005). Why are forests part of the water debate? Timber Communities Australia, Launceston.

Roberts, S. (2005). Water in Tasmanian Forests. Triabunna Probus, Orford.

Forest Tours

The Division also hosted a forest tour on 20th August 2005 for members of the public, as part of Forestry Tasmania's contribution to National Science Week. This tour travelled through forests in north-east Tasmania and looked at how science supported plantation forestry and how plantations are managed to give the desired wood products.

Forestry Tasmania has been producing a high-quality annual journal about Tasmania's forests since 1989. Tasforests is not intended to be solely a forum for scientific papers, but also a means of communicating descriptive or technical information on a wide range of subjects relevant to Tasmania's forests. The journal is available in hardcopy and also online in PDF format from Volume 10 onwards at:

www.forestrytas.com.au/forestrytas/pages/tasforestsonline.html

Contributed articles can be submitted at any time and will be included in issues of the journal as space and time permit. The journal is open to contributors from any organisation as well as private individuals. All contributed articles are peer-reviewed. Subjects such as forest history, machinery developments, silvicultural research, nature conservation and forest ecology are all suitable. The most recent edition, Volume 16, was published in December 2005.

Contents of Volume 16

Astacopsis gouldi Clark: habitat characteristics and relative abundance of juveniles, P.E. Davies, L.S.J. Cook, S.A. Munks and J. Meggs

An assessment of timber values from alternative silvicultural systems tested in wet *Eucalyptus obliqua* forest in Tasmania. U. Nyvold, J.K. Dawson and J.E. Hickey

Fire-attributes categories, fire sensitivity, and flammability of Tasmanian vegetation. A.F. Pyrke and J.B. Marsden-Smedley

The effect of three silvicultural treatments on eucalypt regeneration in dry, inland *Eucalyptus amygdalina* forest in the northern Midlands, Tasmania. C. Hawkins

Natural and planted regeneration after harvesting of Huon pine (*Lagarostrobos franklinii*) at Traveller Creek, western Tasmania. S.M. Jennings, L.G. Edwards and J.E. Hickey

Response of understorey floristics to pre-commercial thinning and fertilising in even-aged eucalypt regeneration M.G. Neyland and A.V. LaSala

Life-history studies and the impact of recent forest harvesting on two frog species, *Crinia signifera* and *Litoria ewingii*. B. Lauck

A comparison of timber quality of blackwood grown in young swamp forest, fenced regeneration, and a plantation G.J. Bradbury

Wood-decay fungi and saproxylic beetles associated with living *Eucalyptus obliqua* trees: early results from studies at the Warra LTER Site, Tasmania. A.J.M. Hopkins, K.S. Harrison, S.J. Grove, T.J. Wardlaw and C.L. Mohammed

A comparison of macrofungi in young silvicultural regeneration and mature forest at the Warra LTER Site in the southern forests of Tasmania. G.M. Gates, D.A. Ratkowsky and S.J. Grove

An inventory of macrofungi observed in Tasmanian forests over a six year period. D.A. Ratkowsky and G.M. Gates



Divisional services to external clients

By Angus MacNeil

Angus.MacNeil@forestrytas.com.au

Staff from the Division of Forest Research and Development work with external clients, such as other forestry companies, in a number of ways, including research contracts and technical service consultancies.

Research Services

The Division has significant experience in delivering contract research and consultancies to industry and other organisations both in Tasmania and abroad. There is a substantial body of know-how and other intellectual property gained by the Division through long experience of native forest management, and specialist skills developed in growing plantation pines and eucalypts for solid timber products.

Divisional staff provide training and operational advice to internal and external clients in harvesting, regeneration, thinning and pruning procedures. Specialist manuals, standard operating procedures and quality assessment protocols for these operations have also been developed. Much of this material is now incorporated as part of Forestry Tasmania's Environmental Management System, which complies with the International Standard ISO 14001.

The Division works with clients in a number of ways such as collaborative research, research services contracts and technical services consultancies on specific projects undertaken on a fee-for-service basis.

Key advantages for clients who use Research Branch Services are:

- Working with a service provider who has a long history of forestry research and development, and provision of technical solutions for a large native forest and plantation estate
- Working with a team who specialise not only in high-quality science but also in converting project outcomes into operational realities in the forest
- Buying knowledge and expertise which is at the leading edge in development of specialist hardwood silvicultural regimes for maximising solid wood production

Specialist technical services are offered in:

- Native forest harvesting
- Native forest seedbed preparation, sowing and remedial treatments
- Native forest silviculture, including pre-commercial thinning and commercial thinning operations
- Plantation silviculture and auditing
- Thinning and pruning regimes to produce clearwood in sawlogs from eucalypt plantations
- Soil surveys to assess sites for plantations
- Health surveillance and audits of eucalypt plantations
- Diagnosis of forest health problems (pests, diseases and abiotic), and advice on the significance of their impacts and management options
- Integrated management of major insect pests in eucalypt plantations
- Environmentally friendly insecticides to control the major insect pests of eucalypt plantations
- Forest monitoring and assessment protocols for biodiversity, and analysis and interpretation of biodiversity data
- Development of appropriate management prescriptions for biodiversity

In 2005/06 the Division prepared 22 confidential reports for various external clients.

Forest Nursery business summary

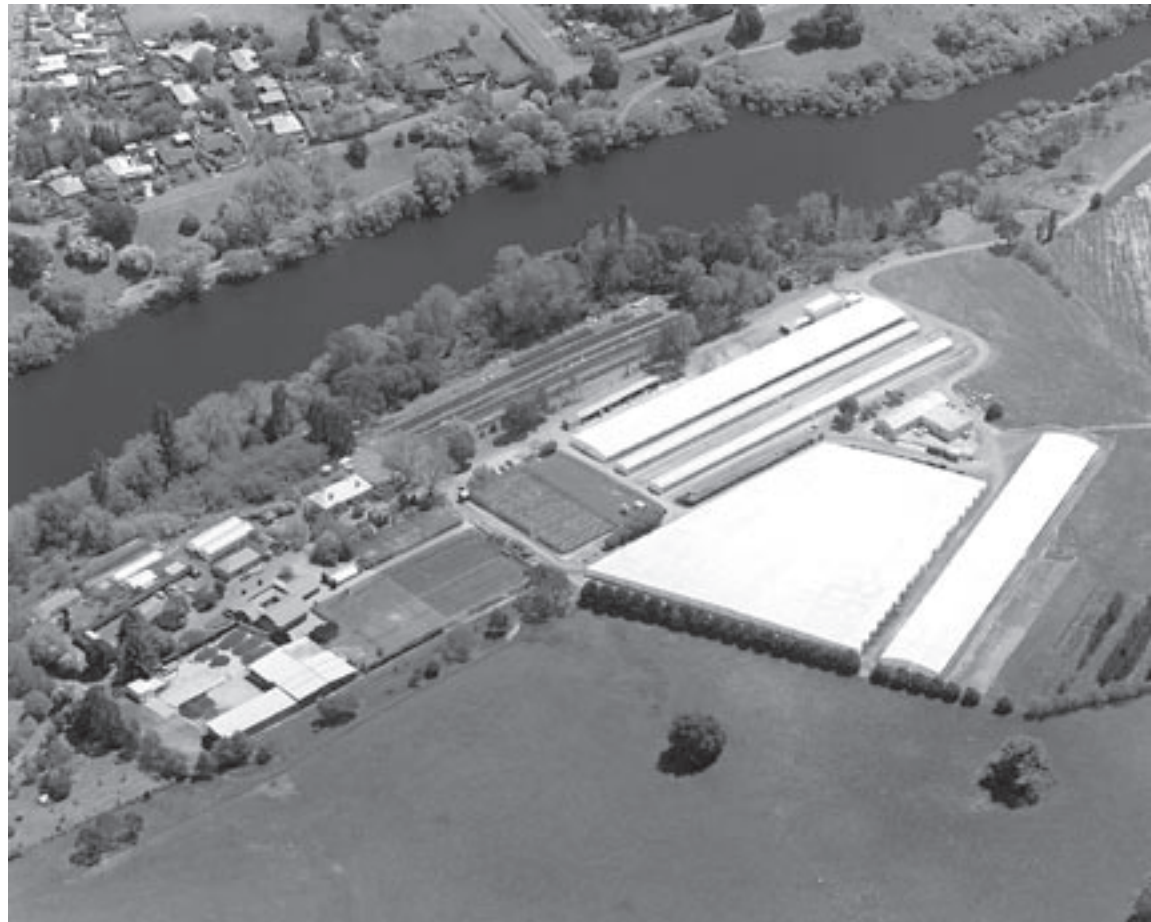
By Peter Moore (Forest Nursery Manager)

Peter.Moore@forestrytas.com.au.

The Forest Nursery was established in 1936 and occupies 80 hectares of land in a prime location within close proximity to the South Esk River, Perth, Tasmania. The function of the Forest Nursery is to provide quality reforestation seedlings to meet the needs of Forestry Tasmania, joint venture partners and private growers. The nursery operates as a commercial trading unit within Forestry Tasmania, being managed by a team of 7 full-time personnel including 1 trainee and being supported by a larger team of skilled casual labour.

The property is also used for growing seed orchards, and other specialist seed crops, the Tasmanian Seed Centre and as a regional administrative facility. Being centrally located within Tasmania, the nursery is ideally placed for convenient transport of seedlings, as well as having a climate suited to the production of cold-hardy seedlings. Historic features of this site include convict era buildings dating back to a military station established in 1814.

In addition to satisfying the business's own internal needs, the nursery has a long history of supplying external customers such as private forest growers and forest plantation companies. On average some 7 - 8 million *Pinus radiata*, *Eucalyptus globulus* and *E. nitens* seedlings are grown every season from seed orchard seed stock.



Production systems at the nursery are highly flexible, with the current focus being large-scale containerised eucalypt seedling and open-root pine production from seed. In addition, the nursery also undertakes the growing of other species utilising various propagation techniques for customers with specific requirements. At full capacity, the nursery is capable of producing approximately 9 million seedlings annually.

In broad terms the Forest Nursery aims to provide Forestry Tasmania with a cost-effective and efficient production and delivery system for seedlings which meet internal requirements, whilst maximising external sales and income. The nursery aims to use seed selected from the best breeding populations, using flexible propagation systems to produce seedlings which meet customer and industry standards. In addition to improving commercial outcomes from seedling sales, the nursery seeks to increase income from non-core business such as consultancies.

For further information please contact the Forest Nursery Manager.

Tasmanian Seed Centre business summary

By Neil McCormick (Tasmanian Seed Centre Manager)
Neil.McCormick@forestrytas.com.au

The Tasmanian Seed Centre operates as a commercial trading unit within Forestry Tasmania. It is staffed by 4 people who are located in Hobart, Perth and Geeveston. They coordinate the collection, extraction, cleaning, testing and storage of seed from:

- native forest trees, for regeneration of harvested coupes
- native forest trees, for general purpose use
- selectively bred trees in seed orchards for use in plantations

In broad terms the Seed Centre aims to provide Forestry Tasmania with a cost-effective and efficient service to meet internal requirements whilst maximising external sales of seed and total external income.

Harvested areas of native forest are regenerated using seed collected from those same areas so that naturally adapted sources of seed are returned to each site. If insufficient on-site seed is available, seed collected from a matched environmental zone can be used. Although the seed is used primarily in Forestry Tasmania's operational program, there are also significant sales to external customers. The Centre also establishes and manages seed orchards to breed improved *Eucalyptus nitens*, *E. globulus*, *Pinus radiata* and rare Tasmanian species.

The Seed Centre aims to maximise the levels of on-site and in-zone seed sown for regenerating harvested native forests. Seed stocks for regeneration need to be maintained at a level that reflects Forestry Tasmania's 3–5 year requirements, with additional stock held for external sales. All seed has to be tested to international standards for germination capacity and stored at a moisture content of less than 10%. The Seed Centre also seeks business with other major Tasmanian forest companies to collect, store and supply their seed requirements for native forest regeneration. Opportunities for marketing selectively improved seed from Forestry Tasmania seed orchards and stands are also sought. The Seed Centre continues to develop a web-site that improves the business image, facilitates external seed sales and will ultimately incorporate "e-Trade".

The Seed Centre also seeks to develop its profile by providing seed to community groups, researchers, arboreta, students and some non-funded Landcare groups. The Tasmanian Seed Centre has extraction kilns at Perth and Geeveston, which incorporate the latest technology. These centres also have cool storage facilities where seed can be stored in conditions that maximise seed life and germination capacity. At Perth there is a seed testing laboratory with a trained seed tester who tests seed to internationally recognised standards. Seed is also tested for moisture levels so that storage life is extended. Both centres have precise, air-operated and mechanical seed cleaning equipment that cleans seed to very high levels of purity.

Qualified Technical Foresters and the experienced staff of the Tasmanian Seed Centre are available to help with technical advice, seed selection and sales enquiries. In addition to seed sales, the Tasmanian Seed Centre offers extraction, storage, cleaning and testing services to all clients at very reasonable cost.

There are 29 species of eucalypts in Tasmania, and these occur in a wide variety of forest types. The Tasmanian Seed Centre is able to collect and supply seed from virtually all of these species and from the range of sites over which they occur. The Centre also offers seed from most of the other tree and shrub species that occur in Tasmania. The Centre also has seed orchards of plantation species, including Tasmanian Bluegum (*Eucalyptus globulus* ssp *globulus*), Shining Gum (*E. nitens*) and Radiata Pine (*Pinus radiata*). These orchards are planted with trees that have been selected for vigorous growth, good form and desirable wood properties and the forest stands grown from this seed produce excellent plantations.

Seed is generally delivered by air freight using postal services, and insurance can be arranged if required. Export documentation including Phytosanitary Certificates can be arranged for international sales.

The Seed Centre also has an on-line shop at:

www.forestrytas.com.au/forestrytas/seedcentre.

For further information and a Seed Catalogue please contact the Tasmanian Seed Centre Manager.

Library and information services

By Andrew Wilson (Librarian)

Andrew.Wilson@forestrytas.com.au

Forestry Tasmania's Library is located in the head office at 79 Melville Street, Hobart. It contains an extensive collection of core technical information and resources which supports the diverse needs of Forestry Tasmania: 16,000 books, 6000 print images and slides, and 250 current serial titles. It also serves as a repository and archive for published Forestry Tasmania technical reports and organisational cultural materials.

The library provides contract information services to the Forest Practices Authority. The library also makes information available to students and other libraries and members of the public who have specific requirements not able to be satisfied from other sources, and thus makes a valuable contribution to community involvement by the corporation. 928 formal loan transactions were recorded for the year (including inter-library loans).

The existing collection of books, journals, videos and photographic images is augmented by information available from electronic sources, with several current journals available both as hard copy and electronically.

Inter-library loan of items not held in the collection is part of the document delivery service offered by the library: 345 transactions were handled during the year. This figure includes both incoming requests from other libraries and outgoing requests from FT staff.

Staffing of the library is with a librarian present three days per week and a library technician two days per week.

For further information contact the Librarian.



Laboratory Services

By Dick Bashford (Laboratory Manager)

Dick.Bashford@forestrytas.com.au

Forestry Tasmania's main laboratory is located at Forestry Tasmania's head office at 79 Melville Street, Hobart.

Services that can be supplied include:

1. Pathology

- Soil testing for *Phytophthora cinnamomi* (using standard lupin bait test)
- Diagnosis of diseased trees - isolation and identification of pathogenic fungi

2. Entomology

- Identification of forest insect pests
- Insecticide bioassays

3. Soil and foliage testing

- Preparation of soil and foliage samples for chemical analysis by external labs
- Assessment of soils for physical characteristics using wet sieve analysis

4. Wood density for wood quality assessment

- Process wood samples including discs and cores to assess basic density
- Cellulose content assessment

The laboratory works in conjunction with other laboratories to obtain specialist analysis.

The laboratory also hosts the Tasmanian Forest Insect Collection (TFIC) which is available for reference by third parties.

Divisional publications

The following publications are available from the Division (Tel: 03 6233 8219 or research@forestrytas.com.au)

Botany

Swamp Forests in Tasmania

Long-term Floristic Monitoring within the Wood Production Forests of North West Tasmania

Mosses and Liverworts of Rainforest in Tasmania

Selecting Viable Populations of Threatened Plants for Conservation Management

National Rainforest Conservation Program Reports:

No.1: Tasmanian Rainforest Research

No.2: Myrtle Wilt

No.3: Floristic and Ecological Studies in Tasmanian Rainforest

No.5: Management of Rainforest in Reserves

No.7: The Effect of Fire on West Coast Lowland Rainforest

No.10: Autecology of *Phyllocladus* and *Anodopetalum* in Tasmania

No.13: Species Collection - Litter Invertebrates

No.14: A Floristic Study of Rainforest Bryophytes and Lichens in Tasmania's Myrtle-Beech Alliance

No.16: The Tasmanian Component of the National Rainforest Conservation Program - Summary of Projects

Native Forests Silviculture

Seed Manual

Pesticide Manual

Native Forests Silviculture Technical Bulletins:

No.1: Eucalypt Seed and Sowing

No.2: *Eucalyptus delegatensis* Forests

No.3: Lowland Dry Eucalypt Forests

No.4: High Altitude *Eucalyptus dalrympleana* and *Eucalyptus pauciflora* Forests

No.5: Silvicultural Systems

No.6: Regeneration Surveys and Stocking Standards

No.7: Remedial Treatment for Understocked Native Forests

No.8: Lowland Wet Eucalypt Forest

No.9: Rainforest Silviculture

No.10: Blackwood

No.11: Silvicultural Effects and Use of Fire

No.12: Monitoring and Regeneration Protection

No.13: Thinning Regrowth Eucalypts

Pests and Diseases

Pests and Diseases Management Plan

Insect Pests of Trees and Timber in Tasmania

Divisional publications (continued)

Pests and Diseases Leaflets series:

- No.1: Leafeating Beetles
- No.2: Autumn Gum Moth
- No.3: Peppermint Looper
- No.4: Fireblight Beetle
- No.5: Sawflies
- No.6: *Phytophthora cinnamomi*
- No.7: Leaf Skeletoniser
- No.8: Eucalyptus Weevil
- No.9: Termites
- No.10: *Sirex* Wasp
- No.11: Control of Browsing Damage

Plantations

Plantation Handbook

Research results for thinning and pruning eucalypt plantations for sawlog production in Tasmania

Acacia melanoxylon plantations in Tasmania, Research and Development

Guidelines for Thinning and Pruning in *Eucalyptus nitens* Plantations for Sawlog Production

Plantation Forestry Bulletin

No. 1: Weed management in Forestry Tasmania plantations

Soils

Rehabilitation Guidelines for Forest Construction

The Effects of Mechanised Forest Harvesting Operations on Soil Properties and Site Productivity

Forest Soils of Tasmania

Forest Soil Conservation Manual

Soils Technical Reports

- No.1: Code Lists for Recording Site and Soil Profile Attributes during Land Resource Field Surveys and for Storage of Soil Laboratory Data
- No.2: Laboratory Procedures for Soil Analysis and Preparation of Plant Materials
- No.3: Site Productivity and Land Suitability for Eucalypt and Radiata Pine Plantations in Tasmanian State Forest: A Framework for Classification and Assessment of Land Resource

Soils Bulletins:

- No.1: Soils of Tasmanian State forests. 1. Piper sheet, North-east Tasmania
- No.2: Soils of Tasmanian State forests. 2. Forester sheet, North-east Tasmania
- No.3: Soils of Tasmanian State forests. 3. Forth sheet, Northern Tasmania

Zoology

Use of Silvicultural Regrowth by Fauna

Land Snails, Landhoppers, Millipeds and Carabids in mature and regrowth forest near Tahune Bridge

Tasmanian Forest Insects and their Host Plants

Division Research Notes

- No.1: Lissotes and logs
- No.2: Logs in a state of decay
- No.3: Bat echoes
- No.4: North-east forest snail

Divisional publications (continued)

- No.5: Testing the Archaeological Potential Zoning system
- No.6: Mount Arthur burrowing crayfish
- No.7: A history of timber-getting in the Southern Forests
- No.8: Use of habitat trees by birds after logging
- No.9: Beetles in retained snips and stream reserves
- No.10: Impact of leaf beetles on growth of eucalypt plantations
- No.11: Commercial Thinning: How much is enough?

Warra

Design of a Hydrologic Research Project for the Warra Long Term Ecological Research Site
Vegetation of the Warra LTER Site. A report and 1:25,000 map

Video recordings of lunchtime talks

Recordings of the following public talks are available in VCR or DVD format (20 – 45 mins duration):

- 26th Feb 04 Dr Denis Alder
Sustainability in forestry: Global and local perspectives
- 25th Mar 04 Dr Simon Grove
Messy forests are healthy forests
- 29th Apr 04 Mark Neyland
Partial harvesting of high and dry forests in Tasmania
- 27th May 04 Dr Jane Elek
Looking after the good bugs: New ways to manage forest pests
- 24th Jun 04 John Hickey
Alternatives to clearfell silviculture in old-growth forests
- 29th Jul 04 Dr Peter Volker
What makes good wood: Comparing old-growth, regrowth and plantation timber
- 19th Aug 04 Dr Sandra Roberts
Understanding the water demands of forests
- 30th Sep 04 Dr Mike Laffan
The real dirt on Tasmanian forest soils
- 28th Oct 04 Neil McCormick
Seed for Forestry Tasmania's regenerated forests
- 27th Jan 05 Tim Wardlaw
Phytophthora cinnamomi: the plant killer
- 27th Jul 05 Sue Jennings
Increasing the sustainable blackwood supply for high value timber
- 15th Aug 05 Tim Wardlaw
A pathologist talking rot
- 16th Aug 05 Steve Read
Sustainable Forest Landscapes – new research approaches
- 17th Aug 05 Peter Volker
How we know what trees to grow
- 18th Aug 05 Pep Turner
Tasmania's wet forests – teeming with bryophytes
- 19th Aug 05 Mark Neyland
Forests regenerate!

Divisional publications (continued)

- 28th Sep 05 Gary King
Conservation of threatened species in State Forest
- 26th Oct 05 Dr Brad Potts
Eucalyptus globulus: a tree for the world
- 30th Nov 05 Dr Sandra Roberts
Water quality in Tasmania
- 25th Jan 06 Mike McLarin
Calculating the sustainable wood supply from Tasmania's public forests
- 22nd Feb 06 John Hickey
Silviculture for ongoing supply of Tasmania's Special Species Timbers
- 29th Mar 06 Dr Mick Brown
The Warra Long Term Ecological Research site – 10 years (and more) of research
- 26th Apr 06 Dr Simon Grove
Beetling around the bush: forestry, research and the Tasmanian Forest Insect Collection

A synopsis of these talks and downloadable files of the presentations can be viewed by following the links on Forestry Tasmania's website from:

http://www.forestrytas.com.au/forestrytas/pages/research_lunch_talks_2.htm

Divisional management structure and key staff overview

The Division is headed by the Chief Scientist, who oversees the following management team:

Principal Research Officer (Native Forests)

- Manages research on techniques aimed at increasing productivity of the harvestable areas in native forests. Coordinates continuous improvement of ecologically sustainable forest management.

Principal Research Officer (Biology and Conservation)

- Manages research into the conservation of natural values and management of pests and diseases. Manages the forest health surveillance program.

Principal Research Officer (Plantations)

- Manages research and extension on plantation silviculture and forest hydrology. Manages operational implementation of research and quality standards monitoring.

Forest Nursery Manager

- Responsible for the annual production of over 8 million pine, eucalypt and other tree seedlings from the Forest Nursery in Perth.

Tasmanian Seed Centre Manager

- Responsible for the collection, storage and distribution of native seed for regenerating native forest and high quality selected seed for plantation use.

Librarian

- Oversees the specialist book and periodical collection in the Forest Library.

Business Manager

- Manages commercial activities, intellectual property issues and marketing.

Executive Officer

- Manages administrative and financial matters.

Divisional management structure and key staff overview (continued)

STEVE READ (Chief Scientist)

Dr Steve Read commenced as Chief Scientist on 18 October 2004. Steve was previously on the staff of the School of Forestry, University of Melbourne, Creswick and the School of Botany, University of Melbourne, Parkville. His research interests range widely across forest science, including recent research on the response of vegetation to browsing. Currently Steve also supervises PhD students working on a number of topics, including sambar deer and bearded pig.

Steve was involved in the previous CRC for Hardwood Fibre and Paper Science and is part of the current CRC for Forestry. He has also:

- Authored some 25 research papers and 50 conference publications and supervised 12 PhD students
- Served as Associate Dean (Coursework) in the University of Melbourne Institute of Land and Food Resources 2001-2004
- Worked on the Land & Biodiversity Implementation Committee of the Glenelg-Hopkins Catchment Management Authority in western Victoria

TIM WARDLAW (Principal Research Officer – Biology & Conservation Branch)

Tim has a Bachelor of Science (Hons) and a PhD from the University of Tasmania. He has 25 years experience in applied forest pathology research, with particular emphasis on disease survey, impact assessment, diagnosis and development of management strategies. He introduced forest health surveillance to Tasmania in 1997. He has a strong record of successfully securing funds for research projects, and has undertaken many consultancies in the Asia-Pacific region.

MARK NEYLAND (Principal Research Officer – Native Forests Branch)

Mark graduated from the Australian National University in 1980 with a Bachelor of Science in Forestry. Mark has spent most of his career as a botanist and ecologist. He has a very broad range of research experience, from studying the ecology and conservation of three rare butterflies and tree ferns, through to producing a set of management guidelines aimed at assisting the rural community with conservation of their forests and woodlands. He has also worked on the distribution, ecology, conservation and management of relict rainforest in eastern Tasmania, and has developed an improved system of harvesting high and dry forests, known as Uneven-Aged Treatment. He has authored nearly 60 publications, from peer-reviewed scientific papers through to technical documents designed to transfer the results of research into forest management systems and guidelines.

PETER VOLKER (Principal Research Officer – Plantations Branch)

Peter has a Bachelor of Science (Forestry) and Graduate Diploma Science from the Australian National University, and a PhD from the University of Tasmania. He is a Fellow of the Institute of Foresters of Australia. His experience includes over 26 years postgraduate work in silvicultural and tree breeding research and operational management of softwood and hardwood plantations, and he specialises in eucalypt genetics, in particular hybridisation. He has overseas consultancy experience both as a private consultant and as an employee of Forestry Tasmania. Peter has organised two international conferences and is currently a Director of the Southern Tree Breeding Association. He has extensive experience in directing and managing collaborative research projects including coordination of many successful funding applications.

ANGUS MacNEIL (Business Manager)

Angus has a Bachelor of Science (Hons) in Marine Biology and has worked for several overseas and Tasmanian companies. His experience includes management of research and development projects, human resources, infrastructure development, administration, and operations, as well as being on the Executive of a medium-sized company. His work centres on marketing, financial, intellectual property and contract management.

Divisional management structure and key staff overview (continued)

NEIL McCORMICK (Tasmanian Seed Centre Manager)

Neil has worked in silviculture for over 36 years. His experience has included research in plantations and native forests, and many years of operational practice as a technical forester covering a wide range of activities. In 1993 Neil established the Tasmanian Seed Centre to supply the organisational seed requirements, and develop a trading unit to market seed and services to external clients. He has grown the business significantly to a stage where it has world-standard facilities and processes, and supplies over 50 native Tasmanian and Australian mainland species, as well as service contracts with several companies.

PETER MOORE (Forest Nursery Manager)

Peter has an Advanced Diploma in Horticulture from TAFE Tasmania, and has worked at the Forest Nursery since 1983. He has wide-ranging experience in nursery production systems, including the use of the latest propagation techniques for plantation pine and eucalypts, as well as the cultivation and large-scale production of a diverse range of ornamental and amenity species. His role encompasses the administration and management of a large-scale nursery utilising automatic seed sowing, open-ground production and containerised technology. His work has also included advising consultancy clients in China on nursery improvement programs.

ANDREW WILSON (Librarian – Forestry Tasmania Library)

Andrew has a Bachelor of Arts degree from the University of Tasmania and, completing his library qualifications in 1976, has been employed in academic, public and special libraries. He has worked at the Forestry Tasmania Library since 1989 in various capacities, and brings extensive experience in providing library services for Forestry Tasmania and external agencies. He has interests in forest history, forest politics and social change.



Dr Steve Read
Chief Scientist



Mark Neyland
Principal Research
Officer
(Native Forests)



Dr Tim Wardlaw
Principal
Research Officer
(Biology &
Conservation)



Dr Peter Volker
Principal Research
Officer
(Plantations)



Peter Moore
Forest Nursery
Manager



Neil McCormick
Tasmanian Seed
Centre Manager



Andrew Wilson
Librarian



Angus MacNeil
Business Manager



Robyn Leach
Executive Officer

Key contacts

DIVISION OF FOREST RESEARCH AND DEVELOPMENT

General enquiries:

Division of Forest Research and Development
Forestry Tasmania
79 Melville Street
Hobart, Tasmania 7000
Australia
www.forestrytas.com.au/forestrytas/pages/research.html

Tel: 03 6233 8219
Int'n'l.Tel.: +61 3 6233 8219
Fax: 03 6233 8292
Int'n'l. Fax: +61 3 6233 8292
email: research@forestrytas.com.au

	In Australia	International	E-mail
Business enquiries:			
Chief Scientist (Steve Read)	Tel: 03 6233 8202	+61 3 6233 8202	Steve.Read@forestrytas.com.au
Business Manager (Angus MacNeil)	Tel: 03 6233 8169	+61 3 6233 8169	Angus.MacNeil@forestrytas.com.au

Research Branches – Principal Research Officers:

Native Forests (Mark Neyland)	Tel: 03 6233 8607	+61 3 6233 8607	Mark.Neyland@forestrytas.com.au
Biology & Conservation (Tim Wardlaw)	Tel: 03 6233 8205	+61 3 6233 8205	Tim.Wardlaw@forestrytas.com.au
Plantations (Peter Volker)	Tel: 03 6233 8138	+61 3 6233 8138	Peter.Volker@forestrytas.com.au

Laboratory:

Laboratory (Dick Bashford)	Tel: 03 6233 8231	+61 3 6233 8231	Dick.Bashford@forestrytas.com.au
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Tasmanian Seed Centre:

Seed Centre Manager (Neil McCormick)	Tel: 03 6233 8165	+61 3 6233 8165	Neil.McCormick@forestrytas.com.au
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www.forestrytas.com.au/forestrytas/seedcentre

Library and Information Services:

Librarian (Andrew Wilson)	Tel: 03 6233 8160	+61 3 6233 8160	Andrew.Wilson@forestrytas.com.au
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Forest Nursery:

Division of Forest Research and Development
Forestry Tasmania
15960 Midlands Highway
Perth, Tasmania 7300
Australia

Tel: 03 6391 6303
Int'n'l.Tel.: +61 3 6391 6303
Fax: 03 6391 6304
Int'n'l. Fax: +61 3 6391 6304
email: nursery@forestrytas.com.au

www.forestrytas.com.au/forestrytas/pages/productsnursery

Forest Nursery Manager (Peter Moore)	Tel: 03 6391 6312	+61 3 6391 6312	Peter.Moore@forestrytas.com.au
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