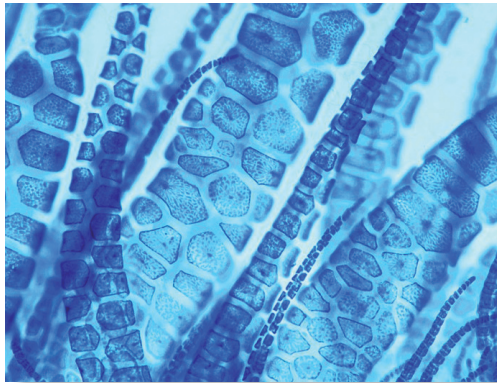


ANNUAL REPORT

Scientific Report of the Science and Public Programs Branch 2004–2005



Inspiring the appreciation and conservation of plants
through exciting, innovative and relevant research



Botanic Gardens Trust
SYDNEY

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Cover photos: (top) *Hernandia bivalves* Photograph by Lotte von-Richter, (centre) *Asparagopsis armata* Harvey (Bonnemaisoniales, Rhodophyta) Material stained with aniline blue and captured using the photomicroscope - Nick Yee, (bottom) *Georgeantha hexandra* Photomicrograph by Carolyn Porter

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Highlights of the Year

- Incorporation of Trust's school and community education programs and science program into new branch, Science and Public Programs, to enhance the Trust's research and education initiatives.
- Fifth year of Australia's Virtual Herbarium (Stage 1), a five-year \$10 million national project to database and make available on the Internet specimen information from all major State and Territory herbaria. During this period over 340,000 specimens have been data-processed here, including nearly all specimens from New South Wales. This enhances distribution details for the *NSW Flora Online* and is an invaluable information source for our stakeholders.
- Publication of 'Herbarium' by Robyn Stacey and Ashley Hay and published by Cambridge University Press featuring over 100 specimens from the Herbarium of New South Wales collections. This handsome book proved to be an effective avenue to inform the community about the science related to the Herbarium through aesthetic illustrations and interesting dialogue.
- 2004-5 saw the culmination of much work by CHR staff involved with the Wollemi Pine. Preparations for the commercial launch in late 2005 have required a large input of scientific expertise to the planning and publicity, and to using the resurgent levels of public interest as a springboard for new scientific collaborations and educational opportunities, especially on conservation themes. Several CHR staff continued their involvement with the Wollemi Pine Species Recovery Team, and good progress was made on several long-term Wollemi Pine research projects, and on a new iteration of the Species Recovery Plan.

- The year saw the submission for publication of the first section – for the Western Plains – of the NSW Native Vegetation Classification and Assessment project. This comprehensive review of the ecological vegetation communities recognised across the State is a major contribution to a systematic understanding of our native vegetation, and will become a standard reference for conservation planning in this State.
- Co-supervision of 57 students from 14 universities including 18 students based fulltime at the Trust, and a continuing commitment to tertiary teaching at several universities, including the University of New England Biosystematics Course.
- Grant and enhancement funding of \$1.2 million (including Australia's Virtual Herbarium \$400,000) to the Trust for 31 projects.
- Maintenance of diverse and high quality research programs, with 63 publications for scientific audiences.
- Launch of *FloraOnline*, the electronic version of the “Flora of New South Wales”.
- Publication of 23 taxonomic papers in *Telopea* volumes 10(3) and 10(4) and continued growth in the number of manuscripts submitted to *Cunninghamia*.
- The year saw the publication of the tenth and last instalment of the Ecology of Sydney Plant Species project, a ten-year compilation of the state of ecological knowledge for 3,550 species (2626 of them native).
- Successful series of exhibitions in the Red Box Gallery, with exhibitions on botanical art and the Margaret Flockton Prize in botanical illustration.
- Recognition and celebration of our role in biodiversity research through the sponsorship of our fourth Eureka Prize (awarded to Great Barrier Reef Marine Park Authority).
- Continued growth in the requests for information from the Botanical Information Service and the Plant Disease Diagnostic Unit.

Part 1: Introduction

The BGT Science Annual Report is structured around the *Three Year Vision for Plant Sciences Branch (2000–2003)*, prepared in response to the 1999 review of Plant

Sciences. The Branch was reviewed again in March 2004. The following introductory material is taken from the Vision document.

Our Environment

The Science Program of the Royal Botanic Gardens and Domain Trust is:

- Obligated first and foremost to the Trust through the relevant Acts and corporate planning.
- Funded primarily by the State Government of NSW and its programs must contribute to that government's policies and goals.
- Obligated under all treaties and strategies to which the State and Federal governments are signatories (e.g. NSW Biodiversity Strategy, National Strategy for the Conservation of Australia's Biological Diversity, Convention for Biological Diversity).
- The oldest and one of the most highly respected scientific units in Australia. (Science in Australia began at the Trust and has always been a strong focus for the discovery, documentation and study of Australian plants).
- Recognised and valued internationally, nationally and within the State for its science programs (with different programs relevant at different levels).
- A critical component for the Trust is to remain one of the worlds leading botanic gardens.
- Accepted as a leading organisation in the conservation and management of NSW's plant biodiversity.

- Part of a national and international collection of herbaria and botanic gardens (and other organisations) contributing to the understanding, appreciation and conservation of Australia's flora.

Vision for Science at the Botanic Gardens Trust

The Botanic Gardens Trust will have exciting, innovative and relevant scientific research programs. It will be recognised throughout New South Wales, Australia and the world as making a major contribution to the discovery and conservation of biodiversity. It will work with the horticultural industry and botanic gardens in plant development and disease diagnosis. Research results and biodiversity data will be communicated using the best available means. The Trust will work in partnership with government agencies, universities, botanic gardens and herbaria to achieve these aims.

All scientific programs will be widely recognised within New South Wales as important and appropriate, with no reduction in the Gardens' international reputation for high quality, progressive science.

Objectives for Science at the Botanic Gardens Trust

- To undertake original research on the plants of New South Wales and neighbouring areas.
- To effectively disseminate the results of research through publications, products and services.
- To play a leading role in the conservation of biodiversity in New South Wales and neighbouring areas.
- To be the primary source of plant diversity information in New South Wales.
- To lead and contribute to the understanding and appreciation of plant diversity.

- To assist in the sustainable management of the botanic gardens and the horticultural industry.
- To contribute to the development of State, national and international policies and legislation.

Priority-setting Criteria

All new programs and projects must be evaluated against the following criteria. Some criteria are deliberately open to interpretation and should be used as a starting point for discussion about a particular program/project. The geographical focus for any program will usually be New South Wales or 'neighbouring' region (in a scientific, geographic or economic-political sense).

The program or project should:

1. Be consistent with the implicit and explicit directions and policies of the State Government of New South Wales
2. Be of scientific merit: i.e. methodologically sound and scientific in approach.
The research should 'change the way we do or think about things'
3. Contribute to a sense of wonder and excitement about plants and their biology
4. Be innovative and/or use the best available methodology
5. Result in better conservation and management of biodiversity
6. Provide a service or knowledge not readily available elsewhere (may be part of a coordinated interagency program)
7. Make best use of our resources, including people, facilities, and preserved and living collections
8. Contribute to, complement, or initiate other programs in the Trust
9. Effectively communicate outcomes to the appropriate audience
10. Raise or maintain the profile of the Trust

12. Preferably attract external funding or result in income to the Trust
13. If consistent with the above criteria, be targeted to meet the greatest needs of the identified stakeholders.

Science Promotion

The Trust's sciences program continued to receive excellent media coverage and staff publicised their work in print, radio and television wherever the opportunities arose.

Dr Tim Entwisle presented a fortnightly item on 702 ABC radio, and maintained his regular contributions to *Nature Australia* and *The Gardens*. Other publications and presentations for general audiences are included in the detailed reports for each section, and in the reference list at the end.

Botanic Gardens Trust Eureka Prize for Biodiversity Research

The Trust's Eureka Prize is awarded to 'an individual, team or organisation for innovative scientific research that makes an outstanding contribution to the conservation of Australia's biodiversity'. The annual Eureka Prize Award ceremony was held in August, in Sydney. Over 700 scientists, science journalists, politicians and 'celebrities' were present when Director Tim Entwisle presented our fourth Eureka Prize to the Great Barrier Reef Marine Park Authority for its Representative Areas Research Program. This made extensive and exhaustive use of data from all available research on the Great Barrier to classify key reef and non-reef bioregions. The research highlighted the inadequacy of the existing reserve network to protect the biological diversity of the reef into the future. The Authority's response was to create zones or bioregions based on scientific, conservation and socio-economic demands. These zones are representative examples of the entire range of marine

habitats. This re-zoning recognized 70 new bioregions and increased 'no-take' zones from 4.6 per cent to 33 per cent of the Reef. Runners up were David Jones, Research Scientist with the CSIRO Centre for Plant Biodiversity Research, nominated for his work on the systematics of Australian orchids, palms, ferns and cycads and Professor Byron Lamont, Curtin University of Technology, for his study of the ecology and conservation of southwest Australian flora over more than 30 years.

Teaching

The number of students supervised continues to increase – 57 compared with 55 last year. Staff also delivered guest lectures at various universities, sometimes presenting blocks of key lectures (e.g. Dr Brett Summerell and Dr Alan Millar at The University of Sydney, and Dr Tim Entwisle at The University of Technology Sydney). Dr Maurizio Rossetto has continued his involvement in the Biological Conservation course at the School of Rural Sciences and Natural Resources (University of New England), coordinated by Associate Professor Caroline Gross. A number of our staff also have adjunct appointments at a number of universities.

Biosystematics course

The Trust continued its strong involvement in the Biosystematics units for tertiary students run in conjunction with the University of New England and the Australian Museum. It has been decided to run the course-specific subjects every second year (i.e. next time will be in 2006).

Honorary research associates

Ms Jocelyn Howell, Mr Alan Leishman and Mr Ken Hill were appointed as new Honorary Research Associates. The Honorary Research Associates continued to be major contributors to our research program and their key research achievements are included within the relevant programs below.

Scientific Committee of the Trust

The members of the committee are the chair, Professor Sue Serjeantson (Australian Academy of Science), and Associate Professor Jeremy Bruhl (University of New England), Dr Dan Faith (Australian Museum), Fleur Kreel (lawyer and writer - Paddington), Dr Jan Tarran (University of Technology, Sydney) and Dr Klaus Koop (Policy and Science Division, Department of Environment and Conservation).

The committee met three times during 2004/05, coinciding with the Trust meetings. Through the provision of general advice and feedback, and the review of scientific projects and programs, the committee continued to have an important role in the management of the Science Program.

Part 2: Conservation & Horticultural Research Section

This Section brings together the Trust's broad expertise in ecology, conservation biology, research horticulture and plant pathology, creating opportunities for multidisciplinary projects and collaboration.

The New South Wales Vegetation Theme includes the survey, mapping and classification of plant communities in the State, as well as long-term research into particular communities and the dynamics of species, populations and vegetation assemblages. It also includes publications on the vegetation of New South Wales for general audiences, and the scientific journal *Cunninghamia*.

The Horticultural Research and Development Theme encompass innovative horticultural research to assist the cultivation of Australian plants, with reference to goals of both the horticultural industry and the conservation sector.

The Fungi and Plant Theme has as its major focus plant health. The research focuses on the nature, classification and control of fungi, both disease-causing and beneficial, and in cultivated and wild situations. The Plant Disease Diagnostic Unit complements services provided by the Department of Agriculture by focussing on pests and diseases of plants in natural ecosystems and amenity horticulture. It also plays an important role in the Gardens' integrated pest management programs.

New South Wales Vegetation Theme

Aquatic vascular plants

A program of Wetland Assessments continues under Surrey Jacobs. Honours student Jo Green (Southern Cross University) completed a study of the usefulness, as environmental indicators, of wetland epiphytes. PhD student Jo Ling continued her investigation and comparison of techniques for wetland assessment using microphyte and macroinvertebrate assemblages.

Classification and status assessment of the vegetation of NSW

The year saw the submission for publication of the first section – for the Western Plains – of John Benson's *NSW Native Vegetation Classification and Assessment* project. This comprehensive review and typology of the ecological vegetation communities recognised across the State is a major contribution to a systematic understanding of our native vegetation, and will become a standard reference for conservation planning in this State.

It involves a complete review of literature and survey data, and field checking. The project mirrors similar work in the United States, Canada and Europe. A database with 89 fields has been established to store information on each listed plant community including scientific name, common name, characteristic species, distribution by various regional boundaries, physiography, estimated or measured areas for pre-European and current extents, threat codes based on IUCN criteria, reservation codes, photographs and a general description.

Senior Technical Officer Chris Allen and Project Officer Jedda Lemmon assists on the project (GIS, figures, statistics, maps, file and database structure). Separate funding was secured from the Natural Heritage Trust for extension of the NVCA project to the South-West Slopes Bioregion, and this component was brought to an advanced level during the reporting period.

Conservation committees

The Trust is represented on a number of inter-agency standing committees and *ad hoc* working groups in the conservation area. Membership on government conservation committees includes:

- NSW Scientific Committee: Doug Benson (retired from this role at end of 2004), Bob Makinson (commenced January 2005).
- NSW Fisheries Scientific Committee: Alan Millar
- NSW Biodiversity Advisory Council: Cathy Offord was appointed during the year
- NSW Cut-flower Advisory committee: Cathy Offord was appointed during the year
- Wollemi Pine Management and Recovery Committee: The Trust is represented by Patricia Meagher, Cathy Offord, John Benson, Rusty Worsman and Bob Makinson.
- North Head Sanctuary Scientific Committee: Doug Benson was appointed during the year.

- Goobarragandra Valley Reserves Trust: Bob Makinson.
- Continuing membership on non-government conservation committees includes:
- Australian Network for Plant Conservation (National Management Committee): Bob Makinson (Vice-President), Tracey Armstrong (committee member – stepped down at end of 2004).

During the year, Cathy Offord was a member of the organizing committee for the highly successful *Fifth Australian Workshop on Native Seed Biology*, held in Brisbane in June 2004.

Internationally, John Benson is a member of the IUCN (World Conservation Union) Commission on Ecosystem Management, and the Species Survival Commission Red-List Committee.

Ecology of Sydney plant species

The year saw the publication in *Cunninghamia* of the tenth and last instalment of the *Ecology of Sydney Plant Species* project. This instalment covered all the Monocotyledon families (about 600 species) including the grasses and orchids.

The project as a whole represents a ten-year compilation of the state of ecological knowledge for 3,550 plant species (2626 of them native, 924 naturalised exotics). It is intended to integrate the large data-set generated by this series with the Trust's internet information systems.

Ecological monitoring

The Gardens has contributed over the years to a number of long-term monitoring projects, providing information of importance to vegetation management and conservation. The long-term monitoring program of Cumberland Plain Woodland vegetation started in 1990 is being continued by Doug Benson and Lotte von Richter, who has replaced Jocelyn Howell. The monitoring component, based at Mount Annan Botanic Garden, includes monthly assessments of plant species abundance as they respond to seasonal changes. Conditions relating to the recruitment of seedlings are being studied both in the field and in the laboratory, and seed dispersal and longevity studies for some of the rarer groundcover species have been included. This is providing insights into plant species distributions and recruitment issues that are relevant to management of the Endangered Ecological Communities of Western Sydney.

Lotte von Richter also coordinates the Streamwatch Committee at Mount Annan Botanic Garden.

Freshwater macroalgal ecology

Lucy Nairn has almost finished writing up her PhD project on the ecology of macroalgal communities in the Southern Highlands of NSW. The project was funded as part of a large ARC grant held by co-supervisors Dr Barbara Downes, The University of Melbourne, and Dr Tim Entwisle. Lucy is investigating the influence of various environmental variables, including water temperature and depth; nutrients; riparian vegetation; flow velocity; light availability and substratum, on macroalgal communities.

Liverpool Plains native grassland survey

Chris Allen and John Benson continued a project to survey the native grasslands of the Liverpool Plains. These grasslands are listed as an endangered ecological community under the NSW Threatened Species Conservation Act and less than 3% of the community remains – most of having been ploughed for crops and improved pasture. GIS layers on soils, woody vegetation, salinity, cadastre, soils, slope and travelling stock routes have been obtained and a stratified sampling program based on soils, slope, and distribution has been developed. Six monthly sampling commenced in spring 2002 providing insights into the effects of drought and “normal” conditions on the distribution of plant species. In the meantime mapping of the current and pre-European extents of the grasslands is underway and a set of 82 permanent plots for sampling and monitoring have been placed across the remnant and derived grasslands.

Conservation genetic research

Dr Maurizio Rossetto’s studies in conservation genetics aim to fulfill two main objectives:

- to provide useful information for rare species management; and
- to better understand the evolutionary and environmental processes leading to rarity (or endemism) and identify the traits that influence species survival.

Collaborative research with Associate Professor Caroline Gross (University of New England) on clonal species shows that while extensive clonality can be an effective mechanism providing resilience to disturbance and a competitive edge towards the surrounding vegetation, it can become a limiting factor when coupled with a preferential outcrossed mating system. Populations reduced to a small number of clones become isolated, and sexual reproduction and recolonisation through

dispersal are negated. In other words, the research shows that rare clonal species are often more vulnerable than initially predicted.

Inefficient dispersal alone can negatively affect the distribution of species. Combined molecular and ecological studies by Dr Rossetto and Robert Kooyman (with the support of J. Hunter, R. Jones and C. Porter) on rare paleo-endemic rainforest trees (*Eidothea hardeniana*, *Elaeocarpus* sp 'Rocky Creek') show that the lack of efficient fruit dispersal mechanisms can be one of the main causes of rarity. These studies show that small differences in fruit morphology between common and rare species can encourage dispersal by very different vectors more or less likely to facilitate expansion when opportunities arise. Interestingly though, the DNA data suggest that some of these species are likely to have survived in low numbers within a small population for a very long time, partly because of their capacity to resprout regularly even without disturbance. In fact in a survey of 258 rainforest plants, we found that characters linked to seed dispersal and resprouting best explain the current distribution of other local rare trees.

Sometimes however, the main cause of rarity is recent evolutionary origins. For example, a DNA-based study by Dr Rossetto showed that the endangered *Acronychia littoralis* represents not one but two distinct natural hybrids, originating from locally common species (*A. imperforata* x *A. wilcoxiana* and *A. imperforata* x *A. oblongifolia*). These hybridisation events are likely to be the consequence of post-glacial climatic and environmental changes that have led to range expansions for the common species and the development of hybrid zones. The fact that evidence of introgression was identified within this species complex has important implications for management, as these taxa are often used in revegetation projects. To better understand these processes new molecular markers (microsatellites) are being developed for *A. littoralis*.

Cumberland Plain seed biology

Cumberland Plain woodland is one of a number of endangered ecological communities occurring in the Sydney region. Many of these communities are degraded and further threatened by proximity to and further expansion of urban Sydney. To achieve success, recovery plans for Cumberland Plain species need information on the seed germination, dormancy and longevity and other ecological characteristics of the species. Lotte von Richter and Doug Benson have been focussing on *in situ* seed ecology, working with students and staff collecting, germinating seeds from the conserved bushland area at Mount Annan and setting up

ongoing field experiments. More than 150 species have been studied and the results are being summarized for a series of publications.

Population and ecological genetics research

A population genetic study (ARC Linkage grant) on the consequences of habitat fragmentation on an early-successional rainforest tree (*Elaeocarpus grandis*) by Dr Maurizio Rossetto and collaborators from NPWS and Southern Cross University, found that this species is capable of rapid colonization of available habitat including a range of sites within the highly disturbed Big Scrub of north eastern NSW. Some loss of diversity occurs as a consequence of these new founder events but gene flow is sufficient to homogenize the genetic composition of this species within the region. The existence of a single provenance within NSW is important information as this species is often used as a precursor to rainforest regeneration due to its rapid growth.

A comparative genetic study currently being completed by Michael Whitehead (Honours, UNSW), shows similar genetic diversity patterns within another related common species, *Elaeocarpus reticulatus*. Although these two common species have different habitat preferences, they are both dispersed by highly vagile vertebrates. These findings support the concept that highly dispersed species can cope better with disturbance and maintain a broader distribution range than inefficiently dispersed taxa (such as *Elaeocarpus* sp 'Rocky Creek').

In order to investigate the influence of past climate change (glacial cycles), environmental barriers, habitat preference and selected life history traits Dr Maurizio Rossetto and Dr Darren Crayn, with the support of Paul Rymer, Peter Ridgeway (Honours, UNSW) and Dr G. Vendramin (IGV CNR Florence, Italy) are investigating phylogeographic patterns across two species (*Elaeocarpus grandis* and *E. largiflorens*) across their entire Australian distribution. These species were selected because they have different ranges and because morphological or ecological differences can be found across their distribution. This study (Hermon Slade Foundation grant) will serve as a precursor to further collaborative studies with Dr Andrew Lowe (University of Queensland) investigating the genetic structure across the Black Mountain Gap (a potential geographical barrier to post-glacial rainforest expansion) across 29 rainforest trees.

In order to obtain more information from existing measures of genetic diversity, it is important to use approaches based on molecular, ecological and pathogenic techniques to assess the correlation between inbreeding and fitness. The development of novel approaches is particularly relevant to the study of short and

long-term evolutionary potential in species for which it can be difficult to evaluate conventional measures of fitness (such as woody trees and shrubs for example). Preliminary investigations using *Telopea speciosissima* (the NSW waratah) and pathogens highly amenable to this type of experimentation (*Phytophthora cinnamomi* and *Phyllosticta telopeae*) have been initiated.

Sydney Region vegetation studies

Ecologist Doug Benson continued a series of observational studies on vegetation dynamics at various sites in the Sydney Basin Bioregion. These include wetland communities on the Hawkesbury-Nepean floodplain and associated riparian vegetation. Another site focussed on recently is Kurnell Dune Forest at Kurnell, where there are issues with naturalised Tallowood trees invading native sclerophyll woodland and heath. Kurnell has particular scientific and historical significance as the site of the first plant collections on the east coast of Australia by Banks and Solander in 1770, and a detailed description of the original vegetation of the Landing Site is being prepared, to assist management and interpretation.

Wollemi Pine ecological studies

John Benson is preparing papers on the field ecology of the Wollemi Pine, covering correlated flora, stem growth and regeneration dynamics, and seedling recruitment (the last two topics in collaboration with Tony Auld of DEC).

Horticultural Research and Development Theme

Horticultural improvement of waratahs

The Waratah (*Telopea speciosissima*, family Proteaceae) is grown as a cut flower crop, and has been a research focus at Mount Annan for some years. Current work is aimed at improving flower quality, especially the browning of the floral bracts prior to harvest. The physiological cause of bract browning in waratahs has been investigated in detail by Amelia Martyn, whose PhD thesis was accepted during the year.

Experiments conducted at Mount Annan Botanic Garden and with commercial growers found that a high intensity of light leads to chronic photoinhibition, pigment destruction and the development of brown and necrotic areas on bracts. Bract browning was reduced and flower quality increased by growing waratahs under 50% shade cloth. This method of reducing browning is being implemented by commercial growers in new and existing plantations. The results of the study were presented at the 7th Australian Wildflower Conference in Brisbane in May this year, gaining the RIRDC Best Paper Award.

A paper by Cathy Offord on the analysis of characters and germplasm of significance to improvement of Australian native waratahs for cut flower production was accepted for publication in *Genetic Resources and Crop Evolution*.

Flannel flower development

A new project commenced, funded by the Rural Industries Research and Development Corporation, that aims to improve the cultivation of Flannel flower (*Actinotus helianthi*, Apiaceae). It continues from previous research lead by Cathy Offord and Lotte von Richter that established the potential of this species as a cut flower, garden and pot plant, and now focuses on the development of intensive cultivation and breeding of vigorous, disease resistant, high yielding varieties. The work is in collaboration with NSW Agriculture and contributing cut flower growers. A book chapter on horticulture of Flannel flower was published in the 'New Crop Industries Handbook'. Papers on fertiliser requirement and seed dormancy of Flannel flower have been submitted for publication.

Seed biology

SeedQuest NSW is a collaborative project between the NSW Seedbank, Horticultural Research at Mount Annan Botanic Garden and the Millennium Seedbank of the Royal Botanic Gardens, Kew (UK). The project is part of a global conservation effort that aims to have 10% of the world's flora held as conservation seed collections by

2010. Through the SeedQuest project, which commenced in late 2003, funding has been provided for a seed science program to investigate NSW plant groups of importance for conservation and horticulture as well as an extensive state-wide field collecting program over three years.

The research aims to improve the quality of seed collections to ensure optimal long term storage; determine the best methods to germinate seed by mimicking environmental cues experienced by seed in the field, including breaking dormancy in some species; and estimate how long seeds are likely to survive in storage and in the field.

The Seedquest NSW research team works closely with scientists at the Millennium Seed Bank in the UK. Seed Research Officer Amelia Martyn developed a plan for collaborative research as part of the SeedQuest NSW program during her visit to the UK in January 2005. Collaborative projects have also been developed with Australian partners of the Millennium Seed Bank Project including Kings Park and Botanic Gardens in Western Australia, the South Australian Seed Conservation Centre and Griffith University in Queensland.

Research by Lotte von Richter on the germination of Cumberland Plain Endangered Ecological Community species continues and a number of publications are in planned.

Several staff attended the International seed Science Society Conference held in Brisbane in April 2005. Cathy Offord made a presentation on the germination and storage of wollemi pine seeds and the implication for conservation. CHR staff were also involved in the organisation and presentation of a five day seed conservation workshop held at Mount Annan as well as organising a two day workshop on seed dormancy presented by Professors Carol and Jerry Baskin of the University of Kentucky.

Orchid research

A three year project commenced which examines the storage, germination and growth of seeds of NSW orchid species and is funded by the Hermon Slade Foundation and University of Western Sydney small project grant. The study is in collaboration with Dr Chris Wood, Millennium Seedbank, RBG Kew and Elizabeth Darley at the University of Western Sydney.

The successful storage of orchid seed is dependant on the ability to test viability of seed and/or regrow that seed at a later point in time. Therefore the ability to properly test seed viability is critical to orchid seed storage. In addition the detection, isolation and storage of specific strains of mycorrhizae is imperative for a successful orchid

storage program. John Siemon has made collections of seed, tubers and soil samples containing mycorrhizal symbionts from several orchid species. Four different methods have been examined to germinate several of these species, including fungal baiting, asymbiotic germination, fungal isolation and inoculation of seed, scattering seed on potting mix surface of ex situ plants. The germinability of seed provides an indication on the reliability of the viability assessment. Recently the endangered *Pterostylis saxicola* was successfully germinated using the fungal baiting and asymbiotic germination methods. Current studies are examining techniques to assess and improve effectiveness of seed viability assessments. Improved techniques will ensure optimum use of seed stocks especially when supply is limited or rare and threatened species are involved.

Wollemi pine research

Patricia Meagher commenced the coordination of the writing of the second draft of the Wollemi pine Recovery Plan, which is due for public comment later in 2005. She has also been involved with the organisation of the launch of the Wollemi pine commercialisation program, commencing with a charity auction and display in October 2005. Focus of this effort is to publicise research findings on the horticulture and conservation of the Wollemi pine so that this information is available for home gardeners and anyone else who wants to grow a Wollemi pine. Work on the biology of the Wollemi pine will continue for some years and will in part be funded through royalties from worldwide plant sales. Currently, publications are being prepared with Cathy Offord and other collaborators on seed storage, the effects of light and soil pH on growth, embryology and anatomical features of the branches of this species.

Volunteer programs

A new volunteer program commenced in Horticultural Research at Mount Annan Botanic Garden in early 2005. Several small teams are assisting with tissue culture of a variety of species, as well as two other volunteers involved in archiving.

Fungi and Plants Theme

Fungi causing leaf-spot diseases of the Proteaceae

Work continued on a major study documenting and describing the species of fungi causing leaf spot diseases on plants in the family Proteaceae in collaboration with Professor Pedro Crous, of the Centraalbureau voor Schimmelcultures, The Netherlands. A number of new species of fungi have been identified and documented during this project including several on economically important species of Proteaceae grown for cut flower production.

PhD student Sophie Peterson continued studies on the biology of *Phyllosticta telopeae*, a fungus that causes a leaf spot of the waratah. Sophie is investigating the population genetics of this fungus in natural and cultivated ecosystems using several different molecular markers. Sophie has also confirmed that another species of *Phyllosticta*, *P. capitata*, is capable of inhabiting the leaf spots caused by *P. telopeae*, complicating diagnosis of the disease.

Fusarium

Professor John Leslie, Kansas State University, and Dr Brett Summerell completed a major new book "The Fusarium Laboratory Manual" for publication by Blackwells Scientific Press. Brett Summerell also taught at workshops on *Fusarium* identification at the University of Pretoria, South Africa, Kasetsart University, Thailand and at Kansas State University, USA with over a 100 participants from all parts of the world trained in identifying all of the major *Fusarium* species that are important in agriculture and horticulture. Brett Summerell also provided advice to a number of land managers following an outbreak of Fusarium Wilt of Canary Island Date palms in Melbourne. A number of new species of *Fusarium* were described during the year and descriptions are currently being finalized for formal publication.

Phytophthora root rot in New South Wales national parks

Phytophthora cinnamomi causes root rot and dieback in several National Parks throughout New South Wales as well as important bushland reserves in Sydney Harbour foreshores. In collaboration with Dr Keith McDougall, DEC and Professor David Guest, University of Sydney our research has focused on the identification of the presence of the pathogen in several national parks where it is causing significant damage to certain ecosystems with potential detrimental effects to several threatened plant and animal species. Detailed studies of the impact of the pathogen

were conducted at Barrington Tops National Park, Werrikimbee National Park, Royal National Park and Beecroft Peninsula Reserve. PhD student Ratiya Pongpisutta completed her studies on the extent of morphological, genetic and pathogenic variation in the organism within New South Wales while PhD student Chris Howard continued studies using microsatellite markers to assess genetic variability within populations of *P. cinnamomi* as a tool to explore the epidemiology and distribution of the pathogen within National Parks. One of the major findings of their work was the recognition that in a number of locations, especially around Sydney, both mating types of the pathogen occurs. This has major implications for the future control of the pathogen as the likelihood of the pathogen evolving is much greater.

Root rot of hydroponic lettuce

PhD student Khalaf Al Hussaen, co-supervised by Dr Jane Tarran, University of Technology Sydney and Brett Summerell, is examining the causes of root rot of lettuce in hydroponic production systems in New South Wales. Khalaf has shown that *Pythium* and *Phytophthora* species are associated with this disease and that the symptoms of the disease are dependent on temperature with the disease more severe when temperatures are above 30°C.

Fungal diseases in Sulawesi, Indonesia

The Australian Centre for International Agricultural Research (ACIAR) provided an extra year of funding to the Trust and the University of Sydney to research diseases affecting cloves and vanilla in North Sulawesi Indonesia. The funding has supported the establishment of a laboratory at Sam Ratulangi University at Manado, Sulawesi that will provide diagnostic capabilities for the region. A new species of *Ceratocystis* has been recovered from cloves (which is a species of *Syzygium*) and has been demonstrated to cause a dieback disease in cloves and was formally described and several species of *Fusarium* have been shown to cause a stem rot disease in Vanilla. Both diseases have a significant impact on the economic stability of the region.

Communication and Services

***Cunninghamia*: a journal of plant ecology for eastern Australia**

Cunninghamia is the flagship scientific publication for the ecology program at the Botanic Gardens Trust. It publishes high quality science of relevance to land and water managers, environmental scientists, consultants, revegetation groups, and other members of the general community. All papers are peer-reviewed. Papers are contributed by our own research staff, universities, staff from other divisions of the Department of Environment and Conservation, other government agencies, and private researchers.

Each issue contains a diverse range of papers, from large vegetation surveys to detailed accounts of rare species and communities. Highlights of issues 3 and 4 of volume 8 include:

- Recovery of treeless vegetation in Kosciuszko National Park after the 2003 fires,
- Floristic patterns along a gradient in grassy box woodlands
- Habit, distribution and phytogeographical affinities on mosses in the Wet Tropics bioregion
- Fire response studies for shrubs in grassy woodlands of New England
- Native riparian vegetation in Tasmania
- Studies on endangered species including population decline in the shrub *Pultenaea glabra* (*Fabaceae*), the preferred habitat for the orchid *Cryptostylis hunteriana* (*Orchidaceae*) and distribution of the vulnerable tree *Angophora inopina* (*Myrtaceae*)
- Vegetation surveys of Montague Island, Werakata (Lower Hunter) National Park, and Basket Swamp National Park, New South Wales; and coastal rainforest of Shoalwater Bay, and woodland communities of the Dawson River Plains, Queensland.
- Conservation issues for the flora of Lord Howe Island

Plant disease diagnosis

The Plant Disease Diagnostic unit, as part of the Plant Pathology section, offers a commercial service for the detection, diagnosis and control of plant diseases. It is used by both external clients and the sites of the Botanic Gardens Trust, to promote plant health and appropriate horticultural practices and to minimise pathogen spread through environmentally safe treatments.

This year, in spite of the loss of 1½ staff positions through voluntary redundancies and internal transfers, the remaining two half-time staff, with invaluable assistance from the three graduate students in Plant Pathology, managed to process only six fewer samples (253) from the previous year. 208 of these were from external clients (a very slight decrease from the previous year) and 45 were from within the Trust. The majority of enquiries (45%) came from commercial consultancy companies (soil-testing laboratories, arborists and horticultural advisors). Private gardeners in the Sydney region were the next most frequent users of the Service (24%), while other Government Departments and Local Councils made up 13% of enquiries. The latter however, tended to be large surveys requiring a greater percentage of time and effort. The remaining 18% were internal BGT enquiries.

The majority (58%) of enquiries from external clients and BGT staff involved testing soils for soil-borne fungal pathogens, particularly *Phytophthora cinnamomi*, the cause of die-back disease. 21 large-scale surveys to identify the presence of *P. cinnamomi* were carried out for a number of National Parks in NSW and local Councils in the Sydney region. As public awareness of the problems caused by this pathogen increases, and the need for its management becomes more important, it is necessary to map its occurrence and distribution. Our Unit is now recognised as the leading laboratory in Sydney capable of performing such surveys.

The Unit is now also recognised as a centre for the identification of *Armillaria* (20% of enquiries), a serious fungal pathogen of many woody plant species. This disease can be detected with a molecular assay, providing an invaluable method of identification in the absence of fruiting bodies. The spread of this disease through Sydney, including Hyde Park, has been mapped largely using our services. Unfortunately this year, for the first time, *Armillaria* was detected in one of the *Ficus hillii* in the Domain.

Testing for Fusarium Wilt disease of the Canary Island Date Palm, caused by *Fusarium oxysporum* f.sp. *canariensis* is now an essential prerequisite before the transplanting of any of these palms. We have continued to receive samples for testing using our specific molecular assay, from clients as far away as South Australia.

A major survey was carried out this year for a client supplying 80 mature *Ficus hillii* to Disneyworld in Hong Kong. All the trees had to be cleared of any disease, including soil-borne fungi, nematodes and insect pests, before being shipped. Such large scale, general survey work is indicative of the recognition our Unit is now receiving.

Centre for Plant Conservation

The Centre has continued to provide a significant point of linkage between the Trust's activities and external clients (comprising other sections of DEC, other State and federal Departments, a range of non-governmental organisations, and a wider community constituency interested in plant conservation issues).

Close involvement has been maintained with the Australian Network for Plant Conservation (ANPC) Inc., a national organisation of plant conservation scientists and practitioners from government, industry, and community sectors. Two Trust staff – CPC Coordinator Bob Makinson, and (to Dec. 2004) Tracey Armstrong from Mount Annan Botanic Garden – are members in individual capacity of the ANPC national committee.

Mr Makinson and Dr Maurizio Rossetto have been involved as presenters in a continuing series of regional courses based on the ANPC's *Guidelines for the Translocation of Threatened Plants in Australia*, a national standard in threatened species management.

The Centre also facilitated public and members' seminars held by the Australian Association of Bush Regenerators.

Conservation Information Systems

Progress in the digital capture of scientific data, and in the development of our database structures and tools, is leading to an increasing focus on conservation-related information systems. These include records of historic and current mapping of vegetation cover, species distributions, survey records, living collections, habitat physical and biological features and Geographical Information Systems (GIS). GIS includes any electronic data and data layers that have a spatial component. Whilst many consider a GIS to be a specialised area for ecologists, mathematicians and IT specialists, it forms integral part of conservation management and also of many taxonomic studies, field surveys, and the maintenance of living collections of conservation significance. Increasingly our information outputs in the taxonomic and specimen records areas must be informed by and compatible with GIS tools (e.g. *the Australia's Virtual Herbarium* project).

We currently maintain data on location of origin of plant voucher specimens, plants identified in surveys and plants kept as living specimens in the BGT gardens. However, we also display and analyse this data in relation to other species to help describe taxonomic distributions and characterise ecological communities. We further use this data in conjunction with abiotic data like rainfall, temperature, soil type, rock

type, topography, salinity, fire history, etc. to detect correlations and information gaps.

Whilst we produce much of our own data, we also source much (e.g. legal boundary, survey, other state and abiotic data) from other agencies and NGOs, to enhance the variables available to us, for analyses and the production of maps and figures for publication and on the web. The capture, cataloguing and use of plant images is another on-going task.

This data is constantly changing and is currently being exchanged, sourced, maintained and updated by Chris Allen. Many new data layers are becoming available and can make decision-making less arbitrary. For example electronic copies of aerial photography of the Trust's estate, accurate to 15cm, will allow horticultural staff to plan beds and know exactly where specific plants or infrastructure can be found. Combined with new differential Geographical Positioning Systems (GPS), a staff member could walk directly to a specific plant and look up its history on the spot.

There are and will be many new sets of data for us to obtain, and to integrate with our own systems. Demand for integrated products is also rising rapidly. Key factors affecting this demand include:

- the rapid evolution of the State's departmental arrangements for Natural Resource Management
- the implementation of new catchment management plans
- changes to the Threatened Species Act
- the loss of vegetation mapping in NSW

The Trust frequently exchanges data with other work-units within the DEC, other State agencies, and with some NGOs. Data exchange requires ongoing discussions on custodianship protocols, and the necessary data formats to enable efficient and safe transfers, storage and archiving of data. We now have enhanced GIS software and new printing capabilities, to streamline analysis and production of outputs in more timely and economic ways.

Part 3: Plant Diversity Section

This Section includes research on the diversity, classification and relationships of plants, and the management and application of our botanical collections and the data associated with these collections. The custodianship of collections in the National Herbarium of New South Wales and the provision of systematics research and information are two core legislative drivers for the Trust. Three key research themes have been established, and ready access to data has been identified as the major communication objective.

The **Flora of Australia Theme** focuses on discovering and documenting the plants and related biota in Australia. Plant systematists throughout Australia and overseas, work together to document our flora. The Trust is part of this collaborative effort, with a long-standing expertise in flowering plant groups such as eucalypts, grasses, sedges and wattles, but also a wide range of expertise in other important groups that are well represented in New South Wales.

The **Origins and Evolution Theme** focuses on the study of plant relationships, as part of international efforts to unravel the history of Australia's biota. Fossils give us tantalising glimpses of the past but the full story of plant evolution is contained within the morphology and genes of current day species. We are focusing our research on key questions in the history of Australia, before and after the splitting of Gondwana over 80 million years ago.

The **Asia-Pacific Biodiversity Initiative** is a theme that builds on the Trust's long-term contribution to the discovery and documentation of plants in our local region outside Australia. As part of our national responsibilities under the Convention for Biological Diversity, we are assisting neighbouring countries to gain the knowledge to manage and conserve their vegetation. Sydney, as Australia's 'gateway to the Pacific', has always looked outward to the Asia-Pacific region. Many countries in this region have been identified as lacking the most fundamental biodiversity information. The Trust is one of the region's chief providers of the expertise and experience needed to address this gap. The emphasis is on training, knowledge exchange and collaborative projects with the host countries.

The **National Herbarium of New South Wales** holds the State of New South Wales' reference collection of about one million preserved plant specimens. The herbarium collection represents a comprehensive and accurate biodiversity record through time (as the flora changes) and space (representing the variation and distribution of species). The maintenance and use of this vital scientific heritage requires expert

scientific and technical curation skills. A key objective over the next few years is to unlock the rich store of information in the herbarium through data processing the collection information as part of the National "Australia's Virtual Herbarium" project.

The Plant Diversity Section also provides a Botanical Information Service. This Service now includes electronic delivery of information, through the internet site *PlantNET*, as well as a plant identification service and self-help reference collection. The scientific journal *Telopea* is published by the Plant Diversity Section.

Flora of Australia Theme

Aquatic Plants

Dr Surrey Jacobs continued studies on aquatic plants with papers published on DNA sequences in *Aponogeton* and *Zostera*, and further studies on *Nymphaea* and *Vallisneria*. As a result of the studies on *Zostera* and *Aponogeton*, new combinations are being made for species in the former genus and new species described in the latter.

Bryophytes

Dr Elizabeth Brown and Matt Renner attended a bryophyte workshop in Paluma, Queensland as part of an Australasian Bryological Society meeting. Fieldwork was undertaken in New South Wales, Queensland and Papua New Guinea by Dr Brown to collect specimens of Lepidoziaceae. Work is continuing on phylogenetic analyses of the Lepidoziaceae (Hepaticae), based on chloroplast and ribosomal DNA data. These are being compared with morphological data to provide new insights into the relationships and evolution of this group in Australia, New Zealand, New Caledonia and Papua-New Guinea. Margaret Heslewood is assisting with this research, which is partially funded by the Hermon Slade Foundation.

Matt Renner, a PhD student at Sydney University, is using the Lejeuneaceae to investigate questions on ecological aspects of speciation as well as looking at their phylogeny. He gave a presentation on his work at the Paluma workshop.

Honorary Research Associate Dr Helen Ramsay, in collaboration with J.R. Spence (Glen Canyon Nature Reserve, Page, USA) and A.J. Shaw (Duke University, Durham USA), completed work on the Bryaceae for Flora of Australia. Dr Ramsay also completed her revision of the Sematophyllaceae in collaboration with B.C. Tan (Singapore University) and W.B. Schofield (University of British Columbia). In addition studies on the diversity of mosses in North east Queensland have been

published in *Cunninghamia* with Andi Cairns (James Cook University). Dr Ramsay has also been finalising work on several papers, which will complete her chromosome studies of Australian, New Zealand and Papua New Guinea mosses.

Cyperaceae

Karen Wilson continued studies of various genera in the family Cyperaceae, largely in collaboration with Dr Jeremy Bruhl (University of New England) and students whom they jointly supervise. The morphology and anatomy of the large widespread genus *Fimbristylis* and its allies continues to be studied by PhD student Ms Kerri Clarke. Dr Kioumars Ghamkar received his PhD for his study of the phylogenetic relationships of this group based on molecular data. Papers summarizing research into the phylogeny of the Abilgaardieae and photosynthetic pathways in the family have been accepted for publication in the proceedings volume of the 'Monocot 3' Conference in California (USA).

Elaeocarpaceae/Tremandraceae

Current research by Drs Darren Crayn and Maurizio Rossetto has resolved a molecular phylogeny of all extant genera in Elaeocarpaceae and Tremandraceae. This phylogeny indicates that the Australian endemic family Tremandraceae, which consists of small, dry-adapted shrubs, has its ancestry within Elaeocarpaceae, a much more widespread family dominated by rainforest trees. More precisely, Tremandraceae is the sister group of a lineage comprising *Elaeocarpus*, *Aceratium* and *Sericolea*. Currently, two students (David Maynard, UNSW and Hannah McPherson, UNE) are working on detailed phylogenies of *Elaeocarpus* and *Tetratheca*, genera which are species rich in Australia and which represent opposite ends of the spectra of ecological preference and vegetative morphology found in this group. A *Flora of Australia* treatment of *Tetratheca*, *Tremandra* and *Platytheca* is a planned output of this study.

Ericaceae: Styphelioideae

In collaboration with Honorary Research Associate Dr Chris Quinn, Margaret Heslewood and Dr Darren Crayn, Dr Elizabeth Brown has continued revision of the systematics of subfamily Styphelioideae. A molecular analysis of the tribe Styphelieae has been submitted for publication. This reveals that many of the current generic concepts are at variance with the molecular estimate of relationships. They are now conducting combined molecular and morphological analyses of groups

identified within the tribe in order to establish morphologically defined genera that receive molecular support. Current work deals with the *Cyathodes* group.

Darren Crayn and Mike Hislop (Western Australian Herbarium) have submitted a paper describing two new species in the endemic Australian genus *Lissanthe*. Results of a morphometric analysis of variation in *Leucopogon lanceolatus*, undertaken by 2003 Janet Cosh studentship recipient Bryony Horton and supervised by Drs Crayn and Brown, are currently being prepared for publication.

Fabaceae

Indigofera: Dr Peter Wilson continued work on the genus *Indigofera*. Studies in the *Indigofera pratensis* species complex with Dr Aniuska Kazandjian, formerly a PhD student at James Cook University, Townsville, continued and a paper clarifying the position of two varietal taxa is in press in *Telopea*. Dr Kazandjian is continuing to write up the remaining part of her thesis research.

Dr Phillip Kodela updated the web information site *WattleWeb* (part of *PlantNET*), a guide to acacias of New South Wales. The site includes interesting facts and figures, ecology and gardening with wattles, as well as links to largely revised *Flora of NSW Online* treatments of *Acacia* species.

Freshwater Algae

Dr Tim Entwisle, Dr Morgan Vis (Ohio University, USA) and colleagues submitted a paper on a species of freshwater red algae from Australia and French Guiana that turned out to be the alternate life phase of *Batrachospermum*, but not the same species in both regions. Work also progressed on a world phylogeny of the Batrachospermales, with a focus on southern hemisphere biogeography.

Dr Stephen Skinner and Dr Entwisle continued their revision of the filamentous green algal genus *Oedogonium* in Australia, funded (half-time) by Australian Biological Resources Study. This three-year project commenced in January 2001, and has now been extended for a further eighteen months to include the remaining genera in the family Oedogoniaceae (i.e. *Bulbochaete* and *Oedocladium*). For *Bulbochaete* there are 4–5 distinctive local species and a number of local varieties and curiously our flora shows clear floristic links to those known for China and the subcontinent. The revision has now been completed and is about to be submitted for publication.

Commencing in July 2004, Dr Skinner, funded (half-time) by Australian Biological Resources Study, and Dr Entwisle are preparing a guide on the non-planktonic freshwater (and soil) Cyanobacteria in Australia. Intended as a aid to initial

identification to the genus, as well as a record of common species, this work will complement the already available guides to coccoid and filamentous planktonic freshwater Cyanobacteria prepared by Dr Baker at SAWater, Dr Fabbro at Central Queensland University, and Dr McGregor at Queensland government Aquatic Ecosystems Health Unit. It is hoped also to be able to produce some floristic reviews of families and genera as part of this work.

Dr Skinner and Dr Entwisle have also obtained funding from the Herman Slade Foundation to complete a survey of the macroalgae of the Border Rivers/Gwydir Catchment Area with a view to presenting a catalogue of these organisms for the catchment with its interesting upland water systems and the wetlands of the inland deltas that feed the Barwon and eventually Darling River.

In conjunction with Dr Simon Townsend and his team at the Northern Territory government Water Monitoring Unit, Dr Skinner and Dr Entwisle have compiled species lists of macroalgae in the Darwin and Daly River catchments. A paper on the Zygnemataceae of these catchments, including *Mougeotia* (6 species), *Spirogyra* (7 species) and *Zygnema* (at least 4 species) is in preparation and will complement recent work in this family by Mr Lewis and Dr Entwisle.

Dr Skinner and Dr Entwisle have revised the records of freshwater Cladophoraceae for Australia, demonstrating the presence and distribution of *Rhizoclonium* (1 species), *Pithophora* (1 species, new local variety), *Cladophora* (5 species) and a freshwater variety of *Wittrockiella* from Lord Howe Island.

Lamiaceae

During this period Nikola Streiber received her PhD for studies on the Lamiaceae conducted at the Trust. She and her supervisors (Drs Barry Conn, Elizabeth Brown and Murray Henwood (University of Sydney) continued to write up their research into the phylogeny of the Australian endemic tribe Chloantheae.

Lichens

Dr Alan Archer, Honorary Research Associate has continued his research into the Australian Graphidaceae while his research on the Solomon Islands Graphidaceae has been submitted for publication.

Marine Algae

Dr Alan Millar successfully arranged to have 1,000 algal specimens, discovered in the holdings of the Mitchell Library (SLNSW), transferred to the National Herbarium for semi-permanent storage. Through the volunteer efforts of Julie Taylor, and a Cosh Bequest grant, the entire collection has now been mounted and databased. Dr Millar has also updated the identifications of all 1,000 specimens.

Dr Alan Millar and Dr George Wilson (Australian Museum) continued their collaborative study of marine algae and their associated invertebrates. This project, partially funded by the Hermon Slade Foundation, is showing that while host specificity may not be as high as predicted, the number of different invertebrate species inhabiting a given plant can be as high as 85. Such species are hoped be useful as surrogates for predicting biodiversity hot spots along the coastal regions.

Dr Millar's survey of the marine algae of New Caledonia in collaboration with Professor Claude Payri from the University of French Polynesia (sponsored by the French Government) has moved into stage two. Type specimens collected by French naturalists and sent to Europe for description, have all been examined in the light of this New Caledonian research. Of the 66 types now housed in the National Herbarium Netherlands (Leiden), 10 have required new combinations and many have been shown to be valid names for recently described species.

Mr Nick Yee's research on the molecular phylogeny of the brown algal order, Sporochnales (supervised by Dr Millar), has been converted to a PhD. Mrs Yola Metti, formerly from the University of British Columbia, Vancouver, Canada, has begun an MSc with Dr Millar, on the molecular phylogeny of the red algal genus *Laurencia*.

The new green algal species *Struvea thoracica* has been described in collaboration with Dr Gerald Kraft (University of Melbourne), and 23 new records for the State of New South Wales have been published in the scientific journal *Phycological Research*.

Dr Millar and his colleague Dr Wilson Freshwater from the University of North Carolina, Willmington, have completed and published their two year survey of the economically important red algal order Gelidiales.

Myrtaceae

A detailed analysis of the Tribe Chamelaucieae (Geraldton Wax group—Myrtaceae) continued with funding from the Australian Biological Resources Study and with the assistance of Margaret Heslewood. The data matrix for this project includes sequence of over 170 species from this Tribe. This year, research has been focussed on sequencing of the nuclear region known as ETS for as many taxa as possible. This has proven difficult in some cases due to primer specificity problems and sequence polymorphism. This new data source has been applied to the analysis of relationships in the eastern Australian species that have been referred to the genus *Babingtonia*. This data, in combination with existing chloroplast DNA sequences and morphological data, is confirming earlier results that indicate that *Babingtonia* species from the eastern states are not closely related to the type species from Western Australia. Furthermore, the species from the eastern states appear to fall into at least three distinct groups. A paper is in preparation that will publish these results and describe at least two new genera to accommodate these species.

Poaceae

Joy Everett, Dr Surrey Jacobs and Elizabeth Norris have continued their research into the morphology of the Australian native species of *Austrostipa* and all other genera in the grass tribe Stipeae. Further data using Scanning Electron Microscopy have also been recorded and tested on selected material to estimate variation and establish scoring systems to enhance the molecular analyses.

Restionaceae

Studies on the Restionaceae by Dr Barbara Briggs continued using both morphological and DNA data. Papers naming new Western Australian species of *Hypolaena* and *Chordifex* have been published and new combinations in *Chordifex* made for four eastern Australian species transferred from other genera.

Asia-Pacific Biodiversity Initiative Theme

Elaeocarpaceae

As part of a project investigating phylogeny, biogeography and evolution in the family Elaeocarpaceae, Drs Darren Crayn and Maurizio Rossetto have established a collaboration with Dr. Mark Coode at RBG Kew (a world authority on Elaeocarpaceae), as well as other collaborators throughout Asia and the Pacific region. Considerable insight has been already gained into the phylogenetic relationships and evolutionary origins of the genera of the family (and a manuscript submitted to *American Journal of Botany*); the focus is now shifting to expanding sampling of Asia–Pacific taxa to further explore biogeography and patterns of diversification in this region. Dr Crayn will visit RBG Kew in July 2005 to further existing collaborations and develop new collaborations.

Juncaceae

PhD student John Hodgson continued his research into sectional and species limits, as well as hybridization within *Juncus*. This research is supervised by Associate Professor Jeremy Bruhl (UNE), Dr Adam Marchant and Mrs Karen Wilson.

Urticaceae

Phylogenetic analyses of the Urticales by Julisasi Hadiah (Kebun Raya Bogor, Indonesia), Barry Conn and Christopher Quinn, based on chloroplast DNA data, support the monophyly of the Urticaceae, *Boehmeria*, *Pilea* and *Procris*, but not of *Elatostema*. At the tribal level, both Boehmerieae and Lecantheae appear paraphyletic, although this may be an artefact of the low taxon sampling. Preliminary analyses of relationships within *Elatostema* do not support the recognition of the subgenus *Pellionia*. Furthermore, *Elatostema* appears paraphyletic, with *E. curtisii* and *E. repens* placed sister to *Procris*, whereas the remaining members of *Elatostema* constitute a very robust clade. Current studies are now focused on the infrageneric relationships within *Elatostema*.

The systematics of *Procris sensu stricto* is currently being studied by Esti Aryianti (a MSc student from Kebun Raya Purwodadi, Indonesia), Barry Conn and Dr Murray Henwood (University of Sydney). Clarification of the phenetic and phylogenetic infrageneric relationship is being investigated, based on morphological features. About twenty species are recognised, two of which are new to science and one is a new combination. Current research is seeking to clarify whether or not the inclusion of *Elatostema curtisii* and *E. repens* into *Procris* require the morphological circumscription of the latter to be modified.

Management of Plant Diversity Information [Karen Wilson, Barry Conn, Gary Chapple]

The Trust has established high level contact with the Global Taxonomy Initiative of the Conference of the Parties to the Convention, on Biological Diversity and other international groups, to further the Asia-Pacific objectives.

The Trust continued its contribution to national and international committees related to the management and dissemination of plant diversity data. The Trust is represented on the Executive Committees of key international database groups (particularly, the Trust is a member of the *Herbarium Information Committee*; member of the IUBS *Taxonomic Database Working Group*; Chair of the *Global Plant Checklist Committee of International Organisation for Plant Information*; vice-chair of the *Global Biodiversity Information Facility (GBIF) Node Managers Committee*; member of *GBIF Electronic Catalogue of Names Committee* and member of the project team of *Species 2000*). Karen Wilson was one of the editors of the *Species 2000/ITIS Catalogue of Life Annual Checklist 2004* on CD-ROM, and Helen Stevenson (Graphic Designer) designed the booklet to accompany the CDs.

The Trust is also a member of the *Species 2000 Asia-Oceania* group and the *Pacific Biodiversity Information Forum*. These groups encourage international and national biodiversity activities in the broad region.

Interactive Keys to the Commercial Trees of Papua New Guinea

This joint project by Barry Conn and Kipiro Damas (Papua New Guinea National Herbarium) is preparing a DELTA dataset to produce keys and descriptions of the common commercial timber species of the Morobe Province of Papua New Guinea. Images are also being incorporated wherever possible. Approximately 350 tree species have been included in the study. The focus is on commercial timber trees, but some non-timber species have also been included. The emphasis has been on trees that grow to at least 20 m high. The information will soon be released to a

publicly accessible website when sufficiently complete to warrant public comment. This three-year project is partially supported by the Pacific Biological Foundation.

Origins and Evolution Theme

Dr Peter Weston has continued his collaboration with an international team to investigate the reproductive biology of species in the paraphyletic 'ANITA' grade of basal angiosperms. The main lineages of this assemblage differentiated very early in the evolutionary history of angiosperms so all of them are likely to show unusual, uniquely specialised characteristics. More importantly, any feature for which these taxa are consistent is likely to be primitive for the angiosperms as a whole. The research team has found that *Amborella trichopoda* (Amborellaceae), the sister species of all other extant angiosperms, is pollinated by both wind and a range of insect species, mostly beetles. *Trimenia moorei* (Trimeniaceae), is also pollinated by wind and insects but the latter constitute a more diverse array of taxa, including species of bees, saw flies and hover flies. These findings are consistent with the hypothesis that ancestral angiosperms had relatively unspecialised pollination systems. Particularly significant is the discovery that *Trimenia moorei* is self-incompatible, raising the possibility that self-incompatibility systems evolved before the major radiation of the angiosperms. *Amborella trichopoda* was also found to be highly specialised in playing host to a remarkably complex community of insect parasites and parasitoids. Two manuscripts by Dr Weston and his colleagues, describing aspects of the reproductive biology of these plants, have been accepted for publication.

Casuarinaceae

Karen Wilson continued a major study of the family Casuarinaceae with interstate collaborators Dr Dorothy Steane (Hobart) and Professor Robert Hill (Adelaide). The project will bring together molecular, morphological, anatomical and palaeontological data to investigate relationships of and within the family, testing hypotheses put forward by the late Dr Lawrie Johnson.

Elaeocarpaceae/Tremandraceae

Drs Darren Crayn and Maurizio Rossetto have continued to investigate the phylogeny, biogeography and within-species diversity of the plant family Elaeocarpaceae (including Tremandraceae) in order to understand some of the evolutionary mechanisms that have influenced speciation and distribution patterns within the Australian flora. Analysis of DNA sequence data, using newly developed techniques that allow for variations in the rate of 'ticking' of the 'molecular clock', calibrated using carefully selected fossil data, (*Elaeocarpus* endocarps dating from the Oligocene, approx. 30 million years ago) allowed a conservative estimate of the time of origin and rate of evolution of the major clades within Elaeocarpaceae (manuscript submitted to *American Journal of Botany*). Of particular interest was the inferred Paleocene origin of the 'Tremandraceae' lineage with a major radiation of *Tetratheca* during the Miocene in Australia, a period in which the general Tertiary aridification of the continent underwent a major intensification. Within the phylogenetic framework, analyses of population-level genetic diversity are being undertaken for more than ten species of *Elaeocarpus* (by Paul Rymer and students Michael Whitehead and Peter Ridgeway) and *Tetratheca* (by student Hannah McPherson) to provide insights into comparative evolutionary responses and speciation mechanisms in closely related rainforest tree species and dry-adapted shrubs.

Freshwater red algae

The long-standing collaboration between Dr Tim Entwisle and Dr Morgan Vis (Ohio University, USA) continued, with contributions in recent years from Hannah McPherson. Field trips to New Caledonia, New Zealand and Tasmania yielded substantial material for molecular sequencing. Collections from New Caledonia included a new species and recollections of *B. bourrelleyi*. Trips to New Zealand and Tasmania uncovered several species that had not been collected from particular localities for 50 years. *Batrachospermum ranuliferum*, a Tasmanian species previously known from only one locality, was collected at a second site.

The study involves other collaborators in Southern Hemisphere countries (including Orlando Necchi in Brazil), and seeks to clarify relationships within the freshwater red algal order Batrachospermales, particularly those of Gondwanic origin. A workshop on the biogeography of the Batrachospermales will be held at the International Phycological Congress in South Africa in 2005.

Myrtaceae

The phylogeny of the family Myrtaceae has been the subject of ongoing research by Dr Peter Wilson and Honorary Research Associate Dr Chris Quinn, assisted by Margaret Heslewood. A paper entitled 'Relationships within Myrtaceae sensu lato based on a *matK* phylogeny' was published in the journal *Plant Systematics and Evolution* as part of a special Myrtaceae issue of papers from the '150 Years' Conference held in Melbourne in late 2003. This publication proposes a new classification of the family that is the first new formal classification of the Myrtaceae since 1898.

Collaborative work has begun with Dr Jim Basinger, University of Saskatchewan, Canada; Dr David Greenwood, Brandon University, Manitoba, Canada, and Dr David Christophel, University of Denver, Colorado, USA to describe a fossilised fruit of capsular Myrtaceae. Specimens of this taxon were recovered from a clay deposit in South Australia dating from the Eocene and were able to be examined by Scanning Electron Microscopy. A paper is being prepared that will name this fossil species and discuss its possible relationships.

Orchidaceae

The majority of orchid species are deceptively pollinated by animals that are lured to the orchids' flowers by "false advertising" – the promise, but not delivery, of food, brood sites or sex. For example, most species of the genus *Diuris* mimic various kinds of pea flowers, but unlike them, they offer neither nectar nor edible pollen. Postgraduate student James Indsto has been investigating the evolution of this relationship by phylogenetically analysing *Diuris* and determining the pollinators of several Sydney species. Pollination is only rarely observed in food mimics and James had to develop an inferential technique to identify the pollinators of his orchids in the absence of direct observation. His DNA-based technique was described in a paper published in *Australian Systematic Botany*. James also made the unexpected discovery that nectar production has evolved independently in several species of *Diuris* from nectarless ancestors. This is best explained as the result of selection for pollinator reliability. James finished the year preparing several manuscripts on the *Diuris* pollination and phylogeny. James is co-supervised by Principal Research Scientist, Dr Peter Weston, who also incorporated these discoveries in an analysis of the evolution of deceptive pollination systems in the tribe Diurideae, for presentation at the International Botanical Congress in Vienna, Austria, in July 2005.

Proteaceae

Principal Research Scientist Dr Peter Weston has been working since 1979 on the phylogeny and historical biogeography of various groups in the Gondwanic family Proteaceae. Powerful new molecular tools have dramatically enhanced our ability to illuminate both of these areas by estimating the timing of divergence of lineages, with confidence estimates. Dr Weston has been collaborating with several international research groups in conducting such analyses on the Proteaceae. One of these involves Dr Nigel Barker (Rhodes University, South Africa) and Frank Rutschmann (University of Zurich, Switzerland) who have combined their own, unpublished *rbcl* sequences and published *atpβ* sequences to estimate the ages of major proteaceous lineages. Some surprising results have emerged from this work, which will be written up for publication in 2005-06. Dr Weston also collaborated with Dr Austin Mast (Florida State University, USA) and Dr Greg Jordan (University of Tasmania) in preparing a successful grant application to the National Science Foundation (USA) for funding for similar work concentrating on the subfamily Grevilleoideae. This grant will support research from 2006 to 2008, concentrating on taxa of particular biogeographic and ecological significance, such as those distributed across wide ocean gaps.

Dr Weston has also been collaborating with Dr Jordan and his student, Rebecca Dillon in testing explanatory theories for the evolution of scleromorphy in the Proteaceae. They found impressive evidence supporting the idea that scleromorphic anatomy may be an adaptation for protecting photosynthetic tissues from excessive solar radiation. This analysis was published in a paper in *American Journal of Botany*.

Dr Barbara Briggs continued her collaboration with Dr R.L. Bieleski of the Horticulture and Food Research Institute of New Zealand Ltd. on an investigation of the complex sugars, polyols, of Proteaceae. A paper reporting the polyols of 82 species and discussing the taxonomic significance of the findings has been submitted.

Poales

Continuing from their studies on Restionaceae, Dr Adam Marchant and Honorary Research Associate Dr Barbara Briggs continued their studies of the families related to Poaceae and Restionaceae. Sequence data on chloroplast DNA was obtained from further taxa and from the *matK* gene. The results of analyses of these data provide support for the Centrolepidaceae as either the sister group to Restionaceae or embedded in that family. There is also robust support for the small Western Australian family Ecdeiocoleaceae, with Joinvilleaceae of the Old World tropics, as the closest living relatives of Poaceae. Three regions of the chloroplast DNA have

been sequenced in *Georgeantha* and *Ecdeiocolea*, the two members of Ecdeiocolaceae.

Vitaceae

Previous research by Dr Maurizio Rossetto showed that *Cissus*, the most species-rich genus of Vitaceae, is not monophyletic in Australia (and most likely worldwide). This means that more accurate phylogenies will need to be developed for this important family (that includes *Vitis*), and also that a new genus is required in Australia (collaboration with Associate Professor B. Jackes from James Cook University). Earlier work on the phylogeny was expanded by the addition of taxa from Malaysia and southern Africa. The new data confirmed the previous findings, supporting the distinctiveness of four Australian endemic species. With the help of Dr Darren Crayn, it has been possible to calculate molecular evolutionary rates and estimate the divergence time of genera within the family. This molecular dating showed that the major radiation of non-rainforest taxa within Australia coincided with the drying of the continent during the Miocene, similar to results found for other Australian groups.

Management of the Preserved Collection

Australia's Virtual Herbarium

The herbaria of Australia — held in botanic gardens, environment agencies and CSIRO — hold a vast source of largely untapped information about the plants of this country. In particular, only half of the more than 6 million preserved plant collections are databased, and there is no 'one-stop shop' for accessing the nation's plant information. During 2001-2002, the Council of Heads of Australian Herbaria, supported by Commonwealth and State environment ministers, unanimously agreed to database the remaining half of the collections and make them available across the Internet. All new plant species and scientific discoveries will then be posted directly onto the Australia's Virtual Herbarium site (mirrored on all herbarium websites), the specimens themselves remaining under the custodianship of each regional herbarium. Funding of \$10 million over five years was secured to complete Australia's Virtual Herbarium: the Commonwealth Government matching \$4 million of State and Territory funds, with an additional \$2 million to be raised from private donors.

In New South Wales, the total number of specimens data-processed is about 543,000, representing about 70% of the total collections. Although it will prove difficult for the Branch to fully data-process the Australian material held by our herbarium, progress has been significantly improved during this financial year, particularly with the near-completion of databasing all specimens collected in New South Wales. Once these data are fully available to the broader community, these collections' records will increase efficiency and accuracy in handling data within the Trust as well as open up new opportunities for delivering plant information to the wider community. Access to these data continues to be made available via the PlantNET website, e.g. providing more detailed spot maps of taxa in the *NSW Flora Online*.

In addition to data processing thousands of specimens the AVH project has resulted in many curatorial benefits to the collections. In particular, identifications of thousands of specimens have been checked, and numerous nomenclatural changes from the literature have been incorporated. There have also been improvements in the physical curation of many specimens, including correct annotation, allocation of geocode information (such as, botanical divisions), and securing of the material to archival papers for long-term preservation. Type specimens have been singled out for special treatment, including conservation treatments and digital photography. The images of types are available on the PlantNET website.

NSW Collections Management System

Dr Barry Conn, Gary Chapple, and Chris Ward continued to work with KE Software to enhance the *NSW Collections* database for the Gardens. The new system incorporates herbarium, horticultural, and floristic survey data into a single database system. Images of plants, including herbarium collections are being included in the database. Solutions to present data to the *PlantNET* website have been developed outside the database framework. The ability to return the result of complex database queries has caused considerable concerns. Sophisticated report writing routines have been developed by Linn Linn Lee to handle these complex queries.

Communication and Services

Botanical Information Service

PlantNET

The electronic version of the 'Flora of New South Wales' has been developed as part of the Trust's *PlantNET* website (<http://plantnet.rbgsyd.nsw.gov.au>). - This *Flora Online* module was developed by Ken Hill. It provides nomenclatural information, botanical descriptions, illustrations, distribution maps, images of herbarium specimens and other plant images. These data are managed by the Trust's *NSW Collections* database. *PlantNET* continues to be enhanced so that plant information, identification keys and images from any region of New South Wales will be available.

Forensic Identification

Government analysts identified forensic material (*Cannabis*) in 32 cases for the Police Service.

Public Reference Collection

Environmental consultants, students, government agencies, and the general community spent nearly 100 hours using the Public Reference Collection to identify plants that they had collected.

Myrtaceae

Dr Peter Wilson was invited to participate in a workshop on the plant family Myrtaceae hosted by the Royal Botanic Gardens, Kew. The workshop was directed towards finalising a global checklist of Myrtaceae, the working copy of which includes over 5,800 species. The project is a cooperative one, involving experts from several

institutions who will check the entries for accuracy. Dr Wilson is contributing to this process and coordinating input from other Australian botanists.

Telopea

Telopea is New South Wales' leading scientific journal for the publication of plant diversity information. The focus of the journal is the discovery and documentation of plant species, and the study of their origins and relationships. The geographical focus is New South Wales, but papers cover other Australian States as well as neighbouring regions of the world. *Telopea* is an internationally recognised journal and all papers are peer-reviewed.

Telopea volumes 10(3) and 10(4) were published: 23 papers in total. Highlights include:

- A revision of *Indigastrum* and the unifoliolate species of *Indigofera*
- The geography and species diversity of South-East Asian *Begonia*
- Twenty-three new species, five subspecies and nine new combinations were published over a range of families including Poaceae (Gramineae), Restionaceae, Orchidaceae, Rutaceae, Rhamnaceae and Myrtaceae.
- Further research results on the lichens of the Pacific, the cosmopolitan fern family Dennstaedtiaceae, and non-marine algae of Australia.

Part 4: Resources Section

The Resources Section provides infrastructure and support for the science program. The section comprises the Library, Botanical Illustration Service, Herbarium Specimen Preparation Facility, Volunteer Program, and Electron Microscopy and Molecular Systematics Laboratories. The section is also responsible for the management of the Branch's vehicles and field-work equipment and in collaboration with the Gardens' Property Coordinator, for issues relating to the Brown Building, which houses the National Herbarium of New South Wales. The Resources Manager also oversees Branch occupational and general health and safety issues, provides agency wide services in managing various capital and other projects and coordinates Critical Incident Planning for the Sydney site.

Library

The Botanic Gardens Library has a world-class collection of botanic, taxonomic and horticultural literature. Its holdings include the latest publications, as well as extensive heritage historical collections of books, journals, manuscripts, photographs, botanical illustrations and maps.

Developments

There has been considerable activity in the Library in the last year and much has been achieved. This can be variously attributed to the assistance of four trainee Library Technicians, a large team of volunteers, three months of casual assistance, and the Library Manager working full-time since February 2004. In addition the new Internet-based Library catalogue allows for greater flexibility in managing the library collection.

A conservation project was established with considerable private donations and Friends funding. These funds are being used to conserve significant historic items, and to undertake a Conservation Assessment to prepare a preservation plan for the Library and its collections.

Staff and volunteers have been relocating and sorting at-risk materials (photographs, slides, illustrations, maps, plans, posters & manuscripts), and storing them in archival storage conditions. A stock-take of the journal collection is also being undertaken by volunteers to create a complete listing of the Library's holdings.

Library staff have been involved throughout the year with exhibitions, displays of heritage materials, induction, student tours and giving lectures. In addition staff have been involved in ongoing discussions with the other two DEC Libraries regarding the development of cooperative services.

Physically, the Library has had many changes: the annexation of an external corridor and cleaners cupboard to provide additional storage (including specialist secure storage for the photographic and image collections); new UV film on windows and UV blinds; improvements to furnishings; extended Reference Collection shelving and the reorganisation of facilities to provide improved work space for readers, library staff and the volunteer teams.

Botanical Illustration

The Botanical illustrators provide illustrations for Trust publications as well as for other sections within DEC. They also maintain the illustration archive both as original illustrations and as an electronic database.

Major taxonomic projects

- Ongoing taxonomic work has been completed for publication in *Telopea*, *Cunninghamia*, *Australian Systematic Botany* and other journals, RBG news, and PhD theses for botanists, honorary research associates and students.

Major projects completed include:

- Nine illustrations of Proteaceae genera to represent the Family for the “Plants and Genera of the World” publication which included scanning to publication standards.
- Prepare two plates of the BGT flowering *Amorphophallus titanum* in May 2005.
- Prepared 17 detailed habit drawings of Threatened Species for NPWS and provide an additional 4 existing half plates and 56 ‘Flora of NSW’ illustrations for their website and booklet. Several covers of Threatened Species Plans where also prepared.
- Preparation of 20 full plates and 32 additions to existing plates of *Cycas* species for a monograph on this genus.
- Marine algae species .
- Illustrations for publication include: *Lissanthe*, *Pomaderris*, *Goodenia*, *Pteridium*.

- Ongoing illustration of Threatened and Vulnerable species.
- Provide illustrations for Complimentary Healthcare council for promotional material and design of a Waratah logo for the Ministry for Science and Medical Research.
- Intermittent work undertaken for Education and Design and Editorial sections, including illustrations for “AusBiota in a Box” evolution education package. Project ongoing.
- Modify *Telopea* illustration for ‘new look’ *Telopea* cover design.

Digital Imaging Project

Illustrations are scanned as they are completed, added to the multimedia module of Emu and linked to the taxonomy and catalogue modules. Electronic versions of the illustrations are available to staff and available on the internet for the public to view. Higher resolution scans are available for publishing when required. The remaining works, namely Margaret Flockton’s drawings and approximately 100 *Eucalyptus* and *Corymbia* illustrations and a collection of Epacridaceae illustrations, are yet to be scanned and added to NSW Collections. A small “gallery” of illustrations is now located in the illustration section of the RBG web page.

Illustrations from volumes 1, 2, 3 and 4 of the Flora of NSW (approximately 8120 images), were digitally photographed at high and low resolution. These are now available for viewing on EMU and “NSW Flora On-line”.

Endangered and Vulnerable Plants

The nationally Endangered and Vulnerable Species Project is continuing with 95 endangered species now illustrated. The current focus of this project is to illustrate New South Wales species being listed as endangered nationally.

Illustration Archive

Illustrations from past and current papers were collected from botanists, and are now filed for future use in web-based projects such as PlantNET and the new Collections Database. The archive also allows the illustrations to be available on request whilst being stored safely.

Volunteers and training

- Regular assistance is given to staff requiring help when scanning images.
- Training of a staff member on the program Illustrator.

Scanning

- Scanning of black and white illustrations for publication in external journals is undertaken by the illustrators to ease the workload in the Design and Editorial section.

Exhibitions and Awards

- Artist in Residence. The Illustrators along with the Red Box Gallery committee established the first Artist in Residence Program, in association with the Sydney College of Fine Art (CoFA). Christopher Gentle, a Sydney based painter and drawer, was appointed Artist in Residence when the initial artist, Alun Leach Jones, withdrew due to illness. The Illustrators assisted Chris to access the living, dried and spirit collections of the Trust and to co-ordinate with other branches in the Gardens to mount the exhibition held in The Red Box Gallery during July and August of this year. CoFA included the Exhibition in their drawing festival – Drawing Connections – thus linking the Trust with other major cultural institutions throughout Sydney who held their own exhibitions, talks and displays. 120 people attended the exhibition opening, many of whom had never been to the Herbarium before or the Red Box Gallery, thus promoting the profile of the Trust and our expanding role as one of Sydney's primary scientific and cultural institutions.
- Margaret Flockton Award. The illustrators assisted once again in the organisation and presentation of the *Margaret Flockton Award for Botanical Illustration*. Sponsored by the Friends of the Gardens, the Award, in its second year was a great success, with approximately 40 entries. The Award Exhibition of selected entries was mounted in the Red Box Gallery and drew an audience of over 1,000 visitors. The exhibition was held in conjunction with *Botanica*, the sister event held by the Friends of the Gardens in Lion Gate Lodge. Both Lesley Elkan and Catherine Wardrop, BGT Botanical Illustrators were awarded Highly Commended for their entries.
- Lesley Elkan entered the Jill Smythies Award, a Scientific Botanical Illustration Award, presented by the Linnean Society of London and was delighted learn that she had received the 2005 medal. She travelled to London in May to attend the annual meeting of the Linnean Society, exhibit a small number of her works in the library and receive the award.

Herbarium Specimen Preparation Facility

All plant specimens coming into the Herbarium are processed and prepared in the Preparation Room before being incorporated into the collection. As part of our

Integrated Pest Management Program (IPM) specimens collected in the field are pressed, dried and frozen (at $< -18^{\circ}\text{C}$) prior to mounting. This ensures specimens are free from pests before they are incorporated into the collection. In-coming and out-going loans and exchanges are also frozen, to ensure that pests are not transmitted between herbaria.

The Preparation Facility is a checkpoint where all specimens entering and leaving the Herbarium are recorded. The Herbarium again received accreditation as an approved Australian Quarantine and Inspection Service (AQIS) facility. This enables us to process specimens received from overseas, and provide a quarantine service for other Australian herbaria.

Ingram and Burrendong Herbarium Collections.

Two large collections of pressed botanical specimens, the Ingram Herbarium and the Burrendong Arboretum Herbarium, have been donated to the Trust. The Ingram Collection, consisting of about 20,000 specimens, was donated to the Trust some years ago by Mr Keith Ingram, a former school inspector and keen naturalist. A group of dedicated volunteers have been mounting the Ingram specimens on archival material at the Ingram residence at Richmond over the past 10 years. Unfortunately, due to the sale of the Ingram property, the collection had to be moved into Sydney earlier than expected.

The herbarium collection of Burrendong Arboretum consists of several thousand specimens and was put together by Mr George Althofer and a group of enthusiasts associated with the Arboretum.

Both collections are being frozen prior to being moved into the Herbarium where they will be sorted, curated and databased before being fully incorporated into the collection. Both collections will be very useful additions to our collection.

Volunteer Programs

The mounting program has as its central goal to have the pressed plant specimens securely mounted on archival quality materials, clearly and correctly labelled, and catalogued in the collection data-base. A major priority is to ensure that all out-going loan material is mounted and data based before being sent out. The program relies on a group of dedicated volunteers, who each give one day per week.

Although most volunteers assist in the mounting program some work with specific research or curation projects, including scanning and data basing type specimens, and curation of the algae and lichen collections occurs.

In February, after 16 years service, Alan Leishman retired from the role of Volunteer Coordinator. Alan had built up the Mounting Program from its small beginnings into the valuable program that exists today.

Databasing program

Volunteers databased in excess of 3,000 specimens during the year, a small decline on last year's 3,835 specimens. Incoming exchange specimens from Canberra continued to be entered through Rapid with the use of electronic exchange of data. It is hoped to increase the number of herbariums that provide electronic for incoming exchange.

Specimen mounting program

Volunteers mounted 22,000 specimens on archival paper, a lower number than last year (25,145 specimens), due to the retirement of Alan Leishman and the loss of some of our volunteers. Outgoing loans, incoming exchange, specimens data based by the AVH and fragile or vulnerable groups within the Herbarium collection were given highest priority. A total of 1,240 cryptogam specimens were also mounted, data based and packaged, slightly less than last year.

Other volunteer programs

Volunteers also assisted with limited general curation and research in the Sciences Program.

Electron Microscopy

Facilities

The Electron Microscopy Laboratory provides facilities for Scanning Electron Microscopy (SEM) including freeze and critical point drying. These techniques are used in research and plant identification. Equipment includes a Cambridge S360 Scanning Electron microscope (SEM) and associated preparation equipment. We also have access to a transmission electron microscope (TEM) through Sydney Hospital.

SEM Projects

Elizabeth Norris together with Joy Everett and Surrey Jacobs have been continuing with the leaf and epidermes study of *Piptochaetium*, *Achnatherum* and *Stipa s. str.* using SEM and light microscopy. This work forms part of an international collaborative project concerning the tribe Stipeae. From her results she is building a matrix with respect to the relationships of these three genera.

Honorary Research Associate Christopher Quinn has published a revision of the *Cyathodes* clade of the Styphelieae (Ericaceae), which was based on cladistic analyses of databases that included characters scored from SEM observations of pollen and leaf micromorphology. Two new genera were described (*Acrothamnus* CJQuinn and *Agiortia* CJQuinn), and several generic reassignments of species of *Leucopogon* s.l. and *Styphelia* s.l. were made. He has also completed a survey of surface micromorphology of the leaves, pollen and seeds of the Eastern species of *Babingtonia* and their allies (family Myrtaceae) for inclusion in analyses of this group conducted jointly with Peter Wilson. He is presently engaged in a study of surface micromorphology of the leaves, pollen and floral parts (sepals, petals, anthers and ovary) of *Monotoca* and its allies for inclusion in an analysis of relationships being undertaken jointly with Dr David Albrecht (Northern Territory herbarium, Alice Springs).

Molecular Systematics Laboratory

The Molecular Systematics Laboratory provides facilities for DNA-based studies of plant relationships, to supplement whole plant and anatomical comparisons.

In this period the Laboratory acquired a new Corbett Research Thermal Cycler for DNA amplification and sequencing procedures; a Millipore RiOs reverse osmosis water purification system, to provide water for analytical procedures; an additional

700 litre chest freezer for storage of specimens for DNA analysis; and a dedicated hot-water boiler, for the cleaning of laboratory glassware.

Associate Professor Jeremy Bruhl from the University of New England was a Visiting Research Fellow in the latter part of 2003, working on molecular systematics of Cyperaceae.

Graduate students using the laboratory included Yolanda Metti (Laurencia, Rhodophyta – the “coral plant”); Robert Gibson (Drosera – the Sundew); Karen Sommerville (Wilsonia, Convolvulaceae); Hanah McPherson (Tetrotheca); Nicholas Yee (Sporochnales, Phaeophyta). PhD degrees were awarded to Kioumars Ghamkhar (Abildgaardieae, Cyperaceae) and Nikola Streiber (Chloanthaceae, Lamiaceae). Patricia Lu-Irving did an honours project on Trachymene and relatives (Apiaceae), and was assessed as first class (University of Sydney).

Graduate student research projects

- Kioumars Ghamkhar (under the supervision of Jeremy Bruhl, UNE Armidale, Karen Wilson and Adam Marchant) submitted his PhD thesis on Abildgaardieae (Cyperaceae). One paper of several based on his work has been submitted for publication.
- A paper reporting on the molecular genetic work of former PhD student Xiufu Zhang was published in *Molecular Phylogenetics and Evolution* (with co-authors Marchant, K. Wilson, and Bruhl).
- Nicholas Yee's MSc candidature at the University of Melbourne (supervised by Gerry Kraft, U. Melb., Alan Millar and Adam Marchant) has been upgraded to a PhD.
- Yola Metti is in the process of converting her MSc to a PhD at the University of New South Wales (supervised by Alan Millar and Peter Steinberg)
- Nikola Streiber (supervised by Murray Henwood, U. Syd., Elizabeth Brown, and Barry Conn) has submitted her PhD thesis, on phylogenetics of Chloanthaceae.
- A report on the molecular genetic component of George Orel's PhD (supervised by Judyth McLeod and Graeme Richards, UWS, and Adam Marchant) was published in the journal *HortScience* in September 2003.

Staff and Research Associate projects

- Murray Henwood, of the School of Biological Sciences, University of Sydney, was the Visiting Research Fellow in the latter part of 2003. His work on relationships within Australian Apiaceae (in collaboration with Adam Marchant and Andrew Perkins) was presented at the *Southern Connections Botanical Conference* in Cape Town in January 2004.
- Bettye Rees and Adam Marchant (with G. C. Zuccarello, University of Leiden) published their findings on Australian *Gymnopilus* species in *Australasian Mycologist*.
- Andrew Perkins, Gillian Towler, George Orel and Adam Marchant were successful in obtaining a grant from the Australian Flora Foundation, to study the *Solanum brownii* species-complex.

A burst water main under the floor of the laboratory caused major disruption, necessitated major repair work, and required the laboratory to be evacuated for some weeks.

Red Box Gallery

The gallery has had a very successful year with an extensive exhibition program including the following –

Exploring Collectors 9 August 2004 to 29 October 2004

The exhibition covered the explorations and collections of past and present botanical collectors who have made significant contributions to the herbarium collection.

BGT Staff Exhibition 15 November 2004 to 3 December 2004

An exhibition of artistic works by Trust staff.

Etienne Cohen 4 December 2004 to 18 December 2004

A private exhibition of paintings by Etienne Cohen.

Orchid Odyssey 20 December 2004 to 27 February 2005

A private exhibition of orchid photographs by Allegra Biggs-Dale. This exhibition also travelled to Mount Annan and Mount Tomah Botanic Gardens.

Panoramas, Plants and People 7 March 2005 to 29 April 2005

This successful exhibition showed the development of the Garden's from 1815 to the present. The exhibition utilized images and objects from the Trust's archives

displayed in a modern context. The exhibition was part of the Discovery after Dark program, where museums and cultural institutions opened from 6:00pm to midnight on Saturday 17 April with 200 visitors viewing the exhibition.

Margaret Flockton Award and Exhibition 7 May 2005 to 15 July 2005

An exhibition of selected works from The Margaret Flockton Award, sponsored by The Friends of the Gardens. The exhibition was well received with over 1,000 visitors.

Critical Incident Planning and Implementation.

The Resources Manager is responsible for the updating and implementation of the Critical Incident Plan (CIP) at the Sydney site.

During the year, there were 13 major incidents in the Sydney Gardens

- Achievements throughout the year include:
- ongoing training of staff in emergency procedures
- up-date of evacuation procedures on the Sydney site
- desk-top exercise simulating a major emergency

Part 5: Appendices

Appendix A: STAFF, HONORARY ASSOCIATES, VOLUNTEERS AND STUDENTS IN PLANT SCIENCES BRANCH

Director Science and Public Programs

Brett Summerell BScAgr(Hons), PhD(Syd)

Executive Assistant

Sheryl Saban (temp)

Administrative Assistant

Kristina McColl BSc(Hons)(UNSW), BushRegenCert

Ifeanna Tooth BSc (Syd), Adv Cert Urb Hort (OTEN) (temp, in part)

CENTRE FOR PLANT CONSERVATION

Coordinator

Bob Makinson BA (Biology) Macq

CONSERVATION AND HORTICULTURAL RESEARCH

Manager

Bob Makinson BA (Biology) Macq (Acting)

NSW Vegetation

Principal Research Scientist

Surrey Jacobs, BScAgr, PhD(Syd)

Special Botanists

Doug Benson BSc(Hons)(UNSW)

John Benson BSc(Macq)

Research Scientist

Maurizio Rossetto BSc (Hons)(La Trobe), MSc, PhD (UWA)

Senior Technical Officers

Chris Allen BEng, BSc(Biology)(Syd), PhD (Syd)

Jocelyn Howell BPharm(Syd), BSc(Macq)

Technical Officer

Jedda Lemmon BA(Sociology)(UNSW)BushRegenCert II (temp)

Technical Assistant

Lyn McDougall BushRegenCert

Fungi and Plants

Senior Technical Officers

Linda Gunn BAgSc(Hons)(Melb)
Suzanne Bullock NZCS, MSc(UNSW)

Technical Officers

Julie Bates, AssDipAppSc(Ultimo TAFE) (temp)

Horticultural Research and Development

Senior Research Scientist

Catherine Offord BScAgr(Syd), MScAgr(Syd), PhD(Syd)

Technical Officers

Lotte von Richter BScAgr(Syd), MScAgr(Syd)
Patricia Meagher BScUrbanHort(Hons)(UTS) (temp)

Senior Technical Officers

John Siemon, BHortSc(Hons) (Uni Qld)

Horticulturalists

Faye Cairncross AdvCertUrbanHort

Technical Officer

Mishy McKensy (temp)
Leah Seed (temp). Commenced 01.11.04

PLANT DIVERSITY

Manager

Barry Conn BScEd, MSc(Melb), MBA (CSturt), PhD(Adel) (Senior Research Scientist)
Karen Wilson BScAgr(Syd), MSc(UNSW) (acting)

Research and Curation

Principal Research Scientist

Peter Weston BSc(Hons), PhD(Syd)
Alan Millar BSc(Hons), PhD(Melb)

Senior Research Scientist

Ken Hill BSc(Hons), MSc(UNE)

Research Scientist

Darren Crayn BSc(Hons), PhD (UNSW)
Peter Wilson BSc(Hons), PhD(UNSW)

Special Botanist

Karen Wilson BScAgr(Syd), MSc(UNSW)

Senior Systematic Botanist & Scientific Editor (Telopea)

Joy Everett BioTechCert (Syd TAFE), BSc(Hons), MSc(Syd)

Botanists

Elizabeth Brown BSc, MSc(Hons), PhD(Auk)

Stephen Skinner BSc(Hons), MSc, PhD(Adel), GradDipEd(Sec.) (temp)

Senior Technical Officer

Louisa Murray BAppSc(CCAE)

Technical Officers

Clare Herscovitch BSc(Hons)(Syd)

Gillian Towler BSc(Macq), AssDipAppSc (HortParkMgt), TreeSurgCert

Hannah McPherson BSc (Hons) (UNSW)

Katherine Downs, BA (UNSW), BSc(Hons) (Syd)

Leonie Stanberg BSc(Syd), DipEd(SCAE)

Linn Linn Lee BA, BSc(Hons) (Syd) (temp)

Liz Norris BSc(Hons) (Macquarie) (temp)

Margaret Heslewood BSc(Hons) (Syd) (temp)

Paul Rymer BSc (Hons) (UWS) (temp) (commenced 29.04.04)

Wayne Cherry BScAgr(Syd), GradDipBioSc(UNSW)

Herbarium Assistant

Zonda Erskine AssDip in FAP(Sydney TAFE)

Australia's Virtual Herbarium**Co-ordinator**

Phillip Kodela BSc(Hons), PhD(UNSW) (temp)

Botanist

vacant

Database staff

Carmen Bennett started 7.2.05

Karen Biddle (temp)

Rachael Gallagher (temp)

Jacqueline Millott BEnvSc(Hons)(UoW) (temp) (LDD 28.1.05)

Chanele Moss – started 8.2.05

Lucy Nairn BSc(Hons) (Monash) (temp)

Amber Pares (temp) (LDD 16.7.04)

Tim Playford – 7.2.05 – 27.5.05

Fiona Powell BSc(Hons) (UNSW) (temp) (LDD 20.8.04)

Ifeanna Tooth BSc(Syd), Adv Cert Urb Hort (OTEN) (temp, in part)

Rhiannon Ward started 7.2.05

Lisa Woods started 14.2.05

Botanical Information Service**Botanist**

Barbara Wiecek BSc(Syd)

Senior Technical Officers

Seanna McCune BAppSc(Hawkes), BushRegenCert

Technical Officers

Gary Chapple BSc(Syd), DipAg(Hawkes)

Robert Coveny HortCert

PlantNET Officer

Peter Hind HortCert

RESOURCES

Manager

Anthony Martin, BioTechCert, BioTechHigherCert, BAppSc(Riverina)

Technical Officer

Alex Newman CertAmenHort(SA), AdvCertHort(SA), BScAg(Hons)(Adel), BMus(Adel)

Laboratories

Senior Technical Officer

Adam Marchant BSc(Hons), PhD(ANU)

Technical Officer

Carolyn Porter BAppSc(Hons)(UTS)

Library

Senior Librarian

Judy Blood BA, Dip Ed (LaT) DipLib (RMIT) BushRegenCert, ArboricultureCert, Multimedia Cert IV

Library Technician

Miguel Garcia AssocDipLibPrac(STC)

Botanical Illustration

Illustrators

Lesley Elkan BSc(UTS), PostGradDipIllus(Newc)

Catherine Wardrop BA(Vis)(ANU), PostGradDipIllus(Newc)

Volunteer Program

Volunteer Program Supervisor

Alan Leishman PhotoengravingEtchingCert (LDD 4.2.2005)

HONORARY RESEARCH ASSOCIATES

Alan Archer PhD(City Lond), CChem, FRSC

Alan Leishman PhotoengravingEtchingCert

Peter Bernhardt BA, MA(SUNY), PhD(Melb)

Don Blaxell BSc(UNSW), DipAgr(Vic)

Barbara Briggs BSc(Hons), PhD(Syd), PSM

Carrick Chambers AM, MSc(NZ & Melb), PhD(Syd), Hon.LLD(Melb), Hon.DSc(UNSW), AHRH

Mike Dingley BioTechCert (STC)

Lionel Gilbert, OAM, BA (Hons) PhD(UNE), LCP(Lond)

John Leslie BA(Dall), MS(UWisc), PhD(UWisc)

David Mabblerley MA, PhD(Cambridge), DPhil(Oxon)

Christopher Quinn, BSc (Hons) (Tas), PhD (Auk)

Helen Ramsay MSc, PhD(Syd)
 Bettye Rees BSc(Hons)(Qld), PhD(UNSW)
 Geoffrey Sainty DipAgr(WAC), GradDipExt(Hawkes)
 Phil Spence
 Joy Thompson BScAgr, MSc(Syd)
 Mary Tindale MSc, DSc(Syd)
 Peter Michael BAgSc(Hons)PhD(Adel)
 Terry Tame DipIndArts(STC), DipEd(Syd)
 Prof John Thomson MSc, MAgrSc, PhD(Melb)
 Edwin Wilson, BSc (UNSW)

VOLUNTEERS

Margaret Bell, Pamella Bell, Chris Belshaw, Carmen Bennett, Carol Bentley, Rosemary Blakeny, Patricia Bradley, Sunday Brent, Harry Brian, Louise Broadhead, Dawn Bunce, Lynette Burne, Diane Calder, Judy Calder, Margaret Carrigg, Daryl Pui-Hang Chan, Kathryn Chapman, Margot Child, Silas Clifford-Smith, Miriam Cort, Mien de Hass, David Drage, Fang Fang, , Helen Flinn, Gladys Foster, Carol Griesser, Pat Harris, Jane Helsham, Janet Heywood, Rachel Hill, Murial Hilsden, Alick Hobbes, Beverley Honey, Leis Hruby, Jean Ingram, Mike Isbell, Zinvddin Ahmed Kahn, Fred Langshaw, Gwenda Levy, Marie Lovett, Anne Lucas, Anne Lupis, Nicole Mason, Toni May, Ann McCallum, Malcolm McDonald, Ena Middleton, Andrew Mitchell, Joan Moore, Peter Mylrea, Jenna Neilson, Roslyn O'Gorman, Jill Payne, Aileen Phips, Syd Pinner, Dorothy Pye, Robin Queenan, Elizabeth Radford, John Richards, Rod Roberts, Mananejela Rodofili, Amanda Rollason, Ben Ross, Betty Ruthven, Li Yuan Shepherd, Graham Shields, Lois Stewart, Julie Taylor, Betty Thurley, Ruth Toop, Shelagh Trengove, Todd Trennery, Sybil Unsworth, Rosemary Varney, Ann Wilcher, Lisa Woods, Xiaojie Yuan.

STUDENTS

Student	Degree	University	Supervisors	Project Title
Ruth Amata	MScAgr	University of Sydney	+Prof. L. Burgess, Dr B. Summerell	Fusarium species associated with millet in Australia and Africa
Alison Bentley	PhD	University of Sydney	+Prof. L. Burgess, Dr B. Summerell	Population biology of <i>Fusarium pseudograminearum</i>
Emma Burns	PhD	UNSW	+Dr R. Brooks, +Dr B. Houlden, Dr D. Crayn, +Dr M. Eldridge	Phylogeography, population history and conservation genetics of the endangered Green and Golden Bell Frog (<i>Litoria aurea</i>)
Betty Mauliya Bustam	MSc	University of New South Wales	+Dr P. Adam, J. Everett, Dr S. Jacobs	Systematics of <i>Austrostipa</i> (Gramineae)

Student	Degree	University	Supervisors	Project Title
Jonathon Carbrera		Mainz University (Germany).	+Dr Gudrun Kadereit, +Prof. Joachim Kadereit, Dr S. Jacobs	Studies in Australian Camphorosmeae (Chenopodiaceae).
Kerri Clarke	PhD	University of New England	+Assoc. Prof. J. Bruhl, +Dr N. Prakash, K. Wilson	Systematic studies in Abildgaardieae (Cyperaceae)

Yvonne Davila	PhD	University of Sydney	+Dr G.M. Wardle, Dr M. Rossetto	Ecological and evolutionary implications of variation in pollinator assemblages on <i>Trachymene incisa</i> (Apiaceae)
Jim Dellow	MScAgr	University of Sydney	Prof. D. Kemp +Dr W. King + Dr S. Jacobs	Weedy Brassicaceae of NSW Wheat areas
Frances Elliot	PhD	Southern Cross University	+Prof. R. Henry, Dr. M. Rossetto	Extent of clonality and taxonomic relationships in <i>Davidsonia</i>
Heather England	BSc (Hons)	University of New South Wales	+Assoc .. P. Adam, Dr C. Allen	Invasion of weeds in Blue Gum High Forest
Cassia Ferguson	BHort Sc	University of Sydney	+Dr Robyn McConchie., Dr Cathy Offord	Effect of the addition of rock dust to potting mixes on the health of potted plants
Alex Freebairn	PhD	University of Sydney	+Dr P. Martin, Dr C. Offord	Reproductive biology and breeding of <i>Grevillea</i>
Kioumars Ghamkhar	PhD	University of New England	+Assoc. Prof. J. Bruhl, Dr A. Marchant, Mrs. K. Wilson	Molecular study of <i>Abildgaardieae</i> (Cyperaceae)
Robert Gibson	PhD	University of New England	+Assoc. Prof. J. Bruhl, +Dr G. Vaughton, Dr B. Conn	Systematics of <i>Drosera peltata</i> complex
Joanne Green	BSc (Hons)	Southern Cross University	Dr S. Jacobs, Dr. S. Skinner	Aufwuchs as a stream health indicator
Greg Guerin	PhD	University of Adelaide	Dr W. Barker, Dr R. Hill, Dr B. Conn	"Systematics of <i>Hemigenia</i> and <i>Microcorys</i> (Lamiaceae)"
Adele Harvey	PhD	La Trobe University	+Dr Wm J. Woelkerling, Dr A. Millar	The crustose coralline algae of NSW
Ken Hill	PhD	University of Technology	+Dr Ken Brown, Dr P. Weston	Phylogeny and biogeography Technology of the genus <i>Cycas</i>
Gavin Hinten	PhD	Southern Cross University	Prof. P. Baverstock, Dr. M. Rossetto	Patterns of mutation of microsatellite loci - a study using island populations of the Australian bush rat
Student	Degree	University	Supervisors	Project Title
John Hodgson	PhD	University of New England	+Assoc. Prof. J. Bruhl, Mrs K. Wilson, Dr A. Marchant	Systematics of <i>Juncus</i> (Juncaceae)
Chris Howard	PhD	University of Sydney	+Prof. L. Burgess, Dr B. Summerell	Population genetics of <i>Phytophthora cinnamomi</i>
Khalaf Hussein	PhD	University of Technology	Dr B. Summerell, +Dr J. Tarran, +L. Tesoriero	Diseases of Lettuce in hydroponics
James Indsto	MSc	University of Wollongong	Dr P. Weston, +Prof. R. Whelan	Species relationships and pollination ecology of <i>Diuris</i>

			+Dr M. Clements	(Orchidaceae) of the Sydney region
Karen Jackson	PhD	University of Sydney	+Prof. L. Burgess, Dr B. Summerell	<i>Fusarium</i> mycotoxins in wheat grain
Peter Jobson	PhD	University of Technology	Ken Brown, Dr P. Weston	A taxonomic revision of <i>Dillwynia</i> (Fabaceae: Sydney Faboideae: Mirbelieae)
Aniuska A. Kazandjian	PhD	James Cook University	+Assoc. Prof. B. Jackes, Dr P. Wilson	Systematics of the <i>Indigofera pratensis</i> complex (Fabaceae): A Morphological and Molecular Approach
Joanne Ling	PhD	University of Western Sydney	+Dr J Bavor, Dr S. Jacobs	Development of a Wetland Assessment protocol using biological techniques
Patricia Lu-Irving	BSc (Hons)	University of Sydney	Dr Adam Marchant, Dr Andrew Perkins, +Dr Murray Henwood	Molecular systematics of genus <i>Trachymene</i> (Apiaceae)
David Maynard	BSc (Hons)	University of New South Wales	Dr M. Rossetto, Dr D. Crayn +Dr S. Bonser	A molecular phylogeny for Australian <i>Elaeocarpus</i> (Elaeocarpaceae) and the affinities of a putative new taxon
Kylie McCall	BHortSc	University of Sydney	J. Siemon, L. von Richter	Storage of seed and mycorrhiza of threatened Australian orchid species
David McKenna	PhD	University of Wollongong	+ Prof. R. Whelan, +Assoc Prof. D. Ayre, +Dr T. Auld, Dr P. Weston	Ecology of fire-sensitive <i>Persoonia</i> species: threatened Species recovery and Management
Hannah McPherson	MSc	University of New England	Dr D. Crayn, Dr M. Rossetto, +Dr C. Gross	Phylogenetics and evolutionary dynamics of the 'Tremandroid' Elaeocarpaceae
Amelia Martyn	PhD	University of Sydney	+Dr R. McConchie, Dr C. Offord	Causes of bract browning in <i>Telopea</i> species
Student	Degree	University	Supervisors	Project Title
Yola Metti	MSc	University of New South Wales	Dr A. Millar, +Prof. P. Steinberg	Morphology and molecular phylogeny of the red algal <i>Laurencia</i> in NSW
Lucy Nairn	PhD	University of Melbourne	+Dr B. Downes, Dr T. Entwisle	Ecology of freshwater macroalgae in sandstone streams of the Southern Highlands, NSW
Chris Nancarrow	PhD deferred	University of Wollongong	+ Prof. R. Whelan, +Assoc. Prof. D. Ayre, Dr P. Weston, Dr C. Offord	Reproductive character Displacement and adaptation of three co-occurring <i>Persoonia</i> species
Jennie Nelson	MSc (Hons)	University of Western Sydney	+Assoc. Prof. S. Burgin, Dr T. Entwisle	Desmids of Western Sydney
Alex Newman	PhD	Macquarie	+Assoc. Prof. D.	Biology of the fig psyllid

		University	Hales, Dr B. Summerell	
George Orel	PhD	University of Western Sydney	+Dr Judyth McLeod, +Graeme Richards, Dr A Marchant	Assessment of horticultural suitability of undomesticated species of Juglandaceae
Sophie Peterson	PhD	University of Sydney	+Prof. L. Burgess, Dr B. Summerell	Biology of <i>Phyllosticta telopeae</i>
Tijana Petrovic	PhD	University of Sydney	+Prof. L. Burgess, Dr B. Summerell	Populations of <i>Fusarium</i> on sorghum
Hien Phan	PhD	University of Sydney	+Prof. L. Burgess, Dr B. Summerell	<i>Fusarium</i> spp. associated with Australian grasses in Northern Queensland
Ratiya Pongpisutta	PhD	University of Sydney	+Prof. L Burgess, Dr B. Summerell	Variability of <i>Phytophthora cinnamomi</i> in National Parks in NSW
Matt Renner	PhD	University of Sydney	Dr Elizabeth Brown +Dr Glenda Wardell	Relationships of the Austral family Lepidoziaceae
Peter Ridgeway	BSc (Hons)	UNSW	Dr. D. Crayn, Dr. M. Rossetto & Dr. +S. Bonser	Phylogeography of <i>Elaeocarpus largiflorens</i> across a putative geophysical barrier
Karin Rutten	PhD	University of Wollongong	Dr A. Millar	Macro-algal blooms and Management
Paul Rymer	PhD	University of Wollongong	+ Prof. R. Whelan, +Assoc. Prof. D. Ayre, +Dr T. Auld, Dr P. Weston	Genetics of fire-sensitive <i>Persoonia</i> species threatened species recovery and management
Josie Saul	PhD	University of Sydney	+Prof. D. Guest & Dr. B. Summerell	Diversity of <i>Phytophthora palmivora</i> in PNG
Student	Degree	University	Supervisors	Project Title
Jennifer Smith	PhD	University of New England	Assoc Prof C Gross, Assoc Prof N Prakash, Dr M Rossetto	Ecology, biology and conservation of <i>Hakea pulvinifera</i>
Karen Sommerville	PhD	University of Technology, Sydney	+Dr Alex Pulkownik, +Prof M. Burchett, Dr. M. Rossetto	Ecological conditions for biodiversity conservation of saltmarsh at Sydney Olympic Park
Robin Stanger	BSc (Hons)	University of Newcastle	Dr C. Offord, L. von Richter	Are habitat specificity and limited reproductive ability affecting the population dynamics of <i>Prostanthera junonis</i> ?
Nikola Streiber	PhD	University of Sydney	+Dr M. Henwood, Dr E. Brown, Dr B. Conn	The systematics of Chloantheae (Lamiaceae)
Jennifer Smith	PhD	University of New England	Assoc Prof C Gross, Assoc Prof N Prakash, Dr M Rossetto	Ecology, biology and conservation of <i>Hakea pulvinifera</i>
Len Tesoriero	PhD	University of Sydney	+Prof. L. Burgess, Dr B. Summerell	Control of soil borne diseases in glasshouse crops

Ha Nguyen Tran	PhD	University of Sydney	Dr B. Summerell +Prof. L Burgess	Populations of <i>Fusarium</i> on maize
Nguyen Vinh Truong	PhD	University of Sydney	Dr. B. Summerell	Quick wilt of black pepper in Vietnam
Jillian Walsh	PhD	University of Sydney	Dr B. Summerell +Prof. L Burgess	<i>Fusarium</i> species associated with native sorghum in Australia
Andrew Watson	MScAgr	University of Sydney	Dr B. Summerell +Prof. L Burgess	<i>Fusarium</i> species causing cob rot of maize in New South Wales
Michael Whitehead	BSc (Hons)	UNSW	Dr M. Rossetto, Dr D. Crayn +Dr W. Sherwin	Population genetic structure and evolutionary dynamics of <i>Elaeocarpus reticulatus</i> in New South Wales
Sabine Wilkins	PhD	University of Berlin	+Prof. W. Greuter, Dr S. Jacobs	Taxonomic studies in the Floating leaved species of <i>Potamogeton</i> (Potamogetonaceae) in Australia
Paul Wynn	PhD	University of Sydney	+Dr Bruce Sutton, Dr Cathy Offord	Water use efficiency of Australian plants
Nick Yee	PhD	University of New South Wales	Dr A. Millar, Dr A. Marchant, +Prof. G. Craft	Molecular phylogeny of the algal order Sporochneales

Appendix B: REPRESENTATION ON EXTERNAL COMMITTEES

Chris Allen

Member, Institute of Wildlife Research, University of Sydney; Member, Royal Zoological Society; New South Wales Weed Society; Member, Ecological Society of Australia; Member, Australian Mammal Society; Member, Australian Plant Society; Member, Australian Microscopical Society

Tracey Armstrong

Member, Australian Network for Plant Conservation (National Management Committee)

Doug Benson

Member, (to Dec 2004) NSW Scientific Committee (NSW Threatened Species Conservation Act); Member, North Head Sanctuary Scientific Committee (Sydney Harbour Federation Trust); Member, Institute of Wildlife Research, University of Sydney; Member, National Trust Bush Management Advisory Committee

John Benson

Member, Integrated Biodiversity Conservation Assessment panel; Member, Institute of Wildlife Research, University of Sydney; Member, IUCN Species Survival Commission Plant Specialist Group; Member, IUCN Commission for Ecosystem Management; Member, Wollemi Pine Conservation Team; Member, Technical Working Group Vegetation Reforms NSW; Member Technical Working Group Vegetation Reforms NSW.

Dr Barbara Briggs (Honorary Research Associate)

Member, Editorial Committee Taxon; Member, Editorial Advisory Board, Nordic Journal of Botany; Committee Member, NSW Division of Australian & New Zealand Association for the Advancement of Science (ANZAAS); Member, General Committee on Botanical Nomenclature; Member, Standing Committee on Names in Current Use; Vice-President Nomenclature Section XVII International Botanical Congress.

Professor Carrick Chambers (Honorary Research Associate)

Member, Research Committee of Australia and Pacific Science Foundation and also Pacific Science Foundation; Member, Griffin Reserves Advisory Committee for Willoughby City Council; Committee Member, Walter Burley Griffin Society Inc.

Dr Barry Conn

Editor, Handbooks of the Flora of Papua New Guinea; Member, Editor, 'HISPID - Herbarium Information Standards and Protocols for Interchange of Data', version 3; International Working Group on Taxonomic Databases for Plant Sciences; Member, Herbarium Information Systems Committee (HISCOM); Coordinator, Flora Malesiana Urticaceae Working Group.

Dr Tim Entwisle

Chair, NSW Biodiversity Research Network; Chair, Australian Systematic Botany Editorial Advisory Committee; Research Associate, School of Biological Sciences, The University of Sydney; Member, International Organising Committee for Eighth International Phycological Congress; Member, Australian Biological Resources Study Advisory Committee (Chair of Flora Subcommittee); Member, Australian Academy of Science National Committee for Plant and Animal Sciences; Member, NSW Agricultural Scientific Collections Trust; Scientific Program Coordinator, International Botanical Congress 2011 bid; Chair, Council of Heads of Australian Botanic Gardens; Judge, East Darling Harbour Sydney Urban Design Competition.

Ken Hill (Honorary Research Associate)
Member, Cycad Specialist Group, IUCN.

Peter Hind

Member, Management Committee, Vale of Avoca Recreational Reserve Trust; Leader, Society for Growing Australian Plants Fern Study Group.

Dr Surrey Jacobs

Member, Animal Care and Ethics Committee, Australian Museum; Member, State Wetlands Advisory Committee for implementing State Wetland Policy (whole of State policy).

Professor David Mabberley (Honorary Research Associate)

Member, Faculty of Natural Sciences, University of Leiden, The Netherlands; Honorary Director and member of Management Group, Joseph Banks Archive Project, Royal Society and The Natural History Museum, London; Council Member, International Association for Plant Taxonomy; Member, Editorial Board, *Journal of South Asian Natural History*.

Lyn McDougall

A Trustee, Katandra Bushland Sanctuary Trust

Bob Makinson

Member, Species Recovery Team for *Grevillea wilkinsonii*; Member, Goobarragandra Valley Reserves Trust (Crown Lands Trust under DLWC); Vice-president, Australian Network for Plant Conservation Inc.; Member, Wollemi Pine Conservation Management (Recovery) Team; Secretary, NSW Biodiversity Research Network

Adam Marchant

Council of the Workers' Educational Association (Sydney).

Tony Martin

Committee member, Microscopical Society of Australia.

Amelia Martyn

Member, International Society for Horticultural Science and Australian Society for Horticultural Science; Member, Australian Society of Plant Scientists; Member, Women In Science, Engineering and Technology Network.

Patricia Meagher

Member, Wollemi Conservation Management (Recovery) Team; Member, Greening Australia Technical Committee.

Peter Michael (Honorary Research Associate)

Member, National Trust Bush Management Committee.

Dr Alan Millar

Member, International Organising Committee, International Phycological Congresses; Member, Nominations Committee, International Phycological Society; Deputy Chair, NSW Fisheries Scientific Committee, Fisheries Management Act; Associate Editor, morphology and taxonomy – journal *Phycologia*; International Marine Experts Group; Research Associate of University of New South Wales; Algal Consultant for International Union for the Conservation of Nature (IUCN).

Cathy Offord

Member, Biological Diversity Advisory Council; Member, NSW Cut-flower Consultative Committee; Program Committee member, International Protea Conference, Melbourne, April 2004; Member, Wollemi Pine Conservation Management Committee, member, NSW Biodiversity Advisory Council (until termination of the committee in 2004 as part of the State TSC Act reforms).

Dr Maurizio Rossetto

Member, IUCN/SSC Reintroduction Specialist Group; Member, Fontainea oraria Recovery Team.

Dr Brett Summerell

Member, Council of Heads of Australian Herbaria; Member, Australian Museum, Research and Curation Advisory Committee; Member, International Society of Plant Pathology Committee on *Fusarium*; Vice-President, International Mycological Association. Member, Forest Health Advisory Committee, NSW Member, Organising Committee for International Mycological Congress 2006 Adjunct Professor, Faculty of Agriculture, Food and Natural Resources, University of Sydney

Dr Mary Tindale (Honorary Research Associate)

Member, Special Committee for Pteridophyta, International Association for Plant Taxonomy.

Dr Peter Weston

Member, Editorial Advisory Board, Kew Bulletin.

Karen Wilson

Convener, Global Plant Checklist Committee, International Organization for Plant Information; Council member, Linnean Society of New South Wales; Convener, Special Committee on Electronic Publishing, International Association for Plant Taxonomy; Co-Convener, Global Species Data Network Task Group, CODATA; Member, ICSU/CODATA ad hoc Group on Data and Information; Team member, Species 2000; Chair, Taxonomy Group, Species 2000; Vice-Chair (to Dec.), Member (from Dec.) Participant Node Managers Committee, GBIF; Member, Electronic Catalogue of Names of Known Organisms Subcommittee, GBIF; Member, Species 2000 Asia-Oceania Committee.

Dr Peter Wilson

Member, International Advisory Board, *Candollea* (Geneva) and *Boissiera*; Member, Committee on Suprageneric Names, International Association for Plant Taxonomy; Member, Committee of the Heads of Australian Herbaria *Consensus Census* Working Group.

Rusty Worsman

Member, Wollemi Pine Management and Recovery Committee.

Appendix C: RESEARCH GRANTS

FUNDING TO TRUST

The Australia & Pacific Science Foundation

Dr Adam Marchant and Dr George Orel - Genetic and horticultural assessment of the Australian native 'bush potato' (*Ipomoea costata*). \$11,000 (2nd year of a 3-year \$42,000 grant)

Australia Flora Foundation

Dr Adam Marchant, Dr George Orel, Gillian Towler, Andrew Perkins - Exploring the horticultural potential of native Australian flowering shrubs in the *Solanum brownii* Group \$3,500 (2nd year of a 3-year \$11,000 grant)

Australian Biological Resources Study

Dr Darren Crayn and Dr Maurizio Rossetto - A revision of *Tetratheca*, *Platytheca* and *Tremandra* and assessment of the phylogeny and biogeography of Tremandraceae & Elaeocarpaceae \$29,009

Dr Tim Entwisle and Dr Stephen Skinner - A Guide to Identification of benthic non-marine Cyanobacteria of Australia \$24,000

Dr Peter Wilson – Defining generic limits within the *Chamelaucium* alliance (Myrtaceae) \$38,000 (3rd year of 3-year \$118,000 grant)

Dr Peter Wilson and Dr Chris Quinn – Generic position of the non persistent-fruited species of *Leptospermum* (Myrtaceae) \$22,000

Dr Alan Millar - Phylogeny of the red algal genus *Laurencia* from the SW Pacific (NSW, LHI, Norfolk Is) \$9,710

Australian Systematic Botany Society – Hansjorg Eichler Research Fund

David Maynard for Honours project on *Elaeocarpus* sp. Rocky Creek \$1,000

Hannah McPherson for fieldwork funds for MSc project on *Tetratheca* \$1,000

Matthew Renner for PhD project on the Lejeuneaceae (Hepaticae) \$1,000

British Ecological Society & International Bracken Group

Prof John Thomson - conference travel - British Ecological Society Annual Meeting in Lancaster, UK, Sept 2004 \$2,125

Community Access to Natural Resources Information (CANRI)

Louisa Murray – HerbLink project: Electronically scanning herbarium collections from NSW \$57,000

Department of Environment and Conservation (DEC) Parks and Wildlife Division, Northern Zone

Dr Maurizio Rossetto - Population ecology and demographic monitoring of *Elaeocarpus*. sp. 'Rocky Creek' \$10,000

Department of Environment and Heritage – Natural Heritage Trust

John Benson - Vegetation Classification Project \$80,000

Department of Infrastructure, Planning and Natural Resources (DIPNR)

Dr Barry Conn and Barbara Wiecek – Plant Identification for native vegetation mapping \$50,000

Environmental Protection Agency (now part of Department of Environment and Planning)

Janelle Hatherly & Bob Makinson - Big Answers to Big Questions - public forums and Internet resources \$30,000 (2nd year of 2-year \$50,000 grant)

Global Biodiversity Information Facility (GBIF)

Dr Barry Conn - Repatriation of electronic data to the Papua New Guinea National Herbarium (Lae) \$36,454 (2nd part of a 12 month \$75,751 grant)

Hermon Slade Foundation

Dr Tim Entwisle and Dr Stephen Skinner - Survey of Macroalgae in the Gwydir and Border Rivers Catchments \$15,600

Dr Elizabeth Brown – Relationships of the Austral family Lepidoziaceae \$18,767 (delayed start – 2nd year of 3-year \$56,000 grant)

Edwin Wilson and Phil Spence – Establishment of a breeding and propagation program of *Latouria* type high-altitude hybrids of New Guinea dendrobiums \$20,000 (3rd year of 3-year \$61,550 grant)

Dr Darren Crayn & Dr Maurizio Rossetto – Evolution and conservation genetics of Australasian Eleocarpaceae \$29,490 (3rd year of 3-year \$90,000 grant)

Dr Alan Millar – Marine Benthic Algae and Invertebrates of Southern NSW \$9,000

Dr Cathy Offord - Storage of NSW rare and threatened NSW orchid species and their associated mycorrhizae \$30,000 (2nd year of a 3 year \$90,000 grant)

Hermon Slade Orchid Fund

Dr Cathy Offord – Development of symbiotic germination protocol for *Pterostylis saxicola*, and other orchid species \$3,500

Janet Cosh Fund

Dr Alan Millar and Katherine Downs - Databasing of W.H. Harvey's seaweed collection \$5,000

Hannah McPherson and Lucy Nairn – Databasing and curation of freshwater algae \$5,000

NSW State Government Enhancement

Dr Tim Entwisle – Australia's Virtual Herbarium \$400,000

Pacific Biological Foundation

Dr Barry Conn – Interactive identification keys to the common trees of PNG \$15,000 (3rd year of 3-year \$45,000 grant)

Scientific Research Fund (Botanic Gardens Trust)

Dr Elizabeth Brown and Margaret Hessewood - Relationships of the Austral family Lepidoziaceae \$3,600

Dr Alan Millar and Nick Yee - Collection of the monotypic, endemic, brown algal genus *Perisporochnus* from the Three Kings Islands, New Zealand - \$2,500

UK Millennium Commission

Seed Quest NSW partnership to supply 250 seedbank collections per year of threatened species of NSW \$240,000 (2nd year of 3-year \$730,000 grant)

FUNDING TO PARTNER ORGANISATIONS

Australian Biological Resources Study

A/Prof Paul Gadek, Dr Chris Quinn & Dr Judy West – Evolution and radiation of Australian hopbushes and allied genera. (2nd year of a 3 year grant to James Cook University).

Australian Centre for International Agricultural Research (ACIAR)

Dr Brett Summerell (with The University of Sydney) – Diagnosis and control of soil borne diseases in Indonesia \$133,333 (3rd year of 3-year \$400,000 grant to The University of Sydney)

Dr Brett Summerell (with The University of Sydney) – Diagnosis and control of soil borne diseases in Indonesia. Extension of existing grant above \$150,000 (1st year of 2-year \$300,000 grant to The University of Sydney)

Dr Brett Summerell (with The University of Sydney and Hanoi Agricultural University) - Development of provincial and district level diagnosis and control of crop fungal diseases in Vietnam \$166,000 (1st year of a 3 year \$500,000 grant to The University of Sydney)

Australian Research Council – Linkage (Australian Post Graduate Industry Award)

Dr Peter Weston (with The University of Western Australia, AGWEST, National Parks and Wildlife Service, Australian Museum, Botanic Gardens & Parks Authority) – A biological basis for efficient breeding of native plants for exports: Australian Goodeniaceae \$57,231 (3rd year of 3-year \$158,000 grant to the University of Western Australia)

Australian Research Council – Linkage

Dr Brett Summerell (with The University of Sydney) - Why does phosphite protect some plants against Phytophthora but not others? \$29,665 (2nd year of a 3 year \$88,604 grant to The University of Sydney, plus shared \$136,928)

Australian Research Council - Research Networks

Macquarie University (administrative body) along with RBGT and 40 other partners. Australian – New Zealand Research Network for vegetation function (sharing in \$2,500,000 over 5 years)

Grains Research & Development Corporation

Dr Brett Summerell(with Department Primary Industries, Qld); University of Sydney and EnTox - Managing Mycotoxin Contamination of Maize (3rd year of a 3-year \$226,000 grant to Department of Primary Industries, Qld)

European Commission

(Institute of Sciences of Food Production CNR, Cranfield University, International Institute of Tropical Agriculture, United States Department of Agriculture, Kansas State University, Royal Botanic Gardens and Domain Trust, The National University of Rio Cuarto, International Crops Research Institute for the semi-arid Tropics).

Integration of Mycotoxin and Toxigenic Fungi Research for Food Safety in Global System (euros\$300,000 in total, c. euros\$8,000 to Dr Brett Summerell for travel)

National Geographic Society

Origin and diversification of the austral genus *Dracophyllum* (Ericaceae) with funds going to Dr Darren Crayn in conjunction with S J Wagstaff, M I Dawson, F Venter, K L Lemson, D A Steane, J Munzinger (sharing in US\$ 20,000)

UNESCO; International Basic Sciences Programme

Dr Juli Hadiah (Centre for Plant Conservation, Bogor Botanic Gardens) & Dr Barry Conn (BGT) Diversity and Phylogeny of *Elatostema* (Urticaceae) of Thailand and Peninsula Malaysia. \$US70,000 = \$AUD91,525 over 2 years, around \$20,000 to BGT.

APPENDIX D: OVERSEAS TRAVEL JULY 2004 – JUNE 2005

Name & Position	Countries / Cities visited	Purpose of visit	Duration	Total Cost	Cost to Trust	Source of Funds
Mrs Karen Wilson, Special Botanist	University of Reading, UK	Participate in Species 2000 meeting	1 -2 July 2004	\$500	No cost	Species 2000
<i>*NB – this was reported in the 2003-2004 Annual Report already, as it tied in with travel that started in June</i>	Panama City, Panama	Participate in Species Plantarum meeting	14 – 16 July 2004	\$700	\$500	
Dr Brett Summerell, Acting Director Plant Sciences	Pretoria, South Africa	Teach and participate in workshop of fungal taxonomy.	23 September – 8 October 2004	\$5,000	No cost	University of Pretoria
Mrs Karen Wilson, Special Botanist	Wellington, New Zealand	Participate in international biodiversity meetings.	1 – 11 October 2004	\$2,100	\$500	Species 2000 / CODATA
Dr Barry Conn, Manager Plant Diversity	Christchurch, New Zealand	Participate in 2 meetings on the management and development of electronic data.	1 – 21 October 2004	\$3,600	No cost	Global Biodiversity Information Facility
Mr John Benson, Senior Plant Ecologist	Bangkok, Thailand	Attend the World Conservation Union's (IUCN) World Conservation Congress	14 – 24 November 2004	\$2,000	No cost	BGT Grant funds
Dr Brett Summerell, Acting Director Plant Sciences	Christchurch, New Zealand	Participate in the Council Heads of Australian Herbaria meeting.	20 – 23 October 2004	\$1,500	\$1,500	BGT recurrent budget

Name & Position	Countries / Cities visited	Purpose of visit	Duration	Total Cost	Cost to Trust	Source of Funds
Dr Barry Conn, Manager Plant Diversity and Dr Elizabeth Brown, Scientific officer	Lae and Morobe Province, Papua New Guinea	Collection of liverworts, and repatriation of biodiversity data to the PNG National Herbarium	6 – 20 November 2004	\$8,600	No cost	Personal funds; Pacific Biological Foundation, and Global Biodiversity Information Facility
Ms Amelia Martyn, Seed Research Officer and Ms Mishy McKensy, Seed Tchnology Officer	Kew, United Kingdom	Attend 'Conservation and Utilisation of Plant Genetic Resources' workshop and technical discussions at the Millennium Seed Bank	12 January – 4 February 2005	\$5,700	No cost	Millennium Seed Bank Kew
Ms Lucy Nairn, Herbarium Assistant	Birmingham, United Kingdom	Participate in the British Phycological Society Winter Meeting	5 – 7 January 2005	\$500	No cost	British Phycological Society, external grant funding
Dr Brett Summerell, Director Science and Public Programs	Bangkok, Thailand	Teach and participate in workshop on fungal taxonomy at the Department of Plant Pathology of Kasetsart University	21 – 31 January 2005	\$3,500	No cost	Department of Plant Pathology of Kasetsart University in Thailand
Dr Peter Wilson, Research Scientist	Kew, United Kingdom	Attend workshop on the family <i>Myrtaceae</i> at the Royal botanic Gardens, Kew	10 – 28 February 2005	\$2,957	No cost	Royal Botanic Gardens, Kew
Mrs Karen Wilson, Special Botanist	Malta	Participate in international biodiversity meetings in Malta	12 – 20 March 2005	\$3,800	\$500	Species 2000 / CODATA
Ms Lesley Elkan, Botanical Illustrator	London, United Kingdom	Receive Jill Smythies Award presented by the Linnean Society of London at their Anniversary Meeting	20 – 31 May 2005	\$4,000	No cost	Linnean Society of London

Name & Position	Countries / Cities visited	Purpose of visit	Duration	Total Cost	Cost to Trust	Source of Funds
Mrs Karen Wilson, Special Botanist	Brussels, Belgium	Participate in international biodiversity meetings.	16 – 23 April 2005	\$3,900	\$500	Global Biodiversity Information Facility and CODATA
Dr Brett Summerell, Director Science and Public Programs	Kansas, USA	Teach and participate in workshop on fungal taxonomy at Kansas State university	25 June – 5 July 2005	\$5,000	No cost	Kansas State University
Dr Barry Conn, Senior Research Scientist	Bogor, Indonesia	Lecture at 4 th National Training Course for Botanic Gardens Staff of Kebun Raya.	23 May – 6 June 2005	5500	no cost	Kebun Raya Botanic Garden, Indonesia
	Kepong, Malaysia	Participate in plant conservation seminar and workshop in Malaysia	27 June – 19 July 2005	5000	No cost	Friends of the Royal Botanic Gardens

Appendix E: COOPERATIVE RESEARCH

Chris Allen

- Sydney Harbour foreshore vegetation mapping 1:2,000 scale with Maritime.

Dr Alan Archer

- Chemotaxonomy of species of the lichen genus Graphidaceae with Prof. J.A. Elix of the Australian National University.

John Benson

- Classification and assessment of the status of the plant communities in New South Wales with New South Wales National Parks and Wildlife Service and Environment Australia.

Dr Barbara Briggs

- Phylogeny of Restionaceae with Dr H.P. Linder, Zurich University, Switzerland.
- Distribution of polyols in Proteaceae with Dr R.L. Bielecki, Horticulture and Food Research Institute of New Zealand Ltd.

Dr Elizabeth Brown

- Systematics of *Asterella* (Aytoniaceae) with Dr. C. Cargill, Centre for Plant Diversity, Canberra.
- Molecular Phylogeny and Systematics of *Fossombronia* in NSW with W. Cuddy, H. McPherson and with Dr. C. Cargill, Centre for Plant Diversity, Canberra.
- Systematics of *Epacris* (Epacridaceae) in New South Wales with Dr Y. Menadue, University of Tasmania.
- Reconstructing Phylogeny using epacrids as a case study with Dr P. Schols and Dr F. Lens, Institute of Botany and Microbiology, Leuven, Belgium.

Professor Carrick Chambers

- Classification and description of a new species of fern in the genus *Blechnum* recently collected in mountain areas near Mt Jaya in eastern Papua in collaboration with P. Edwards and R. Johns at the Royal Botanic Gardens Kew, England.

Dr Barry Conn

- Phylogeny of *Westringia* (Lamiaceae) with Dr R. de Koh, Royal Botanic Gardens, Kew, UK.

Dr Darren Crayn

- Systematics and the evolution of ecophysiological traits in Bromeliaceae and relatives with Prof. J. Andrew & C. Smith, University of Oxford, UK and Dr. K. Winter, Smithsonian Tropical Research Institute, Republic of Panama.
- Systematics, classification and evolution of the Ericaceae sens. lat. with Prof. K.A. Kron, Wake Forest University, NC, USA.
- Systematics and evolutionary dynamics of Elaeocarpaceae with Dr M. Rossetto and M. Coode, Royal Botanic Gardens, Kew, UK.
- Spatial analysis of taxonomic and genetic diversity in Australian Ericaceae with Dr S. Bickford, CSIRO, Canberra.
- Conservation genetics of the green and golden bell frog, *Litoria aurea* with E. Burns, University of New South Wales.

- Developing biogeographic know-how: Improving species divergence and dispersal estimations to examine geological and climatic evolutionary drivers, with Dr A. Lowe, University of Queensland, Dr Mike Pole, University of Queensland, Dr M. Rossetto, Prof D. Lambert, Massey University, Palmerston North, NZ, Dr. P. Hollingsworth,

Dr Tim Entwisle

- Molecular systematics, biology and biogeography of freshwater red algae with Dr M. Vis of Ohio University, USA.
- Ecology of stream macroalgae and bryophytes with Dr B. Downes of The University of Melbourne, Victoria.

Joy Everett and Dr Surrey Jacobs

- Continuing studies in the grass tribe Stipeae with the Stipoid Grasses Working Group, including Dr M. Barkworth, Utah State University, USA; Dr R. Bayer, CSIRO, Canberra; C. Hsiao, USDA, USA; Dr M. Arriaga, Buenos Aires; Dr A. Torres, Buenos Aires and Dr F. Vasquez, Spain.

Ken Hill

- Cycad nomenclature with Dr D. Stevenson, New York Botanical Garden, USA.
- The Cycad Pages Internet site with Dr D. Stevenson, New York Botanical Garden, USA.
- Taxonomy of Asian Cycads with Dr C.J. Chen, Beijing Herbarium, Beijing, China, Dr N.T. Hiep, Hanoi Herbarium, Hanoi, Vietnam and A. Lindstrom, Nong Nooch Tropical Garden, Sattahip, Thailand.
- Molecular Phylogeny of the Cycadophyta with M. Chase, Jodrell Laboratories, Royal Botanic Gardens Kew, UK and D.W. Stevenson, New York Botanical Garden, USA.

Dr Surrey Jacobs

- Macrophytes as indicators of stream health with G. Sainty, Sainty and Associates.
- Aponogetonaceae, Zosteraceae and Hydrocharitaceae with D. Les, University of Connecticut, USA.
- Nymphaeaceae with Dr T. Borsch, Germany, Khidir Hiln, Virginia, USA and C.B. Hellquist, North Adams, Massachusetts, USA.
- Chenopodiaceae with Dr. G. Kadereit, Prof. H. Freitag, Germany.

Professor David Mabberley

- Molecular systematics of Labiatae (Viticoideae, Teucroideae), with Dr. R.J.P. de Kok, CSIRO, Canberra, Dr D.L. Steane, Dept. Plant Science, University of Tasmania, Dr A. Paton, Royal Botanic Gardens, Kew, Dr S.J. Wagstaff and Dr R.G. Olmstead, University of Colorado.
- Revision of Labiatae of New Caledonia, with Dr R.J.P. de Kok, CSIRO, Canberra.
- Ecology and systematics of *Vitex* (Labiatae) in Sri Lanka with Dr B.M.P. Singhakumara, University of Jayawardanapura, Colombo.
- Systematics of Malesian Meliaceae, with Dr C.M. Pannell, Oxford, UK.
- Botany of red cedar, with John McPhee, Historic Houses Trust NSW.
- Revision of *Picrella* (Rutaceae) in New Caledonia, with T.G. Hartley, CSIRO, Canberra and Dr E. Soepadmo, FRIM, Keping Malaysia.
- Revision of *Grewia* in Madagascar with Prof. P. Morat, Natural History Museum, Paris.
- Study of Ferdinand Bauer's colour-code for plant illustration with Dr E. Pignatti-Wikus, Trieste and Dr C. Riedl-Dorn, Vienna.
- Nomenclature of Kauris with Timothy Waters, University of Oxford, UK.
- Effect of fire on Borneo Rainforests with Karl Eichhorn, University of Leiden, The Netherlands.
- *Iris* nomenclature with Dr P. Goldblatt, Missouri Botanic Garden, St. Louis, USA.

Bob Makinson

- Taxonomy of *Astrotricha* with M.J. Henwood, University of Sydney, monograph and Flora of Australia treatment.

Dr Adam Marchant

- Genetic and horticultural assessment of the Australian native “Bush Potato” (*Ipomoea costata*) with G. Orel, UWS; A. Hill, independent consultant; K. Courtenay, TAFE-WA Kimberley; Dr M. Henwood, University of Sydney; Assoc. Prof. P. Matthews, Museum of Ethnology, Osaka, Japan; Prof. Y.Sato, Research Institute for Humanities and Nature, Kyoto, Japan.
- Relationships of South Eastern Asian *Camellia* species, with G. Orel, UWS; Assoc. Prof. R. Spooner-Hart, UWS, Prof. G. Fuyang Research Institute of Sub-Tropical Forestry, China; R. Cherry, Proprietor, Paradise Plants wholesale nursery, Kulnura; J. Rob, Paradise Plants wholesale nursery, Kulnura; Dr J. McLeod, UWS; Prof. L. Legendre, Laboratoire de Biotechnologies Végétales appliquées aux Plantes Aromatiques et Médicinales, Université Jean Monnet, Saint Etienne, France;
- Relationship of Restionaceae Dr B. Briggs (BGT), Dr A. Perkins; Prof. P. Linder (Zurich), Dr C. Hardy (Millersville University, USA), Dr E. Sinclair, Murdoch University.
- Relationships within Australian Apiales Dr M. Henwood, University of Sydney; Dr A. Perkins, BGT and University of Sydney; P. Lu-Irving, recently graduated student of the University of Sydney.
- Molecular systematics in Cyperaceae Assoc. Prof. J. Bruhl, University of New England; K. Wilson, Botanic Gardens and Domain Trust; Dr K. Ghamkhar, Centre for Legumes in Mediterranean Agriculture, University of Western Australia; and other members internationally of the “Cyperaceae Phylogeny Group”
- Cultivar identification and genetics of essential oil production in Lavenders, with P. Stiles, President of Australian Lavender Industry, Dr J. McLeod, G. Orel, and Prof B. McGlasson, UWS, Prof. D. Leach, Southern Cross University, and Prof. L. Legendre, Laboratoire de Biotechnologies Végétales appliquées aux Plantes Aromatiques et Médicinales, Université Jean Monnet, Saint Etienne, France.
- Exploring the horticultural potential of native Australian flowering shrubs in the *Solanum brownii* Group with Dr A. Perkins, G. Towler, S. Bartlett, and G. Orel (UWS).
- Thesis advisor to John Hodgon, studying relationships within *Juncus*, under Ass. Prof. J. Bruhl (UNE) and Karen Wilson
- Thesis advisor to Robert Gibson (NSW Department of Infrastructure, Planning and Natural Resources), studying relationships within *Drosera*, under Ass. Prof. J. Bruhl (UNE) and Dr B. Conn
- Affinities of Juglandaceae species from South and Central America, and from South-East Asia with G. Orel, Dr. J. McLeod and G. Richards, UWS.
- Relationships among Southern Hemisphere *Basidiomycete* spp., with Dr B. Rees (UNSW).

Amelia Martyn and Cathy Offord

- Research on seed and embryo development and maternal effects for seed of NSW native plant species with Dr F. Hay and Dr R. Probert (Millennium Seed Bank, Royal Botanic Gardens Kew).
- Seed longevity studies for Australian species with Dr R. Probert (Millennium Seed Bank, Royal Botanic Gardens Kew) and Australian Millennium Seedbank partners.
- Recalcitrant seed storage and desiccation tolerance assessment with Dr C. Wood (Millennium Seed Bank Project of the Royal Botanic Gardens Kew); and Dr S. Ashmore and Ms A. Parisi, Griffith University, Qld.
- Germination and dormancy breaking for Australian species with Dr R. Probert and Dr J. Dickie (Millennium Seed Bank, Royal Botanic Gardens Kew) and Australian Millennium Seedbank partners.

Dr Alan Millar

- DNA research on Sporochneales with Nick Yee, and Dr G.T. Kraft, University of Melbourne and Dr Adam Marchant.
- Systematics of coralline algae of the east coast of Australia with Dr Wm J. Woelkerling, La Trobe University, Victoria.
- New Zealand representatives of the red algal family Delesseriaceae with Dr W. Nelson, Museum of New Zealand, Wellington.
- Marine floristics of East African coast with Prof. E. Coppejens and Dr O. De Clerck, University of Gent, Belgium.
- Molecular phylogeny of red algal order Gelidiales with Dr Wilson Freshwater, University of North Carolina.
- Marine algae of New Caledonia with Prof. C. Payri, University of French Polynesia and Dr W. Prud'homme van Reine (University of Leiden)
- Biogeographical similarities between South Africa and eastern Australia with Prof. J. Bolton (University of Cape Town).
- Invertebrate epifauna of macroalgae - with Dr G. Wilson and Dr D. Faith (Australian Museum)
- DNA research on the red algal genus *Laurencia* with Yola Metti and Prof. P. Steinberg (UNSW).

Dr Cathy Offord

- Reproductive biology and breeding of *Grevillea* with Dr P. Martin & Ms A. Freebairn of the University of Sydney.
- Bud anatomy of the Wollemi Pine with Dr G. Burrows, Charles Sturt University.
- Pollination and seed set in *Wollemia nobilis* (Araucariaceae) with Prof. N. Prakash, University of New England.
- Causes of bract browning in *Telopea* species with Dr R. McConchie and Ms A. Martyn, University of Sydney.
- Flannel flower development with Dr R. Worrall, Dr N. Wade and L. Tesoreiro, NSW Agriculture and Dr L. Campbell, University of Sydney
- Lipid characterization of Araucariaceae seeds with Dr C. Duke and Dr R. Duke, University of Sydney.

Dr Chris Quinn

- Systematics and biogeography of the Vittadinia group of Asteraea (Asteraceae) with Dr T.K. Lowrey, University of New Mexico, Albuquerque, USA.
- Molecular systematics of hobbushes and their allies (Sapindaceae) with A/Prof P.A. Gadek, James Cook University, Cairns.

Dr Helen Ramsay

- Bryaceae revision for the Flora of Australia vol 51.(2005) -with J. Spence, National Park Service, Page Arizona U.S.A.
- Sematophyllaceae revision for Australia (2002,2004) -published with W.B. Schofield, University of British Columbia, Vancouver, Canada and B.C. Tan, University of Singapore, Singapore.
- Distribution and phylogeography of the mosses of north-east Queensland (2004) - published with A. Cairns, James Cook University, Townsville, Qld

Dr Maurizio Rossetto

- Population and conservation genetics of three *Elaeocarpus* species (Elaeocarpaceae), with Prof. P. Baverstock, Southern Cross University and John Hunter, NSW NPWS.
- Phylogenetic studies on the Australian Vitaceae, with Assoc. Prof. B. Jackes, James Cook University.
- Population dynamics of two *Cissus* species (Vitaceae), with Dr C. Arnold University of Agricultural Sciences, Vienna.

- Evolutionary and ecological studies of *Trachymene* (Apiaceae), with Dr G. Wardle and Y. Davila, University of Sydney.
- Genetic diversity in fragmented populations of *Davidsonia* (Cunoniaceae), with Prof. R. Henry and F. Elliot, Southern Cross University.
- Patterns of microsatellite mutation in bush rats, with Prof. P. Baverstock and G. Hinten, Southern Cross University.
- Conservation genetics of the rare and endangered *Hakea pulvinifera* (Proteaceae), with Dr. C. Gross and J. Smith, University of New England.

John Siemon and Cathy Offord

- Germination and seed storage of NSW orchid species with Dr C. Wood (Millennium Seed Bank, Royal Botanic Gardens Kew, UK), Ms L. Darley (University of Western Sydney) and Australian Millennium Seedbank partners.

Dr Brett Summerell

- Ecology and taxonomy of *Fusarium* and related fungi, soilborne diseases of plants caused by fungi, and fungal diseases in Vietnam and Indonesia with Professor Lester Burgess, University of Sydney.
- Diseases in hydroponic systems with Dr Jane Tarran, University of Technology Sydney
- Genetics of *Fusarium* with Professor John Leslie, Kansas State University.
- Diseases of trees with Professor Michael Wingfield, FABI, University of Pretoria.
- Biosystematics of fungi on Proteaceae with Prof. Pedro Crous, CBS Netherlands & Dr Joanne Taylor, University of Botswana.
- Phytophthora root rot in NSW National Parks with Dr Keith McDougall from DEC.
- Biology and control of *Phytophthora* root rot with Professor David Guest, University of Sydney

Karen Wilson

- Systematic studies in Juncaceae with Dr J. Bruhl and Mr J. Hodgon.
- Polygonaceae for Flora of Australia with Bob Makinson and Mrs G. Perry, Western Australian Herbarium.
- Systematic studies in Abildgaardieae (Cyperaceae) with Assoc. Prof. J. Bruhl, Ms K. Clarke and Mr K. Ghamkhar, University of New England.
- Systematics of *Carpha* (Cyperaceae) with Assoc. Prof. J. Bruhl and Ms Xiufu Zhang, University of New England.
- Systematics of *Lepidosperma laterale* (Cyperaceae) with Assoc. Prof. J. Bruhl and Mr J. Hodgon, University of New England.
- Phylogenetic study of Casuarinaceae with Dr D. Steane, University of Tasmania and Prof R. Hill, University of Adelaide.

Dr Peter Wilson

- Molecular phylogeny and systematics of Myrtaceae with Prof. K.J. Sytsma, University of Wisconsin, Madison, USA.
- Systematics of the *Indigofera pratensis* complex with Dr A. Kazandjian, Dr M. Waycott and Adjunct Associate Professor B. Jackes, School of Tropical Biology, James Cook University, Townsville.
- Relationships and generic concepts in the *Chamelaucium* alliance, particularly *Baeckea* sens. lat. and *Micromyrtus*, with Dr B.L. Rye and Mr M. Trudgen, Western Australian Herbarium.
- Fossil fruit of Myrtaceae from the Eocene of South Australia with Dr J. Basinger, University of Saskatchewan, Canada; Dr David Greenwood, Brandon University, Manitoba, Canada; and Dr D. Christophel, University of Denver, Colorado, USA.
- Description of new species of *Haloragodendron* (Haloragaceae) from the Blue Mountains, with Dr M. Moody, University of Connecticut, USA (now at Indiana University)
- Description of new species of *Xanthostemon* (Myrtaceae) from the Solomon Islands, with F. Pitisopa, Solomon Islands Forestry Department.

Dr Peter Weston

- Systematics, biogeography and comparative biology of the Diurideae (Orchidaceae) with Dr M.A. Clements, CSIRO Division of Plant Industry, Dr M. Henwood and Dr A. Perkins, University of Sydney, Mr J. Indsto, Westmead Institute for Cancer Research, Dr J. Mant and Dr R. Peakall, Australian National University, Dr F. Schiestl (Geobotanical Institute ETH Zurich, Switzerland), Professor R. Whelan (University of Wollongong).
- Systematics, biogeography and comparative biology of the Mirbelieae-Bossiaee (Fabaceae) with Associate Professor M.D. Crisp, Australian National University, Mr J. Indsto, Westmead Institute for Cancer Research, Mr P.C. Jobson, University of Technology Sydney.
- Evolution of the breeding systems of relictual angiosperms with Associate Professor P. Bernhardt, Saint Louis University, Associate Professor J. Bruhl, University of New England, Dr T. Sage, University of Toronto, Dr H. Azuma, Kyoto University, Professor L.B. Thien, Tulane University.
- Phylogeny of the Goodeniaceae with Dr Siegfried Krauss, Kings Park and Botanic Garden, Perth.

APPENDIX F: PLANT SCIENCES PUBLICATIONS

Archer, A.W. (2004) Additional synonymy in the Australian Graphidaceae. *Australasian Lichenology* 55: 16-17.

Archer, A.W. (2005) Australian species in the genus *Diorygma*. *Australasian Lichenology* 56: 10-11.

Archer, A.W. (2004) Additions to the lichen flora of Fiji and Vanuatu based on Graphidaceae in the F.R.M. Wilson collection at the National Herbarium of New South Wales. *Telopea* 10(4): 771-767

Briggs, B.G. & Johnson, L.A.S. (2004) New combinations in *Chordifex* (Restionaceae) from eastern Australia and new species from Western Australia *Telopea* 10(3): 683-700.

Conn, B.J., Brown, E.B., Fairley, A.T. (2004) *Utricularia sandersonii* (Lentibulariaceae), a new record for Australia. *Telopea* 10(4): 811-814.

Entwisle, T.J. and Weston P.H. (2005) Majority rules, when systematists disagree. *Australian Systematic Botany* 18(1): 1-6.

Harden, G.J., Fox, M.D. and Fox, B.J. (2004) Monitoring and assessment of restoration of a rainforest remnant at Wingham Brush, NSW. *Austral Ecology* 29: 489-507.

Hill K.D., Nguyen, H.T. & Phan, L.K. (2004) The genus *Cycas* (Cycadaceae) in Vietnam. *The Botanical Review*. 70(2):134-193

Hill, K.D., Stevenson, D.W & Osborne, R.O. (2004) The world list of cycads. *The Botanical Review* 70(2):274-298.

- Hill, K.D.**, (2004) An analysis of morphological characters used in classification of the Cycadaceae. In Lindstrom, A.J. (ed.), *The Biology, Structure & Systematics of the Cycadales*, Proc. of the Sixth International Conference on Cycad Biology, Thailand, 29 July - 3 Aug, 2002, pp 6-29.
- Hill, K.D.**, Stevenson, D.W & Osborne, R.O. (2004) The world list of cycads. In Lindstrom, A.J. (ed.), *The Biology, Structure & Systematics of the Cycadales*, Proc. of the Sixth International Conference on Cycad Biology, Thailand, 29 July - 3 Aug, 2002, pp. 195-212.
- Hill, K.D.**, (2005) Diversity and evolution of gymnosperms, in *Plant Diversity and Evolution - Genotypic and Phenotypic Variation in Higher Plants*, ed. R.J. Henry (CABI Publishing, Wallingford UK)
- Horton, B.M., **Crayn, D.M.**, Clarke, S.W. and Washington, H. (2004) *Leionema scopulinum* (Rutaceae), a new species from Wollemi National Park. *Telopea* 10(4): 815-822.
- Hosking J.R., **Conn, B.J.** & Lepschi, B.J. (2004) Plant species first recognised as naturalised for New South Wales over the period 2000-2001. *Cunninghamia* 8: 175-187.
- Indsto, J.O., **Weston, P.H.**, Clements, M.A., Whelan, R.J. (2005) Highly sensitive DNA fingerprinting of orchid pollinaria remnants using AFLP. *Australian Systematic Botany* 18(3):
- Jacobs, S.W.L.** (2004) The tribe Triodieae (Chloridoideae: Gramineae) *Telopea* 10(3): 701-704 .
- Jacobs, S.W.L.** (2004) A new combination in *Lachnagrostis* (Gramineae) *Telopea* 10(4): 939.
- Jacobs, S.W.L.** (2004) Lectotypification of *Alisma oligococcum* F.Mell. (Alismataceae). *Telopea* 10(4): 840.
- Jordan, G.J., Dillon, R.A. & **Weston, P.H.** (2005) Solar radiation as a factor in the evolution of scleromorphic leaf anatomy in Proteaceae. *American Journal of Botany* 92: 789–796.
- Kadereit, G., Gotzek, D., **Jacobs, S.**, & Freitag, H. (2005) Origin and age of Australian Chenopodiaceae. *Organisms, Diversity & Evolution* 5: 59-80.
- Les, D.H., Moody, M.L. & **Jacobs, S.W.L.** (2005) Phylogeny and systematics of *Aponogeton* (Aponogetonaceae): the Australian species. *Systematic Botany* 30: (3) 503-519.
- Lucas, E.J., Belsham, S.R., Nic Lughadha, E.M., Orlovich, D.A., Sakuragui, C.M., Chase, M.W., and **Wilson, P.G.** (2005) Phylogenetic patterns in the fleshy fruited Myrtaceae – preliminary molecular evidence. *Plant Systematics and Evolution* 251: 35-51.
- Mabberley D.J.** & Stuessy, T.F (2004). Editorial. *Taxon* 53: 1-2
- Mabberley D.J.** (2004) More French 'firsts' ignored: Dumont de Courset's Le Botaniste Cultivateur. *Taxon* 53: 187-192
- Mabberley** (2004 with D. DIXON) Proposal to reject the name *Ficus novae-valliae* Dum. Cours. (Moraceae). *Taxon* 53: 208
- Mabberley** (2004) Proposal to reject the name *Fraxinus tetragona* Dum. Cours. (Oleaceae). *Taxon* 53: 209
- Mabberley D.J.** (2004) Taxonomy. Pp. 1599-1602 in *Life Sciences Encyclopedia* vol. 12. London
- Mabberley D.J.** (2004) Robert Brown 200: Introduction. *Telopea* 10: 497-498
- Mabberley & Ramon** (2004) The ecological status of the carob-tree (*Ceratonia siliqua* L., Leguminosae) in the Mediterranean. *Bot. J. Linn. Soc.* 144: 431-436

Mabberley D.J. (2004) European discovery, classification and naming. Pp. 23-41, 108-110 in V. Sripathy (ed.), *Red Cedar in Australia*. Historic Houses Trust of New South Wales, Sydney [see also *Insites Autumn 2004*: cover, 2-4]

Mabberley D.J. (2004) Foreword. Pp. 9-10 in M.F. Large & J.E. Braggins, *Tree-ferns*. Timber Press, Portland, Oregon & Cambridge, UK

Mabberley D.J. (2004) Ferdinand Bauer, John Joseph Bennett, John Carne Bidwill, Robert Brown, Patricia Bury, William Griffith, Francis Hamilton, William Herbert, William Jack, Aylmer Bourke Lambert, Richard Anthony Salisbury. Var. pp. in *Dictionary of Nineteenth-Century British Scientists*. Thoemmes, Bristol

Mabberley D.J. (2004) A key to *Dysoxylum* (Meliaceae) in Australia, with a description of a new species from Far North Queensland. *Telopea* 10: 725-29

Mabberley D.J. (2004) Foreword. Pp. v-vi in W. [illus.W.T. Cooper], *Fruits of the Australian tropical rainforest*. Nokomis, Melbourne

Mabberley D.J. (2004 with R.P.J. de KOK) Labiatae. *Flore de la Nouvelle-Calédonie et Dépendances* 15: 20-141

Mabberley D.J. (2004) Vitaceae. *Flore de la Nouvelle-Calédonie et Dépendances* 15: 142-152.

Mabberley D.J. (2004) *Citrus* (Rutaceae): a review of recent advances in etymology, systematics and medical applications. *Blumea* 49: 481- 498

Mabberley D.J. (2005) Director's Notes. *Urban Hort.* Spring 2005: 16

Mabberley D.J. & Goldblatt P. (2005) *P. Belamcanda* Adanson included in *Iris* Linnaeus, and the new combination, *I. domestica* (Linnaeus) Goldblatt & Mabberley (Iridaceae: Irideae). *Novon* 15: 128-132

Mabberley, D.J. (2004) Foreword. Pp. 3-4 in D. Moore, *The Botanist William Curtis (1746-1799) and St Mary's Battersea*. St Mary's Church, Battersea, London.

Mabberley, D.J. (2004) William Aiton, William Townsend Aiton, Alexander Anderson, Valentine Bartholomew, Robert Brown, Priscilla Bury, Arthur Harry Church, Edred John Henry Corner, James Cunninghame, Johann Jakob Dillenius, Peter Good, Mary Harrison, Arthur Henfrey, Robert ('Robin') Hill, John Hope, James Naesmyth, David Nelson, George Sherriff, [with D. Evans], Walter Stiles, Sydney Vines, Edmund Warbung, Richard Warner, Edward Wilson. *Oxford Dictionary of National Biography*. Oxford University Press. Pp. 54

Martyn, A., Offord, C. and McConchie, R. (2004). Can shading reduce bract browning in waratahs? *Journal of the International Protea Association* 46 (April): 34-36.

Kraft, G.T. and **Millar, A.J.K.** (2005). *Struvea thoracoides* (Cladophorales), a new deep-water chlorophyte from the Great Barrier Reef and New Caledonia. *Phycologia* 44: 305-311.

Millar, A.J.K. & Freshwater D.W. (2005) Morphology and molecular phylogeny of marine algal order Gelidiales (Rhodophyta) from New South Wales, including Lord Howe Island and Norfolk Island. *Australian Systematic Botany* 18: 215-263

Neumann, M.J., Backhouse, D., Carter, D.A., **Summerell, B.A.** and Burgess, L.W. (2004) Genetic structure of populations of *Fusarium proliferatum* in soils associated with *Livistona mariae* palms in Little Palm Creek, Northern Territory Australia. *Australian Journal of Botany* 52(4): 543-550.

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SCIENTIFIC PUBLICATIONS AVAILABLE FOR SALE

SCIENCE

Telopea (a journal of systematic research) and **Cunninghamia** (a journal of plant ecology for eastern Australia) are published by the Gardens in March and September (Telopea) and July and December (Cunninghamia). They are available from the Gardens Shops or by

subscription, or on exchange to other organisations. Copies of most back issues are still available for sale from the Gardens Shop in Sydney.

Setting the Scene: the Native Vegetation of NSW (1999) by J.S. Benson, published by the Native Vegetation Advisory Council. \$8.75.

The nature of pre-European native vegetation in south-eastern Australia: a critique of Ryan, D.G., J.R. and Starr, B.J. (1995) The Australian Landscape — Observations of Explorers and Early Settlers (1997) by J.S. Benson & P.A. Redpath, offprint from *Cunninghamia* 5(2): 285-329, \$5.50.

Collection, Preparation and Preservation of Plant Specimens (Royal Botanic Gardens Sydney 2nd edition, 1995) \$6.85.

Riverside Plants of the Hawkesbury*Nepean by J. Howell, L. McDougall & D. Benson (Royal Botanic Gardens Sydney, 1995) \$10.95.

Rare Bushland Plants of Western Sydney (1999) Revised edition, by Teresa James, Lyn McDougall and Doug Benson (Royal Botanic Gardens Sydney) \$13.15.

Sydney's Bushland: More than meets the eye by J. Howell & D. Benson (Royal Botanic Gardens Sydney, 2000) \$27.95

Mountain Devil to Mangrove: a Guide to Natural Vegetation of the Hawkesbury*Nepean Catchment by D. Benson, J. Howell and L. McDougall (Royal Botanic Gardens Sydney, 1996) \$21.95.

Missing Jigsaw Pieces: the Bushland Plants of the Cooks River Valley by D. Benson, D. Ondinea & V. Bear (Royal Botanic Gardens Sydney, 1999) \$13.15.

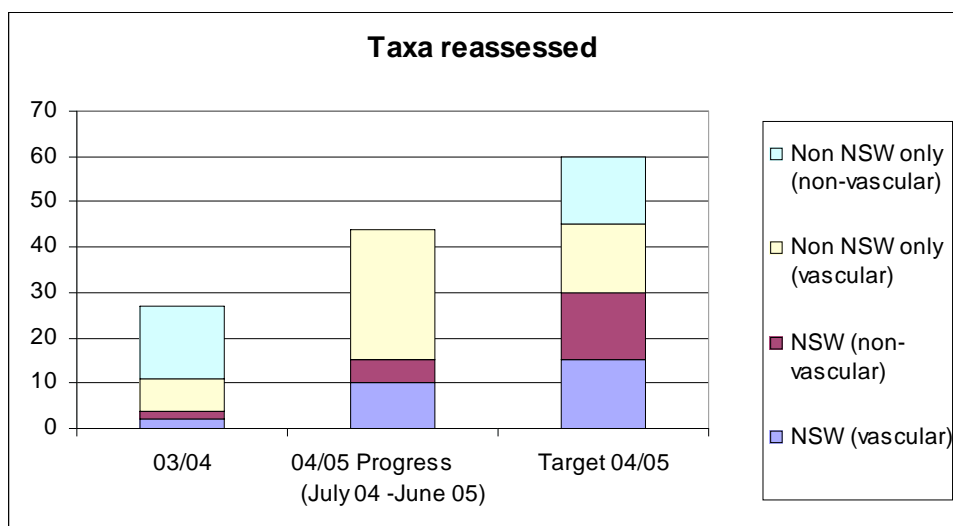
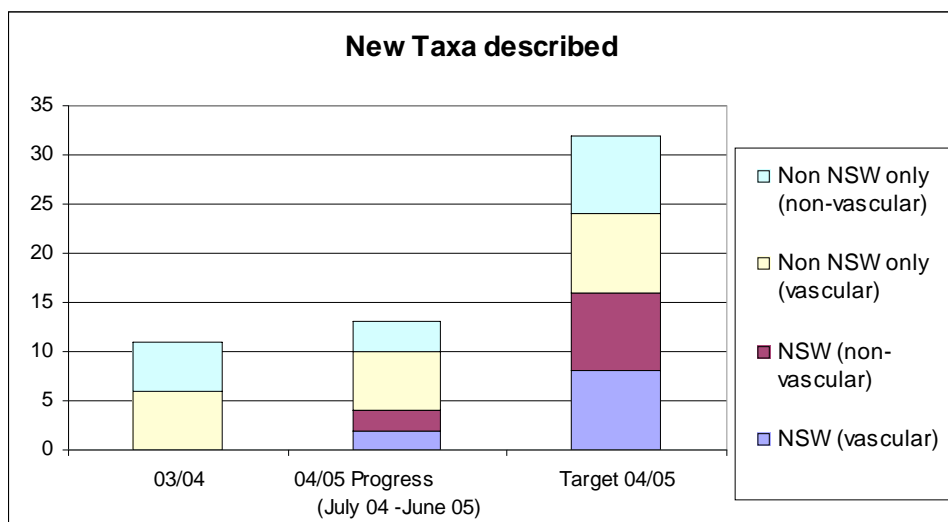
EDUCATION

Bush Foods of New South Wales by Kathy Stewart and Bob Percival. Aboriginal use of plants (Royal Botanic Gardens Sydney, 1996) \$9.90

Appendix G: PERFORMANCE INDICATORS

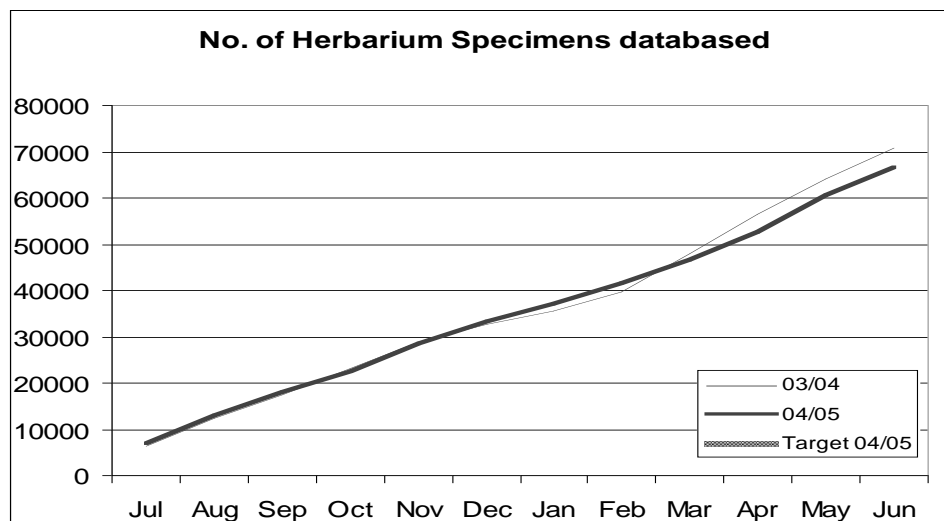
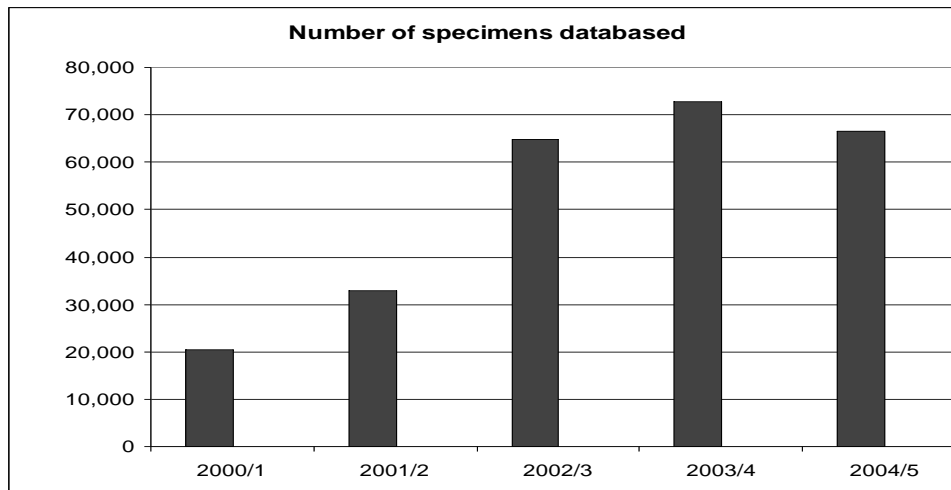
New taxa described or reassessed

There were 14 new species described by Trust scientists, an increase on the previous year but still below the target set for this year. This target is an inspirational one given that much of the discovery of new species is incidental and cannot be planned. A number of projects focused on the documentation of new species, especially non-vascular plants; algae and fungi have a large number of species still to be formally described.

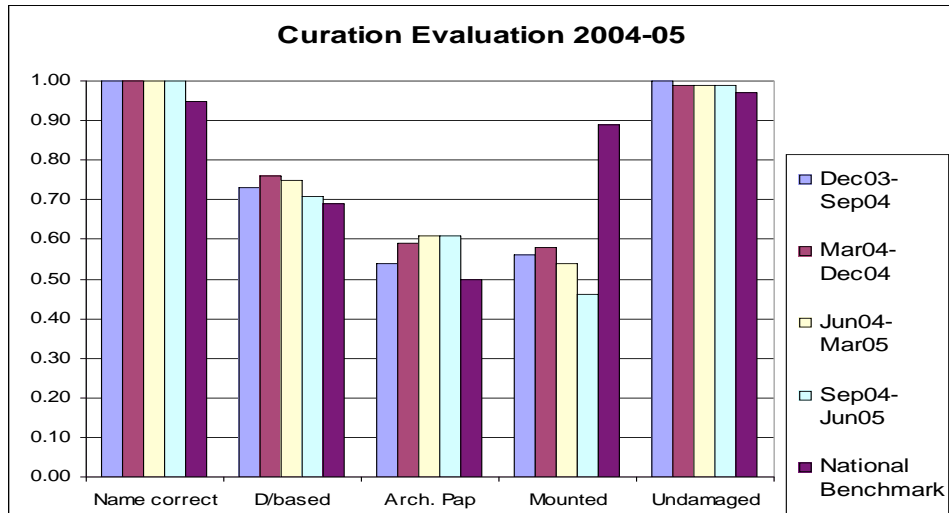


Databasing and Curation evaluation

Databasing continued at a very high level largely thanks to the Australia's Virtual Herbarium project. Due to a number of issues with continuity in staffing the number of specimens databased was just below the target for 2004/5.

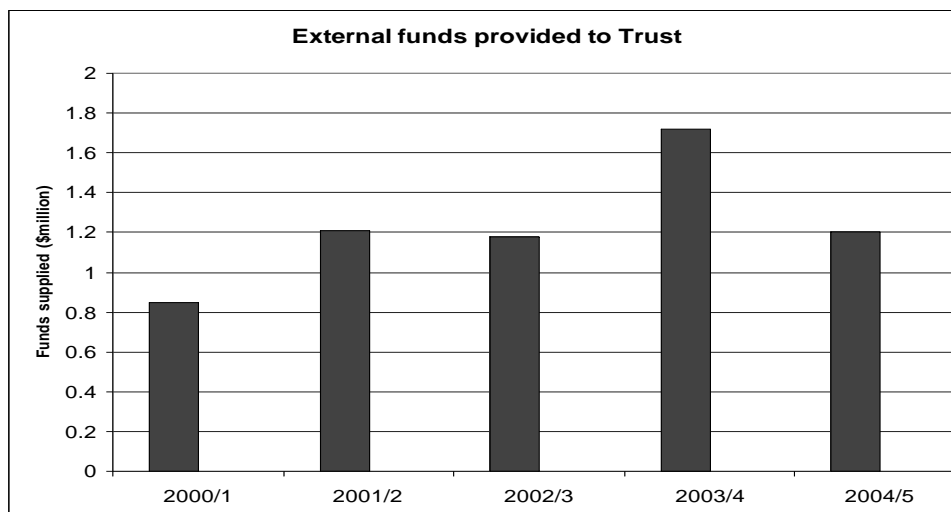
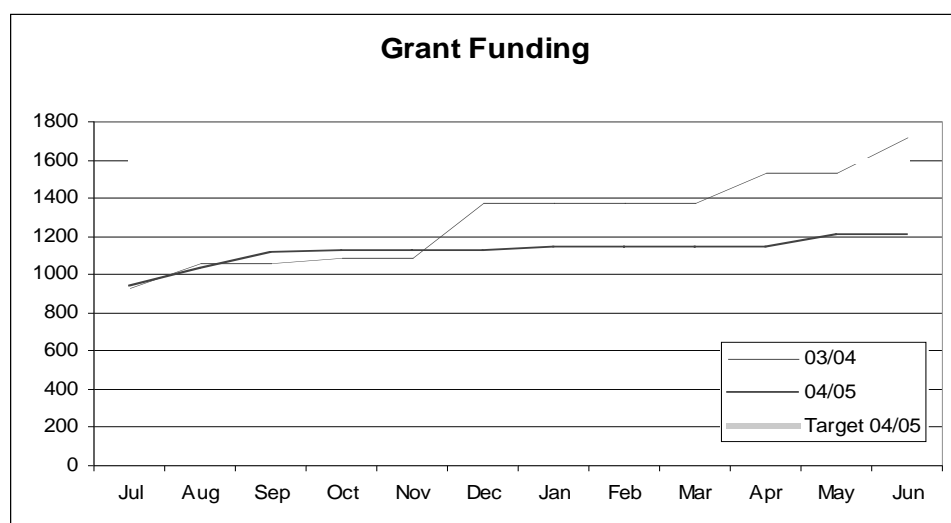
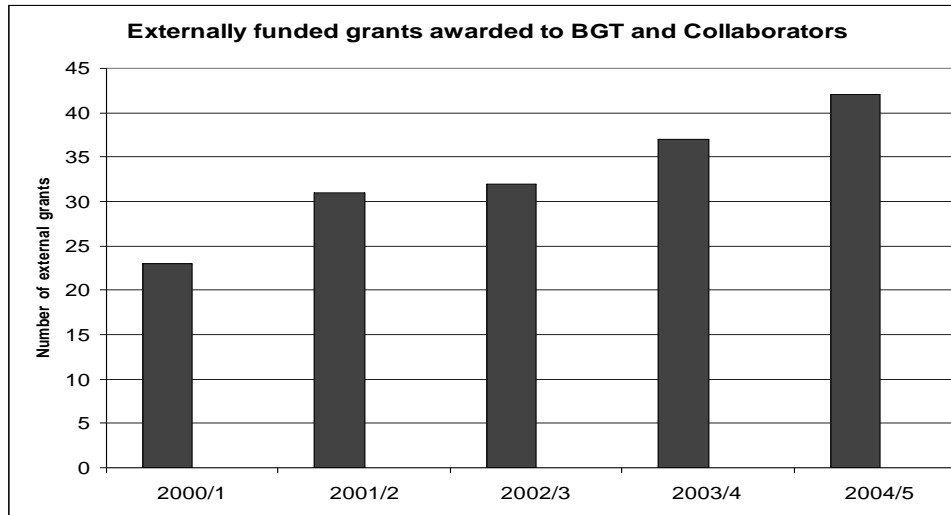


Curation of herbarium specimens in the National Herbarium of NSW in most cases meet or exceed the national benchmark for Australian herbarium. The exception is for mounting of specimens where there are still a large number of specimens unmounted in the collection. This reflects the age and large volume of the Trusts collection. Our mounting program, staffed by volunteers, continues to make significant inroads into mounting the collection, especially new accessions. Note the year-to-year fluctuations are due to inadequacies in the current sampling techniques.



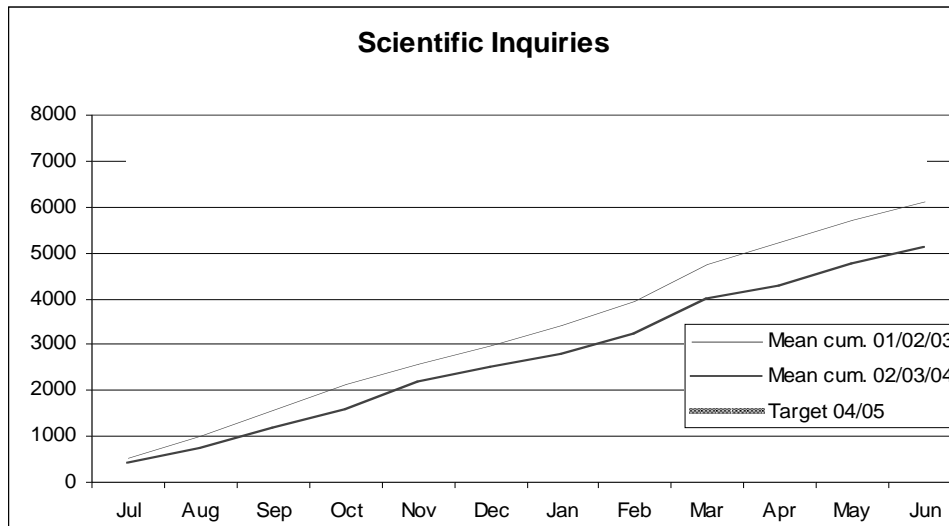
Grant Funding

Although some significant larger grants finished this year, there was a pleasing continuation of the increase in the number of grants from previous years. While the total value was less this year, their long term trend (data not provided) is still positive. Note that this includes grants awarded directly to BGT as well as those awarded to other institutions where Trust staff are co-investigators.

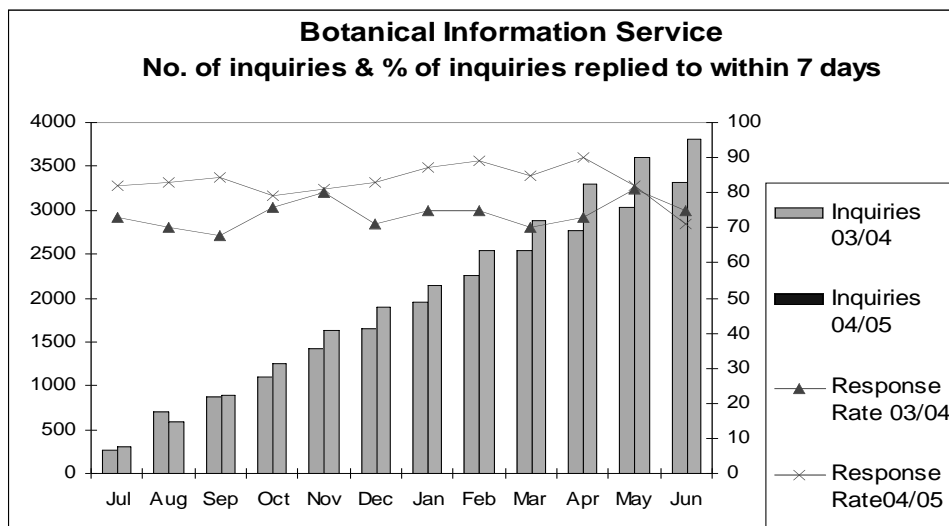


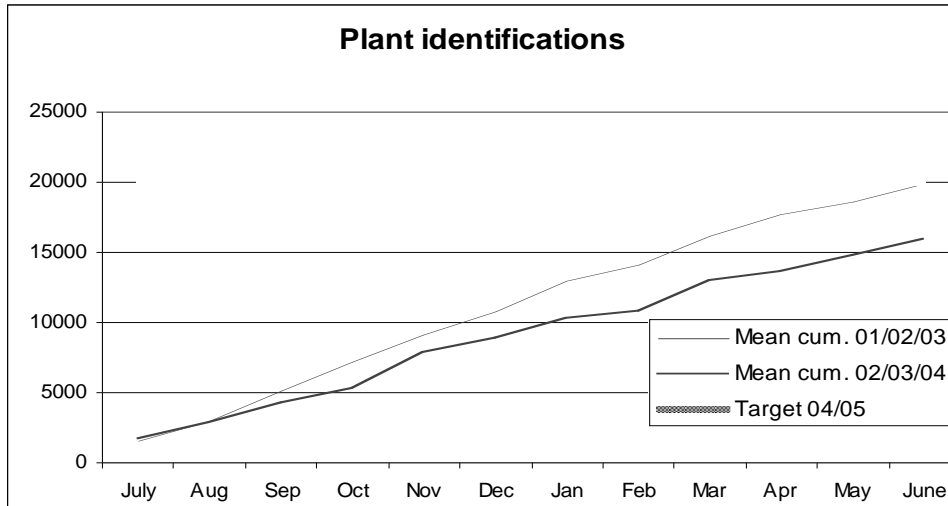
Scientific Inquiries

The majority of scientific inquiries are directed through either the Botanical Information Service or the Plant Disease Diagnostic Unit. However all members of the scientific staff receive a variety of inquiries dealing with their own area of expertise. In addition our internet information portal, PlantNET, elicits a variety of inquiries.

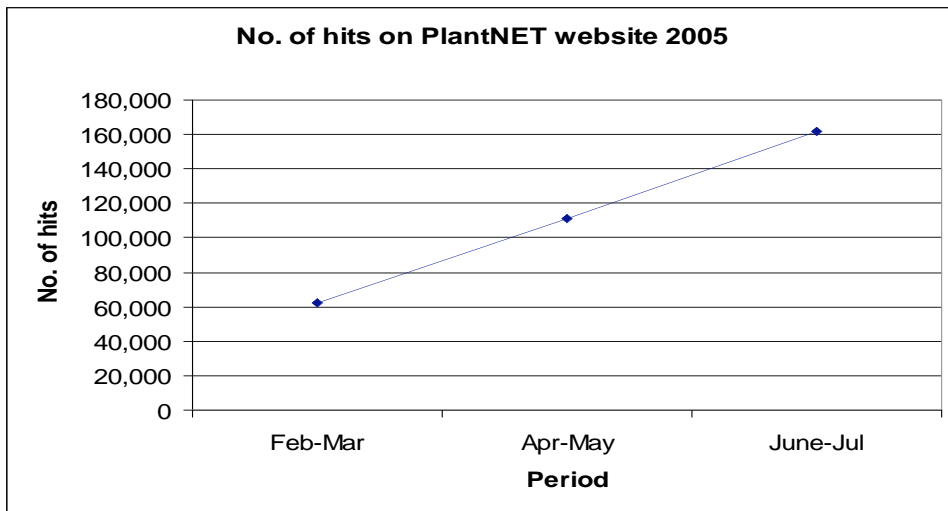


Botanical Information Service - The Trust's target for service delivery was 70% of Inquiries to be answered within 7 days. This target was met in 2004/05 and was above the response rate for last year in all months.



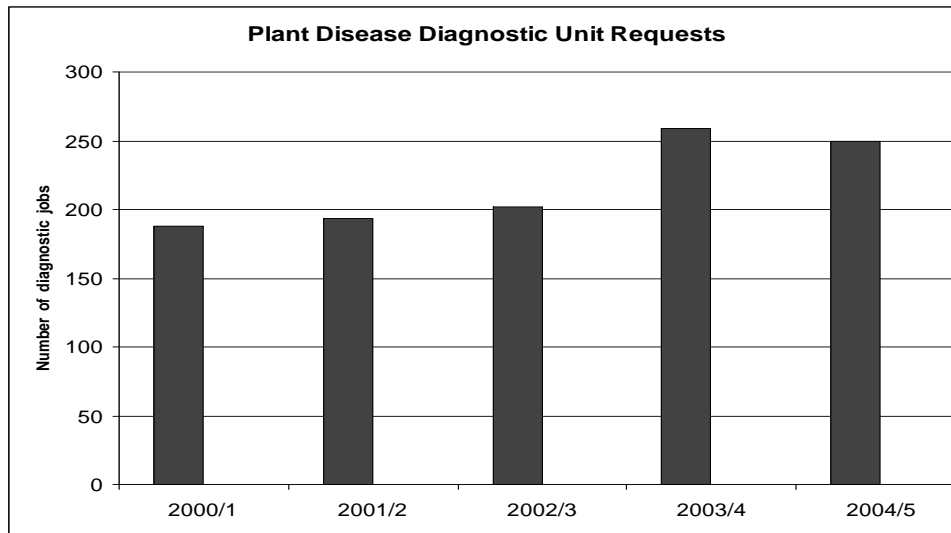


PlantNET, including the NSW Flora On-line website, is the Trust's on-line plant information service. Patronage continues to grow. It has been available to a limited extent in previous years but was formally launched early in 2004-05.



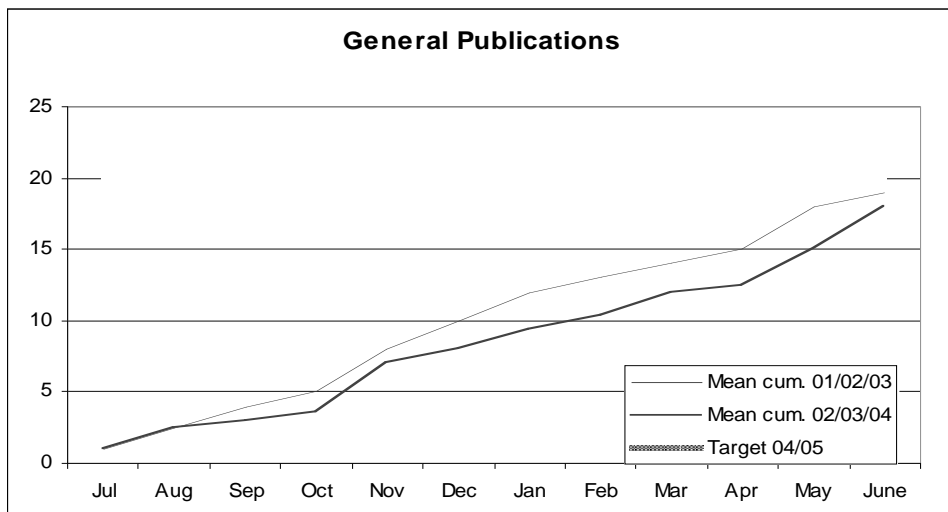
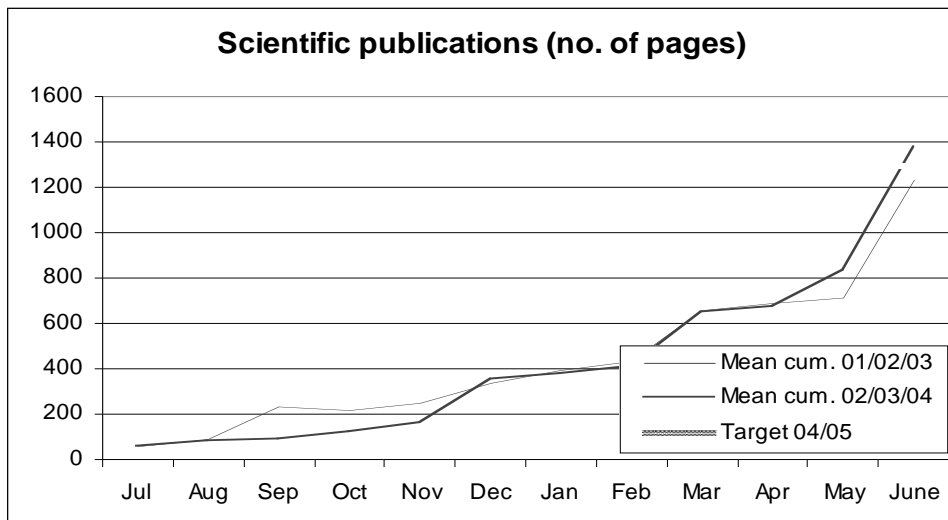
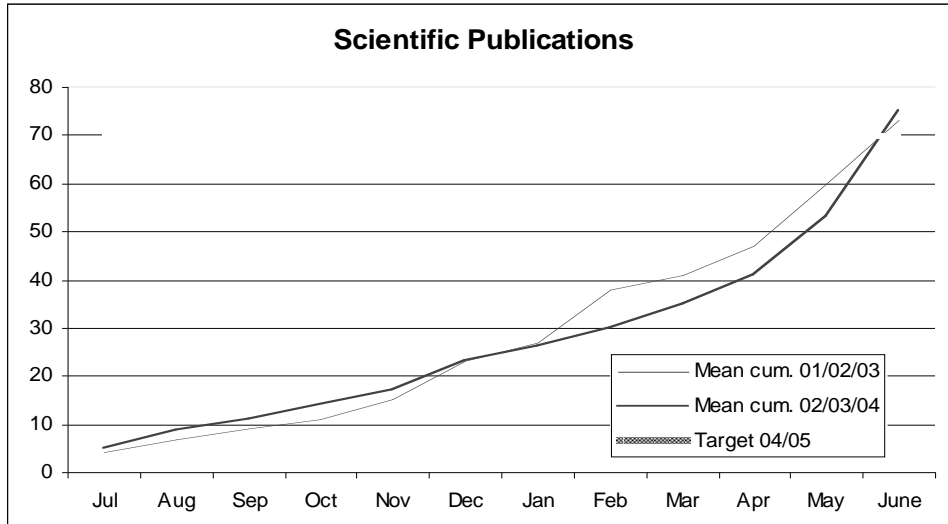
Plant Disease Diagnostic Unit

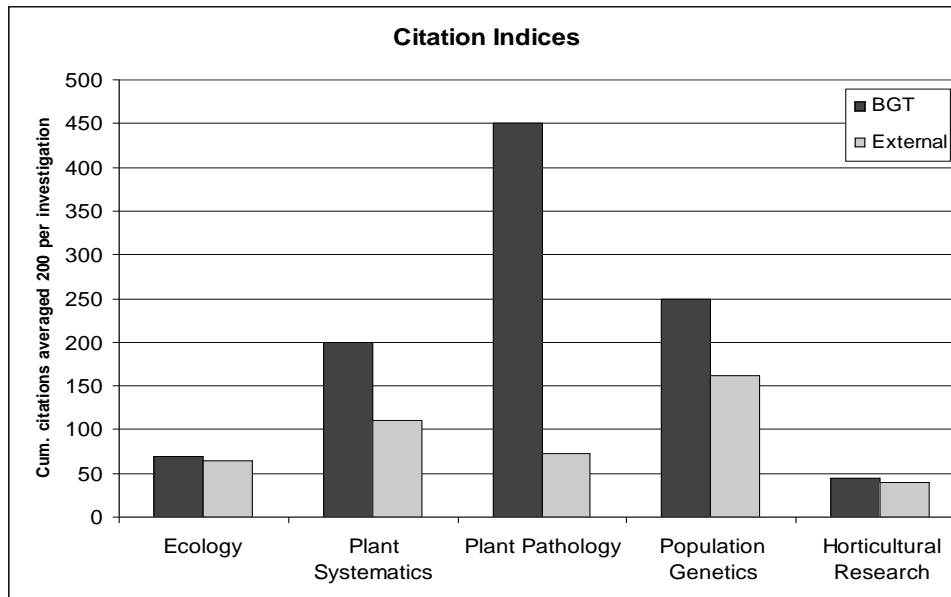
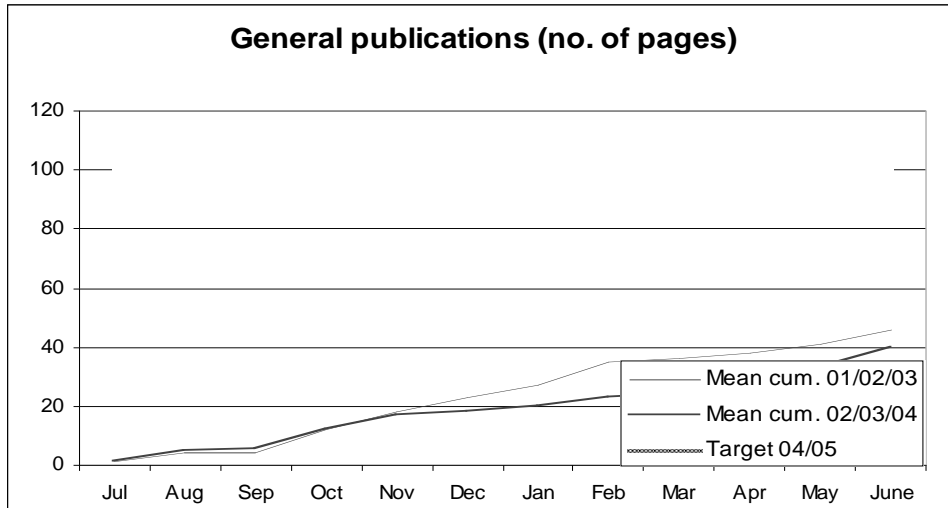
The number of requests for diagnosis at the PDDU was maintained at the high level achieved in 2003-04. Most diagnoses were for detection of soil borne pathogens.



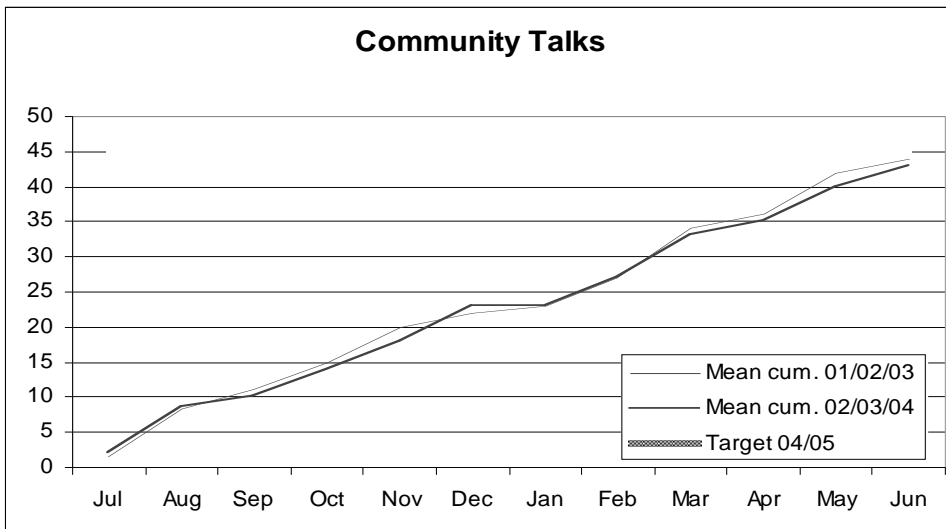
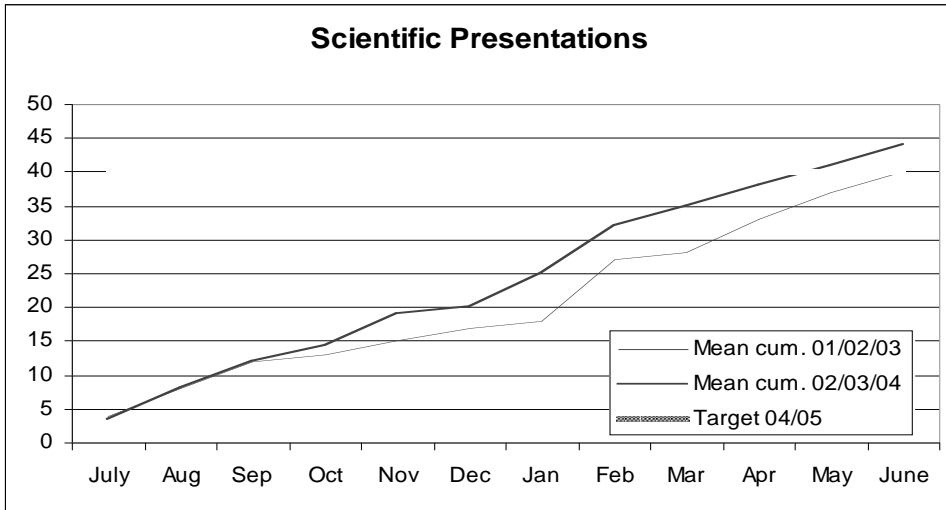
Publications, presentations and students supervised

The Trust's goal is to publish a mix of papers for general and scientific audiences, with a target of 20 papers per year for general audiences and 70 for scientific audiences (averaged over the last three years). This 3-year cycle, the Trust was slightly under target for this indicator, and above for the next.





This graph compares the number of times scientific papers by groups of our researchers are cited in international journals with a comparative group of researchers from other Australian institutions. Note that this is not the complete number of times papers have been cited as the International Scientific Index does not collate information from all journals.



The 57 students supervised this year maintains the high level of student supervision built up over the last five years. This is close to the capacity for supervision with existing staff levels.

