

Director's

SUMMARY 2013

OUR VALUES

Through leadership, integrity, service, innovation and team-building, these values and beliefs guide our actions:

- We are committed to providing leadership in research and through such efforts be an exemplar for others
- We are dedicated to best practice in all our endeavours
- We are resolved to produce in a timely manner innovative and relevant outputs
- We are pledged to seek better ways and better science
- We value a collaborative, engaging, caring approach to team-building.

OUR VISION

To make the Australian Tropical Herbarium a leader in tropical plant biodiversity research, that conducts diverse, relevant and innovative research; converts that research into useful products; offers training, inspiration and engagement with the community; and, by collaborating with others, achieves a greater understanding of sustainable tropical systems.

RESEARCH PARTNERS

The Board, staff, students and associates of the Australian Tropical Herbarium thank the following funding partners for helping support our research.

Australian Biological Research Study (ABRS)
Australian Government Caring for our Country Program (CfoC)
Australian Centre for International Agricultural Research (ACIAR)
Australian Orchid Foundation (AOF)
Australian Research Council (ARC)
Australian Systematic Botany Society (ASBS)
BHP Billiton Cannington Community Fund
Biodiversity and Climate Research Centre (BiK-F), Frankfurt, Germany
CSIRO Summer Student Program
Conservation International (CI), Critical Ecosystem Partnership Fund
Daintree Rainforest Observatory (DRO)
Flora Malesiana Foundation

German Academic Exchange Service (DAAD)
German Research Foundation
Griffith University/James Cook University Collaborative Grants Scheme
JCU Centre for Tropical Biodiversity and Climate Change (CTBCC)
JCU Centre for Tropical Environmental Sustainability Science (TESS)
JCU Faculty of Science and Engineering (FSE)
National Environmental Research Program (NERP)
The Nature Conservancy (TNC)
North Queensland Wildlife Trust (NQWT)
Queensland Government Dept. Environmental Heritage Protection (EHP)
Queensland Parks and Wildlife Service (QPWS)
Skyrail Rainforest Foundation (SRF)
Wet Tropics Management Authority (WTMA)
World Wildlife Fund (WWF)
Grants to ATH personnel in 2013 totalled \$546,000.

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ATH Staff and students. Back row (l-r) Kaylene Bransgrove, Frank Zich, Janani Jayanthan, Melissa Harrison, Andrew Thornhill, Stuart Worboys, Katharina Schulte, Ashley Field, Gerry Turpin. Front row (l-r): Eda Addicott, Andrea Lim, Darren Crayn. Absent: Sook-Ngoh Phoon, Yumiko Baba, Gary Wilson, Craig Costion, Lalita Simpson, Mark Newton, Sandra Abell-Davis, Tony Page.

FROM THE DIRECTOR

As Director of the Australian Tropical Herbarium, it is satisfying to reflect on the activities and achievements of the organisation over 2013. We enjoyed a successful year characterised by solid growth in several key result areas and the achievement of all milestones and performance targets.

A highlight of 2013 was Gerry Turpin's winning of the Deadly Award for Indigenous Scientist or Science Project of the Year. This prestigious award honours Gerry's contribution to ethnobotanical research and science engagement in tropical Australia. The Tropical Indigenous Ethnobotany Centre (TIEC) continues to build momentum through Gerry's activities.

Our research program continues to diversify while retaining a core focus on plant systematics and biodiversity studies. Income to the ATH from competitive external grants remains strong and research outputs of consistently high quality continue to increase in number year on year. We believe this is due in part to our commitment to building and maintaining effective research partnerships – being good collaborative partners is what drives us.

For research to have impact it must be accessible. ATH staff deliver the fruits of our research to end-users in government and the community through a number

of initiatives including the Tropical Indigenous Ethnobotany Centre, the Regional Ecosystem mapping program, the Plant Identification Workshops, and the award-winning 'Rainforest Key'. Other ways in which we engage including roles on various external advisory committees and boards and through contracted research activities. We continue to strive to find new and better ways to deliver our science and ensure it has impact, such as the proposed Australian Savanna Plant Information System (ASPIS).

Since establishment in 2008 we have delivered strongly on our agenda, testament to the dedication and talent of our staff, students and associates. At the close of the sixth and penultimate year of operation under the current joint venture agreement, the ATH is looking forward to a renewed agreement and continuing to develop our research, training and outreach programs.

It is my great pleasure to present this sixth annual Director's Summary report. I hope you enjoy reading it.



Prof. Darren Crayn
Director, Australian Tropical Herbarium



INTRODUCTION

The Australian Tropical Herbarium (ATH) is a joint venture of the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Director National Parks (DNP), Queensland Department of Science, Information Technology, Innovation and the Arts (DSITIA), and James Cook University (JCU). The ATH's activities are overseen by the ATH Board comprising representatives of the three main participants (CSIRO, JCU, DSITIA), the Director, and an independent chair. The ATH is physically located within the Australian Tropical Forest Institute (ATFI) building on the Cairns campus of JCU, and administratively is part of JCU's Faculty of Science and Engineering (FSE).

The Sir Robert Norman Building (housing ATFI and the ATH) was completed in November 2007 and movement of the MBA and QRS collections was completed by the start of February 2008. The building was officially opened by The Hon. Anna Bligh, Premier of Queensland on 4 March 2008, and the inaugural Director commenced duty on 31 March 2008, the Operational Date of ATH.

The ATH boasts state-of-the-art facilities and infrastructure for specimen processing, photography, pest and climate control, and field, Herbarium and laboratory research. The main activity is management of the more than 170,000 plant specimens that comprise the CNS collection, a merger of the collections (and staff) of the Australian National Herbarium – Atherton (QRS), the Queensland Herbarium – Mareeba (MBA) and part of the JCU Herbarium collection (JCT) to form an unsurpassed representative collection of north Queensland's flora. Research at the Australian Tropical Herbarium is undertaken on the following themes:

THEME 1 – BIODIVERSITY, TAXONOMY, EVOLUTION

Assessment of tropical plant and fungal biodiversity through systematics and evolutionary studies, including taxonomy, biology, biogeography, ecology, and genetics;

THEME 2 – THREATS AND IMPACTS

Impacts of fragmentation, degradation, weeds and threatening processes on tropical flora, such as exploring genetics and reproductive strategies of environmental weeds leading to improved control strategies, and exploring ecophysiology and quantitative genetics in understanding climate change impacts;

THEME 3 – PLANTS FOR PEOPLE

Documenting traditional uses of tropical plants and fungi (ethnobotany), and innovative utilisation of tropical plant and fungal resources, such as biodiscovery and bioprospecting, novel crops and commercialisation;

THEME 4 – PLANNING AND MANAGEMENT

Planning and management of tropical flora, biodiversity and ecosystems;

THEME 5 – UNLOCKING OUR KNOWLEDGE

Developing more effective ways to deliver research outputs to the community including training and capacity-building.

2013 HIGHLIGHTS

Media: The ATH received considerable media coverage during 2013 including 15 print or online media articles, 4 radio interviews and TV coverage of the "Deadly Awards".

Publications: 18 scientific papers and 4 general articles were published, and 2 research student theses were submitted.

Presentations: 55 research talks were presented to scientific audiences, and 6 to community audiences.

Research grants income: \$546,000 in external competitive research grant income was received.

Postgraduate students: Dr Caroline Puente-Lelievre was awarded her PhD in 2013 (JCU, "Systematics and biogeography of the Styphelieae (Epacridoideae, Ericaceae)"; supervised by **Darren Crayn**, Elizabeth Brown, Mark Harrington, and **Paul Gadek**).



Gerry Turpin, ethnobotanist was honoured with the Deadly Award for Scientist or Science Project of the Year. This is the first time the 'Deadlys' (or the National Aboriginal and Torres Strait Islander Music, Sport, Entertainment and Community Awards) have included an award for a scientist or science project.

The award, sponsored by CSIRO, recognises Turpin's role in establishing the Tropical Indigenous Ethnobotany Centre – a partnership between Traditional Owners, the ATH, The Cairns Institute at James Cook University, CSIRO, and the Queensland Government.



ATH Board members: (L-R) Dr Greg Leach (Chair), Prof Andrew Young, Dr Christine Williams, Prof Jeffrey Loughran, Dr Judy West, Prof Paul Gadek.

GOVERNANCE

BOARD

The ATH Board oversees the operations of the ATH and sets overall strategic management policy and objectives. The Board comprises two representatives of each of the Participants (CSIRO, DSITIA, JCU), the Director, and an independent Chairperson. The Board meets twice per year, in April and October.

At December 31, 2013, ATH Board members were:

- Dr Greg Leach (Independent Chairperson)
- Prof Paul Gadek (JCU)
- Dr Gordon Guymmer (DSITIA)
- Prof Jeff Loughran (JCU)
- Dr Judy West (CSIRO)
- Dr Christine Williams (DSITIA)
- Prof Andrew Young (CSIRO)
- Prof Darren Crayn (Director)

ATH DIRECTOR

The ATH Director oversees the day-to-day operations of the ATH including managing staff and volunteers, developing and directing the Research Program as approved by the Board, promoting the ATH, developing and maintaining strategic external partnerships, and working to meet the agreed ATH Key Performance Indicator targets. The Director is also required to maintain a significant personal research program.

The Director reports to the Pro-Vice Chancellor (Science and Engineering) and to the ATH Board.

Hon. Ian Walker visits ATH.



SERVICE

RAINFOREST PLANT IDENTIFICATION WORKSHOPS

The ATH in partnership with the Wet Tropics Management Authority delivers a series of workshop-style courses covering the skills needed to identify both native and weedy plant species in the rainforests of the Wet Tropics. The courses are suitable for a broad range of users, including environmental professionals, rangers, students and interested public. The courses are hands-on, with participants visiting local rainforests to put into practice their classroom learning.

In 2013 three workshops were delivered: a specialist course for environmental staff at the Department of Transport and Main Roads in Cairns; introductory and advanced modules in Cairns (general public) and introductory and advanced modules in Paluma (general public).

SCIENTIFIC ENQUIRIES

A total of **162** scientific enquiries (excluding identifications) were answered by ATH staff.

IDENTIFICATIONS

A total of **360** plant identifications were performed by ATH staff for the general public.

VISITORS

During 2013, **204 people** visited the ATH for non-scientific reasons, many of whom were part of group tours.

DIGNITARIES

- The Hon. Ian Walker MP (Queensland Minister for Science, Information Technology, Innovation and the Arts); and
- Dr Albert Schram (Vice Chancellor, UNITECH, PNG) and Larry Orsak (UNITECH, PNG).

REPRESENTATIVE ROLES (EXTERNAL)

ATH staff served the scientific and broader community at local, national and international levels through roles on twenty-two professional and community committees.

5th International Orchid Conservation Congress, La Réunion (France) Organising Committee (**Micheneau C**)

Australasian Mycological Society (AMS), treasurer (**Abell-Davis S**)

Australasian Systematic Botany Society (ASBS), Treasurer (**Zich F**)

Australasian Systematic Botany Society, Chapter convener, Cairns (**Schulte K**)

Australian Systematic Botany journal, Editorial Board (**Crayn D**)

Australian Barcode of Life Network Steering Committee (**Crayn D**)

Australian Biological Resources Study Advisory Committee, Chair, Research Committee (**Crayn D**)

Australian Orchid Foundation Research Committee (**Crayn D**)

Cairns and Far North Environment Centre (CAFNEC) Management Committee (**Worboys S**)

Cost Action FA1103 Endophytes in Agriculture and Biotechnology (**Abell-Davis S**)

Council of Heads of Australasian Herbaria, member of the Executive, CNS member (**Crayn D**)

Daintree Rainforest Observatory Scientific Committee (**Crayn D**)

Friends of the Botanic Gardens, Cairns, Patron (**Wilson G**)

Fungimap Australia (**Abell-Davis S**)

Indigenous Contact Officer for Cape York (Weeds) (**Turpin G**)

IUCN Carnivorous Plants Working Group (**Wilson G**)

Managers of Australasian Herbarium Collections (MAHC) (**Zich F**)

National Environmental Research Program, Tropical Ecosystems Hub, Rainforest Implementation Group (**Crayn D**)

Plant Species Biology journal, International Organization of Plant Biosystematists Board (**Gadek P**)

Society for Growing Australian Plants, Cairns Branch, Newsletter Editor and Treasurer (**Worboys S**)

Society of Australian Systematic Biologists, Secretary (**Thornhill A**)

Wet Tropics Management Authority Scientific Advisory Committee (**Crayn D, Turpin G**)

REVIEWING AND REFEREEING

During 2013 ATH staff reviewed or refereed 11 international journal manuscripts, 30 grant proposals, 2 books, and 4 theses.

MEDIA

Media coverage of ATH activities during 2013 included 7 print, 8 online media articles, 4 radio interviews and TV coverage of the "Deadly Awards".

Sandra Abell-Davis 'Fears for tiny marsupial with a taste for truffles. Bettong forest alert' appeared in the Townsville Bulletin 13/11/13 regarding a possible decline in the northern bettong which may relate to a loss of biodiversity of native truffle species and potential impacts on sclerophyll forest ecosystem function.

Darren Crayn NERP project "Genetic Diversity of the Wet Tropics rainforest – key to effective conservation" was featured in the Wet Tropics Management Authority (WTMA) eBulletin (14 May 2013); "Back stage pass to the world of Banks" in WTMA – *Wet Tropics Guide Network eNews* (July 2013).

John Dowe "Palms reach milestone" Townsville Palmetum celebrated its 25th birthday, *Townsville Sun* 18 Sep 2013.

Gerry Turpin was honoured with the inaugural 'Deadly Award for Scientist or Science Project of the Year' which received considerable media coverage in print, online and on radio including two articles in the Cairns Post, three in various newsletters, the Awards ceremony broadcast on SBS TV, and two radio interviews (*ABC Radio Torres Strait* and *Radio National*). Other related media included "Work to preserve tradition spreads" *Cairns Post* 12 Sep 2013; "Gerry wins a Deadlys" *DSITIA staff newsletter*; "The Deadlys 2013 – Inaugural Prize for Science", *Remote Indigenous News* Sep 2013; "Congratulations to a Deadly Scientist", JCU website; "Tropical champion – Deadly Awards winner – Gerry Turpin Ethnobotanist", Growing our Futures newsletter, 28 Oct 2013.

JCU student Megan Grixti's rediscovery of a rare moss. "Megan finds holy grail of moss" and "Moss mystery – Julatten local finds super rare species, key to a centuries old question", *Port Douglas and Mossman Gazette*, 17 Oct 2013; "Mystery moss rediscovered", JCU website.

Katharina Schulte, Darren Crayn and **Craig Costion** featured in the Cairns Post (12 Sept 2013) "JCU trio delving into plant DNA for fast ID".

David Tng featured in the Wet Tropics Management Authority (WTMA) eBulletin (14 May 2013) "David Tng's big trees".

WEBSITE

The ATH website (www.ath.org.au) received 207,173 hits and 34,089 visits in 2013. These numbers are 14.3% and 3.6% higher than those for 2012, indicating increased interest in the website.

SOCIAL MEDIA

In late 2013 the ATH Facebook page was launched - <https://www.facebook.com/tropicalherbarium>

FACILITIES

HERBARIUM

The ATH collection, a fully databased and representative archive of preserved plant specimens that supports the ATH's research and botanical information delivery programs, is comprised of:

- c. 170,000 specimens that are pressed, dried and mounted on herbarium sheets held in the Collection Room
- c. 16,000 specimens that are preserved in 70% ethanol held in the Spirit Room
- c. 2500 wood blocks

Over 1,800 new herbarium specimens were accessioned, 4,003 collection records were edited and 2,142 specimens were re-identified in 2013. Maintenance of up-to-date plant nomenclature, specimen processing times, herbarium service delivery (such as specimen loans) and collection hygiene (free from insect and fungal pests) exceeded agreed benchmarks.

PUBLIC REFERENCE COLLECTION (PRC)

The Public Reference Collection contains an expanding collection of north Queensland native plants and weeds now totalling 3,769 specimens and 2,528 taxa. It is open for use by the general public during normal business hours. In 2013, usage totalled 80 hours by 43 external users.

LIBRARY

The ATH library collection contains over 500 titles, including all the major serials on the taxonomy of plants relevant to tropical Australia.



Kaylene Bransgrove examining a fungal culture.



Water fern (*Azolla pinnata*) and water lily.



CSIRO summer student Sarah Mannel and Dr. Katharina Schulte.

LABORATORY

The ATH maintains a state of the art molecular genetics lab capable of supporting a wide range of DNA-based biodiversity and evolutionary research methods including sequence analysis and genotyping using a range of techniques from AFLPs to microsatellite analysis. Users during 2013 included seven ATH research staff, numerous visiting researchers and students (both international and local), one summer research student, two lab volunteers, and eleven PhD students.

DNA/TISSUE BANK

Research on plant genetics at the ATH is underpinned by our collections of DNA samples and frozen tissue representing the great majority of vascular plant genera present in the wet rainforests of North Queensland, and significant representation of the non-rainforest flora. Holdings currently consist of over 6750 samples (755 of which were added during 2013). We continue to build on our collections with the main strategic focus being on achieving representative coverage of all northern Australian biomes.

RESEARCH

Research undertaken at the Australian Tropical Herbarium falls under five themes. These themes and the research projects within them are detailed on the following pages.

THEME 1 – BIODIVERSITY, TAXONOMY, EVOLUTION

Assessment of tropical plant and fungal biodiversity through systematic and evolutionary studies, including taxonomy, biology, biogeography, ecology, and genetics of tropical plants and fungi.

RE-EVALUATION OF TAXONOMIC CONCEPTS IN AUSTRALIAN ORCHIDACEAE BASED ON MOLECULAR PHYLOGENETIC EVIDENCE

Team: Katharina Schulte, Claire Micheneau, Agustina Arobaya, Sarah Mannel (CSIRO Summer Student), Darren Crayn, Mark Clements (CANBR), Joe Miller (CANBR), Peter Weston (Botanic Garden Trust, Sydney)

Background: This project aims to rigorously re-evaluate highly controversial taxonomic concepts in Australian Orchidaceae based on multi-locus molecular phylogenetic evidence. DNA barcodes and highly informative nuclear markers are used to reconstruct comprehensive phylogenies, infer character evolution and historical biogeography, and develop molecular identification tools for conservation and legislative enforcement. This research is supported by an Australian Biological Resources Study BushBlitz grant, the Skyrail Rainforest Foundation, the CSIRO student summer student program, a JCU FSE Faculty grant, and the National Environmental Research Program (NERP).

Research Outputs: Publications: Jersáková et al. (2013a), Simo-Droissart et al. (2013a). **Presentations:** Arobaya (2013), Arobaya et al. (2013a, b, c, d, e), Edwards et al. (2013), Jersáková et al. (2013b), Micheneau et al. (2013a, b, c), Stevart et al. (2013).

2013 Achievements: Field work was undertaken in diverse locations across the Australian Wet Tropics and Cape York Peninsula, and in Manokwari, West Papua (Indonesia). Over 2,300 complete orchid DNA barcodes have been produced and draft phylogenies have been obtained for several groups, including Australasian *Dendrobium*, Australasian *Bulbophyllum*, and the genus *Calochilus*. These have provided detailed insights into the systematics of these groups and their spatio-temporal and morphological evolution.

Development of a next-generation sequencing pipeline for large-scale phylogenetic datasets continued. Once established, this will allow larger datasets to be generated at lower cost.

PHYLOGEOGRAPHY OF ORCHID SPECIES COMPLEXES OF THE AUSTRALIAN WET TROPICS

Team: Lalita Simpson, Katharina Schulte, Claire Micheneau, Mark Clements (CANBR), Keith MacDonald (DSITIA), Marcia Goetze (Universidade Federal Rio Grande do Sul), Ashley Field, Darren Crayn

Background: This project aims to provide important insights into phylogenetic relationships of closely related orchid taxa of the Australian Wet Tropics and to unravel their biogeographic history in the context of Cenozoic climate change. The project will increase our understanding of patterns of morphological variation within species complexes and will provide insights into the role of past climate changes for the diversification of these groups. Thus, it will help to improve taxon delimitation and conservation management. This project is externally funded by an Australian Biological Resources Study BushBlitz grant, the Australian Orchid Foundation, the Eichler Research Fund (Australian Systematic Botany Society), Wet Tropics Management Authority student grant, Australian Conservation Taxonomy Grant (The Nature Conservancy and the Thomas Foundation) and the National Environmental Research Program (NERP).

Research Outputs: Presentations: Schulte (2013), Schulte and Micheneau (2013a,b), Schulte et al. (2013a, b, c), Simpson (2013b), Simpson et al. (2013a, b, c, d, e). **Thesis:** Simpson (2013a).

2013 Achievements: Numerous samples were collected during fieldwork across Wet Tropics mountaintops and Cape York Peninsula. In particular, extensive sampling of the Cooktown orchid across its range was completed and genetic profiles obtained for over 120 samples.

Studies on the phylogeography of the *Dendrobium speciosum* complex completed including a new component modelling the species' distribution under future climate scenarios. A publication on this work is in preparation.

ORIGINS OF THE WET TROPICS FLORA – A MOLECULAR PHYLOGENETIC PERSPECTIVE

Team: Darren Crayn, Craig Costion, Andrew Thornhill, various collaborators on specific clades.

Background: Published molecular phylogenies exist from many lineages with members in the Australian tropical flora. This study aims to gap-fill these phylogenies with missing Australian taxa and use them to generate general explanations about the tempo and direction of evolution of Australia's tropical rainforest flora: which elements of the extant rainforest flora are derived from Gondwanan stock (relictual taxa) that have differentiated in situ, which are the invasive elements, and where (and when) have they come from?

2013 Achievements: Datasets for 20 published studies were re-compiled. Work proceeded on adding taxa for which data became available after the original studies were published. Datasets for northern Australia, New Guinea and New Caledonia have been developed, together containing over 3200 species. Analysis of these large datasets will require supercomputer time.

PHYLOGENETICS AND EVOLUTIONARY DYNAMICS OF ELAEOCARPACEAE

Team: Yumiko Baba, Sook-Ngoh Phoon, Darren Crayn, Katharina Schulte, Maurizio Rossetto (National Herbarium of NSW), Mark Coode (Kew Gardens, UK).

Background: Molecular phylogenetic and biogeographic work is clarifying the origins and patterns of diversification among lineages within the Elaeocarpaceae/Tremandraceae complex. Within the phylogenetic framework, we are analysing population-level genetic and morphological diversity in selected species in order to provide an insight into taxon boundaries, comparative evolutionary responses and speciation mechanisms in dry-adapted shrubs and rainforest tree species. This research is supported by the Australian Biological Resources Study, and the Skyrail Rainforest Foundation.

Research Outputs: General Publications (unrefereed): Phoon (2013a, 2013b). **Presentations:** Niisalo et al. (2013), Phoon and Crayn (2013a, 2013b), Phoon et al. (2013a, 2013b).

2013 Achievements: Compilation and analysis of a 4-locus molecular dataset has resolved the relationships of all of the genera in Elaeocarpaceae, and provided insights into the relationships among over 120 species of *Elaeocarpus*. Morphological and population genetics work on one of the difficult species groups – the *E. obovatus* group – has resolved the question of how many species there are and the relationships among them. Similar work on a problematic group of Asian species confirmed the accuracy of the existing taxonomy.

PhD student Yumiko Baba submitted her PhD thesis, and PhD student Sook-Ngoh Phoon won 'Best Poster' awards at two conferences.

MACROFUNGI OF NORTHEAST QUEENSLAND

Team: Sandra Abell, Kaylene Bransgrove, David Largent (Humboldt University, California), Sarah Bergemann, Kerri Kluting, Griffin Cummings (MTSU, Tennessee) and various collaborators.

Background: Fungi are one of the most diverse and species-rich groups of life yet are understudied worldwide, and especially in far north Queensland. This project aims to facilitate and expand mycological research and collections within this region. Organisation of the FNQ MycoBlitz in 2009 by the ATH coordinated by Sandra Abell-Davis has continued to encourage both national and international collaborators to continue their research in the WTWHA. Of particular note are the more than 1000 collections made by Professor Emeritus David Largent during annual field trips from 2009 through 2012.

Research Outputs: Publications: Bergemann et al. (2013), Largent et al. (2013a, 2013b). **Presentations:** Bransgrove et al. (2013a, 2013b), Crayn et al. (2013a). **Community Talks:** Abell-Davis and Bransgrove (2013).

2013 Achievements: Fifteen field trips were conducted to various sites throughout the Wet Tropics and collection of specimens for a reference collection for the Daintree Rainforest Observatory commenced. Three papers on the Entolomatoid fungi were published in the journal Mycotaxon. Collaborators continue to add to the ATH MycoBlitz fungi collections. PhD student Kaylene Bransgrove's presentation of work on mountaintop fungi won the Pauline Ladiges Prize for Best Student Presentation at the 'Systematics Without Borders' international conference in Sydney in December.

HOST SPECIFICITY OF FUNGAL ENDOPHYTES OF TROPICAL AUSTRALIAN RAINFORESTS

Team: Kaylene Bransgrove (PhD student), Sandra Abell-Davis, Brett Summerell (Royal Botanic Gardens Sydney).

Background: This project investigates the diversity and co-evolutionary relationships of fungi that form mutualistic associations with mountain-top restricted plant taxa. The focus of the project is foliar fungal endophytes, the fungi that grow without causing symptoms throughout the plant. Fungal endophytes are known to contribute to plant, and therefore forest health, and are being used elsewhere as a measure of fungal diversity in forests. This study is the first to investigate tropical fungal endophytes in an Australian context and will specifically address elucidating their biodiversity and host specificity in the forests of the Wet Tropics. In addition, host specificity will also be investigated using infra-specific taxonomic units of the host, and across a biogeographic barrier (Black Mountain Corridor), both for the first time internationally. Species of *Elaeocarpus* will be used as a model host for this investigation. This research is funded by the National Environmental Research Program (NERP) and the Wet Tropics Management Authority (WTMA).

Research Outputs: Presentations: Bransgrove et al. (2013a, b). **Community Talk:** Abell-Davis and Bransgrove (2013).

2013 Achievements: Eleven *Elaeocarpus carolinae* populations (40 trees each, and 30 leaves per tree) have been harvested. DNA analysis (microsatellite sequencing) was used to verify their haplotypes. The results suggest that further genetic regions will require sequencing to further verify the haplotyping. Fungal endophytes have been isolated from each leaf resulting in more than 3000 fungal cultures. The cultures represent more than 100 distinct groups (potential species).

Bransgrove won the Pauline Ladiges Prize for Best Student Presentation at the 'Systematics Without Borders' conference in Sydney, Dec 2013, for her presentation on this work.

AUSTRALIAN ANIMAL/PLANT CO-EVOLUTION

Team: Andrew Thornhill, Ashley Field, Sarah Mannel, Darren Crayn, Gerry Cassis (UNSW)

Background: The notion of co-evolutionary 'arms-races' between plants (which may evolve defence mechanisms such as toxins) and the animals that consume them (which may evolve means to avoid or evade the defences) has been the subject of much research. This project employs molecular phylogenetic analysis to test hypotheses of co-evolution between insects and their plant hosts at a whole-biota scale across Australia. We will use phylogenies of two major insect groups (the 'true' bugs, and Australian butterflies) and their host plants to reconstruct evolutionary pathways and look for evidence of co-evolution between the plants and animals.

2013 Achievements: Molecular phylogenies of 180 genera of butterflies and 600 genera of Australian plants were reconstructed and preliminary analyses performed. For Heteroptera (true bugs) a preliminary molecular phylogeny of over 700 genera was reconstructed, the largest phylogeny to date for this group. A second analysis will be conducted in early 2014 to include missing genera. This tree will be combined with a subset of the Australian plant genus level phylogeny, based on a large bug/plant interaction database that has been compiled by Gerry Cassis.

DNA BARCODING OF ECTOMYCORRHIZAL HYPOGEOUS FUNGI

Team: Sandra Abell-Davis, Susan Nuske (PhD student), Christine Hof (WWF), Ashley Bunce (Qld EHP), Andy Baker (Qld NPRSR), Leho Tedersoo (University of Tartu, Estonia), Teresa Lebel (Landcare Auckland, Royal Botanic Gardens Melbourne), Michael Castellano (Oregon State University), Kentaro Hosaka (National Museum of Nature and Science Japan), David Largent (Humboldt University).

Background: Hypogeous fungi are an incredibly diverse and polyphyletic group, that have co-evolved with animals (that eat and disperse them) and plants (that form ectomycorrhizas). Despite their ecological importance they have been relatively understudied in the Australian tropics. This set of projects aims to generate and use DNA barcodes to identify and classify Hysterangiales species collected from the Australian tropics, and determine how the community of ectomycorrhizal fungi collected as hypogeous sporocarps relates to the functional (root-tips) ectomycorrhizal fungal community within the same habitat. This project will also identify the fungi found in the scats of a specialist mycophagous marsupial (*Bettongia tropica*) and those in the soil and plant root-tips to determine the importance of the bettong in providing dispersal of fungal spores as an ecosystem service. This project is supported by Caring for our Country in a new collaboration with the World Wildlife Fund (WWF), the Environmental Heritage Protection (EHP) and the Queensland Parks and Wildlife Service (QPWS).

Research Outputs: Presentations: Abell-Davis (2013), Bransgrove et al. (2013b). **Community Talks:** Abell-Davis and Bransgrove (2013).

2013 Achievements: Pilot studies have been conducted and environmental sequence data from soil collected in 2012 is currently being analysed. Funding for this project has been secured from Caring for Our Country and the North Queensland Wildlife Trust.

EVOLUTION AND SYSTEMATICS OF BROMELIACEAE

Team: Georg Zizka (Research Institute Senckenberg and Goethe University Frankfurt), Katharina Schulte, Daniele Silvestro, Daniel Cáceres, Ingo Michalak, Sascha Heller, M. Schmidt, J. Schneider (Research Institute Senckenberg and Goethe University Frankfurt), Rafael Louzada (Universidade de Sao Paulo), Elton Leme (Herbarium Bradeanum, Sao Paulo), Ana Maria Benko-Iseppon (Univerdidade Recife), Kurt Weising (University of Kassel), Pierre Ibsch (University of Applied Sciences Eberswalde), Marcia Goetze (Universidade Federal de Rio Grande do Sul, Brazil).

Background: Bromeliaceae are one of the most important epiphyte families of the Neotropics. Within the family, several lineages underwent rapid radiations in different regions of Central and South America (e.g. Bromelioideae: eastern Brazil, Puyoideae: Andes), whilst others exhibit only a low diversity today (e.g. *Fosterella*: Andes). To unravel the factors that contributed to the evolutionary success of different bromeliad lineages, molecular phylogenies are used to reconstruct the evolution of key traits (e.g. tank habit, leaf succulence, flower morphology), changes in diversification rates, and the historical biogeography of the groups and to explore correlations among these and with the Cenozoic history of the Neotropics (climate, geology, vegetation). The project consists of several subprojects that are mainly funded by the German Research Foundation, the German Academic Exchange Service (DAAD), and the Biodiversity and Climate Research Centre, Frankfurt.

Research Outputs: Presentations: Cruz et al. (2013), Givnish et al. (2013), Goetze et al. (2013), Heller et al. (2013), Louzada et al. (2013).

2013 Achievements: Work progressed significantly on several related projects, resulting in the submission of seven papers on a range of topics including the phylogeny and evolution of the family, the diversity and levels of endemism of Costa Rican bromeliads, the intrageneric relationships and evolution of several genera (*Aechmea/Gravisia* complex, *Orthophytum*, *Portea*), chromosome evolution, and the effect of key innovations on speciation and extinction rates in Bromeliaceae, based on a novel Bayesian approach.

Other projects in this Theme led by ATH researchers (staff, students and Associates) are listed below. Information of these projects is available on the ATH website - www.ath.org.au

- Biodiversity of mountain-top macrofungi of the Wet Tropics.
- Biology and diversity of tropical entomopathogenic fungi.
- Community phylogenetic turnover through time in a dry rainforest environment.
- Dating species biome shifts using a continental analysis of Acacia and the eucalypts.



Pandanus solmslaubachii, Cairns Botanic Gardens.

THE PUBLIC REFERENCE
COLLECTION CONTAINS
AN EXPANDING COLLECTION
OF NORTH QUEENSLAND NATIVE
PLANTS AND WEEDS NOW
TOTALLING 3,769 SPECIMENS
AND 2,528 TAXA



Immature foxtail palm fruit (*Wodyetia bifurcata*).

- DNA Barcoding of Australian tropical trees.
- Genetic diversity in the Australian sandalwood *Santalum lanceolatum*.
- Identifying refugia and hotspots of phylogenetic diversity in the Wet Tropics flora.
- Out of cite – recognising the true impact of taxonomic research.
- Photosynthetic pathways in Bromeliaceae, based on carbon isotope ratios of 1870 species.
- Pollination biology, evolution and systematics of anagraecoid orchids.
- Species concepts in Australian *Platynerium* ferns. Systematics and evolution of the epacrids (Epacridoideae, Ericaceae).
- Systematics of *Tecomanthe* sp. 'Roaring Meg' (L.J.Brass 20236).
- Systematics of the Huperzioid lycopods.
- The angiosperm phylogenetic hotspots of the world.
- Vegetation of the MacAlister Range (northeast Queensland).

THEME 2 – THREATS AND IMPACTS

Impacts of fragmentation, degradation, weeds and threatening processes on tropical flora, such as exploring genetics and reproductive strategies of environmental weeds leading to improved control strategies, and exploring ecophysiology and quantitative genetics in understanding climate change impacts on the tropical flora.

THREATENED ENDEMIC PLANTS OF PALAU

Team: Craig Costion

Background: The Critical Ecosystem Partnership Fund of Conservation International funded a project to work on the threatened endemic plants of Palau. A large scale assessment of the status of endemic plants was assessed by looking at the archaeological record in Palau for evidence of historic deforestation. In addition to this, five rare endemic species were inventoried in the field between 2011-2012 to estimate their population sizes. This data is contributing to assessment of their IUCN threatened status and/or status as valid endemic species.

Research Outputs: Publications: Costion et al. (2013).

2013 Achievements: The conservation status of the palm *Ponapea palauensis* was revised in the light of a quantitative assessment of its population size and the results published. The status of the single island endemic shrub *Maesa canfieldiae* was resolved and shown to be a taxonomic synonym of the more widespread *M. tetrandra*, a species of Least Concern.

EFFECTS OF CLIMATE CHANGE ON THE WET TROPICS MOUNTAIN-TOP FLORA

Team: Craig Costion, Lalita Simpson, Petina Pert (CSIRO), Darren Crayn

Background: The mountains of the Wet Tropics and Cape York Peninsula represent cool islands in a sea of warmer (lowland) climates and harbour a very rich biota with high levels of endemism. The plants and fungi of these mountains are especially vulnerable to global warming as upward species' range shifts leave them nowhere to go. This study aims to document centres of diversity for the endemics above 1,000 metres and to model the distribution and extent

of suitable climates for these species under future climate change scenarios.

2013 Achievements: We documented 19 species endemic to the uplands above 1000 m elevation in the Wet Tropics and determined their climate niche. Analysis of the fate of those climate niches under future climate scenarios has been completed and a manuscript is in preparation.

CREATING A PHYLOGENETIC HEAT MAP OF AUSTRALIA'S FLORA: A NEW MEASURE TO CONSERVE BIODIVERSITY

Team: Andrew Thornhill, Joe Miller (CANBR), Darren Crayn, Craig Costion, Nunzio Knerr (CANBR), Carlos Gonzalez-Orozco (University of Canberra), Shawn Laffan (UNSW), Brent Mishler (UC Berkeley).

Background: Australia has 3,500 genera and 25,000 native plant species of which approximately 85% are endemic. A changing environment and the demand for resources will continue to increase with a growing population and knowing where to protect land will become more important. This project aims to advance our knowledge of the genetic spatial distribution of Australia's flora to improve conservation planning.

2013 Achievements: A phylogenetic tree containing 2,300 of the 3,500 Australian plant genera was constructed. Spatial data (geographically explicit specimen records) comprising over 3 million records have been compiled for the same genera to combine with the phylogeny. Analysis of these data will take place in early 2014 pending the completion of the software pipeline.

THEME 3 – PLANTS FOR PEOPLE

Documenting traditional uses of tropical plant and fungal resources, and innovative utilisation such as biodiscovery and bioprospecting, novel crops and commercialisation.

DEVELOPMENT AND DELIVERY OF GERMPASM FOR SANDALWOOD AND WHITEWOOD IN VANUATU AND NORTHERN AUSTRALIA

Team: Tony Page

Background: In Vanuatu we are working in partnership with the national Forestry Department to identify the conditions required for successful wild sandalwood (*Santalum* spp.) and whitewood (*Endospermum medullosum*) industries based on sustainable production in agroforestry systems. Natural populations of sandalwood are currently endangered due to unsustainable whole-tree extraction. This project is funded by the Australian Centre for International Agricultural Research.

Research Outputs: Publications: Settle et al. (2012).

2013 Achievements: Work continued toward replication of sandalwood grafted seed orchards for dissemination to planting hot spots around Vanuatu. Whitewood seed was collected from natural populations for establishment of a gene resource/provenance planting.

DEVELOPMENT OF A PNG TIMBER INDUSTRY BASED ON COMMUNITY-BASED PLANTED FORESTS: DESIGN AND IMPLEMENTATION OF A NATIONAL GERmplasm DELIVERY SYSTEM

Team: Tony Page, Julio Ugarte Guerra (JCU).

Background: The production of high quality timber and other forest products from planted trees and forests represents an important development opportunity for Papua New Guinea. This project addresses an important constraint to the development of such an industry, i.e. the unavailability of adequate supplies of timber tree germplasm (seeds or planting stock). The germplasm shortage results both from a lack of accessible, good quality sources and from an absence of mechanisms for delivery from source to end-user. We are working in three project hubs in the development of a model approach to germplasm production and delivery, suitable for post-project scaling-up (within-hub) and scaling-out (to new hubs). Teak (*Tectona grandis*) has been selected as the focal species, due principally to its established high commercial value and demand, growing local interest in its cultivation, and its proven suitability to lowland PNG conditions. Wider application of the approach will be facilitated by the preparation of a "flexi-media" toolkit. As well as documenting the approach, the tool-kit, in DVD form, will include print-ready and broadcast-ready training and extension material designed for different target groups. This project is funded by the Australian Centre for International Agricultural Research.

2013 Achievements: Supply and demand surveys for agroforestry seedlings were undertaken and the commercial feasibility of smallholder tree nurseries in East New Britain was determined. Work continued toward establishment of Core Seed Production areas for Teak and Local Priority Species. Extension materials were developed to contribute to a training 'toolkit'.

TROPICAL INDIGENOUS ETHNOBOTANY CENTRE (TIEC) PARTNERSHIP

Background: The TIEC is a partnership between Traditional Owners (TO), the ATH, JCU's The Cairns Institute, Qld. Govt. DSITIA, CSIRO and other government agencies and organisations. Development of the TIEC, housed at the ATH, and research projects undertaken in association with it will advance through mutually beneficial partnerships. Projects will research and collate existing ethnobotanical data, promote and carry out research in a respectful and culturally appropriate way, and provide awareness, training and education.

The TIEC aims for recognition as the centre for ethnobotanical research in the Australian tropics, with a focus on north Queensland. Future activities may include neighbouring countries.

The following four projects were undertaken under the auspices of the TIEC.

Team: Gerry Turpin, Rosemary Hill and Ilisapeci Lyons (CSIRO), Eda Addicott, Sarah Warne and Katrina Keith (JCU's The Cairns Institute), Darren Crayn.

TWO-WAY KNOWLEDGE - BUILDING SYNERGIES BETWEEN INDIGENOUS KNOWLEDGE AND THE ATLAS OF LIVING AUSTRALIA'S SCIENCE

Team: Ilisapeci Lyons and Rosemary Hill (CSIRO), Gerry Turpin, Mandingalbay Yidinji People, John LaSalle (Atlas of Living Australia/CSIRO).

Background: A project was brokered between Mandingalbay Yidinji Aboriginal Corporation (Cairns), CSIRO and the TIEC to explore opportunities to strengthen knowledge partnerships between Indigenous knowledge and science with a Mandingalbay land and sea country focus. This pilot project will aim to achieve the following objectives: to support Indigenous-driven development of a two-way knowledge system that builds on synergies between Indigenous knowledge and the scientific capability of the Atlas of Living Australia (ALA); to evaluate the particular benefits and risks for Indigenous people involved in the pilot of linking with the ALA, including Indigenous concepts of risks and benefits; and to contribute to the Mandingalbay Yidinji People's goals for country through a two-way information system with the ALA.

2013 Achievements: An initial meeting took place to present and discuss the project with the Mandingalbay Yidinji Aboriginal Corporation. Further meetings will take place in early 2014 to negotiate a research agreement.

MBABARAM TRADITIONAL PLANT USE RESEARCH

Team: Gerry Turpin, Ashley Field, a Mbabaram Traditional Owner and Hans Wohlmut (Southern Cross University).

Background: A pilot project with the Mbabaram Aboriginal Corporation, NQ, and Southern Cross University, NSW (SCU), has been brokered by TIEC for SCU to research the properties of medicinal plants of the Mbabaram people. TIEC, with assistance from Mbabaram Traditional Owners, will collect and prepare plant materials used in traditional medicines.

2013 Achievements: A small number of Mbabaram medicinal plants were analysed for biological activity. Extracts of one species showed a level of inhibition of tumour necrosis factor (TNF) which compares favourably with other known inhibitors, a highly noteworthy result.

MAPOON TRADITIONAL PLANT USE RESEARCH

Team: Gerry Turpin, Mapoon Rangers, Jane Blackwood (Mapoon Ranger Coordinator).

Background: Research on traditional plant use within the lands of the Tjungundji, Yupungathi, Warrangku, Taepithiggi, Thanakwithi and Mpakwithi clans in the Mapoon region, Western Cape York Peninsula is being conducted with the Mapoon Rangers. The outcomes include provision of a knowledge base of plant use and vegetation of these areas to inform land management.

Other projects in this Theme led by ATH researchers (staff, students and Associates) are listed below. Information of these projects is available on the ATH website - www.ath.org.au

2013 Achievements: Plant collections and observations were undertaken across 42 sites. A report documenting the bush tucker and bush medicinal uses and scientific names of the plants was provided to the community along with Regional Ecosystem and broad vegetation maps of the area and a reference herbarium of the plants. It is recommended that further recording of cultural and ecological information should take place with more of the Elders and knowledge holders.

- Medicinal and Edible Plants of Guugu Yimithirr, Cape Flattery - Hopevale
- Silviculture of agarwood (*Aquilaria* spp.)

THEME 4 – PLANNING AND MANAGEMENT

Planning and management of tropical flora, or biodiversity and ecosystem management.

REGIONAL ECOSYSTEM MAPPING

Team: Eda Addicott, Peter Bannink, Jeanette Kemp, John Neldner (DSITIA), Mark Newton.

Background: As part of the Queensland Herbarium's state-wide Regional Ecosystems (RE) Mapping program, ATH staff are mapping (at 1:100,000 scale) Cape York Peninsula (CYP) and Einasleigh Uplands (EIU) bioregions. Mapping and survey is being done in blocks of 1:250,000 scale map sheets.

2013 Achievements: A seamless RE mapping coverage for CYP and an updated RE mapping coverage for EIU were released as part of version 8 of the state wide RE mapping. All vegetation survey sites for the CYP were finalised in the CORVEG database. Substantial work was completed towards numerical classification of vegetation site data from the CORVEG database for CYP. This is to support expert based descriptions of the REs. Work started on the re-alignment of Wet Tropics bioregion mapping line work to match updated imagery.

NUMERICAL CLASSIFICATION OF REGIONAL ECOSYSTEMS AND PATTERNS OF PLANT DIVERSITY DISTRIBUTION

Team: Eda Addicott (MPhil candidate), Susan Laurance (JCU), John Neldner (DSITIA), Darren Crayn

Background: This project will test whether statistical classification models of Regional Ecosystems using site data available from the CORVEG database reflect the subjective RE classification. The aim of the project is to develop an analysis methodology for classification of REs across the rest of Queensland using CYP as a case study. Community measures of diversity and the species diversity measures of taxonomic diversity and phylogenetic diversity will be used to test whether the REs reflect the floristic diversity of the CYP. This project is supported by the Queensland Herbarium and JCU student research funds.

2013 Achievements: Eda Addicott initiated this project as the research component of her Master of Philosophy studies.

THEME 5 – UNLOCKING OUR KNOWLEDGE

Training and capacity building including developing more effective ways to deliver Herbarium "products" to the community.

RAIN FOREST KEY

Team: Frank Zich, Ashley Field, Chris Quinn (volunteer), Peter Bostock (DSITIA), Jim Croft (CANBR), Siobhan Duffy (CSIRO), Judy West (DSEWPAC).

Background: The "Australian Tropical Rain Forest Plants" (a.k.a. the Rain Forest Key, or RFK) is an interactive multiple-entry identification and information system. A total of 138 characters, covering morphology - habit, bark, leaves, flowers, fruits and seedlings - and some geographic and ecological information ensure reliability and power of the key is high. Illustrated help notes assist with interpretation of characters and plant images help to confirm identification. The latest version, published in 2010, includes 2,553 species of trees, shrubs, vines, herbs, parasites, saprophytes, palms and pandans of northern Australian rain forests. Further developments a fern module (some 300 spp.) and distribution maps for all species.

2013 Achievements: A test version of the fern module was deployed and tested. The character list and states were revised and updated and the coding reviewed ready for entry into LucID Builder. The image database of taxa now contains 1837 images contributed primarily by Bruce Gray, Ashley Field, Garry and Nada Sankowsky and the Australian Plant Image Index. Character help notes have been written and help illustrations and a glossary compiled. Taxon descriptions and other information have been collated into Fact Sheet Fusion and edited.

SAVANNA KEY

Team: Frank Zich, Eda Addicott, Darren Crayn, Paul Williams (volunteer), Ailsa Holland (DSITIA), Kevin Thiele (WA Herbarium), Ian Cowie (NT Herbarium), Donna Lewis (NT Herbarium), Jim Croft (CANBR), Peter Doherty (Atlas of Living Australia).

Background: The Australian tropical savanna biome covers the top one third of the continent. The region is undergoing rapid change, with pressures from rapidly expanding agricultural and resources sectors. However the lack of a comprehensive Flora for most of the biome means that biodiversity surveys and conservation planning are severely hindered. Currently, plant identification resources for the biome are dispersed, in technical literature and therefore difficult to access, and inconsistent in format and taxonomy. Field guides where available are taxonomically incomplete, local in scope, and vary in quality. We aim to produce, over the next 7 years, a comprehensive, authoritative interactive identification key to Australian tropical savanna plants that is free for use over the internet. The product will be similar to the proven 'Rainforest Key', which has enjoyed broad stakeholder uptake. Development of a business plan for this project was partly funded by BHP Billiton Cannington Community Fund.

2013 Achievements: A draft checklist of savanna vascular plant taxa was compiled, comprising over 9500 taxa. This checklist will undergo expert review in 2014 which is expected to reduce the numbers significantly (e.g. obligate rainforest taxa will be removed). The business plan for the project was drafted.



Cycas ophiolitica.

PUBLICATIONS AND PRESENTATIONS
TOTAL 18 REFEREED SCIENTIFIC PAPERS,
4 UNREFEREED PUBLICATIONS,
2 THESES, 55 RESEARCH PRESENTATIONS
AND 6 COMMUNITY TALKS



Dendrobium speciosum.

APPENDIX I – PUBLICATIONS AND PRESENTATIONS

Publications and presentations by ATH authors in 2013 for scientific and general audiences are detailed below. These total 18 refereed scientific papers, 4 unrefereed publications, 2 theses, 55 research presentations (oral and poster) and 6 community talks.

SCIENTIFIC PAPERS

1. Bergemann SE, Largent DL, Abell-Davis SE (2013) *Entocybe haastii* from Watagans National Park, New South Wales, Australia. *Mycotaxon* 126, 61-70.
2. Cáceres DAG, Schulte K, Schmidt M, Zizka G (2013) Diversity and levels of endemism of the Bromeliaceae of Costa Rica – an updated checklist. *Phytokeys* 29, 17-62.
3. Cooper WE (2013a) A taxonomic revision of *Garcinia* L. (Clusiaceae) in Australia, including four new species from tropical Queensland. *Austrobaileya* 9(1), 1-29.
4. Cooper WE (2013b) *Cryptocarya cercophylla* W.E.Cooper (Lauraceae) A new species from Queensland's Wet Tropics. *Austrobaileya* 9(1), 75-79.
5. Costion C, Kitalong AH, Perlman S, Edwards WE (2013) Palau's rare and threatened palm *Ponapea palauensis* (Arecaceae): Population density, distribution, and threat assessment. *Pacific Science* 67(4), 599-607.
6. Field AR, Bostock PDB (2013) New and existing combinations in Palaeotropical *Phlegmariurus* (Lycopodiaceae) and lectotypification of the type species *Phlegmariurus phlegmaria* (L.) T.Sen & U.Sen. *Phytokeys* 20, 33-51.
7. Hardy OJ, Born C, Budde K, Daïnou K, Dauby G, Duminil J, Ewédjè E-E BK, Gomez C, Heuertz M, Koffi GK, Lowe AJ, Micheneau C, Ndiade-Bourbou D, Piñeiro R, Poncet V (2013) Comparative phylogeography of African rain forest trees: A review of genetic signatures of vegetation history in the Guineo-Congolian region. *Comptes Rendus Geoscience* 345: 284-296.
8. Jersáková J, Trávníček P, Kubátová B, Krejčíková J, Urfus T, Liu Z-J, Lamb A, Ponert J, Schulte K, Čurn V, Vrána J, Hřibová E, Doležel J, Leitch IJ, Suda J. (2013a) Genome size variation in the subfamily Apostasioideae: filling the phylogenetic gap in orchids. *Botanical Journal of the Linnean Society* 172(1), 95-105.
9. Largent DL, Bergemann SE, Kluting KL, Cummings GA, Abell-Davis SE (2013a) Five *Leptonia* species from New South Wales and Queensland. *Mycotaxon* 125, 11-35.
10. Largent DL, Bergemann SE, Kluting KL, Cummings GA, Abell-Davis SE (2013b) Three new species of *Inocephalus* with cuboid basidiospores from central New South Wales and northeastern Queensland, Australia. *Mycotaxon* 123, 301-319.
11. Ohlsen DJ, Field AR. (2013) A new fern species for Queensland: *Diplazium squamuligerum* (Rosenst.) Parris (Woodsiaceae) *Austrobaileya* 9(1), 114-125.
12. Prickett R, Honorio EN, Baba Y, Baden HM, Alvarez CM, Quesada CA. Floristic inventory of a one hectare of palm-dominated creek forest in Jenaro Herrera, Peru. *Edinburgh Journal of Botany* 69(2), 259-280.
13. Puente-Lelievre C, Harrington MG, Brown EA, Kuzmina M, Crayn DM (2013) Cenozoic extinction and recolonization in the New Zealand flora: the case of the fleshy-fruited epacrids (Styphelieae, Styphelioideae, Ericaceae). *Molecular Phylogenetics and Evolution*, 66, 203-214.
14. Settle DJ, Page T, Doran J, Bush D, Sethy M, Viji I (2012) Vanuatu Whitewood (*Endospermum medulosum*): Basic density and diameter, heritability and future breeding objectives. *International Forestry Review* 14, 463-475.
15. Simo-Droissart M, Micheneau C, Sonké B, Droissart V, Plunkett GM, Lowry II PP, Hardy OJ, Stévant T. (2013a) Morphometrics and molecular phylogenetics of the continental African species of *Angraecum* section *Pectinaria* (Orchidaceae). *Plant Ecology and Evolution* 146: 295-309.
16. Sotowa M, Ootsuka K, Kobayashi Y, Hao Y, Tanaka K, Ichitani K, Flowers J, Purugganan M, Nakamura I, Sato Y-I, Sato T, Crayn D, Simon B, Waters D, Henry R, Ishikawa R. (2013) Molecular relationships between Australian annual wild rice, *Oryza meridionalis*, and two related perennial forms. *Rice*, 6, 26.
17. Zizka G, Schneider JV, Schulte K, Novoa P. (2013) Taxonomic revision of the Chilean *Puya* species (Puyoideae, Bromeliaceae), with special notes on the *Puya alpestris* - *Puya berteroniana* species complex. *Brittonia*. 1-21.
18. Wannan BS. (2013) New records for Queensland in *Lindernia* All. (Linderniaceae). *Austrobaileya* 9(1), 126-129.

GENERAL PUBLICATIONS (UNREFEREED)

1. Neldner V, Addicott E, Newton M, Bannink P. (2013a) Regional Ecosystem certified maps of the Einasleigh Uplands bioregion v8, Queensland.
2. Neldner V, Addicott E, Newton M, Bannink P. (2013b) Regional Ecosystem certified maps of the Cape York bioregion v8, Queensland.
3. Phoon SN (2013a) *Elaeocarpus stipularis*. *Flora of Peninsular Malaysia Online Newsletter*, vol. 138/12.
4. Phoon SN (2013b) *Elaeocarpus polystachyus*. *Flora of Peninsular Malaysia Online Newsletter*, vol. 135/9.

THESES

1. Puente-Lelievre C. (2013) Systematics and biogeography of the Styphelieae (Epacridoideae, Ericaceae). PhD, James Cook University (supervisors Crayn D, Gadek P, Harrington M, Brown EA)
2. Simpson L. (2013a) Resolving species limits in the contentious *Dendrobium speciosum* complex. BSc Hons. (result: Class 1), James Cook University (supervisors Schulte K, Crayn D, Gadek P)

RESEARCH PRESENTATIONS

1. Abell-Davis S (2013) Sporocarp size/abundance dispersal strategies of hypogeous fungi. Asian Mycological Congress. China National Convention Centre, Beijing (China) [oral].
2. Addicott E (2013) Vegetation Communities of Cape York Peninsula: Evaluating the Regional Ecosystem Framework of Queensland. Masters Candidature confirmation seminar [oral].
3. Arobaya, A (2013) Phylogeny and evolution of the antelope orchids (*Dendrobium* sect. *Spatulata*, Orchidaceae). PhD confirmation seminar, JCU, Cairns [oral].
4. Arobaya A, Field A, Micheneau C, Crayn D, Clements M, Gadek P, Schulte K (2013a) Phylogeny and evolution of the antelope orchids: a molecular test of controversial taxonomic concepts. Systematics Without Borders, Australasian Systematic Botany Society and the Society of Australasian Systematic Biologists, Sydney [poster].
5. Arobaya AYS, Field AR, Crayn DM, Clements M, Gadek P, Schulte K. (2013b) Phylogeny and evolution of the antelope orchids: molecular studies to test controversial taxonomic concepts. 9th International Flora Malesiana symposium, Bogor, Indonesia [oral].
6. Arobaya AYS, Field AR, Micheneau C, Crayn D, Clements M, Gadek P, Schulte K. (2013c) Phylogeny of *Dendrobium* sect. *Spatulata* based on plastid and nuclear data sheds light on the evolution of the Antelope orchids. 5th International Orchid Conservation Congress, La Réunion [poster].
7. Arobaya AYS, Field A, Micheneau C, Crayn D, Clements M, Gadek P, Schulte K. (2013d) Phylogeny and evolution of the Antelope orchids: a molecular test of controversial taxonomic concepts. School of Marine and Tropical Biology postgraduate conference, JCU, Townsville [oral].
8. Arobaya AYS, Field A, Micheneau C, Crayn D, Clements M, Gadek P, Schulte K. (2013e) Phylogeny and evolution of the Antelope orchids: a molecular test of controversial taxonomic concepts. Bushblitz Symposium – Adding to Australia's biodiversity picture, Canberra, Australia [poster].
9. Bransgrove K, Abell-Davis S, Crayn D, Summerell B. (2013a) Mountain-top fungal endophytes of the wet tropics, Queensland: biodiversity, host specificity, biogeography and systematics. Systematics Without Borders, Australasian Systematic Botany Society and the Society of Australasian Systematic Biologists, Sydney NSW [oral].
10. Bransgrove K, Abell-Davis S, Crayn D, Summerell B. (2013b) Biodiversity and host specificity of the fungal endophytes of the wet tropics of north-east Queensland, Australia. 9th International Flora Malesiana symposium, Bogor, Indonesia [oral].
11. Costion C, Edwards W, Ford A, Metcalfe D, Cross H, Harrington M, Richardson JE, Lowe A, Crayn D. (2013) Layers in the landscape: The SE Asian flora in NE Queensland. South East Asian Gateway Evolution (SAGE) 2013, Berlin, Germany [oral].
12. Crayn DM, Costion C, Bransgrove K, Abell-Davis S, Simpson L, Schulte K, Metcalfe D, Rossetto M, Lowe A, Williams S. (2013a) What is at risk? Identifying rainforest refugia and hotspots of plant genetic diversity in the Wet Tropics and Cape York Peninsula. National Environmental Research Program (NERP) Tropical Ecosystems Hub Conference, Cairns [oral].
13. Crayn D, Costion C, Harrington M, Thornhill A. (2013b) Historical dynamics of the Sahul-Sunda floristic exchange and the impact on northern Australian biodiversity. Systematics Without Borders, Australasian Systematic Botany Society and the Society of Australasian Systematic Biologists, Sydney NSW [oral].
14. Crayn DM, Costion C, Harrington M. (2013c) The Sahul-Sunda floristic exchange: dated molecular phylogenies document post-Miocene intercontinental dispersal. 9th International Flora Malesiana symposium, Bogor, Indonesia [oral].
15. Crayn D, Harrington M, Costion C. (2013d) Who wins when north and south collide? The historical dynamics of intercontinental floristic exchange across Wallacea. South East Asian Gateway Evolution (SAGE) 2013, Berlin, Germany [oral].
16. Crayn D, Harrington M, Costion C. (2013e) Who wins when north and south collide? The historical dynamics of intercontinental floristic exchange across Wallacea. Southern Connections 2013 Conference, Dunedin, New Zealand [oral].
17. Cruz GAS, Leme EMC, Silvestro D, Zizka G, Schulte K, Benko-Iseppon AM. (2013) Molecular phylogeny and character evolution of the genus *Cryptanthus* Otto & A. Dietr. (Bromeliaceae). Monocots V - 5th International conference on comparative biology of Monocotyledons, New York (USA) [poster].
18. Edwards M, Stévant T, Geerinck D, Simo M, Droissart V, Micheneau C, Plunkett GM. (2013) Taxonomic revision and molecular phylogeny of *Ancistrorhynchus* (Orchidaceae), an Angraecoid genus from continental Africa. Botany 2013, New Orleans, Louisiana (USA) [oral].
19. Field AR, Mannel S, Crayn DM, Thornhill A. (2013) Australian butterfly and host plant co-evolution: A whole-biota phylogenetic perspective. Systematics Without Borders, Australasian Systematic Botany Society and the Society of Australasian Systematic Biologists, Sydney NSW [oral].

20. Field AR. (2013a) Australian tropical rainforest plants: new fern and lycopod module. Systematics Without Borders, Australasian Systematic Botany Society and the Society of Australasian Systematic Biologists, Sydney NSW [poster].
21. Givnish TJ, Barfuss MHJ, Van Ee B, Riina R, Schulte K, Horres R, Gonsiska PA, Jabaily RS, Crayn DM, Smith JAC, Winter K, Brown GK, Evans TM, Holst BK, Luther H, Till W, Zizka G, Berry PE, Sytsma KJ. (2013) Adaptive radiation, historical biogeography, correlated and contingent evolution, and net rates of diversification in Bromeliaceae. Monocots V - 5th International conference on comparative biology of Monocotyledons, New York (USA) [oral].
22. Goetze M. (2013) Disentangling phylogenetic relationships in Brazilian bromeliads (*Aechmea* subgen. *Ortgiesia*): evolutionary and taxonomic implications. ATH Science Circle [oral].
23. Heller S, Paule J, Leme E, Michalak I, Silvestro D, Kanz B, Steinbeisser G, Schulte K, Benko-Iseppon AM, Forzza R, Zizka G. (2013) Systematics, evolution and biogeography of Bromelioideae (Bromeliaceae) - New results. Monocots V - 5th International conference on comparative biology of Monocotyledons, New York (USA) [oral].
24. Jersáková J, Trávníček P, Kubátová B, Krejčíková J, Urfus T, Li, Z-J, Lamb A, Ponert J, Schulte K, Čurn V, Vrána J, Leitch IJ, Suda J. (2013b) Genome size variation in the subfamily Apostasioideae: filling the phylogenetic gap in orchids. Orchids 2012 – IV Scientific conference on Andean orchids. Guayaquil, Ecuador [poster].
25. Louzada RB, Schulte K, Wanderley MG, Silvestro D, Zizka G, Barfuss MHJ, Palma-Silva C. (2013) Molecular phylogeny of *Orthophytum* (Bromeliaceae) elucidates infrageneric relationships and demonstrates the taxonomic significance of the inflorescence type. Monocots V - 5th International conference on comparative biology of Monocotyledons, New York (USA) [oral].
26. Micheneau C, Clements M, Simpson L, Weston P, Crayn DM, Schulte K. (2013a) Systematics and evolution of taxonomically challenging groups: what can molecular data tell us? A case study from the *Dendrobium* alliance in Australia (Orchidaceae). Bushblitz Symposium – Adding to Australia's biodiversity picture, Canberra (Australia) [poster].
27. Micheneau C, Simpson L, Weston PH, Crayn DM, Clements MA, Schulte K. (2013b) Phylogeny and evolution of Australasian Dendrobiums (Epidendroideae, Orchidaceae). 5th International Orchid Conservation Congress, La Réunion (France) [oral].
28. Micheneau C, Schulte K, Field A, Crayn D, Kocyan A, Clements M. (2013c) Phylogenetics of Australasian Aeridinae (Vandeeae, Orchidaceae). Monocots V - 5th International conference on comparative biology of Monocotyledons, New York (USA) [oral].
29. Miller J, Thornhill A, Gonzalez-Orozco C, Knerr N, Laffan S, Mishler B, Bui E. (2013) *Acacia* biogeography: Phytoregionalizations and evolution of major lineages. Systematics Without Borders, Australasian Systematic Botany Society and the Society of Australasian Systematic Biologists, Sydney NSW [oral].
30. Niisalo MA, Pennington RT, Richardson JE, Pennington TD, Crayn DM, Baba Y, Phoon SN, Rousteau A. (2013) When the fossils and molecular phylogeny do not meet – complex biogeography of the amphipacific tree genus *Sloanea* (Elaeocarpaceae). 9th International Flora Malesiana symposium, Bogor, Indonesia [oral].
31. Phoon SN, Crayn D. (2013a) How many taxa in the West Malesian *Elaeocarpus polystachyus* group? Evidence from morphometric analysis. Systematics Without Borders, Australasian Systematic Botany Society and the Society of Australasian Systematic Biologists, Sydney NSW [poster]. **Winner, Best ASBS Student Poster.**
32. Phoon SN, Crayn D. (2013b) How many taxa in the West Malesian *Elaeocarpus polystachyus* group? Evidence from morphometric analysis. School of Marine and Tropical Biology Postgraduate Conference 2013, James Cook University, Townsville [poster]. **Winner, Best Poster.**
33. Phoon SN, Baba Y, Crayn D. (2013a) Phylogenetics of the rainforest tree genus *Elaeocarpus* (Elaeocarpaceae): insights from four-locus molecular sequences. Systematics Without Borders, Australasian Systematic Botany Society and the Society of Australasian Systematic Biologists, Sydney NSW [oral].
34. Phoon SN, Baba Y, Crayn DM. (2013b) Phylogeny of *Elaeocarpus* (Elaeocarpaceae): insights from four-locus molecular sequences. 9th International Flora Malesiana symposium, Bogor, Indonesia [oral].
35. Piñeiro R, Dauby G, Micheneau C, Kaymak E, Hardy OJ. (2013) Comparative phylogeography of two shade-tolerant and a light-demanding African rainforest trees. International Biogeography Society – 6th Biennial Meeting, Miami, Florida (USA) [oral].
36. Schulte K. (2013) Why develop a genetic reference library for Australasian Orchidaceae? My research in 3 minutes presentation. ATFI Scholarly Event, JCU Cairns [oral].
37. Schulte K, Micheneau C. (2013a) Rapid species identification and discovery in the age of next generation sequencing – opportunities and challenges. Systematics Without Borders, Australasian Systematic Botany Society and the Society of Australasian Systematic Biologists, Sydney NSW [oral].
38. Schulte K, Micheneau C. (2013b) Rapid species identification and discovery in the age of next generation sequencing – opportunities and challenges. Bushblitz Symposium – Adding to Australia's biodiversity picture, Canberra (Australia) [oral].
39. Schulte K, Micheneau C, Simpson L, Crayn DM, Clements MA. (2013a) How to cope with megadiverse groups? An integrative approach towards reconciling taxonomic concepts in Dendrobiinae (Orchidaceae). BioSyst.Eu 2013 Global Systematics, Vienna (Austria) [oral].



Drosera sp. Droseraceae

18 VOLUNTEERS CONTRIBUTED
A TOTAL OF 1,681 HOURS,
WITH 1659 SPECIMENS MOUNTED
AND CONTRIBUTIONS IN THE
LABORATORY (118 HOURS)
AND HERBARIUM (783 HOURS)



Crinoline stinkhorn (*Phallus indusiatus*).

40. Schulte K, Micheneau C, Simpson L, Weston PH, Crayn DM, Clements MA. (2013b) The *Dendrobium* alliance revisited: A molecular phylogenetic approach towards reconciling taxonomic concepts in Dendrobiinae (Orchidaceae). Monocots V - 5th International conference on comparative biology of Monocotyledons, New York (USA) [oral].
41. Schulte K, Micheneau C, Simpson L, Weston PH, Crayn DM, Clements MA. (2013c) The *Dendrobium* alliance revisited: A molecular phylogenetic approach towards reconciling taxonomic concepts in Dendrobiinae (Orchidaceae). Systematics Without Borders, Australasian Systematic Botany Society and the Society of Australasian Systematic Biologists, Sydney NSW [oral].
42. Simo-Droissart M, Micheneau C, Sonké B, Droissart V, Plunkett G, Lowry II PP, Hardy OJ, Stévant T. (2013b) Morphométrie et phylogénie des *Angraecum* section *Pectinaria* (Orchidaceae) en Afrique continentale. Symposium Paul Duvigneaud, Université Libre de Bruxelles, Bruxelles (Belgium) [poster].
43. Simpson L. (2013b) What is at risk? Phylogeography and taxonomy of orchids endemic to Queensland's mountain top biodiversity hotspots. PhD confirmation seminar, JCU, Cairns [oral].
44. Simpson L, Clements M, Crayn D, Schulte K. (2013a) Australia's King Orchid - one species or many? A molecular approach to resolving taxonomic limits within the *Dendrobium speciosum* complex (Orchidaceae). Bushblitz Symposium – Adding to Australia's biodiversity picture, Canberra, Australia [poster].
45. Simpson L, Clements M, Crayn D, Schulte K. (2013b) What is at risk? Phylogeography and taxonomy of orchids endemic to Queensland's mountain top biodiversity hotspots. Systematics Without Borders, Australasian Systematic Botany Society and the Society of Australasian Systematic Biologists, Sydney NSW [oral].
46. Simpson L, Clements M, Crayn D, Schulte K. (2013c) Disentangling the *Dendrobium speciosum* complex: A phylogeographic approach to resolving taxonomic limits within Australia's King Orchid. 5th International Orchid Conservation Congress, La Réunion (France) [poster].
47. Simpson L, Clements M, Crayn D, Schulte K. (2013d) Australia's King Orchid - one species or many? A phylogeographic approach to resolving taxonomic limits within the *Dendrobium speciosum* complex (Orchidaceae). BioSyst.EU Global Systematics Conference, Vienna (Austria) [poster].
48. Simpson L, Clements M, Crayn D, Schulte K. (2013e) Disentangling the *Dendrobium speciosum* complex: A phylogeographic approach to resolving taxonomic limits within Australia's King Orchid. Monocots V. 5th - International conference on comparative biology of Monocotyledons, New York (USA) [poster].
49. Stévant T, Micheneau C, Simo-Droissart M, Droissart V, Lowry II PP, Verlynde S, Geerinck D, Descouvières P, Sonké B, Hardy O, Edwards M, Carlsward B, Plunkett G. (2013) New insights into developing a natural generic taxonomy of the Continental African angraecoid orchids. 5th International Orchid Conservation Congress, La Réunion (France) [poster].
50. Thornhill A. (2013) Detecting the age of biomes using the species of eucalypts (Myrtaceae and *Acacia* (Fabaceae) and dated phylogenies. Systematics Without Borders, Australasian Systematic Botany Society and the Society of Australasian Systematic Biologists, Sydney NSW [oral].
51. Wanma JF, Manusaway J, Manusaway H, Gunawan E, Arobaya AYS. (2013) Phylogeography and systematic of the timber wood of *Pometia* endemic to biodiversity hotspot of the tropical lowland rainforests of West Papua. Systematics Without Borders, Australasian Systematic Botany Society and the Society of Australasian Systematic Biologists, Sydney NSW [poster].
52. Wilson GW, Venter F. (2013) Studies of *Nepenthes* in Austro-Papua. 9th Flora Malesiana Symposium, Bogor, Indonesia [oral].
53. Wilson GW. (2013a) Carnivorous plants, crocodiles and travels of an errant botanist. ATFI Scholarly Event, Cairns [oral].
54. Yeates DK, Davies KA, Lewis ML, Giblin-Davis RM, Purcell M, Taylor GS, Thornhill A, Scheffer SJ. (2013) Diversification, coevolution and host plant evolution in *Fergusonina* galling flies feeding on Myrtaceae. Systematics Without Borders, Australasian Systematic Botany Society and the Society of Australasian Systematic Biologists, Sydney NSW [oral].
55. Zich F, Addicott E, Cowie I, Crayn D, Croft J, Doherty P, Holland A, Thiele K. (2013) Australian Savanna Plant Identification System: a collaborative initiative toward an interactive identification and information system for all Australian savanna plants [poster]. Systematics Without Borders, Australasian Systematic Botany Society and the Society of Australasian Systematic Biologists, Sydney NSW [poster].

COMMUNITY TALKS

1. Abell-Davis SE, Bransgrove K. (2013) Fungi at Flecker – an introduction to the world of fungi, Friends of the Botanic Gardens, Cairns QLD.
2. Addicott E. (2013) Vegetation Communities of Cape York Peninsula: Evaluating the Regional Ecosystem Framework of Queensland. QLD Government seminar series, Mareeba QLD.
3. Field AR. (2013b) The natural history of orchids native to the Cairns Region. Cairns Orchid Society Annual Conference May 6th 2013.
4. Field AR. (2013c) Tall facts on small trees – Growing bonsai trees in Australia, Friends of the Botanic Gardens, Cairns QLD.
5. Wilson GW. (2013b) Vegetation Survey and Mapping in Queensland. Teh Tarik Seminar, Science Faculty, Monash University Malaysia, Kuala Lumpur.
6. Wilson GW. (2013c) Carnivorous plants, crocodiles and travels in the Asia-Pacific. Friends of the Botanic Gardens, Cairns.

APPENDIX 2 - PARTICIPANTS IN ACTIVITIES, 2013



ATH PhD students: Lalita Simpson, Kaylene Bransgrove, Yumiko Baba, Agustina Arobaya, Sook-Ngoh Phoon, Caroline Puente-Lefevre. Photo: Andrea Lim.



ATH Volunteers (l-r): Janani Jayanthan, Garry Sankowsky, Mary Gandini, Nada Sankowsky, Murray Borrell, Nanette Fairbairn, Charles Clarke, Chris Quinn. Photo: Andrea Lim.

STAFF

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 Ms Yumiko Baba (JCU)
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 Ms Kaylene Bransgrove (JCU²)
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 Ms Melissa Harrison (JCU²)
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 Ms Jeanette Kemp (DSITIA)
 Ms Raelee Kerrigan (external grant)
 Ms Andrea Lim (DSITIA)
 Ms Sarah Mannel (external grant)
 Dr Claire Micheneau (external grant)
 Mr Mark Newton (DSITIA)
 Dr Tony Page (JCU¹)
 Dr Katharina Schulte (CSIRO/JCU)
 Dr Andrew Thornhill (CSIRO/JCU)
 Mr David Tng (external grant)
 Mr Gerry Turpin (DSITIA)
 Mr Stuart Worboys (JCU/external grant)
 Mr Frank Zich (CSIRO)

¹ together contribute 1FTE research position

² together contribute 1FTE Laboratory Manager position

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 Mr Habat Asad (JCU)
 Ms Yumiko Baba (JCU)
 Ms Kaylene Bransgrove (JCU)
 Ms Janet Gagul (JCU)
 Ms Marcia Goetze (Universidade Federal de Rio Grande do Sul, Brazil)
 Ms Margaret Heslewood (University of Adelaide)
 Mr Anton Lata (JCU)

Ms Arlene Lopez-Sampson (JCU)

Ms Susan Nuske (JCU)

Ms Claudia Paz (JCU)

Ms Sook-Ngoh Phoon (JCU)

Ms Lalita Simpson (JCU)

Mr Hanington Tate (JCU)

Ms Dannielle Tela (JCU)

Mr Julio Ugarte Guerra (JCU)

Mr Gary Wilson (JCU)

VOLUNTEERS

Eighteen volunteers contributed a total of 1,681 hours to ATH activities. The work undertaken was mostly mounting herbarium specimens (606 hours, 1659 specimens mounted), and individuals with specialist skills made very significant contributions in the laboratory (118 hours), Herbarium (783 hours) and field.

Mr Murray Borrell

Ms Anna Cole

Dr Charles Clarke

Mrs Nanette Fairbairn

Mr Roger Fryer

Mrs Mary Gandini

Ms Kayza Grenfell

Ms Kim Hood

Ms Janani Jayanthan

Ms Raelee Kerrigan

Ms Sarah Mannel

Ms Sandy Perkins

Dr Chris Quinn

Ms Vivien Richardson

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