



AUSTRALIAN TROPICAL HERBARIUM

# ANNUAL REPORT 2013

*Dendrobium prenticei* (Photo: Andrea Lim)



Australian Government  
Director of National Parks



Queensland  
Government



JAMES COOK  
UNIVERSITY  
AUSTRALIA

## 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.



**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.

The Board at the April 08, 2014 meeting approved this report.

Signed,

Greg Leach  
Chair, Australian Tropical Herbarium  
Board

Darren Crayn  
Director, Australian Tropical  
Herbarium

## **BACKGROUND**

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) 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 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 160,000 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:

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.

### **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.

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## Achievements against Key Performance Indicators

The 2011-2015 ATH Strategic Plan (Appendix 4) was ratified by the Board in late 2011. This Plan contains revised Key Performance Indicators (KPIs) and targets that better reflect the activities and aspirations of the ATH and link explicitly with the ATH Objectives. These KPI's were employed for the first time in the 2011 report. Since they depart substantially from those established in the ATH Agreement and which applied from 2008 through 2010, the 2013 numbers are compared with those for 2011 and 2012 only.

### Objective 1: Create synergies and opportunities through collaboration

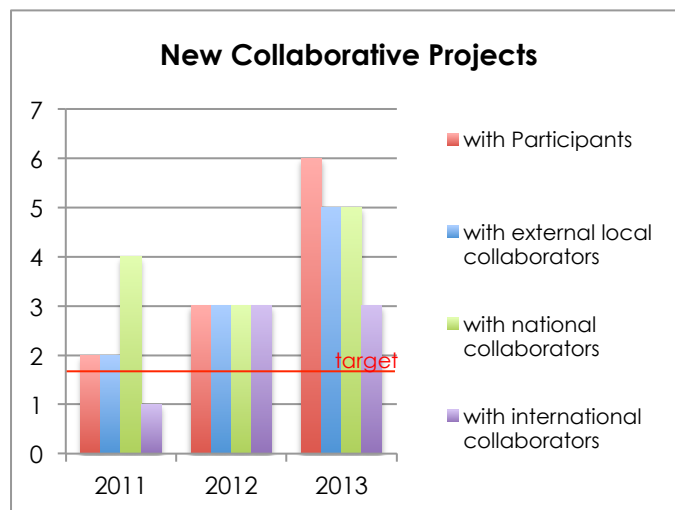
**KPI 1.1** - Enter into the following number of multidisciplinary, collaborative projects on average per annum with research and industry or business partners: one local, one national, and one international.

**Achieved** – Eight new collaborative projects with local, national and/or international partners commenced in 2013: “Angiosperm phylogenetic hotspots of the world (national, international - see p. 42); “Australian Animal/Plant co-speciation” (national – see p. 42); “Barcoding of ectomycorrhizal hypogeous fungi” (local, national, international – see p. 43); “Effects of climate change on the endemic trees and shrubs of the Wet Tropics mountain-top flora” (local - see p. 46); “Creating a phylogenetic heat map of Australia's flora: A new way to protect biodiversity” (national, international - see p. 47); “Mapoon plant use survey” (local – see p. 49); “Two-way Knowledge - building synergies between Indigenous Knowledge and the Atlas of Living Australia's science” (local, national – see p. 50); “Numerical classification of Regional Ecosystems and patterns of plant diversity distribution” (local – see p. 52).

### Objective 2: Improve each Participants' individual research capabilities and reputations through the undertaking of activities collectively that could not have been undertaken individually

**KPI 2.1** - Initiate two projects linked with Participants' personnel per annum.

**Achieved** – Six new collaborative projects were launched with Participants' personnel: “Angiosperm phylogenetic hotspots of the world with a range of national and international collaborators including N. Knerr and A. Schmidt-Lebuhn from CANBR (see p. 42); “Barcoding of ectomycorrhizal hypogeous fungi” with Ashley Bunce from Qld EHP and Andy Baker from Qld NPRSR (see p. 43) “Effects of climate change on the endemic trees and shrubs of the Wet Tropics mountain-top flora” with Petina Pert from CSIRO (see p. 46); “Creating a phylogenetic heat map of Australia's flora: A new way to protect biodiversity” with N. Knerr and J. Miller from CANBR (see p. 47); “Two-way Knowledge - building synergies between Indigenous Knowledge and the Atlas of Living Australia's science” with Peci Lyons, Ro Hill and John LaSalle from



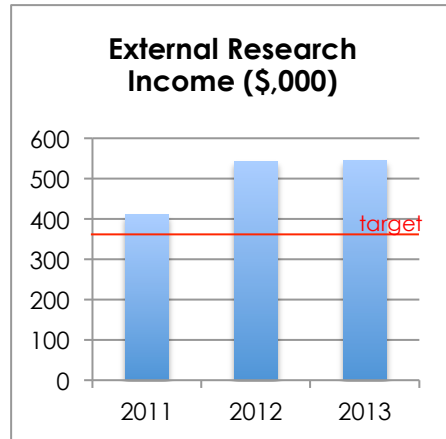


CSIRO (see p. 50); and “Numerical classification of Regional Ecosystems and patterns of plant diversity distribution” with John Neldner from DSITIA (see p. 52).

**Objective 3: Develop research excellence**

**KPI 3.1** - Win \$137,000 of competitive or peer reviewed research grants and external grants or donations on average per annum per research FTE.

**Achieved** – \$545,981 (see p. 17). The target was \$480,000<sup>1</sup>.

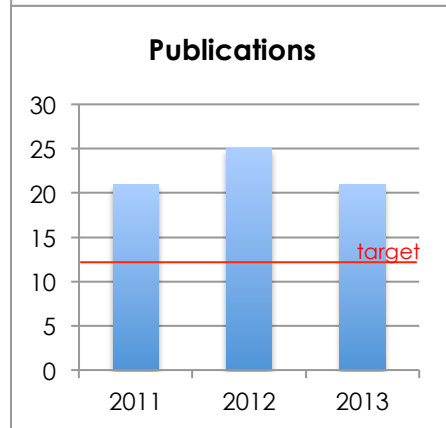


**KPI 3.2** - Achieve agreed project milestones

**Achieved** – All required milestone reports for externally funded grants were accepted by the relevant grant agency (outcomes for grants are detailed from p. 31).

**KPI 3.3** - Publish 3.5 refereed scientific papers/articles in leading national or international journals, refereed conference papers, books or book chapters on average per annum per research FTE.

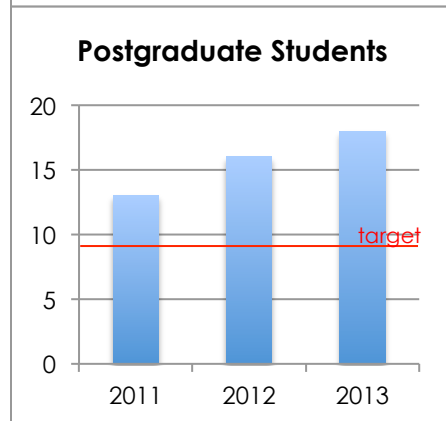
**Achieved** - ATH achieved **21 refereed publications** (2 theses, 19 papers - see Appendix 1). The target was 12 scientific publications based on 3.5 FTE research active JV staff<sup>1</sup>.



**Objective 4: Achieve excellence in research training**

**KPI 4.1** - Each research FTE as supervisor of 2.5 Doctoral or Masters Degree students on average per annum, including 0.5 Queensland graduates and 0.5 overseas graduates.

**Achieved** – **18 postgraduate students supervised** of which six are Queensland and eleven are overseas graduates (see p. 63). The target was 9 (including 2 Queensland and 2 overseas graduates)<sup>2</sup>.



**KPI 4.2** - Increase research quality, productivity and on-time completions

<sup>1</sup> based on 3.5 FTE research active staff funded through the ATH joint venture. Regional Ecosystem mapping staff were not classified as research-active because the RE mapping programme does not produce HERDC publications nor does it seek external grant support.

<sup>2</sup> based on 3.5 FTE research active staff funded through the ATH joint venture. Regional Ecosystem mapping staff were not classified as research-active because the RE mapping programme does not produce standard publications nor does it seek external grant support.

Students supervised by ATH staff are actively engaged and expectations around publications, quality and productivity are reinforced and monitored through meetings held with each student at least twice-weekly. **One PhD student submitted her thesis during 2013.**

**KPI 4.3** - *Maintain periodical training/learning event series (e.g. journal club) for students*

**Achieved** – a training and science discussion series – the ATH Science Circle - focused on systematics and related disciplines (e.g. historical biogeography) was coordinated by **Katharina Schulte, Ashley Field, and Claire Micheneau**. Events included workshops on methods and approaches in systematics and biogeography which were popular with ATH personnel and other JCU staff and students.

**KPI 4.4** - *Students meet University requirements for ongoing candidature (e.g. progress reports, seminars training etc.)*

**Achieved** – all students met or exceeded their 2013 candidature requirements.

### **Objective 5: Facilitate Commercialisation opportunities**

**KPI 5.1** - *relevant staff participate in one training/awareness event every two years on average*

No training or awareness events specifically focused on commercialisation were attended in 2013. However, the Australian Tropical Forest Institute held a scholarly event for ATFI residents and collaborators, which was attended by several ATH staff, wherein discussions took place regarding opportunities for commercialisation.

### **Objective 6: Improve the management of the collections**

**KPI 6.1** - *>90% specimens with accurate and reliable names.*

**Achieved** – nomenclature is up to date in all taxonomic groups except *Corymbia/Eucalyptus*.

**KPI 6.2** - *100% of the collection data based and available electronically.*

**Achieved** – all collections are data based, however the MBA collection records have not yet been merged into the ATHIS database. ATHIS is available to the public for query-only access. CNS data are delivered through Australia's Virtual Herbarium and the Atlas of Living Australia.

**KPI 6.3** - *Collection to be free of any pest infestations.*

**Achieved** – no infestations of psocids or other herbarium pests were detected in the Collection Room.

**KPI 6.4** - *New accessions to be processed and incorporated within 12 weeks of receipt.*

**Achieved** – all incoming material in 2013 was processed within 12 weeks of receipt of all information required for processing.

**KPI 6.5** - *Loan requests fulfilled within 4 weeks of receipt.*

**Achieved** – the one loan request received in 2013 was fulfilled within 4 weeks.

**Objective 7: Maintain a supportive, rewarding and productive work environment**

**KPI 7.1 - Number of staff training courses completed**

Staff undertook a wide range of training activities during 2013, including first aid, 4WD vehicle handling, and research methods (details p. 20). All staff and students participated in at least one training activity.

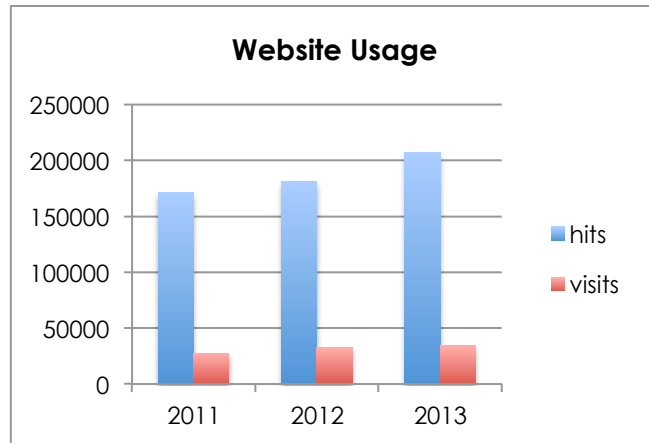
**KPI 7.2 - Nil time lost to injuries**

**Achieved** – nil lost-time injuries during 2013

**Objective 8: Promote the ATH**

**KPI 8.1 - Website content is up to date**

**Achieved** – the website was updated in 2013, and achieved over 34,000 visits during the year, 3.6% more than 2012 (see p. 15).

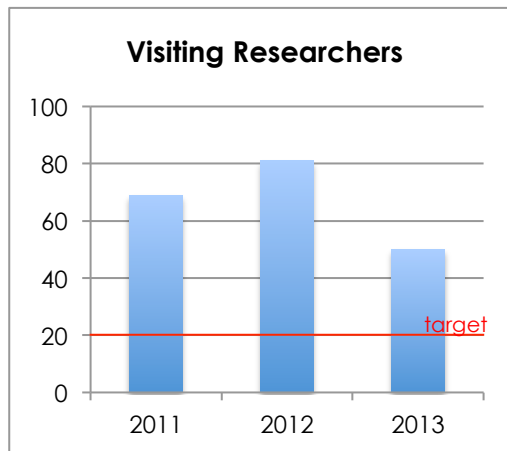
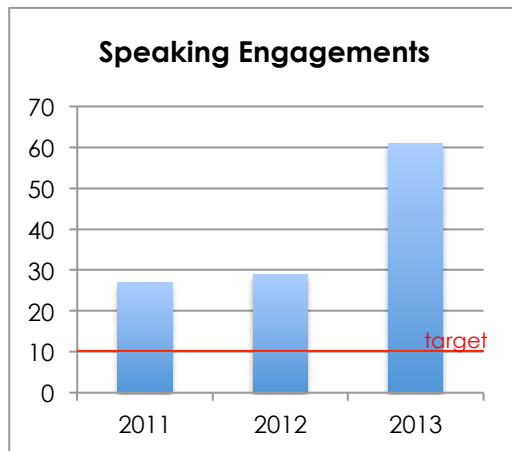


**KPI 8.2 - Perform ten speaking engagements (seminars, lectures etc.) per annum**

**Achieved** – ATH staff presented **55 research seminars** for scientific audiences, and **six public talks** (see Appendix 1).

**KPI 8.3 - Welcome twenty visiting national and international scientists (working on collections or collaborating with ATH staff on manuscripts, field research, etc.) on average per annum**

**Achieved** – ATH was **visited by 50** scientists for research purposes.



## **Governance**

### **Board**

The ATH **Agreement** requires that the ATH be governed by a **Board** whose role it is to oversee the operations of the ATH and set overall strategic management policy and objectives. The **Board** comprises two representatives of each of the **Participants** (CSIRO, DSITIA, JCU) 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 Guymer (DSITIA)
- Prof Jeff Loughran (JCU)
- Dr Judy West (CSIRO)
- Dr Christine Williams (DSITIA)
- Dr Andrew Young (CSIRO)

### **ATH Director**

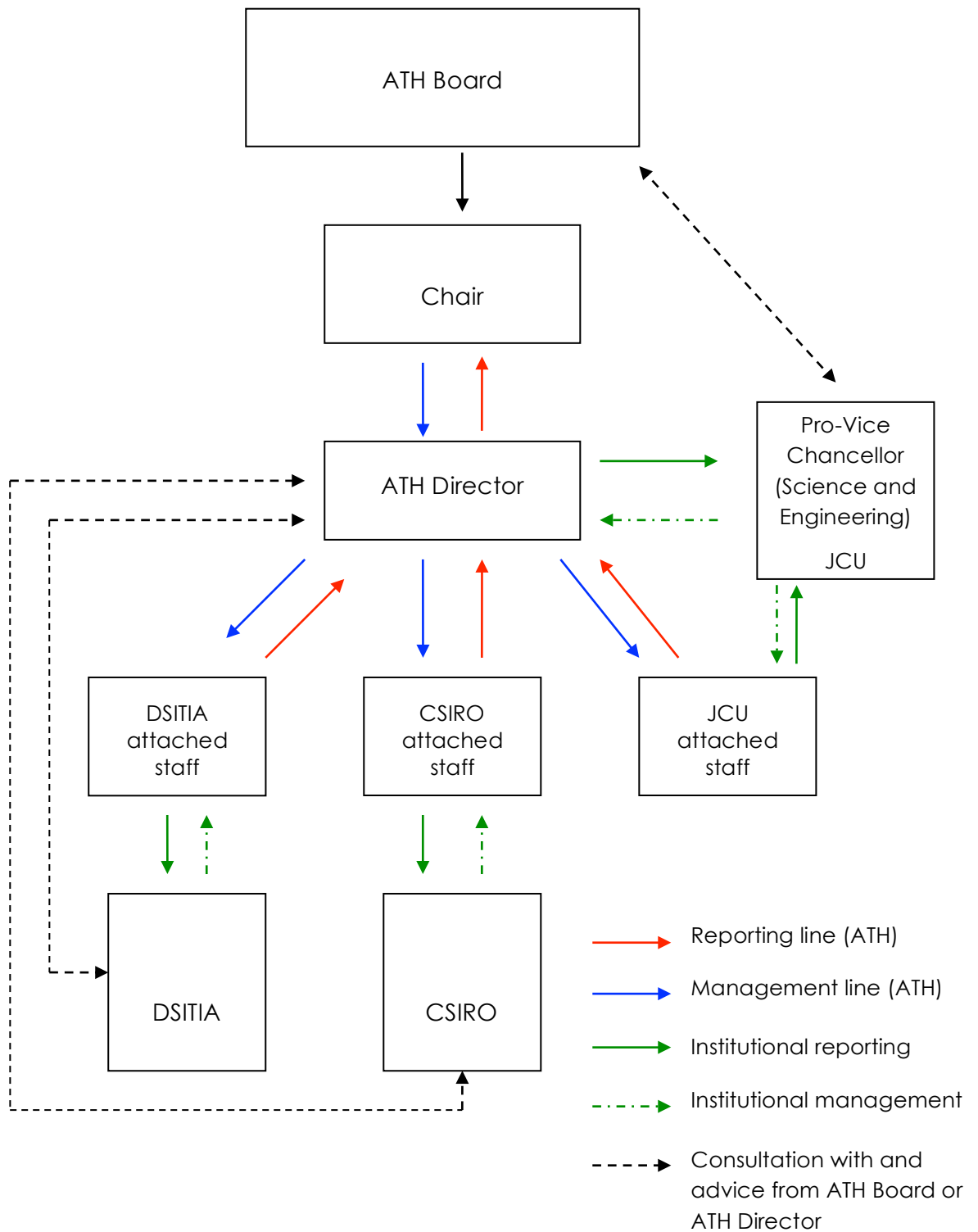
The Director's role is to oversee the day-to-day operations of the ATH including:

- managing staff and volunteers,
- developing and directing the Research Program as approved by the Board,
- promoting the ATH,
- developing and maintaining strategic external partnerships,
- working to meet the agreed ATH Key Performance Indicator targets,

The Director is also required to maintain significant personal research activity.

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

## Reporting Structure



# Activities 2013

## Public Engagement

### Rainforest Plant Identification Workshops

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).

### Media

The ATH received considerable media coverage during 2013 including 7 print, 8 online media articles, 4 radio interviews and TV coverage of the "Deadly Awards".

'*Fears for tiny marsupial with a taste for truffles. Bettong forest alert*' appeared in the Townsville Bulletin 13/11/13 regarding a potential decline in trap success may relate to a loss of biodiversity of truffles species (studied by **Sandra Abell-Davis**) 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); Radio interview about TIEC, **Gerry Turpin** and the Deadly awards, *ABC Far North*.

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

**Gerry Turpin** was honoured with the inaugural 'Deadly Award for Scientist or Science Project of the Year'. Gerry received considerable media coverage in print, online and on radio. Two articles in the Cairns Post, three in various newsletters, the Awards on SBS TV, and two radio interviews (*ABC Radio Torres Strait* and *Radio National*); "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.



Megan Gixti “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.

**Sook-Ngoh Phoon** “In the Spotlight – *Elaeocarpus polystachys* Wall. ex Mull. Berol.”, *Biological Diversity Clearing House Mechanism*; “In the Spotlight – *Elaeocarpus stipularis* Blume”, *Biological Diversity Clearing House Mechanism*; “In the Spotlight – *Elaeocarpus angustifolius*”, *Biological Diversity Clearing House Mechanism*.

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

“Australian Conservation Taxonomy Award” appeared in the Australian Systematic Botany Society Newsletter 155: 3 (June 2013) announcing that ATH/JCU PhD candidate **Lalita Simpson** won the award with “unanimous support from the Research Committee” for her project: *What is at risk?*

*Phylogeography and taxonomy of orchids endemic to Queensland's mountain top biodiversity hotspots*”. The award (\$9,000) will fund part of Lalita’s molecular studies and travel expenses to attend the next two ASBS conferences to present her research.

**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](http://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.

Website content was updated in 2013. In 2014 we envisage a website review and restructure to allow for additional functionality, such as secure staff-only pages.

The website is maintained and updated by Katharina Schulte.

### **Social Media**

In late 2013 the ATH Facebook page (<https://www.facebook.com/tropicalherbarium>) was developed and launched.



Mr Gerry Turpin, winner of the inaugural 'Deadly Award for Scientist or Science Project of the Year'.

It quickly reached over 150 'likes'. An ATH Social Media policy has been developed to govern implementation through social media of the ATH's engagement objectives.

### **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).

#### **Group Tours**

In 2013, **10 group tours** (including VIP delegations) of the ATH were conducted. A total of **184 people** participated in these tours; the most significant are listed below.

- Chinese Academy of Social Sciences (6 people);
- Tropical North Queensland TAFE (14 people);
- JCU Open Day Rainforest Walk (10 people);
- 1<sup>st</sup> year Science students (38 people);
- 2<sup>nd</sup> year Science students (58 people);
- JCU Open Day (20 people);
- Carey Grammar (17 people);
- JCU BZ 3620 students (15 people); and
- Candlenut Steiner School (6 people).

This does not include scientists visiting to conduct research (see p. 23)

## **External Cash Income to Joint Venture**

### **Research Grants (Competitive)**

Total research grant income to the ATH in 2013 was **\$545,981**. Details of grants are provided below (2013 component of total grant value, funds source, project title, total grant value and duration, ATH grantee(s)).

**\$120,000**, Australian Biological Resources Study (ABRS) BushBlitz Grant. Re-evaluation of current taxonomic concepts in Australian Orchidaceae utilizing phylogenies based on DNA barcodes and highly informative nuclear markers. \$360,000 over 3 years (2011-2014). **Schulte K, Crayn D.**

**\$115,459** National Environmental Research Program (NERP). What is at risk? Identifying rainforest refugia and hotspots of plant genetic diversity in the Wet Tropics and Cape York Peninsula. \$320,000 over 3.5 years (2011-2014). **Crayn D, Costion C, Bransgrove K, Schulte K, Abell-Davis S.**

**\$60,000**, Australian Centre for International Agricultural Research (ACIAR). Developing a sustainable wild sandalwood industry in Vanuatu. \$1.2 million over 5 years (2009-2014). **Page T (0.25 FTE).**

**\$50,000**, Australian Centre for International Agricultural Research (ACIAR). Development of a PNG timber industry based on community-based planted forests: design and implementation of a national germplasm delivery system. \$1 million over 5 years (2009-2014). **Page T (0.25 FTE).**

**\$46,875**, Australian Centre for International Agricultural Research (ACIAR). Domestication of galip nut (*Canarium indicum*). \$750,000 over 4 years. **Page T. (0.25 FTE).**

**\$45,000**, Australian Biological Resources Study (ABRS). Systematic studies in the Polystachyus-XIB group complex of *Elaeocarpus* L. \$135,000 over 3 years (2011-2014). **Crayn D, Baba Y, Phoon SN.**

**\$33,000**, Australian Biological Resources Study (ABRS) Bush Blitz Tactical Taxonomy Grant 'Revision of *Gynaikothrips* (Insecta, Thysanoptera: Phlaeothripidae) on *Ficus* trees in Australia, utilising morphological and molecular data.' Tree D, Mounds L, **Field AR.**

**\$27,500**, Australian Centre for International Agricultural Research (ACIAR). Development and delivery of germplasm for sandalwood and whitewood in Vanuatu and northern Australia. \$1.1 million over 5 years (2010-2015). **Page T (0.25 FTE).**

**\$11,000**, Daintree Rainforest Observatory Biodiversity Surveys. Macrofungi surveys of the Daintree Rainforest Observatory Field Station. **Abell-Davis SE, Bransgrove K.**

**\$9,995**, Griffith University/James Cook University Collaborative Grants Scheme. Lach L, Carroll AR, **Field AR.**

**\$7,500**, CSIRO Summer Student Program. Diversification and evolution of the Beard orchids (*Calochilus*, Orchidaceae): a molecular study. \$7,500 over 3 months, Dec 2013 - Feb 2014. **Mannel S.**

**\$4,000** Faculty of Science and Engineering, James Cook University: FSE Faculty Grant. Next Generation Sequencing Capability. \$8,000 over 2 years 2013 - 2014. **Micheneau C, Thornhill A, Schulte K, Crayn D, Simpson L, Bransgrove K, Dillon N.**

**\$3,500.** The Australasian Systematic Botany Society & Nature Conservancy: Australian Conservation Taxonomy Award. What is at risk? Phylogeography and taxonomy of orchids endemic to Queensland's mountain top biodiversity hotspots. \$9000 over 18 months, May 2013 - Nov 2014. **Simpson L.**

**\$3,000,** Australian Geographic Society Sponsorship. 125<sup>th</sup> Anniversary Archibald Meston expedition to the summit of Mt Bellenden Ker. **Field AR.**

**\$2,000,** James Cook University Graduate Research Scheme Funding 2013 for professional training support on the systematics of *Elaeocarpus*. **Phoon SN.**

**\$1,991,** Skyrail Rainforest Foundation Student Grant. Biodiversity and evolution of rainforest epiphytes in *Dendrobium*: the Australo-Papuan antelope orchids. (\$3982 over 2 years, July 2012 - June 2014. **Arobaya A.**

**\$1,964,** Wet Tropics Management Authority student research grant. Phylogeography and taxonomy of orchids endemic to Queensland's mountain top biodiversity hotspots. \$3927 over 2 years, April 2012 - April 2014. **Simpson L.**

**\$1,281,** North Queensland Wildlife Trust (NQWT) Grant. Ecosystem service of fungal spore dispersal for ectomycorrhizal sclerophyll forests. **Nuske S,** Congdon B, **Abell-Davis SE.** \$5151 over 1 year.

**\$1,000,** Wet Tropics Management Authority (WTMA) Grant. Arbuscular mycorrhiza diversity in a chronosequence of rainforest restoration sites. Paz C, **Abell-Davis SE.** \$4000 over 1 year.

**\$500,** Australian Biological Resources Study (ABRS) Student Travel Bursary Program 2012/2013 for conference attendance. Systematics Without Borders, Australasian Systematic Botany Society and the Society of Australasian Systematic Biologists, Sydney NSW. **Phoon SN.**

**\$216,** (USD200), Flora Malesiana Foundation Financial Support in attending the 9th Flora Malesiana Symposium, Bogor, Indonesia. **Phoon SN.**

**\$200,** Australasian Systematic Botany Society Student Assistance for conference attendance. Systematics Without Borders, Australasian Systematic Botany Society and the Society of Australasian Systematic Biologists, Sydney NSW. **Phoon SN.**

NOTE: For grants won by proportional ATH staff (Abell-Davis, Gadek, Page), grant value is proportioned by the staff member's nominal ATH FTE (i.e. 0.25).

### **Fees for Service**

During 2013, the ATH charged external clients \$33,948 in fees. This included Plant ID workshop fees (\$17,246), research consultancy income (\$11,620), sitting fees and honoraria (\$1,904) and conference/meeting sponsorship (\$3,178).

### ***Negotiations Relating to Biodiscovery Act***

During 2013 the Board (nor any third party authorised by the Board) did not engage in any negotiations with respect to authorities under or compliance with the *Biodiscovery Act 2004* (Qld).

### ***Intellectual Property***

During 2013, IP with the potential for commercialisation was created in three project areas:

- Collections development (see p. 28) – IP is represented by biodiversity information and plant material contained in the collections and associated databases.
- Regional Ecosystem mapping (see p. 54) – IP is contained in the mapping products.
- Australian Tropical Rainforest Plants – Information System (see p. 53) – IP is contained in the Key products.

## Management

### Staff

Two Postdoctoral Fellows were appointed on external grant funds:

**Dr Craig Costion** undertakes research on “Identifying rainforest refugia in the Wet Tropics and Cape York Peninsula”. Funding: National Environmental Research Program (NERP).

**Dr Claire Micheneau** undertakes research on “A re-evaluation of current taxonomic concepts in Australian Orchidaceae utilising phylogenies based on DNA barcodes and highly informative nuclear markers”. Funding: Australian Biological Resources Study (ABRS) BushBlitz Grant.

**Dr Andrew Thornhill** was appointed CSIRO/JCU Postdoctoral Fellow (until end 2014). Andrew’s research at the ATH will focus on using large molecular phylogenies to address broad scale questions on the origins, evolution and biogeography of the Australasian flora.

**Ms Raelee Kerrigan** was appointed on external funds on a part time basis (0.4 FTE) for 6 months to assist with curation in the Herbarium.

**Ms Melissa Harrison** continued as Laboratory Manager on a part time basis (0.6FTE), the remaining 0.4FTE was backfilled by ATH/JCU postgraduate student **Kaylene Bransgrove**, undertaking curatorial duties in the Herbarium.

Six new postgraduate students began studies with ATH supervisors in 2013:

**Mr Habat Asad** (thesis title “Manipulation and Management of Pollination and Fruit Set in Mango.” JCU, PhD full-time, supervised by **Page**).

**Ms Janet Gagul** (thesis title “Systematics and evolution of the genus *Elaeocarpus* L. (Elaeocarpaceae)”. JCU PhD full-time, supervised by **Crayn** and **Gadek**).

**Ms Arlene Lopez** (thesis title “Plant Breeding Systems of *Aquilaria*”, JCU, PhD full time, supervised by **Page** and Jeff Sayer).

**Ms Susan Nuske** (thesis title “Ecosystem service of fungal spore dispersal by mammals”. JCU, PhD full-time, supervised by **Abell-Davis**).

**Ms Danielle Tela** (thesis title “Seasonality of cockatoo grass *Alloteropsis semialata*, an important resource of the endangered northern bettong”, JCU, Grad. Dip. Res. Methods, full time, supervised by **Abell-Davis**).

**Mr Julio Ugarte** (thesis title “Feasibility of smallholder germplasm supply systems, JCU, PhD, supervised by **Page** and Jeff Sayer).

**Ms Yumiko Baba** submitted her PhD thesis (JCU, "Evolution, systematics and taxonomy of *Elaeocarpus* (Elaeocarpaceae) in Australasia", supervised by **Crayn** and **Gadek**) and is currently preparing a revised version.

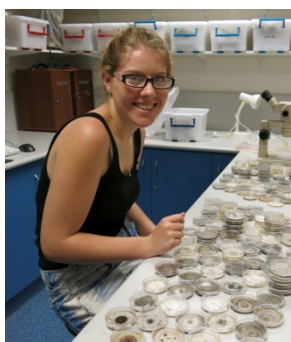
**Dr Caroline Puente-Lelievre** was awarded her PhD in 2013 (JCU, "Systematics and biogeography of the Styphelieae (Epacridoideae, Ericaceae)", supervised by **Crayn**, Elizabeth Brown, Mark Harrington, and **Gadek**).



Caroline Puente-Lelievre with her PhD testamur

### **Volunteers**

Seventeen volunteers contributed a total of 1,681 hours to ATH activities. The work undertaken was



Secondary student Kim Hood assisting in the mycology lab (Photo: Andrea Lim)

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. This year Anna Cole from TNQIT – TAFE, assisted in the Herbarium (63 hours) and two secondary school students on work experience assisted in the molecular and mycology labs (24 hours).

A thank-you lunch for the volunteers was held on 12 December, which was well attended by both volunteers and staff.

### **Training Received**

Cardio-pulmonary resuscitation refresher. JCU Cairns.

**Harrison M, Micheneau C, Arobaya A, Bransgrove K, Phoon SN, Simpson L.**

Senior First Aid. JCU Cairns. **Zich F, Schulte K, Costion C, Thornhill A, Elisala T.**

'R' Statistics package workshop. JCU Cairns. **Addicott E, Abell-Davis SE.**

4WD off-road safety. **Thornhill A, Gagul J. Arobaya A.**

Species distribution modelling – a practical hands-on tutorial for novices. ATH Science Circle, Workshop presented by Lalita Simpson, JCU, Cairns. **Bransgrove K, Costion C, Field A, Micheneau C, Phoon SN, Schulte K, Wilson G.**

Taming the BEAST: An introduction to dating molecular phylogenies. ATH Science Circle, Workshop presented by Andrew Thornhill, JCU, Cairns. **Bransgrove K, Costion C, Field A, Gagul J, Mannel S, Micheneau C, Phoon SN, Schulte K, Simpson L.**

Resilience and influencing skills in the tertiary sector. **Lim A.**

Advisor training workshop JCU, Cairns. **Micheneau C.**

CBA Geneious workshop, Canberra. **Micheneau C.**

CBA BEAST2 workshop, Canberra. **Micheneau C.**

The Strategic Researcher, JCU, Cairns. **Schulte K.**



Publishing smarter, JCU, Cairns. **Schulte K.**

How to enhance your profile in JCU's research portfolio, JCU, Cairns. **Schulte K.**

Networking towards collaboration, JCU, Cairns. **Schulte K.**

The bigger picture, JCU, Cairns. **Schulte K.**

### **Training/Teaching Provided**

**Addicott E.** CORVEG site training – 3<sup>rd</sup> year Botany intensive BZ3620/5620, JCU Cairns; Regional Ecosystems and vegetation classification – lecture. BZ2480, JCU, Cairns.

**Crayn D.** 'Tropical Flora of Australia' BZ3620/5620, JCU Cairns.

**Page T.** Agroforestry and Nursery Training Workshop, East New Britain Province, Papua New Guinea, October 2013.

**Schulte K, Field A, Micheneau C.** ATH Science Circle (organisers).

**Schulte K.** Estimating evolutionary trees. *Evolutionary Biology (BZ2820/BZ5820)*, JCU, Cairns, 22 April. Guest lecture.

**Schulte K.** Phylogenetics I. *Evolutionary Biology (BZ2820/ BZ5820)*, JCU, Cairns, 29 April. Guest lecture.

**Schulte K.** Phylogenetics II. *Evolutionary Biology (BZ2820/ BZ5820)*, JCU, Cairns, 2 March. Guest lecture.

**Simpson, L.** Species distribution modelling – a practical hands-on tutorial for novices. Workshop. *ATH Science Circle, JCU, Cairns. 28 March.*

**Thornhill A.** "Taming the BEAST" teaching workshop. JCU Cairns.

**Thornhill A.** "Raiding the GenBank" teaching workshop. JCU Cairns.

**Thornhill A.** Early Career Researcher Intensive Week. JCU Cairns.

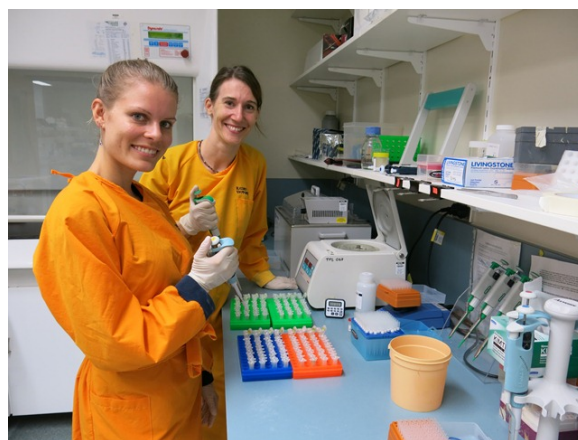
**Turpin G.** Ethnobotany training including plant collection and plant identification - Mapoon Rangers, Mapoon, 10 June.

**Turpin G.** Ethnobotany training including plant collection and plant identification - Skills on Country for Young Traditional Owners, Mitchell River Traditional Custodians Advisory Group. 1 October.

**Worboys SJ.** Rainforest Plant Identification Workshop, Cairns. For environmental staff at the Department of Transport and Main Roads in Cairns. 15-17 April 2013. 5 Participants.

**Worboys SJ.** Rainforest Plant Identification Workshop, Cairns. For members of the general public in Cairns. 10-12 June 2013. 10 Participants.

**Worboys SJ, Thornhill A.** Rainforest Plant Identification Workshop, Paluma. For members of the general public in Paluma and Townsville. 29 November – 1 December 2013. 12 participants.



Sarah Mannel received a CSIRO Summer Studentship to undertake research on *Calochilus* orchids with Katharina Schulte (r). (Photo: Andrea Lim)

**Wilson G.** 'Tropical Flora of Australia' BZ3620/5620, JCU Cairns.

### **Workplace Health and Safety**

No work-related lost time injuries were reported in 2013. Five staff were trained in Senior First Aid, five in cardiopulmonary resuscitation and one in 4WD off-road safety (see above).

### **Building/Infrastructure**

The ATH acquired approximately 24 m<sup>2</sup> of additional office space in the Sir Robert Norman Building (E2) in 2013. This comprises two standard (c. 12 m<sup>2</sup>) offices housing postdocs Andrew Thornhill and Craig Costion.

Environmental management systems continued to perform satisfactorily in 2013.

The second backup power generator and temporary fuel storage installed in 2011 remained in place throughout 2013.

### **IT and Networks**

Three mutually exclusive networks exist in ATH, servicing DSITIA, CSIRO and JCU staff respectively. The operation of these, while inefficient for internal communications, ran relatively smoothly.

IT Helpdesk service provision by JCU has been generally satisfactory although delays occur during times of peak demand.

## Science

### Scientific Visitors

The ATH hosted 50 visitors undertaking scientific research (see Appendix 2) including studies on the collections and collaborative activities of a scientific nature with ATH personnel.

### Conference, Meeting and Workshop Participation

**Abell-Davis SE.** Cost Action FA1103 Conference Endophytes for Plant Protection: the state of the art. Berlin, Germany; IOBC-WPRS meeting. Induced resistance in plants against insects and diseases. Avignon, France; Asian Mycological Congress, Beijing, China; ATH Retreat (Wetherby Station).

**Addicott E.** Einasleigh Uplands Bioregion offsets corridors. Mareeba QLD.

**Arobaya A.** Flora Malesiana Symposium, Bogor, Indonesia; ASBS Conference, Sydney, Australia; School of Marine and Tropical Biology Conference, Townsville, Australia; "Systematics Without Borders" joint Australasian Systematic Botany Society Conference/Society of Australian Systematic Biologists/Invertebrate Biodiversity & Conservation conference, December, University of Sydney.

**Bannink P.** ATH Retreat (Wetherby Station).

**Bransgrove K.** Flora Malesiana Symposium, August, Bogor, Indonesia; "Systematics Without Borders" joint Australasian Systematic Botany Society Conference/Society of Australian Systematic Biologists/Invertebrate Biodiversity & Conservation conference, December, University of Sydney; CPR Refresher Course (JCU); Fungi Workshop (Cairns Botanic Gardens); University Adelaide Systematics and Phylogenetics Workshop; Introduction to Statistics (1 day) (JCU); Advanced Statistics (2 days) (JCU); BEAST/Molecular Dating Workshop (JCU); ATH Retreat (Wetherby Station).

**Crayn D.** "Systematics Without Borders" joint Australasian Systematic Botany Society Conference/Society of Australian Systematic Biologists/Invertebrate Biodiversity & Conservation conference, December, University of Sydney; ATH/Centre for Tropical Biodiversity and Climate Change Workshop JCU Cairns; Australian Biological Resources Study (ABRS) Advisory Committee meeting, Sydney NSW; Council of Heads of Australasian Herbaria (CHAH) meeting, Sydney; Flora Malesiana Symposium, Bogor, Indonesia; Southern Connections Conference, Dunedin NZ; Biodiversity and Genomics Conference, Canberra ACT; ATH Retreat (Wetherby Station).



9th Flora Malesiana Symposium, Bogor, Indonesia (August 2013)  
– ATH participants (l-r) Darren Crayn, Sook-Ngoh Phoon, Kaylene Bransgrove and Gary Wilson.

**Elisala T.** National Indigenous Science Experience Program, Redfern, Sydney NSW.

**Field AR.** Australasian Systematic Botany Society Conference, Sydney, Australia; ATH Retreat (Wetherby Station).

**Harrison M.** ATH Retreat (Wetherby Station).

**Lim A.** ATH Retreat (Wetherby Station).

**Micheneau C.** 5<sup>th</sup> International Orchid Conservation Congress, La Réunion; CBA Biodiversity Genomics Conference, Canberra; TESS seminars, ATH/JCU, Cairns; Bushblitz Symposium – Adding to Australia's biodiversity picture, Canberra; Post Doc Lunch with HoS Professor Mike Kingsford, ATH/JCU, Cairns; NERP TE and Reef Rescue Conference, Pullman Reef Hotel Casino, Cairns; ATH Retreat (Wetherby Station).

**Newton M.** Einasleigh Uplands Bioregional Workshop - Offset Corridors. Mareeba, QLD; ATH Retreat (Wetherby Station).

**Page T.** World Teak Conference, Bangkok; Teak Germplasm Development in Papua New Guinea, March 2013

**Phoon, SN.** ATFI 'Scholarly Event' – Collaboration Workshop; Species distribution modelling – a practical hands-on tutorial for novices, ATH/JCU Cairns; School of Marine and Tropical Biology Postgraduate Conference, Townsville; Using Word in Thesis Workshop. JCU Cairns; Critical Thinking Workshop. JCU Cairns; Basic Mapping and GIS Skills Workshop. JCU Cairns; Flora Malesiana Symposium, Bogor, Indonesia; "Systematics Without Borders" joint Australasian Systematic Botany Society Conference/Society of Australian Systematic Biologists/Invertebrate Biodiversity & Conservation conference, December, University of Sydney; ATH Retreat (Wetherby Station).

**Schulte K.** Bushblitz Symposium – Adding to Australia's biodiversity picture, Canberra; BioSyst.EU – Global systematics! Conference. Vienna, Austria; Monocots V - 5<sup>th</sup> International conference on comparative biology of Monocotyledons, New York, U.S.A.; "Systematics Without Borders" joint Australasian Systematic Botany Society Conference/Society of Australian Systematic Biologists/Invertebrate Biodiversity & Conservation conference, December, University of Sydney; NERP TE and Reef Rescue Conference, Pullman Reef Hotel Casino, Cairns; ATH Retreat (Wetherby Station).

**Simpson L.** BioSyst.EU – Global systematics! Conference. Vienna, Austria; "Systematics Without Borders" joint Australasian Systematic Botany Society Conference/Society of Australian Systematic Biologists/Invertebrate Biodiversity & Conservation conference, December, University of Sydney; Postgraduate training workshop in systematics. University of Adelaide

**Thornhill A.** "Systematics Without Borders" joint Australasian Systematic Botany Society Conference/Society of Australian Systematic Biologists/Invertebrate Biodiversity & Conservation conference, December, University of Sydney; Centre for Biodiversity Analysis genomic conference, April, CSIRO, Canberra; ATH Retreat (Wetherby Station).

**Turpin G.** National Indigenous Science Experience Program, Redfern, Sydney NSW; World Indigenous Network Conference, Darwin; FunGIS Conference, Pacific International Hotel, Cairns; Biocultural Mapping Workshop (ACEAS), Cairns; International Conference on Indigenous Research, JCU; Deadly Awards, Sydney

Opera House, Sydney; CSIRO Capability Review workshop, Canberra; EcoTAS (Ecological Society of Australia), Auckland, NZ; PestFest seminar, Mareeba; ATH Retreat (Wetherby Station).

**Wilson GW.** Flora Malesiana Symposium, Bogor, Indonesia; ATH Retreat (Wetherby Station).

**Worboys S.** ATH Retreat (Wetherby Station).

**Zich F.** "Systematics Without Borders" joint Australasian Systematic Botany Society Conference/Society of Australian Systematic Biologists/Invertebrate Biodiversity & Conservation conference, December, University of Sydney; Australasian Systematic Botany Society Committee Meeting and Annual General Meeting, Sydney; Managers of Australasian Herbarium Collections annual meeting, Sydney, November 2013; ATH Retreat (Wetherby Station).

### **Representative Roles (External)**

**Abell-Davis SE,** Australasian Mycological Society (AMS), treasurer; Fungimap Australia, member; Cost Action FA1103 Endophytes in Agriculture and Biotechnology, International member.

**Crayn D,** Australian Biological Resources Study Advisory Committee, Chair, Research Committee; Australian Orchid Foundation Research Committee, member; Australian Barcode of Life Network Steering Committee, member; Council of Heads of Australasian Herbaria, member of the Executive, CNS member; Daintree Rainforest Observatory Scientific Committee, member; National Environmental Research Programme, Tropical Ecosystems Hub, Rainforest Implementation Group, member; Wet Tropics Management Authority Scientific Advisory Committee, member.

**Gadek P,** *Plant Species Biology*, International Organization of Plant Biosystematists, Board Member.

**Micheneau C.** 5<sup>th</sup> International Orchid Conservation Congress, La Réunion (France) Organising Committee member.

**Thornhill A,** Society of Australian Systematic Biologists, Secretary.

**Schulte K.** *Australasian Systematic Botany Society*, Chapter convener, Cairns.

**Schulte K, Micheneau C, Field A.** ATH Science Circle, organiser.

**Turpin G,** Scientific Advisory Committee member, Wet Tropics Management Authority (WTMA); Indigenous Contact Officer for Cape York (Weeds).

**Wilson GW,** Friends of the Botanic Gardens, Cairns, Patron.

**Wilson GW,** Member, IUCN Carnivorous Plants Working Group.

**Worboys, SJ.** Society for Growing Australian Plants, Cairns Branch. Newsletter Editor and Treasurer.

**Worboys, SJ.** Cairns and Far North Environment Centre (CAFNEC). Management Committee member.

**Zich F,** Australasian Systematic Botany Society (ASBS), Treasurer; Managers of Australasian Herbarium Collections (MAHC).

## **Reviewing, Refereeing, Editing**

ATH staff reviewed a range of manuscripts, grant proposals and theses during 2013.

**Journal Manuscripts (total 11):** *Australian Journal of Botany* (1 manuscript), *Australian Systematic Botany* (4), *Austrobaileya* (1), *Botanical Journal of the Linnean Society* (2), *Journal of Biogeography* (1), *Nuytsia* (1), *Perspectives in Plant Ecology, Evolution and Systematics* (1).

**Grant Proposals (total 30):** Australian Biological Resources Study (29 proposals), Caring for Our Country Grants (1).

**Books edited (total 2):** Murray N (2013) *Wabu Jananyu: Cultural Plant Use by the Giringun Aboriginal Tribal Groups of North Queensland*. 3E Innovative. (Reviewed and edited by Stuart Worboys); Mjöberg E (in press) *Amongst Stone Age People in the Queensland Wilderness*. Translated by Fryer SM. (Reviewed and edited by Stuart Worboys)

**Theses (total 4):** PhD (2 theses), Honours (2 theses).

## **Field Trips**

A total of 224 ATH staff person-days were spent on fieldwork in 2013.

**Abell-Davis SE, Nuske S.** Pilot study to Davies Creek, 1 day.

**Abell-Davis SE, Hof C, Grover D, Bunce A, Llewellyn G.** Pilot study to Davies Creek, 1 day.

**Addicott E, Newton M,** Allen J, Lakefield National Park and Kalpowar Station, Cape York, for checking Regional Ecosystem mapping and collecting CORVEG site data, 8 days.

**Addicott E, Newton M,** Neldner J, Hann River and Kimba Rd, Cape York, for checking Regional Ecosystem mapping and collecting CORVEG site data, 7 days.

**Addicott E, Newton M,** Field A, Bannink P, East Trinity Inlet, Cairns, for tour of site for future mapping 1 day.

**Arobaya AYS,** collecting orchid specimens for Orchidaceae (*Dendrobium* sect. *Spatulata*), Mt Arfak Nature Reserve, West Papua, Indonesia, 2 months.

**Bransgrove K,** Fechner N, Atherton Tablelands, Daintree and environs, collect fungi. 4 days,

**Bransgrove K.** and Bransgrove C. Mt Lewis, Oliver Creek, Mt Baldy, CSIRO Plots. 9 days.

**Bransgrove, K** and Bransgrove C. Atherton Tableland, Mt Lewis, Collect *Elaeocarpus carolinae*, 15 days.

**Bransgrove K, Simpson L.** Mt. Windsor, Mt Lewis, Lamb's Head, Mt Haig/Mt Edith. Collect *Elaeocarpus* and *Bulbophyllum*. 6 days.

**Field A,** Gray B. Chillagoe for *Gardenia wilhelmii*, 1 day.

**Field A,** Lach L. East Trinity for pilot ant-plant trip, 1 day.



**Field A, Micheneau C, Thornhill A.** Mossman River for Aeridinae (Orchidaceae), 1 day.

**Field A.** Mt Lewis for *Sorapilla papuana* 1 day.

**Field A, Newton M, Addicott E.** East Trinity for East Trinity monitoring pilot trip, 1 day.

**Field A, Newton M.** Lake Euramoo for CorVeg sites, 1 day.

**Field A, Simpson L, Micheneau C, Bransgrove K.** Kanawarra for *Bulbophyllum*, Aeridinae (Orchidaceae) and Elaeocarpaceae, 1 day.

**Field A, Turpin G.** Watsonville for Indigenous bush medicine plants, 1 day.

**Field A, Zich F.** McDowall Range for *Tecomathe* sp. Roaring Meg, 1 day.

**Kemp J, Newton M.** Irvinebank-Herberton area, Wet Tropics, for collecting CorVeg site data, 5 days.

**Kemp J, Newton M.** Wallaman Falls area, Wet Tropics, for collecting CorVeg site data, 3 days.

**Micheneau C, Field A, Thornhill A.** Mossman Gorge, for Orchidaceae (subtribe Aeridinae), 1 day.

**Simpson L, Bransgrove K, Field A, Micheneau C.** Mt Lewis for Orchidaceae (subtribe Aeridinae and genus *Bulbophyllum*) fungi and Elaeocarpaceae, 1 day.

**Simpson L,** Gray, B. Carrington Falls, Mt. Baldy (Herberton Range), for Orchidaceae (*Dendrobieae*), 1 day.

**Simpson L, Bransgrove K,** Gray, B. Mt Edith, Mt. Haig (Tinaroo Hills), for Orchidaceae (in particular *Bulbophyllum*) and fungi, 1 day.

**Simpson L, Bransgrove K, Goetze M.** Kaphalim Rock (Lambs Range) for Orchidaceae and fungi, 1 day.

**Simpson L, Bransgrove K.** Mt Windsor (Windsor Tableland) for Orchidaceae and fungi, 3 days.

**Simpson L, Bransgrove K, Linderhaus T.** Devils Thumb (Carbine Tableland) for Orchidaceae and fungi, 2 days

**Simpson L,** Roberts L. Mt Finnigan (Cedar Bay NP) for Orchidaceae, 2 days.

**Turpin G.** Mapoon Rangers, Mapoon for Bush Tucker and Bush Medicine Project, 5 days.

**Turpin G.** Guguu Yimithirr Traditional Plant Use recording, Hopevale, 3 days.

**Turpin G.** Mbabaram Medicinal Plants Project, Watsonville, 1 day.

**Wilson GW, Venter F,** Rentz D. Cape York, to continue field studies of *Nepenthes*, 14 days.

**Wilson GW.** Peninsula and Sarawak Malaysia – field studies of *Nepenthes*, 60 days.

**Worboys SJ.** Botanical survey of Kulla Land Trust lands. Stewart River catchment, east of Coen.

## Facilities

### **Collections**

#### **Infrastructure and Equipment**

In 2013 there were no major infrastructure or equipment changes. Climate control systems and other infrastructure performed to expectations.

#### **Accessions**

New Herbarium specimens accessioned into CNS in 2013 totalled 1,887 (based on allocation of CNS numbers). In addition 4,003 collection records were edited and 2,142 specimens were re-determined.

New accessions into the DNA/Tissue Bank totalled 755 samples. Full details are provided on p. 30.



#### **Loans and Exchange**

Loans sent from CNS: 1 (134 specimens).

Loans received for CNS staff: 3 (119 specimens).

Loans returned to CNS (CNS, QRS, and MBA specimens): 0 (0 specimens).

Loans returned from CNS: 0.

Exchange material sent: 0 (bulk consignments sent in early 2014).

Exchange material received: 314 specimens (3 consignments).

#### **Usage and Access**

The main collection was utilised by 20 scientific visitors for a total of 353 hours.

#### **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.

#### **Physical Curation**

During 2013, three staff were assigned Herbarium duties on a part time basis to undertake databasing and incorporation of new specimens (total 0.7 FTE). This level of staffing was barely sufficient to keep up with databasing incoming accessions leaving little resources for other aspects of physical curation. This year staff processed routine accessions from staff, students and exchange specimens from other herbaria. We are still anticipating additional significant acquisitions over the next few years (e.g. Seagrass Watch Program collection of marine angiosperms, and Jeanette Kemp's reference collection to be incorporated into the PRC), which will require significant curation resources in order to meet the KPI target for processing times.

### **Names Curation**

New taxonomic literature is being routinely applied to the collection. Several notable curatorial targets still remain to be addressed, including applying nomenclatural changes in *Corymbia-Eucalyptus*. The casual staff (0.7 FTE, see above) are consumed with data entry leaving little time for names curation.

### **Database**

The database, ATHIS, became operational in May 2009 and has since operated reliably and with fast communication speeds.

Over 2013, seven ATH staff and students used the database for routine data entry and updating. Remaining staff, students and many associates have database 'query only access'. The use of web-based Oracle forms continues to be very effective in enabling users to log on from any IT network.

Progress has been made on the integration of MBA collection records into the database, with validation checks producing numerous records requiring editing to conform with replicates. Integration is anticipated to be completed in 2014.

### **Climate Control**

Climate control (temperature and relative humidity) and alarm/fire suppression systems functioned reliably with no significant issues to report. Climate parameters were stable and well constrained within set limits.

JCU Estate Office addressed the issue of backup power and fuel supply to the ATH and adjacent buildings in the 2012 cyclone season by installing a hired secondary backup generator and temporary fuel storage. These facilities remained for the 2013 cyclone season.

### **Pest Management**

ATH's pest control strategy proved effective. No insect pests were detected in the Collection Room during 2013.

## ***Molecular Laboratory***

### **Infrastructure and Equipment**

No significant infrastructure and/or equipment purchases occurred during 2013. With the exception of the liquid handling robot, all current equipment and infrastructure items are in good repair.

During 2013, increasing difficulty in accessing essential communal equipment, in particular, autoclave services, was experienced. Purchase of a dedicated ATH autoclave in 2014 will alleviate the issues with access and undoubtedly result in far less 'down-time'.

### **Accreditation and Compliance**

The Laboratory Manager, Melissa Harrison is the Quarantine Accredited Person through until November 2014. The ATH has ceased operations as a Quarantine

Approved Premise (QAP). In 5 years we have not required this endorsement for our activities, and the expense to maintain the QAP was unnecessary. A JCU plant QAP is located in the neighbouring building if required.

The molecular laboratory underwent a chemical safety audit in 2013. No significant issues were identified.

### **DNA/Tissue Bank**

Holdings currently consist of c. 6750 samples (755 of which were added during 2013). Our collection represents the great majority of vascular plant genera present in the wet rainforests of North Queensland, and significant representation of the non-rainforest flora. We continue to build on our collections with the main strategic focus being on achieving representative coverage of all northern Australian biomes.



Ms Janani Jayanthan assisting in the molecular lab (Photo: Andrea Lim)

Throughout 2013, the merging of old collections into the new storage format to achieve a more streamlined and efficient system continued. Over 300 archival DNA samples have been transferred to the new storage system.

There have been 1000 samples catalogued to date in the tissue collection (external to project collections).

### **Usage**

The number of laboratory users increased throughout 2013, continuing the trend over previous years: seven ATH research / post doctoral staff, numerous visiting researchers and students (both international and local), one summer research student, two lab volunteers, and eleven PhD students (some of whom are not directly supervised by ATH staff, but utilised our resources on a 'fee for service' basis). Further to this, the ATH laboratory provided mentoring for several high school work experience students. General management, training and technical assistance to users is provided by one part time (0.8 FTE) manager (Melissa Harrison).

## Research

Following are details of research undertaken as per the ATH research plan 2013 (Appendix 5). ATH staff are in bold. Projects are listed under the ATH Research Theme to which they contribute principally. Projects conceived and begun in 2013 and therefore not in the 2013 research plan (Appendix 5) are marked "NEW".

### **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.

#### **Phylogeography of orchid species complexes of the Australian Wet Tropics**

**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.

**2013 goals:** One or more species of mountain top endemic orchid species (from genus *Bulbophyllum*) will be selected for analysis. Field collections and DNA extraction of these aimed to be completed, and AFLP analysis well advanced.

#### **2013 Achievements:**

**L. Simpson** presented the results of her molecular studies in the *Dendrobium speciosum* complex at three international and one national conference (1 talk, 3 poster presentations).

**L. Simpson** successfully completed her PhD confirmation seminar in February 2013, following a research presentation and submission of a project proposal and a draft manuscript about the taxonomy and phylogeography of the *D. speciosum* complex.

**L. Simpson** worked with **K. Schulte** and **D. Crayn** on a manuscript on the taxonomy and phylogeography of the *Dendrobium speciosum* complex (presenting the results of Simpson's Honours research) including a new component modelling the species' distribution under future climate scenarios. Submission to an ISI journal anticipated in early 2014.

**L. Simpson** carried out extensive fieldwork on the mountain tops throughout Australian Wet Tropics to collect *Bulbophyllum* samples for the molecular analyses of mountain top endemics. Fieldwork was conducted at Carrington Falls, Mt. Baldy, Mt. Edith, Mt. Haig, Kalphalim Rock, Mt. Windsor, Mt. Lewis, Devil's Thumb, and Mt. Finnigan. Bruce Gray, Lewis Roberts, Tapio Linderhaus and **Kaylene**

**Bransgrove** assisted with the field work. Fieldwork is expected to be completed in 2014.

**L. Simpson** developed the methodological approach for her population genetic studies further and changed it from AFLPs to a Next Generation Sequencing approach (RAD sequencing). **L. Simpson** aims to establish this novel NGS technique in the ATH lab in 2014.

**L. Simpson** was awarded the Australian Taxonomy Conservation Award (\$9,000) for her PhD project to fund the Next Generation sequencing component of her study and the participations in two ASBS conferences. She presented her PhD project at one international conference (1 talk).

**L. Simpson** gave a workshop on species distribution modelling at the ATH Science Circle in March 2013.

**K. Schulte** continued AFLP studies in the Cooktown orchids. Altogether, AFLP profiles for 120 samples and nine primer combinations were generated. PhD candidate **M. Goetze** (Universidade Federal Rio Grande do Sul) was trained during her internship at ATH in 2013 in AFLP techniques by **K. Schulte**, and greatly assisted with AFLP data generation. Completion of data analyses is anticipated in 2014.

**K. Schulte** organised a symposium on hybrid speciation at one international conference (BioSyst.EU - Global systematics, Vienna 2013)

**Support:** ABRS Bushblitz grant to **Schulte, Crayn** and Clements: \$360K (over 3 years), Wet Tropics Management Authority student grant to **Simpson**: \$3,927 (over 2 years), Australian Conservation Taxonomy Grant to **Simpson**: \$9,000 over 3 years, National Environmental Research Programme (NERP) \$320K (**Crayn D, Costion C, Schulte K, Abell-Davis S, Bransgrove K**, et al.)

**Team:** **Lalita Simpson** (PhD student), **Katharina Schulte, Claire Micheneau**, Mark Clements (CANBR), Keith MacDonald (DSITIA), **Ashley Field, Darren Crayn**

**Presentations:** Crayn et al. (2013a); Simpson (2013); Simpson et al. (2013a, 2013b, 2013c, 2013d, 2013e)

### **DNA-Barcoding tropical Australian trees**

**Background:** DNA barcoding is the use of short, standardised DNA sequences to identify biological unknowns. ATH is working to barcode Australian tropical rainforest trees.

**2013 Achievements:** ARC linkage grant submitted with Smithsonian Institution as the primary industry partner with aims to build on the northeast Queensland DNA barcode dataset and to build a complete DNA barcode phylogeny for the CSIRO Robson Creek 25 hectare plot on the Atherton Tablelands.

**Support:** National Environmental Research Programme (NERP) \$320K (**Crayn D, Costion C, Schulte K, Abell-Davis S, Bransgrove K**, et al.)

**Team:** **Craig Costion, Darren Crayn**, John Kress, Alison Shapcott.

**Presentations:** Costion et al. (2013); Crayn (2013); Crayn et al. (2013a)

## **Host specificity of fungal endophytes of tropical Australian rainforests**

**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.

**2013 Goals:** Locate populations of *Elaeocarpus carolinae* north and south of the Black Mountain Corridor (BMC), isolate and culture fungal endophytes from collected leaves, extract fungal DNA from collected leaves (allows identification of endophytes which do not grow in culture), identify endophytes using traditional morphological and with molecular means, present results at relevant conferences.



FUNgals: Kaylene Bransgrove, Sandra Abell-Davis, Melinda Greenfield.  
(Photo: Andrea Lim)

**2013 Achievements:** Eleven *Elaeocarpus carolinae* populations North (4) and South (7) of the BMC have been located. From those populations 40 trees (20 trees North, 20 South) have had 30 leaves harvested. Each individual tree has had DNA extracted with microsatellite sequencing 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 have been assigned to in excess of 100 morphological groups (potential species). DNA of a minimum of three representatives of each morphological group now await DNA extraction for molecular identification and/or confirmation of species. The preliminary results of the project were orally presented in 2013 by Kaylene Bransgrove at one national (ASBS where she received an award for best student presentation) and one international conference (Flora Malesiana).

**Support:** National Environmental Research Program (NERP) grant to Crayn et al. (\$320K over 3 years for all projects).

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

**Presentations:** Bransgrove et al. (2013a, 2013b)



## **Re-evaluation of taxonomic concepts in Australian Orchidaceae based on molecular phylogenetic evidence**

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 will be used to reconstruct comprehensive phylogenies, infer character evolution and historical biogeography of Australian Orchidaceae, and to develop molecular identification tools for conservation and legislative enforcement.

**2013 goals:** Field collections, DNA extractions, sequencing of plastid and nuclear loci, data analysis, participation in 1 international conference, preparation of a manuscript.

### **2013 Achievements:**

**L. Simpson** and **A. Field** conducted fieldwork in the Australian Wet Tropics (e.g. Atherton Tablelands, Mt. Baldy, Kalphalim Rock, Mt. Windsor, Mt. Lewis, Devil's Thumb, and Mt. Finnigan), with focus on Dendrobiinae, Bulbophyllinae, and Vandeeae.

In the reporting period the team were able to increase the holdings at the ATH orchid DNA bank by more than 25 % to more than 1,980 DNA extracts in total (i.e. 530 new extractions), with tissue samples provided by M. Clements or collected in the field, with focus on Dendrobiinae, Bulbophyllinae, Vandeeae, and *Calochilus*. Altogether, the team have so far produced over 2,300 complete orchid DNA barcodes.

**K. Schulte** and **C. Micheneau** further advanced DNA sequencing and data analysis for Dendrobiinae, including previously missing sections of *Dendrobium*. The resulting phylogeny provided detailed insights into the evolution of the Australasian *Dendrobiums*. Molecular dating analyses and diversification rate analyses revealed novel insights into the temporal diversification of Dendrobiinae. The results were presented at 4 international and 2 national conferences (8 talks and 1 poster). Submission of a manuscript is anticipated for 2014.

**C. Micheneau** began a molecular work on Australasian Aeridinae in collaboration with Mark Clements and Alexander Kocyan (University of Potsdam, Germany)

**A. Arobaya** continued her PhD studies on the biodiversity, phylogeny and evolution of the Antelope orchids (*Dendrobium* sect. *Spatulata*), supervised by **K. Schulte**, **D. Crayn** and **P. Gadek**. **A. Arobaya** conducted field work in Manokwari, West Papua (Indonesia) collecting *Dendrobium* specimens for her PhD research. **A. Arobaya** received further lab training by M. Harrison and sequenced one marker (ITS) for her study group.

**A. Arobaya** worked on her literature review and a draft paper as part of the requirements for her PhD candidature at JCU. She participated in a writing support course at JCU and received writing training by Liz Tynan from the Graduate Research School at JCU. Confirmation of her candidature is pending the successful completion of the required writing tasks.

**A. Arobaya** presented the first results of her molecular studies in three oral presentations (1 international and 2 national) and four poster presentations (3

international and 1 national).

**K. Schulte, C. Micheneau** and M. Clements submitted a proposal to the CSIRO summer studentship program for molecular phylogenetic study on the Beard orchids (*Calochilus*, *Thelymitrinae*), which was included in the CSIRO summer studentship program.

**S. Mannel** (Bachelor student JCU) successfully applied for the CSIRO summer studentship (\$7,500), and completed the 10 weeks internship at the ATH (Dec. 2013 - Feb. 2014), supervised by **K. Schulte, C. Micheneau** and M. Clements. During her internship Mannel produced a well resolved 5-marker phylogeny for *Calochilus*. Further, she examined the spatio-temporal evolution of *Calochilus* based on a dated phylogeny and distribution records, and investigated a set of morphological characters to evaluate their taxonomic value.

**L. Simpson** continued her molecular work on a framework phylogeny for Australasian *Bulbophyllum*s. In February-March **L. Simpson** visited G. Fischer at Hong Kong's Kadoorie Farm Botanical Gardens to collaborate on a broader level phylogenetic study on *Bulbophyllum*. **L. Simpson** and G. Fischer conducted preliminary data analyses to resolve phylogenetic relationships among Asian and Australasian *Bulbophyllum* groups.

In total, **L. Simpson** obtained 374 samples representing 144 *Bulbophyllum* species from 50 sections for her study, the majority of which were provided by M. Clements. Sequencing for 97 % of the Australian species as well as for an initial subset of the genus were successfully completed with two molecular markers (ITS, *ycf1*). The study provides first insights into the phylogenetic placement of Australian *Bulbophyllum*s.

**K. Schulte** continued to curate the orchid living collections. **L. Simpson** and the ATH volunteers greatly assisted in the maintenance of the living collections.

**C. Micheneau** continued to develop the establishment of a next-generation sequencing pipeline for large-scale phylogenetic datasets, successfully applied for a Faculty Grant (JCU) for Next-Generation bioinformatics infrastructure (\$8,000), and participated in a series of CBA Biodiversity Genomics Conference workshops held at Canberra (i.e. Preparing Samples for Sequencing workshop, Population and Speciation Genomics workshop, Geneious workshop, BEAST2 workshop).

**K. Schulte** continued to curate the orchid living collections. **L. Simpson** and the ATH volunteers greatly assisted in the maintenance of the living collections.

**Support:** ABRS BushBlitz grant \$360K over 3 years (**Schulte K, Crayn D, Clements M, Weston P, Cross H, Lowe A**), JCU/CSIRO postdoc support \$20K over 2 years (**Schulte**), Skyrail rainforest foundation grant (**A. Arobaya**, \$3,982), PhD scholarship to **A. Arobaya** (from Indonesian government, over 3 years). CSIRO student summer studentship \$7,500 to **S. Mannel** (for 10 weeks), FSE Faculty Grant (JCU) \$8,000: *Next Generation Sequencing Capability* (**Micheneau C, Thornhill A, Schulte K, Crayn D, Simpson L, Bransgrove K**, and Dillon N).

**Team:** **Katharina Schulte, Claire Micheneau, Agustina Arobaya** (PhD student), **Darren Crayn**, Mark Clements (CANBR), Joe Miller (CANBR), Peter Weston (Botanic Garden Trust, Sydney)

**Presentations:** Micheneau et al. (2013a, 2013b); Schulte (2013); Schulte and Micheneau (2013a, 2013b); Schulte et al. (2013a, 2013b, 2013c).

## **Entomopathic fungi**

**Background:** The application of entomopathogenic fungi as biocontrol agents to reduce the reliance of the agricultural industry on chemicals is yet to be realised. A JCU honours project in 2010 identified the entomopathogen *Beauveria bassiana* as having a high potential to work as an artificial endophyte biocontrol agent of weevils in the Australian Cavendish variety of banana. Endophytes are fungi that live within leaf and stem tissue (without causing disease to their plant hosts) that may produce toxic compounds to deter herbivory. A much larger library of local *B. bassiana* isolates has now been compiled with multiple copies stored at both the ATH and DAFF. We have also extracted the DNA of 20 individuals of *B. bassiana* and have sequenced two regions (ITS and EF1-alpha). Sequencing data analysis has been completed and added to an existing global phylogeny with a manuscript currently in review. This project is continuing as a component of a QAAFI fully funded UQ PhD project on banana pests through a new collaboration also including the ATH/JCU and DAFF. Currently this project is on hold while the PhD student has deferred to take up a fellowship at CIAT in Columbia until June 2014. A new project is currently under development that will produce a systematic catalogue of arthropod infecting fungi in the genus *Cordyceps sensu lato* (Hypocreales, Ascomycota) from the rainforests of Australia, in collaboration with BRIP, UQ and DAFF.

**2013 Goals:** Project suspended while student completes Fellowship at CIAT in Columbia. Proposal writing for funding applications. Completion of manuscripts. Conference attendance.

**2013 Achievements:** PhD project suspended until June 2014. An ABRs funding application is currently pending. One manuscript is in review and another is in preparation. Sandra Abell-Davis has made new collaborations for future projects during conference attendances.

**Support:** DAFF in kind support, UQ in kind support, QAAFI scholarship and project support, ABRs funding application pending.

**Team:** Melinda Greenfield (UQ, PhD student), **Sandra Abell-Davis**, Ian Newton (DAFF), Mike Furlong (UQ), Myron Zalucki (UQ), André Drenth (QAAFI), Roger Shivas (QDAFF/BRIP), Elizabeth Aitken (UQ), Alistair McTaggart (QDAFF/UQ), Tom Marney (QDAFF/BRIP/UQ), Joseph Spatafora (OSU).

## **Origins of the Wet Tropics flora – a molecular perspective**

**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, date them, and use them to generate general explanations about tempo and direction of evolution of the tropical rainforest flora: what elements of the extant rainforest flora are derived from Gondwanan stock (relictual taxa) that have differentiated in situ, what are the invasive elements, and where (and when) have they come from?

**2013 Goals:** To re-analyse and update over 20 published molecular studies that have taxa from both the Sahul and Sunda, using the same method for each

analysis. The preferred molecular dating method will most likely be BEAST. To build and date a phylogeny of the species that occur in northern Australia, New Guinea and New Caledonia.

**2013 Achievements:** 20 published studies were re-created and re-analysed using BEAST. We will now try and include additional taxa sequences for each project that have either been created by our lab group or have become available since the original publication. Alignments of *matK*, *ndhF* and *rbcL* have been created and combined for the species of northern Australia, New Guinea and New Caledonia. The combined alignment contains over 3200 species and we will require special time allowance on an international supercomputer to complete the analysis.

**Support:** JCU-ATH postdoctoral funds, National Environmental Research Program (NERP).

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

**Presentations:** Crayn et al. (2013b, 2013c, 2013d, 2013e)

### **Identifying refugia and hotspots of phylogenetic diversity in the Wet Tropics flora**

**Background:** This study is investigating, using a plot-based approach, the relative performance of taxonomic diversity (species counts) and phylogenetic diversity (branch lengths on molecular phylogenies: PD) measures for conservation priority setting. This project is aligned with the tropical tree DNA-barcoding project and data will contribute to both projects.

**2013 Goals:** Publish results.

**2013 Achievements:** The underlying phylogeny was revised and constrained to APG III. The paper was revised with some additional analyses and is now in review with *Diversity and Distributions*. David Hilbert from CSIRO was added as a co-author and collaborator on the project for contributing his dataset on rain forest stability through time.

**Support:** grants to Andy Lowe and Darren Crayn, JCU New Professor grant \$3K, ATH in-kind (c. \$10K). National Environmental Research Programme (NERP) \$320K (**Crayn D, Costion C, Schulte K, Abell-Davis S, Bransgrove K**, et al.)

**Team:** Craig Costion, Darren Crayn, Mark Harrington, Andy Lowe (U. Adelaide, State Herbarium of South Australia), Hugh Cross (U. Adelaide), Dan Metcalfe (CSIRO SE), Andrew Ford (CSIRO SE).

**Presentations:** Costion et al. (2013), Crayn et al. (2013a).

### **Phylogenetics and evolutionary dynamics of Elaeocarpaceae**

**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.

**2013 Goals:** PhD student Yumiko Baba expects to complete her studies by the end of the year. Discrete studies within the thesis include a multigene molecular phylogeny of *Elaeocarpus*, and a combined morphometric and molecular phylogeographical analysis of the *E. obovatus* complex. The molecular phylogenetic study and at least one new species description will be submitted for publication. PhD student Sook-Ngoh Phoon will complete amplification of the selected DNA markers (plastid: *trnL-F*, *trnV-ndhC*, *trnH-psbA*; nuclear: ITS and *Xdh*) aimed at inferring the phylogeny, historical biogeography and evolutionary divergence times of the genus *Elaeocarpus*. Former PhD student Hannah McPherson will submit a paper on phylogenetic systematics and biogeography of the *Tetratheca* group.

**2013 Achievements:** Yumiko Baba compiled a 3-locus molecular dataset comprising 114 *trnL-F*, 112 *trnV-ndhC* and 93 ITS sequences from a broad sample of Australian, the Pacific and Asian species. Analysis of these data has resolved monophyly of the all of the genera in Elaeocarpaceae except *Elaeocarpus*. For the morphometric analysis of the *E. obovatus* complex, a total of 27 qualitative variables for 84 specimens comprising both vegetative and floral attributes were scored and analysed by clustering and the predictive analysis. The analysis provided support for new circumscriptions for the morphologically complex group. For the population genetic analysis, the same specimens scored for morphometrics were used. Amplification of 6 microsatellite markers from 170 selected samples was completed and the ploidy of representatives of each genetic group was estimated by flow cytometry measurements.

Sook-Ngoh Phoon compiled a 4-locus molecular dataset comprising 153 *trnL-F*, 146 *trnV-ndhC*, 155 *trnH-psbA* and 59 *Xdh* sequences from a broad sample of Madagascar, Asia, Malesia, Australasia and the Pacific islands. Amplification of the three plastid markers was successfully sequenced for 155 taxa, including the outgroups, but the nuclear markers are facing paralogous problem, where only small amount of the samples were successfully sequenced using Sanger Sequencing methods. Therefore, the Next-Generation Sequencing technology is currently undertaken, which has been shown to be useful in resolving paralogous problem. Preliminary analysis of the available data has resolved monophyly of *Elaeocarpus* and relationships between *Elaeocarpus*, *Aceratium* and *Sericolea*. Within *Elaeocarpus*, *E. holopetalus* from Australia is identified as a distinct lineage and sister to all other *Elaeocarpus* species sampled.

During August 2013, Darren Crayn, Yumiko Baba and Sook-Ngoh Phoon travelled to the UK to work with the world expert on Elaeocarpaceae, Dr Mark Coode, at herbaria K (Kew, London) and E (Edinburgh). Through two weeks of intensive study of specimens and discussions with Coode, Baba and Phoon learnt a great deal about the patterns of variation in morphology, the interpretation of key morphological characters of *Elaeocarpus*, and the range of species and their distributions.

**Support:** Skyrail grants totaling \$9.4K (**Baba Y**), Australian Biological Resources Study grant \$135K (**Crayn D, Phoon S-N, Baba Y**).

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

**Presentations:** Niisalo et al. (2013); Phoon and Crayn (2013a; 2013b; 2013c); Phoon, Baba and Crayn (2013a; 2013b).

**Publications:** Phoon (2013a); Phoon (2013b).

### **Systematics of miscellaneous tropical flora**

Staff at ATH are engaged in small taxonomic projects on a range of different Australian tropical plant groups. These small projects are outlined in brief below.

Support: These projects are all largely collections- and field-based. Some molecular phylogenetic and population genetic study will be undertaken as appropriate, which will be funded internally.

### **Species concepts in *Platycterium bifurcatum*, *P. hillii*, *P. veitchii* and *P. willinckii***

Recent molecular phylogenetic investigations have resolved the systematic relationships among *Platycterium* ferns outside of Australia. The relationships among three taxa presently recognised as occurring in Australia have not been investigated and they are presently not recognised outside of Australia. They are ecologically separated and morphologically distinct, however the importance of these phenotypic characters remains unknown.

**2013 Goals:** Generation of a DNA bank and rhizome and frond scale collection set of *Platycterium* from tropical Australia for phylogenetic investigations.

**2013 Achievements:** DNA material, rhizome and leaf vouchers of all three Australian *Platycterium* were collected. The locations sampled include Cannia Gorge, Blackdown Tableland, Canarvon Gorge, Eungella, Mt Stuart, Paluma, Kinrara Crater, Lava Plains, Cardwell, Tully, Mt Hypipamee, Bramston Beach, Lamb Range, Font Hills, Mt Lewis and Daintree. Additional sampling sites for future population genetics studies were identified. DNA samples of the following non-Australian *Platycterium* were obtained and lodged in the ATH DNA bank: *P. andinum* Peru, *P. alcicorne* Tanzania, *P. coronarium*, Malaysia, *P. elephantotis* Cameroon, *P. ellisii* Madagascar, *P. grande* Philippines, *P. holttumii* Thailand, *P. madagascariense* Madagascar, *P. quadridichotomum* Madagascar, *P. ridleyi* Malaysia, *P. stemmaria* Cameroon, *P. wallichii* Thailand, *P. wandae* Papua New Guinea, *P. willinckii* Indonesia.

**Team:** Ashley Field, Joseph Holtum (JCU), Cassandra Denne (Honours Student, JCU), Katharina Schulte, Peter Bostock (DSITIA)

### **Nepenthes in Australasia**

**Background:** Gary Wilson is working toward his PhD (part-time) on the systematics and ecology of *Nepenthes* pitcher plants in Australasia. Extensive field and herbarium observations, pollination research, and population genetics are being used to determine appropriate taxon boundaries in this iconic genus.

**2013 Goals:** Extensive field observations and collecting of material for morphometric and population genetic analysis will be undertaken.

**2013 Achievements:** Completed two weeks of fieldwork on the Australian taxa in northern Cape York, Conducted comparative studies of *Nepenthes* with co-workers in Indonesia and Malaysia while a Visiting Scientist at Monash University, Malaysia. Established a living collection of study taxa in the ATH Shade house in Cairns

**Presentation:** Wilson and Venter (2013); Wilson (2013a, 2013b, 2013c)

**Team:** Gary Wilson, Charles Clarke, Katharina Schulte, Darren Crayn, David Rentz (retired), Fanie Venter (consultant).

#### **Tecomanthe sp. 'Roaring Meg' (L.J.Brass 20236)**

**Background:** The systematics of the genus *Tecomanthe* (Bignoniaceae) are being investigated by Frank Zich and Andrew Ford (CSIRO) with a focus on the status and relationships of *Tecomanthe* sp. 'Roaring Meg' (L.J.Brass 20236).

**2013 Goals:** Complete morphological work and draft taxonomic paper describing the new species. Explore sources of material for genus-level molecular phylogenetic work.

**2013 Achievements:** Additional leaf samples have been collected to contribute to a generic level phylogeny of Bignoniaceae in Australia. Progress was made in scoring and recording of morphological features of *Tecomanthe* sp. 'Roaring Meg' (L.J.Brass 20236) and *Tecomanthe hillii*.

**Team:** Frank Zich

#### **Taxonomy and Phylogeny of Hypogeous Fungi**

**Background:** The majority of the hypogeous fungi taxa collected in the Wet Tropics region so far have been from the order Hysterangiales. This order is 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 project aims to formally describe and name up to 12 new species out of 26 Hysterangiales species that have already been collected from the Australian tropics.

**2013 Goals:** The species descriptions produced during 2012 will be compiled into manuscripts for publication. The ITS sequence data produced during 2012 will be used to verify the morphological taxonomic groupings and give weight to those new species descriptions. Sequencing of at least two other genes (possibly EF1-alpha and LSU) will also commence in 2013. On the completion of sequencing an analysis of the phylogeography of the Hysterangiales will then be re-evaluated in the context of Australasian diversity and affinities.

**2013 Achievements:** Due to staff changes in 2013 this project did not continue in this form. Much of this research has been incorporated into the "Barcoding of ectomycorrhizal hypogeous fungi" project (p. 43).

**Support:** \$6K from Environmental Protection Agency, \$7K from ATH postdoc research funds.



**Team:** Sandra Abell-Davis, Teresa Lebel (Landcare Auckland, RBG MEL), Michael Castellano (Oregon State University), Kentaro Hosaka (National Museum of Nature and Science Japan), David Largent (Humboldt University).

### **Fungi of northeast Queensland**

Mycology, the research of fungi, is understudied worldwide. Mycology in the wet tropics bioregion of far north Queensland has been especially neglected. There is a current surge in interest both nationally and internationally for research to be carried out within the wet tropics bioregion. One of the aims of the ATH is 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. Collaborators continue to add to the ATH Mycoblitz fungi collections.

**2013 Goals:** Continue species descriptions for the Entolomatoid fungi, accession fungi specimens, perform macrofungi collection trips, network with and support mycologists to visit the WTWHA and to deposit specimens in the ATH.

**2013 Achievements:** Three publications in Mycotaxon were achieved for the Entolomatoid fungi, there were 15 macrofungi field trips to Oliver Creek, Daintree River Observatory, Mt Lewis, Mt Baldy and Mt Haig, funding secured for collection of reference specimens at the Daintree River Observatory. The *Inocybe* (Matheny, Bougher and Barrett) collections from 2012 have now been databased.

**Support:** *Entoloma* fungi supported by the Largent trust and National Science Foundation; Daintree River Observatory \$11,000.

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

**Publications:** Largent et al. (2013a; 2013b), Bergemann et al. (2013).

### **Biodiversity of mountain-top macrofungi of the Wet Tropics**

**Background:** The mountain-tops of the Wet Tropics World Heritage Area (WTWHA) house a diverse but poorly documented fungal flora. These fungi form essential relationships with the specialised or endemic mountain-top plant flora. Existing collections of fungi from the WTWHA are primarily from opportunistic expeditions or scientists targeting specific taxa. In this project, specific mountain-top sites will be monitored systematically to provide the first ongoing biodiversity survey for macrofungi in the WTWHA, the first documentation of seasonality of macrofungi in the WTWHA and to explore the effects of forest composition on fungal diversity.

**2013 Goals:** To conduct seasonal surveys of existing plots at Oliver Creek, Mt Lewis, Mt Baldy and Mt Haig.

**2013 Achievements:** Seasonal surveys of existing plots at Oliver Creek, Mt Lewis, Mt Baldy and Mt Haig were conducted. A preliminary checklist is being compiled.

**Support:** National Environmental Research Program (NERP) grant to Crayn (\$320K over 3 years for all projects).

**Team:** **Kaylene Bransgrove** (PhD student), **Sandra Abell-Davis**, **Darren Crayn**, Brett Summerell (RBG Sydney).

### **NEW - The angiosperm phylogenetic hotspots of the world**

Areas of species richness and diversity have most commonly been identified based on units of traditional morphological taxonomy. With the age of molecular systematics we have been steadily increasing the number of organisms that have had their DNA sampled. We are now in a position where large datasets can be created based on what has already been collected. We will use DNA data already stored in the online repository GenBank, to create a genus level phylogeny of world plants. This will then be combined with the spatial information for each genus from the Discover Life project. The hope is that we will identify which areas of the world are rich in plant genetic diversity and also areas that are high in unique genetic diversity. We will also show what happens when arbitrary borders are removed from an analytical dataset.

**2013 Goals:** Create world plant genus phylogeny. Collate distributional records for each plant genus.

**2013 Achievements:** We searched for over 14,000 plant genera in Genbank and have found at least one DNA sequence for over 10,150 genera. Sequences have been downloaded for 13 genes and have been aligned. These alignments still need to be better refined using a supercomputer. Our collaborators from America have searched GBIF and downloaded over 38 million plant records. Of these, 21.5 million records have longitude and latitude co-ordinates with more than 2 decimal points, suggesting that they are accurately recorded. We have noticed that there are some areas of the world that lack sufficient sampling and we are therefore searching alternate Herbarium collection sources to see if these gaps can be filled.

**Support:** JCU-CSIRO postdoctoral funds.

**Team:** **Andrew Thornhill**, Joe Miller (NSF, US), **Darren Crayn**, Nunzio Knerr and Alexander Schmidt-Lebuhn (CANBR), Dan Rosauer (ANU), Carlos Gonzalez-Orozco (UC), Shawn Laffan (UNSW), Brent Mishler (UC Berkeley), John Pickering (University of Georgia).

### **NEW - Australian Animal/Plant co-speciation**

It has been assumed that in an attempt to stay ahead of their host or pest that there has been an evolutionary arms race between animals and plants with plants evolving defences against folivores and animals adapting to these defences or colonising new hosts in response. If this is true then closely related animals would be more likely to occur or feed on plants that are closely related

to each other. The advent of molecular phylogenetic analyses has enabled us to further explore these hypotheses at a whole-biota scale across Australia. By utilising the Australian genus level phylogeny we can create a subset of host plants and link them to a phylogeny of animals that occur on them. This is reliant on a through phylogeny of the animal group in question being available which is not yet the case in many instances. However, there are some groups that have been sampled enough to allow us to test the co-evolutionary theories. In particular there is enough genetic data and host/plant information for us to analyse the Australian butterflies. There is also similar data for the bug subfamily Heteroptera. We will use both of these groups to create large scale 'tanglegrams' to track the evolutionary path and look for congruence that would suggest co-evolution between the plants and animals.

**2013 Goals:** To search GenBank for sequences that can be used to create a tanglegram of Australian butterfly and plants. This will also be done for the large Hemiptera (Bug) group, Heteroptera.

**2013 Achievements:** A genus level phylogeny of butterflies was created in May and combined with a subset of the Australian plant phylogeny. Treemap software was used to combine these two phylogenies and the resulting tanglegram combined around 180 butterfly genera with 600 plant genera. Ashley Field presented these results at the Systematics Without Borders conference in the Animal-Plant interactions symposium co-organised by Andrew Thornhill and Gerry Cassis. Sarah Mannel completed a special topics project on the butterfly genus *Graphium* and their associated plant hosts. Sarah presented the results in a 15 minute oral presentation and written report, as well as part of Ashley's presentation at the Sydney conference. Heteroptera sequences have been downloaded and a first run phylogeny contained over 700 genera, the largest phylogeny reconstructed to date for this group. A second analysis will be conducted in early 2014 to include missing genera and exclude genera that are not necessarily herbivorous. This tree will be combined a subset of the Australian plant genus level phylogeny, based on a large bug/plant interaction database that has been compiled by Gerry Cassis.

**Support:** JCU-CSIRO postdoctoral funds

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

### **NEW - Barcoding of ectomycorrhizal hypogeous fungi**

**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 project aims to barcode, using the ITS region, the collections that have already been made and complete the descriptions to name up to 12 new species out of 26 Hysterangiales species collected from the Australian tropics.

A new project developed in 2013 has the objective of determining how the community of ectomycorrhizal fungi that were collected as hypogeous sporocarps relates to the functional (root-tips) ectomycorrhizal fungal community within the same habitat. The project will also examine the diversity of fungi found

in the scats of a specialist mycophagous marsupial (*Bettongia tropica*) to determine their importance in providing dispersal of fungal spores as an ecosystem service. As a component of this project the DNA bar-coded library of hypogeous fungi will be used to compare with sequences that are to be extracted from soil, root-tips and from bettong scats. This project will be one objective of a Federally funded project (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).

**2013 Goals:** Commencement of PhD project, literature review and proposal. Application for funding from Caring for Our Country and North Queensland Wildlife Trust.

**2013 Achievements:** PhD candidate Susan Nuske has commenced this project, prepared a research proposal and completed writing a literature review. The confirmation of candidature seminar will be presented in January 2014. 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.

**Support:** \$6000 from Environmental Protection Agency, \$5,151 North Queensland Wildlife Trust, \$700,000 over 5 years Caring for our Country 2014-2018.

**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, RBG MEL), Michael Castellano (Oregon State University), Kentaro Hosaka (National Museum of Nature and Science Japan), David Largent (Humboldt University).

Two further projects were proposed for 2013 but did not proceed as external funds were not obtained:

**Field, Schulte**, Perrie (Mus. NZ), Bostock (Qld DSITIA)- Resolving complex relationships in *Huperzia* (Lycopodiaceae) – a total evidence approach to improve species concepts and conservation of Australasian tassel ferns.

**Harrington, Schulte, Gadek** - Taxonomic revision of Australian Sapindaceae: a combined molecular and morphological approach.

## **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.

### **Cenozoic diversification in Bromeliaceae: character evolution and climate change**

**Background:** Bromeliaceae are one of the most important epiphyte families of the Neotropics, and are highly successful in colonising terrestrial as well as epiphytic habitats. 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 built based on DNA sequence data and AFLP fingerprints and used to reconstruct the evolution of key traits (e.g. tank habit, leaf succulence, flower morphology). The correlation between trait evolution, the Cenozoic history of the Neotropics (climate, geology, vegetation), and changes in diversification rates will be explored and the historical biogeography of the groups will be reconstructed. 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.

**2013 Achievements:** Marcia Goetze (PhD candidate, Universidade Federal de Rio Grande do Sul, Brazil) undertook a 9 months research stay at the ATH, supervised by **K. Schulte** working on the molecular phylogeny of a Brazilian bromeliad group (*Aechmea* subgen. *Ortgiesia*, Bromelioideae). During her research stay, M. Goetze successfully generated an extensive AFLP data set based on nine primer combinations, and produced a well advanced manuscript, submission anticipated in 2014.

D. Silvestro, **K. Schulte** and G. Zizka worked on a manuscript investigating the effect of key innovations on speciation and extinction rates in Bromeliaceae, based on a novel Bayesian approach to estimate diversification rates developed by D. Silvestro during his PhD candidature. The study was published in the journal *Evolution* (Silvestro et al., (2013).

N. Wagner, D. Silvestro, G. Zizka, K. Weising and **K. Schulte** published a molecular study on the spatiotemporal evolution of the bromeliad genus *Fosterella* in the Central Andean biodiversity hotspot, in the *Journal of Biogeography* (Wagner et al. 2013).

**K. Schulte** and **D. Crayn** contributed to a molecular study examining the evolution and net species diversification in Bromeliaceae, published in *Molecular Phylogenetics and Evolution* (Givnish et al., 2013).

D. Cáceres, **K. Schulte**, M. Schmidt, and G. Zizka published a study about the diversity and levels of endemism of Costa Rican bromeliads (part of PhD thesis of D. Cáceres) in *Phytokeys*.

S. Heller, **K. Schulte**, G. Zizka and E. Leme submitted a paper about intrageneric relationships and character evolution in two Bromelioideae genera (*Aechmea*: Gravisia complex, and *Portea*), decision pending.

R. Louzada, **K. Schulte**, G. Wanderley, C. Palma-Silva and G. Zizka submitted a molecular study on the intrageneric relationships and character evolution in *Orthophytum* (part of PhD thesis of R. Louzada), decision pending.

J. Gitai, J. Paule, **K. Schulte**, A. Benko Iseppon and G. Zizka submitted a paper on chromosome evolution in Bromeliaceae based on chromosome counts, flow cytometry, and molecular phylogenetic evidence, decision pending.

**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 Ibisch (University of Applied Sciences Eberswalde).

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

**Publications:** Cáceres et al. (2013), Wagner et al. (2013).

### **Threatened Endemic Plants of Palau**

**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 was used to assess their IUCN threatened status and/or status as valid endemic species.

**2013 Goals:** Publish results from fieldwork component. Conduct genetic analysis on *Timonius* complex in Palau Islands to verify taxonomic status of an allegedly critically endangered species.

**2013 Achievements:** Publication of one paper and another accepted in *Pacific Science*. Molecular work for the *Timonius* samples completed with manuscript in final draft stage.

**Support:** ATH internal funds for *Timonius* sequencing (\$2,500).

**Publications:** Costion et al. (2013).

### **NEW - Effects of climate change on the endemic trees and shrubs of the Wet Tropics mountain-top flora**

**Background:** Little information was documented prior to this project on the distribution and a richness of endemic plants on the mountain-tops of northeast Queensland. This study aimed to document centres of diversity for the endemics

above 1,000 meters and to model future habitat suitability for these species under different climate change scenarios.

**2013 Goals:** Model habitat suitability for all 19 mountain-top endemic trees and shrubs under 3 climate scenarios and assess the threatened status of each species under the IUCN Red List Criteria.

**2013 Achievements:** Analysis completed and paper is in final draft stage.

**Support:** National Environmental Research Program (NERP) grant to Crayn (\$320K over 3 years for all projects).

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

### **NEW - Creating a phylogenetic heat map of Australia's flora: A new way to protect biodiversity**

**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. A genus level phylogenetic tree of Australia's flora has been constructed using multiple DNA genes. The spatial information of four million specimen records from the Australian Virtual Herbarium has been combined to define areas of Australia with the greatest amount of genetic diversity that should be conserved for the future.

**2013 Goals:** To complete an Australian genus level phylogeny of plants and combine this data with spatial records from Australia's Virtual Herbarium in Biodiverse.

**2013 Achievements:** The genus level phylogeny is completed and contains 2300 genera of which 1861 are angiosperms. The spatial data for the analysis has been formatted into Alvers-Equal conical and over 3 million records have been compiled to combine with the phylogeny. The Biodiverse analysis is to be run in early 2014 pending the completion of the Biodiverse pipeline by our collaborators in Canberra.

**Support:** JCU-CSIRO postdoctoral funds

**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).



## ***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.

### **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 Ecosystem Science 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 five projects were undertaken under the auspices of the TIEC.

**Support:** ATH, DSITIA, CSIRO, The Cairns Institute (JCU) in-kind total c. \$40K.

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

### **Medicinal and Edible Plants of Guugu Yimithirr, Cape Flattery - Hopevale**

**Background:** Research is being undertaken to document the ways in which Indigenous peoples of the Cape Flattery-Hopevale area (NE Qld) use plants for medicine and bush tucker.

**2013 Achievements:** A field trip was conducted in the Cape Bedford area on the Dhiidhaarr Clan Country (Guugu Yimithirr), Cape York Peninsula to identify key issues and concerns to be addressed towards developing a future Rangers Program. Included in the report were Regional Ecosystems and broad Vegetation maps, a list of traditional plants and areas of environmental concerns.

**Team:** **Gerry Turpin**, Guugu Yimithirr people.

### **Napranum Traditional Ecological Knowledge recording**

**Background:** This project is collecting baseline information on the biodiversity of plants on both culturally and biologically important areas around Napranum and providing an opportunity for a two-way exchange of Traditional Ecological Knowledge (TEK) and biological survey and identification methods between Traditional Owners and researchers.

**2013 Achievements:** This project did not proceed due to resignation of some staff. However, this allowed a project to be undertaken with the Mapoon Rangers, Mapoon (see below)

**Team:** Gerry Turpin, Napranum Rangers and Elders.

#### **Mbabaram traditional plant use research**

**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 total of 5 Mbabaram medicinal plants were collected and sent to SCU to be analysed. All the materials were extracted in methanol, because this solvent extracts a very broad range of constituents including many that would not be extracted in traditional aqueous preparations. Out of the 5 samples, one showed 34% inhibition of tumour necrosis factor (TNF), a highly noteworthy result when compared with 39% for dexamethasone (a very potent pure chemical). This extract may contain a chemical that is a very potent inhibitor of TNF.

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

#### **NEW - Mapoon plant use survey**

**Background:** A traditional plant use survey was undertaken with the Mapoon Rangers on country within the lands of the Tjungundji, Yupungathi, Warranku, Taepithiggi, Thanakwith and Mpakwithi clans in the Mapoon region, Western Cape York Peninsula. The aim of this survey was to record and document traditional plant uses of the Mapoon peoples, provide a bushtucker and bush medicine list, and to provide Regional Ecosystem and Vegetation Community information for land management purposes.

**2013 Achievements:** There were 42 collection and observational sites with 56 plants recorded. Of the 56 plants recorded, 20 were collected with 6 remaining unidentified due to infertile material. A report was provided which included a bushtucker and bush medicine list with updated scientific names, regional ecosystem and broad vegetation maps, and recommendations that further recording of cultural and ecological information should take place with more of the Elders and knowledge holders. A reference herbarium of the plants collected was also provided.

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

### **NEW - Two-way Knowledge - building synergies between Indigenous Knowledge and the Atlas of Living Australia's science**

**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.

**Team:** Illisapeci Lyons and Rosemary Hill (CSIRO SE), **Gerry Turpin**, Mandingalbay Yidinji People, John LaSalle (ALA/CSIRO).

### **Davidsonia domestication: productivity constraints in Far North Queensland**

Due to staff changes (departure of Cornelius) this project was discontinued and unspent funds returned to the funding body.

**Support:** RIRDC (\$60,000)

**Team:** Jonathan Cornelius, Tony Page, Stuart Worboys.

### **Development and delivery of germplasm for sandalwood and whitewood in Vanuatu and northern Australia**

**Background:** In Vanuatu, the Agroforestry and Novel Crops Unit (ANCU), in partnership with the national Forestry Department is identifying 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.

**2013 Achievements:** Replication of sandalwood grafted seed orchards for dissemination to planting hot spots around Vanuatu. Collection of whitewood seed from natural populations and establishment of a gene resource/provenance planting. Measurement of Whitewood Progeny Trials at 2-years. Gender determination in the elite plus trees identified in the whitewood Provenance-Family trial in Santo (IFP).

**Support:** ACIAR c. \$1.2M over 5 years (**Page T**).

**Team:** Tony Page

### **Development of a PNG timber industry based on community-based planted forests: design and implementation of a national germplasm delivery system**

**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.

**2013 Achievements:** Undertake supply and demand surveys for agroforestry seedlings and determine commercial feasibility of smallholder tree nurseries in East New Britain. Establishment of Core Seed Production areas for Teak and Local Priority Species. Development of extension materials to contribute to training ‘toolkit’.

**Support:** ACIAR c. \$1M over 5 years (**Page T**).

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

### **Silviculture of agarwood (*Aquilaria* spp.)**

**Background:** JCU's Agroforestry and Novel Crops Unit (ANCU), is pioneering research in agarwood silviculture, focusing on morphological variation, reproductive biology and physiology.

**2013 Achievements:** Develop understanding of phenotypic differences between different morphotypes planted in Australia. Establish stages flower and fruit development to advance understanding of reproductive phenology. Undertake preliminary controlled pollinations to improve understanding of mating system in *Aquilaria*.

**Support:** Wescorp Agarwood.

**Team:** Tony Page, Arlene Lopez (JCU).

One project proposed for 2013 did not proceed as external funds were not obtained;

**Crayn**, Dillon (Qld DAFF), Innes (Qld DAFF), etc. Breeding better mangoes – using phylogenomics to discover species relationships and genetic diversity of wild mangoes to facilitate targeted crop improvement.

## ***THEME 4 – PLANNING AND MANAGEMENT***

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

### **Regional Ecosystem Mapping**

As part of the Queensland Herbarium's State-wide Regional Ecosystems (RE) Mapping Programme, 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 Goals:** Remnant regional ecosystem mapping for the map sheets of CYP will be developed into a seamless coverage across the whole Cape. All the vegetation survey data will be compiled to assist in writing the definitive RE technical descriptions for vegetation across the entire CYP. Work will continue updating the seamless vegetation mapping for the EIU, with completion of the detailed technical descriptions as a solid basis for the provision of web-based RE descriptions and keys.

**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.

**Support:** ATH and DSITIA in-kind (c. \$320K).

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

**Presentation:** Wilson (2013).

**Publication:** Neldner et al. (2013a, 2013b).

### **NEW - Numerical classification of Regional Ecosystems and patterns of plant diversity distribution**

**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 RE's 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 RE's reflect the floristic diversity of the CYP.

**2013 Goals:** Commencement of MPhil project

**Support:** Queensland Herbarium, JCU student research funds

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

## **THEME 5 – UNLOCKING OUR KNOWLEDGE**

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

### **Rain Forest Key**

**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 development is mostly focused on adding the fern module (some 300 spp.) and distribution maps for all species.

**2013 Goals:** To undertake ongoing maintenance of species coding, descriptions, and nomenclature and include additional taxa not yet included in the key. Maintain web delivery.

For the fern module, revise coding of all 300 taxa, revise character list and states, produce test version of the key. Continue compiling database of taxon images, character help notes and illustrations. Write and finalise editing of descriptions for species profiles.

**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.

**Support:** ATH, CSIRO, JCU, DSITIA in-kind (c. \$25K).

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

### **Savanna Key**

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.

**2013 Goals:** Significant effort will be devoted to securing substantial funding from the private sector. The establishment of the project IT infrastructure platform (IdentifyLife project) allowing commencement of coding of species. A draft checklist of the savanna vascular flora will be completed by the end of 2013. If funding is secured a comprehensive project plan will be developed.

**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 will reduce the numbers significantly (e.g. obligate rainforest taxa will be removed). Letters of support from a number of key stakeholder groups were collected. A small grant (\$5,000) was secured from BHP's Cannington Community Fund to develop a project plan. This was largely completed in 2013, with final laying out, printing and delivery to BHP expected in early 2014.

**Team:** Frank Zich, Eda Addicott, Darren Crayn, Gary Wilson, Paul Williams (volunteer), Ailsa Holland (DSITIA), Kevin Thiele (WA Herbarium), Ian Cowie (NT Herbarium), Donna Lewis (NT Herbarium), Jim Croft (CANBR).

**Support:** ATH, CSIRO, JCU, DSITIA, Western Australian Herbarium, Northern Territory Herbarium, Atlas of Living Australian in-kind; BHP Cannington Community Fund (\$5000).

**Presentations:** Zich et al. (2013).



## Appendix 1 – Publications and Presentations

Publications and presentations by ATH authors in 2013 for scientific and general audiences are detailed below (ATH authors in bold). These total 19 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-Bourobou 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. (2013) 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. (2013) 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. Wagner N, Silvestro D, Brie D, Ibisch P, Zizka G, Weising K, **Schulte K**. (2013) Spatiotemporal evolution of *Fosterella* (Bromeliaceae) in the Central Andean biodiversity hotspot. *Journal of Biogeography* 40(5), 869-880.
18. 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.
19. **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.** (2013) 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** (2013) Vegetation Communities of Cape York Peninsula: Evaluating the Regional Ecosystem Framework of Queensland. Masters Candidature confirmation seminar [oral].
3. **Arobaya,** (2013a) 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** (2013b) 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.** (2013c) Phylogeny and evolution of the antelope orchids: molecular studies to test controversial taxonomic concepts. 9<sup>th</sup> International Flora Malesiana symposium, Bogor, Indonesia [oral].
6. **Arobaya AYS, Field AR, Micheneau C, Crayn D,** Clements M, **Gadek P, Schulte K.** (2013d) Phylogeny of *Dendrobium* sect. *Spatulata* based on plastid and nuclear data sheds light on the evolution of the Antelope orchids. 5<sup>th</sup> International Orchid Conservation Congress, La Reunion [poster].
7. **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. 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.** (2013f) 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]. **Winner, Pauline Ladiges prize for best student presentation.**

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. 9<sup>th</sup> 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. 9<sup>th</sup> 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 - 5<sup>th</sup> 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.** (2013) 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 - 5<sup>th</sup> 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 - 5<sup>th</sup> 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. (2013) 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 - 5<sup>th</sup> 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). 5<sup>th</sup> 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 - 5<sup>th</sup> 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). 9<sup>th</sup> 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. 9<sup>th</sup> 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 – 6<sup>th</sup> 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].
  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 - 5<sup>th</sup> 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. (2013) Morphométrie et phylogénie des *Angraecum* section *Pectinaria* (Orchidaceae) en Afrique continentale. Symposium Paul Duvigneaud, Université Libre de Bruxelles, Bruxelles (Belgium) [poster].
  43. **Simpson L**. (2013) 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. . 5<sup>th</sup> 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. 5<sup>th</sup> - 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. 5<sup>th</sup> 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 . 9<sup>th</sup> 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**. The natural history of orchids native to the Cairns Region. Cairns Orchid Society Annual Conference May 6<sup>th</sup> 2013.
4. **Field AR**. (2013) 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

### **Staff**

Dr Sandra Abell-Davis (JCU <sup>1</sup> )	Ms Raelee Kerrigan (external grant)
Ms Eda Addicott (DSITIA)	Ms Andrea Lim (JCU)
Ms Yumiko Baba (JCU)	Ms Sarah Mannel (external grant)
Mr Peter Bannink (DSITIA)	Dr Claire Micheneau (external grant)
Ms Kaylene Bransgrove (JCU <sup>2</sup> )	Mr Mark Newton (DSITIA)
Dr Craig Costion (external grant)	Dr Tony Page (JCU <sup>1</sup> )
Prof Darren Crayn (CSIRO/JCU/DSITIA)	Dr Katharina Schulte (CSIRO/JCU)
Dr Ashley Field (DSITIA)	Dr Andrew Thornhill (CSIRO/JCU)
Prof Paul Gadek (JCU <sup>1</sup> )	Mr David Tng (external grant)
Ms Melissa Harrison (JCU <sup>2</sup> )	Mr Gerry Turpin (DSITIA)
Ms Janani Jayanathan (external grant)	Mr Stuart Worboys (JCU/external grant)
Ms Jeanette Kemp (DSITIA)	Mr Frank Zich (CSIRO)

<sup>1</sup> together contribute 1FTE research position

<sup>2</sup> together contribute 1FTE Laboratory Manager position

### **Research Students**

Ms Eda Addicott (JCU)  
Ms Agustina Arobaya (JCU)  
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 (JCU)  
Ms Susan Nuske (JCU)  
Ms Claudia Paz (JCU)



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

Ms Sook-Ngoh Phoon (JCU)  
Ms Lalita Simpson (JCU)  
Mr Hanington Tate (JCU)

Ms Dannielle Tela (JCU)

Mr Gary Wilson (JCU)

Mr Julio Ugarte (JCU)

### **Volunteers**

Mr Murray Borrell

Ms Kayza Grenfell

Dr Chris Quinn

Ms Anna Cole

Ms Kim Hood

Ms Vivien Richardson

Dr Charles Clarke

Ms Janani Jayanthan

Mr Garry Sankowsky

Mrs Nanette Fairbairn

Ms Raelee Kerrigan

Mrs Nada Sankowsky

Mr Roger Fryer

Ms Sarah Mannel

Mr David Tng

Mrs Mary Gandini

Ms Sandy Perkins

Ms Heather Winsor



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

### **Visiting Researchers**

Dr Tatiana Arias (University of Hong Kong)

Mrs Wendy Cooper (independent taxonomist)

Ms Deidre Bean (botanical artist)

Dr Michael Davis (University of Sydney)

Mr Anthony Carpenter  
(Department of Agriculture,  
Fisheries & Forestry, St Stephens)

Dr Natalie Dillon (QLD Department  
of Agriculture, Fisheries & Forestry)

Prof Jeremy Bruhl (University of New  
England)

Dr John Dowe (James Cook  
University)

Mr John Clarkson (Queensland  
Parks & Wildlife Service)

Mr Andrew Ford (CSIRO)

Barry Conn (NSW Herbarium)

Dr Robyn Glade-Wright (James  
Cook University)

Mr Bill Cooper (artist)

Dr Morag Glen (University of Tasmania)

Ms Marcia Goetze (Universidade Federal de Rio Grande do Sul, Brazil)

Ms Louise Hucks (QLD Department of Agriculture, Fisheries & Forestry)

A/Prof Betsy Jackes (James Cook University, Townsville)

Mr Bruce Jennison (Wet Tropics Management Authority)

Mr Rigel Jensen (Australian Wildlife Conservancy)

Ms Lynne Jones (Australian Quarantine and Inspection Service)

Mr Oystein Lofthus (University of Oslo)

Dr Juan Losada (Arnold Arboretum, Harvard University)

Mr Bob Makinson (Royal Botanic Gardens & Domain Trust, Sydney)

Dr Mike Mathieson (Queensland Department of Environment & Heritage Protection)

Bernard Mollet (studying *Hibbertia*, France)

Mr Stephen McKenna (Department of Agriculture, Fisheries & Forestry)

Prof Dr Christoph Neinhuis (Technische Universität, Dresden)

Dr Paul Nelson (JCU, Earth and Environmental Sciences)

Mr Ivan Novaic (Botanical Illustrator)

Dr Larry Orsak (University of Technology, PNG)

Dr Axel Poulsen (University of Oslo)

Ms Chrissie Prychid (University of New England)

Prof David Rentz (Adjunct, JCU Cairns)

Dr Andy Shepard (CSIRO)

Mr Bryan Simon (QLD Herbarium)

Dr Albert Schram (Unitech, PNG)

Ms Margaret Stimpson (University of New England)

Dr Gerhard Tarmann (Tiroler Landesmuseum Ferdinandeum, Austria)

Mr John Thompson (QLD Herbarium)

Mr Simon Thompson (QLD Herbarium)

Ms Kathy Thompson (Dept of Agriculture, Forestry & Fisheries)

A/Prof Dorset Trapnell (University of Georgia, USA)

Mr David Tng (University of Tasmania)

Ms Desley Tree (Dept of Agriculture, Forestry & Fisheries)

Ms Michelle Venter (JCU)

Dr Stephanus Venter (Consultant)

Dr Bruce Wannan (Queensland Department of Environment and Heritage Protection)

Ms Barbara Waterhouse (Department of Agriculture, Fisheries & Forestry)

Mr John Westerway (Department of Agriculture, Fisheries & Forestry, NT)

Mr Lahiru Wijedasa (Singapore Botanic Gardens)

## **Research Collaborators**

Dr Bruce Beehler (Conservation International)

Mr Peter Bostock (Queensland Herbarium)

Dr Neale Bougher (Western Australian Herbarium)

Dr Elizabeth Brown (National Herbarium of NSW)

Dr Mark Clements (CSIRO)

Dr Charles Clarke (Monash University, Kuala Lumpur, Malaysia)

Dr Mark Coode (Royal Botanic Gardens, Kew, UK)

Mrs Wendy Cooper (naturalist and local landowner)

Mr Ian Cowie (Northern Territory Herbarium)

Mr Jim Croft (Centre for Australian National Biodiversity Research)

Dr Stefan Dressler (Senckenberg Institute, Germany)

Dr Nigel Fechner (Queensland Herbarium)

Mr Andrew Ford (CSIRO)

Prof Thomas Givnish (University of Wisconsin, USA)

Mr Bruce Gray (CSIRO, retired)

Ms Megan Gixti (James Cook University)

Dr Roy Halling (New York Botanical Garden, USA)

Ms Margaret Heslewood (National Herbarium of NSW)

Dr Rosemary Hill (CSIRO)

Mr Michael Hislop (Western Australian Herbarium)

Ms Ailsa Holland (Queensland Herbarium)

Ms Tarita Holm (Palau Conservation Society, Palau, Federated States of Micronesia)

Dr Joseph Holtum (JCU)

A/Prof David Hughes (Penn State University, USA)

Mr Bob Jago (Cairns City Council)

Dr Mirko Karan (Queensland Department of Science, Information Technology, Innovation and the Arts)

Ms Jeanette Kemp (Queensland Department of Science, Information Technology, Innovation and the Arts)

Prof Hiromi Kobori (Tokyo City University, Japan)

Dr Robert Kooyman (Royal Botanic Gardens Sydney)

Ms Ann Kitalong (The Environment Inc., Palau, Federated States of Micronesia)

Prof Kathy Kron (Wake Forest University, USA)

Dr Maria Kuzmina (Canadian Centre for DNA Barcoding)

Dr Lori Lach (JCU)

Prof David Largent (Humboldt State University, USA)

Ms Donna Lewis (Northern Territory Herbarium)

Dr David Lorence (National Tropical Botanic Garden, Hawaii, USA)

Prof Andy Lowe (University of Adelaide and State Herbarium of South Australia)

A/Prof Brandon Matheny (University of Tennessee, USA)

Mr Keith McDonald (Queensland National Parks and Wildlife)

Dr Hannah McPherson (National Herbarium of NSW)

Dr Marlien van der Merwe (National Herbarium of NSW)

Dr Dan Metcalfe (CSIRO)

Dr Nathalie Nagalingum (National Herbarium of NSW)

Dr V. John Neldner (Queensland Herbarium)

Dr Daniel Ohlsen (University of Melbourne)

Prof Takashi Osono (Kyoto University, Japan)

Dr Leon Perrie (Te Papa Tongarewa- Museum of New Zealand)

Dr Chris Quinn (retired, JCU Adjunct)

Prof David Rentz (retired, JCU Adjunct)

Dr Maurizio Rossetto (National Herbarium of NSW)

Mr Gabriele Ruffato (Penn State University, USA)

Dr Anna Schmidt (Penn State University, USA)

Dr Daniele Silvestro (Senckenberg Research Institute & Goethe University, Frankfurt, Germany)

Prof Andrew Smith (University of Oxford, UK)

Dr Stephanie Stuart (Macquarie University)

Dr Brett Summerell (National Herbarium of NSW)

Dr Kevin Thiele (Western Australian Herbarium)

Dr Kathy Thomson (Dept. Agriculture Fisheries & Forestry)

Mr David Tng (University of Tasmania)

A/Prof Dorset Trapnell (University of Georgia, USA)

Dr Desley Tree (Dept. Agriculture Fisheries & Forestry)

Dr Stephanus Venter (independent researcher)

Dr Steve Wagstaff (Landcare Research, New Zealand)

Dr Bruce Wannan (Queensland Department of Environment and Heritage Protection)

Prof Michelle Waycott (University of Adelaide and State Herbarium of South Australia)

Ms Ellen Weber (Wet Tropics Management Authority)

Prof Kurt Weising (University of Kassel, Germany)

Dr Henk van der Werff (Missouri Botanical Garden, USA)

Dr Peter Weston (National Herbarium of NSW)

Dr Paul Williams (JCU)

Prof Steve Williams (JCU)

Dr Klaus Winter (Smithsonian Tropical Research Institute, Republic of Panama)

Prof Georg Zizka (Senckenberg Institute, Germany)

# Appendix 3 – 2013 Financial Statement and Audit Certificate



Crowe Horwath  
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## INDEPENDENT AUDIT REPORT

### Report on the Financial Report

We have audited the accompanying special purpose financial report of James Cook University – Australian Tropical Herbarium (“the University”), which comprises the operating statement of income and expenditure from 1 January 2013 to 31 December 2013 and the Principal Investigator Certification of Research Use.

### Responsibility for the Financial Report

The authorised officers of the University are responsible for the preparation of the financial report and have determined that the accounting policies adopted are appropriate to meet the needs of the funding bodies. The University’s responsibilities also includes such internal control relevant to the preparation and fair presentation of the financial report that is free from material misstatement, whether due to fraud or error; selecting and applying appropriate accounting policies; and making accounting estimates that are reasonable in the circumstances.

### Auditor’s Responsibility

Our responsibility is to express an opinion on the financial report based on our audit. No opinion is expressed as to whether the accounting policies used are appropriate to meet the needs of the funding body. We have conducted our audit in accordance with Australian Auditing Standards. Those standards require that we comply with relevant ethical requirements relating to audit engagements and plan and perform the audit to obtain reasonable assurance whether the financial report is free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial report. The procedures selected depend on the auditor’s judgment, including the assessment of the risks of material misstatement of the financial report, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the entity’s preparation of the financial report that gives a true and fair view in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity’s internal control. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of accounting estimates made by the University, as well as evaluating the overall presentation of the financial report.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

### Independence

In conducting our audit, we have complied with the independence requirements of Australian professional ethical pronouncements.

Crowe Horwath NQ is a member of Crowe Horwath International, a Swiss Verein. Each member firm of Crowe Horwath is a separate and independent legal entity. Liability limited by a scheme approved under Professional Standards Legislation other than for the acts or omissions of financial services licensees.

**Auditor's Opinion**

In our opinion, and in accordance with the guidelines of the State of Queensland acting through the Department of State Development, Trade and Innovation, the Environmental Protection Agency, Commonwealth Scientific and Industrial Research Organisation and Director of National Parks, the Operating Statement of Income and Expenditure attached for the period 1 January 2013 to 31 December 2013 for the James Cook University have been drawn up to represent accurately the financial transactions relevant to the "Australian Tropical Herbarium" Agreement.

**Basis of Accounting**

Without modifying our opinion, we draw attention to the Principal Investigator Certification of Research Funds Use, which describes the purpose of the financial report. The financial report has been prepared for the purpose of fulfilling the University's financial reporting responsibilities under the Grant Agreement. As a result, the financial report may not be suitable for another purpose.

*Crowe Horwath NQ*

**Crowe Horwath NQ**



**M. Andrejic**  
Principal

Townsville, *31 MARCH* 2014

Australian Tropical Herbarium (ATH)  
Operating Statement of Income and Expenditure  
From 1 January 2013 to 31 December 2013



	To End 2012 \$	2013 \$	Total \$
<b>ATH Director's Salary</b>			
Stakeholders Contribution	883,746.65	194,374.66	1,078,121.31
Salary and on Costs	(831,518.90)	(195,728.29)	(1,027,247.19)
<b>Funds Available</b>	<b>52,227.75</b>	<b>(1,353.63)</b>	<b>50,874.12</b>
<b>Administrative Support Salary</b>			
Stakeholder Contributions	310,976.67	82,950.00	393,926.67
Salary and on Costs	(320,278.70)	(79,118.40)	(399,397.10)
<b>Funds Available</b>	<b>(9,302.03)</b>	<b>3,831.60</b>	<b>(5,470.43)</b>
<b>Molecular Technician</b>			
Stakeholders Contributions	340,216.00	75,000.00	415,216.00
Salary and on Costs	(307,029.53)	(96,113.70)	(403,143.23)
<b>Funds Available</b>	<b>33,186.47</b>	<b>(21,113.70)</b>	<b>12,072.77</b>
<b>CSIRO-JCU Postdoctoral Research</b>			
Stakeholders Contribution	778,366.00	191,972.00	970,338.00
Salaries and on Costs	(558,123.76)	(134,472.44)	(692,596.20)
Relocation	(10,935.61)	(2,000.00)	(12,935.61)
Research Costs	(68,193.22)	(25,460.96)	(93,654.18)
<b>Funds Available</b>	<b>141,113.41</b>	<b>30,038.60</b>	<b>171,152.01</b>
<b>Molecular Systematics Laboratory</b>			
Stakeholder Contributions	250,000.00	-	250,000.00
JCU Contribution from Services Fund	-	21,107.20	21,107.20
Lab Fitout	(187,392.21)	-	(187,392.21)
Expenditure to set up lab	(83,714.99)	-	(83,714.99)
<b>Funds Available</b>	<b>(21,107.20)</b>	<b>21,107.20</b>	<b>(0.00)</b>
<b>Establishment Costs - ATH Office</b>			
Stakeholder Contributions	75,000.00	-	75,000.00
Expenditure to set up office	(73,514.02)	8.22	(73,505.80)
<b>Funds Available</b>	<b>1,485.98</b>	<b>8.22</b>	<b>1,494.20</b>
<b>Operating Income</b>			
Stakeholder Contributions	211,491.50	32,990.00	244,481.50
Consultancy	16,411.37	16,880.00	33,291.37
Identification Services Fee Income	8,957.54	-	8,957.54
Plant ID Workshop Income	19,308.53	17,245.50	36,554.03
Ethnobotany Workshop	2,909.09	1,523.89	4,432.98
AQIS Access Fees	4,160.00	1,903.64	6,063.64
Publications	150.00	572.69	722.69
<b>Total Operating Income</b>	<b>263,388.03</b>	<b>71,115.72</b>	<b>334,503.75</b>
<b>Operating Costs</b>			
Salaries and On Costs	(26,159.93)	(25,742.76)	(51,902.69)
Board Costs	(7,767.75)	(2,957.68)	(10,725.43)
Herbarium Consumables	(13,801.99)	(1,086.84)	(14,888.83)
Infrastructure Maintenance	(1,727.58)	(1,372.18)	(3,099.76)
Minor Equipment	(12,745.18)	(3,136.50)	(15,881.68)
Printing, stationery, postage	(23,895.21)	(3,094.66)	(26,989.87)
Reporting/Publications/Marketing	(13,274.12)	(3,188.00)	(16,462.12)
Recruitment Costs	(8,060.79)	(917.21)	(8,978.00)
Service costs for IT	(5,000.00)	-	(5,000.00)
Staff development/training	(8,608.48)	(912.00)	(9,520.48)
Subscriptions/memberships	(2,869.43)	(867.61)	(3,737.04)
Telecommunications	(11,390.57)	(2,279.21)	(13,669.78)
Travel	(24,128.30)	(9,370.70)	(33,499.00)
Library	(2,569.45)	(661.45)	(3,230.90)
Software	(1,617.14)	-	(1,617.14)
Lab Consumables	(297.41)	-	(297.41)
Miscellaneous	(9,832.65)	(1,279.05)	(11,111.70)
Special Purchases	(20,204.42)	3,784.55	(16,419.87)
Plant ID Workshop	(5,543.18)	(2,029.21)	(7,572.39)
TIEC (Ethnobotany)	(8,868.34)	-	(8,868.34)
Grant Development	(4,215.64)	(1,160.59)	(5,376.23)
Student and Pilot Project Support	(2,425.00)	-	(2,425.00)
Staff Retreat	-	(1,996.82)	(1,996.82)
6 Year Review	-	(4,270.74)	(4,270.74)
<b>Total Operating Costs</b>	<b>(215,002.56)</b>	<b>(62,538.66)</b>	<b>(277,541.22)</b>
<b>Operating Funds Available</b>	<b>48,385.47</b>	<b>8,577.06</b>	<b>56,962.53</b>
<b>Total Per Year</b>	<b>245,989.85</b>	<b>41,095.35</b>	
<b>Total Operating Funds Available as at 31 December 2013</b>			<b>287,085.20</b>

**Director Certification:**

I certify that the grants funds disclosed on the attached statement of income and expenditure for this project for the stated period have been expended for the purpose of the grant and in accordance with the guidelines of the contract

Professor Darren Crayn  
Director - Australian Tropical Herbarium  
James Cook University

March 2014



## Appendix 4 – 2011-2015 ATH Strategic Plan

OBJECTIVE	STRATEGY	PERFORMANCE INDICATORS AND TARGETS
<p>1. Create synergies and opportunities through collaboration</p>	<ul style="list-style-type: none"> <li>- identify and address key knowledge gaps and stakeholder research needs</li> <li>- engage with organisations and researchers having capabilities complementary to those of ATH</li> <li>- recruit/develop staff with strong collaboration skills</li> <li>- provide opportunities for personnel to engage with peers</li> </ul>	<p>1.1 Enter into the following number of multidisciplinary, collaborative projects on average per annum with research and industry or business partners: one local, one national, one international.</p>
<p>2. Improve each Participants' individual research capabilities and reputations through the undertaking of activities collectively which could not have been undertaken individually</p>	<ul style="list-style-type: none"> <li>- develop and foster interactions and research links between ATH and Participants' personnel</li> <li>- develop research capability (through recruitment, training and investment) that is complementary to that possessed by Participants</li> </ul>	<p>2.1 Initiate two projects linked with Participant's personnel per annum.</p>
<p>3. Develop research excellence</p>	<ul style="list-style-type: none"> <li>- identify and actively pursue potential income sources and key collaborators</li> <li>- provide co-funding for grant applications where appropriate</li> <li>- encourage cross-disciplinary linkages between ATH research theme areas</li> <li>- produce innovative and relevant outputs in a timely manner</li> <li>- develop and implement publication and dissemination strategies which maximise high quality outputs</li> <li>- improve research uptake by all stakeholders</li> <li>- mentor research students and early career researchers</li> </ul>	<p>3.1 Win \$137,000 of competitive or peer reviewed research grants and external grants or donations on average per annum per research FTE.</p> <p>3.2 Achieve agreed project milestones</p> <p>3.3 Publish 3.5 refereed scientific papers/articles in leading national or international journals, refereed conference papers, books or book chapters on average per annum per research FTE.</p>

4. Achieve excellence in research training	<ul style="list-style-type: none"> <li>- identify and incorporate research training and development opportunities in project planning</li> <li>- attract high quality students</li> <li>- engage in undergraduate teaching in relevant areas</li> <li>- provide effective mentorship and support to students</li> <li>- foster a performance culture among research students</li> <li>- encourage qualified personnel to supervise students and provide access to relevant training</li> <li>- support student participation in training and development activities</li> <li>- maintain a stimulating intellectual environment</li> </ul>	<p>4.1 Each research FTE as supervisor of 2.5 Doctoral or Masters Degree students on average per annum, including 0.5 Queensland graduates and 0.5 overseas graduates.</p> <p>4.2 Increase research quality, productivity and on-time completions</p> <p>4.3 Maintain periodical training/learning event series (e.g. journal club) for students</p> <p>4.4 Students meet University requirements for ongoing candidature (e.g. progress reports, seminars training etc.)</p>
5. Facilitate Commercialisation opportunities	<ul style="list-style-type: none"> <li>- encourage awareness among personnel of commercialisation potential and commercialisation implications of their research</li> </ul>	<p>5.1 relevant staff participate in one training/awareness event every two years on average</p>
6. Improve the management of the collections	<ul style="list-style-type: none"> <li>- implement developments in best-practice collections management</li> <li>- participate actively in relevant fora (e.g. MAHC)</li> <li>- develop and maintain representative collections which support research</li> </ul>	<p>6.1 &gt;90% specimens with accurate and reliable names.</p> <p>6.2 100% of the collection databased and available electronically.</p> <p>6.3 Collection to be free of any pest infestations.</p> <p>6.4 New accessions to be processed and incorporated within 12 weeks of receipt.</p> <p>6.5 Loan requests fulfilled within 4 weeks of receipt.</p>
7. Maintain a supportive, rewarding and productive work environment	<ul style="list-style-type: none"> <li>- recruit and retain quality personnel through recognising and rewarding excellence, performance and productivity</li> </ul>	<p>7.1 Number of staff training courses completed</p>

	<ul style="list-style-type: none"> <li>- support personnel training and development needs</li> <li>- support personnel in maintaining an appropriate work/life balance and job satisfaction</li> <li>- maintain a safe and healthy workplace</li> <li>- foster a social atmosphere in the workplace where appropriate</li> <li>- provide incentives/support for and reward research excellence</li> <li>- foster a performance culture</li> </ul>	7.2 Nil time lost to injuries
8. Promote the ATH	<ul style="list-style-type: none"> <li>- promote the ATH, its activities and the Participants through speaking engagements, media, conference participation and a web presence</li> <li>- emphasise, in all appropriate communications, the ATH joint venture model and roles of Participants</li> </ul>	<p>8.1 Website content is up to date</p> <p>8.2 Perform ten speaking engagements (seminars, lectures etc.) per annum</p> <p>8.3 Welcome twenty visiting national and international scientists (working on collections or collaborating with ATH staff on manuscripts, field research, etc.) on average per annum.</p>

## Appendix 5 – 2013 ATH Research Plan

List of research projects involving significant contributions from ATH staff, proposed for 2013. Projects are listed under the research theme to which they contribute principally, although they may contribute to other themes also.

2013 Research Projects Australian Tropical Herbarium	Staff Commitment <sup>1</sup>	Duration <sup>2</sup>			
		2013	2014	2015	
<b>THEME 1 – BIODIVERSITY, TAXONOMY, EVOLUTION</b>					
1.1 Phylogeography of orchid species complexes of the Australian Wet Tropics	LS 1.0, KS 0.2, CM 0.2, AF 0.1	■	■	■	■
1.2 DNA-Barcoding tropical Australian trees	CC 0.2, DC 0.1	■	■	■	■
1.3 Host specificity of fungal endophytes of tropical Australian rainforests	KB 1.0, SA 0.1	■	■	■	■
1.4 Re-evaluation of taxonomic concepts in Australian Orchidaceae ...	KS 0.6, CM 0.8, AA 1.0, DC 0.1	■	■	■	■
1.5 Endophytic fungi	SA 0.2	■	■	■	■
1.6 Origins of the Wet Tropics flora – a molecular perspective	postdoc 0.6, CC 0.1, DC 0.2	■	■	■	■
1.7 Identifying refugia and hotspots of phylogenetic diversity in the Wet Tropics flora	CC 0.5, DC 0.1	■	■	■	■
1.8 Phylogenetics, systematics and evolutionary dynamics of Elaeocarpaceae	YB 1.0, SP 1.0, DC 0.2	■	■	■	■
1.9 Systematics of miscellaneous tropical flora	AF 0.4, KS 0.05, GW 0.5, FZ 0.1, SA 0.2	■	■	■	■
1.10 Taxonomy and phylogeny of hypogeous fungi	SA 0.2, MH 0.1	■	■	■	■
1.11 PROPOSED: Resolving complex relationships in <i>Huperzia</i> (Lycopodiaceae) ...	AF 0.4	■	■	■	■

<sup>1</sup> Proportion of staff members' **total research time** devoted to the project (for many staff research time is < 1 FTE). Proportions may not sum to 1 for each staff as some time may be spent on other small projects not listed here. AA=Agustina Arobaya, AF=Ashley Field, CC=Craig Costion, CM=Claire Micheneau, DC=Darren Crayn, EA=Eda Addicott, FZ=Frank Zich, GT=Gerry Turpin, GW=Gary Wilson, JC=Jonathan Cornelius, KS=Katharina Schulte, KB=Kaylene Bransgrove, LS=Lalita Simpson, MH=Mark Harrington, MN=Mark Newton, PB=Peter Bannink, PG=Paul Gadek, SA=Sandra Abell-Davis, SP=Sook-Ngoh Phoon, SW=Stuart Worboys, TP=Tony Page, YB=Yumiko Baba

<sup>2</sup> Duration of project under current funding. If further funds are secured some projects may continue beyond the duration indicated.

1.12 PROPOSED: Taxonomic revision of Australian Sapindaceae ...	MH 0.8, KS 0.05, PG 0.05								
<b>THEME 3 – PLANTS FOR PEOPLE</b>									
3.1 Tropical Indigenous Ethnobotany Centre (TIEC)	GT 1.0, EA 0.05, DC 0.05								
3.2 <i>Davidsonia</i> domestication: productivity constraints in Far North Queensland	TP 0.1, SW 0.1								
3.3 Development and delivery of germplasm for sandalwood and whitewood ...	TP 0.3								
3.4 Development of a PNG timber industry based on community-based planted forests ...	TP 0.1								
3.5 Silviculture of agarwood ( <i>Aquilaria</i> spp.)	TP 0.3								
3.6 PROPOSED: Breeding better mangoes ...	DC 0.2								
<b>THEME 4 – PLANNING AND MANAGEMENT</b>									
4.1 Regional Ecosystem Mapping	EA 0.9, MN 1.0, GW 0.6, PB 0.5								
<b>THEME 5 – UNLOCKING OUR KNOWLEDGE</b>									
5.1 Rainforest Key	FZ 0.5, AF 0.2								
5.2 Savanna Key	FZ 0.1, GW 0.1, EA 0.05, DC 0.1								