

DIRECTOR'S SUMMARY 2010



Australian Tropical Herbarium

Our Values

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

We are committed to providing leadership in plant biodiversity 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 value a collaborative, engaging, caring approach to team-building.

Our Vision

To be the leader in tropical plant biodiversity research in Australasia and Malesia, achieving a greater understanding of sustainable tropical ecosystems.



ATH Staff and students. Back row (l-r) Stuart Worboys, Paul Gadek, Frank Zich, Peter Bannink. Middle row (l-r) Katharina Schulte, Mark Harrington, Mark Newton, Stephanus (Fanie) Venter, Gary Wilson, Louise Hucks. Front row (l-r): Andrea Lin, Caroline Puente-Lelievre, Melissa Harrison, Yumiko Baba, Sandra Abell-Davis, Eda Addicott, Darren Crayn. Absent: Sook-Ngoh Phoon, Jonathan Cornelius, Craig Costion, Tony Page, Gerry Turpin. Photo: Robyn Wilson. Front cover: *Hoya australis*. Photo: G.W. Wilson. Inner back cover: *Neolamarkia cadamba*. Photo G.W. Wilson.

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- **Publications:** 14 scientific papers, 3 book chapters and 1 Regional Ecosystem Map Sheet were published, and 3 student theses submitted.
- **Rainforest Key Edition 6 launched:** this edition, the first online version, was launched on Dec. 9. It is a significant upgrade from the previous edition, adding over 300 species and boasting a new (Lucid) platform with greater functionality. Online use of the product is now free of charge, bringing it to a far greater audience.
- **Presentations:** 23 research talks were presented to scientific audiences, and 10 to community audiences.
- **Research grants income:** over \$425,000 in external competitive research grant income was received.
- **Ethnobotany Centre Partnership workshop:** ATH co-hosted a successful workshop to develop a model for an Indigenous-driven ethnobotany centre, to be based at ATH. Participants endorsed a model and a strategy to develop and implement it. Ethnobotany projects have already begun.
- **Plant Identification workshops:** a programme of plant identification workshops (developed in modular format and based on the Rainforest Key) were delivered in Cairns, Atherton, Mareeba, Paluma and Townsville to over 120 participants from Government, the business community and the public.
- **Postgraduate students:** Two new students began postgraduate studies at the ATH. In total, ATH staff supervise 17 postgraduate research students.
- **Visitors:** over 400 visitors were welcomed during 2010, including 64 researchers visiting for scientific purposes, and a number of VIPs including Prof Penny Sackett (Chief Scientist for Australia) and the Hon Bob Katter (Federal Member for Kennedy)
- **Collections:** over 3000 new specimens were added to the herbarium collection, and over 1400 DNA samples were added to the DNA/Tissue Bank.
- **Memorandum of Understanding** signed with the Cairns Botanic Gardens: this MoU will foster better collaboration between the two institutions on a range of relevant activities.

From the Director

The end of the ATH's third year of operation sees the ATH in a strong and growing position. During 2010 our outputs increased considerably owing partly to increased staff numbers and partly to projects begun in the previous years beginning to bear fruit. The shape of our research portfolio changed somewhat with some legacy projects brought by staff with them to ATH being completed or discontinued. The ATH's research portfolio now more strongly reflects the Board-approved research themes.

A highlight of 2010 was the launch of the new online edition of the Rainforest Key. This is the culmination of over 40 years of research by CSIRO botanists in north Queensland, led by Mr Bernie Hyland. ATH staff will continue development of this valuable product to increase functionality and the range of plants covered.

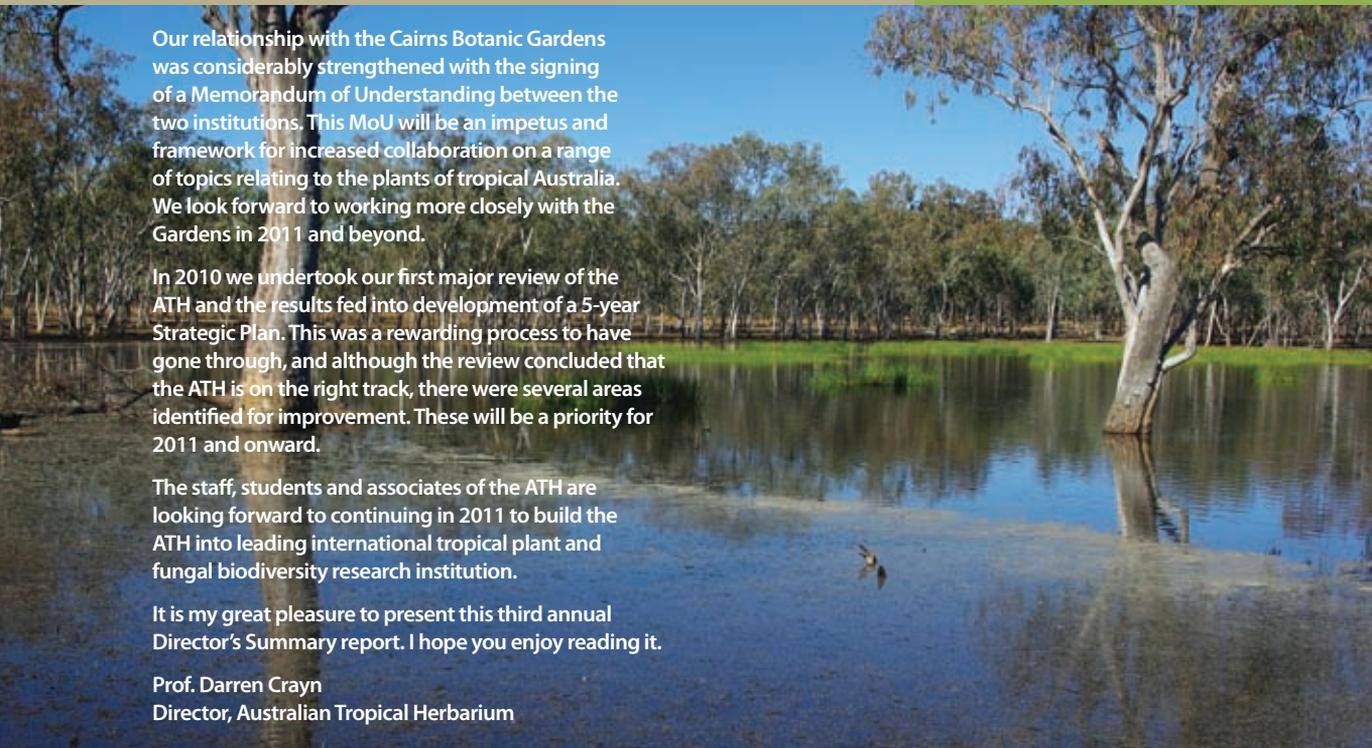
Our relationship with the Cairns Botanic Gardens was considerably strengthened with the signing of a Memorandum of Understanding between the two institutions. This MoU will be an impetus and framework for increased collaboration on a range of topics relating to the plants of tropical Australia. We look forward to working more closely with the Gardens in 2011 and beyond.

In 2010 we undertook our first major review of the ATH and the results fed into development of a 5-year Strategic Plan. This was a rewarding process to have gone through, and although the review concluded that the ATH is on the right track, there were several areas identified for improvement. These will be a priority for 2011 and onward.

The staff, students and associates of the ATH are looking forward to continuing in 2011 to build the ATH into leading international tropical plant and fungal biodiversity research institution.

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

Prof. Darren Crayn
Director, Australian Tropical Herbarium



Introduction

The Australian Tropical Herbarium (ATH) is a joint venture of the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Director National Parks (DNP), Queensland Department of Environment and Resource Management (DERM), Queensland Department of Employment, Economic Development and Innovation (DEEDI), and James Cook University (JCU). The ATH's activities are overseen by the ATH Board comprising representatives of the three main participants (CSIRO, JCU, DERM) and an independent Chairperson. The ATH is physically located within the Sir Robert Norman building (housing the Australian Tropical Forest Institute - ATFI) 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 and curation, 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 covers a range of topics including tropical plant and fungal taxonomy and evolution, ethnobotany, ecology, climate change studies, development of identification tools, agroforestry and regional ecosystem mapping.

Governance

Board

The ATH is 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, DERM, JCU), the ATH Director and an independent Chairperson. The **Board** meets twice per year, in April and October.

As of December 31 2010, ATH Board members are:

- Dr Greg Leach (Independent Chairperson)
- Dr Jeremy Burdon (CSIRO)
- Prof Darren Crayn (ATH Director)
- Prof Paul Gadek (JCU)
- Dr Gordon Guymer (DERM)
- Prof Jeffrey Loughran (JCU)
- Dr Judy West (CSIRO)
- Dr Christine Williams (DERM)

ATH Director

The ATH Director reports to the Pro Vice Chancellor (Science and Engineering) and to the ATH Board. The Director's role is to undertake the day to day management of the ATH, and to conduct research in accordance with the Research Themes.

Facilities

Herbarium

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

- c. 160,000 specimens that are pressed, dried and mounted on herbarium sheets held in the Collection Room
- c. 16,000 specimens that are preserved in 70% ethanol held in the Spirit Room
- c. 2500 wood blocks

New herbarium specimens accessioned into CNS in 2010 totalled 3057. In addition 2033 collection records were edited and 415 specimens were re-determined.

The ATH received 64 visitors undertaking scientific research on the collections and collaborative activities of a scientific nature with ATH collaborators.

The orchid collection of Alick Dockrill, one of Australia's foremost orchid experts, was incorporated. This collection comprised over 1200 individual collections from across Australia, with many collections over 50 years old. Incorporation of the collection required many hours of volunteer time, involving transfer of the delicate specimens onto herbarium sheets and careful cross-checking of the often sparse collection information.

The ATH's integrated pest control strategy proved effective; the collections remained free of pest outbreaks. Maintenance of up-to-date plant nomenclature, specimen processing times and herbarium service delivery (such as specimen loans) exceeded agreed benchmarks.

Public Reference Collection (PRC)

The Public Reference Collection (PRC) is an expanding collection of herbarium specimens (currently over 2100 species), literature, interactive CD keys and other resources for identifying plants, available to the public, consultants, and other interested persons to identify their own collections. In 2010, usage of the PRC totalled 60 hours by 49 external users.

Library

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

Laboratory

The ATH maintains a state of the art molecular genetics lab capable of supporting a wide range of DNA-based biodiversity and evolutionary research methods including sequence analysis, genotyping using a range of techniques from RFLPs to microsatellite analysis.

DNA/Tissue Bank

The ATH is developing a cryo-bank of plant and fungal DNA and frozen tissue samples, archived at -80 deg. C. This bank will support molecular genetics studies as well as being an unrivalled resource for bioprospecting in tropical Australian plants and fungi.

Holdings currently consist of c. 5000 samples (1400 of which were added during 2010) representing the majority of vascular plant genera present in the wet rainforests of North Queensland.

Major events

Launch of the online Australian Tropical Rainforest Plants Edition 6

Forty years of research and data collection in Australia's northern rainforests culminated with the launch of the online *Australian Tropical Rainforest Plants* Edition 6 interactive key and information system (a.k.a the "Rainforest Key") – available at www.anbg.gov.au/cpbr/cd-keys/rfk/index.html. This edition features additional plant groups, primarily herbs, grasses, palms and pandans, and a new operating software system, Lucid. Ongoing development of this CSIRO project has been based at the Australian Tropical Herbarium since its establishment.

From its first edition in 1971, it has grown and developed into the largest computer-based key in the world, including over 2500 species. The online version of the Rainforest Key allows anyone with an interest and an internet connection to identify plants from the Australian tropical rainforests.

The launch proceedings were introduced by Dr Judy West, Executive Director of the Australian National Botanic Gardens, and the formal launch performed by Andrew McLean, Executive Director of the Wet Tropics Management Authority. In attendance were several people with a long involvement in the key's development, including Bernie Hyland, Bruce Gray, Siobhan Duffy and Frank Zich.

Ethnobotany workshop

The Australian Tropical Herbarium is in the process of developing an Indigenous driven tropical ethnobotany centre in partnership with JCU's Cairns Institute, DERM, and CSIRO Sustainable Ecosystems. Potential functions of the centre include:

- Supporting Indigenous decision-making about plants and plant knowledge;
- Protection of Indigenous intellectual and cultural property rights over plants;
- Keeping traditional and cultural knowledge alive;
- Passing cultural knowledge on to the younger generation;
- Getting information back into the community.

To work towards this goal ATH hosted a workshop in November 2010. The workshop brought together Traditional Owners and other interested parties from across tropical northern Queensland, Brisbane and Commonwealth representatives to discuss a proposed model for the centre. The concept of an Indigenous-driven ethnobotany centre was well received, and a working committee was established with a view to work towards this goal. A detailed report on the workshop outcomes and prospects for the centre model will be completed by mid 2011. Funding for the workshop was provided by ATH, DERM, CSIRO Ecosystem Sciences, the Tropical Landscapes Joint Venture and JCU's Cairns Institute.

BushBlitz

BushBlitz is Australia's largest nature discovery project - a three-year multi-million dollar partnership to document the plants and animals in hundreds of properties across Australia's National Reserve System. A number of ATH staff participated in a BushBlitz flora survey at the Cloudlands Nature Reserve near Tarzali.

Dissemination and Promotion of Taxonomic Knowledge

In 2010, the ATH played a major role in facilitating the dissemination and promotion of taxonomic knowledge through its participation in the Taxonomy Research and Information Network (TRIN, a Commonwealth Environmental Research Facilities hub). TRIN aims to enhance and accelerate taxonomic research and delivery of information on Australia's biodiversity.

User testing of interactive keys

In July the ATH hosted a series of workshops designed to test a range of interactive identification keys (mangroves, rodents, rainforest plants) being developed to gain detailed user feedback on their performance and the degree to which the products meet user needs. The workshops were run by Helen Eddy-Costa from TRIN and facilitated by the developers of the interactive keys, including Frank Zich. A total of 15 workshops were run and were attended by 60 members of the taxonomic information user-community in Far North Queensland.

TRIN Field Day

TRIN's major event in Cairns for 2010 was the "TRIN Interactive Field Day" (9th December). Information sessions were well attended, with 65 registered visitors from government and the private sector, and many unregistered participants. The day was all about developers and researchers sharing taxonomic information with end users – information was presented on new tools for coral, mangrove, rodent, wattle and orchid identification. Sophisticated resources such as the Atlas of Living Australia were introduced, and a number of short talks were given on topics as diverse as DNA barcoding and field data acquisition.

Rainforest Plant Identification Workshops

In 2010, ATH was funded to prepare and present a series of plant identification skills short courses. In this series of workshop-style courses botanists from the Australian Tropical Herbarium and the Wet Tropics Management Authority taught skills needed to identify both native and weedy plant species in the rainforests of the Wet Tropics. The courses were designed for a broad range of users, including environmental professionals, rangers, students and others who would like to gain advanced knowledge and skills. The courses were designed to be hands-on, with participants visiting local rainforests to put into practice their classroom learning. Eleven workshops (total 20 days tuition) were delivered across five locations: Cairns, Atherton, Mareeba, Paluma, and Townsville. Attendees totalled 122 for all workshops, representing 20 organisations plus the general public. Fifty-two DERM/QPWS rangers attended.



Rainforest Key 6th Edition development team at the launch. L-R: Frank Zich, Bruce Gray, Bernie Hyland, Judy West and Siobhan Duffy.



Participants in the TRIN field day, 9 December 2010.

Service

Scientific Enquiries

A total of 112 scientific enquiries (excluding identifications) were answered by ATH staff.

Identifications

A total of 208 plant identifications were performed by ATH staff for external clients.

Visitors

During 2010, 345 persons visited the ATH for non-scientific reasons, many of whom were part of group tours. Of these visitors 32 were international, including groups from Appalachian State University and Emporia University in the United States.

VIPs

- Prof Penny Sackett (Chief Scientist for Australia)
- Hon. Bob Katter (Federal Member for Kennedy)
- Ms Wendy Richardson (The Queensland Party)
- Mr Aidan McLindon (The Queensland Party)
- Mr Darren Hunt (The Queensland Party)

Group Tours

In 2010, 27 group tours (including VIP delegations) of the ATH were conducted. A total of 150 people participated in these tours. This does not include scientists visiting to conduct research.

Representation Roles (External)

Abell-Davis S, Australasian Mycological Society, Councillor.

Cornelius J, *International Forestry Review*, Editorial Advisory Board.

Crayn D, Australian Biological Resources Study Advisory Board, member; Australian Canopy Crane Research Station Scientific Committee, member; *Australian Systematic Botany*, Associate Editor; Council of Heads of Australasian Herbaria; NE Herbarium International Review Panel, member; TreeBol - Australasian regional coordinator.

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

Harrington M, Australian Systematic Botany Society, North Queensland Chapter Convenor.

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

Worboys S, Cairns and Far North Environment Centre, Secretary.

Zich F, Australian Systematic Botany Society, Councillor.

Communications

Media

'Easy on the eyes, not the nose', article in the Townsville Bulletin regarding the White Crinoline Stinkhorn *Phallus indusiatus*, based on interview with Sandra Abell-Davis 20/2/2010.

'Garden-variety deal sows seeds for studies', article in the Cairns Post regarding the Memorandum of Understanding between the Australian Tropical Herbarium and the Cairns Botanic Gardens, 25/5/2010 and also an article in the Cairns Sun 30/6/2010.

Warmington D, Memorandum of Understanding between the Australian Tropical Herbarium and the Cairns Botanic Gardens. Friends of the Botanic Gardens Newsletter 59:7.

Worboys SJ, 'What is a weed?' Interview, Fiona Sewell, ABC Local Radio.

Website

The ATH website received 92,739 hits and 13,333 visits in 2010. In December, the average number of daily hits was 391, more than 50% higher than the average for the full year. This spike coincided with strong interest generated by the launch of the online rainforest key.

Implementation of the new website design and refresh of content occurred in early 2010. The website continues to be maintained and updated by Katharina Schulte.

Research

Research is undertaken at the Australian Tropical Herbarium on the following five themes:

THEME 1 – BIODIVERSITY, TAXONOMY, EVOLUTION

Assessment of tropical plant and fungal biodiversity through systematic 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

Training and capacity-building including developing more effective ways to deliver research outputs to the community.

Following are details of research undertaken at ATH during 2010. Research outputs from each project are cited in brief – full details can be found in “Publications and Presentations” on pages 26-30.

Theme 1 – Biodiversity, Taxonomy, Evolution

DNA-Barcoding tropical Australian trees

Team: **Darren Crayn** (ATH), Andy Lowe (U. Adelaide, State Herbarium of South Australia), Hugh Cross (U. Adelaide), **Craig Costion** (ATH and U. Adelaide), **Melissa Harrison** (ATH), Maria Kuzmina (Canadian Centre for DNA Barcoding).

Prof. Crayn is an Australasian coordinator for ‘treeBOL’, an ambitious long term global project to DNA-barcode the trees of the world. ATH’s role is to barcode Australian tropical rainforest trees.

Research outputs

Research presentations: Crayn & Lowe (2010); Costion et al. (2010); Costion, Lowe & Crayn (2010).

2010 Achievements

*The team obtained a total of 3,065 sequences (vouchered): 1,535 of *rbcl*, 1025 of *matK*, and 505 of *trnH-psbA*. Over 500 species were barcoded (≥ 2 replicates) for *rbcl*; 317 for *matK*; and 199 for *trnH-psbA*. Data were submitted to BOLD (Barcode of Life Data System) and analysis of those data begun. Extensive testing of DNA preservation in herbarium specimens was undertaken. Failure of most specimens to yield usable DNA led to the abandonment of herbarium specimens as a routine source of material for DNA barcoding in this project. A new protocol was developed for the problematic *trnH-psbA* which has been adopted in slightly modified form by the BOLD team.*

Endophytic fungi

Team: **Sandra Abell-Davis** (JCU, ATH), Melinda Greenfield (JCU Honours Student), Natalie Dillon (DPI&F), David Astridge (DPI&F), Ian Newton (DPI&F).

Endophytes are fungi that live within leaf and stem tissue without causing disease to their plant hosts and that produce toxic compounds to deter herbivory. Their application as biocontrol agents to reduce the reliance of the agricultural industry on chemicals is yet to be realised.

Research outputs

Thesis: Greenfield (2010).

Research Presentation: Greenfield et al. (2010).

2010 Achievements

*In 2010 an honours project undertaken by Melinda Greenfield determined that the fungus *Beauveria bassiana* could act as an artificial endophyte in the Australian Cavendish variety of banana. There were different levels of both the capacity to colonise plants and the ability to kill banana weevil borers for the eight isolates of *B. bassiana* used in the experiments. It was also found that colonisation was significantly higher in the banana corm, where the weevil borer does the most damage. However, the level of colonisation does appear to decline over time for the isolates that were used in this study. This may have been a result of plant stress due to a decline in nutrient availability from the unfertilised media in which the plants were grown.*

Entomopathic fungi

Team: **Sandra Abell-Davis** (JCU, ATH), Marcin Skladaniewicz (JCU Honours student), Will Edwards (JCU), Roger Shivas (BRIP Herbarium), Anthony Young (BRIP Herbarium), Nigel Hywel-Jones (BIOTEC Thailand).

This project aims to update the knowledge of representatives of *Ophiocordyceps* (Family Clavicipitaceae), focusing on taxonomy, ecological constraints and distribution across the North Queensland Wet Tropics. *Cordyceps* spp are common pathogens of insects and other arthropods all around the world, yet the information on the Australian representatives, especially for the Wet Tropics, is very poor. Worldwide, representative species have been proven to be a source of unique chemical compounds



Weevil colonised by the fungus *Beauveria bassiana* (Photo: Melinda Greenfield)

with medicinal applications (e.g. cyclosporin), as well as possible biocontrol agents (e.g. *Metarhizium anisopliae*).

2010 Achievements

The Honours student enrolled to undertake these studies had to discontinue due to changes in personal circumstances. A new collaboration has been made with Dr. David Hughes currently of Harvard University who will be commencing an assistant professorship at Penn State University in April 2011. This collaboration will include hosting and supervision of PhD students and assisting with their data collection in the Wet Tropics. In a recent six-day field trip, six new species were isolated from local ant species in the Wet Tropics.

Evolution of photosynthetic pathway in plants (especially Bromeliaceae)

Team: **Darren Crayn** (ATH), **Katharina Schulte** (ATH), Andrew Smith (U. Oxford, UK), Klaus Winter (Smithsonian Tropical Research Institute, Panama), Walter Till (Botanical Institute, Vienna, Austria), Thomas Givnish (U. Wisc., USA), Georg Zizka (Senckenberg Institute, Germany)

This multidisciplinary project aims to clarify the evolution of key ecophysiological traits, such as Crassulacean acid metabolism (CAM) in the bromeliads and other lineages. This is being achieved by: (1) using molecular data to build improved phylogenetic trees for the group, and (2) determining the occurrence of CAM in bromeliad species by carbon isotope analysis of plant tissue.

Research outputs

Research Presentation: Silvestro et al. (2010).

2010 Achievements

A paper reporting a multilocus phylogeny of Bromeliaceae was accepted for Am. J. Bot. (ERA rank A). An oral presentation was given reporting on an evolutionary analysis of CAM photosynthesis in the Andean genus Puya.

Fire and fungi

Team: **Sandra Abell-Davis** (JCU, ATH), Andy Baker (DERM), Mark Parsons (DERM), Jonathan Roth (DERM), Andrew Hedges (DERM), **Mark Harrington** (ATH).

This project will involve habitat attribute analysis of essential food resources (primarily truffle fungi and cockatoo grass) for the endangered northern bettong (*Bettongia tropica*) supporting recovery knowledge. Plots shall harvest material (cockatoo grass, truffles and truffle mycelium) to ascertain seasonal and/or fire interval parameters that are considered suited towards maintaining northern bettong habitat. A DNA library for the truffle species that have been collected (60 species to date) is being developed which will allow molecular identification of the mycelium samples and characterisation of the taxonomic diversity.

Research outputs

Research Presentation: Abell-Davis et al. (2010).

2010 Achievements

A DNA library of truffle species occurring in northern bettong habitat has been generated. Field sites have been selected where the effects of season and fire on the production of truffle extramatrical mycelium will be determined. The fire regimes that were examined in these studies had no significant effect on the quantity of food resources available to tropical bettongs.

Origins, evolution and molecular identification of Lauraceae

Team: Marlien van der Merwe (National Herbarium of NSW), Maurizio Rossetto (National Herbarium of NSW), Henk van der Werff (Missouri Botanical Garden), Peter Weston (National Herbarium of NSW), **Darren Crayn** (ATH), **Mark Harrington** (ATH).

Lauraceae is a large, globally distributed plant family of about 3000 species, mostly rainforest trees. This project aims to improve our understanding of the origins and evolution, and revise the taxonomy if necessary, of this family (focusing on the subfamily Cryptocaryeae) by conducting: (1) phylogenetic, divergence-time and historical biogeographical analyses; (2) phylogeographic studies on selected taxa to determine species limits and the relative importance of vicariance vs. dispersal in species radiation in Lauraceae. Furthermore, a DNA-barcode database for Cryptocaryeae will be developed.

2010 Achievements

A nuclear RPB2 dataset of 90% of Australian leafy Lauraceae species was completed and analysis initiated. In addition, a plastid DNA dataset of three loci (trnH-psbA, trnL-trnF, plus matK provided by Harrington) was compiled. Several other plastid loci were assessed for their phylogenetic utility and shown to be insufficiently variable; these were not pursued further. Very low evolutionary rates were observed across the data in both plastid and nuclear loci rendering the resolution of robust clades problematic. Several species appear to be polyphyletic.

Origins of the Wet Tropics flora – a molecular perspective

Team: **Mark Harrington** (ATH), **Craig Costion** (ATH, U. Adelaide), **Darren Crayn** (ATH).

We are gap-filling published molecular phylogenies with missing Australian taxa, dating these phylogenies, and using 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 (relict taxa) that have differentiated in situ, what are the invasive elements, and where have they come from?

Research outputs

Scientific papers: Biffin et al. (2009); Harrington & Gadek. (2010); Jones, Gadek & Harrington (2010).

Research Presentations: Costion, Harrington & Crayn (2010); Crayn, Harrington and Costion (2010); Harrington, Costion & Crayn (2010).

2010 Achievements

The set of available dated molecular phylogenies for lineages represented in the Wet Tropics has been finalised and preliminary multi-lineage analyses undertaken and presented at international conferences. Considerable progress was made towards finalising the publication plan for this programme. Relationships of the basal angiosperms, especially Piperales, and certain monocot lineages will have priority.

Phylogenetic diversity analysis in the Wet Tropics flora

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

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) measures for conservation priority setting. This project is aligned with the tropical tree DNA-barcoding project and data will contribute to both projects.

Research outputs

Research Presentations: Costion, Lowe & Crayn (2010).

2010 Achievements

Collection, vouchering, DNA extraction and generation of sequence data from the rbcL locus has been completed for over 600 genera of Wet Tropics plants. These data are now being prepared for analysis.

Phylogenetics and evolutionary dynamics of Elaeocarpaceae

Team: **Yumiko Baba** (ATH, PhD student), **Darren Crayn** (ATH), **Maurizio Rossetto** (National Herbarium of NSW), **Hannah McPherson** (National Herbarium of NSW), **Mark Coode** (Kew Gardens, UK).

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 diversity in selected species in order to provide an insight into comparative evolutionary responses and speciation mechanisms in dry-adapted shrubs and rainforest tree species.

Research outputs

Thesis: McPherson (2009).

Research Presentations: Baba & Crayn (2010a); Baba & Crayn (2010b).

2010 Achievements

Yumiko Baba undertook extensive field work in 2010, sampling Elaeocarpus from across its tropical and subtropical distribution in Australia, with the main target of this sampling being the widespread species Elaeocarpus obovatus. In the laboratory, a range of molecular markers was assessed for usefulness in developing phylogenies. Two chloroplast markers and one nuclear marker have now been sequenced for 95% of Australian Elaeocarpus.

Hannah McPherson was awarded her PhD for an investigation into species distribution patterns

and processes driving speciation in the Australian endemic genus Tetratheca at a variety of taxonomic, geographic and temporal scales. Evolutionary processes were explored using a hierarchy of molecular approaches: phylogenetic reconstruction, comparative phylogeography and population genetics.

Phylogeny and population dynamics of Cunoniaceae

Team: **Margaret Heslewood** (PhD student, National Herbarium of NSW and U. Adelaide), **Maurizio Rossetto** (National Herbarium of NSW), **Darren Crayn** (ATH), **Andy Lowe** (U. Adelaide, State Herbarium of South Australia), **Johan Pillon** (IRD, New Caledonia).

Cunoniaceae is a family of mostly rainforest trees thought to be of Gondwanan origin. This project investigates the origins and evolution of the family and in particular the genus *Ceratopetalum* using dated molecular phylogenies for *Ceratopetalum* species to evaluate the role of long distance dispersal and vicariance in explaining present distributions. Furthermore, present day genetic structure and geographic distribution of *Ceratopetalum* species will be determined to infer the strength and directions of gene flow within and between populations for each taxon.

2010 Achievements

Laboratory work was completed and work was mostly directed toward preparation of papers and Heslewood's PhD thesis (submission expected mid 2011). Progress on each of the manuscripts was as follows: (1) Dated phylogeny for the Cunoniaceae – data analysis is largely complete except for divergence-time analyses; (2) Comparative phylogeography of Ceratopetalum species – analytical phase is about half complete. This work will likely be published as two papers based on analyses of the microsatellite and sequence data respectively; (3) Population genetics of C. apetalum and C. succirubrum – this manuscript is in the final stages of preparation and will likely be submitted within 1-2 months.

Re-evaluation of current taxonomic concepts in Australian Dendrobieae based on molecular evidence

Team: **Katharina Schulte** (ATH), **Mark Clements** (Centre for Plant Biodiversity Research, Canberra), **Darren Crayn** (ATH), **Peter Weston** (Royal Botanic Gardens, Sydney)

This project aims to rigorously re-evaluate highly controversial taxonomic concepts in Australian Dendrobieae based on multi-locus molecular phylogenetic evidence. The project has two main components: the first will resolve broader phylogenetic relationships among Dendrobieae using DNA sequences from highly informative plastid and nuclear markers, and the second focuses on the finer scaled phylogenetic relationships within notorious species complexes in Dendrobieae such as the Cooktown orchid (*Vappodes bigibba* group) using molecular fingerprint techniques (AFLPs). The resulting phylogenetic trees will be used to infer evolution of key morphological characters to evaluate their taxonomic utility, and to thoroughly re-evaluate current taxonomic concepts. Further, the historical biogeography of Australian Dendrobieae will be reconstructed using a dated phylogeny and discussed in the context of relevant events in earth history, especially concerning past geography and climate. The outcomes of this project will be highly relevant for conservation and legislative enforcement of Australian Dendrobieae.

2010 Achievements

Several field trips were undertaken to sample orchid material with focus on currently under-collected taxa from the Australian Wet Tropics. The ATH orchid living collection was greatly expanded by these activities. Two volunteers (Cameron Kilgour and Tapio Linderhaus) assisted in mounting living plants and maintaining the collection.

One technician (Alessia Mortari) and one volunteer (Ulrike Eilers) assisted with molecular work. The team successfully:

- extracted high quality DNA from 94 orchid samples,
- established a lab protocol for the amplification of the nuclear marker *xdh* in *Dendrobieae*,
- obtained *xdh* sequence data for 60 orchid samples,
- established an AFLP protocol for *Dendrobieae*, and
- conducted AFLP pilot studies in two species complexes within *Dendrobieae*.

In April 2010 a large grant proposal was submitted to support ongoing work on this project.

Systematics and evolution of Styphelioideae (Ericaceae)

Team: **Caroline Puente-Lelievre** (ATH, PhD student), **Darren Crayn** (ATH), Elizabeth Brown (National Herbarium of NSW), Mike Hislop (Western Australian Herbarium), Chris Quinn (National Herbarium of NSW).

This project aims to resolve the generic limits within the *Astroloma-Styphelia* group, a problem clade of Ericaceae subfamily Styphelioideae, using nuclear and plastid nucleotide sequences. Patterns of relationship will be studied at genus and species level using established molecular techniques. The taxonomic assessment and publication of poorly known and/or undescribed species of high conservation value will be a priority.

Research outputs

Research Presentations: Puente-Lelievre (2010); Puente-Lelievre, Brown et al. (2010); Puente-Lelievre, Harrington et al. (2010).

2010 Achievements

160 new samples from Western Australia, Queensland and New Zealand were collected and genomic DNA was extracted.

The DNA dataset for the Styphelioideae has been enlarged to 169 *atpB-rbcL*, 170 *matK*, 176 *rbcL*, 36 *trnV-ndhC* and 26 *trnL-trnF* sequences. Additionally, a range of molecular markers was evaluated for variability and capacity of to resolve phylogenetic relationships among species in the *Astroloma-Styphelia* clade.

Preliminary analyses of the data have resolved the main lineages in the *Astroloma-Styphelia* clade that are expected to form the basis for a new generic classification. Morphological synapomorphies that support these genera have been identified in some cases.

SEM images of pollen from representatives of nearly all the lineages within the *Styphelia-Astroloma* clade including undescribed species have been obtained. Preliminary results show that pollen morphology is highly variable within the group and at least partially congruent with phylogeny, which suggests potential to yield useful characters to diagnose monophyletic genera.

Systematics of *Tecomanthe*

Team: **Frank Zich** (ATH), Andrew Ford (CSIRO), **Mark Harrington** (ATH).

The systematics of the genus *Tecomanthe* (Bignoniaceae) will be investigated with a focus on the status and relationships of *Tecomanthe* sp. Roaring Meg (L.J.Brass 20236).

2010 Achievements

Populations at Mt Misery (Daintree) were visited during the spring flowering season but few plants were found to be in flower. Hand pollinations were unsuccessfully conducted on the available flowers. Morphological descriptions have therefore not been completed. Sourcing of material for genus-level molecular phylogenetic work continues.

In April 2010 a large grant proposal was submitted to ABRIS BushBlitz to support ongoing work on this project.

Systematics of *Wilkiea*

Team: **Frank Zich** (ATH), Andrew Ford (CSIRO), **Darren Crayn** (ATH).

The systematics of the genus *Wilkiea* (Monimiaceae) will be investigated with a focus on the status and relationships of *Wilkiea* sp. Palmerston (B.Hyland 80RFK).

2010 Achievements

A taxonomic paper has been completed and approved by internal review. This will be submitted for publication in early 2011.

Theme 2 – Threats And Impacts

Cenozoic diversification in Bromeliaceae: character evolution and climate change

Team: **Katharina Schulte** (ATH), Georg Zizka (Research Institute Senckenberg & Goethe University Frankfurt), Kurt Weising (University of Kassel), Pierre Ibisch (University of Applied Sciences Eberswalde), Daniele Silvestro, Daniel Cáceres, and Ingo Michalak (PhD candidates, Biodiversity and Climate Research Institute & Research Institute Senckenberg), Sascha Heller (Diploma student, Goethe University Frankfurt), Natascha Wagner (PhD student, University of Kassel), Rafael Louzada (PhD student), Universidade de Sao Paulo.

Bromeliaceae are one of the most important epiphyte families of the Neotropics, and are highly successful in colonizing 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 sub-projects that are mainly funded by the German Research Foundation and the Biodiversity and Climate Research Centre, Frankfurt.

Research outputs

Scientific Paper: Schulte et al. (2010).

Research Presentations: Cáceres et al. (2010); Schulte (2010a); Schulte (2010b); Schulte et al. (2010); Silvestro et al. (2010); Silvestro, Schulte & Zizka (2010), Wagner et al. (2010).

Thesis: Heller (2010).

Community Talk: Schulte (2010).

2010 Achievements

The team was successful in reconstructing multi locus phylogenies for Fosterella (5 plastid markers), Bromelioideae (5 plastid, 2 nuclear markers), the Gravisia complex (AFLPs) and Orthophytum (AFLPs) and dating the Fosterella and Bromelioideae phylogenies. Databases of the distribution of the groups were further developed. Additional plant material was collected in Bolivia by I. Michalak and N. Wagner.

K. Schulte and G. Zizka organised the workshop "Cenozoic diversification in Bromeliaceae", held in April 2010 at the Research Institute Senckenberg, Frankfurt, Germany.

Theme 3 – Plants For People

Medicinal Plants of Cape Flattery - Hopevale

Team: **Gerry Turpin** (ATH), **Stephanus (Fanie) Venter** (ATH).

Research is being undertaken to document the ways in which Indigenous people of the Cape Flattery-Hopevale area (NE Qld) use plants for medicine.

Research outputs

Research Presentation: Venter & Turpin (2010)

2010 Achievements

A four-day field trip to Cape Flattery was completed in September, with the principal focus being edible and medicinal plants of the Cape Flattery dunefields. On this trip, Gerry Turpin undertook surveys on country with a Gugu Yimithirr Elder, carrying out recorded interviews on the cultural uses for the plants growing in the Hopevale-Cape Flattery area.

Developing a sustainable wild sandalwood industry in Vanuatu

Team: **Jonathan Cornelius** (ATH, JCU), **Tony Page** (ATH, JCU)

In Vanuatu, the JCU Agroforestry and Novel Crops Unit, in partnership with the national Forestry Department is identifying the conditions required for a successful wild sandalwood (*Santalum* spp.) industry based on sustainable production in agroforestry systems. Natural populations of sandalwood are currently endangered due to unsustainable whole-tree extraction.

Research outputs

Scientific Papers: Jones, Waycott et al. (2010); Page, Potrawiak et al. (2010); Page, Southwell et al. (2010).

General Publications: Page, Tate et al. (2010); Page, Tunگون et al. (2010).

2010 Achievements

The study was completed in 2010.

Papua New Guinea tree germplasm project

Team: **Jonathan Cornelius** (ATH, JCU), **Tony Page** (ATH, JCU) and PNG partners

Development of a PNG timber industry based on community-based planted forests.

2010 Achievements

2010 was the first year of project operation, following the opening workshop in late 2009. Agreements have been drawn up with participating communities in three PNG provinces. Teak genetic resources in PNG have been safeguarded and enhanced through local seed collections and import of new high quality seed sources from Costa Rica, Laos, and Thailand. A methodology for participatory selection of local priority species has been designed and documented, and one species selection workshop was held in East New Britain.

Domestication of galip-nut (*Canarium indicum*)

Team: **Jonathan Cornelius** (JCU, ATH), **Tony Page** (JCU, ATH)

In Papua New Guinea, JCU's Agroforestry and Novel Crops Unit (ANCU), with research partner NARI (the National Agricultural Research Institute), is working on domestication of galip-nut, *Canarium indicum* (Burseraceae), a widely-consumed local nut species. Development of the galip-nut industry is an important alternative in cocoa-producing provinces such as East New Britain, due to the continuing spread of the cocoa pod borer.

2010 Achievements

The clonal garden and other ex situ genetic conservation areas at NARI in Kerevat, East New Britain has been expanded and consolidated.

Theme 4 – Planning And Management

Regional Ecosystem Mapping

Team: **Eda Addicott** (ATH), **Peter Bannink** (ATH), **John Neldner** (DERM), **Mark Newton** (ATH), **Gerry Turpin** (ATH), **Gary Wilson** (ATH).

As part of the Queensland Herbarium's State-wide Regional Ecosystems (RE) Mapping Programme, ATH staff are mapping (at 1:100,000 scale) REs for the Cape York Peninsula and Einasleigh Uplands bioregions and parts of the Channel Country bioregion and the Gulf Plains bioregion. Mapping and survey is being done in blocks of 1:250,000 scale map sheets.

Research outputs

RE Map Sheets: Neldner et al. (2010)

2010 Achievements

Mapping pre-clearing and remnant coverage of vegetation communities and regional ecosystems for the Coen 1:250 000 map sheet at a scale of 1:100 000 was completed and published. A first draft of seamless regional ecosystem coverage for all of Cape York was created. Compilation and verification of vegetation survey data for the whole of the Gulf Plains bioregion was commenced.

Theme 5 – Unlocking Our Knowledge

Plant Identification Workshops - Development

Team: **Frank Zich** (ATH), **Stuart Worboys** (ATH), **Darren Crayn** (ATH), **Ellen Weber** (WTMA), **Steve Goosem** (WTMA), **Betsy Jackes** (JCU).

Interactive plant identification keys are used in workshop mode to provide practical hands-on training for informed members of the wet tropics community (e.g. land managers, students, NGO groups) to learn and develop skills in plant identification techniques. These workshops generate community interest and awareness and

appreciation of the diverse and unique local and regional flora, and will provide a forum for the community to provide feedback on the Rain Forest Key.

Research outputs

General Publications: Australian Tropical Herbarium and the Wet Tropics Management Authority (2010a; 2010b; 2010c).

2010 Achievements

Three plant identification skills training modules were developed. The first, an introductory module, aimed at the interested layperson, and covering the basic leaf, flower and fruit features needed to identify most tropical rainforest plants. The second module focused on weeds, the third on more challenging details of plant anatomy such as flower and fruit structure. Eleven plant identification workshops were held in Cairns, Paluma, Mareeba, Townsville and Atherton, and were attended by over 120 people including botanical professionals, DERM staff and interested laypeople.

Australian Tropical Rainforest Plants – Information System

Team: Frank Zich (ATH), Judy West (CSIRO), Siobhan Duffy (CSIRO)

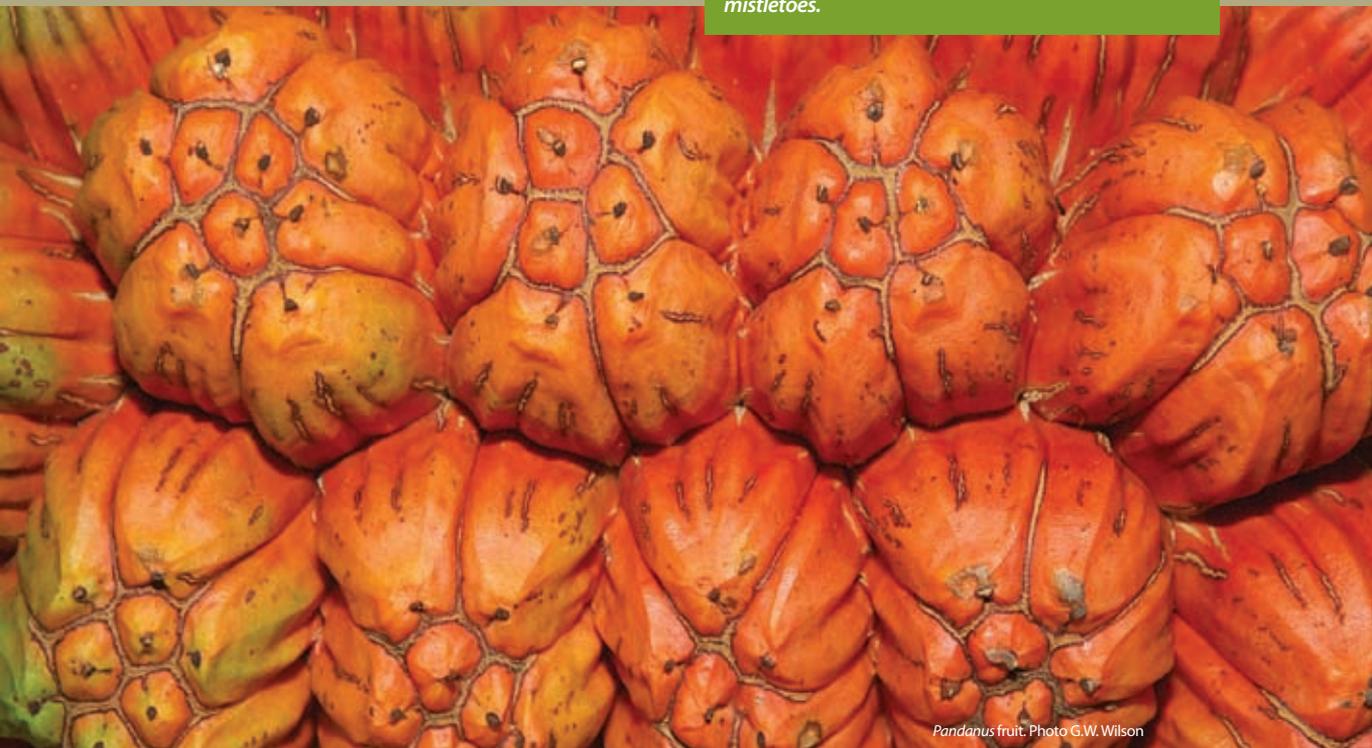
The “Australian Tropical Rain Forest Plants - Information System” (a.k.a. the Rain Forest Key, or RFK) is an interactive multiple-entry identification and information system for over 2500 spp of plants. A total of 138 characters, covering morphology - habit, bark, leaves, flowers, fruits and seedlings - and some geographic and ecological information ensure reliability and power of the key is high. Illustrated help notes assist with interpretation of characters. Plant images help to confirm identification.

Research outputs

Online Resources: Hyland et al. (2010)

2010 Achievements

The RFK Edition 6 Online was launched in December 2010, including over 2500 species of trees, shrubs, vines, herbs, palms, pandans, epiphytes and mistletoes.



Pandanus fruit. Photo G.W. Wilson



Nepenthes rowaniana and wasp. Photo G.W. Wilson

Publications and Presentations

Publications by ATH authors in 2010 for scientific and general audiences are detailed below (ATH authors in bold).

Regional Ecosystem Map Sheets

Neldner VJ, **Addicott EP**, **Newton M**, **Bannink P** (2010) Vegetation Communities and Regional Ecosystem 1:100,000 Survey and Mapping of the Cape York Peninsula Bioregion: Coen 1:250,000 map sheet.

Online Resources

Hyland BPM, Whiffin T, **Zich FA**, Duffy S, Gray B, Elick R, **Venter S**, Christophel D (2010) Australian Tropical Rainforest Plants Ed 6. Online version.

Scientific Papers

Biffin E, Lucas EJ, Craven LA, da Costa IR, **Harrington MG**, Crisp MD (2009) Evolution of exceptional species richness among lineages of fleshy-fruited Myrtaceae. *Annals of Botany (London)* 106, 79-93.

Cooper WE, Ford AJ (2010) *Trichosanthes odontosperma* (Cucurbitaceae), a new species from Queensland's Wet Tropics. *Austrobaileya* 8(2), 125-131.

Cornelius JP, Mesén F, Ohashi ST, Leão N, Silva CE, Ugarte-Guerra LJ, Wightman KE (2010) Smallholder production of agroforestrygermplasm: Experiences and lessons from Brazil, Costa Rica, Mexico and Peru. *Forest Trees and Livelihoods* 19(3): 201-216.

Cornelius JP, Weber JC, Sotelo-Montes C, Ugarte-Guerra LJ (2010) Phenotypic correlations and site effects in a Peruvian landrace of peach palm (*Bactris gasipaes* Kunth). *Euphytica* 173(2): 173-183.

Harrington MG, **Gadek PA** (2010) Phylogenetics of hopbushes and pepperflowers (*Dodonaea*, *Diplopeltis* - Sapindaceae) based on nuclear ribosomal ITS and partial ETS sequences incorporating secondary-structure models. *Australian Systematic Botany* 23, 431-442.

Henry RJ, Rice N, Waters DLE, Kasem S, Ishikawa R, Hao Y, Dillon S, **Crayn D**, Wing R, Vaughan D. (2010) Australian *Oryza*: utility and conservation. *Rice* 3: 235-241.

Jones LM, **Gadek PA**, **Harrington MG** (2010) Population genetic structuring in a rare tropical plant: *Idiospermum australiense* (Diels) S.T.Blake. *Plant Systematics and Evolution* 286, 133-139.

Jones BL, Waycott M, Robson HLA, Calladine A, **Page T** (2010) Isolation and characterization of microsatellite loci in *Santalum lanceolatum* and *Santalum leptocladium* (Santalaceae). *American Journal of Botany* 97(10): 299-316.

Leakey RRB, **Cornelius JP** (2010) Forest trees and livelihoods: guest editorial. *Forest Trees and Livelihoods* 19(3): 199-200.

Page T, Moore GM, Will J, Halloran GM (2010) Breeding behaviour of *Kunzea pomifera* (Myrtaceae): self-incompatibility, intraspecific and interspecific cross-compatibility. *Sexual Plant Reproduction* 23(3): 239-253.

Page T, Potrawiak A, Berry A, Tate H, Tunгон J, Tabi M (2010) Production of sandalwood (*Santalum*

australedonicum) for improved smallholder incomes in Vanuatu. *Forest Trees and Livelihoods* 19(3), 299-316.

Page T, Southwell I, Russell M, Tate H, Tunгон J, Sam C, Dickinson G, Robson K, Leakey RRB (2010). Geographic and phenotypic variation in heartwood and essential-oil characters in natural populations of *Santalum austrocaledonicum* in Vanuatu. *Chemistry and Biodiversity* 7(8): 1990-2006.

Phoon S-N (2010) Illiciaceae. pp. 137-143. In: R Kiew, RCK Chung, E Soepadmo, LG Saw & PC Boyce (eds) *Flora of Peninsular Malaysia: Series II: Seed Plant, Volume 1*. Forest Research Institute Malaysia, Kepong.

Phoon S-N (2010) Myricaceae. pp. 145-149. In: R Kiew, RCK Chung, E Soepadmo, LG Saw & PC Boyce (eds) *Flora of Peninsular Malaysia: Series II: Seed Plant, Volume 1*. Forest Research Institute Malaysia, Kepong.

Phoon, S-N (2010) Schisandraceae. pp. 211-217. In: R Kiew, RCK Chung, E Soepadmo, LG Saw & PC Boyce (eds) *Flora of Peninsular Malaysia: Series II: Seed Plant, Volume 1*. Forest Research Institute Malaysia, Kepong.

Wagstaff SJ, Dawson MI, **Venter S**, Munzinger J, **Crayn DM**, Steane DA, Lemson KL (2010) Origin, diversification and classification of the Australasian genus *Dracophyllum* (Richeeae, Ericaceae). *Annals of the Missouri Botanical Garden* 97, 235-258.

Schulte K, Silvestro D, Kiehlmann E, Vesely S, Novoa P, Zizka G (2010) Detection of recent hybridization between sympatric Chilean *Puya* species (Bromeliaceae) using AFLP markers and reconstruction of complex relationships. *Molecular Phylogenetics and Evolution* 57, 1105-1119.

Theses

Greenfield, M (2010) Biocontrol of weevil borers in Cavendish bananas by the entomopathogenic fungal endophyte *Beauveria bassiana*. James Cook University. Honours. Supervisor: **Abell-Davis SE**.

Heller, S (2010) Molecular analyses within *Aechmea* (Bromeliaceae) – the *Gravisia* complex. Goethe University, Frankfurt, Germany. Diploma. Supervisors: Zizka G, **Schulte K**, Kanz B.

McPherson, H (2009) Phylogenetics and evolutionary dynamics of *Tetralochea* (Elaeocarpaceae). University of New England. PhD. Supervisors: Gross C, **Crayn DM**, Rossetto M.

General Publications (unrefereed)

Australian Tropical Herbarium and the Wet Tropics Management Authority. (2010a) Australian Tropical Rainforest Plants. Rainforest Plant Identification Workshop (Advanced). Participant's Workbook. ATH and WTMA, Cairns, Queensland.

Australian Tropical Herbarium and the Wet Tropics Management Authority (2010b) Australian Tropical Rainforest Plants. Rainforest Plant Identification Workshop (Introductory). Participant's Workbook. ATH and WTMA, Cairns, Queensland.

Australian Tropical Herbarium and the Wet Tropics Management Authority. (2010c) Weeds of the Wet Tropics. Introduction to Rainforest Weed Identification. Participant's Workbook. ATH and WTMA, Cairns, Queensland.

Crayn DM (2010) Book Review: Australian Palms by John Leslie Dowe. *Australian Systematic Botany Society Newsletter* 142: 16-18.

Page T, Tate H, Bunt C, Potrawiak A, Berry A (2010) Socio-economic constraints to smallholder sandalwood in Vanuatu. Project Final Report FST/2007/057. Canberra, Australian Centre for International Research.

Page T, Tungon J, Tabi M, Kamasteia P (2010) Vanuatu Sandalwood: A growers guide for sandalwood production in Vanuatu. Canberra, Australian Centre for International Agricultural Research.

Research Presentations

Abell-Davis SE, Gadek PA, Pearce CA, Congdon BC (2010) The spatial distribution of hypogeous fungi explains the habitat restriction of an endangered marsupial, *Bettongia tropica*. Ninth International Mycological Congress (IMC9), Edinburgh, UK [poster].

Baba Y, Crayn DM (2010a) Molecular investigation of sectional classification of Australasian *Elaeocarpus*. ATFI Seminar Series, JCU Cairns Campus [oral].

Baba Y, Crayn DM (2010b) Molecular investigation of sectional classification of Australasian *Elaeocarpus*. 8th International Flora Malesiana Symposium, Singapore Botanic Gardens, Singapore [oral].

Cáceres D, Schulte K, Schmidt M, Zizka G (2010) Diversidad, ecología y distribución de la familia Bromeliaceae en el Oeste de Panamá (Chiriquí, Bocas del Toro y Comarca Ngöbe Buglé). X Congreso Latinoamericano de Botánica, La Serena, Chile [poster].

Costion C, Harrington MG, Crayn DM, Richardson JE (2010) The Malesian "intrusive" flora in tropical north Queensland. 2010 International Meeting of the Association for Tropical Biology and Conservation, Bali, Indonesia [oral].

Costion C, Crayn DM, Lowe A, Cross H, Metcalfe D, Ford A. (2010) Tree DNA-barcoding in the Queensland Wet Tropics. TreeBoL 2010 Symposium, New York Botanical Garden.

Costion C, Lowe A, Crayn DM (2010) DNA Barcoding Trees: Emerging technologies for species delineation, diversity estimation, and tracking illegal logging of timber species in the tropics. 8th International Flora Malesiana Symposium, Singapore.

Crayn D, Harrington MG, Costion C (2010) New perspectives on the origins of the Australian Wet Tropics flora: Phylogenetic evidence and the Gondwanan relictualism versus Laurasian invasion debate. ATFI Seminar Series, JCU Cairns Campus [oral].

Crayn DM, Lowe A. (2010) Barcoding Australia's Trees. TreeBoL 2010 Symposium, New York Botanical Garden.

Greenfield MJ, Newton I, Dillon N, Astridge D, Abell-Davis SE (2010) Biocontrol of weevil borers in Cavendish bananas by the endophyte *Beauveria bassiana*. Ninth International Mycological Congress (IMC9), Edinburgh, UK.

Harrington MG, Costion C, Crayn DM (2010) What has Gondwana given us? Phylogenetic evidence for plant origins in the Australian Wet Tropics and SE Asia. 2010 International Meeting of the Association for Tropical Biology and Conservation, Bali, Indonesia [oral].

Puente-Lelievre C, Brown EA, Quinn CJ, Heslewood MM, Harrington MG, Crayn DM (2010) Molecular phylogenetic analysis of Styphelieae (Styphelioideae, Ericaceae). School of Marine and Tropical Biology Conference. Townsville, Queensland [oral].

Puente-Lelievre C (2010) Solving the *Styphelia-Astroloma* puzzle: delimiting generic boundaries and evolutionary relationships on this problematic Ericaceae clade. Western Australian Herbarium seminar series [oral].

Puente-Lelievre C, Harrington M, Brown EA, Crayn DM (2010). Historical Biogeography of the New Zealand Styphelieae, Styphelioideae, Ericaceae. Australian Systematic Botany Society Conference, Lincoln, New Zealand [oral].

Schulte K (2010a) Biodiversity and climate change – research opportunities in the Australian Wet Tropics. Seminar Series at the Dept. of Botany and Molecular Evolution, Research Institute Senckenberg, Frankfurt, Germany [oral].

Schulte K (2010b): Phylogeny and evolution of Bromeliaceae – new insights based on multi-locus molecular evidence. ATFI Seminar Series, JCU Cairns Campus [oral].

Schulte K, Silvestro D, Winter K, Smith JAC, and Zizka G (2010) Rapid diversification in *Puya* (Bromeliaceae) and Cenozoic climate change: a case study in the Chilean *Puya* clade. 2010 Australian Systematic Botany Society Conference, Lincoln, New Zealand [oral].

Silvestro D, **Schulte K, Winter K, Smith JAC, Zizka G (2010):** Intra-specific variations of the photosynthetic pathway in Chilean *Puya* (Bromeliaceae) and their correlations with climate parameters. 19th International Symposium Biodiversity and Evolutionary Biology of the German Botanical Society (DBG), Vienna [oral].

Silvestro D, **Schulte K, Zizka G (2010)** Cenozoic diversification of Bromelioideae: character evolution and climate change. Workshop "Cenozoic diversification in Bromeliaceae", Dept. of Botany and Molecular Evolution, Research Institute Senckenberg, Frankfurt, Germany [oral].

Wagner N, Silvestro D, **Schulte K, Zizka G, and Weising K (2010)** A journey through space and time - biogeographical analysis of *Fosterella* (Bromeliaceae). 19th International Symposium Biodiversity and Evolutionary Biology of the German Botanical Society (DBG), Vienna [oral].

Wilson GW (2010) Donors Hill regional ecosystem mapping. ATFI Seminar Series, JCU Cairns Campus [oral].

Venter S, Turpin G (2010) Contributions to Ethnobotany. ATFI Seminar Series, JCU Cairns Campus [oral].

Community Talks

Crayn D, Zich F, Harrington M (2010) Presentation to BZ2605 Plant Diversity and Adaptations class, JCU Cairns.

Schulte K (2010) Phylogeny and evolution of Bromeliaceae. Friends of the Botanical Gardens Cairns, Cairns Botanic Gardens.

Schulte K (2010) Applications of AFLPs in ecological and conservation genetics. BT3450 guest lecture, JCU Cairns.

Wilson GW (2010) Regional Ecosystems, IBAs and Biodiversity Conservation. Talk given to Post Conference Tour Group from 19th World Conference of Soil Science.

Wilson GW (2010) Co-lead part of the Post Conference tour to the Wet Tropics of attendees of the International National Climate Change Adaptation Research Facility Conference, Sunshine Coast, October.

Wilson GW (2010) Climate Change & Agriculture. Cairns Botanic Gardens Walk and Talk Program.

Wilson GW (2010) Ancient Seed Plants & Evolution in the Wet Tropics. JCU Science Faculty Public Lecture, Cairns.

Wilson GW (2010) Regional ecosystem survey and mapping. EV3625/5625 Tropical Agroforestry class, JCU Cairns.

Wilson GW (2010) Weeds and the precautionary principle. EV3625/5625 Tropical Agroforestry class, JCU Cairns.

Wilson GW (2010) Exposé of the cycads of the Wet Tropics. Presentation to Palm & Cycad Organisation of Australia (PACSOA) Brisbane chapter.



Epipremnum amplissimum. Photo G.W. Wilson



Flowers of the foxtail palm, *Wodyetia bifurcata*. Photo G.W. Wilson

Income

External Competitive Research Grants

Total competitive research grant income won by ATH staff in 2010 was **\$426,160**. Details of grants are provided below (2010 component of grant value, funds source, project title, total grant value and duration, ATH grantee(s))

\$84,000, Commonwealth Environmental Research Facility (CERF), through the Taxonomic Resource and Information Network (TRIN), DNA-barcoding Australia's tropical trees. **Crayn D.**

\$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, Cornelius J. (both 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, Cornelius J. (both 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, Cornelius J. (both 0.25 FTE)**

\$37,500, Australian Research Council Linkage Grant, Evolution of halophytes: a phyloinformatic approach to understanding and exploiting the traits underlying salt tolerance in plants. **Crayn D.**

\$31,465, Australian Biological Resources Study (ABRS), A revision of generic limits within the *Astroloma-Styphelia* clade and an assessment of the phylogeny of Styphelioideae. \$97,046 over 3 years (Jul 2008-Jun 2011). **Crayn D.**

\$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, Cornelius J. (both 0.25 FTE)**

\$25,000, Marine and Tropical Scientific Research Facility (MTRSF), Identification Skills Workshops – Australian Tropical Rainforest Plants. \$50,000 over 1 year (Jul 2009 – Jun 2010), **Crayn D, Worboys S, Zich F.**

\$22,000, Marine and Tropical Sciences Research Facility (MTRSF). Rainforest Plant Identification Training for Wet Tropics QPWS and IPA/Working on Country Indigenous Rangers, **Crayn D, Worboys S, Zich F.**

\$20,000, Queensland Department of Environment and Resource Management (Queensland Parks and Wildlife Service) for the period January 2009 to August 2011. Funding also includes \$30,000 in-kind support. Fire and fungi project. **Abell-Davis S. (0.25 FTE)**

\$9,000, Conservation International – Critical Ecosystem Partnership Fund. Assessment of the threatened status of the endemic plants of Palau. \$36,000 over 2 years (Jul 2010 to Jun 2012). **Costion C.**

\$2,800, Biodiversity and Climate Centre, Frankfurt, Germany: BiK-F Incoming Travel Grant. **Schulte K.**

\$2,500, Skyrail Rainforest Foundation. Systematics, origins and evolution of the rainforest canopy tree genus *Elaeocarpus* (Elaeocarpaceae) in Australasia. \$5,000 over 2 years (2009-2010). **Baba Y.**

\$2,000, Hansjorg Eichler Research Fund, Australian Systematic Botany Society. Phylogenetic assessment of pollen morphology within the *Styphelia-Astroloma* clade (Styphelioideae, Styphelioideae, Ericaceae). **Puente-Lelievre C.**

\$1,500, University of Adelaide Student Support Fund – Travel and Conference Fees. 2010 Association for Tropical Biology and Conservation meeting, Bali, July. **Costion C.**

\$1,020, Skyrail Rainforest Foundation. Systematics, origins and evolution of the rainforest canopy tree genus *Elaeocarpus* (Elaeocarpaceae) in Australasia. \$4,080 over 2 years (mid 2010-mid 2012). **Baba Y.**

\$1,000, Australian Biological Resources Study – Travel Bursary. 2010 Flora Malesiana Conference – Singapore. **Baba Y.**

\$1,000, Australian Biological Resources Study – Travel Bursary. 2010 Flora Malesiana Conference – Singapore. **Puente-Lelievre C.**

\$1,000, Australian Biological Resources Study – Travel Bursary. 2010 Flora Malesiana Conference – Singapore. **Costion C.**

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

Fees for Service

During 2010 ATH charged external clients **\$35,247** in fees. This included data provision fees (\$30,000), collecting service fees (\$1,530), herbarium access fees (\$2,080), specimen identification service fees (\$540) and advisory board sitting fees (\$1,097). In addition, \$8,600 was levied by ATH as overheads on research grants.



Mangrove forest. Photo G.W. Wilson.

People

Board

Dr Greg Leach (Independent Chairperson)
Dr Jeremy Burdon (CSIRO)
Prof Paul Gadek (JCU)
Dr Gordon Guymmer (DERM)
Prof Jeffrey Loughran (JCU)
Dr Judy West (CSIRO)
Dr Christine Williams (DERM)

Staff

Dr Sandra Abell-Davis (JCU¹)
Ms Eda Addicott (DERM)
Ms Yumiko Baba (JCU²)
Mr Peter Bannink (DERM)
Dr Jonathan Cornelius (JCU¹)
Mr Craig Costion (external grant)
Prof Darren Crayn (Director: CSIRO/JCU/DEEDI)
Prof Paul Gadek (JCU¹)
Dr Mark Harrington (CSIRO/JCU)
Ms Melissa Harrison (JCU²)
Ms Louise Hucks (external grant)
Mr Cameron Kilgour (external grant)
Ms Andrea Lim (DEEDI)
Dr Alessia Mortari (external grant)
Mr Mark Newton (DERM)
Dr Tony Page (JCU¹)
Ms Caroline Puente-Lelievre (JCU²)
Dr Katharina Schulte (CSIRO/JCU)
Mr Gerry Turpin (DERM)
Mr Gary Wilson (DERM)
Mr Stuart Worboys (external grant)
Mr Frank Zich (CSIRO)

¹together contribute 1 full-time-equivalent Molecular Systematist position

²together contribute 1 full-time-equivalent Laboratory Manager position

Research Students

Waipana Awarau (Diploma)
Yumiko Baba (PhD)
Daniel Cáceres, (PhD)
Craig Costion (PhD)
Melinda Greenfield (BSc Hons)
Sascha Heller (Diploma)
Margaret Heslewood (PhD)
Titus Kakul (PhD)
Anton Lata (MSc)
Rafael Louzada (PhD)
Ingo Michalak (PhD)
Hannah McPherson (PhD)
Sook Ngoh Phoon (PhD)
Caroline Puente-Lelievre (PhD)
Daniele Silvestro (PhD)
Hanington Tate (MSc)
Gary Wilson (PhD)

Volunteers

Murray Borrell
Eloise Edwards
Ulrike Eilers
Nanette Fairbairn
Mary Gandini
Rae Garrett
Cameron Kilgour
Tapio Linderhaus
Alessia Mortari
Garry Sankowsky
Nada Sankowsky
Philip Smith
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