

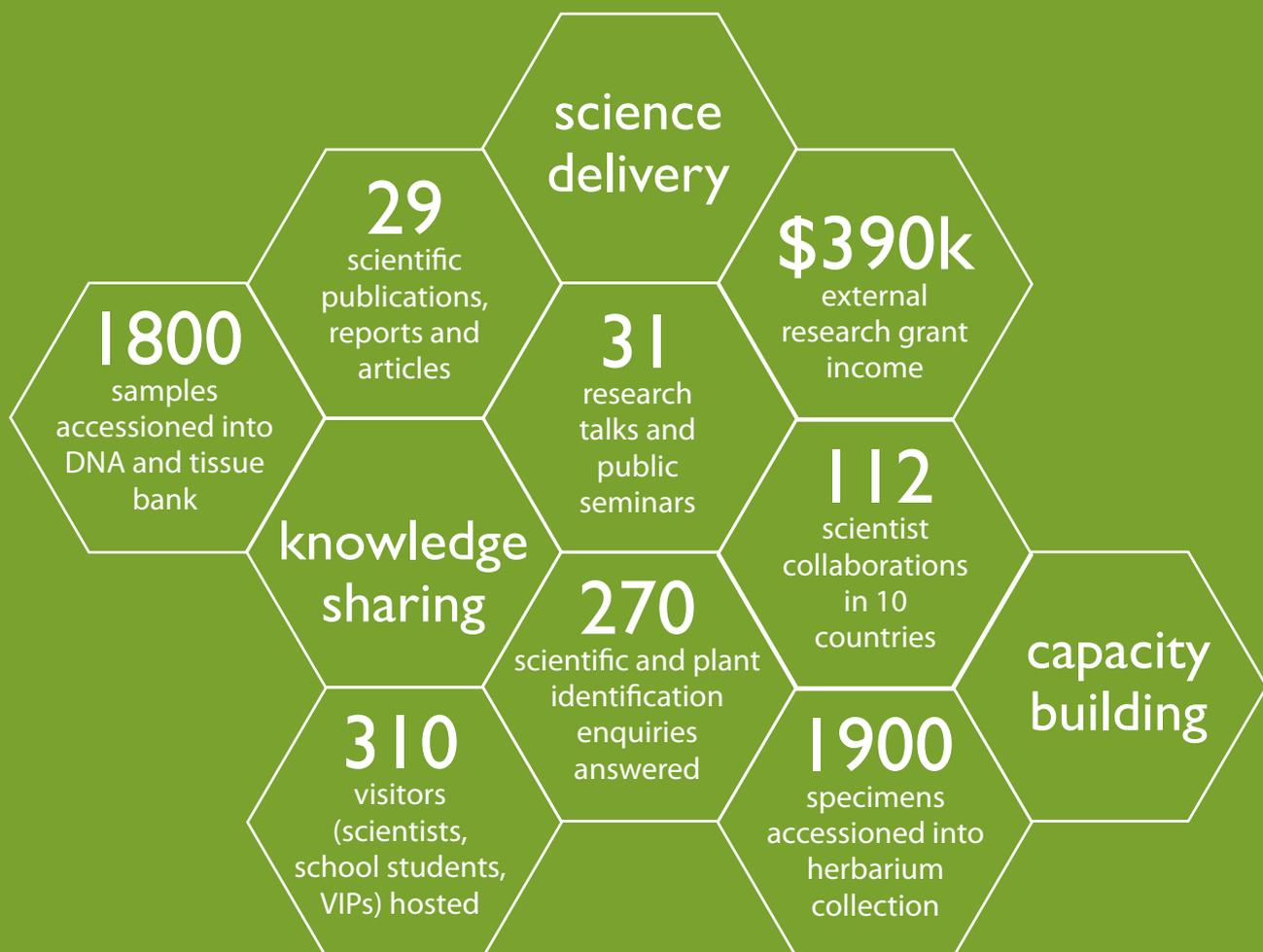
**TROPICAL PLANT
KNOWLEDGE FOR SCIENCE
AND SOCIETY**

**PLANT SCIENCE AT THE
AUSTRALIAN TROPICAL HERBARIUM 2017**

IMPACT STORY

A NEW PARADIGM FOR QUEENSLAND'S VEGETATION CLASSIFICATION

Land use legislation in Queensland is underpinned by the Regional Ecosystem classification framework. Regional Ecosystems are vegetation communities that are consistently associated with a particular geology, landform and soil. The vegetation communities are currently classified using standardized qualitative methods. ATH and Queensland Government botanist Eda Addicott is completing her PhD studies at JCU on developing and testing a new standard quantitative methodology for classifying vegetation communities within the Regional Ecosystem framework. The rollout of this new methodology across the State is improving the robustness, repeatability and transparency of Regional Ecosystem mapping methodology and fundamentally strengthens the evidence base for the regulation of land use in Queensland, including clearing, conservation and restoration.



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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, and Innovation (DSITI), and James Cook University (JCU). The ATH is located on the Cairns campus of JCU, and administratively is part of JCU's Division of Tropical Environments and Societies.

The ATH's vision is to be a leader in tropical plant biodiversity research, that conducts diverse, relevant and innovative research; translates 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.

The ATH Board oversees the operations of the ATH and sets overall strategic management policy and objectives. The Board comprises two representatives of each of the joint venture participants, and an independent Chair.

We acknowledge Aboriginal and Torres Strait Islander People as the first inhabitants of the nation and acknowledge Traditional Owners of the lands where our staff, students, and associates live, learn and work.



ATH Board members and Director. Top row (l–r): Mr Peter Cochrane (Chair, ATH Board), Dr Linda Broadhurst (Director, Australian National Herbarium, National Research Collections Australia, CSIRO), Prof Iain Gordon (Deputy Vice Chancellor, Division of Tropical Environments and Societies, James Cook University), Dr Gordon Guymmer (Director, Queensland Herbarium, Queensland Department of Environment and Science). Second row (l–r): Dr Mark Jacobs (Assistant Director General, Queensland Department of Environment and Science), Prof Marcus Lane (Dean, College of Science and Engineering, James Cook University), Prof Andrew Young (Director, National Research Collections Australia, CSIRO), Prof Darren Crayn (Director, ATH).

DISCOVERIES MAKING A DIFFERENCE

KEEPING INDIGENOUS PLANT KNOWLEDGE ALIVE

Plants have been at the centre of Indigenous cultures for millennia, and Traditional Owners are custodians of profound knowledge of the properties and uses of plants. The Tropical Indigenous Ethnobotany Centre (TIEC) partnership, based at the ATH, works through mutually beneficial partnerships with Traditional Owners to research traditional use of plants. Knowledge flow is two-way: Traditional Owners are empowered to keep their knowledge strong and to participate in and benefit from new discoveries (see p. 20).



Project Leader Gerry Turpin, exploring culturally significant flora on Olkola country, Cape York Peninsula. Photo: B. Menadue.

Exemplar project - Mbabaram traditional plant use research. Project Leader – Gerry Turpin.

This collaborative project involving the Watsonville Aboriginal Corporation (Mbabaram) and the National Institute of Complementary Medicine (NICM, University of Western Sydney) is investigating the bioactive potential of medicinal plants of the Mbabaram people. TIEC, with assistance from Mbabaram Traditional Owners, collects and prepares plant materials used in traditional medicines for analysis by NICM under agreement. Subject to further funding, TIEC will work towards an agreement to commercialise any medicinal plants with potential.



Wain-tchor (*Ipomoea pes-caprae*), a north Queensland plant of Indigenous cultural significance. Photo: S. Turpin.

UNDERSTANDING PATHOGENS

Managing diseases in natural and managed environments such as farms and nurseries requires knowledge of the pathogens that cause them. Research by ATH scientists is helping improve the understanding of the factors involved in fungal diseases of myrtaceous plants such as eucalypts and myrtles, and insects. Research is also underway into fungi that can help control nematode diseases of bananas.



Project leader Sandra Abell.

Exemplar project - Entomopathogenic fungi. Project Leader – Sandra Abell.

Fungi that infect insects are common in tropical regions. Despite their abundance, they have never been taxonomically studied in Australia. Recent samples taken from ants, flies, scale insects and spiders from Australian rainforests have revealed over 150 species probably new to science. This project focuses on the genera *Akanthomyces*, *Cordyceps*, *Gibellula*, *Hirsutella*, *Hypocrella*, *Ophiocordyceps*, and *Torrubiella*. A systematic revision and interactive identification guide to at least 40 Australian species will be made available. This project will contribute to a better understanding of the health of insect communities and the identity of potential biological control agents of insect pests.



A huntsman spider colonised by an entomopathogenic fungus. Photo: A. Lim.



Project leader Ashley Field collecting lycopytes on Cape York Peninsula for research. Photo: D. Baume.

DISCOVERING NEW SPECIES

Herbarium collections are the real frontiers of plant species discovery – most new species are discovered not by intrepid explorers in wild and remote places, but by scientists working painstakingly on existing, understudied collections. ATH scientists have named over 40 new species of plants and fungi since 2008 including wild relatives of lilly-pillies, melons, mangosteens, heathers, quandongs and truffles, and are currently working on many more. The potential utility of plants and fungi to humans (for fibre, fuel, food, medicine or amenity), their role in the environment, and their conservation can only be addressed once they have been discovered, named and accurately classified.

MAPPING AND MEASURING OUR BIODIVERSITY HERITAGE

Land use decision-making such as conservation reserve selection and management is based upon assessments of vegetation type and condition, threat, rarity and importance. We are contributing substantially to the evidence base for such decisions in northern Australia through mapping of Regional Ecosystems as well as identification of hotspots of biodiversity. For the latter, we are applying novel assessment methods that incorporate measures of evolutionary distinctiveness, which enables better management for a range of predicted, and unforeseen, environmental futures.

Exemplar project – Evolutionary diversity of ferns and lycopytes. Project Leader – Ashley Field.

In contrast with many flowering plants, lineages of ferns and lycopytes are often very widespread, linking floras all around the world. Australian ferns and lycopytes are very diverse. Some show Gondwanan and Oceanian affinities, whereas others have apparently arrived recently by long distance dispersal from the Western Palaeotropics and the Neotropics. Research at the ATH has linked into a worldwide network of fern and lycopyte scientists to study the global evolutionary history of ferns and lycopytes from their deep time origins to recent diversification processes that are critical to their survival. New species are described as they are found.

Exemplar project - Regional Ecosystem Mapping. Project Leader – Eda Addicott.

The Queensland Herbarium's Regional Ecosystems (RE) Mapping Program is an extensive survey, mapping and monitoring program of the State. The RE maps, which show pre-clearing, remnant vegetation and regional ecosystems, are important tools for governments, landholders and scientists to plan and manage the natural environment, developments and vegetation restoration. ATH staff have developed and successfully tested a new standard vegetation classification methodology for the Cape York Peninsula (CYP). Future work aims to implement this method across the other bioregions mapped by ATH staff (Einasleigh Uplands and Wet Tropics) as well as bioregions across the rest of Queensland.

Schizaea dichotoma, member of an ancient fern lineage. Photo: A. Field.

PROVIDING USEFUL TOOLS FOR THE COMMUNITY

A vast amount of information on the ecology, biology, uses and conservation status, of Australia's native plants has been compiled through over 240 years of scientific endeavour. This wealth of data will greatly improve our ability to sustainably manage our biodiversity. Publicly and freely available through the Atlas of Living Australia (ala.org.au), the data can only be utilised if the species name is accurately known. Knowledge for identifying plants can be very difficult to access by non-specialists: highly technical, expensive and held in distant libraries. The development and deployment of web-based interactive identification systems and apps targeted at the non-specialist enables almost anybody, anywhere to identify and learn about Australia's flora.

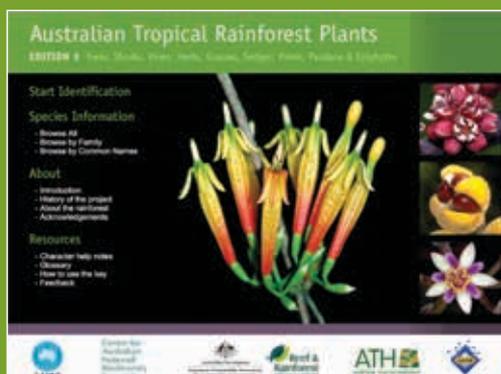
This helps all community sectors to achieve their land and environmental assessment, management, educational, scientific and recreational goals. Principal beneficiaries include the resources, agricultural and horticultural industries, Indigenous land managers, private and public conservation estate managers, students, tourists, and scientific researchers.

Exemplar project – Australian Tropical Rainforest Plants Identification System. Project Leader – Frank Zich.

The Australian Tropical Rainforest Plants identification system (www.anbg.gov.au/cpbr/cd-keys/rfk/) is an easy to use, free, online system that enables almost anybody, anywhere to identify nearly 3000 species of tropical rainforest plants in Australia. The uptake by the user community has been overwhelming – over 15,000 visits per month. The ATH continues to develop this system including extending its taxonomic and geographical coverage, and is working to initiate an even more exciting project: the Australian Savanna Plant Identification System (see p.20).



Project leader Frank Zich.



Front page of the online Australian Tropical Rainforest Plants identification system.

Exemplar project – Mountain plant conservation. Project Leader – Stuart Worboys.

Herbarium collections provide important information about plant distributions and therefore about the environmental requirements (niches) of species. By combining data from existing collections with extensive new field survey data for species distribution modeling analyses, we are predicting the impact of climate change on the rare and endemic plant species of Australia's tropical mountain tops.



Project leader Stuart Worboys enjoying an unusually sunny afternoon on Thornton Peak, Daintree National Park. Photo: H. Hancock.

PREDICTING BIODIVERSITY IMPACTS OF ENVIRONMENTAL CHANGE

The one thing that is constant in the environment is change. Predicting the impacts that environmental change will have on biodiversity is critical to ensuring we manage for its survival and adaptation. We are leading several modelling projects that are determining the nature and extent of climate change threats to the plant species of tropical mountains in Australia and South America, many of which are found nowhere else on Earth.



Rhododendron lochia, Australia's only native Rhododendron, which is restricted to the mountains of Queensland's Wet Tropics. Photo: D. MacLeod.



Project leader Rismita Sari (centre left) with field assistants on the hunt for wild mangosteen species in Indonesia.

UNDERSTANDING WILD RELATIVES OF DOMESTICATED PLANTS

Modern agriculture is re-discovering the potential of wild relatives of crop species as sources of traits for disease resistance, drought and salt tolerance, and nutritive value. Northern Australia has unique wild relatives of many important crops including rice, banana, cotton, melon, coffee, mangosteen, macadamia and sandalwood. ATH researchers are contributing to collaborative research programs on wild crop relatives that aim to improve food security in the tropics worldwide.

Exemplar project – The origins of mangosteen.
Project Leader – Rismita Sari.

The mangosteen – *Garcinia mangostana* – is highly prized for its sweet, juicy flesh. Native to Indonesia, it is at least 250 species of *Garcinia* worldwide, although the number is highly disputed. Australia has at least nine native *Garcinia* species, several of these only described scientifically in the last few years. This project aims to shed light on the origins of the mangosteen by using genetics to discover which species it is most closely related to. The knowledge gained will assist with crop improvement programs which seek to increase production, fruit shelf life and disease resistance.



Garcinia zichii, *Garcinia zichii*, one of six native Australian species of the mangosteen genus. This species was named by ATH Adjunct researcher Dr Wendy Cooper in honour the Collections Manager of the Australian Tropical Herbarium, Mr Frank Zich. Photo: J. Dowe.



Project co-leader Lizzy Joyce.

PIECING TOGETHER THE ORIGINS AND EVOLUTION OF THE FLORA

From where did our flora come? How has it evolved? How will it adapt to environmental change? ATH researchers are using genetic analysis to peer into the past and discover the origins of some of our most unique flora such as orchids, fungi, ferns, and quandongs. Piecing together the evolutionary pathways of lineages from their deep time origins to the modern-day species enables a better understanding of not only how organisms evolve, but how and why ecosystems change through time. This knowledge is essential to predict how species might adapt in a changing world.

Exemplar project – The Sunda-Sahul Floristic Exchange. Project Leaders – Elizabeth Joyce and Darren Crayn.

Understanding the processes that generate and maintain biodiversity in tropical ecosystems is vital for informing conservation decisions. The southeast Asian archipelago is one of the most biogeographically interesting places on Earth. It lies at the convergence of the Sunda and Sahul continental shelves, which collided from about 23 million years ago allowing plant species to migrate between previously isolated Sundanian and Sahulian floras. This study uses molecular phylogenies of multiple lineages to determine the dynamics of this exchange through time, and to better understand how it contributed to the assembly and evolution of the floras of Asia, Australasia and the Pacific.



Fruit and fallen leaves of the rainforest tree *Elaeocarpus grandis*. Photo: A. Lim.

BUILDING USEFUL CLASSIFICATIONS

Biological classifications, or taxonomies, are systems for ordering knowledge of the relationships among organisms and governing the scientific naming of them. Classifications and names are the way we communicate about organisms both in science and in daily life, and like a well-organised library, an accurate classification improves the efficiency and quality of research and communication. ATH scientists are using their discoveries to refine plant classifications, ensuring that they reflect the most accurate and up-to-date knowledge.

Exemplar project – Taxonomy of orchids.
Project Leaders – Katharina Schulte and Lars Nauheimer.

Australia harbours a rich and highly distinctive orchid flora. Based on DNA sequence data we are discovering the evolutionary relationships (phylogeny) among orchids. The results provide a scientific evidence base for re-examining controversial taxonomies in order to improve our classification system. Our studies cover a broad range of Australian orchids, such as the genus *Thelymitra*, and the highly diverse orchid tribe Diurideae which harbours the majority of Australian orchid species including many threatened species. Phylogenetic evidence is used to improve orchid classifications at higher taxonomic levels (e.g. at genus level) as well as to answer questions about species, such as “how many species does this group of similar-looking plants represent?”.



An orchid *Thelymitra canaliculata*. Photo: M. Clements.



Project leaders Katharina Nargar and Lars Nauheimer. Photo: S. Worboys.

SCIENCE DELIVERY—LOCAL TO GLOBAL

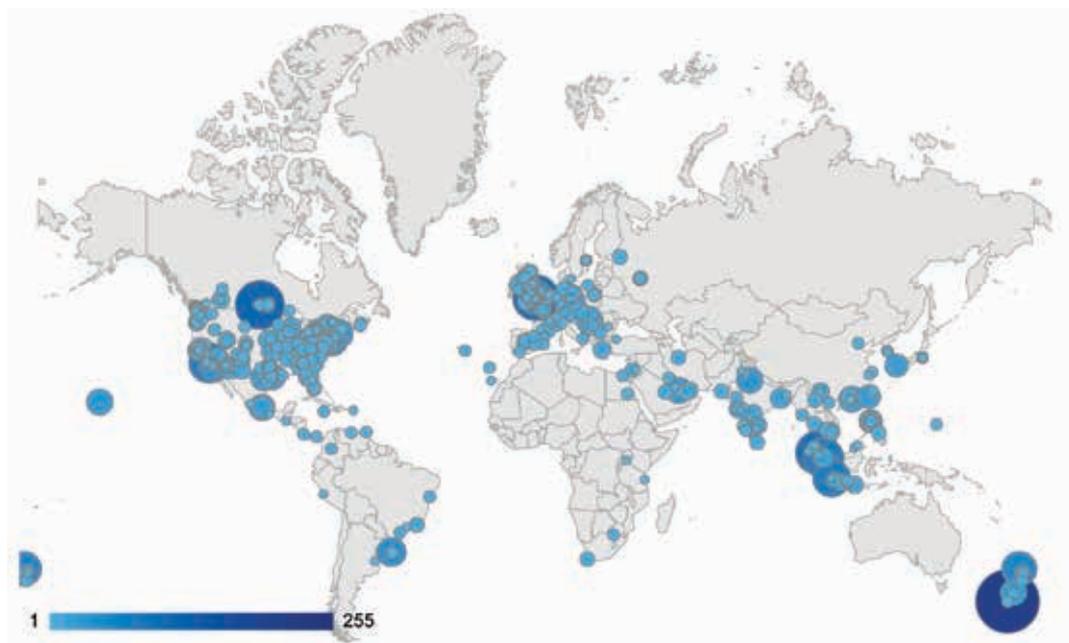
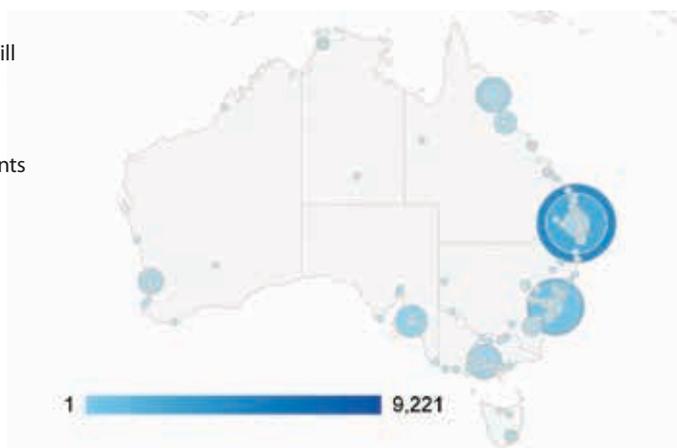
Science at the Australian Tropical Herbarium is improving knowledge of plants in northern Australia. Key programs include Regional Ecosystem mapping of the Cape York, Einasleigh Uplands and Wet Tropics Bioregions, research on traditional plant use by north Queensland Indigenous peoples, and the studies of the origins, evolution and conservation of Australia's tropical flora.

Beyond Australia, ATH staff and students work with researchers around the world on problems of local to global relevance. Our research is undertaken with colleagues on almost all continents including in Argentina, Brazil, China, Estonia, Federated States of Micronesia, Germany, Indonesia, Japan, Malaysia, New Zealand, Papua New Guinea, Singapore, Solomon Islands, UK, USA and Vanuatu. Institutional relationships through organisations such as the Council of Heads of Australasian Herbaria provide further collaborative partnerships.

Global programs to which the ATH contributes include the International Barcode of Life project (iBOL) the largest biodiversity genomics initiative ever undertaken (ibol.org). This initiative aims to construct a DNA barcode reference library that will be the foundation for a DNA-based identification system for all multi-cellular life. The ATH also contributes to Global Plants, the world's largest community-contributed database used by students

and researchers worldwide (plants.jstor.org). Through Global Plants, herbaria share high quality images of their plant Type specimens, experts determine and update plant names, and students discover and learn about plants in context, supporting research and teaching in botany, ecology and conservation.

ATH research has global impact: our scientific publications have been cited thousands of times by researchers all over the world, and the Australian Tropical Rainforest Plants online identification system website receives around 15,000 hits per month, many from outside of Australia.



Maps showing the national (top) and global usage of one ATH product, the Australian Tropical Rainforest Plants online identification system.

SHARING OUR KNOWLEDGE

COMMUNITY ENGAGEMENT, SERVICE, AND REPRESENTATIVE ROLES

ATH staff share their botanical expertise in many ways. We regularly give community talks and lectures on our research and other topics of current interest in Australia and overseas, we teach University plant science as well as giving talks to primary and secondary school groups and TAFE classes, and we host herbarium tours and talks for a broad range of stakeholder groups.

Through the Rainforest Plant Identification Courses, we deliver, in partnership with the Wet Tropics Management Authority, modular workshop-style tuition in the skills and resources needed to identify

We also provide a plant identification service which supports professionals in the commercial and not-for-profit sectors, as well as members of the public and students. We maintain a Public Reference Collection of authoritatively identified plant specimens that is free to use, and allows students, consultants and others identify and learn about north Queensland plants.

ATH staff share their expertise in many other ways, including through roles on various Councils, Advisory and Scientific Committees and Reference Groups for Commonwealth, State and Local Governments and not-for-profit groups and societies, numbering 24 such roles in 2017.



ATH botanist Stuart Worboys delivering plant identification training in the field and classroom.

both native and weedy plant species in the rainforests of the Wet Tropics. The many past participants include environmental professionals, rangers, students and interested public.

ATH staff have delivered many other workshops to community and professional groups on diverse topics as plant pathogens, fire in the landscape, techniques for documenting cultural plant use, and plant classification.



SCIENTIFIC COLLECTIONS – FOUNDATIONAL INFRASTRUCTURE

Biodiversity science is enabled by research collections of expertly curated biological specimens. Such collections constitute an authoritative storehouse of information about biodiversity and underpin taxonomic, genetic, agricultural and ecological research - making these vital resources for conservation and the development of sustainable land and marine management systems.

The ATH boasts extensive research collections housed in facilities that are the state-of-the-art for preservation and research. The research herbarium comprises more than 180,000 pressed, dried plant specimens. The 'wet' collection of more than 17,300 samples preserves the soft parts of plants (e.g. fruits) in fluids for anatomical and other studies. A wood block collection enables research on the structural and functional properties of wood. Our DNA and tissue collection of over 21,000 samples representing over 3,000 species is the foundation of studies on genetics and evolutionary biology. Several thousands of specimens and samples are added each year to the ATH collections as a result of research activities.

HERITAGE COLLECTIONS

Among the ATH collections are items of immense scientific and cultural significance. These include three of the original botanical specimens collected in 1770 at the Endeavour River (now Cooktown) by Joseph Banks and Daniel Solander, botanists on Cook's first circumnavigation of the globe (1769-1772).

Other important items include over 18,200 collections (46,000 items) of B.P.M. (Bernie) Hyland, the eminent and pioneering botanist of Australia's northern rainforests, 9,300 collections (26,600 items) of Bruce Gray, and orchid specimens from the collection of Alec Dockrill.



An herbarium specimen held in the ATH collections. Photo: Frank Zich.



ATH research worker Raelle Kerrigan curating the herbarium collections. Photo: A. Lim

SUMMARY OF ACHIEVEMENTS 2017

SCIENCE DELIVERY – LOCAL TO GLOBAL

Our science was communicated broadly through:

- 25 peer-reviewed publications
- 4 reports and general articles
- 24 research seminars at international conferences and local meetings
- 47 hours of lectures
- 17 public talks to mostly local groups.

This science was supported in part by:

- \$393,386 external research grant income
- collaborations with 112 scientists in 10 countries.

SHARING OUR KNOWLEDGE

ATH staff shared our knowledge through:

- training and knowledge sharing workshops delivered to Indigenous groups in north Queensland;
- plant identification training delivered through workshops to the public and to government and industry stakeholders;
- responding to 236 scientific enquiries and 31 requests for plant identifications for external stakeholders;
- hosting 279 public visitors participating in school, public and professional group tours;
- hosting 30 scientists undertaking research at the ATH;
- 16 representative and leadership roles on international, national, and local bodies.
- communicating through 9 media items.

BUILDING, IMPROVING AND MOBILISING OUR COLLECTIONS

- 1,902 herbarium specimens accessioned into CNS, 4,241 collection records edited and 2,517 specimens re-determined.
- 1,800 samples accessioned into the DNA and Tissue Bank, which now contains over 19,000 samples
- over 8.1 million specimen records downloaded in more than 22,000 download events by a range of external user groups through the Atlas of Living Australia portal (ala.org.au)
- 2076 images of 734 TYPE specimens available through JSTOR as part of the Global Plants project (plants.jstor.org).

The ATH thanks its many wonderful volunteers for their valuable contributions to our specimen processing, field and research programs.



PUBLICATIONS

SCIENTIFIC PAPERS

Badry MO, **Crayn DM**, Tate JA (2017) *Hibiscus diversifolius* subsp. *rivularis* (Bremek. & Oberm.) Exell (Malvaceae) in Australia. *Austrobaileya* 10, 113-120.

Brozynska M, Copetti D, Furtado A, Wing RA, **Crayn D**, Fox G, Ishikawa R, Henry RJ (2017) Sequencing of Australian wild rice genomes reveals ancestral relationships with domesticated rice. *Plant Biotechnology Journal* 15, 765-774.

Bui EN, **Thornhill AH**, González-Orozco CE, Knerr N, Miller JT (2017) Climate and geochemistry as drivers of eucalypt diversification in Australia. *Geobiology* 15, 427-440.

Burgess TI, White D, McDougall KM, Garnas J, Dunstan WA, Català S, Carnegie AJ, **Worboys S**, Cahill D, Vettraino A-M, Stukely MJC, Liew EY, Paap T, Bose T, Migliorini D, Williams B, Brigg F, Crane C, Rudman T, Hardy GESJ (2017) Distribution and diversity of *Phytophthora* across Australia. *Pacific Conservation Biology* 23, 150-162.

Cooper WE (2017) *Thismia hawkesii* W.E.Cooper and *T. lanternatus* W.E.Cooper (Thismiaceae), two new fairy lantern species from the Wet Tropics Bioregion, Queensland, Australia. *Austrobaileya* 10, 130-138.

Cruz GAS, Zizka G, Silvestro D, Leme EMC, **Schulte K**, Benko-Iseppon AM (2017) Molecular phylogeny, character evolution and historical biogeography of *Cryptanthus* Otto & A. Dietr. (Bromeliaceae). *Molecular Phylogenetics and Evolution* 107, 152-165.

Dowe JL (2017) Baron Ferdinand von Mueller, the "Princeps of Australian Botany," and a historical account of his Australasian palms. *Palms* 61, 21-40.

Dowe JL (2017) A family's contribution to Queensland botany: John Howard Simmonds [Snr] (1862-1955), Rose Simmonds (née Culpin) (1877-1960) and John Howard Simmonds [Jnr] (1901-1992). *Austrobaileya* 10, 168-183.

Dunning LT, Liabot A-L, Olofsson JK, Smith EK, Vorontsova MS, Besnard G, Simpson KJ, Lundgren MR, **Addicott E**, Gallagher RV, Chu Y, Pennington RT, Christin P-A, Lehmann CER (2017) The recent and rapid spread of *Themeda triandra*. *Botany Letters* 1-11.

Field AR (2017) Arrival of Tawny Coster butterflies on the East Australian Coast coinciding with the winds of Tropical Cyclone Debbie. *North Queensland Naturalist* 47, 28-31.

Forster PI, **Gray B** (2017) *Cycas distans* P.I.Forst. & B.Gray (Cycadaceae), a new species from southern Cape York Peninsula, Queensland. *Austrobaileya* 10, 74-84.

Franklin DC, Morrison SC, **Wilson GW** (2017) A colourful new Australian reaches Talaroo: the Tawny Coster butterfly, *Acraea terpsicore*. *North Queensland Naturalist* 47, 10-13.

Gray B (2017) *Taeniophyllum walkeri* B.Gray (Orchidaceae), a new species from north Queensland. *Austrobaileya* 10, 65-69.

Gray B (2017) *Didymoplexis micradenia* (Rchb.f.) Hemsl. (Orchidaceae): A new record for the Australian flora. *Austrobaileya* 10, 200-204.

Gray B, Low YW (2017) First record of *Geosiris* (Iridaceae: Geosiridoideae) from Australasia: a new record and a new species from the Wet Tropics of Queensland, Australia. *Candollea* 72, 249-255.

Gray B, Low YW (2017) *Gastrodia umbrosa* B.Gray (Orchidaceae, Gastrodieae): A new mycoheterotrophic orchid endemic to the Atherton Tableland, Queensland, Australia. *Austrobaileya* 10, 86-92.

Gray LK, **Clarke C**, Wint GRW, Moran JA (2017) Potential effects of climate change on members of the Palaeotropical pitcher plant family Nepenthaceae. *PLoS One* 12, e0183132.

Gruenstaeudl M, **Nauheimer L**, Borsch T (2017) Plastid genome structure and phylogenomics of Nymphaeales: conserved gene order and new insights into relationships. *Plant Systematics and Evolution* 303, 1251-1270.

Hislop M, **Puente-Lelievre C** (2017) Five new species of *Styphelia* (Ericaceae: Epacridoideae: Styphelieae) from the Geraldton Sandplains, including notes on a new, expanded circumscription for the genus. *Nuytsia* 28, 95-114.

Nuske SJ, Vernes K, May TW, Claridge AW, Congdon BC, Krockenberger A, **Abell SE** (2017) Redundancy among mammalian fungal dispersers and the importance of declining specialists. *Fungal Ecology* 27, 1-13.

Nuske SJ, Vernes K, May TW, Claridge AW, Congdon BC, Krockenberger A, **Abell SE** (2017) Data on the fungal species consumed by mammal species in Australia. *Data in Brief* 12, 251-260.

Schöner CR, Schöner MG, Grafe TU, **Clarke CM**, Dombrowski L, Tan MC, Kerth G (2017) Ecological outsourcing: a pitcher plant benefits from transferring pre-digestion of prey to a bat mutualist. *Journal of Ecology* 105, 400-411.

Van Jaarsveld E, **Venter F** (2017) *Ledebouria loedolffiae*, eine neue, Felsen besiedelnde halbsukkulente Zwiebelpflanze des Ostkaps. *Avonia* 35, 134-139.

GENERAL PUBLICATIONS AND REPORTS (UNREFEREED)

Gaguj J (2016) Molecular phylogenetics of *Elaeocarpus* (Elaeocarpaceae) with a focus on New Guinea species: Eichler Research Fund Report. *Australasian Systematic Botany Society Newsletter* 167, 4–8.

Kaslar L (2016) Evolutionary relationships in the Leek orchid alliance (subtribe Prasophyllinae). CSIRO vacation scholarship 2015/2016, final report (unpublished).

Shellberg J, Sinnamon V, Paul P, Drewien G, Howley C, Connor S, Alpher B, **Turpin G**, Jaensch R, Jardine T, Schultz P (2016) The Bio-Geo-Cultural Diversity of Mitchell River Delta Wetlands: Topsy Creek to South Mitchell River Coastal Study Area. Report to The Christensen Fund, the Kowanyama Aboriginal Shire Council, the Kowanyama Aboriginal Land and Natural Resources Management Office, and the Abm Elgoring Ambung Corporation. 475 pp.

Shellberg J, Ross M, Lowdown J, Coleman F, Malcom B, Preece N, van Oosterzee P, Grimes K, **Turpin G**, **Newton M**, Carroll J, Coates J, Ross T, Hogbin A, Kulka G, Jack L, Kulka H, Ross A, Ross D, Kulka K, Bramwell W, Preece L (2016) Kimba Plateau Physical and Biological Diversity, Olkola Country, Cape York Peninsula. Published by Olkola Aboriginal Corporation, through the Department of Environment and Heritage Protection, 117 pp.

Zich F, Kerrigan RA (2016) Australian Tropical Rainforest Plants Identification System. *Australian Plant Conservation Newsletter* 25(1), 10–12.

THESES

Asad, HU (2017) Improving mango breeding efficiency through improved pollen storage, fruit retention and understanding of the heritability of quantitative tree architectural traits. PhD thesis, James Cook University. Supervised by **Crayn D**, Page T (University of the Sunshine Coast), and Bally I (Department of Agriculture and Fisheries, Queensland).

Nuske SJ (2017) The importance of declining mammalian fungal specialists for ectomycorrhizal fungal dispersal. PhD thesis, James Cook University. Supervised by **Abell S**, Congdon B and Krockenberger A.

RESEARCH AND COMMUNITY PRESENTATIONS (PRESENTER UNDERLINED)

Abell S (2017) Treasure hunting in the tropics, Soapbox Science women in science public event.

Addicott EP et al. (2017) When rare species are unimportant but height is: linking plot-based classifications to mapped plant communities in a tropical savanna, Australia. International Association for Vegetation Science conference, Palermo, Sicily [oral].

Crayn D (2017) Geeks on peaks, Pecha Kucha, Tanks Arts Centre, Cairns. Radio interview with Kym Morris, ABC Local Gardening show.

Crayn D (2017) In search of plants: how the botany of Cook's first voyage changed the world, Cooktown Discovery Festival.

Joyce E, Nauheimer L, Nargar K, Holtum J, Thiele K, Crayn D (2017) Origins of the northern Australian flora: Role of the Sunda-Sahul floristic interchange. Systematics 2017: Integrating Systematics for Conservation and Ecology, ASBS Conference, Adelaide [oral]. *WINNER Pauline Ladiges Prize for Best Student Talk.

Joyce E (2017) Origins of the northern Australian flora: role of the Sunda-Sahul floristic exchange. Centre for Tropical Environmental Sustainability Science (TESS) Annual Meeting, Palm Cove [oral]. *WINNER Prize for Best Student Talk.

Joyce E, Nauheimer L, Nargar K, Thiele K, Holtum JAM, Crayn DM (2017) Origins of the northern Australian flora — role of the Sunda-Sahul floristic exchange. 3rd South East Asia Gateway Evolution (SAGE) Meeting, Bogor, Indonesia. [oral]

Mertin A (2017) Phylogenomic insights into the evolution of the Greenhood orchids (Pterostylidinae, Orchidaceae). NRCA summer student symposium, CSIRO, Canberra [oral].

Mertin A, Clements MA, Nauheimer L, Nargar K (2017) Phylogenomic insights into the evolution of the Greenhood Orchids (subtribe Pterostylidinae) in space and time. "Systematics 2017: Integrating Systematics for Conservation and Ecology" ASBS Conference, Adelaide [oral].

Murphy D, **Crayn D** (2017) Comparative biogeography of Australian plants. XIX International Botanical Congress, Shenzhen, China [oral].

Nargar K (2017) What can 1000 plastomes tell us about orchid evolution? TESS Annual Conference, Palm Cove [oral].

Nargar K, Wagner N, Atsawaranant A, Nauheimer L, Clements MA (2017) Australasian orchid diversification in time and space: a phylogenomic study. "Systematics 2017: Integrating Systematics for Conservation and Ecology" ASBS Conference, November 2017, Adelaide [oral].

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Nauheimer L, Clements MA, Schley, R, Schulte K (2017) Disentangling complex evolutionary relationships in the Sun Orchids (*Thelymitra*, Orchidaceae). 19th International Botanical Congress, Shenzhen, China [poster].

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Phoon, S-N, Baba Y, Rossetto M, Coode MJE, Griffin P, Kamariah AS, Chung RCK, **Crayn DM** (2017) Historical biogeography of *Elaeocarpus* (Elaeocarpaceae): origins and radiation in Sahul and beyond. 3rd SAGE Meeting, Bogor, Indonesia [oral].

Sari R (2017) A molecular analysis of globose and ovoid Mangosteen. International Conference on Tropical Plant Conservation and Utilization, Bogor Botanic Garden, Bogor, West Java, Indonesia. 18-20 May 2017 [poster].

Sari R (2017) Australian *Garcinia* and its phylogenetic relationships. Systematics 2017: Integrating Systematics for Conservation and Ecology, ASBS Conference, Adelaide [poster].

Schulte K (2017) Collection genomics. National Collections and Marine Infrastructure meeting, CSIRO, Canberra [oral].

Schulte K, Clements MA (2017) Unlocking the botanical treasure chest: collection genomics of Australia's highly diverse orchid flora. Out of the box: Sharing strategies for accessing natural history collections symposium, Canberra [oral].

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Turpin G (2017) Aboriginal School Students Presentation, Holloways Beach, Cairns, 1 November 2017.

Turpin G (2017) Deadly Science Getaway, Aboriginal Schoolgirls Retreat (James Cook University), Orpheus Island, 9-10 September 2017.

Turpin G (2017) National Science Week Presentation, Cairns Botanic Gardens, 17 August 2017.

Turpin G (2017) TedX Presentation, James Cook University Open Day, 20 August 2017.

Worboys S (2017) Wet Tropics Guide School Presentation. "Leeches and Lost Species – Surveying the Mountain Flora of the Wet Tropics" and "Noah Creek as a Wet Tropics Refugium" 13th October 2017 [oral].

Zich F (2017) Biosecurity and international movement of herbarium specimens. MAHC annual general meeting, Melbourne [oral].

PARTICIPANTS IN ACTIVITIES 2017

STAFF

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Mr Mark Newton (DES)
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Mr Frank Zich (CSIRO)

¹ together contribute 1 full time equivalent Laboratory Manager position

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Mr Luke Windle
Ms Heather Winsor



The Sir Robert Norman Building incorporating the Australian Tropical Herbarium. Photo: B. Newton.

OUR HISTORY

Prior to the establishment of the ATH, plant biodiversity science research in Australia's tropical northeast was undertaken at three centres: the CSIRO Atherton Herbarium (QRS), the Mareeba Collection (MBA) of the Queensland Herbarium, and James Cook University (JCT). The retirement in 2002 of the Director of the Atherton Herbarium, the eminent botanist Dr Bernie Hyland, led to discussions between the CSIRO, James Cook University and the Queensland Government regarding a joint venture herbarium project. An agreement to establish the Australian Tropical Herbarium was signed on 30th of April 2006.

The Sir Robert Norman Building was completed on the Smithfield campus in November 2007, containing

state-of-the-art facilities purpose-designed for the joint venture. The QRS and MBA collections were moved into the new premises soon thereafter. The Hon. Anna Bligh, Premier of Queensland opened the building on the 4th of March 2008 and the inaugural Director commenced duty on the 31st of March, the Operational Date of ATH.

During the seven-year term of the first ATH Agreement, the organisation grew from nine staff (full time equivalents) and three postgraduate students to 15 staff and 18 postgraduate students, and increased its outputs, outcomes and impact many-fold. On April 1 2015 the Joint Venture partners agreed a further 10-year term.

AUSTRALIAN TROPICAL HERBARIUM – THE FUTURE

The ATH joint venture agreement was renewed in early 2015. The Board's strategic vision for 2015–2025 will be enacted through an ambitious agenda of research and engagement activities. Two of the most important initiatives to be developed during the next term are the Tropical Indigenous Ethnobotany Centre (TIEC) Partnership and the Australian Savanna Plant Identification System. We invite potential partners to discuss with us how you can help ensure, through supporting these important initiatives, that development in northern Australia is environmentally and culturally sustainable.

TROPICAL INDIGENOUS ETHNOBOTANY CENTRE (TIEC) PARTNERSHIP

Bridging Indigenous Knowledge and western science in innovative ways for a sustainable future.

Indigenous knowledge is recognised globally for its potential value in contemporary biodiversity conservation, management and biodiscovery. In tropical Australia, Indigenous peoples' strong and diverse presence on country presents an opportunity to work with Indigenous knowledge and management systems and strengthen community awareness of biocultural diversity. The TIEC was established in 2010 to promote and facilitate Indigenous-driven research, and is the only research unit or department dedicated to Indigenous plant knowledge in Australia. The TIEC is a partnership between Traditional Owners, the ATH, JCU's The Cairns Institute, Queensland Government, CSIRO and other government agencies and organisations. Development of the TIEC, housed at the ATH, and research projects undertaken in association with it advance through mutually beneficial partnerships. Projects aim to research and collate existing ethnobotanical data in a respectful and culturally appropriate way, and provide awareness, training and education.

The TIEC seeks substantial funding support to initiate new projects and develop its research and engagement partnerships.

AUSTRALIAN SAVANNA PLANT IDENTIFICATION SYSTEM

Is it a weed? A threatened species? Poisonous? Is it culturally significant, is it new to science?

Australian savannas are globally renowned for their biodiversity, and are amongst the most intact on earth. Sustainability of development depends upon access to knowledge of this biodiversity, and the tools to allow managers and others to identify it.

The Australian Savanna Plant Identification System (ASPIS) project will produce simple and accessible online tools and apps to enable almost anybody, anywhere to accurately identify and learn about Australia's savanna plants. Focused on Australia's north, the ASPIS project will transform existing knowledge, generate new data, and harness cutting edge technologies to deliver authoritative biodiversity knowledge to a broad stakeholder community. ASPIS will be a globally significant, legacy project, the largest and most complete of its kind, covering all plant species (8500+) of Australia's tropical savanna. The ASPIS consortium is seeking investment partnerships totaling \$11.4 million over 7 years.



Brachychiton, a charismatic savanna plant. Photo: I. Cowie



Ethnobotanist Gerry Turpin.



Contact us

Public reference collection opening times: Mon-Fri, 9am – 4pm.

Phone: +61 7 4232 1837

Email: enquiry@ath.org.au

Web: www.ath.org.au

Facebook: www.facebook.com/tropicalherbarium

Postal: Sir Robert Norman Building (E2), JCU Smithfield Campus, PO Box 6811, Cairns QLD 4870

Street: Sir Robert Norman Building (E2), JCU Smithfield Campus, McGregor Road, Smithfield Qld 4878

Location: E2.118K (Building E2; Room 118K)

Australian Tropical Rainforest Plants Identification System - free to use online at www.anbg.gov.au/cpbr/cd-keys/rfk/

