ATH
Australian Tropical Herbarium

TROPICAL PLANT KNOWLEDGE FOR SCIENCE AND SOCIETY

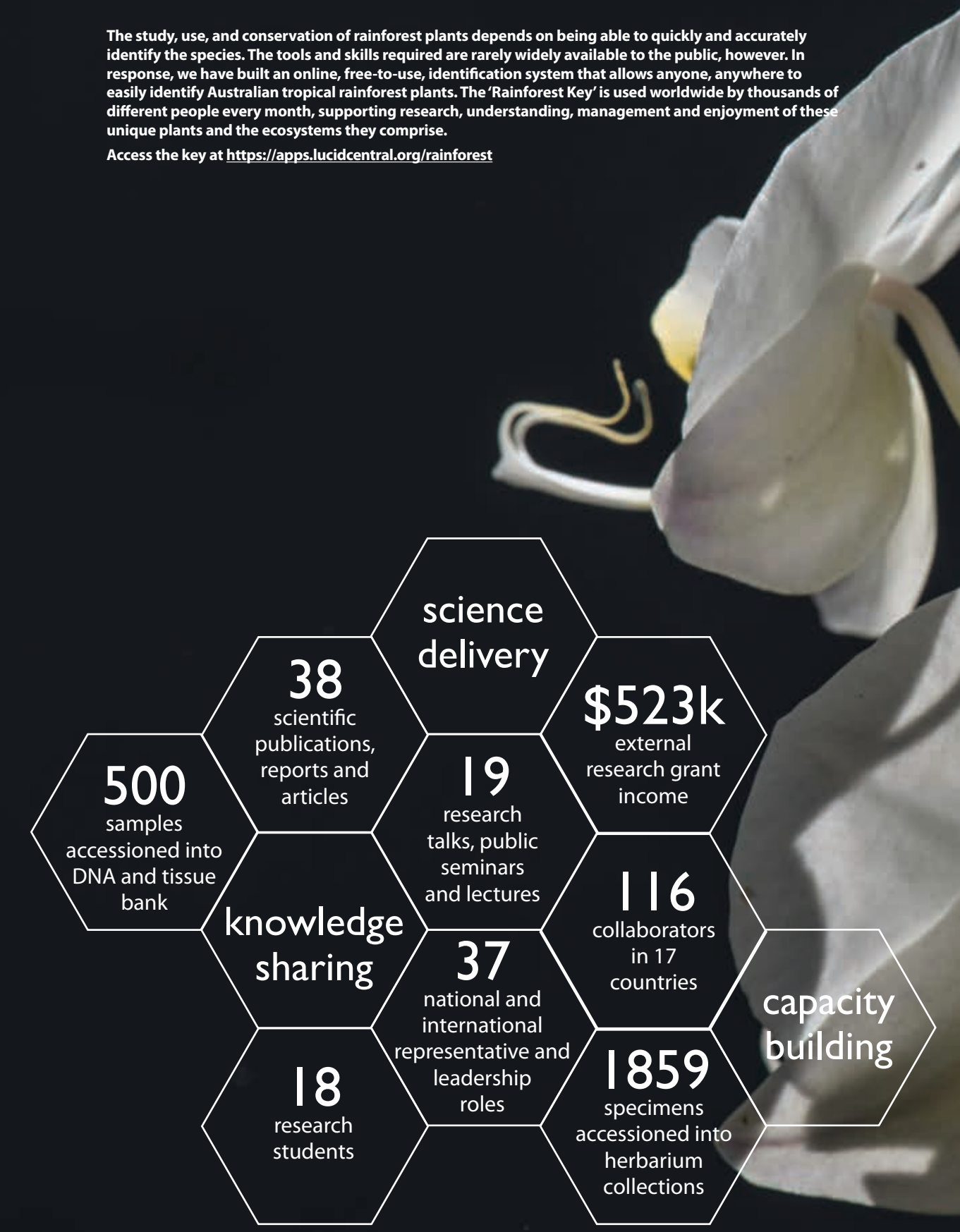
PLANT SCIENCE AT THE
AUSTRALIAN TROPICAL HERBARIUM **2020**

IMPACT STORY

DIY RAINFOREST PLANT IDENTIFICATION FOR EVERYBODY

The study, use, and conservation of rainforest plants depends on being able to quickly and accurately identify the species. The tools and skills required are rarely widely available to the public, however. In response, we have built an online, free-to-use, identification system that allows anyone, anywhere to easily identify Australian tropical rainforest plants. The 'Rainforest Key' is used worldwide by thousands of different people every month, supporting research, understanding, management and enjoyment of these unique plants and the ecosystems they comprise.

Access the key at https://apps.lucidcentral.org/rainforest



Cover art: *Neolamarckia cadamba,* photo Gary Wilson.

CONTENTS

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 and Environment (DES), 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.

Mr. Peter Cochrane,
Chair, Australian Tropical Herbarium Board

Dr. Linda Broadhurst,
Director, Centre for Australian Plant Biodiversity Research

Dr. Andrew Young,
Director, National Research Collections Australia CSIRO

Prof. Marcus Lane,
Dean, College of Science and Engineering, James Cook University

Prof. Andrew Krockenberger
Dean of Research
James Cook University

Dr. Mark Jacobs,
Deputy Director, Queensland Dept. Environment and Science

Dr. Gordon Guymer,
Director, Queensland Herbarium, Queensland Dept. Environment and Science

Prof. Darren Crayn
Director, Australian Tropical Herbarium

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.

SUMMARY OF ACHIEVEMENTS 2020

SCIENCE DELIVERY – LOCAL TO GLOBAL

Our science was communicated broadly through:

- 27 peer-reviewed publications
- 4 theses
- 3 web resources
- 8 reports and general articles
- 12 research seminars
- 6 public talks and lectures.

This science was supported in part by:

- $523,000 external research grant income
- collaborations with 116 scientists in 17 countries.

SHARING OUR KNOWLEDGE

ATH staff shared our knowledge through:

- hosting public visitors participating in school, public and professional group tours, and scientists undertaking research at the ATH;
- mentoring 16 research students (Honours, Masters, and Doctoral)
- 37 representative and leadership roles on international, national, and local bodies.
- communicating through numerous media items including radio, newspaper, Facebook and Twitter.

BUILDING, IMPROVING AND MOBILISING OUR COLLECTIONS

- 1859 herbarium specimens incorporated into the collections, 4,100 collection records edited and 1,951 specimens re-determined.
- c. 500 samples incorporated into the DNA and Tissue Bank, which now contains over 22,500 samples
- over 10 million specimen records downloaded in more than 6,000 download events by a range of external user groups through the Atlas of Living Australia portal (ala.org.au).

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

Peanut tree *(Sterculia quadrifida)* a plant of Indigenous cultural significance. Photo: S. Venter.

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. For more information visit www.tiec.org.au

Exemplar project – Towards and Indigenous-led Bush Food Industry Project Leader – Mr Gerry Turpin.

This collaborative project led by the University of Queensland and involving the Mbabaram Aboriginal Corporation and other Indigenous organisations and businesses is developing new bush food plants for wild harvest and cultivation. It is also investigating new ways to protect Indigenous intellectual property through new technologies for product traceability and transparent and secure information flows.

Mbabaram man, TIEC manager and Ethnobotanist Gerry Turpin, and Yidinji woman and Research Assistant Nyoka Hrabinsky

Navisporus floccosus, newly recorded for Australia, is a very aggressive pathogen of street trees (e.g. *Ficus* and *Millettia pinnata*) in the Australian tropics. Photo: M. Barrett.

UNDERSTANDING PATHOGENS

Managing plant diseases in natural and managed environments such as farms and nurseries requires knowledge of the pathogens that cause them. Vigilant border security, efficient early detection and rapid suppression are the primary weapons protecting Australian industry and environment from non-native diseases. Research by ATH scientists is helping document the diversity of pathogens, enable their rapid identification, and understand their ecological interactions with plants and insects.

Exemplar project – Polypore pathogens.
Project Leader – Dr Matt Barrett.

Many species of polypore wood rotting fungi are serious tree pathogens (e.g. Ganoderma spp., Phellinus noxius), or affect wood quality in plantations and native forests. However, Australia lacks a systematic understanding of pathogenic polypores, and indeed wood rotting fungi generally. The information gap places limitations on foresters and arborists when confronted with an unknown fungus, and hinders accumulation of data on pathogenic species. Most Australian polypore species records are outdated or incorrect, while information on hosts and the nature of host-fungus relationships is often lacking. This project is conducting a review of Australian records, supplemented with hundreds of new observations validated by DNA sequencing, to create an information system for Australasian polypores, good, bad or ugly. This system will provide a validated checklist, a multi-access identification tool, and enable rapid searching by host and pathogenicity. Dozens of previously unreported polypores occur on living trees, and the pathogenic load on Australian forests is more diverse than currently appreciated.

An undescribed genus and species of 'brown-rot' polypore fungus. The diversity of brown-rot polypores in Queensland rainforests is turning out to be higher than expected based on data from other tropical biomes. Photo: M. Barrett.

Research Scientist Matt Barrett examining fungal cultures in the laboratory. Photo: M. Newton.

Senior Botanist Dr Ashley Field collecting lycophytes for research.

DISCOVERING NEW SPECIES

Herbarium collections are the real frontiers of plant species discovery – most species new to science 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 50 new species of plants and fungi in the last 10 years 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 scientifically named and accurately classified.

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

In contrast with many flowering plants, lineages of ferns and lycophytes are often very widespread, linking floras all around the world. Australian ferns and lycophytes 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 lycophyte scientists to study the global evolutionary history of ferns and lycophytes from their deep time origins to recent diversification processes that are critical to their survival. New species are described as they are found.

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

Senior Technical Officer Mark Newton (seated) travelling from a survey site on Stanley Island, north Queensland. Photo E. Addicott.

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 unforseen, environmental futures.

Exemplar project - Regional Ecosystem Mapping. Project Leader – Ms 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 Cape York Peninsula (CYP). This method has been implemented across the Gulf Plains and North West Highlands Bioregions. Future work aims to implement this across other bioregions mapped by ATH staff (Einasleigh Uplands and Wet Tropics) and the rest of Queensland. The rollout of this new methodology 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.

Principal Botanist Dr Eda Addicott surveying vegetation on Flinders Island. Photo: M. Newton.

ENVIRONMENTAL BIOSECURITY

The plant biosecurity group develops basic and applied research programs to understand the ecological traits (e.g. seed germination, competitive ability) and evolutionary processes (e.g. polyploidy, rapid adaptation) that cause introduced plants and fungi to become invasive, and how that knowledge can be better used to reduce their impact on the environment and the economy. We have a broad range of national and international collaborators, allowing for cross-continental studies of species of interest. We offer our capabilities to the public and private sector, and help to design and to develop case-specific targeted studies. We also develop outreach activities to promote public awareness about good land management practices.

Exemplar project – Fire and weeds - Project leaders - Dr Daniel Montesinos and Mr Gerry Turpin.

Invasive weeds can produce thousands of seeds per year, which can remain viable in the soil for decades despite above-ground control actions such as spraying. Management of this soil seed bank is challenging, and often overlooked, but we know that numerous weeds experience increased germination after fire. This could be used to our advantage if we understand the conditions that can trigger massive germination events, so we can act immediately after the fire to eliminate the newly germinated weeds. We are assessing which fire conditions increase weed seed germination, and for which weed species, to assess cost-effective post-fire actions to deplete soil seed banks. This project is undertaken as a collaboration with Traditional Owners, and other land managers.

Mr Gerry Turpin (Mbabaram Traditional Owner and ATH Ethnobotanist) initiating a cultural burn on Mbabaram country. Photo: D. Montesinos.

Collections Manager Frank Zich (l) and visiting researcher Michael Lovave in the collection room.

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 Western scientific endeavour, and thousands of years of experimentation by Indigenous Australians. This wealth of knowledge can greatly improve our ability to sustainably manage our biodiversity, but can only be utilised if the species name is accurately determined. 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 – Mr Frank Zich.

The 8th edition of the Australian Tropical Rainforest Plants identification system was released in late 2020 as an easy to use, free, online system (https://apps.lucidcentral.org/rainforest/) and mobile app that enables almost anybody, anywhere to identify over 2760 species of tropical rainforest plants in Australia. The uptake by the user community has been overwhelming – over 2,000 users and up to 13,000 page visits per month.

A species profile from Edition 8 of the online Australian Tropical Rainforest Plants identification system.

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. We are leading projects that are determining the nature and extent of climate change threats to the plant species of tropical mountains, many of which are found nowhere else on Earth.

Threatened mountain plants propagated at Royal Botanic Gardens Victoria, Cranbourne. Photo: W. Worboys.

Exemplar project – Tropical mountain plant conservation.
Project Leader – Mr 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 and climate tolerance experiments, we are predicting the impact of climate change on the rare and endemic plant species of Australia's tropical mountain tops. Simultaneously, we are taking precautionary action to secure them in ex-situ living collections in partnership with seven public botanic gardens, and two seed banks. Find out more about this project at www.tromps.org.au

Rhododendron lochiae, one of only two Australian native Rhododendrons, which is restricted to the mountains of Queensland's Wet Tropics. Photo: D. MacLeod.

Project leader Stuart Worboys enjoying a break from fieldwork on Bell Peak, north east Queensland, Australia. Photo: D. Crayn.

Bubbia semecarpoides, a flowering plant of ancient lineage. Photo: J. Dowe.

PIECING TOGETHER THE ORIGINS AND EVOLUTION OF AUSTRALIA'S 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.

PhD student Elizabeth Joyce examining Australian pitcher plants on Cape York Peninsula. Photo: S. Prober.

Exemplar project – The Sunda-Sahul Floristic Exchange. Project Leaders – Ms Elizabeth Joyce and Prof 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 separated 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.

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 – Collection genomics of Australian orchids.
Project Leader – Dr Katharina Nargar.

Australia harbours a rich and highly distinctive orchid flora, however many orchid species are rare and threatened in nature. ATH scientists extract genomic data from existing herbarium collections, some several decades old, to assemble the genealogy of Australia's orchids. In 2020, the project team developed a genomic orchid 'bait' kit, which enables the rapid generation of over 1500 DNA markers, even from old and degraded herbarium material. The team generated genomic resources for the orchid mega-genus *Bulbophyllum* resulting in genomic reference data for over 600 orchids. Our collection genomics research provides a rigorous scientific evidence base for re-examining controversial taxonomies in order to improve our orchid classification and answer questions such as "how many different species does this group of similar-looking plants contain?"

Australian rainforest epiphyte *Bulbophyllum gadgarrense*. Photo: A. Lim.

Postdoctoral Fellow Dr Lalita Simpson completed her PhD on *Bulbophyllum* in 2020. Photo: K. Nargar.

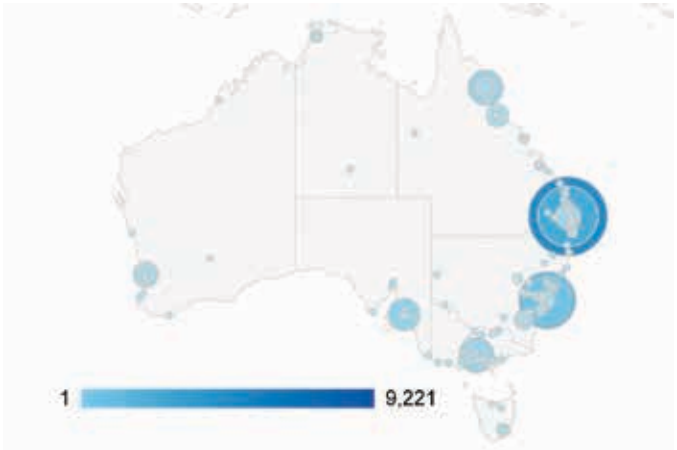
Research Scientist Dr Katharina Nargar. Photo: T. Linderhaus.

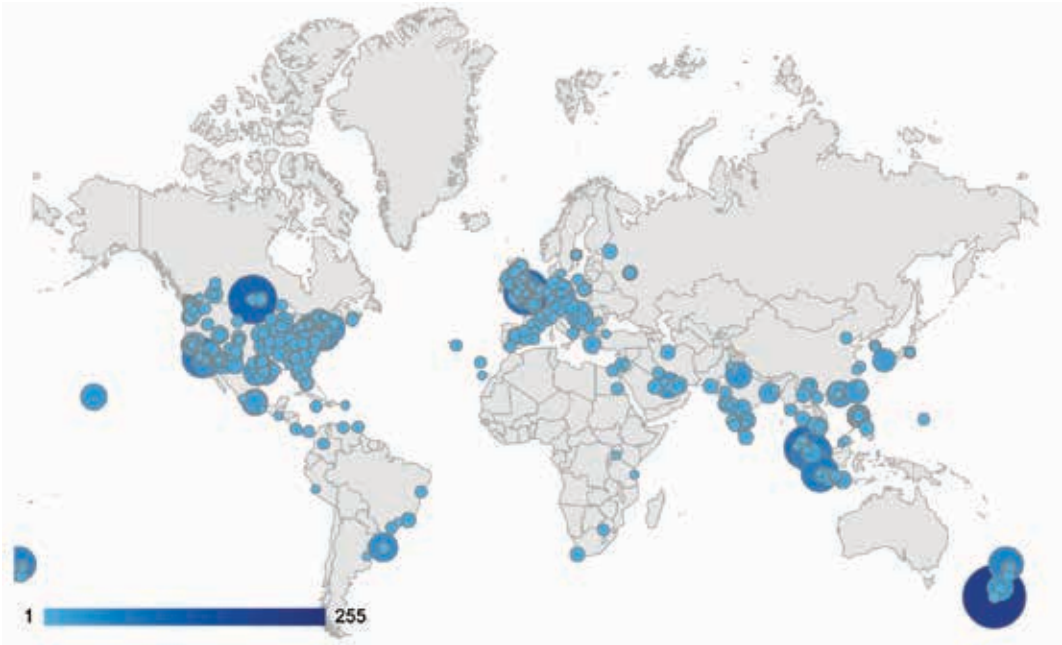
SCIENCE DELIVERY–LOCAL TO GLOBAL

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 in partnership with First Nations people on traditional plant use, and the provision of identification resources for 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 Brazil, China, Denmark, Estonia, France, Indonesia, Japan, New Zealand, Papua New Guinea, Sweden, UK, USA and Vanuatu. Institutional relationships through organisations such as the Council of Heads of Australasian Herbaria provide further collaborative partnerships.

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, workshop-style tuition in the skills and resources needed to identify both native and weedy plant species in the rainforests of the Wet Tropics. The many past participants include environmental professionals, Indigenous 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.

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.

In 2020 ATH staff served the community through leadership and advisory roles on 37 representative bodies, including various Councils, Advisory and Scientific Committees and Reference Groups for Commonwealth, State and Local Governments, not-for-profit groups and societies, and the IUCN.

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

Taxonomist Raelee Kerrigan curating the herbarium collection. Photo: A. Lim.

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 about 22,000 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 of B.P.M. (Bernie) Hyland, the eminent and pioneering botanist of Australia's northern rainforests, 9,300 collections of Bruce Gray, and orchid specimens from the collection of Alec Dockrill.

Laboratory Manager Melissa Harrison curating the genetic sample collection. Photo M. Newton.

An herbarium specimen held in the ATH collection. Photo: F. Zich.

PUBLICATIONS

WEB RESOURCES AND APPLICATIONS

Worboys SJ, Carette T 'Australian Tropical Rainforest Plants Part 1' Training video - https://www.youtube.com/watch?v=xqNCFhN20cw

Worboys SJ, Carette T 'Australian Tropical Rainforest Plants Part 2' Training video - https://www.youtube.com/watch?v=BI8AVJxuleM

Zich FA, Hyland BPM, Whiffin T, **Kerrigan RA**. 'Australian Tropical Rainforest Plants, Edition 8.' Available at https://apps.lucidcentral.org/rainforest/ Also available as a mobile app.

SCIENTIFIC PUBLICATIONS

Addicott E, Laurance SGW, **Bannink P**, Thompson S (2020) The intertidal plant communities in north-eastern Australia, their carbon stores and vulnerability to extreme climate events. *Aquatic Conservation: Marine and Freshwater Ecosystems* **30**, 2298–2312.

Baba Y, Rossetto M, **Crayn DM** (2020) Identifying evolutionary lineages in the *Elaeocarpus obovatus* complex: population genetics and morphometric analyses support a new subspecies, *Elaeocarpus obovatus* subsp. *umbratilis*, from northern Queensland, Australia. *Australian Systematic Botany* **33**, 346–379.

Bougher NL, **Barrett MD** (2020) Fungi and slime moulds recorded in surveys at Kings Park and Bold Park – urban bushlands Perth, Western Australia. *Western Australian Naturalist* **31**, 191–251.

Chen J-T, **Nargar K** (2020) Editorial: Orchid genomics and developmental biology. *Frontiers in Plant Science* **11**, article 1013.

Crayn DM, Hislop M, Puente-Lelièvre C (2020) A phylogenetic recircumscription of *Styphelia* (Ericaceae, Epacridoideae, Styphelieae). *Australian Systematic Botany* **33**, 137–168.

Crous PW, Wingfield MJ, Chooi YH, Gilchrist CLM, Lacey E, Pitt JI, Roets F, Swart WJ, Cano-Lira JF, Valenzuela-Lopez N, Hubka V, Shivas RG, Stchigel AM, Holdom DG, Jurjevi, Kachalkin AV, Lebel T, Lock C, Martín MP, Tan YP, Tomashevskaya MA, Vitelli JS, Baseia IG, Bhatt VK, Brandrud TE, De Souza JT, Dima B, Lacey HJ, Lombard L, Johnston PR, Morte A, Papp V, Rodríguez A, Rodríguez-Andrade E, Semwal KC, Tegart L, Abad ZG, Akulov A, Alvarado P, Alves A, Andrade JP, Arenas F, Asenjo C, Ballarà J, **Barrett MD**, Berná LM, Berraf-Tebbal A, Bianchinotti MV, **Bransgrove K**, Burgess TI, Carmo FS, Chávez R, Moková A, Dearnaley JDW, de A. Santiago ALCM, Freitas-Neto JF, Denman S (2020) Fungal Planet description sheets: 1042–1111. *Persoonia - Molecular Phylogeny and Evolution of Fungi* **44**, 301–459.

Dowe JL (2020) The Australian paintings of Marianne North, 1880–1881: landscapes '*doomed shortly to disappear*'. *Cunninghamia* 20, 1–33.

Dowe JL, Latifah D (2020) Oranges or kings? The cryptic etymology of Zippelius's *Orania regalis*. *Palms* **64**, 121–130.

Dowe JL, Maroske S (2020) John Dallachy (1804–71): from gardener to botanical collector. *Historical Records of Australian Science* **31**, 87–100.

Dowe JL, Maroske S (2020) John Dallachy (1804–71): collecting botanical specimens at Rockingham Bay. *Historical Records of Australian Science* **31**, 101–117.

Dowe JL, Maroske S, May T (2020) Flowers and fungi: illustrations by Ferdinand von Mueller's nieces. *Australian Garden History* **32**, 12–15.

Dowe JL, May TW, Maroske S, Smith LT (2020) The Wehl family of South Australia and their botanical connections with 'Dear Uncle' Baron Ferdinand von Mueller. *Swainsona* **34**, 1–79.

Ferreira B, **Montesinos D**, Sales F (2020) Mucilage in Portuguese Lamiaceae. *Botany Letters* **167**, 430–438.

Field AR (2020) Classification and typification of Australian lycophytes and ferns based on Pteridophyte Phylogeny Group classification PPG I. *Australian Systematic Botany* **33**, 1–102.

Field AR (2020) Lycopodiaceae, in P.G. Kodela (ed.), Flora of Australia. Australian Biological Resources Study, Department of Agriculture, Water and the Environment: Canberra. **NOTE:** 39 individually published taxon profiles are included in the Lycopodiaceae treatment.

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Fisher MF, Payne CD, Chetty T, **Crayn D**, Berkowitz O, Whelan J, Rosengren KJ, Mylne JS (2020) The genetic origin of evolidine, the first cyclopeptide discovered in plants, and related orbitides. *Journal of Biological Chemistry* **295**, 14510-14521.

Hierro JL, Eren Ö, **Montesinos D**, Andonian K, Kethsuriani L, Özcan R, Diaconu A, Török K, Cavieres L, French K (2020) Increments in weed seed size track global range expansion and contribute to colonization in a non-native region. *Biological Invasions* **22**, 969–982.

Joyce EM, Thiele KR, Slik FJW, **Crayn DM** (2020) Checklist of the vascular flora of the Sunda-Sahul Convergence Zone. *Biodiversity Data Journal* **8**, e51094.

Joyce EM, Thiele KR, Slik JWF, **Crayn DM** (2020) Plants will cross the lines: climate and available land mass are the major determinants of phytogeographical patterns in the Sunda–Sahul Convergence Zone. *Biological Journal of the Linnean Society* **132**, 374-387.

Kennedy H, Telford IRH, **Crayn DM**, Bruhl JJ (2020) Validation of two informally named species of *Melichrus* (Ericaceae: Epacridoideae) from north-eastern New South Wales. *Telopea* **23**, 187–196.

Lebel T, Syme K, **Barrett MD**, Cooper JA (2020) Two new species of *Asproinocybe* (Tricholomataceae) from Australia. *Muelleria* **38**, 77–85.

Lyons I, Hill R, Deshong S, Mooney G, **Turpin G** (2020) Protecting what is left after colonisation: embedding climate adaptation planning in traditional owner narratives. *Geographical Research* **58**, 34-48.

Meagher D, **Cairns A**, Tangney R (2020) *Camptochaete monolina* sp. nov. and *Camptochaete subporotrichoides* (Bryophyta: Lembophyllaceae) from the Australian Wet Tropics. *Telopea* **23**, 213–220.

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Rye BL, **Barrett MD** (2020) A new species that's worth its salt: *Verticordia elizabethiae* (Myrtaceae: Chamelaucieae), a salt-tolerant rarity from semi-arid Western Australia. *Nuytsia* **31**, 259–263.

Venter S (2020) The rediscovery of *Bulbophyllum scaphosepalum* Schltr. (Section *Codonosiphon*) Orchidaceae. *Avonia* **38**, 196–205.

THESES

Addicott E (2020) A new classification approach: improving the Regional Ecosystem Classification system in Queensland, Australia. PhD Thesis, College of Science and Engineering, James Cook University.

Bloesch Z (2020) Two novel hybrids identified in Australian Thelypteridaceae ferns. B.Sc. Hons. Thesis, College of Science and Engineering, James Cook University.

Simpson L (2020) Phylogenomic insights into the spatio-temporal evolution of the Asian and Australasian *Bulbophyllum* (Orchidaceae). PhD Thesis, College of Science and Engineering, James Cook University.

Waiin-Adu V (2020) A journey of culture: The migration of traditional plant medicine from the Takuu Atolls to Port Moresby, Papua New Guinea. Graduate Diploma Thesis, James Cook University and University of Papua New Guinea.

GENERAL PUBLICATIONS AND REPORTS (UN-REFEREED)

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Harrison M, **Bismar M**, **Crayn DM** (2020) Progress towards mass production of *Eucalyptus cloeziana* by tissue culture. Report for Bio-Gene Technology Ltd.

Pérez-Escobar OA, Dodsworth S, Bogarín D, Bellot S, Balbuena JA, Schley R, Kikuchi I, Morris SK, Epitawalage N, Cowan R, Maurin O, Zuntini A, Arias T, Serna A, Gravendeel B, Torres MF, **Nargar K**, Chomicki G, Chase MW, Leitch IJ, Forest F, Baker WJ (2020) Hundreds of nuclear and plastid loci yield insights into orchid relationships. bioRxiv preprint. Link.

Rouse A, **Worboys S** (2020) Botanical exploration of Australia's tropical mountains: how the hunt for Australian rhododendrons turned into a major win for conservation in North Queensland. *Journal of the American Rhododendron Society* Winter 2020, 3–6.

Schmidt-Lebuhn A, **Nargar K** (2020) Sequencing the genomes of Australian plants. ECOS 271. Published online: https://ecos.csiro.au/sequencing-australian-plants-genomes/?utm_source=ECOS-2020-10&utm_medium=newsletter&utm_campaign=ECOS

Simpson L, **Dillon N**, **Crayn DM** (2020) Analysis of genetic diversity among Kava plants from the Island of Vanuatu. Report for Forney Enterprises.

Wagner ND, Clements MA, **Simpson L**, **Nargar K** (2020) Conservation genomics of an Australian orchid complex with implications for the taxonomic and conservation status of *Corybas dowlingii*. bioRxiv preprint. Link.

Worboys S (2020) Orchids of the Melville Range. *Native Plants Queensland* **59**, 21-27.

Elaeocarpus sp. Windsor Tableland. Photo: F. Venter.

Melicope xanthoxyloides. Photo: J. Dowe.

RESEARCH TALKS, COMMUNITY PRESENTATIONS AND LECTURES

Barrett M (2020) Collecting and Identifying Australian Polypores. Virtual presentation to MYCOmmunity Applied Mycology and Learning Lab, Aug. 2020, Melbourne

Bloesch Z (2020) Introductory seminar. Honours program, College of Science and Engineering, James Cook University, Cairns, March.

Bloesch Z (2020) Final seminar. Honours program, College of Science and Engineering, James Cook University, Cairns, Oct. 19.

Crayn D (2020) Securing a future for Australia's climate-threatened endemic tropical montane flora: An ex-situ conservation approach based on multidisciplinary science and multi-institutional partnerships. Institute of Biology, University of Leipzig (Germany) seminar series, Nov. 26.

Crayn D (2020) Species. Lecture in 'Tropical Flora of Australia' (BZ3620/5620), JCU, June.

Crayn D (2020) Introduction to phylogenetics. Lecture in 'Tropical Flora of Australia' (BZ3620/5620), JCU, June.

Crayn D (2020) Uses of phylogenies. Lecture in 'Tropical Flora of Australia' (BZ3620/5620), JCU, June.

Crayn D (2020) Biogeography. Lecture in 'Tropical Flora of Australia' (BZ3620/5620), JCU, June.

Field AR (2020) Using phylogenetics to investigate continental, biome and habitat shifts and radiations in *Phelgmariurus* (Lycopodiaceae). Centre for Tropical Environmental and Sustainability Science (TESS), James Cook University, Cairns, Apr. 29. Video: https://mediasite.jcu.edu.au/Mediasite/Play/5aaed48f8f834512a6af5618d44721761d

Joyce EM, Crayn D (2020) The Sunda-Sahul Floristic Exchange through space and time: new insights into a classic biogeographic hotspot. International Humboldt Day symposium (virtual), organized by the Centre for Biodiversity Analysis, Canberra, Sep. 17.

Joyce EM (2020) Understanding the Sunda-Sahul Floristic Exchange through space and time. Institute of Biology, University of Leipzig (Germany) seminar series, Nov. 26.

Montesinos D (2020) Ecological intensification for sustainable agriculture and forestry. Centre for Tropical Environmental and Sustainability Science (TESS), James Cook University, Cairns, Mar. 25. Video: https://mediasite.jcu.edu.au/Mediasite/Play/caa1e684979c45b286a91dae60f7a8211d

Nargar K (2020) Mobilising collections through genomics. CANBR Science Review, talk. Feb. 17.

Nargar K (2020) Genomic insights into the origin and diversification of the Australian orchid flora. Canberra Orchid Society, invited talk. Feb 05.

Nargar K, Schmidt-Lebuhn AL (2020) Plant Systematics and Population Genetics. CANBR Science Review, talk, Feb. 17

Nargar K, Lauderau C, Pignal M, Clements M (2020): Orchid conservation in New Caledonia. 10th Pacific Island Conservation Conference, invited talk, Nov. 25.

Nargar K (2020) Genomics for Australian Plant Initiative. National Collections and Marine Infrastructure Annual Forum, CSIRO, talk, Nov. 19.

Nargar K (2020). Assembly and evolution of Australia's orchid flora. Atlas of Living Australia 10th anniversary webinar, invited talk, Nov. 04.

Video: https://webcast.csiro.au/#/webcasts/alaseminar

Mangroves, Cape Flattery. Photo: F. Venter.

Fern grove, Mt Bellenden Ker. Photo: S. Worboys.

ATH PERSONNEL 2020

STAFF

QUEENSLAND GOVERNMENT

Dr Eda Addicott (Principal Botanist)
Mr Peter Bannink (Senior Computer Support Officer)
Dr Ashley Field (Senior Botanist)
Mr Mark Newton (Senior Technical Officer)
Mr Gerry Turpin (Ethnobotanist)

CSIRO

Dr Katharina Nargar (Research Scientist)
Mr Frank Zich (Collections Manager)

JAMES COOK UNIVERSITY

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Dr Daniel Montesinos (Senior Research Fellow)
Dr Matthew Barrett (Postdoctoral Research Fellow)
Ms Melissa Harrison (Laboratory Manager)
Mr Stuart Worboys (Technical and Project Officer)
Ms Nyoka Hrabinsky (Research Assistant)
Ms Robyn Fortune (Administration)

EXTERNAL GRANTS

Ms Raelee Kerrigan (Scientific Officer)
Dr Lars Nauheimer (Postdoctoral Research Fellow)
Dr Stephanus (Fanie) Venter (Postdoctoral Research Fellow)
Ms Maricris Bismar (Laboratory Technician)

RESEARCH STUDENTS

Ms Eda Addicott (completed 2020)
Ms Zoe Bloesch (completed 2020)
Ms Kaylene Bransgrove
Mr Patrick Cooke
Ms Samantha Forbes
Ms Janet Gagul
Ms Melinda Greenfield
Ms Lizzy Joyce
Ms Helen Kennedy
Ms Kali Middleby
Mr Dale Perkins
Ms Rismita Sari
Mr Arun Singh Ramesh
Ms Alexandra Rozhkova
Ms Lalita Simpson (completed 2020)
Mr Gerry Turpin
Ms Vagi Waiin-Adu (completed 2020)
Mr Karma Yeshi

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Mr Roger Fryer
Dr Nicky Horsfall
Ms Evelyn Jung
Ms Parneet Kaur
Ms Claudine Marzik
Ms Pamela Schultz
Ms Pam Tacheci
Ms Heather Winsor
Ms Sharren Wong
Ms Isabel Zorn

The Sir Robert Normal 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.

ATH
Australian Tropical Herbarium

Contact us / office hours

Public reference collection opening times: Mon-Fri, 9am – 4pm.
Phone: +61 7 4232 1837
Email: enquiry@ath.org.au
Web: www.ath.org.au, www.tiec.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 edition 8 - free to use online at https://apps.lucidcentral.org/rainforest

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