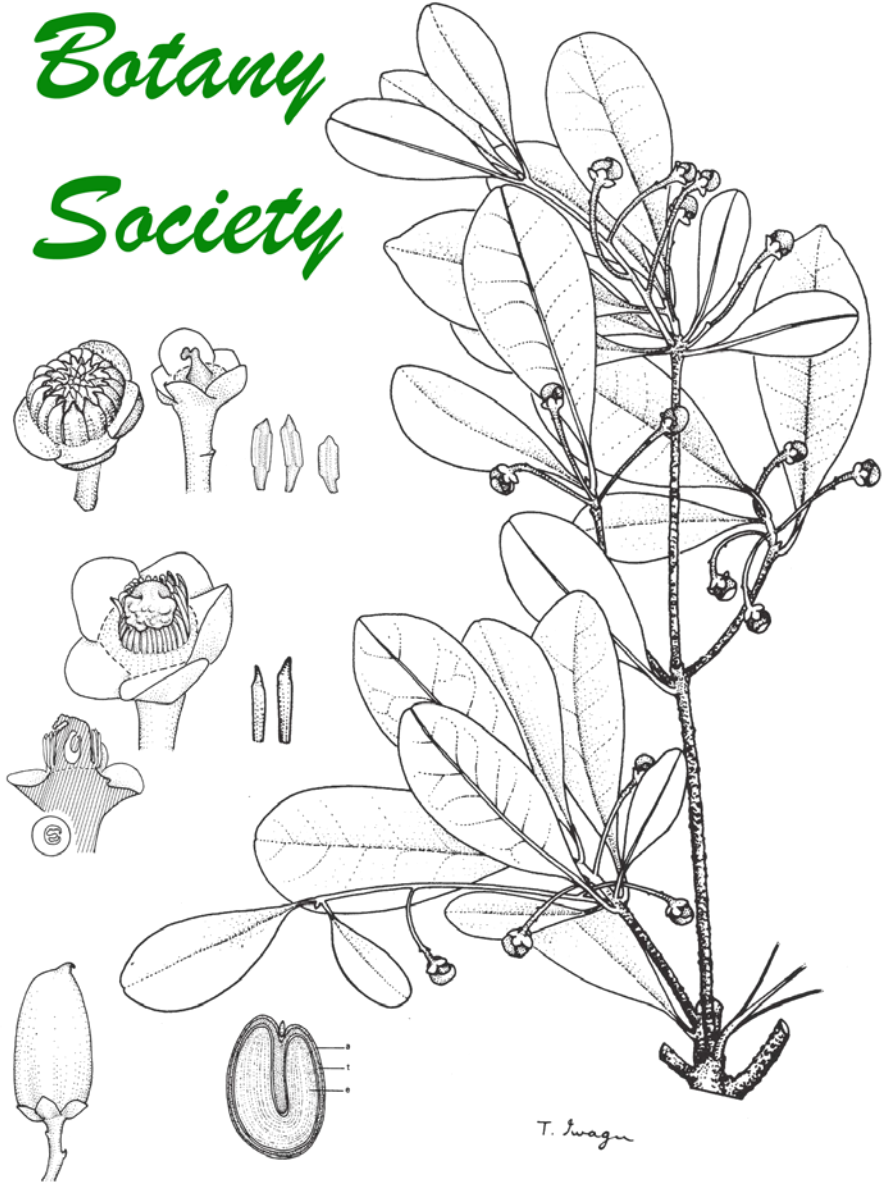


ASBS

*Australasian
Systematic
Botany
Society*



Newsletter

No. 155 June 2013

Price: \$5.00

ISSN 1034-1218

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Grant application closing dates:

Hansjörg Eichler Research Fund:
on March 14th and September 14th each year.
Australian Conservation Taxonomy Award:
on March 14th 2013

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Cover image: *Ternstroemia monostigma* W.R.Barker
(Pentaphragmaceae), a New Guinea endemic.
Male and female flowers and parts (minus petals),
fruit, seed in section. Artist Taikika Iwagu.
With permission of the National Herbarium of
Papua New Guinea.

Publication dates of previous issue

Australas. Syst. Bot. Soc. Newslett. 154 (March 2013):
ASBS Web site: 8th April 2013; Printed version: 16th April 2013

From the President

Since the last issue of our Newsletter Robyn and I had three weeks in May in the Top End of the Northern Territory. Plant systematist and ecologist Chris Martine from Bucknell University, Pennsylvania, had suggested we join up during continuation of his work on the breeding systems of *Solanum* species – Chris and I had worked through a wet Kimberley a decade before. I therefore had the opportunity of picking up on my work on *Lindernia* and other genera in the region. A poor wet had been resurrected by an Easter holidays washed out with flooding rains and most of the *Lindernia* species were evident.

We renewed acquaintances in one of Australia's botanical frontiers and made new ones, including other members of Chris's team, social insect biologist Beth Capaldi Evans and student Gemma Dugan. It was reassuring to find how much National Parks in Kakadu appreciated the value and needs of our taxonomic work; their assistance over the five days in the Park was more than we anticipated and maximised the returns from our visit. Notable was their facilitation of negotiation with the local Gundjeihmi Aboriginal Corporation to gain permission from the relevant elders for guided access into two areas with rare unnamed *Lindernia* species. We were also assisted greatly by the knowledge of Ian Cowie and Glenn Wightman of the NT Herbarium and Kym Brennan of the Flora and Fauna Division. Kym took time off to join us in the field: his decades of intimate field knowledge of our plants added much more than an extra pair of eyes.

Apart from an additional weekend foray with Kym into a very dry Litchfield National Park we were based at Philip and Emma Short's working at the Northern Territory Herbarium. Robyn's focus was on updating her long-standing Acanthaceae and Malvaceae manuscripts, while I consolidated my manuscript on the taxa separable under what has been long recognised as the common widespread species, *Stackhousia intermedia*.

Entering the NT Herbarium in Palmerston one's immediate impression is always of a welcoming, active workplace of staff and volunteers. An impressive number of ecologists uses the specially cooled and dehumidified reference room and main herbarium, identifying collections from the vegetation monitoring plots in both Kakadu and the broader Top End.

However, behind this welcoming, functional impression for visitors is an all too common reality of a staff struggling to cope with needs of maintaining the collection and its associated data and the variety of tasks and services. Little or no monographic work – so important given the incomplete knowledge of the the flora of the region – is taking place. The Top End Flora programme, collating current knowledge, has slowed considerably and maintaining the hard-attained datasets of specimen information and the census is very difficult. Staff are effectively in holding mode undertaking the administrative demands of modern government and servicing the needs of users within and outside the Territory. Volunteers are important in this as

Australasian Systematic Botany Society Inc.

Nominations for membership of Council

In accordance with Section 13 of the Society's Rules, nominations are hereby called for membership of Council. Council consists of the following positions: President, Vice-President, Secretary, Treasurer and two (2) Councillors.

Nominations must be received by the Secretary, John Clarkson, PO Box 156, Mareeba Qld (john.clarkson@qld.gov.au) before 5 pm Tuesday 8th October.

Nomination forms are included with this Newsletter, or can be obtained from the Secretary (john.clarkson@qld.gov.au) or from the ASBS web site www.anbg.gov.au/asbs

Notes

- A member may be nominated simultaneously for any number of positions on Council but is ineligible to hold more than one position at one time.
- While under the Society's Rules there are limits to the number of consecutive years for each Council position, all incumbent Councillors are eligible for re-election.



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in other herbaria. Funds were found to employ one to move the whole collection to better accommodate its growth over the past few years and into the future. Good news is that Philip Short, having resigned for other challenges, completed his *Brachyscome* revision, since submitted, something he struggled to do under the pressures of low staffing at the Herbarium.

It is sad to see a Herbarium that we have visited several times over the past 30 years struggling in this way as a result of five of seven positions becoming vacant in recent times. Even with eventual filling of three of these, staffing levels will be at a historical, less than adequate, low. Even sadder is this not being an isolated occurrence in our region.

Meeting of Council

Council participated in a phone conference during June. More than a dozen agenda items were discussed in the two hours. The phone conference cost less than \$5 by way of an easy-to-use on-line application.

Nominations for Council due by 8th October

While all current members of Council are eligible for another term, all of us encourage other members keen to participate in progressing Society activities to nominate for positions.

Burbidge Medallist Phil Garnock-Jones

Council unanimously approved awarding a Burbidge Medal to Emeritus Professor Phil Garnock-Jones of the Victoria University, Wellington. He will be presented with this prestigious award and deliver the Burbidge Lecture at the Sydney conference later in the year. His exemplary leadership in publication and promotion of high scientific and nomenclatural standards in plant systematics and evolutionary studies make him highly appropriate as New Zealand's first Medallist.

Research grants

Congratulations to those successful in our March round of grants. In case people are wondering, Mike Bayly ex officio coordinates the Research Committee. He does not play a part in assessing the submitted proposals.

Australasian plant systematics white paper

Progress has been slow in the last couple of months in the face of other activities, but we are keen to progress the assembly of data for a draft white paper as laid out in the last issue.

The coming conference in Sydney

It's time for people to organise attending the *Systematics without Borders* conference being held in Sydney on 1–6 December. While papers are a high standard the participants interact in a low key way. It's a great way to be exposed to the passions of fellow systematists; lots of friendships are forged and renewed. And the conference this year is one of the rarer ASBS ones, being enriched by collaboration with

kindred biological societies. The last date for early-bird registration and submission of abstracts is 30th August. For details see the conference web site: www.systematics2013.org

Editors needed

While Robyn Barker is welcome back in the editorial team – her “fillers” from the web add lots of interest – we are still on the lookout for one or two people to take over from us.

Bill Barker

ASBS Inc. business

Hansjörg Eichler Research Fund, March 2013 round

This round we had five applications. It was a competitive field, and grants were awarded to the following three students.

- Megan Hirst, The University of Melbourne, *Phylogenetic and morphological approaches in a key Australian plant genus, Brachyscome*. \$2000.
- Emma Lewis, The University of Melbourne, *Systematics and phylogeography of Duboisia myoporoides (Solanaceae)*. \$2000.
- Todd McLay, The University of Melbourne, *Investigating species limits and hybridisation in grass trees species (Xanthorrhoea; Xanthorrhoeaceae) in New South Wales and Queensland: A next generation sequencing approach*. \$2000.

Unsuccessful applicants were provided with feedback on their applications and we have encouraged them to resubmit in future rounds.

The next round of applications will close on September 14th 2013.

Australian Conservation Taxonomy Award

Through our agreement with The Nature Conservancy, and with financial support from The Thomas Foundation, we considered applications, in the March grant round, for the second instalment of the Australian Conservation Taxonomy Award.

The winner of the award, with unanimous support from the Research Committee, including The Nature Conservancy, was Lalita Simpson, James Cook University (ATH), for her project: *What is at risk? Phylogeography and taxonomy of orchids endemic to Queensland's mountain top biodiversity hotspots*.

The award is for up to \$9,000 and will include funding for Lalita to attend the next two ASBS conferences to present her research.

This was the second and final ACT Award under the current agreement, but we are in discussion with The Nature Conservancy about the possibility of continuing this valuable award.

Mike Bayly

Australasian Systematic Botany Society Inc.

Notice of Annual General Meeting

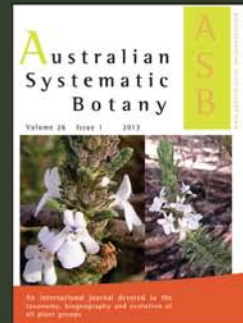
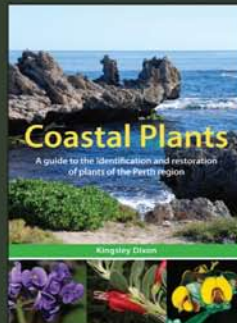
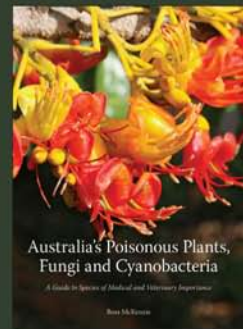
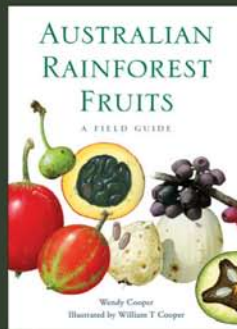
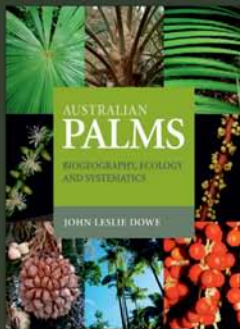
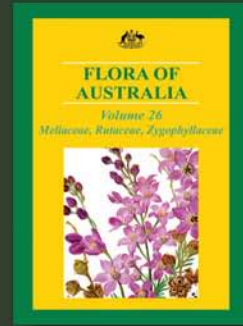
In accordance with Section 25 of the Society's Rules, notice is hereby given that the annual general meeting of the Australasian Systematic Botany Society Inc. will be held on Tuesday 3rd December in the DT Anderson Lecture Theatre, Heydon-Laurence Building, University of Sydney, NSW beginning at 5:00 pm (AEDT).

The purpose of this meeting is to:

- confirm the minutes of the annual general meeting held on Tuesday 25th September 2012 (see *ASBS Newsletter* 153:5-20).
- receive reports from Council on activities of the Society during the preceding financial year,
- declare the results of the vote for membership of Council.



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Phylogeny, classification and pollination biology of *Prostanthera* (Lamiaceae)

Trevor Wilson
National Herbarium of New South Wales

Introduction

Prostanthera (Lamiaceae) contains at least 100 species across Australia and is classified into two sections based on differences in reproductive morphology (Conn 1984, 2004). Variation in anther morphology has been a commonly used feature for distinguishing it from its sister taxa (e.g. *Hemigenia*), as well as for circumscribing infrageneric relationships. *Prostanthera* sect. *Klanderia* is distinguished from *P.* sect. *Prostanthera* by having reduced anther appendages, but recent molecular evidence supports an alternative set of relationships that are not similar to those based on anther morphology (Guerin 2008, Wilson et al. 2012). Also, although some recently discovered *Prostanthera* species have large anther appendages, they have been placed within section *Klanderia* due to similar floral morphology (e.g. *P. porcata*, Conn 1984).

In addition to anther morphology, the sections are distinguished by other floral features that appear to correspond to two separate pollination syndromes (Faegri and Van der Pijl 1979). Species of *Prostanthera* sect. *Prostanthera* are regarded as entomophilous since the corolla is mauve, purple-blue to white, has a wide, shallow floral tube, and has a large abaxial lobe. *Prostanthera* sect. *Klanderia* is regarded as ornithophilous since the corolla is variously red, yellow or green, it is long and tubular, and the abaxial lobe is reduced and reflexed (Keighery 1980, Keighery 1982b, Keighery 1982a, Conn 1984). Although there is strong evidence that this morphology corresponds to entomophily and ornithophily in other Lamiaceae (Huck 1992, Wester and Claßen-Bockhoff 2007), much like most of Australian flora, data for *Prostanthera* pollinators are limited to anecdotal evidence (Conn 1984). Therefore, pollination syndromes of *Prostanthera* remain speculative since there are no objective quantitative/qualitative data on floral visitors.

My current research, together with Drs Barry Conn (National Herbarium of New South Wales) and Murray Henwood (University of Sydney), aims to examine the relationships within *Prostanthera* using molecular data rather than morphological data to avoid the complications of convergent evolution. The specific objectives are to:

- Determine if there are quantifiable morphological differences between the sectional groups based on reproductive morphology
- Determine the infrageneric relationships and test the monophyly of sections and series (*sensu* Bentham) by constructing a molecular phylogeny
- Assess the pollination syndromes within *Prostanthera* using evidence-based pollinator observations and an examination of floral phenology and pollination mechanisms
- Implement ancestral state reconstruction of floral morphology with an understanding of pollination syndromes to provide an inference of the evolution of pollination in *Prostanthera*.

Hansjörg Eichler Scientific Research Fund support

The financial support provided through the Hansjörg Eichler Scientific Research Fund permitted me to observe significantly more species of *Prostanthera* than was possible with available funding. Therefore a more detailed and comprehensive representation of *Prostanthera* pollination was possible. In particular, the grant enabled the study of some rare plants with more unique floral characteristics, such as the cross-shaped flowers of *Prostanthera cruciflora* (*P.* sect. *Prostanthera*, Fig. 2c), and the putatively ornithophilous flowers of *P. porcata* (*P.* sect. *Klanderia*, Fig. 2a) that have long anther appendages.

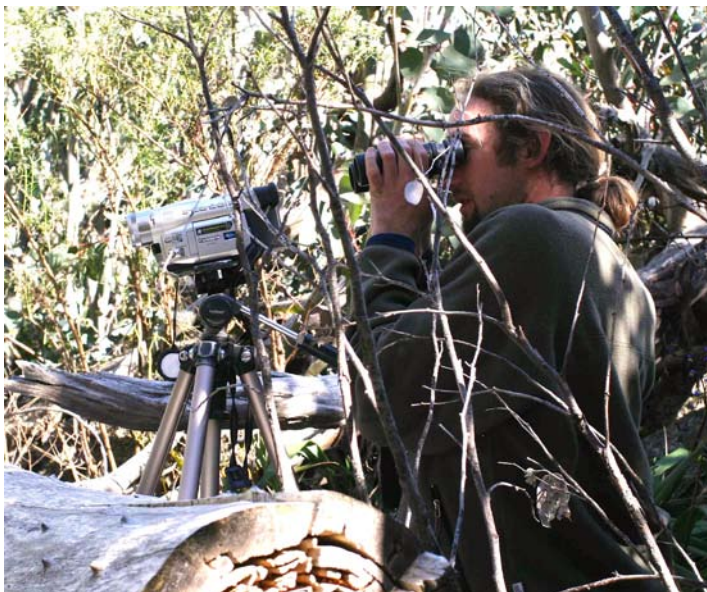


Fig. 1. Dr Trevor Wilson observing *Prostanthera monticola* on the plateau of Mt Buffalo National Park.

Ph. T. Wilson

Field work

Studies in the field (Fig. 1) lasted between 2007 and 2009 and incorporated 365 1-hour censuses across 12 species, which represent the breadth of floral diversity within *Prostanthera*. However, fieldwork first required a thorough investigation of suitable *Prostanthera* populations from which to observe. Research was conducted on the Mount Buffalo National Park (*P. monticola*, *P. rotundifolia*, *P. lasianthos*), Pilliga Nature Reserve (*P. ringens*), Mt Kaputar NP (*P. cruciflora*, *P. nivea*), Warrumbungles NP (*P. nivea*), Illawarra Escarpment NR/The Royal NP (*P. sieberi*), Blue Mountains Botanic Gardens/Blue Mountains NP (*P. lasianthos*, *P. saxicola*), Brisbane Waters NP (*P. linearis*), Pulletop NR (*P. serpyllifolia*) Taleeban NR/Gubbatta NR/Hiawatha State Forest (*P. aspalathoides*), and Budawang NP (*P. porcata*).

The pollinators of a large population of *P. porcata* (Fig. 2a) were studied in Budawang NP. Two separate observation trips supported that flowers of this plant are regularly visited by honeyeaters (Meliphagidae), such as the Eastern Spinebill (*Acanthorhynchus tenuirostris*) (Fig. 2b). At Mt Kaputar NP, *Prostanthera cruciflora* (Fig. 2c) was visited more often by flies than bees. In addition to the expected insect pollinators of *P. lasianthos*, it was surprising to observe birds pollinate this

putatively entomophilous species (Fig. 2d).

Future work

The relationships within the Prostantheroideae (Lamiaceae) are currently being studied (at NSW and USYD). The pollinator observations and measurements of floral morphology will be included in upcoming articles comparing morphological variation and association with pollinators.

Acknowledgements

I gratefully acknowledge the Australasian Systematic Botany Society for financial support provided through the Hansjörg Eichler Scientific Research Fund. This support provided valuable additional resources for my research program towards the degree of Doctor of Philosophy

(University of Sydney – completed 2011). The following people generously provided field assistance and companionship: Rob Smith, Jan Allen, Louisa Murray, Barry Conn, Ido Issler, Emma McIntosh, Anja Klungenböck, Andrew Perkins, Lauren Dukas, Fran Daniels, Marjan Medhat, Robin McAlpine, Mahtab Amjadi, Mark Norman, Ben Hinton, and Endymion D. Cooper.

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Fig. 2. Anticlockwise from top left: a, The rare and remote *Prostanthera porcata* with the mountains of Budawang NP in the background; b, A juvenile Eastern Spinebill (*Acanthorhynchus tenuirostris*) visiting flowers of *Prostanthera monticola* on the plateau of Mt Buffalo NP; c, *Prostanthera cruciflora* with the peaks of the Nandewar Ranges in the Background, Mt Kaputar NP; d, A Beefly (*Staurostichus* sp., Bombyliidae), a dubious pollinator, visits a flower of *P. lasiantha* at Mt Buffalo NP.

Ph. T. Wilson

Olearia phlogopappa in Tasmania: the botany of the (sub)Antarctic voyage of the discovery “ships” Spirit and Hilux in the year 2008

Andre Messina

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Members of the society may remember meeting me for the first time at the ASBS conference in Adelaide 2008, where I had the opportunity to outline my plans to revise the stellate haired species of *Olearia*, with a focus on the morphologically variable *O. phlogopappa* complex: *O. brevipedunculata* N.G.Walsh, *O. lirata* (Sims) Hutch., *O. rugosa* (F.Muell. ex W.Archer bis) Hutch., and *O. stellulata* (Labill.) DC. This species complex is widespread throughout south-eastern Australia. I felt I had a pretty good handle on the taxa, and where holes in the taxonomy existed, as I had undertaken extensive collecting in Victoria and southern New South Wales. However, shortly after my seminar I met with colleagues from HO. They suggested that I was taking on a very complicated group, and that among other things, I needed to get their specimens on loan, and have a good long chat with Alex Buchanan about the variation in *O. phlogopappa* in Tasmania. Not long after the conference, a colleague at La Trobe University pointed out that the common name of *O. phlogopappa* in Tasmania was ‘variable daisy bush’. He then went on to discuss the anguish he had endured during his travels in Tasmania attempting to distinguish between the seven varieties of *O. phlogopappa* outlined in the *Students Flora of Tasmania*, six of which were endemic to Tasmania (Curtis 1963). My handle on this species complex seemed to be slipping. And then came the loan from HO... After several weeks of shuffling through some 500 odd herbarium sheets labelled *O. phlogopappa*, *O. stellulata*, and occasionally *O. lirata*, I had sorted sheets into approximately 20 piles that I thought represented distinct or localised morphological forms, few of which could be readily assigned clearly into any one of the taxa in Curtis (1963).

It was at this point that I realised that I had no idea, and that a trip to Tasmania was vital if I was going to make any sense at all of these specimens. And not just to a few places in Tasmania as I had been planning. I was going

to have to see as much of that little island as possible. Herbarium specimens had been collected from nearly every island in Bass Strait, along all three coastlines of Tasmania, and near every town, road, lake and mountain, some of which I had read about and others that even Google didn’t know about. After much arm waving, excited jumping around and wobbling like a lost little boy in Neville Walsh’s office, and several emails with Alex Buchanan I began to organise a list of places to visit. This was followed by days of prioritising over which forms I really needed to see. After carefully weighing up site visitation based on ease of access: “is it worth the half day walk into this locality, or should I go to four others that I can get to easily instead”, I finally produced a much shortened list of locations. This translated into a three-week non-stop daisy-collecting trip to Tasmania including Flinders and Bruny Islands. It was a tough compromise.

After weeks of planning, on the evening of Tuesday the 17th of November 2008, myself, field assistant Erin Cox and a Toyota Hilux full of camping gear and a tower of neatly cut cardboard boarded the ferry to Devonport. After a restless night on the boat, we wearily started our attempt to drive to all the little highlighted dots I had placed on my map of Tasmania. The plan was simple; spend the first few days on the north and north-eastern coast of Tasmania and Flinders Island, then as the weather warmed up, head south along the west coast, before driving back up through the central highlands, by which time the weather should be fine, even at the higher altitudes. After getting sunburnt in Penguin, and having crystal-clear days of daisy collecting at Mt Strzelecki, Ben Lomond, Cube Rock and Cradle Mountain in the first week of travels I was confident that this plan was nothing less than genius. Travelling down the west coast was also spectacular; we spent a day collecting thick, smooth-leaved daisies (*O. phlogopappa* subsp. *phlogopappa*) in the sun from the fore dunes of Trail Harbour beach

with the roar of the ocean thundering along at our backs, while in the silence of the leeward side of the same dunes grew much thinner and rough-leaved daisies (*O. stellulata*) (Fig. 1). Upon arriving in Queenstown and seeing the stark cliffs it became clear why I had not seen too many botanical records in that town. After spending an hour trying to find a petrol station that would sell me some diesel, and a rather lengthy conversation with a lady in an op shop who was wearing a tea cosy on her head as a type of beanie, we quickly headed back into the hills where there are daisies and the magnificent Lake St Clair, which at dusk had a thin low layer of cloud sitting just above that water. Our first night in southern Tasmania was at Mt Field; here I met with the small, grey-leaved daisy that had tried so hard to look like *O. brevipedunculata* on the herbarium sheet I had seen at MEL. After seeing it in amongst the rocks in the blazing sun, I could see it was clearly much closer to the plants I had seen earlier in the trip, growing in the boulder-fields at Ben Lomond (*O. phlogopappa* subsp. *subrepanda* (DC.) Messina). *Olearia brevipedunculata* was to remain endemic to mainland Australia.

Unfortunately our night at Mt Field was to be the

last of the fine weather. Not long after arriving in Hobart, just as everyone had assured me that it would, the weather turned, and the grey streets of downtown Hobart were accompanied by grey sky and rain. To lift our spirits, and as a welcome change after two weeks in tents, I booked us into the wackiest hotel I could find in Hobart, the Mayfair. Here is where we were based for the next two days, drinking cups of tea in the eccentric 19th century decor, between short trips around Mt Wellington and the East shore of the Derwent River. It also gave me an opportunity to visit HO, meet with Alex and most importantly empty my full press into their drier. With a newly emptied press, we then headed further south to the beaches of Bruny Island, the coal dunes at South Cape, and the dramatic cliffs and tessellated pavements of the Tasman Peninsula. Here we collected the same two rough and smooth leaved daisies that we had seen on the west coast at Trial Harbour (Fig. 1). The remaining few days were spent collecting oblong, green-leaved daisies in montane forest (*O. phlogopappa* subsp. *gunniana* (DC.) Messina) and small, obovate, grey-leaved daisies in subalpine heath in the central highlands (*O. phlogopappa* subsp. *subrepanda*). Finally on the 6th of December,

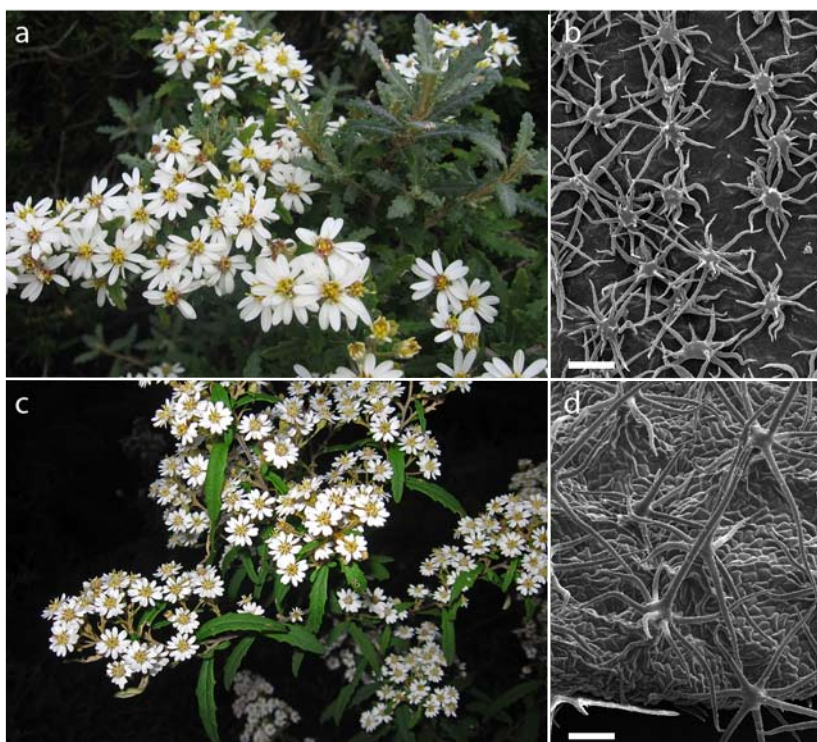


Fig. 1. Examples of flowering branches and SEM images of stellate hair structure on the adaxial surface of juvenile leaves, (a-b) *Olearia phlogopappa* subsp. *phlogopappa*, (c-d) *Olearia stellulata*. Scale bar represents 100µm.

exhausted, tired, wet with no apparent prospect of ever becoming dry again, we once again boarded the ferry back to Melbourne.

The 52 *Olearia* collections made during this trip (Fig. 2), along with material collected during trips throughout Victoria and New South Wales have been used in DNA sequencing and chemical analysis using metabolomic profiling of *O. phlogopappa* and other members in *Olearia* section *Asterotriche*. The results of these two studies are currently being prepared for publication, and won't be discussed in great length here. These collections along with 600 herbarium specimens held at BRI, CANB, HO and MEL have also been used for morphometric analysis of the *O. phlogopappa* complex. Morphometric analysis was principally focused on leaf characters, such as shape, size, and indumentum, but also included floral characters, such as capitulum size and arrangement. The morphometric analysis resolved five main groups, confirming the distinction of the five previously described species: *O. phlogopappa*, *O. lirata*, *O. stellulata*, *O. brevipedunculata*, and *O. rugosa* (Table 1). *Olearia phlogopappa* and *O. rugosa* were shown to be variable species. Patterns in variation emerged in both species, with morphological forms corresponding to differences in distribution or ecology. Based on these data, nine subspecies have been recognised in *O. phlogopappa*; three are new subspecies, and six are new combinations. Similarly, five subspecies are recognised in *O. rugosa*; four are new subspecies, and one is a new combination. The results of this analysis have been published in Australian Systematic Botany (Messina *et al.* 2013) as part of a full taxonomic treatment of the complex.

This trip to Tasmania has been vital in the revision of the *O. phlogopappa* complex. Seeing populations first-hand has contributed greatly to a better understanding of differences in the ecology of taxa, and inter- and infraplant variation within populations. This information helped with the interpretation of the morphometric analysis, and assisted with determining the best taxonomic placement of individuals that were outliers in the analysis.

Acknowledgements

I wish to thank the Australasian Systematic Botany Society for providing funding for this trip to Tasmania through the Hansjörg Eichler

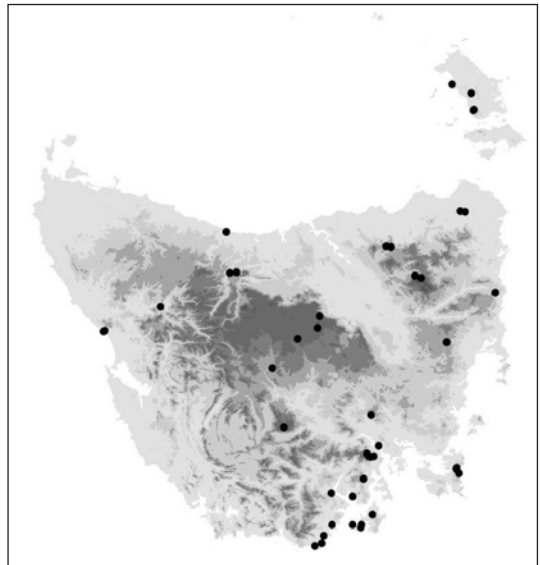


Fig. 2. Collection localities in Tasmania, 18th November– 5th December 2008. All specimens deposited at MEL, duplicate specimens held at CANB, H, and LT

Scientific Research Fund, and to the many members of this society who have helped during the course of my PhD research (of which there are far too many to mention here). Additional funding was provided by La Trobe University. I would like to thank Erin Cox and Karen Muscat for assisting with fieldwork in Tasmania. Staff (past and present) at HO helped tremendously with locality information and providing use of equipment while in Tasmania, and kindly loaned me a giant pile of specimens. I am also thankful to BRI, CANB, and K for further specimen loans. Finally I wish to thank staff at MEL and La Trobe University for facilitating this research, in particular my supervisors Pete Green, Susan Hoebee and Neville Walsh. My apologies to Sir Joseph Dalton Hooker for butchering the title of *Flora Tasmaniae*.

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Table 1. Species identified in morphometric analysis, discriminating characters, and distribution.

Character	<i>O. brevipedunculata</i> N.G. Walsh	<i>O. livata</i> (Sims) Hutch.	<i>O. phlogopappa</i> (Labill.) DC.	<i>O. rugosa</i> (F. Muell.) ex W. Archer bis) Hutch.	<i>O. stellulata</i> (Labill.) DC.
Petiole	Sessile	Petiolate	Subsessile to petiolate	Subsessile to petiolate	Petiolate
Lamina					
Shape	Elliptic or obovate	Lanceolate	Variable	Variable	±Ovate
Margin	Entire	Subentire	Entire or lobed	Subentire or lobed	Toothed
Venation	Indistinct below	Deeply impressed	Indistinct below	Deeply impressed	Impressed
Adaxial colour	Grey-green	Green	Grey or green	Green	Green
Adaxial indumentum	Dense stellate hairy	Becoming glabrous	Glabrous to moderate stellate hairy, often with sessile glands	Tuberculate, tubercules >0.2 mm long	Tuberculate, tubercules <0.2 mm long
Abaxial colour	Grey	White or cream	White, cream or yellow	Golden	Yellow or golden
Abaxial indumentum	Dense stellate hairy	Moderate to dense stellate hairy	Dense stellate hairy, often with sessile glands	Moderate to dense stellate hairy	Dense stellate hairy
Capitula arrangement	Terminal, sessile, solitary	Terminal, in large dense panicles or corymbs	Terminal or subterminal, solitary or in sparse to dense panicles or corymbs	Terminal or upper axillary, solitary or in small, loose corymbs	Terminal or subterminal, in dense panicles or corymbs
Distribution	Australian Alps, absent in Tasmania	Widespread throughout SE Australia	Widespread throughout SE Australia	Eastern Victoria and NE Tasmania	West and south coast of Tasmania, also in the Otway Ranges and Wilsons Promontory, Victoria
Habitat	Alpine heath and low subalpine woodlands	Damp sclerophyll forest, mostly below 700 m altitude	Coastal scrub, montane forest, subalpine woodland, and alpine heath	Damp sclerophyll forest, in gullies and swampy areas, associated with granite outcrops	Damp sclerophyll forest and scrub, often near to the coast up to 500 m altitude

Progress report on studies in biogeography and evolutionary history of the cycad *Macrozamia*.

James Ingham

School of Biological Sciences, University of Queensland

¹For my PhD, I am studying an Australian endemic genus of cycad, *Macrozamia*. Particularly, I am investigating the biogeography and evolutionary history of the genus by constructing phylogenies and allele networks from chloroplast and nuclear DNA sequences from all 41 described species. One paper investigating the divergence of the MacDonnell Ranges Cycad, *M. macdonnellii*,

has already been published (Ingham *et al.* 2013; Fig. 1). However, there is still lots to be done. I am currently in the process of building a nuclear DNA data set to complement the chloroplast sequences already in hand. This should provide a more complete understanding of the evolutionary history of the group as chloroplast DNA can only infer past seed movement. Another interesting facet of the genus is that there are at least three species complexes that are morphologically very similar - species boundaries within these groups are not clear. So, to further the understanding of the evolutionary history of the genus as

¹ This progress report from a recent grantee is welcome. James has already published some of his work: Ingham J.A., P.I. Forster, M.D. Crisp & L.G. Cook (2013). Ancient relicts or recent dispersal: how long have cycads been in central Australia? *Diversity and Distribution* 19(3): 307–316. *Eds.*



Fig. 1. The author with *Macrozamia macdonnellii*. Ph. J. Ingham

a whole, a part of my studies focuses on the *M. plurinervia* species complex, a complex of six species currently described on subtle morphological variation. All six species, *M. conferta*, *M. cranei*, *M. machinii*, *M. occidua*, *M. plurinervia* and *M. viridis*, are listed as threatened on the IUCN red list. This project, funded by an ASBS Hansjörg Eichler grant, aims to establish clear species boundaries, estimate species' genetic diversity and to provide insight into genetic processes that might be influencing speciation within the group. It is hoped that one outcome of this project will be to aid the Queensland government in designing a more effective conservation management scheme for the group.

Back in March of last year, I had projected to complete this Eichler-funded project by the start of this year. It appears that this completion date was far too optimistic. The ensuing lab work presented many difficulties to overcome; extracting DNA had to be modified as the

previous protocol stopped working, additional microsatellite loci had to be designed and trialled as it appears that *Macrozamia* have a surprisingly low level of genetic variation, microsatellite multiplex protocols had to be optimised to efficiently genotype multiple loci at once in order to keep costs down and 'odd' genotype results had to be verified. In case your eyes just glazed over reading that list of lab jargon, the important message here is that unexpected obstacles associated with each step in the lab work have delayed progress by about 8 months. But perseverance will prevail! All but the last step, verifying 'odd' genotype results, has been completed. When I say 'odd' genotypes, I mean genotypes that one would not expect, such as all individuals from a population sharing the same heterozygous genotype. To ensure the accuracy of these results, individuals are being re-scored by another person, some samples are being re-genotyped using alternate methods and some individuals are being spot-sequenced to ensure that the alleles observed are 'real'. In other words, we're trying very hard to ensure the accuracy of the data! Some

money from the grant still remains and is being used to fund this quality control testing, and I expect to have all the data quality tested within a month (assuming that additional obstacles don't come up!).

For the last two months, my mind has been consumed with thoughts of analyses. The interplay between environment, morphology and genetics leads one down many paths of comparison. Preliminary analyses have been done on the 'good' data to get a sneak-peek at the results, but any conclusions at this point would be a bit premature. I will present the results at the next ASBS/SASB conference in Sydney this December, and I aim to publish the results later this year or early next.

A sincere thanks to the society for funding this research. It has admittedly been a very arduous but enlightening journey, and I look forward to presenting the results to everyone at the next conference!

Polyploidy and hybridisation in the *Lepidosperma costale* (Cyperaceae) species complex

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Introduction

The genus *Lepidosperma* Labill. (Schoeneae: Cyperaceae) has its centre of diversity in Australia with some species occurring in New Zealand, New Caledonia, West Papua and southern Asia. Currently, 73 named species are recognised and these have recently been typified; however, a large number of species remain to be formally described (Barrett and Wilson, 2012). *Lepidosperma* spp. are remarkable among sedges for their frequent occurrence in dryland habitats of Australia, particularly Western Australia. Many *Lepidosperma* spp. have an affinity for rocky substrates such as banded ironstone formations, granite outcrops, and laterite breakaways where they are a significant component of ecological communities and provide important ecological services (Barrett, 2013).

The ongoing revision of *Lepidosperma* has been slowed by the complicated morphological variation, characterised by high levels of homoplasy, within the genus. This complexity has thus far precluded a reliable key for the genus, which has meant that some *Lepidosperma* taxa have been overlooked in surveys and conservation assessments. Complex morphological patterns are currently a major barrier to resolving species limits and developing a phylogenetic classification of *Lepidosperma*. Consequently we sought to use molecular and cytogenetic techniques to elucidate some of the evolutionary relationships and processes of diversification within the genus. This research is timely because as the search for minerals, particularly iron ore, marches south through Western Australia, more and more *Lepidosperma* species are being impacted by mining due to their frequent occurrence on rocky sites.

One group of particular conservation concern is the *Lepidosperma costale* species complex. This group is usually associated with banded

ironstone and granite outcrops across the Western Australian wheatbelt. These rocky substrates in the wheatbelt are often surrounded by large tracts of cleared land and little native vegetation remains. As currently understood three named species occur in this complex: *L. costale* Nees, *L. benthamianum* C.B. Clarke, and *L. gibsonii* R.L. Barrett. The application of the first two names is currently unclear and these names may be synonyms. Without an adequate understanding of the taxonomic units within this species complex it is possible that unidentified taxa may be severely impacted by mining. Consequently, the aims of my PhD research were to investigate the cytogenetic, phylogeographic, and phylogenetic relationships within this species complex to provide information to inform a new taxonomic treatment of the group.

Polyploidy

Chromosome changes such as polyploidy or aneuploidy were expected to occur in *Lepidosperma* given the frequency with which these phenomena are reported in other cyperaceous genera including *Carex*, *Rhynchospora*, *Schoenoplectus*, and *Eleocharis*. Unfortunately, our and previous attempts (e.g. de Lange *et al.*, 2004) to count the minute chromosomes in the genus have met with limited success. Consequently, we developed a flow cytometry protocol that could be used to estimate genome size and infer ploidy. We sampled 2372 plants from 27 populations across the range of the species complex and found four ploidies: diploid, triploid, tetraploid, and pentaploid. Diploid and tetraploid plants were by far the most common ploidies (~22% and ~78% of total individuals, respectively).

Fig. 1 shows the distribution of ploidy across the range of the *Lepidosperma costale* species complex. Populations usually contain a single ploidy and diploid individuals are more common in the northern, while tetraploids

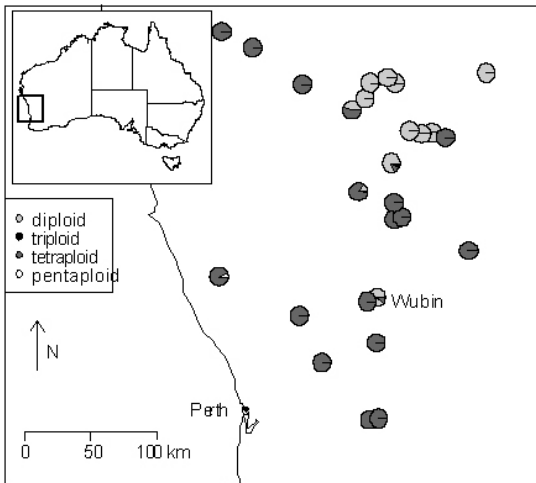


Fig 1. Geographic distribution of DNA diploids, triploids, tetraploids, and pentaploids in the *Lepidosperma costale* species complex. Proportion of circle filled indicates proportion of DNA ploidy in each population. The inset shows the position of the study area within Western Australia.

are more common in the southern, portion of the geographic range. Occasionally ploidy levels co-occur on a granite rock. We intensively investigated the distribution of these plants on a single granite outcrop and found that even when the ploidy races occurred in close proximity, the distribution of each ploidy was largely non-overlapping (Fig. 2).

Several triploid plants were found at the contact zone between diploid and tetraploid plants in the population shown in Fig. 2. It is not clear how these few plants were formed and spread, however vegetative reproduction and apomixis are both viable explanations given the very small area in which these triploid plants occur.

Microsatellite markers

To further explore patterns of ploidy distribution across the range and to understand the origin of, and genetic diversity in, polyploid populations we developed a suite of nuclear and chloroplast microsatellite markers (Wallace *et al.*, 2011; Barrett *et al.*, 2012).

Because some *Lepidosperma* spp. reproduce vegetatively via rhizomes we used nuclear markers to assess the level of clonality in *L. gibsonii*, an exclusively diploid taxon. Multiple samples were taken from clumps and revealed that, surprisingly, there was no evidence of clonality in this diploid taxon. In fact, clumps,

particularly larger clumps, often contained several genetically distinct individuals. In general, there were very high levels of genetic diversity within diploid populations across the range of the species complex.

In contrast, there were much lower levels of genetic diversity in polyploid populations. In fact, some tetraploid populations contained only a single genotype, which suggests that vegetative reproduction or apomixis may be promoted by polyploidy in the *L. costale* complex as it is in other angiosperm taxa (Kao, 2007). The six triploid plants at the contact zone in the intensely studied population (Fig. 2) were also genetically identical suggesting that a single triploid plant formed at this location and then spread vegetatively or via apomixis. This further suggests that triploids have limited fertility although the extent to which these triploid plants may provide a 'triploid bridge' for the formation of new tetraploid lineages remains unclear.

Interestingly, some tetraploid plants had chloroplast microsatellite genotypes that differed markedly from diploid and other tetraploid *L. costale* genotypes; these haplotypes were more similar to those found in other *Lepidosperma* species. This pattern was only evident in plants of higher ploidy, often in plants intermediate in morphology between *L. costale* and other species, a pattern consistent with reticulate evolution (hybridisation). This possibility was further investigated by DNA sequencing.

DNA sequencing

DNA sequencing was used to investigate the possible reticulate origins of some polyploid plants/populations. Sequence data were first obtained from a selection of plants from several populations for nuclear ribosomal DNA (nrDNA: ETS and ITS) and chloroplast DNA (*trnL-F*). All plants had identical nrDNA sequences suggesting that, if these plants were of hybrid origin, concerted evolution had effectively erased one parental copy of nrDNA. On the other hand, two major types of chloroplast DNA sequence were found: one that corresponded to the diploid *L. costale* complex sequences and another that was more similar to sequences obtained from individuals in the *L. scabrum* clade (based on sequence

data in a large preliminary sequence database for *Lepidosperma*; R Barrett *et al.*, in prep).

To further explore these potentially reticulate origins it was necessary to develop low-copy nuclear markers for *Lepidosperma* because chloroplast DNA is almost always uniparentally inherited (most often maternally in angiosperms) and nrDNA undergoes concerted evolution that can quickly erase any evidence of hybridisation. Consequently, a variety of low-copy nuclear DNA markers (which are biparentally inherited and do not undergo frequent recombination) were tested to find markers that could provide an independent assessment of these complex origins. The support provided by the Hansjörg Eichler fund was used to assist with the development of these markers. Transcriptome data for *L. gibsonii* was used to design primers for low-copy nuclear regions that had proven useful in other angiosperm taxa. One region in particular, *arodeh* (arogenate dehydrogenase), proved the most useful and reliable to amplify, clone, and sequence. Results from this work confirmed the hybrid origin of some higher ploidy plants (*L. costale* complex + *L. scabrum* clade) and also identified other hybridisation events between tetraploid *L. costale* individuals and tetraploid individuals from the *L. tenue* clade. These markers will be useful for future work required to further understand the evolutionary relationships within *Lepidosperma*.

Conclusion

The evolutionary patterns within the *L. costale* complex are complex. At the moment it seems feasible to clearly distinguish several evolutionary significant units: (1) *L. gibsonii* (diploid), (2) all other diploids, (3) autotetraploids, and (4) allotetraploids formed with *L. scabrum*. Other hybrids appear to be relatively rare but more work and further sampling is needed to quantify the frequency of hybridisation between *L. costale* individuals with other *Lepidosperma* taxa, and the extent to which polyploidy breaks down reproductive barriers between taxa in *Lepidosperma*.

Although only relatively simple morphological measurements were made in this study it appears unlikely that morphology can be used (at least in the field) to distinguish between diploids and autotetraploids, although it is possible to

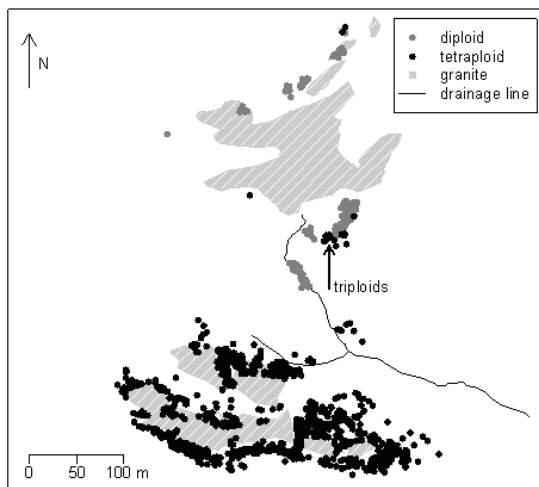


Fig 2. Microgeographic distribution of *Lepidosperma costale* species complex cytotypes at Wubin Rocks (n=1619). All plants in the quadrat were sampled. The arrow indicates the location of six triploid plants.

distinguish allopolyploids from autotetraploids and diploids. It is, however, relatively easy, cheap and efficient to distinguish diploids and autotetraploids in the laboratory using a flow cytometer. Fresh material can be stored at 4°C for at least two weeks before laboratory analysis.

Implications

Careful consideration is required when planning the conservation and restoration of *L. costale* complex populations, and likely many other *Lepidosperma* taxa. Future conservation assessments should take into account the evolutionary significant units and the cryptic biodiversity in this species complex. Particular care should be taken when collecting and returning local provenance germplasm to degraded sites because it is not uncommon to find plants of different ploidies growing in close proximity. The unintentional mixing of ploidies during restoration could have negative consequences by causing reproductive interference and ultimately reducing the fitness of the restored population (Levin, 2002).

Acknowledgements

I thank the Australasian Systematic Botany Society for their support through the Hansjörg Eichler Scientific Research Fund. This research was also supported by Mt Gibson Iron Pty Ltd, Gindalbie Metals Pty Ltd, and the University of Western Australia. Drs Matt Barrett,

Russell Barrett and Martha Ludwig (UWA) are thanked for their guidance. Marie Jouault and Lydia Guja assisted with field and lab work. The relevant authorities and land managers are thanked for granting permission to access their land.

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Miscellanea

Botanist beware

Scientists are apparently being duped by conferences, websites and journals which appear to be prestigious but are actually imitators cashing in on established names. The example given in an article in the *New York Times* of April 7th 2013 (Web ref. 1) is that of an invitation to scientists to participate in a conference Entomology-2013 where the sanctioned conference of the Entomological Society of America is titled Entomology 2013. The former is to be held in September in Orlando, Florida, the latter in November in Austin, Texas. Those invitees who accepted an invitation to attend the former conference have apparently later been charged a large fee and instead of mixing with leading entomologists they will be mixing with those who have paid to be able to present.

Alarm was also raised in the article over the proliferation of open-access journals which will publish anything for a fee. Referred to as “predatory publishers” by librarian and academic, Jeffrey Beal of the University of Colorado, he has since 2009 been compiling a list of journals which he considers should be black-listed (Web ref. 2). Beal has extremely stringent criteria for determining which journals are included in his list of “Potential, possible, or probable predatory scholarly open-access journals”.

The basis of much of the *New York Times* article stemmed from a special issue of *Nature* of 28th March 2013. Entitled *The future of*

publishing and with all articles freely available, it is more balanced and covers the above issues as well as the true cost of scientific publishing, Creative Commons licences and the problems experienced by libraries in this new world (Web ref. 3). One example cited within their pages is the article “Sham journals scam authors” in which two cases are given where existing long-established journals without a dedicated website have had their identities stolen by counterfeit journal websites. Manuscripts submitted are readily accepted (normal editorial practices such as refereeing are apparently dispensed with) and the fee for publication quickly pocketed. One of the examples cited is that of the botanical journal *Wulfenia*, published by the Regional Museum of Carinthia in Klagenfurt, Austria.

Our own Australasian biological community is probably small enough for much of the scamming to be not really a problem. That said, the *Australasian Journal of Herpetology* is in Beal’s list. We would be interested to hear if any of our colleagues have had similar experiences they are able to pass on through the newsletter.

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- Web ref. 1: www.nytimes.com/2013/04/08/health/for-scientists-an-exploding-world-of-pseudo-academia.html?pagewanted=all&r=0
- Web ref. 2: <http://scholarlyyoa.com/individual-journals/>
- Web ref. 3: www.nature.com/news/specials/scipublishing/index.html

Robyn Barker

Articles

Plant structure and systematics research at the Queensland University of Technology (QUT), Brisbane.

Tanya Scharaschkin

This article provides a general overview of some of the plant research being conducted by a number of researchers at the Queensland University of Technology (QUT) Brisbane. Details about student projects and research facilities have been limited to those of relevance to plant structure and systematics. Academics, technicians and research students involved in plant research are in the Faculty of Science and Engineering, mainly in the School of Earth, Environment and Biological Sciences (EEBS), with a few exceptions. Our offices and laboratories are housed in a number of different buildings at the Gardens Point campus (e.g., P, Q, R, S, M Blocks) and we have strong collaborative links with Queensland Herbarium (BRI) and Mt Coot-tha Botanic Gardens.

Research and teaching facilities

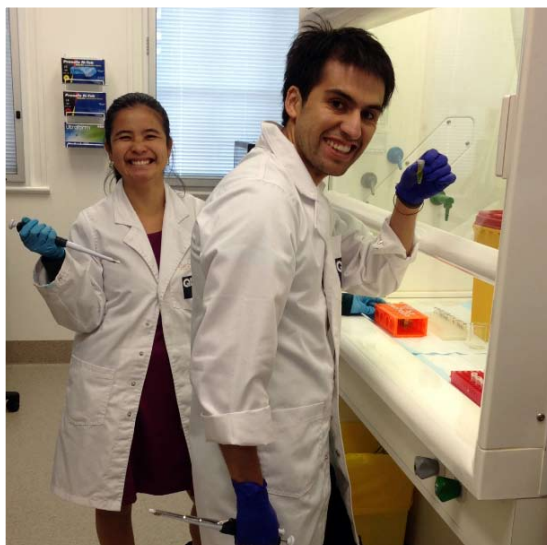
In the past couple of years we have seen some major refurbishments to existing labs and the construction of the new Science and Engineering Centre. The Science and Engineering Centre, which was officially opened earlier this year, has achieved a 5-star Design Education V1 Certified rating from the Green Building Council of Australia and is a building worth visiting just for the sake of looking around and playing with the very large interactive computer displays. In mid-June we hosted the AGM of the Royal Society of Queensland, and one of the highlights was a tour of the new building with its innovative teaching and research space. A number of large labs, equipped with about \$17 million in new equipment, have been grouped together as the Central Analytic Research Facility (CARF). Of particular relevance to plant systematics and structure research are two CARF laboratories (Molecular Genetics and Analytical Microscopy) and two EEBS laboratories (Ecology and Plant Sciences). The combined central and school-level laboratories have greatly increased our research capacity. It is going to take a while for some of us to discover the potential these resources provide for developing new or different approaches to

addressing our research questions. A summary of the major resources is provided below, but please refer to the CARF website for more information.

At the CARF Molecular Genetics laboratory (R block, Level 4) we have all we need for DNA extraction, PCR and sequencing, including Life Technologies 3500 Genetic Analyser, QIAGEN QIAextractor, QIAGEN Rotor-Gene Q, Life Technologies Ion Personal Genome Machine (PGM) Sequencer, and a Life Technologies Ion Proton Sequencer (Fig. 1).

The CARF Analytical Microscopy laboratory (P block, Level 6) has microtomes and microscopes along with the necessary tissue preparation, processing and sectioning equipment. The microtomes include Leica EM UC6 Ultramicrotome, Leica EM UC7 Ultramicrotome, Leica RM2245 Rotary microtome. Scanning Electron Microscopes (SEMS) are JEOL JSA 6360A, Zeiss Sigma VP Field Emission, JEOL 7001F, Hitachi Analytical TableTop Microscope TM3000, FEI 3D FIB, FEI Quanta. Transmission Electron Microscopes (TEM) are JEOL 2100

Fig. 1. CARF – Molecular Genetics laboratory with Melody Fabillo and Hernán Retamales.



LaB6, JEOL 1400 LaB6) (Fig. 2). For those of us examining morphological characters for systematics studies, we have lots of options for image capture and analytical software in the light microscopy area associated with the following instruments: Leica M125 Zoom Stereo Microscope, Leica MeF3 Inverted Metallographic Microscope, Zeiss Axio Imager M2m, Nikon A1R Confocal Microscope, and a Nikon Eclipse Ti Inverted Microscope. We are still working out the ideal set up and arrangement for some of this equipment.

The EEBS Plant Sciences laboratory (M block, Level 5) is where most of the plant structure research is conducted. Part of the lab is set up for freehand sectioning, staining, chromosome squash and resin embedding. We use the rotary microtome at CARF to cut thin sections, and bring slides with resin or paraffin-embedded samples to the Plant Sciences lab for staining. This lab has two Nikon microscopes (Nikon SMZ 800 Stereo, Nikon eclipse 50i compound) with the full NIS Elemental digital image analysis. The stereoscope has a drawing tube attachment that can be used for illustration.

Fig. 2. CARF – Analytical Microscopy and Microtomy laboratory. Karma Wangchuck using the SEM for examining moss sporophytes.



The EEBS Ecology laboratory (R block, Level 1) includes ample bench space for sorting out bulky and messy samples and room for storing our field gear. We also have about ten large growth cabinets that are used for a variety of experiments (e.g., seed germination, plant drought stress), an insectary and a temperature and humidity controlled walk in room that houses our local QUT herbarium. Additional microscopes, scanners for biological samples (seeds, leaves) and photography resources (such as time lapse video) are available in this lab.

The plant diversity garden (R block courtyard) (Fig. 3). Since 2008 we have been building up a living collection of plants that are required for practicals. Whilst this may not sound interesting enough to even warrant a mention, what we have accomplished in an urban, space-limited campus, is to establish a wide variety, both taxonomically and ecologically, of plants that we use for plant diversity units. Some of the trees are now big enough for students to use keys to develop skills in plant identification. A rainwater tank and automated irrigation system keeps the pots watered. The first couple of years of starting this garden saw the pots being used as cigarette and trash receptacles (amongst other less desirable usages) but we hardly see any rubbish in the pots any more.

Plant researchers and research themes

Prof. Sagadevan Mundree and other researchers based at the Centre for Tropical Crops and Biocommodities (CTCB) are using innovative biotechnology solutions to improve our understanding of the way plants adapt to extreme environments. Every year, drought and salinity stress has a severe impact on agriculture across the world, resulting in significant yield and economic losses. Using a native Australian resurrection plant as a model system and Next Generation Sequencing technologies, in parallel with physiological analyses, Sagadevan Mundree and his team of researchers (Dr Brett Williams, Dr Sudipta Das Bhowmik, Mr Hao Long, Mr Alam Cheng, Ms My linh Hoang, Mr Isaac Njaci and Mr Peraj Karbachi) are dissecting the molecular pathways and physiological mechanisms used by extremophiles for adaptation to extreme environments. Advancing our knowledge

of plant adaptive mechanisms is essential for the continued security of agriculture and will pave the way for the development of crops that are more resilient to environmental stresses.

Dr Jennifer Firm is a theoretical and applied ecologist who specializes in linking ecological theory to practical management. Her research focuses on identifying the mechanisms that facilitate opportunities for invasive plant species. She investigates both bottom-up (soil nutrients) and top-down (herbivory) controls on plant species diversity in grassland communities (Firm 2007, 2009; Han *et al.* 2012). She is involved in quantifying the complex role between biodiversity and ecosystem function, and the population level significance of plant phenotypic plasticity in response to disturbance (Firm *et al.* 2012).

Dr Peter Prentis uses a combination of high throughput genomics, bioinformatics and ecological experiments to examine the relative influence of the landscape and environmental conditions on gene flow and local adaptation in plant species. Pete's research has led to the development of new theory for understanding the evolution of plant invasiveness. He has led efforts to test theory about the adaptation of invasive plants to novel habitats. Research questions that he is currently investigating include the genomics of speciation in island plants, the role of artificial selection on genome architecture and gene expression variation, and whether similar or different genes are involved in adaptation to novel environments.

Tanya Scharaschkin's plant systematics group has been growing steadily (see student projects below) since she first joined ASBS. Tanya is leading the establishment and development of research capacity to investigate plant structure (anatomy and morphology) at QUT. Along with plant systematics, Tanya is interested in investigating the potential link between ecophysiological performance and resource utilisation with plant structure. Some of



Fig. 3. R Block courtyard teaching garden with Plant Biology students during a practical.

this research is being conducted on weeds, in collaboration with Dr S. Osunkoya and Dr. K. Dhileepan (Biosecurity Queensland-DAFF), and has involved a number of honours students (Richard Boyne and Karina Pyle), and a current Masters student (Joshua Buru). Tanya is collaborating with Dr Hervé Sauquet and others on the eFLOWER project (<http://eflower.myspecies.info/>) involved in answering key questions on the evolution of flowers. She continues to be involved with Annonaceae, mainly in projects involving pollination biology (Pang *et al.* 2013), in collaboration with Prof Richard Saunders (Univ. of Hong Kong). Non-plant systematics research has involved collaborations with Dr Andrew Geering and Dr Roger Shivas (Plant Pathology-DAFF), joint supervision of a PhD student (Alistair McTaggart) and publications on smuts and viruses (Geering *et al.* 2010; McTaggart *et al.* 2012a; McTaggart *et al.* 2012c, 2012b).

Research students: past and present

Karma Wangchuck (supervised by Dr. Tanya Scharaschkin, Dr. Matthew Gray and Dr David G. Long at the Royal Botanic Garden, Edinburgh) is working on the phylogeny of the Sino-Himalayan Pterobryaceae Kindb. (Bryophyta: Hypnales, Bryopsida) using morphological and molecular data (Fig. 4). Pterobryaceae is a family of pleurocarpous mosses distributed throughout tropical and warm temperate regions of the world. The placement and number of genera within the family in Sino-Himalayan region is not clear.

The systematic treatment of Sino-Himalayan Pterobryaceae is aimed to 1) develop well-resolved phylogeny using both molecular and morphological data, 2) address phylogenetic issues, such as distinctness and monophyly of *Calypothecium* and *Pterobryopsis*, and 3) undertake detailed taxonomic revision of Sino-Himalayan Pterobryaceae. Karma will be presenting some of his results at the International Association of Bryologists (IAB) Congress in London in July 2013. Karma holds a Royal Government of Bhutan scholarship and QUT fee waiver scholarship for 4 years (June 2010-April 2014). After completion, he plans on returning to Sherubtse College in Bhutan to continue teaching and working on Bhutanese bryophytes.

Melodina “Melody” Fabillo (supervised by Tanya Scharaschkin, Dr Peter Prentis and Mr John Thompson-BRI) commenced her PhD in March 2011. She is working on the systematics of *Tripogon* (Poaceae: Chloridoideae). *Tripogon* is a genus of grasses with ca. 40 species distributed in Africa, America, Asia and Australia (Fig. 5a). The sole, but widespread Australian species, *Tripogon loliiformis*, is a morphologically variable resurrection plant, and it has been suggested that it could be more than one species. Melody is using DNA sequence data and morphological data

(through stereomicroscopy, light microscopy and scanning electron microscopy) to obtain a robust, well-supported phylogeny of the genus, including multiple accessions of *Tripogon loliiformis* from across Australia, along with representatives of the genus occurring on other continents. She aims to determine the monophyly of the genus *Tripogon*, the relationships of the different species to each other and the monophyly and placement of the Australian *Tripogon*. Her study will try to identify unambiguous synapomorphies that could be of value for subsequent taxonomic revisions. She presented preliminary results at the 2012 ASBS Conference in Perth and will be presenting more recent results at the Monocot Conference (New York) and Botany Conference (New Orleans) in July 2013. Melody holds a tuition fee waiver scholarship from QUT and is employed as a sessional academic at the same university. She was a recipient of the 2012 and 2013 ABRs Student Bursary. She is on leave as a lecturer in animal developmental biology at the University of the Philippines.

Hernán Retamales (supervised by Tanya Scharaschkin, Dr Steven Cameron and Dr Rosa Scherson at the Univ. of Chile) is working on the anatomy, character evolution and phylogenetic position of the Chilean Myrtaceae (Fig. 5b). Myrteae is the largest of the 17 recognised

Fig. 4. Left, Karma Wangchuck and David Long collecting mosses in Bhutan; right, Karma and Tanya’s haul of fern fronds (above) that formed part of dinner that night (below).



Fig. 5. a, Melody Fabillo finally finds *Tripogon* at "the Granites" near Mt. Magnet, WA; b, Hernán Retamales in Chile.



tribes in Myrtaceae (c. 2500 species) and it is mainly distributed in rainforest areas of South America and Australasia. The Chilean Myrtaceae are in the tribe Myrteae. Chile is rich in genera but has few representatives per genus, most of which are endemic. This distribution pattern has been attributed to the geographic and historic isolation of the country since the Pliocene uplift of the Andes and the formation of the arid diagonal zone during the Miocene. Hernán's research will make extensive use of anatomy, morphology and micromorphology, in combination with molecular data. Hernán has been awarded a Chilean scholarship to undertake his PhD in Australia

Joshua Buru (supervised by Tanya Scharaschkin, Dr Peter Prentis, and Dr S. Osunkoya and Dr K. Dhileepan at Biosecurity Queensland-DAFF) is studying the biology of cat's claw creeper, *Dolichandra* (syn. *Macfadyena*) *unguis-cati* (Fig. 6). There are two distinct forms of cat's claw creeper in eastern Australia and Joshua will attempt to determine if the variations are significant enough to warrant different biological control strategies, as indicated by a pilot study (Boyne *et al.*, in review). He will study the morphology, anatomy, germination rates and growth response of these two forms to different levels of water and light. Joshua is currently enrolled in a research Masters but hopes to articulate to a PhD and plans to extend his project

to include host-specificity tests and molecular assessment of genotypic diversity of both forms of the weed. Joshua was nominated by the Government of Botswana for a scholarship to study at QUT, which he commenced in January 2013. Prior to starting at QUT, Joshua worked as an aquatic weed biologist in the Aquatic Vegetation Control Unit (AVCU) in Maun, a town in the north-western part of Botswana that is a gateway into the Okavango Delta. At least he won't have to keep an eye out for crocodiles or hippos while working on cat's claw creeper.

John Thompson (supervised by Tanya Scharaschkin, Dr. Matthew Gray, Dr Gordon Guymer-BRI and Mr Byran Simon-BRI) began a PhD in January 2013 on a systematic study of the Australian cleistogamous panicoid grasses (Fig. 7a). John retired in 2012 after 21 years as a botanist at the Queensland Herbarium

Fig. 6. Joshua Buru in Queensland with cat's claw creeper.



(BRI) where his main duties were survey and mapping of Queensland and curator of Poaceae, Boraginaceae and Polygalaceae. He maintains connection with BRI as an honorary associate. John's PhD research focuses on species in three genera (*Calyptochloa*, *Cleistochloa* and *Dimorphochloa*) all of which have a unique reproductive system (Thompson and Simon 2012). These plants have two types of inflorescences with different pollination strategy in any given individual: terminal inflorescence with chasmogamous spikelets and axillary inflorescence with cleistogamous spikelets. In grass taxonomy, terminal inflorescences and spikelets are used extensively to provide most of the morphological data, while axillary inflorescences have been used sparingly. The morphology of the axillary cleistogamous spikelets varies across the genera and could provide useful distinguishing characters. Phenetic analysis of morphological data together with phylogenetic analysis of morphological and molecular data will be used to delimit new taxa and determine evolutionary relationships of the group.

Cristina Latorre is a volunteer in the plant systematics group under the supervision of Tanya Scharaschkin (Fig. 7b). She graduated as a forester from the University of Chile. She

has been involved in an investigation of the reproductive biology of *Alstroemeria pallida* Graham (supervised by Dr Paulette Naulin, University of Chile). Her undergraduate thesis was on the floristic evaluation for conservation purposes in the Santuario de la Naturaleza (Nature Sanctuary) Cerro El Roble, Región Metropolitana, Chile (supervised by Dr Gustavo Cruz, Univ. of Chile). She also has IT skills regarding GIS and cartographic management. Cristina is currently assisting with projects on the Australian resurrection grass, *Tripogon loliiformis*, and has been helping Tanya update the database on the publications of the Proceedings of the Royal Society of Queensland.

Richard Boyne (supervised by Tanya Scharaschkin, and Dr. O. Osunkoya at Biosecurity Queensland-DAFF) completed his honours project in June 2011 (Fig. 8). His honours thesis was on the "Comparative leaf anatomy of invasive and non-invasive climbers under different light levels: implications for ecophysiological performance and phenotypic plasticity", one small aspect of which has recently been accepted for publication (Boyne *et al.* in press) and it is hoped more papers will follow. After completing his honours, Richard

undertook an internship at the Australian National Herbarium, Canberra and worked as an experimentalist at the Centre for Wet Tropics Agriculture, South Johnstone, Queensland. Richard is currently in the United Kingdom visiting plant researchers from the Natural History Museum, the Royal Botanic Gardens at Kew and Edinburgh, and the CABI labs in Surrey. He has been working as a volunteer at the herbaria at Kew and Edinburgh, and has recently been offered a position at Kew to digitise herbarium specimens.

Fig. 7. a, A momentous day: John Thompson with his grass samples ready for DNA extraction. b, Cristina Latorre at work in Chile.



Karina Pyle (supervised by Tanya Scharaschkin, and Dr. K. Dhileepan at Biosecurity Queensland-DAFF) completed her honours in 2008 and recently joined the technical team at EEBS. Karina's project focussed on simulated herbivory trials on bellyache bush (*Jatropha gossypifolia*). Prior to honours, she completed a summer research internship investigating the subterranean tuber abundance of cat's claw creeper (*Dolichandra* (syn. *Macfadyena*) *unguis-cati*) which indicated the need for seed-feeding biocontrol agents along with other approaches (Osunkoya *et al.* 2009). Karina plans on undertaking a PhD in the near future.



Fig. 8. Richard Boyne at Edinburgh. Ph. R. Boyne

Other activities of the Scharaschkin research group

Our research activities have been discussed above, but we are interested in lots of other things as well. Most of us are planning on attending ASBS 2013 in Sydney, so you'll be able to ask us more about some of these academic and non-academic activities. A number of us are avid gardeners (Karma, John, Tanya), many of us like hiking (Hernán, Christi, Tanya), at least one is a good chess player (Joshua), another a taekwondo expert (Hernán) and another an experienced jewellery-maker (Melody). Some of our non-academic activities led to the formation of a group called "Crafty Scientists" so that we can learn from each other's artistic skills. Melody has shared her passion for jewellery making and Tanya her interest in crocheting and hopes to start a botanical art group. Melody also runs workshops at The Edge (State Library of Queensland) some of which have involved using plant anatomy to provide the inspiration for fabric design (Fig. 9a). A number of us also participate in monthly walks with Naturalists Anonymous, a group organized by Tanya and now in its 5th year, with the aim to learn about the natural history of places near Brisbane (Fig. 9d, e). We are all participating in the 2013 Global Corporate Challenge and have formed a team called "Botanical Buddies", although as one of the figures clearly shows (Fig. 9b, c), we probably won't be in the top 20 teams at QUT!

Acknowledgements

This article has been a team effort with

individual contributions from researchers and students along with input from technicians regarding equipment and resources (a special thanks goes to Mark Crase and Rachel Hancock). As compiler of the content and instigator of this article, I take responsibility for any mistakes. Complaints can come to me; compliments should go directly to the relevant person.

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Fig. 9. Anti-clockwise from top left: a, Melody Fabillo teaching “microscopy for fashion” workshop at The Edge; b, plant systematics students at QUT, who, along with Tanya have formed a Global Corporate Challenge 2013 team called “Botanical Buddies”; c, Tanya keeping track; d, Matt Gray (far right) explains the work done by a bush care group *Naturalists Anonymous* (Matt is one of the botanists not in EEBS but still involved in plant systematics research projects); e, Matt Gray and John Thompson.

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Canberra's new National Arboretum

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2013 marks the centenary of the naming of Canberra as the capital of the Commonwealth of Australia, way back in March 1913. A wide variety of celebrations are happening throughout the city to mark this auspicious occasion.

The celebrations formally started at sunrise on 1st February 2013. Some wonderful live singing and a short series of speeches from Commonwealth and Territory dignitaries and the Friends group were perfectly timed to conclude as the sun rose in a spectacular display of light and colour. This was the opening of the National Arboretum Canberra (NAC). A special, family focussed, open day was held the next day (Fig. 1).

The NAC has risen phoenix-like out of the ashes of the forest fires that burnt through most of the native forests, pine plantations, and nearly 500 houses in Canberra in 2001 and 2003. Following the second and more catastrophic fires, which included the first documented tornado of forest fire origin, the ACT Government included plans for a national arboretum situated on 250 hectares at the west end of Lake Burley Griffin.

Walter and Marion Griffin included a continental arboretum at the west end of their central lake in their drawings for the new national capital.

Some initial plantings were done on the 'green hills' where Himalayan cedars (*Cedrus deodara*: Fig. 2) and pencil pines (*Cupressus sempervirens*) were planted around 1917-1930. The third hill of this group, was to be planted with *Cedrus atlantica*, but there are no records of this being done and no trees survive if they were indeed planted. The three 'green hills' were to anchor the major 'arboretum axis' extending from Capital Hill westwards. This axis was never developed, unlike the two other major axes of Commonwealth Avenue and Kings Avenue.

The new Arboretum thus fits in well with the Griffin's original concept. It also picks up the theme of a 'continental' flavour with species from around the world being planted there.

The Arboretum design was put out to an international competition. From some 45 entries received a distinguished panel unanimously selected the '100 Forests 100 Gardens' design submitted by a consortium of Melbourne landscape architects, Taylor Cullity Lethlean and Sydney architects Tonkin Zulaikha Greer. The forests are laid out in an innovative patchwork design that is modern and looks to the future, rather than trying to replicate the Victorian origins of the arboretum concept. Bold stripes, about 130-140m wide,

Fig. 1. Kids and kites: the National Arboretum Canberra's amphitheatre on the open day on 2nd February 2013; the Margaret Whitlam Pavilion stands out on its further perimeter. Ph. Roger Hnatiuk



of diverse tree species are spread from east to west across the site and separated by allées that provide access to all forests by pedestrians and emergency crews alike. They will keep clear views outwards from the site while serving as fire breaks to reduce the risk of future fires spreading.

The criteria for selecting species started with rare and endangered species around the world, in keeping with the biodiversity goals of the plan. In addition, species of iconic and ethno botanic significance were included. Each species had to meet a number of other criteria, such as, could it be expected to survive in the climatic and soil conditions of Canberra; was the danger of becoming weedy either low or non-existent; would the species contribute to the diversity of mature canopy heights required as part of the planning to reduce the risk of fires spreading should they come to the site in the future? The species were also laid out so that there will be a changing vista of colour through the seasons, for which Canberra is well known. There will be the strong contrasts of evergreens (conifers as well as broadleaved trees) with year-round colour, against the kaleidoscope of colour changes in deciduous trees as they pass through annual phases of spring flowers and new leaves through maturity to autumnal brilliance, and then the quietude of leafless winter branches.

Attention to detail is a hallmark of the design.

Each forest has a unique layout of trees with a story to tell and different experiences for visitors as they walk through them. Stories include the ginkgo forest (*Ginkgo biloba*), laid out in a pattern that was taken from that of the Forbidden City in Beijing, and the weeping snow gums (*Eucalyptus lacrimans*) planted in hexagonal patterns reflecting those of snowflakes.

The designers deliberately chose ‘monoculture’ as a prime basis for most forest patches, because they were so impressed when they did their initial site perusal, with their experience of walking through the two monospecific forests that survived the fires. The qualities of colour, trunk patterns, sound and smell of the mulch layers as they walked through, the patterns of branches and leaves against the sky as they looked up contrasted hugely between the cork oak (*Quercus suber*) and Himalayan cedars (*Cedrus deodara*: Fig. 2) that they wanted to recreate that experience for visitors with each of the forests. The size of most forest patches was chosen so as to make it possible for visitors to find themselves within a space where all they could see would be trunks of the one species.

There will be about 104 forests when planting is complete, though, as with any large garden, one can expect numbers to change through time as circumstances change. The idea of ‘100 Forests’ is not really an engineer’s concept of

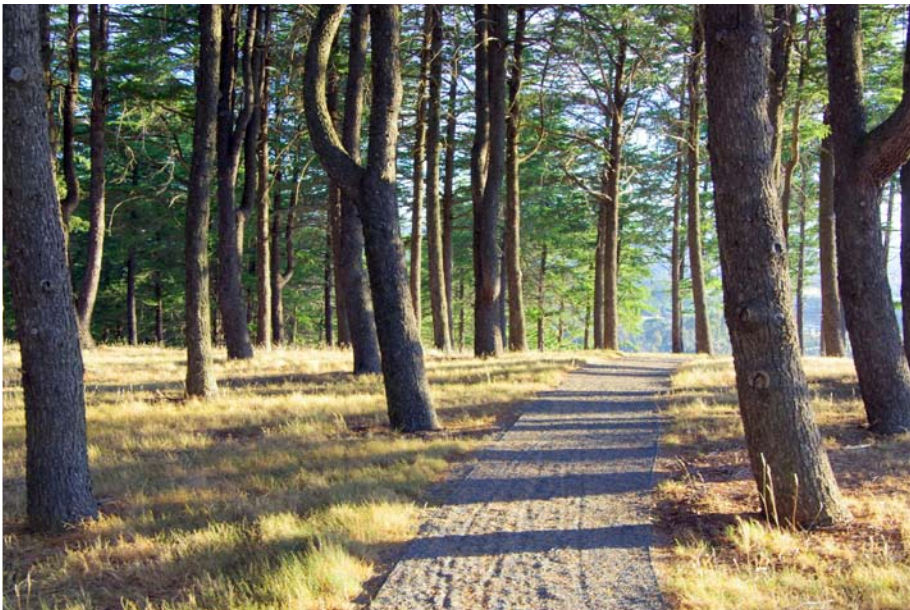


Fig. 2. The established stand of *Cedrus deodara* (NAC Forest 11) at the National Arboretum Canberra, 18 Dec 2012. The species is listed by the IUCN with the category Least Concern.

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mathematical precision; rather, remember that centipedes don't really have 100 legs for 100 different reasons.

122 species of trees are listed for the site. A few sites have more than one species, especially one Forest where 16 species of eucalypts native to the Southern Tablelands of NSW/ACT have been planted as part of a special conservation themed planting. There are 29 species of conifers, including several Australian ones (*Callitris*, *Araucaria*, and *Wollemia*: Fig. 3). Exotic conifers include *Cedrus*, *Cupressus*, *Metasequoia*, *Picea*, *Pinus*, *Platycladus*, *Podocarpus*, *Pseudolarix*, *Sequoiadendron*, *Taxodium* and *Widdringtonia*. About a third of the species are Australian natives. Amongst other plantings are an interesting assortment of genera that form the basis for telling the northern hemisphere equivalent to our southern stories of Gondwana – the Laurasian story. Here you have those biogeographic disjuncts every bit as spectacular as those we are so familiar with 'down here'. So there are *Magnolia*, *Liriodendron* and *Nyssa* to remind us of the complexity of past continental movements and their impacts on the biota of planet earth.

Conservation has been a prime concern in species selection. For all sorts of pragmatic reasons 100 species of endangered trees could not be sourced from around the world. Some countries would not release their valued and rare germplasm; in other cases obtaining



Fig. 3. *Wollemia nobilis* (NAC Forest 32), listed by the IUCN as Critically Endangered. Ph. R. Hnatiuk.

adequate seeds was simply impossible. Even war intruded on the posting of a packet of 1000 seeds from Lebanon. In the end, there are 42 species planted at the site that have endangerment ratings by the IUCN (e.g. Figs. 3, 4, 6). One is extinct in the wild, *Franklinia*

Fig. 4. The plantings of *Acer buergerianum* (NAC Forest 73). The planting includes two varieties of which var. *formosanum* is classified as Critically Endangered by the IUCN.

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alatomaha from the southern USA. It apparently occurred over just a hectare or so of land along the Alatomaha river. By the mid 1800s it could not be found in the wild and only survived because of seed collected early after its discovery by Europeans. The brilliant colour of its autumn foliage meant that it was in cultivation and that is now the only source of its genetic line. Land use change is principally believed to be the cause of its extinction – what is new?

The Arboretum also is the home of the National Bonsai and Penjing Collection of Australia. This project, which is a joint endeavour by the ACT Government and the bonsai community of Australia, presents some of the highest quality bonsai produced in Australia. Imported trees are not accepted, although offers have been made, simply because the important quarantine procedures protecting Australian agriculture would most likely cause the death of the trees. It is not ethical to put an organism that is over a hundred years old, through such a process where its death is likely, just so that a survivor might be displayed here. However, that limitation has not detracted from the amazing quality and diversity of trees on display. The feature attracts literally hundreds of people a day to see these small trees. There is also an Arboretum in Miniature being developed, where many of the full sized forests will also be represented in the Collection by their miniature versions, grown from the same stock as was

put in the ground.

Research is one of the key concepts underlying a functioning arboretum. At the NAC, the Australian National University has several forests that they are using to determine the responses of different eucalypts to a drying and warming climate. *Corymbia maculata* and *Eucalyptus tricarpa*, which have quite different water use strategies, are being grown and will be part of a complex experiment that controls access to water. There is also ‘citizen science’ being practiced at the site. Teams of volunteers are organised to record tree heights and diameters as the trees grow from seedlings through to mature trees. For many of the species, this is likely to be the first time that their growth has been formally measured, especially in the early stages of growth. Other citizen science projects include records of frogs, birds, and mycorrhizal fungi.

Many other features are already in the Arboretum too. The Village Centre is a magnificent architectural structure designed to blend in with the rounded hills of the surrounding landscape. It is constructed in the shape of an eccentric dome with shafts of light streaming through as if the veins of a leaf were penetrating into the roof. The dome rises some 12 metres above floor level and extends some 45 m across. Massive Tasmanian oak beams arc overhead, coming to rest just above a wide expanse of glass that allows amazing views over Lake Burley Griffin, many parts



Fig. 5. Friends tree planting *Allocasuarina verticillata* (NAC Forest 100). While the species is not threatened, it is a major food source of the Glossy Black Cockatoo, which is listed as vulnerable or endangered in three States.

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Fig. 6. Plantings of *Platanus orientalis* (IUCN category Least Concern, NAC Forest 53) on the rising hill slope; in tree guards in the foreground are *Podocarpus totara* (IUCN Least Concern) and *Sophora microphylla* (Forest 64), while the wedge on centre right has *Metasequoia glyptostroboides* (IUCN Endangered, Forest 54). Ph. R. Hnatiuk.

of Canberra and the hills beyond. The space can seat up to 500 people or accommodate nearly 900 standing. At the other end of the built scale is the intimate, Margaret Whitlam Pavilion. Seating only about 80 people, it stands proud on its promontory (Fig. 1). It too has spectacular views into the heart of Canberra and is designed for smaller events including weddings and meetings.

There are impressive and large public sculptures on the site already. One called *Nest III*, is modelled after a wedge-tailed eagle sitting on its nest. It stands at the top of the highest summit on the site, Dairy Farmers Hill. Made from found metal, mostly agricultural and marine, it is nearly life size with the nest reaching some 3.5 m across. The Hill also provides a vantage point for 360 degree views across Canberra and to the Brindabella Ranges.

The *Wide Brown Land* sculpture stretches some 35 metres across and 3.5 m high. It is sculpted in corten steel and follows the shape of Dorothea Mackellar's hand written manuscript of her now iconic poem *My Country*. She wrote this, as a 19 year old, when she was homesick while on a visit to England.

It is now 10 years since the inception of the new Arboretum, about 7 years from the first of the recent plantings, but 96 years since the first plantings. There are a few remnant eucalypts from time before. Visitors are thus faced with a diversity of landscapes, from just-planted, knee-high trees to dense forests of cork oaks and Himalayan cedars. Amongst the activities of the Friends of the National Arboretum (Fig. 5) is a diversity of guided tours from 20 minutes to 1.5 hours. There are also many kinds of self-guided tours available. While some people say they wish they would be here in 50 years when the seedlings have grown, I say to them, 'Don't you enjoy your children/grandchildren when they are small?' The National Arboretum is a source of great pleasure to all who visit now, and that enjoyment will continue, but change as the years pass.

There are so many more things to tell about this newest of the national features of the Capital city. But really, you need to come to visit it and take them in for yourself. You can find more information at www.nationalarboretum.act.gov.au


KeyBase update (still teaching them new tricks)

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In the December 2012 ASBS Newsletter we introduced and described our work on KeyBase (<http://www.rbg.vic.gov.au/keybase>), a new, web-based system for managing and deploying interactive, dichotomous keys. In this article, we describe our progress with the KeyBase application and with one KeyBase project – *Flowering Plants of Australia* – which aims to develop a complete dichotomous key to all species of flowering plants in Australia. We then describe some of the planned next steps with KeyBase and the *Flowering Plants of Australia* project.

Since we introduced KeyBase, we have redesigned the interface and added a score of new features. These include better access to KeyBase projects from the *Home* page, query boxes for finding keys (across the whole of KeyBase or within a one or more projects), and help and information pages. Principal new features are the *Select* and *Filter* features.

Select is used to add or remove taxa within a single key in KeyBase. It is accessed using the *Select* button  at the top right of the list of remaining taxa in the Key Player, or from the top right of the key's header when viewing a bracketed or indented key. Click on *Select* and KeyBase will present a dialog box with two lists, one of all taxa included in the key and one of taxa to be excluded from the key. Move taxa from the *Included* to the *Excluded* list, and KeyBase will remove the excluded taxa from the key, cutting its couplets down to suit. *Select* is particularly useful when using a long key in a situation where you are able *a priori* to exclude a number of taxa from the identification, or to check the key differences between a small number of taxa. For example, if you move all but a few taxa to *Excluded*, then KeyBase will give you a small key comprising the key separating couplet(s) for the remaining taxa. This is handy when you just can't quite remember the key difference between two or more taxa.

Filter is used to filter all KeyBase keys to a subset of taxa. Accessed via the *Filter Keys* link in the top right of the KeyBase header bar, *Filter* provides access to a page where you can

choose one or more KeyBase projects and paste a list of taxa to include in the filter. Consider, for example, that you are planning to key out one or more specimens collected at a particular locality. Keys for only the taxa known to occur at or near that locality will generally be easier and quicker to use than keys to all the taxa in Australia. KeyBase can provide filtered keys to relevant taxa if you can provide the list of taxa that occur at the site. A good way to do this is to use the *Atlas of Living Australia* or *Australia's Virtual Herbarium*. In the ALA you can use the *Species by Location* or *Mapping and Analysis* functions to retrieve a list of all taxa known to occur within a defined radius of a site or within a defined polygon or region. In the AVH you can upload a shapefile, if you have one, or select an IBRA region or local government area to retrieve a list of taxa for that region.

Once you have a suitable list of taxon names, paste them into the taxon list box on the *Filter* page and click *Create Filter*. KeyBase will check and filter all the keys in the nominated project, leaving only the keys and taxa that are relevant to your identification. Effectively, this creates a cut-down version of KeyBase for just the area you nominate, rather than for the whole of Australia.

Of course, filtering any information system (such as KeyBase) by geographic area is both powerful and dangerous. It's powerful because a key to a reduced, local set of taxa is easier to use than a key to all taxa. It's dangerous, however, because if the geographic filter falsely excludes some taxa that do occur at the site (e.g., poorly collected taxa or range extensions), any resulting filtered key may lead you astray. A solution is to use a relatively large area for the filter, and to carefully check the resulting identification against independent sources. A future solution may be for services such as the ALA to provide lists of taxa modelled to occur at a given location, rather than known to occur there. This will reduce the likelihood of false absences.

Currently, KeyBase includes six projects, the largest being the *Flowering Plants of Australia* project. Our plan for this project is to:

1. Upload the best available keys, published and unpublished, for flowering plants in Australia;
2. Edit all keys as necessary to make them current and consistent with the Australian Plant Census;
3. Track and list taxa for which there is no available key, and facilitate and encourage new keys to be written for these.

The following statistics give a good indication of what we've been able to achieve so far, in around 3 months of work since the project commenced:

- The project currently includes 1288 keys, including the *Key to Families* from the *Flora of Australia*, 169 keys to genera within families, 1067 keys to species within genera and 51 keys to infraspecific taxa;
- Together, 2304 genera and 12,228 species are represented in the keys;
- The APC currently lists 21,919 species in 2644 genera. Of these, 20,807 species are in 1532 non-monotypic genera (i.e. genera for which we need a key);
- The *Flowering Plants of Australia* project in KeyBase, hence, currently covers 87% of APC genera and 59% of species. 70% of genera that need a key have one in KeyBase.

Sources of keys so far are as follows:

- All published *Flora of Australia* volumes;
- Keys from revisionary treatments in all Australian taxonomic house journals and *Australian Systematic Botany*;
- Keys from the Floras of New South Wales, Victoria and South Australia in cases where all species in a genus occur in the State;
- Keys from some (but not yet all) unpublished *Flora of Australia* treatments (these are being loaded progressively as authors provide permissions).

Of course, uploading existing keys is only the first step. Once all available keys have been gathered, work will need to commence to:

- update keys with new taxa described since the key was published;
- update keys to reflect taxonomic changes (e.g. changed names, new circumscriptions) that have occurred since the key was published. The ultimate aim is to bring all keys into alignment with the taxonomy of the *Australian Plant Census*;
- write and upload new keys for those genera

for which there is no key.

In addition to this work on the keys in the *Flowering Plants of Australia* project, we will be continuing with KeyBase application development in the coming months. Planned enhancements (time permitting) include:

- *KeyBase editing environment*. Currently, new keys uploaded to KeyBase need to be written in an external application such as a text editor or the Lucid Phoenix desktop application. Similarly, editing a KeyBase key involves downloading the key, editing it externally and then re-uploading it. We plan to create an editing environment in KeyBase so these operations can happen on- instead of off-site.

- *KeyBase linkages with external nomenclators*. Currently, the *About* page for any key displays, amongst its metadata, a listing of all taxa in the key. It would be useful for those projects that aim to conform to an external nomenclator (such as the APC) to also list missing and non-matching taxa. For example, it would be useful for the *Flowering Plants of Australia* project if the *About* page for every key listed all taxa in the key, all taxa in the key that are not in the APC, and all taxa in the APC that are not in the key. These lists will provide an indication of the key's currency, and a useful reference point for maintaining the key in the face of changing taxonomy.

- *Virtual keys*. Some KeyBase projects (e.g. *Flowering Plants of Queensland*, *Flowering Plants of Tasmania*) provide regional (in these cases, state-based) keys. A virtual key will be a filtered key from a more encompassing project (in this case, the *Flowering Plants of Australia* project) comprising the taxa that occur within the region. Using virtual keys it will be possible to quickly populate a regional project with filtered keys derived from the broader project. In general, a filtered key may not be as good as a key written specifically for a given region, so any bespoke keys uploaded to these regional projects will mask or hide the matching virtual key.

All in all we believe that KeyBase is working well. More enhancements are planned, so watch this space. And please, feel free to register and contribute to KeyBase – it's a community resource, and the more contributors the better.

Typification of *Bedfordia* species (Asteraceae: Senecioneae)

Anthony E. Orchard

In 2004 I published a revision of *Bedfordia*, based on material then available to me. Subsequently I visited the herbarium of the Natural History Museum in Florence, the Muséum National d'Histoire Naturelle, Paris, the herbarium of the Royal Botanic Gardens, Kew, and that of the Natural History Museum, London. In each I discovered type material additional to that cited in my monograph. Other specimens are available via JSTOR®. The following summarises those discoveries, and should be read in conjunction with the original paper.

***Bedfordia arborescens* Hochr.**

The holotype of this name is in G, with a photograph at CANB. There is an isotype in L (1840).

***Bedfordia salicina* (Labill.) DC.**

The undoubted holotype specimen of *Cacalia salicina* Labill., the basionym of *Bedfordia salicina*, is in the Webb herbarium in FI (Webb 103152). This sheet has not only a printed Webb herbarium label confirming that it is ex herbarium Labillardière, but also has attached a draft description of the species in what appears to be Labillardière's hand. A second sheet in FI (Herb. Webbium 103153) lacks a collector or locality, but is probably an isotype. A third sheet in FI (Herb. Webbium 103154) is definitely an isotype. Other probable or definite isotypes are in at least five herbaria. The full list of types and probable types is as follows:

T: J.J.H. de Labillardière, Habitat in capite Van-Diemen, [SE Tasmania]; holo: Nova Hollandia, ex herb. *Labillardiere s.n.*, FI, Herb. Webbium 103152; iso: Nova Hollandia, ex herb. *Labillardiere s.n.*, FI, Herb. Webbium 103154; Van Diemen, *Labillardiere s.n.*, P710444, herb. Webb; Van Diemen, *Labillardiere s.n.*, P710445 herb. Maire, herb. Cosson; Australie. *Labillardiere s.n.*, P710446 fragment, herb. Richard, herb. E.Drake; Nov. Holl., without collector, n. 82, P698457, herb. Maire, herb. Poirét, herb Cosson; *Cacalia salicina*, BM895646,

herb. Labillardiere; *ibid*, GH66788 (fragment); *ibid*, (no collector or locality), K, herb. P.B.Webb, herb. Hooker (excl. Gunn specimen); Nov. Holl., *Labillardiere* 82, L1841 *p.p.* (excl. Gunn specimen); *Cacalia salicina*, without collector, FI, herb. Webb103151, herb. Desfontaines; possible iso: without locality or collector, FI, Herb. Webbium 103153; Nouvelle Hollande, Côte méridionale, Voyage aux Terres-Australea, Capitaine Baudin 1801, P; Nouv. Hollande, Voyage du capitaine Baudin 1804, NY162503. In addition there are in P a number of specimens attributed to d'Entrecasteaux which may also have been collected by Labillardière.

In FI (Herb. Webbium 103155) there is a proof sheet of Labillardière's tab. 179 from *Nov. Holl. Pl. 2: 37* (1806) with handwritten caption and numbering.

***Bedfordia linearis* (Labill.) DC.**

The undoubted holotype specimen of *Cacalia linearis* Labill., basionym of *Bedfordia linearis*, is in the Webb herbarium in FI (Webb 103148). This sheet has not only a printed Webb herbarium label confirming that it is ex herbarium Labillardière, but also has attached a draft description of the species in what appears to be Labillardière's hand. There is another specimen in the Webb herbarium in FI (Webb 103147, ex herb. Desfontaines), without collector, but bearing the name *Cacalia linearis*, which is probably an isotype, and a similar specimen in K (herb. Hooker, mounted with Gunn specimens) with just the name *Cacalia linearis*. A specimen in BM (895694) is an undoubted isotype, as is another in P (710443) with a printed label 'Nouvelle Hollande - Labillardière'.

In FI (Herb. Webbium 103149) there is a proof sheet of Labillardière's tab. 178 from *Nov. Holl. Pl. 2: 36* (1806) with handwritten caption and numbering.

Reference

Orchard, A.E. (2004) A revision of *Bedfordia* (Asteraceae), *Muelleria* 19: 81–94.

News

News from the West

Last spring, Western Australian Herbarium staff conducted a brief but productive collecting foray west of Woodanilling in the southern Avon Wheatbelt, targeting a group of small nature reserves that were botanically poorly known. Prior to this trip, only 50 specimens representing 37 species had been collected from these reserves. A single day of coffee-fuelled collecting provided a 10-fold increase in our knowledge, with more than 500 specimens gathered, representing more than 350 species. There were some interesting and noteworthy finds including a new species of *Leucopogon*, ten specimens of known undescribed species, new populations of several conservation-listed species, and range extensions for a number of more widespread taxa.

In addition to achieving some exceptional conservation outcomes, the trip was a great for staff morale as we shared knowledge, stories, an abundance of good food and some refreshing beverages around the campfire at our base at Kenmare Community Hall (Fig. 1). This was the first in what we hope will be a series of collecting expeditions, targeting areas under-represented in the state collection.

Changes to Western Australia's Department of Environment and Conservation

At the end of the current financial year, Western Australia's Department of Environment and Conservation (DEC) will be divided into two agencies—one to carry out environmental

regulation and administer the *Environmental Protection Act 1986* (the Department of Environment Regulation, or DER), and the other to be responsible for parks and wildlife while administering the *Conservation and Land Management Act 1984* and the *Wildlife Conservation Act 1950* (the Department of Parks and Wildlife, or DPaW). The Western Australian Herbarium will form part of the latter agency (see <http://dpaw.wa.gov.au/plants-and-animals/wa-herbarium>). The new FloraBase URL is <http://florabase.dpaw.wa.gov.au> whilst staff email addresses change to *Firstname.Lastname@dpaw.wa.gov.au*. Postal and delivery addresses for the herbarium remain the same.

Juliet Wege
Western Australian Herbarium

Wattle key updated

An update of the WATTLE key has now been deployed on the web at LucidCentral (www.lucidcentral.org/).

The update is called WATTLE2 and it includes 1223 taxa of *Acacia* sens. lat. that occur in Australia; this is 58 more taxa than in the 2001 version of WATTLE that was published on CD. WATTLE2 includes all formally described taxa of *Acacia* sens. str., *Acaciella*, *Vachellia* and *Senegalia*, together with phrase-name taxa and common hybrid entities where these exist in the public domain accompanied by a description.

Fig. 1. Left, Paul Gioia at Wingedynne Nature Reserve, making a collection as he only knows how—with coffee in hand—with coffee in hand. Right, Sue Carroll and Mike Hislop press their collections by sunset at Kenmare Community Hall. Ph. J. Wege



This interim edition of WATTLE ver. 2 does not include species profiles for the taxa. Moves are afoot to rectify this situation but in the meantime you can at least use the key.

When you click on “WATTLE Acacias of Australia ver. 2. By B.R. Maslin” at LucidCentral you will see that there are two options for playing the key:

1. Lucid Key Server Edition
2. Lucid Java Applet Player

Personally I prefer the latter. By clicking on “Use this version” for (2) an applet version of

the Lucid Player will be downloaded to your computer (at c. 760 kb this can take a few seconds to load); the Player will then run and remain active within your browser. If you close your browser you need to revisit the url <http://www.lucidcentral.org/> to reload the Player.

If you detect error in WATTLE2 please contact me because I plan to maintain the currency of the data and provide regular updates.

Bruce Maslin
May 21, 2013

From the Web

WONS funding in limbo

Australia’s Weeds of National Significance (WONS) programme, initiated in 1999 with 20 weeds considered to be among Australia’s worst, promoted a coordinated national approach to their control using funds primarily from the Commonwealth’s Caring for our Country programme. Strategic planning and implementation were overseen by a national coordinator and a steering committee for each species. In 2012 a further 12 weed species were added to the original list.

In May 2013, the Commonwealth government announced that the WONS programme would no longer be given priority funding (Web ref. 1) and its future is unclear.

Web ref. 1. www.abc.net.au/news/2013-05-16/wons-budget/4693566

Publication of the ICN (Melbourne Code)

The *International Code of Nomenclature for algae, fungi, and plants* (the Melbourne Code) was published on 20 December 2012

- in hardcopy as *Regnum Vegetabile* vol. 154 – see www.koeltz.com/product.aspx?pid=204604
- and online – see the International Association for Plant Taxonomy web page at www.iapt-taxon.org/nomen/main.php

The Melbourne Code, the ICN, replaces the Vienna Code, published in 2006 under the title *International Code of Botanical Nomenclature* (ICBN) and incorporates the decisions taken at the XVIII International Botanical Congress

held in Melbourne in July 2011.

The changes in the rules include provision for electronic publication and the option of using English instead of Latin for descriptions of new taxa, both of which came into effect on 1 January 2012, and the requirement for “registration” of new names of fungi, coming into effect on 1 January 2013.

Three sites for registration of fungal names

The Nomenclature Committee for Fungi (NCF) has recommended three repositories for fungal names as required under Article 42.1 of the ICN, starting 1st January 2013.

These are:

- **Mycobank** www.mycobank.org/ [on servers in Belgium and the Netherlands]
- **Index Fungorum** www.indexfungorum.org/ [on server at Landcare Research, New Zealand]
- **Fungal Names** <http://fungalinfo.im.ac.cn/fungalname/fungalname.html> [on server of the Institute of Microbiology, Chinese Academy of Science]

The announcement is contained in the mycological journal *IMA Fungus* 3(2): 44-45(2012) (see www.imafungus.org/Issue/32/03.pdf), while the official report by the committee was published in *Taxon* in February 2013 (Redhead & Norvell (2013)). A ‘Memorandum of Cooperation’ regarding the sharing of registration data has been signed.

Reference

Redhead, S.A. & Norvell, L.L. (2013) Report of the Nomenclature Committee for Fungi 19: Official

repositories for fungal names. *Taxon* 62: 173–4 (viewable at www.ingentaconnect.com/content/iapt/tax/2013/00000062/00000001/art00014)

The citation gap and its effects on taxonomy

Phil Garnock-Jones's plea for systematic papers to receive appropriate recognition had an airing in *Taxacom* recently (Web ref. 1, with two responses from the Taxacom list included). This is a topic we have covered before for ASBS (see *ASBS Newsletter* 136 (2008) 36–38). His plea is similar to most such articles, but unfortunately they seem to have little effect outside our discipline.

Web ref. 1: <http://theobrominated.blogspot.co.uk/2013/02/the-citation-gap-and-its-effects-on.html>

Compilations from the Linnean Society of London

While volumes of the Linnean Society of London are generally not available except to subscribers, free access is available to the following compilations ("virtual issues").

Alfred Russel Wallace (1823–1913)

To mark the centenary of the death of Alfred Russel Wallace the Society has produced an online issue of papers that have appeared in their journals (Web ref. 1).

Four of the papers at the Linnean Society site are by Wallace, although his greater work can be accessed through the more comprehensive Alfred Russel Wallace page (Web ref. 2) or website (Web ref. 3). The remaining 13 papers are more recent and have been written by some of the many authors inspired by Wallace's

ideas and his role in the history of evolutionary thought.

J.D. Hooker

A similar virtual issue was produced on the occasion of the centenary of J.D. Hooker's death (Web ref. 4), but those looking for mention of his time in Australia will find little coverage.

Monocotyledons

A further virtual issue (Web ref. 5) is the pre-conference publication relating to the 5th International Conference on Comparative Biology of Monocotyledons (Monocots V) being held in New York in July. It includes ten significant papers from the 19th to early 21st centuries to show how the study of monocots has been represented in the Society's journals and how this has changed over this period.

Annonaceae

While Annonaceae is not big in Australia, volume 169 issue 1 of the *Botanical Journal*, entitled the *Natural History of Annonaceae*, contains 11 articles on various aspects of the family (Web ref. 6).

Web references

Web ref. 1. [http://onlinelibrary.wiley.com/journal/10.1111/\(ISSN\)1095-8312/homepage/alfred_russel_wallace_virtual_issue.htm](http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1095-8312/homepage/alfred_russel_wallace_virtual_issue.htm)

Web ref. 2. <http://people.wku.edu/charles.smith/index1.htm>

Web ref. 3. <http://wallacefund.info/>

Web ref. 4. [http://onlinelibrary.wiley.com/journal/10.1111/\(ISSN\)1095-8339/homepage/joseph_dalton_hooker_virtual_issue.htm](http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1095-8339/homepage/joseph_dalton_hooker_virtual_issue.htm)

Web ref. 5. [http://onlinelibrary.wiley.com/journal/10.1111/\(ISSN\)1095-8339/homepage/monocots_virtual_issue.htm](http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1095-8339/homepage/monocots_virtual_issue.htm)

Web ref. 6. <http://onlinelibrary.wiley.com/doi/10.1111/boj.2012.169.issue-1/issuetoc>

Australasian Systematic Botany Society Inc.

Society for Australian Systematic Biologists

Invertebrate Biodiversity & Conservation

Combined Conference 2013

“Systematics without Borders”

Venue: University of Sydney

Dates: 1st–6th December 2013

For announcements see: www.systematics2013.org

Conference reports

3rd National Postgraduate Training Workshop in Systematics

Emma Lewis^a, Todd McLay^a & Megan Hirst^b

^aDepartment of Botany, University of Melbourne; ^bNational Herbarium of Victoria

The 3rd student workshop in systematics was held at The University of Adelaide on 16-21 June 2013 and was sponsored by the Australian Biological Resources Study (ABRS) as part of their 40th anniversary celebrations, and the Australian Centre for Evolutionary Biology & Biodiversity (ACEBB). As for the previous workshops held in 2008 and 2011, it was designed for postgraduate students in their first and second years that have a systematics component to their projects. The program, identifying the different needs of participants, comprised a range of specific and more generalised topics, covering methods in phylogenetic analyses, imaging techniques, DNA barcoding, next-generation sequencing, systematics theory, nomenclature and the taxonomic process, collection management, databases, publishing results, grant funding and job opportunities. The workshop also provided an opportunity to meet and network with other PhD students undertaking a wide range of projects. It was attended by 30 participants from 12 institutions throughout Australia and New Zealand.

The workshop was very rewarding, both academically and socially. The student short talks were a highlight for many as we were able to showcase our own research and hear what other postgraduate systematists were working on. As students of plant systematics, it was great for us to find that a large component of the group were fellow botanists (14 of 30, 15 if you count cyanobacteria as an honorary plant) which ensured there was plenty of lovely pictures of flowers and discussions about chloroplast markers. It was also interesting to hear about systematic research in animals. We learned a great amount on a diverse array of invertebrates, including sand-dwelling meiofauna, castle-building termites and house-pet tarantulas. The tours of the State Herbarium of South Australia and the South Australian Museum were informative and enjoyable, and we thank the curators of both for affording us a 'behind the scenes' glimpse of these great research institutions.

The social highlight of the week was the Wednesday night pub dinner where we had a chance to relax and get to know the other



Fig. 1. Mark Harvey from the WA Museum, one of the workshop presenters in his element! From left: Emma Lewis, Virginie Gaget, Tiffany Schenk, Ellen Hickman, Meg Hirst, Mark Harvey, Joey Gerlach

Ph. A. Austin

students and academics. A delicious lunch on campus marked the end of the workshop and provided us with a chance to exchange contact details and say goodbye to our new friends. In addition to the two workshop dinners, lunch and morning and afternoon tea were generously provided. Not only did this ease the financial burden on students, but it facilitated more time to socialise with fellow students and academics involved in the program (just don't mention the free muffins ever again!).

On behalf of the students we would like to thank

the staff and students of University of Adelaide for organising the week and making us feel so welcome on campus. In particular we would like to acknowledge Michelle Guzik and Andy Austin for organising the workshop. We would also like to thank the many gifted lecturers who gave their time to teach us and the generosity of the workshop sponsors. The Postgraduate Training Workshop in Systematics is an incredibly valuable experience for students and we hope it continues for many years to come.

Entertainment at the Society's 2012 Perth conference dinner

Juliet Wege

ASBS 2012 Perth Conference Committee

This report, intended as part of the conference proceedings, is included to show the levels to which an ASBS conference dinner can degenerate. A previous example was provided by the reviewer in this issue of the Taller Tree of Liff. He gave a memorable speech at the 1990 conference dinner in Canberra that severely tainted the developing aura of two of his colleagues through illuminating, though perhaps questionable, analysis of their field activities¹. Eds.

In an era of global delivery of information, e-publishing and ebook readers, rapid downloads and instant gratification, we decided to focus the conference dinner entertainment around the physical lure of books. Kelly Shepherd launched the *Taller Tree of Liff*, a resurrected,

¹ See: Advice for the over-educated. After -dinner talk at ASBS symposium *Indo-Pacific biogeography at the Crossroads* held in Canberra in August 1990. *Australian Systematic Botany Society Newsletter* 65 (1990) 20–25.

revised, expanded and retitled second edition of Brendan Lepschi's critically acclaimed *Tree of Liff* (Fig. 1). Alas, despite being regaled with many amusing stories, we never received any insight into who inspired his definition of *Lablab*:

herbarium botanists who don lab coats when doing work which patently does not require one, in the vain hope this will equate with 'doing science' and give them some much needed credibility).

I was fervently hoping to be able to read some passages from another book—a mythical Mills & Boon-style romance novel set in Western Australia in the 1970s or early 80s and featuring a botanist as the protagonist. This elusive botanical treasure has long been rumoured to exist and apparently features

Fig. 1. Passion pervaded the Conference Dinner: for the sumptuous meal and for botanical and literary wisdom at its more eccentric – but none could match the grab for the filthy lucre. Clockwise from lower left: John Hosking, Peter Jobson, Wayne Gebert, Bill Barker, Pina Milne, Barbara Briggs, Yumiko Baba, Brendan Lepschi, Wendy Thompson, Frank Hemmings, Pauline Ladiges.

Ph. R. Barrett



characters loosely based on reality. I (along with a number of my colleagues) have trawled dodgy book exchanges throughout Perth and the greater south-west region on our quest for this supposed tale of floral lust, ever hopeful of the botanical discovery of the decade. I've even scoured bibliographies of Australian romance novels only to be overwhelmed by the number of possibilities (e.g. *Hibiscus Heart*, *Granite Folly*, *Mistaken Identity*, *Desert Quest* and *The Girl at Saltbush Flat*, to name but a few).

It is perhaps fortuitous that this book has never been unearthed, for it led Ryonen Butcher to anticipate what such a book might sound

like, reading passages from her evocatively titled *Herbarium Heat*—a fictional account of the fractious relationship between Western Australian botanist Anita Grady (able to spot an interesting species through the car window at 100 km/hr) and cladist Jack Mallett:

Male, 1.8 m tall; trousers flared, shirt fitted, widely lapelled, tie wide. Indumentum dark, dense, sinuous. He was a magnificent specimen of a man. She tried to imagine him pressed to the sheet... From their nettlesome first encounter, love blossomed.

We were left breathless for more.

ABRS report

Flora of Australia

The latest volume of the *Flora of Australia*, Volume 26, has now been published. This volume describes 3 families - Meliaceae, Rutaceae and Zygophyllaceae - in all 61 genera and 588 species. Thirty three authors, illustrators and photographers have contributed to this volume, as well as numerous referees, librarians, herbarium staff and editors, and I thank them all for their work.

The book is available from CSIRO Publishing for \$170 hardcover, and \$130 softcover (plus postage).

Staffing

We farewelled Gail Kenmuir on June 19th, with the traditional, over-catered, ABRS morning tea. She will be much-missed, and we wish her well in the future. Many of you will have had contact with Gail from her work with the ABRS grants - all grant queries should now go to Sam Cocks. We also farewelled Vivek Vijayraghavan, who completed his graduate placement with Bush Blitz, and welcome in his place Daniela Binder, who will also work with Bush Blitz.

Grants

By the time you read this, I hope that the list of successful 2013-14 research grant applications will be available on our website at www.environment.gov.au/biodiversity/abrs.

Applications for the next grant rounds will open in August (Research grants), November (Churchill fellowships) and March (student

travel bursaries).

Bush Blitz Surveys

The final survey for the current Bush Blitz program took place in May at Henbury Station, south of Alice Springs in the Northern Territory. The property is owned by R.M. Williams and managed as part of Australia's National Reserve System. In addition to the scientific work, the survey hosted a successful pilot of the Bush Blitz TeachLive project. This project is being run in conjunction with Earthwatch Australia and the Australian Science Teachers Association and involved five middle school (years 5 to 8) science teachers working with scientists in the field. Teachers then used Skype and other online resources to "teach live" back to their classrooms from the field.

Since 2009, the Bush Blitz program has completed 17 species discovery surveys across all states; three each in New South Wales, South Australia, the Northern Territory and Western Australia, two each in Victoria, and Tasmania, and one in Queensland.

Bush Blitz symposium

Bush Blitz is hosting a symposium, *Adding to Australia's Biodiversity Picture*, on Tuesday 30 July at Old Parliament House, Canberra. This is a free event, and registration details can be found on the Bush Blitz website at: <http://www.bushblitz.org.au/>

Annette Wilson
Editor, *Flora of Australia*
June 2013

Book reviews

A reference and picture guide to the Sydney region's flora

Bort (Robert) Edwards

School of Biological Sciences, The University of Queensland, St Lucia

Native Plants of the Sydney Region from Newcastle to Nowra and West to the Dividing Ranges (3rd edition).

By Alan Fairley and Philip Moore.

Jacana an imprint of Allen and Unwin.

2010. 624 pp. ISBN: 9781741755718.

RRPAUD \$59.99 (soft cover).

<http://www.allenandunwin.com/default.aspx?page=94&book=9781741755718>

Native Plants of the Sydney Region is an attractive field guide and invaluable to anyone exploring the Sydney area (west of the Great Dividing Range between the Hunter-Hawkesbury divide and Nowra). While a stout 614 pages, this book is certainly preferable to hauling all four volumes of the *Flora of New South Wales* along for a walk. For a backpack or glovebox it is well proportioned and can be held with one hand, always useful in the field. Clever use of page space reduces bulk and allows easy comparison of related taxa, with text and illustration on the same page.

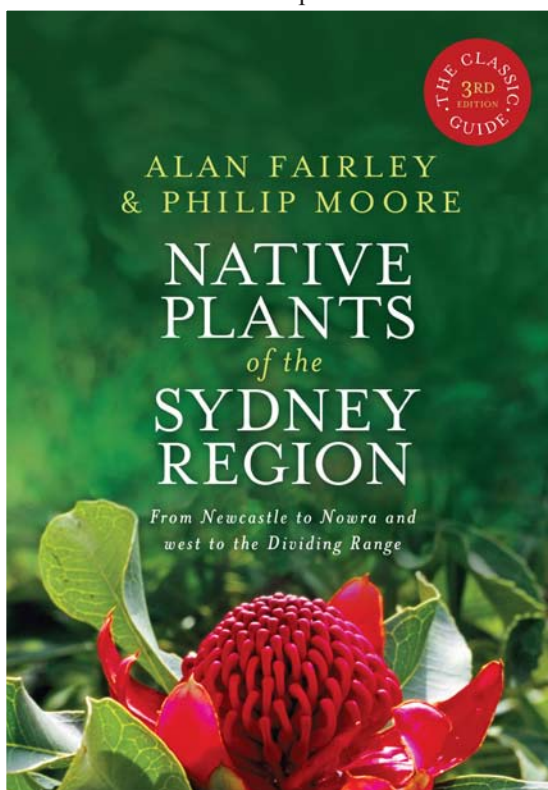
For the more experienced botanist, the brief species descriptions are concise and use familiar diagnostic language which, while potentially daunting to the uninitiated, is supported by a decent glossary. It is quite comprehensive including close to 1,400 species (omitting severely range restricted taxa) almost all of which are lavishly illustrated with clear, well-proportioned photographs. Keys are provided for some of the more difficult genera

(e.g. *Acacia*, *Eucalyptus*) and floral diagrams, used to clarify terminology, are useful for particular groups (e.g. simple and compound umbels in *Apiaceae*).

However, as with most comprehensive field guides where no master key is provided, *Native Plants of the Sydney Region* struggles when confronted by a specimen where the higher taxonomy is unknown to the user (for those experienced enough for this to not be a problem the need for a guide may well be moot in the first place). This will leave a novice user having to wade (un) systematically from front to back in the hopes of stumbling over an appropriate picture. Ordering groups by predominant colour of flowers, while a strangely discomfoting solution, may have been more scientific than the method employed, with the arrangement of families cheerfully described as:

those exhibiting features (character states) considered by botanists to be primitive are presented ahead of those considered advanced.

While it should be noted that ordering based on some vague concept of complexity and progression of evolution is not unique to this guide (see most bird guides) the interpretation of a directional evolutionary progression of characters, and thus the species that possess them, reinforces the frustrating (and sadly common) misinterpretation of phylogenies as



being “ladders of progress”. Early branching species-poor sister lineages are incorrectly deemed “primitive” or “ancient” despite co-occurring with, and experiencing exactly the same amount of evolutionary time as, their supposedly “modern” counterparts. Presumably no plants were consulted as to the perceived utility and ‘modernity’ of their character states, nor whether they had been transported forward or back in time.

The taxonomy itself claims to be “up to date” and revised from the previous edition. This is open to some debate (beyond the usual problem of any two systematists having three conflicting opinions), appearing heavily conservative and not up to recent speed in many areas. The framework follows a relatively unmodified Takhtajan and Cronquist model, with many changes in higher classification and generic boundaries ignored. For example Sterculiaceae is still recognised (generally considered obsolete, including in *NSW Flora Online*), as are the genera *Acmena* (now *Syzygium*), *Callistemon* (now *Melaleuca*) and the transfer of the majority of *Austromyrtus* to *Gossia*.

While taxonomic change always warrants specific consideration and even debate, many

changes (often precipitated by compelling molecular data) should be considered ‘best practice’. If anachronistic concepts are considered desirable or friendlier (to a readership expected to be conservative?), then the inclusion of alternative/preceding synonyms could be considered. Such transparency of the taxonomic process may in fact help break down some of the barriers to the acceptance and understanding of nomenclatural change in the broader community, as well as allowing users to update their mental taxonomy on the fly. In general, integrating field guides with current concepts in classification would benefit the sadly rare perception of systematics as a dynamic endeavour, rather than as an entrenched and concrete dogma.

Aside from these philosophical objections, the guide itself is very approachable. The introduction includes a handy few pages on general environments within the region, major vegetation types and a couple of broad maps. This book will appeal to a wide audience, from a ready reference for the serious botanist to an accessible picture guide for the casual bushwalker, and would make a perfect gift for anyone wishing to be introduced to the flora of the Sydney region.

In the (exact) footsteps of two Western Australian botanist-explorers

Tony Orchard

c/o Australian Biological Resources Study, Canberra, ACT

Explorers Routes Revisited: Roe Expedition 1836. *Compiled and edited by Lesley Brooker, Hesperian Press, Carlisle, WA. 2012, 162 pp. ISBN 978 0 85905 504 8. RRP AUD \$40 (soft cover)*

Explorers Routes Revisited: Clarkson Expedition 1864. *Compiled and edited by Lesley Brooker, Illustrated by Belinda Cale, Hesperian Press, Carlisle, WA. 2012. 130 pp. ISBN 978 0 646 58625 0 & 978 0 85905 546 8. RRP \$40 (soft over)*

*Obtainable only from the author, Lesley Brooker, PO Box 518, Kalamunda, WA 6926, for \$40 each (no GST), plus postage, or can be collected in Perth (phone 9293 4757).
<http://lesmikebrooker.com/explorer.htm>*

These two books will prove to be of great interest to taxonomists struggling to make sense of early Western Australian botany. They are part of a series which sets out to retrace, in as much detail as possible, the routes of the early land explorers. Others in the series published to date are on the Moore expeditions of 1836 and Drummond 1841-42.

As anyone who has worked on WA plants knows, it can be very frustrating to have to deal with a plant for which the only known distributional information is “Swan River Colony”. Unfortunately, there are many of these. Taxonomists need to relocate rare plant populations to obtain better material for study; conservationists need to locate populations to protect them.

The format in both books reviewed here is the same. The journals of the expedition members

are transcribed, day by day, this information is analysed and translated to modern localities, and the results mapped against current roads, hills, rivers and other features. The geographical nomenclature used by the 19th century explorers was of course, provisional, and much has changed. These changes are explained.

The amount of scholarship included in these accounts is incredible. The author and her husband have obviously travelled thousands of kilometres backwards and forwards across the explorers' tracks. They have climbed the same hills, admired the same vistas, found the same waterholes and campsites; in fact they have immersed themselves entirely in the subject. The literature research is equally impressive. For all persons named in the journals there is a brief biography, with details of when they settled in particular localities, any governmental positions held, details of their children and later descendants, and the later history of the properties. The derivation of place names is investigated in equal detail.

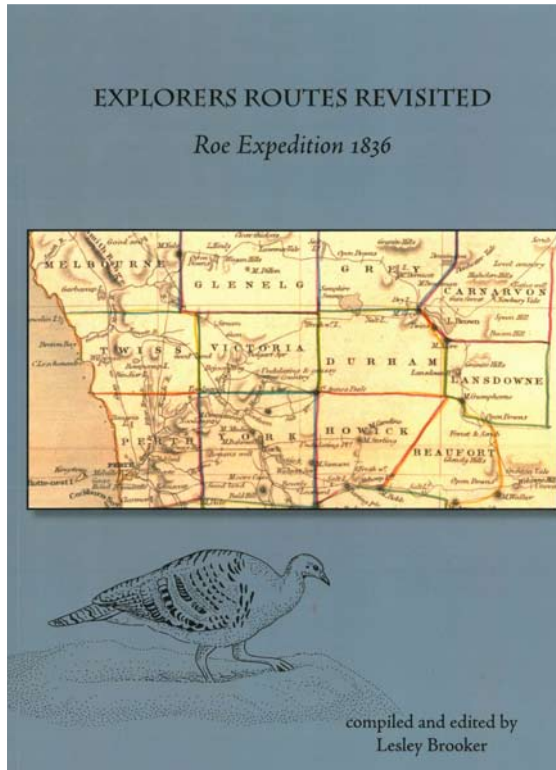
The books are heavily illustrated. I have already mentioned the maps, where each day's travel is plotted onto modern base maps showing roads and other features. As well as modern maps there are excerpts from older ones as well. In addition there are hundreds of colour photographs illustrating landscape features, waterholes, plants and vegetation, many carefully chosen to reflect an approximation of contemporary conditions. There are several Google Earth images. The books end with a number of appendices, summarising surviving collections from the expeditions, their identity, and probable dates and exact places

of collection. Other appendices summarise place names, their current equivalents, and derivation. The books are heavily referenced and well indexed.

So much for generalities. What of the two explorers and their expeditions?

John Septimus Roe was of particular interest to me because of his links with Allan Cunningham. Roe was born in Newbury, Berkshire, in 1797, seventh son of the Rev. James Roe and his wife Sophia. He received a good education, enabling him in 1813 to enter the Royal Navy as a midshipman. He studied mathematics and navigation at the Royal Mathematical School, Christ's Hospital, and in 1817 was appointed master's mate under Lieutenant Phillip Parker King of the New South Wales Surveying Service. The two arrived in Sydney in September 1817 in the *Dick*, with orders to complete

the survey of the northern and north-western coasts of Australia begun by Flinders nearly 15 years earlier. They were provided with the tiny cutter *Mermaid* and a crew. The King's botanist, Allan Cunningham, newly arrived in the colony, was added to the complement as naturalist. In 1818 the *Mermaid* undertook the first of three circumnavigations of the continent (1817-18, 1819-20, 1820), as well as a voyage to Tasmania, 1818-19. When the *Mermaid* was condemned, she was replaced by the *Bathurst* for a final survey voyage and circumnavigation in 1821-22. On this final voyage Roe fell fifty feet from the masthead to the deck (30 June 1821), suffering a head wound which later resulted in blindness in his right eye. Roe was promoted to Lieutenant in 1823, and in 1824 was involved in establishing a colony on Melville Island.



In 1829 he was appointed Surveyor-General of the new Swan River Colony. He conducted at least 16 expeditions over the next 40 years, until his retirement in 1870. He died at Perth in 1878, leaving 13 children. The 1836 expedition was inspired by George Fletcher Moore, who had heard aborigines at Fremantle talk of the “Molyean”, a body of salt water far to the east. Moore wondered if this was the long-sought-for inland sea and persuaded Roe to join him on an expedition to try to find it. The expedition left York on 5th October 1836, travelled 200 kilometres east, then 185 kilometres north-west to the vicinity of Belcubbin, 140 kilometres west to the Wongan Hills, then south to Perth. They did not find the Molyean, which was later determined to be part of the Salt River, which occasionally flooded extensively in the Caroline Gap region.

Roe probably learnt the rudiments of plant collecting from Allan Cunningham during the *Mermaid* and *Bathurst* voyages, but apparently only the rudiments. His collections generally bear no dates, and only the vaguest of localities (usually only ‘in the interior’, ‘Swan River Colony’ or ‘east of York’). A large proportion subsequently became types, so any information on their exact provenance is valuable. Brooker has identified 37 specimens, held in K and PERTH, which seem likely to have been collected on this expedition. Evidence supporting this conclusion (from known plant distributions, routes of other expeditions etc.) is given. The author has searched along the expedition route for these plants and has documented where they have been located (in most cases within a few kilometres of the route). This is valuable information.

In 1833 the Austrian Baron Charles von Hügel visited the Swan River and made Roe’s acquaintance. At that time Roe gave Hügel duplicates of some of his collections, and it is likely that he sent later material to Vienna as well. Hügel’s collections were studied there by Stephan Endlicher, and by Bentham, Fenzl and Schott. Other material found its way to Kew, possibly reflecting the link with Cunningham. Unfortunately, Brooker has only been able to survey the holdings of K and PERTH. The holdings in W still await a detailed study (there are however photographs of three W specimens supplied by Alex George).

The text in this book is heavy going in parts. As Surveyor-General, Roe had to make detailed maps of his route, which involved labelling every bump in the landscape (more or less). The text is liberally laced with references to “Hill a” through to “Hill z” which can get a bit tedious, especially as many still have no formal name. This is not a criticism of the book – the author is at pains to interpret this as best she can. They are a function of the type of expedition. More useful are quite detailed descriptions of the original vegetation, much of which has long since disappeared.

The Clarkson expedition was separated by a generation from that of Roe. Barnard Drummond Clarkson (1836-1909) was an Australian-born settler from Doodlakine, who was joined by another native-born settler, Charles Harper (1842-1912) and two or three others, in a search for pastoral land north-east of present Toodyay (then called Newcastle). The expedition left Newcastle on 27 June 1864, travelling to Doodlakine, then north-eastwards to Mount Manning and the Hunt Ranges, the Mount Jackson area and the Hammersley Lakes, before returning westwards through Wialki to Doodlakine and Newcastle. Both Clarkson and Harper kept diaries, providing two different viewpoints of the expedition. Harper collected a small number of specimens during the expedition. Fourteen of these have been located in MEL. Thirteen are illustrated with quality scans of the herbarium sheets. Most bear a collecting number and a latitude and longitude, but as the expedition’s calculations of longitude were mostly very erroneous, the author has calculated the correct data for each. I found this a much more readable book, due entirely to the fact that as a collection of narratives, rather than carefully compiled data on compass directions, unnamed hills, etc., it is much easier to visualise the day-to-day activities.

I hope it is clear that I am very enthusiastic about these books, and I trust the author and her husband can find the time, enthusiasm and resources to continue the series. The books have been reviewed here as a botanical taxonomic resource. However, I am sure they will be of great interest to a much wider audience, particularly those with an interest in so-called Australianiana. The books contain

a wealth of peripheral information on places and people in the first decades of European settlement in Western Australia. They are well-written, extremely well-illustrated, and thoroughly researched. They are stoutly bound and on good quality paper. It seems churlish to make any criticism, and the following notes are negligible. Proof reading has in general been meticulous. I found only a handful (c. 5 in 300 pages) of minor typographical slips. Colour saturation in several of the colour photographs was a bit overdone, giving a somewhat garish

appearance to some pages, but mostly the illustrations are good to excellent. In the Roe book the specimens are described as being in either K or PERTH, but unfortunately it is often not clear which are in which herbarium. These small blemishes are, I repeat, of little consequence.

The books deserve a place in every botanical reference library, and in the libraries of enthusiasts everywhere who appreciate good historical natural history research.

A British freshwater algal Flora – an aid to identifying our own flora

Michelle T. Casanova
Royal Botanic Gardens, Melbourne

The Freshwater Algal Flora of the British Isles: An Identification Guide to Freshwater and Terrestrial Algae (2nd Edition). Edited by David M. John, Brian A. Whitton and Alan J. Brook. Cambridge University Press, Cambridge. 2011
896 pp. ISBN: 9780521193757. RRP AUD \$255. (hardback plus DVD)
<http://www.cambridge.org/9780521193757>

Why don't more people get interested in looking at phytoplankton, and algae in general? The diversity of morphology and metabolism is enormous; many of them are as pretty as flowers and there is a thrill in accessing a world of beauty and life that is not available to everyone. Most students are introduced to microalgae in their text books, but it probably takes a good, passionate, teacher to switch students on to fascination with the group. The trouble is that there are fewer and fewer algal experts, and fewer of them teaching these days. So far as I know, in the whole bush-blitz program only one set of phytoplankton samples were collected and identified; this, despite the fact that the biodiversity of algae probably outweighs the diversity of all the other groups put together (including the insects!). Identification of microalgae (actually, any algae) is difficult for the novice. Knowing how to collect, how to process and how to preserve is the stuff for hands-on workshops, and then when you get a drop of water under the microscope for the first time, you won't necessarily know what to look for. I've seen many students spending time looking at bubbles, or 'grunge', trying to work out which species of chlorophyte or

diatom it might be. The first clue will be that the living things will be coloured (often green), sometimes moving, and that they will have a regular sort of structure (and then you find some *Botryococcus* looking just like brown 'grunge'). It is hard enough with a tutor, so what value could there be in a book?

Well, the new edition of the British algal flora by John, Whitton and Brook is very good. For a start it looks good. Quality production, beautiful cover, lots of pictures, coloured and line drawings. It comes with a DVD as well, with literally hundreds of photographs of algae and some really useful discussion in pdf format. The introductory chapters of the book are a breath of fresh air, with field methods and diagrams of home-made apparatus for collecting and concentrating algae. Lab methods for observing, counting and preserving samples are all very useful. These chapters are written by people who have done a lot of collecting, done it for fun, and have been meticulous about it. Advice about what to do when you get home (don't let the *Daphnia* eat all the interesting things; look at the small and delicate things first because they die under the intense light of a microscope) is really practical, and comes from probably centuries of accumulated experience and fascination with algae. Because I've been looking at algae for a while I know about tapping the coverslip to move the cells around gently, but I've never seen it written as an instruction before. I'm impressed by the practicality of the text. I can only suppose it comes from the 'amateur' influence. A lot of natural history had an amateur beginning in the British Isles, and it appears the amateur influence continues to this

day. Some of the fantastic photographs were taken by an 'amateur'. This contrasts markedly with the essentially 'professional' approach to phycology in Australia. If people aren't paid to do it here, then often, it doesn't get done.

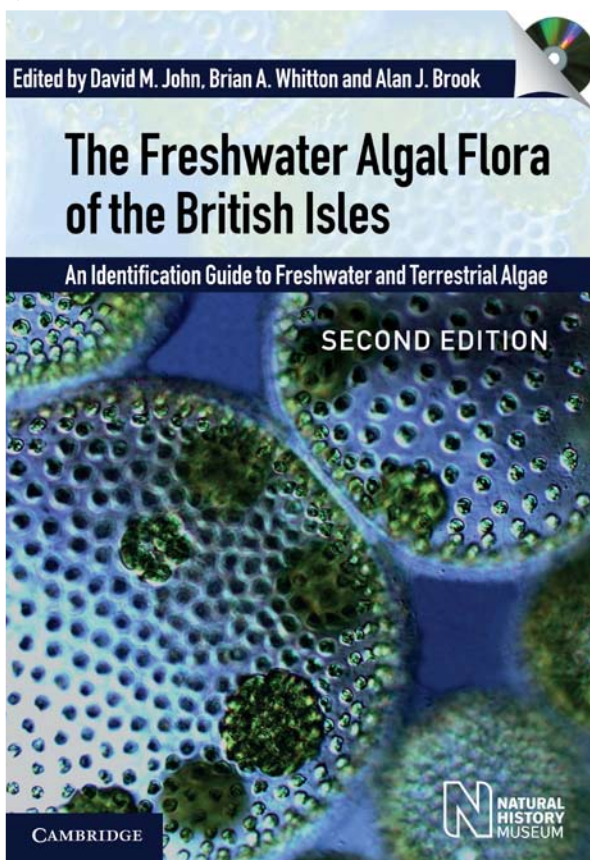
The rest of the book is divided into taxonomic chapters, dealing with each group of the algae by phylum. I could complain that there is a lack of recognition of the latest phylogenetic approaches (Streptophyta is nowhere to be seen) but, really, identification of algae is not necessarily enhanced by reference to the morphological details and processes that define the phylogeny of the algae. It is sufficient that there is recognition of the interrelatedness of groups due to sequential endosymbiotic events and that the relationships are generally recognised in the taxonomic treatments.

To see how useful the keys were for identification of algae to species (or as far as I could go, given the likelihood of a different flora in Australia as compared to the British Isles), I sampled some local lake water. I can't really comment on the use of the Key to Phyla because I'm familiar with the phyla, and at this level the colour (presence of particular pigments) and number of flagella, and direction of the flagella are important characteristics. Some groups are made up of quite diverse members (e.g. the Cryptophyta whose key entry says "Cells brown, blue, blue-green, red, red-brown, olive green or yellow-brown") which makes allocation to a phylum an exercise in faith, rather than recognition. My sample had some cyanobacteria, and the chapter on cyanobacteria quickly separated them into

four orders and, since mine had heterocysts but no branches, they were in the Nostocales. I found the page quickly because the left-hand page running title gives the phylum:order of species on that page and the right-hand page gives the genus. I could recognise that my specimen was in family Nostocaceae, but then it is possible to get lost. I can't find a key to the genera and the treatments get stuck into a description of the first genus (arranged alphabetically:

Anabaena) and a species key (in genera where there are more than a couple of species). So I used my copy of Baker and Fabbro (1999) where it keyed out to *Nodularia*. Two species of *Nodularia* in the British Isles, and my material doesn't really fit either. No drawing, but a photo on the DVD of *N. spumigena* (which also occurs in Australia) which didn't help much. Well, it could be something that doesn't occur in the British Isles, and cyanobacteria are really difficult, so I'll give them the benefit of the doubt.

A skinny desmid was also present in my sample. Already I know it is in Chlorophyta, and the phylum key gets me there, but only if you consider motility to be a consequence of flagella. My desmid was gliding about on the slide. Not a diatom because it didn't have a siliceous wall, and the bright-green chloroplasts on either side of a central clear area are a give-away. The key in Chlorophyta takes me to desmids right away, but the desmid key makes a difficult start, making me decide if the cells are cylindrical or oval in apical view. My specimen is long and thin and there is no way it's going to turn on its end, no matter how many times I tap the slide.



Keying it out both ways leads me to conclude they must be cylindrical in apical view and I find I have a species of *Closterium* (go to page 632). Actually *Closterium* starts on page 616, it finishes on page 632, but that's okay because I just flipped back to the start of the genus. The key to species is straightforward and my *Closterium* keys out to either *C. kutzingii* or *C. setaceum*. A quick check of Day *et al.* (1995) reveals that both those species have been recorded for Australia and for Victoria. Measurements and reference to the DVD (lots of photos and measurements to confirm) make me happy to call it *C. setaceum*. Success! And I did it myself, without having to send a photo to Algae-L.

In my specialist group (the Characeae) *The Freshwater Algal Flora of The British Isles* provides an excellent pictorial glossary on the DVD, a good key and species descriptions, although I'd like more detail in the illustrations in relation to end-cell characteristics and whorl morphology. I am a bit fussy, but I'm in the midst of producing my own illustrations for the treatment on Australian Characeae. I won't make you suffer through my inexpert attempts to work out the other species in my sample, but I think I'm a reasonable candidate to try it out, even though I've been looking at freshwater algae for at least two decades. This book is a great deal better (hugely better) than anything else I've been trying to use for general algal determination (except asking an expert with

30-40 years of knowledge). I can find species names, and now, using the web, I can check and confirm my determinations without trying to access a whole lot of extremely old literature (in German, Swedish, French or Latin), or doing a pic-flip to get to the closest thing.

I probably haven't expressed it well, but I LOVE this book, despite it's (and likely my) shortcomings and I'll be using it a lot in the future! If anyone else wants to identify algae to species, I don't know how you'll go, because I use a lot of my experience to lead me to reasonable answers. However, if this book doesn't help, nothing will. It will be a long time before we can produce a similar species-level treatment for the whole algal flora of Australia, we just don't have the expertise, financial resources or enough keen amateurs to get it done. In the mean-time *The Freshwater Algal Flora of the British Isles* will be sitting right beside my microscope (oh dear, I need a bigger desk).

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- Day, S.A., Wickham, R.P., Entwisle, T.J. & Tyler, P.A. (1995). Bibliographic check-list of non-marine algae in Australia. *Flora of Australia Supplementary Series* 4: i-vii, 1-276.

A top of the range field guide to Australian tropical rainforest fruits

John Clarkson
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Australian Rainforest Fruits: a Field Guide. By Wendy Cooper with illustrations by William T. Cooper. CSIRO Publishing, Collingwood, Victoria. 2013. 272 pp. ISBN: 9780643107847. RRP AUD \$59.95 (paperback).
www.publish.csiro.au/pid/6968.htm

If the 616 page, 2004, Nokomis edition of *Fruits of the Australian Tropical Rainforest* is likened to a Rolls Royce, then this 272 page, CSIRO version, *Australian Rainforest Fruits: a Field Guide*, is a Toyota LandCruiser, and a top of the range model at that. I can't imagine anyone who would be tempted to pack the

Nokomis edition for a day's rambling in the rainforest but here we have 504 illustrations from that magnificent tome perfectly formatted for use in the field. To the untrained eye which, by the way, after a career working primarily in savannah woodlands, grasslands and heaths, I can probably lay claim to, rainforests can be frustrating places to work. Except in some depauperate dry rainforests, leaves and flowers are often well out of reach. Only when fruit is strewn on the ground beneath fruiting trees is there a chance to easily collect material which can aid identification. Producing a field guide which works with rainforest fruit makes perfect sense to me.

Readers who use any of the common field guides to Australian birds will feel perfectly at ease with this book. Each species entry comprises an illustration of one or more fruits in full colour together with a seed or seeds or a cross-section of a fruit, or both. A scale bar at the bottom of each page indicates how each drawing relates to life size. On the facing page, a short 4-6 line description is given of the fruit, plant habit, leaves, key features and distribution. The eclectic mix of key features serves to indicate how well acquainted the author of

the text is with each plant in the field. Consider the description of the fruit of *Fagraea berteriana* (p. 120) where the skin is described as “peeling off the fruit in a sheet like cellophane”. A small line drawing of a leaf or leaflet gives a basic indication of venation and, for most species with simple leaves, the arrangement of leaves on the stem. For species with compound leaves, a second small drawing shows the arrangement of the leaflets within the compound leaf but unfortunately no indication of the leaf attachment. The Australian mainland distribution, derived from specimen data from AVH, supplemented by data from ATH and BRI, is depicted in a small outline map. The common name and plant family complete what is a perfect exercise in packing an awful lot into a small space.

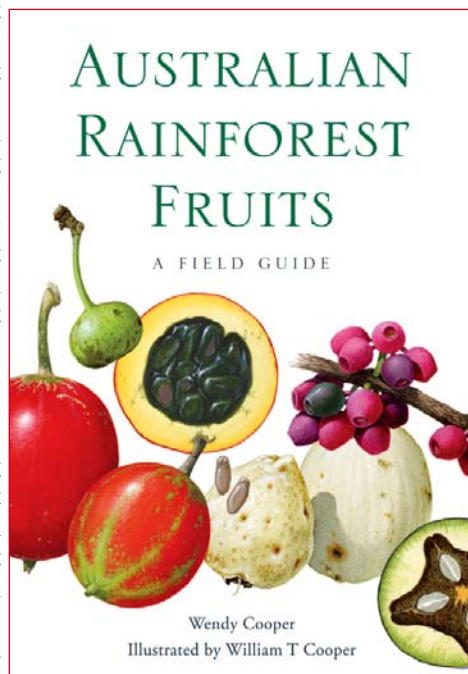
Species are arranged by colour of the mature fruit, then by size and fruit type. A handful of species like *Syzygium tierneyanum*, where the mature fruits can be red or white, and *Diploglottis campbellii*, where the aril can be red or yellow, appear twice. Users who are not intuitively lured to the appropriate section of the book by the coloured tabs on the margin of each page are guided there by a short key which, not surprisingly, relies heavily on colour. Even those with no botanical experience will find it easy to use. However, I suspect most users will plough right in and not

even notice this key or for that matter the one page introduction that explains how to use the book, provides a warning not to eat the fruit, and, more importantly, explains why some genera are assigned to families which differ from those in *Fruits of the Australian Tropical Rainforest*. Species in the Nokomis edition are arranged alphabetically by family so readers who flip from one book to the other might find themselves confused at times.

A checklist is provided to rainforest fruiting [sic] plants (excluding orchids) from eastern Australia. Species from far north Queensland to Victoria are included although the geographic range of the species included in the book extends to the Northern Territory and Western Australia. The list appears to be fairly comprehensive although I note *Rhodosphaera rhodantha* discussed on page 134 is missing. I am pleased to see grasses and sedges, two families often overlooked by lovers of rainforest, included. The list however might have been improved by highlighting, in some way, those species included in the text. This would have

served to alert users to closely related, and perhaps visually similar, species which are not illustrated. There is no way a hard copy book could include all known species and remain a field guide, so there is always a risk that users may be tempted to accept the closest match found as the identity of an unknown. I'd suggest one way around this would be to buy a copy of the larger, and more inclusive, *Fruits of the Australian Tropical Rainforest* and use this as a final check when you get home.

A glossary of technical terms is included but, as the use of these has been kept to a minimum, it has only been necessary to include less than 2 dozen words - a good sign in a book largely directed at non-botanists. However, with plenty of space available, it might have been worth



defining calyx and receptacle both of which are used in the key (p. 1) where their presence or absence is used to split black or blackish drupes and berries.

Faced with well over 2,000 illustrations from the Nokomis edition, it must have been a challenge for the authors to choose which species to include in this field guide or, perhaps an even bigger challenge, which to leave out. With the authors based on the Atherton Tablelands in Far North Queensland, it is perhaps not surprising to see that about 90% of the 504 species included are to be found in the area between Cooktown and Cardwell, about 40% occur south of Rockhampton, but south of the Queensland/New South Wales border this falls to just 26%. West of the Queensland/Northern Territory border it is less than 23%. I'm not grumbling because I live in the 90% area but surely this is an argument for a series of regional-based guides. However, perhaps the market for such books in Australia is not big enough and the resulting small print run might price the book beyond potential buyers.

Proof reading appears to be of an exceptionally high standard. I found very few errors; *Alphitonia petrei* instead of *Alphitonia petriei* (p. 185); *Syzygium hemilampra* subsp. *hemilampra* instead of *Syzygium hemilamprum* subsp. *hemilamprum* (pp. 210, 211, 265); *Pleomele* referred to Dracaenaceae in the text (p. 80) but to Asparagaceae in the rainforest checklist (p. 217); *Mackinlaya* referred to Apiaceae in the text (p. 16) but to Araliaceae in the rainforest checklist (p. 214); *Cochlospermum* referred to Malvaceae in the text (p. 204) but to Bixaceae in the rainforest checklist (p. 218); and *Ficus henneana* (p. 234) in the rainforest checklist rather than *F. superba* var. *henneana*.

Niemeyera antiloga appears twice in the index (p. 262), once out of alphabetical order. The author has attempted to link the name which appears in this book with that used in *Fruits of the Australian Tropical Rainforest* and I could find only one example where this has not been done. The synonym *Orites megacarpus* should be listed under *Nothorites megacarpus* (p.194). To have so few errors when dealing with so many plant names, is an outstanding effort.

Only one thing about this book disappoints me but I know it is something which was totally beyond the control of both the author and the artist. Once again we have a CSIRO publication, that relies heavily on imagery, poorly served by whoever is responsible for the quality of the colour plates; a point I made when reviewing Nick Ramanowski's *Wetland Plants (ASBS Newsletter 152:27-29)*. Anyone familiar with the magnificent illustrations in *Fruits of the Australian Tropical Rainforest* would immediately recognise that the quality of the reproductions here falls short of that standard. At first I thought this might have been an artefact of the scale-reduction but even images reproduced at original size are similarly afflicted. But let's not dwell on that. If you are not fortunate enough to own a copy of *Fruits of the Australian Tropical Rainforest* you would probably marvel at the quality of the images here and be none the wiser. If you don't own a copy, then I hope *Australian Rainforest Fruits: a Field Guide* entices you into buying one. You need both and for good measure in this book from CSIRO Publishing you get illustrations of 24 species not included in Coopers' earlier rainforest fruit books (Table 1). Anyway, doesn't every well-equipped garage need a workhorse parked beside the Rolls?

Table 1. The additional 24 species in *Australian Rainforest Fruits: a Field Guide* not illustrated in *Fruits of the Australian Tropical Rainforest*.

Anacardiaceae	Monimiaceae	Sapindaceae
<i>Rhodospaera rhodanthema</i>	<i>Endressia wardellii</i>	<i>Diploglottis bernieana</i>
Annonaceae	<i>Palmeria hypotephra</i>	<i>D. campbellii</i>
<i>Meiogyne hirsuta</i>	Moraceae	<i>Guioa montana</i>
Costaceae	<i>Ficus coronata</i>	<i>Rhysotoechia florulenta</i>
<i>Costus potierae</i>	Myrtaceae	<i>Sarcopteryx stipata</i>
Cunoniaceae	<i>Syzygium bamagense</i>	<i>Toechima dasyrrhache</i>
<i>Davidsonia johnsonii</i>	<i>S. buettnerianum</i>	Sapotaceae
Ebenaceae	<i>S. crebrinerve</i>	<i>Pouteria xerocarpa</i>
<i>Diospyros</i> sp. (Swipers Flat)	<i>S. moorei</i>	Winteraceae
Elaeocarpaceae	Podocarpaceae	<i>Tasmannia</i> sp. (Mt Bellenden Ker)
<i>Elaeocarpus hylobroma</i>	<i>Podocarpus elatus</i>	
Meliaceae	Rutaceae	
<i>Synoum glandulosum</i>	<i>Citrus australasica</i>	
subsp. <i>glandulosum</i>	var. <i>australasica</i>	

A book for aspiring botanical artists

Rod Seppelt
Australian Antarctic Division, Kingston, Tasmania

Exotic Botanical Illustration with the Eden Project. By Meriel Thurston and Rosie Martin.

Batsford an imprint of Anova Books, London. 2012. 144 pp. ISBN: 9781849940313. RRP AUD \$34.99
<http://store.anovabooks.com/9781849940313-exotic-botanical-illustration.html>

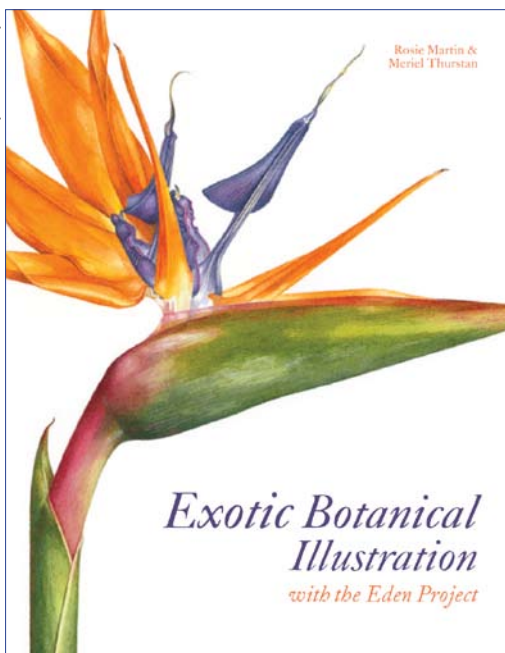
In his foreword to the volume the Chief Executive of The Eden Project in Cornwall states: "...the work of botanical artists is based on the revelation that science and art stem from the same root – observation." To this I would add – careful and accurate observation.

The book is written and illustrated by Rosie Martin and Meriel Thurstan, two highly accomplished botanical artists "...whose greatest gift is the encouragement of others through the sharing of their talents." This is far more than a collection of exquisite paintings of "exotic" flora grown in the superb conservatories of The Eden Project in Cornwall, England.

The book is based on the authors' botanical art classes at the Eden Project. As such, the highly accomplished illustrations take on a somewhat secondary role to the primary emphasis of the book – an informative instruction manual for the botanical artist. The rich colour palette of the subject plants provides a huge array of significant challenges to the artist, not just in the form of leaves, flowers and their colours, but in the faithful rendition of both form and colour.

I have recently also had the pleasure of

reviewing a second superb book on Botanical Art. In both, the diversity of subject material demonstrates a wide range of plant subjects, from the mundane (but not necessarily simple), like vegetables and fruit, to the highly complex like open pine cones, fern crosiers, the spider lily (*Hymenocallis*), to give just a very few examples. So, what is so special about this volume?



The book is not so much about The Eden Project. Rather, it is a wonderful textbook of the art and technique of botanical artistry. The plant subjects take on a secondary role to the primary value of the book – a botanical art textbook with a very clear emphasis on colour.

More than half the pages are devoted to a study of colour: its composition; primary, secondary, tertiary, and complementary colours; colour selection; experiments in constructing a range of colours; and techniques in using colour. An understanding of colour

is fundamental to both this book and to any artist.

A brief introductory section discusses paint quality and selection, studio lighting, keeping material fresh, tools and materials. While the application of paint is a classical and traditional art, the unashamed use of technological aids, such as mirrors and lenses, have long been used to assist the artist in producing a faithful rendition of the subject. The use of digital imagery to record detail and ephemeral features is also briefly discussed and encouraged.

A concession to artistic license is given in the discussion and examples used in a chapter on composition, "the placing of your subject on the paper in a way that makes your illustration

attractive to the viewer.” As the authors add, “There is ... no point in making a painstakingly accurate record of a plant if the viewer’s eye passes quickly over it.”

A short section discusses drawing techniques: putting a three dimensional subject onto a two dimensional surface; techniques for detailing surface shape and patterns; tonal variation using pencils; structural drawing and scales.

Central to the success and value of the book are around 40 pages devoted to understanding and using colour. A landscape artist once told me that her palette consisted of only seven colours, and black was conspicuously absent, since in nature there is no true black. It was therefore pleasing to find, in this book, instructions on how to construct black and gray shades using primary and complementary colours. A limited colour palette may seem constrictive. However, as is so capably shown in the book, with just six primary colours – cool and warm yellow, red, and blue, supplemented with only three others

– a violet, rose, and Sap Green, - almost any colour can be produced in a plethora of shades.

A further 20 pages are devoted to demonstrating a variety of techniques to develop patterns, textures, washes, surface bloom and sheen, contrasting highlights and lowlights, and the use of coloured pencils. The final 40 pages demonstrate the results of mastering the use of colour and technique to produce beautiful images of, as the book title suggests, “Exotic” plants.

This is one of the most useful books I have come across that deals with the artistry of botanical colour illustration – not just for the beauty of the completed works, but for the emphasis on theory and the understanding of the theory behind producing a coloured work of exquisite beauty. Its real value lies in the emphasis on mastering colour and techniques and the book should be on the bench, not the shelf, of every aspiring botanical artist.

Liff is hard, so laugh even harder

David Morrison

Swedish University of Agricultural Sciences, Uppsala, Sweden

The Taller Tree of Liff. By Brendan Lepschi. Over Educated Publications, Canberra. 2012.

32 pp. RRP AUD \$5 (paperback), postage costs vary.

Available from the author: Australian National Herbarium, Centre for Australian National Biodiversity Research GPO Box 1600 Canberra ACT 2601.

Email Brendan.Lepschi@csiro.au

In the middle of 1982, a couple of poms named Douglas Adams and John Lloyd rented Donna Summer’s beach house in Malibu (Los Angeles) and sat on the sundeck to write a book. In this book they tried to connect the contents of a gazetteer with all of the concepts that should be in a dictionary but are not because they don’t yet have a name. When *The Meaning of Liff* was published the next year it became rather successful and was reprinted regularly over the next few years. Therefore, over Christmas 1988 they sat down on the sundeck of a beach house in Palm Beach (Sydney) to expand this book into *The Deeper Meaning of Liff*, which was

just as successful when it was finally published in 1990.

Sitting in the town of Canberra, a location well known for its complete lack of beach houses, a young man named Brendan Lepschi looked on enviously and decided that three could play at this game. Sadly, not having the same quality of literary agent, or a collaborator to offer sage advice, Brendan chose *The Kew Index* rather than a gazetteer, when trying to find names for his list of as-yet unlabelled concepts. As a result, he entirely failed to meet any sun-tanned celebrities while writing his book.

Nevertheless, in the limited world of plant systematics *The Tree of Liff* (Better Than You Productions, 1997) was a success, even earning a positive notice in *Taxon* (Rudolf Schmid, 47: 534-535, 1998), as well as in the *ASBS Newsletter* (Alex George: 92: 32, 1997), and going through five printings.

Brendan is now 15 years older and 15 years wiser. Undeterred by his utter failure to overlook the azure waters of the Pacific while writing, he has now released the “resurrected,

revised, expanded and retitled” second edition of his book, *The Taller Tree of Liff*. As before, it provides “words for the various situations, objects and experiences encountered by botanists in their rich and exciting daily lives.” The main difference this time is that: “A few definitions from the previous edition have been omitted [and] ... To make up for the shortfall, some 35 new definitions have been added to this edition”.

Brendan’s book is thus required reading, in the same way as the *Macquarie Dictionary* isn’t. That is, Brendan’s book is entertainingly readable, unlike most other lexicographical tomes. It is shorter and funnier than any comparable phrase book, in almost any language. Learning a language would be a pleasure not a chore, if all lexicons were like this one.

Actually, the idea that there are things in the world for which there are, as yet, no names crosses cultural as well as scientific boundaries. For example, most Western countries are full of people who live together as husband and wife and yet are unmarried. A man cannot refer to such a woman as his “partner”, because that sounds too much like a business arrangement, nor can he refer to her as his “girlfriend”, because many husbands have one of them as a well as a wife. Swedes long ago decided to resolve this issue by creating a new word. The Swedish expression for cohabitation is “samma boende”, usually shortened to “samboende”. The man thus refers to the woman as his “sambo”. Inexplicably, this useful word has not yet caught on in the English-speaking world.

This example is relevant to this review because Swedish is a language that readily uses

compound words for new concepts. Modern English is not such a language, and thus it is necessary to steal words from elsewhere, instead (e.g. cul-de-sac, barramundi, dollar, muesli, moped, and cider). Hence the absolute necessity for books like *The Deeper Meaning of Liff* and *The Taller Tree of Liff*.

Mind you, the title of Brendan’s book is not quite as original as the author would have us believe. For example, I find that in manuscript no. 283 in the Bodleian Library, entitled *The Mirroure of the Worlde* (a 15th century manual of moral instruction for the laity) there is this text:

But liche as Godde planted erthely paradys ful of goode treis and with fruit and in the myddes he planted a tree that men calle the tree of liff because that his fruit hadde vertu to kepe the liff of theyme that sholde eete therof from dethe, from sekenesse, from agyng, and fro febilnesse.

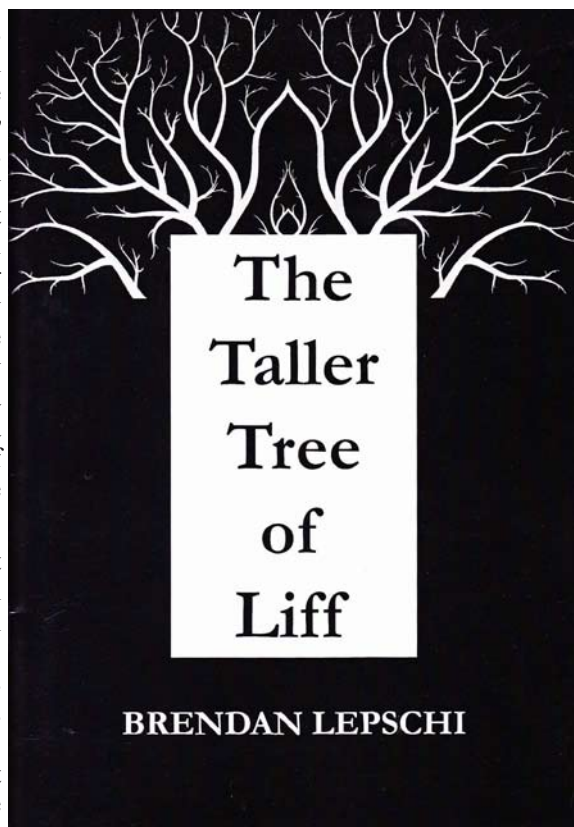
If only Brendan’s book had the same beneficial effects as these fruits,

then he would certainly have achieved fame and fortune by now.

In the book a large number of women are thanked during the preliminary text, but after that the personal references are restricted to “male botanists”, “older male botanists” and “senior managers” (the latter under various synonyms). Clearly, females should be demanding an equal level of disparagement in the book, particularly older ones. In this regard, I offer the following additions to the book:

Hemistylus (n.)

The fashion sense of older female botanists. Cf. *schmalzia* (for males).



Morisonia (adj.)

Descriptive of the state achieved by imbibing *liquidamber* (q.v.).

Samba (vb.)

To cohabit as husband and wife without being married.

Zamia (adj.)

Two specimens that look like the same species but you know they aren't.

Zombia (n.)

One who spent too long in an old herbarium, breathing naphthalene.

So, buy yourself a copy of the book, check out the required writing style, and create your own definitions. There are two "blank" pages at the end of the book apparently provided for this very purpose.

An introduction to insect-induced plant galls in Australia

Lyn Cook

School of Biological Sciences, The University of Queensland, St Lucia

Life in a Gall: The Biology and Ecology of Insects that Live in Plant Galls. By *Rosalind Blanche*
CSIRO Publishing, Colingwood, Victoria. 2012. 80 pp. ISBN: 9780643106437. RRP AUD \$29.95 (paperback)

www.publish.csiro.au/pid/6814.htm

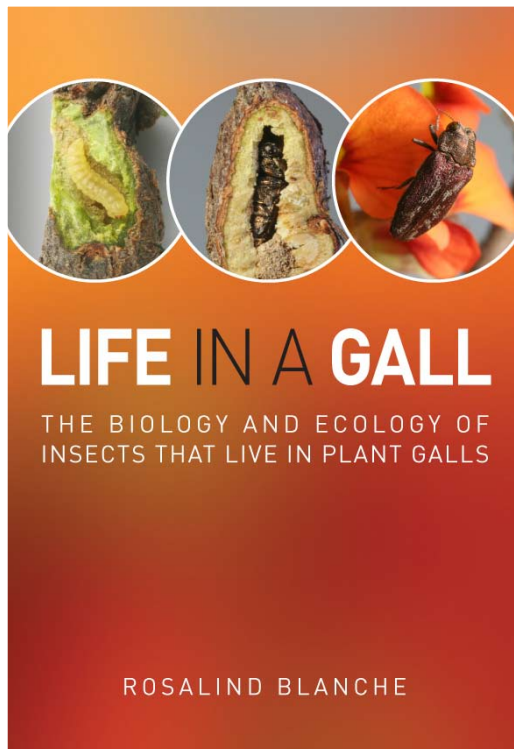
I grew up in the bush, but I didn't really "see" the bush until I moved to the city. In a small timber town, plants were either good (useful) or rubbish. Rubbish was to be weeded out, cut down or burned and I earned pocket money for cutting down "weeds" such as "she-oak" (pronounced with a sneer) and sally wattle (spat out with disgust). Hillsides were to be kept clear of any encroaching bush for pasture and any orchid, daisy or non-palatable shrub or herb was to be pulled or sprayed. Any insect, and most mammals that were not domesticated, were pests. By the time I left home at 17 to go uni for the first time, I had no idea that the trees and shrubs that I spent my weekends chopping down on our bush block in the foothills of the Macleay River catchment were even native. I had never heard of galls.

How things have changed. I now go to our bush block, which has become "overgrown" with the absence of chainsaws, tomahawks, cattle and horses, and see the *Diurus*, *Cordylina*, *Pultenaea*, *Dianella*, *Lomandra*, *Casuarina torulosa*, *Acacia melanoxylon*, and hundreds of other plant species in this diverse part of the mid-north coast. And I also see the galls. They are everywhere. On the eucalypts

along the creek line, I have discovered two previously unknown species of scale insect that induce conspicuous galls several centimetres long. On the *Melaleuca salicina* on the creek flats I discovered another undescribed galler, sparking an Australia-wide search that has now uncovered more than 50 undescribed scale insect galls of Melaleuceae. There are galls on the acacias, there are galls on the peas, there are galls on the casuarinas and there are LOTS of galls on the eucalypts. Most of these are probably undescribed. That's a thing about Australian plant galls induced by insects – they are very

diverse and largely undescribed.

Even for those gall-inducing insects that have been formally described, there is scant information readily available for them. The



Atlas of Living Australia has no images for any of the 100 or so described galling scale insects. There is an occasional image of a gall-inducing wasp, fly, thrips or scale insect posted on the websites of various museums, but most of the available information and images are on community websites, such as Flickr and NOAH, and personal sites such as Brisbaneinsects.com. Predictably, the accuracy of identifications and life history information on the community sites is poor.

For the serious cecidologist (someone who studies galls) there are several academic tomes, such as the *Biology of insect-induced galls* (1992) and the 817 page *Biology, Ecology, and Evolution of Gall-Inducing Arthropods* (2005). I think the recent publication of *Life in a Gall*, by Rosalind Blanche, fills a gap in the available information about Australian gall-inducing insects. I see it as sitting between the dense writings available for academics and the community web-based snippets.

The book is divided into several chapters that give basic information about gall-inducing insects found in Australia. It provides a general explanation of plant galls and how they are thought to be induced. It then covers the major insect groups that induce galls, with images of galls and their gall-inducers. There is another section on some of the unusual biologies of the gallers, such as the male of the scale insect *Cystococcus* that carries its young sisters away from the gall on its abdomen, and the strong-armed soldiers of some galling thrips. There are sections on benefits and detriments of gallers, from the perspective of both humans and other organisms. The book finishes with descriptions of how to go about collecting and studying gallers.

The images and descriptions should allow a novice cecidologist to gain some idea of which insect group might be responsible for a gall-in-the-hand and a general feel for the diversity and adaptations that have arisen in disparate insects that gall plant tissue. I think I would have found it useful as a first-read when I embarked on my current research path.

There are a few mistakes in the book, such as the immature males in a gall of *Cystococcus* being described as “wood shavings”. I don’t think these should detract too significantly for

the target audience, which I see as school kids and naturalists, or even serious entomologists who have had little exposure to gallers. Overall, it is a taster – a short and readable overview of some of the gallers of plants in Australia.

With the target audience in mind, I lent the book to my teenage nephew and asked for his opinion. He read it on a road trip from Ames Iowa to Denver Colorado (USA), and his review follows.

A beginner’s guide to galls

Robert Valencia-Cook
Gilbert High School, Iowa, USA

The book, although small, contains detailed information about galls for a beginning biologist. The pictures suited the sections very well, for example, the picture of the bush coconut in the section on gallers as bush tucker, and the examples of each major class of insect galler. The pictures helped to show the large diversity among galls.

There is a section on beneficial galls, but there is very little information about whether the galls not mentioned in this section are purely detrimental to the plant or whether there are some mutualisms. At times, mutualism was hinted at but the explanations mostly seemed to be that the galls were taking nutrients from the plants and not giving anything back.

Throughout the book, paragraphs used both scientific and common name. This takes up a lot of space, and makes it complicated to read because of the redundancy. I ended up skipping some paragraphs because there was a lot of parenthesized names with little biological material in between. Sometimes I realized that I had skipped some that wasn’t scientific and had to go back to read it. If the book is targeted for a general audience, using just the common name would make the material more accessible. The book could read better if only one name (scientific or common name) was used consistently throughout. A glossary could be used at the end to give the alternative name.

I knew practically nothing about galls beforehand, and actually thought that some of the galls were normal plant parts, especially the stem swelling and leaf-deforming galls. I found the parts about the benefits of galls for humans, for example, as biocontrol agents and food, the

most interesting. I hadn't thought about galls being other than parasites of plants.

I would recommend the book to high school

and early college students wanting to learn about gall insects and the plants they affect.

The herbal heritage of Malaysia

Betsy Jackes

James Cook University, Townsville

Malaysian Herbal Heritage. Edited by Vimala Subramaniam.

Forest Research Institute Malaysia, Kepong. 2013. 146 pp. ISBN 978-967-5221-90-3. RRP MYR RM 108 (USD \$108) (hardback)

<http://www.frim.gov.my/?p=9451>

This is a well-illustrated coffee table book describing 50 important Malaysian heritage plants. The book is clearly written although a few phrases indicate the native tongue of the writer was not English, but the meaning is clear. This book aims "to preserve the traditional knowledge of herbs used in the prevention and treatment of diseases". Fifty Malaysian plants regarded as the most important plants with medicinal properties have been selected from the 2000 species reported as having medicinal or well-being uses. However, only about 1200 higher plants are regularly used by various communities.

The book is divided into five chapters together with an introduction, glossary and index. The latter includes the scientific name and the main common name by which the plant is widely known. The titles of these chapters are: General Tonics; Women's Health; Men's Health; Aromatic Plants for Personal Care and the last chapter is devoted to Preventive Health Care. This book is timely as more and more people are turning to natural remedies as alternatives to synthesised products, partly because of cost

and partly because of faith in remedies that have been tested over centuries. There is also concern for what we may be losing or have lost as habitat destruction continues. Several of the contributors raise the question of sustainability.

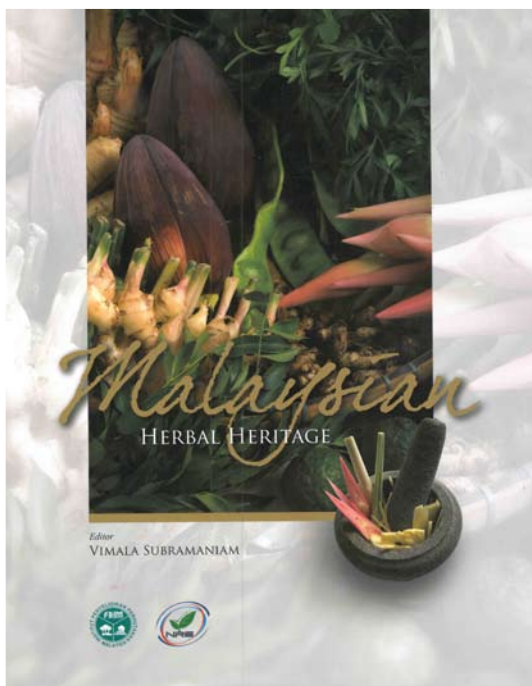
Each chapter follows the same format of an introduction followed by descriptions of the 10

species included in each chapter. I particularly enjoyed the introduction to Chapter One, as I had no idea there were so many different tonics. In fact it seems as though there was not only a general "pick-me-up" tonic but also a separate one for each organ of the body!

Each species description is supported by a full page photograph of the plant as well as several smaller ones, illustrating the main features or even advertising products made from the plant. Besides the scientific name and authority, there is the name of the Family and

one or more common or vernacular names as well as the parts of the plant that are used to treat various ailments. Each description follows a similar format.

Following the name and main common name i.e., the one by which it is 'locally known', are the salient features of the species, where it occurs naturally and if cultivated. For many species the method of propagation is also included. The last paragraph discusses what part of the plant is used and the ailments for which it is suitable. An example is *Centella asiatica*, "the whole plant is used as a tonic



and as a cooling drink to relieve heatiness. The dry leaves are taken as herbal tea to stimulate blood circulation. It also helps to boost mental activity, hence to strengthen memory". A tip at the bottom of the page suggests the leaves be eaten raw as a salad to prevent aging! I could not find a definition of 'heatiness' in the glossary, but I assume it is the equivalent of fever. Did you know that the seeds of *Brucea javanica*, if swallowed, can be used to treat haemorrhoids amongst other conditions?

Only in Chapter 5 are the chemicals listed for the active components, many of the plants included in this chapter are ones for personal use. Most of these species are considered to be high in natural antioxidants.

There were several irregularities that I noticed. *Ficus deltoidea* is a shrub or small tree but in the description it is initially described as a herb but later as a tree. The flowers of

Murraya koenigii are described as large but the flowers of *Citrus hystrix* are considered small and yet both are very similar in size. This is one occasion when measurements would help. The book is remarkably free of spelling errors although p. 41, suggest 'odoring' should be odors, p. 45 bareable to bearable, p. 53 unpleasent to unpleasant and p. 105 informaion to information. These are minor errors and do not distract from an otherwise well-presented clearly written book. Some readers might like to see some references.

I thoroughly enjoyed reading this book and found the contents very interesting, but I did wonder what coffee tables it is meant to grace, as the price will put it out of the reach of many. I would like to see the information included here, be more readily available and the number of plants described increased. This traditional information needs to be well documented.

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Australian Systematic Botany Society Newsletter No. 53

Systematic Status of Large Flowering Plant Genera

Edited by Helen Hewson, 1987

This Newsletter issue includes the reports from the February 1986 Boden Conference on the “Systematic Status of Large Flowering Plant Genera”. The reports cover: the genus concept; the role of cladistics in generic delimitation; geographic range and the genus concepts; the value of chemical characters, pollination syndromes, and breeding systems as generic determinants; and generic concepts in the Asteraceae, Chenopodiaceae, Epacridaceae, *Cassia*, *Acacia* and *Eucalyptus*.

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Evolution of the Flora and Fauna of Arid Australia (book)

Edited by W.R. Barker & P.J.M. Greenslade. Peacock Publications, ASBS & ANZAAS, 1982

This collection of more than 40 papers will interest all people concerned with Australia’s dry inland, or the evolutionary history of its flora and fauna. It is of value to those studying both arid lands and evolution in general. Six sections cover: ecological and historical background; ecological and reproductive adaptations in plants; vertebrate animals; invertebrate animals; individual plant groups; and concluding remarks.

Cost: \$20, plus \$10 postage (in Australia).

This book is almost out of print. There are a few remaining copies.

To order a copy of this book email Bill Barker at bill.barker@sa.gov.au

History of Systematic Botany in Australia (book)

Edited by P.S. Short. A4, case bound, 326 pp. ASBS, 1990

For all those people interested in the 1988 ASBS symposium in Melbourne, here are the proceedings. It is a well presented volume, containing 36 papers on: the botanical exploration of our region; the role of horticulturalists, collectors and artists in the early documentation of the flora; the renowned (Mueller, Cunningham), and those whose contribution is sometimes overlooked (Buchanan, Wilhelmi).

Cost: \$10, plus \$10 postage (in Australia)

Cheques payable to “ASBS Inc.” Mastercard & Visa payments accepted.

Only a few copies left!

To order a copy of this book email Frank Udovicic at Frank.Udovicic@rbg.vic.gov.au

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The Australasian Systematic Botany Society is an incorporated association of over 300 people with professional or amateur interest in botany. The aim of the Society is to promote the study of plant systematics.

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Membership is open to all those interested in plant systematics. Membership entitles the member to attend general meetings and chapter meetings, and to receive the Newsletter. Any person may apply for membership by filling in a "Membership Application" form, available on the Society website, and forwarding it, with the appropriate subscription, to the Treasurer. Subscriptions become due on 1 January each year.

The ASBS annual membership subscription is AU\$45; full-time students \$25. Payment may be by credit card or by cheques made out to Australasian Systematic Botany Society Inc., and remitted to the Assistant Treasurer. All changes of address should be sent directly to the Assistant Treasurer as well.

The Newsletter

The Newsletter is sent quarterly to members and appears simultaneously on the ASBS Website. It keeps members informed of Society events and news, and provides a vehicle for debate and discussion. In addition, original articles, notes and letters (not exceeding ten published pages in length) will be considered. Citation: abbreviate as *Australas. Syst. Bot. Soc. Newslett.*

Contributions

Send copy to the Editor preferably by email attachment submitted as: (1) an MS-DOS file in the form of a text file (.txt extension), (2) an MS-Word.doc file, (3) a Rich-text-format or .rtf file in an email message or attachment or on an MS-DOS disk or CD-ROM. Non-preferred media such as handwritten or typescripts by letter or fax are acceptable, but may cause delay in publication in view of the extra workload involved.

Formatting of submitted copy. Please use Word formatting buttons for paragraph indents, bullets, etc. and for tables. All text must be in upper and lower case; e.g., do not use upper case for titles, headings or authors in reference lists. Do not format primitively with tabs, which change with the Normal style sheet. If embedding tables or references or other Objects from other software (Excel, bibliographic software, etc.) ensure that these are converted to Word tables or paragraphs. Letters in abbreviations of Australian States (SA, WA, etc., but Vic., Qld) and organisations (e.g. ASBS, ABRS) should not be separated by full-stops, but initials should be (e.g. W.R. Smith, not WR Smith).

Images. Send images individually with captions in accompanying text document or email, not arranged in composite. Do not include them embedded in a text file. If you do, you will be asked for them separately. Inclusion of images supplied may depend on space being available. Resolution needs to suit press as well as web publication. So improve scanned resolution if printing your image is pixellated at a width of at least 7 cm (up to a 15 cm full page). Contact the Editors for further clarification.

The deadline for contributions is the last day of February, May, August and November. All items incorporated in the Newsletter will be duly acknowledged. Authors alone are responsible for the views expressed, and statements made by the authors do not necessarily represent the views of the Australasian Systematic Botany Society Inc.

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Advertising

Advertising space is available for products or services of interest to ASBS members. The current fee is AU\$100 per full page, \$50 per half-page or less.

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A 20% discount applies for second and subsequent entries of the same advertisement. Advertisements from ASBS members are usually exempt from fees but not the insertion costs in the case of a flyer. Contact the Newsletter Editors for further information.

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