fostering research into the biology and cultivation of the Australian flora

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Council Meeting April 2010

Here are some of the items discussed at the April Council meeting:

- The priority of the meeting was to review and short-list this year's preliminary research applications. In all, twenty applications were received. As usual, the research objects were diverse, covering conservation of Australian plant diversity and threatened species, effects of climate change, enhancement of cultivation, plant species with potential for cultivation, and reduction of collections from native ecosystems. After deliberation, six applicants were selected and will be asked to submit full applications. These will then be submitted to our Scientific Research Committee who will make recommendations to the next Council meeting in August.

- The Foundation will provide two cash prizes at the Ecological Society of Australia's annual conference in December 2010. $250 each will be awarded for the best spoken paper and the best poster presented at the conference.

- The Treasurer was authorized to purchase MYOB accounting software.

- The President updated the meeting on progress of the essay competition. The purpose of the competition is to increase awareness of the work of the Foundation and is aimed at university students in plant sciences in Australia. A prize of $1,000 will be awarded for the best two thousand word essay on one of the following topics: *Priorities for the Conservation of the Australian Flora,* or *Priorities for the Cultivation of the Australian Flora*. Closing date for entries is 18th July.

Thank you to our donors

Without the generous support of our donors and benefactors the Foundation would not be able to carry out its research objectives. Donations of $2 and over are tax-deductible.

The Council would like to sincerely thank the following people and organizations who have recently made donations to the Research Fund:

Australian Plants Society Hunter Valley Group NSW, Australian Plants Society Newcastle Group NSW; Australian Plants Society NSW Region; Australian Plants Society Sutherland Group NSW; Australian Plants Society SA Region; Australian Plants Society Wangaratta Branch Vic; SGAP Mackay Branch Qld; Mr Philip Cameron; Dr Roger Carolin; Prof. H. Clifford; Mr Ian Cox; Dr Rhonda Daniels; Mrs Hazel Dempster; Mr Roger Ellliot; Mr Phillip Esdale; Mr Frank Gleason; Dr Peter Goodwin; Dr Margaret Johnston; Mrs E. King; Dr G Kirby; Mr Patrick Laher; Mrs Margaret Lee; Dr Paddy Lightfoot; Dr Geoffrey Long; Dr Peter McGee; Shirley Pipitone; Dr M. Reed; Mr W. Reed; Mr Gordon Rowland; Mr John Scown; Judith Smith; Mr Ross Smyth-Kirk; Mrs Diana Snape; Prof. Acram Taji; Dr Greg Unwin; Dr A. Wheeler; Dr Tim Wood.

New progress reports

The following grantees have recently sent in progress reports for their projects. They can be viewed on the Foundation's website www.aff.org.au

Dr Nicholas Paul, Professor Rocky de Nys and Dr Symon Dworjanyn on the project: *"Green caviar" and "sea grapes": Targeted cultivation of high-value seaweeds from the genus* Caulerpa. It can be seen here
Dr Phil Ainsley on the project: *Developing a screening tool to determine the impact of climate change on seed germination in threatened native plant species*. It can be seen here.
Dr Margaret Johnston has provided a progress report on the project: *An evaluation of the temperature and daylength requirements of Australian potted colour species*. It can be seen here.
Professor Robert Henry has sent in a progress report on the project: *Impact of climate on the genetic diversity of native species using Microlaena stipoides as a model.* It can be seen here.

Summaries of Final Reports

Each year the Australian Flora Foundation funds a number of grants for research into the biology and cultivation of the Australian flora. While the grants are not usually large, they are often vital in enabling such projects to be undertaken. Many of the projects are conducted by honours or postgraduate students, hopefully stimulating their interest in research into Australia's flora. This work is only made possible by the generous support of donors and benefactors.

Presented here are brief summaries of completed projects. Full reports of these and other projects can be viewed on the Foundation's website www.aff.org.au

Harnessing native Fabaceae for agriculture - the importance of mycorrhizal fungi
Mark Tibbett, Megan H. Ryan, Susan Barker, Yinglong Chen, Matthew D. Denton, Tamara Edmonds-Tibbett, Christopher Walker
School of Plant Biology, University of Western Australia

Australian native perennial Fabaceae have been little explored with regard to their root biology and the role played by arbuscular mycorrhizal (AM) fungi in their establishment, nutrition and long-term health. Some of these species, notably *Cullen*, are now being evaluated for use in agricultural systems. As Australian agricultural soils generally have elevated levels of phosphorous (P), it is likely that the mechanisms naturally used by the legumes, including their symbiosis with AMF, will be disrupted. We hypothesised that native legumes, grown in an agricultural soil, would host a different set of species of AM fungi than exotic legumes.

Project field site at Katanning WA

We therefore investigated the colonisation morphology in roots and the AM fungi, identified by spores extracted from rhizosphere soil, of the native legumes *Cullen australasicum*, *C. tenax* and *Lotus australis* and the exotic legumes *L. pedunculatus* and *Medicago sativa*.

The level and density of colonisation by AM fungi, and the frequency of intraradical and extraradical hyphae, arbuscules, intraradical spores and hyphal coils all differed between host plants. However, none of these measures consistently differed between the native and exotic legume species. Instead, there were strong similarities between species in the same genus. The three dominant species of AM fungi in rhizosphere soil differed with host plant, but one fungus (*Glomus mosseae*) was always the most dominant. Sub-dominant species of AMF were the same between species in the same genus. No consistent differences in dominant spores were observed between the exotic and native legume species.

Our results suggest that plant host influences the mycorrhizal community in the rhizosphere soil and that structural and functional differences in the symbiosis may occur at the plant genus level, not the species level or due to plant provenance. When the non-dominant species are considered there was a remarkably high species diversity of around twenty species. If these represent a remnant population of native AMF, they could provide a springboard for the regeneration of a more natural symbiotic system as native plants are re-introduced and the effects of agriculture, such as high available P, are diminished over time.

Life histories and reproductive strategies of plants in the desert and halophytic genus *Frankenia* in Australia.

Dr Lyndlee C. Easton
School of Biological Sciences, Flinders University

The aim of this project was to investigate basic germination requirements for Australian species of *Frankenia* in relation to seed age, light requirements, temperature preferences, salinity tolerance, and soil properties.

Germination strategies play a major role in the persistence of all plant taxa, particularly in arid zone halophyte species. The evolution of germination strategies is a consequence of plant taxa responses to environmental cues. Arid zone halophytes have evolved germination strategies under selective pressures – notably in relation to seed age, light requirements, temperature preferences, salinity tolerance, and soil properties – whereby they respond to a sequence of environmental cues that indicate periods of relatively high probability of subsequent seedling survival. Elucidating these strategies is of fundamental importance to the understanding of halophyte life histories. *Frankenia* in particular has several rare and little known species, and the vulnerability of these species cannot be assessed without basic life history data. This data is also a prerequisite for the consideration of *Frankenia* in salinity remediation, mine-site remediation, and coastal revegetation projects.

The underpinning aim was to investigate reproductive strategies, and in particular the large-seeded versus small-seeded strategies in relation to environmental variables that are commonly experienced by arid zone halophyte plant taxa. Previous research has shown that larger-seededness arose several times in Australian *Frankenia* as a result of evolution towards fewer ovule

numbers per fruit, although both the larger-seeded and smaller-seeded species still co-occur in biogeographical proximity. By restricting the analysis of seed packaging strategy variations to similar habitats and within a genus, it was possible to uncover ecological correlates that would otherwise have been masked by the strong effects of habitat differences and phylogenetic constraints on seed mass. The hypothesis that large-seededness is favoured over small-seededness in drought and/or saline stressed environments could thus be tested.

The key finding was that overall, larger-seedness is advantageous for rapid germination after transitory water availability, and for providing resources to seedlings if resources become limiting before their successful establishment. Smaller-seeded species delay germination until both soil-water availability and cooler temperatures persist over a long time period, improving the chances of successful establishment for the more slowly growing seedlings that are reliant on their surroundings for resources.

The Australian Flora Foundation is a not-for-profit voluntary organization with the sole objective of fostering scientific research into Australia's flora.

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