

## The Centre for Plant Biodiversity Research

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THE critical importance of advancing knowledge for management of Australia's plant biodiversity has been recognized by two of the country's prominent research and conservation organizations. In 1993 the **Centre for Plant Biodiversity Research** was established in Canberra. This is a joint venture between the CSIRO Division of Plant Industry and the Australian Nature Conservation Agency (ANCA), through the Australian National Botanic Gardens (ANBG), which ANCA administers. The national perspective of the Centre combines the programmes and activities of the two herbaria and the native plant research of both institutions.

The newly consolidated Australian National Herbarium forms a core to the Centre. The CSIRO herbarium is currently being extended through construction of a new wing, which will allow the collections and staff of the CSIRO herbarium and that of the ANBG to be brought together. The amalgamated herbarium consists of nearly 1 million specimens with a broad coverage of Australia and Melanesia, particularly New Guinea. A specialist rainforest collection is held in north Queensland at Atherton, with research emphasis on the tropical rainforest flora. While most of the Australian National Herbarium collection consists of vascular plant specimens, it also has an extremely good representation of the cryptogamic flora of Australia and New Guinea, the moss and liverwort collection being the largest in Australia.

In addition to the strong research emphasis of the combined herbaria, an existing reference herbarium of the ANBG will be further developed to provide a shop front to the public, and to augment the public information activities of the Centre.

The activities of the Centre focus on three main areas relating to Australia's plant biodiversity: research, scientific collections and the information technology area of botanical data management and information transfer. In particular, the Centre aims:

- to conduct **research** in plant diversity, evolution and systematics, horticulture and conservation biology of vascular plants and fungi to provide a basis for sustainable management and the understanding, conservation and use of Australian vegetation;
- to expand, develop and manage **scientific collections** as a permanent record of Australian plant diversity and as a resource for research on Australian and related floras;
- to take responsibility for the co-ordination, maintenance and upgrading of important **national botanic databases** developed by ANCA and CSIRO, including the *Australian Plant Name Index*, the *Census of Australian Vascular Plants* and the *Economic Plants of Australia*.

Participants of the Centre will continue to take an active role in the development of national and international standards of botanical data exchange, and to collaborate closely with the Australian Environmental Resources Information Network and international projects such as the International Organization for Plant Information, the International Working Group on Taxonomic Databases for the Plant Sciences and the Biodiversity Information Network, etc.

### RESEARCH

Bringing together the wide-ranging skills and expertise of the two groups has provided greater scope to develop new collaborative projects. The Centre provides one of the best opportunities that Australia and the region has seen to develop a range of stimulating research projects on our native plants and the ecosystems of which they are part. The research priorities of the Centre concentrate on the development of the information base and the patterns and processes operating within plant species and communities.

### Systematics

The Australian National Herbarium is itself a centre for biosystematic studies

and taxonomic revisions of the Australian flora with particular focus on groups of national interest, such as Myrtaceae, Poaceae, Proteaceae, Orchidaceae, Malvaceae, Lorantheae, Musci and the rainforest groups Lauraceae and Rutaceae. The basis of using Australian plants as genetic resources is a knowledge of their identity and relationships. Data derived from morphological features are enhanced by the inclusion of anatomy, cytology, phytochemistry, isozyme analysis and breeding system studies. The Centre attempts to provide answers to fundamental questions such as: What are the taxa represented? What are their geographic and ecological distributions? What are their evolutionary and biogeographic relationships? Our research in this area further expands the collaborative work between the existing native plant research programme of Plant Industry and the ANBG and other parts of ANCA such as the Australian Biological Resources Study which takes responsibility for the *Flora of Australia*.

It is anticipated that the Centre will have some role in the area of mycology and fungal systematics in the future. This will include an element of the Centre's education role in assisting with the training of desperately needed mycologists and bryologists.

The Centre pays particular attention to the transfer of the results of research on systematics to users. To this end we have made considerable progress in development and application of areas of information technology, such as interactive computer identification and information systems on rainforest species and eucalypts.

### Genetic resources

Projects in this area concentrate on the use of wild plants as genetic resources for improving their related crops, e.g., soybean and cotton improvement with wild *Glycine* and *Gossypium* germplasm. Research on host pathogen variation and co-evolution and the use of isozyme and molecular markers to monitor and

manipulate host resistance genes allows us to contribute to the selection of resistance genes for effective disease resistance in some crops.

### Conservation biology

Research of the Centre is addressing one of the most pressing issues in conservation biology, that of managing plant populations and communities in the face of diminishing numbers of plants in a population and the fragmented nature of the vegetation remnants. An understanding of the ecology of individual species, their population dynamics, factors affecting population size and resilience to change, and of communities, is essential for their conservation and effective management.

A significant component of the work of the Centre relates to rare and threatened species, including research for recovery plans, and maintenance of the national rare or threatened plants list in close collaboration with the Endangered Species Unit of ANCA.

Studies of genetic variation and mating systems of widespread and related rare species are used to identify differences in genetic patterns or processes that are related to rarity. At the ecosystem level we are involved in the development of conservation plans for endangered communities through floristic and genetic surveys, with implementation via liaison with conservation agencies and landholders.

Fire is a part of most of Australia's ecosystems, extending into agroecosystems. Research in this area is aimed at better understanding fire-vegetation interactions and managing fire through knowledge of the effects of different fire regimes.

Interactions between plants and pathogens or symbiotic organisms have often been neglected in studies of ecosystem dynamics and plant biodiversity. In the Centre, this is being addressed in two major studies. First, studies of epidemiology, genetic structure, evolution and maintenance of genetic variation in pathogen populations, as well as genetics of resistance and demography of host populations are allowing us to elucidate the longer term

evolutionary dynamics of plant-fungal pathogen interactions.

A second approach involves a new initiative studying the area of soil micro-organisms, in particular the diversity of the nitrogen-fixing bacteria associated with shrubby legumes in southern Australian ecosystems. A clear view of the specificity of the interaction of these bacteria with their hosts should provide results to assist in rehabilitation of degraded ecosystems and the conservation of particular endangered species.

### BIOLOGICAL COLLECTIONS

Members of the Centre take an active role in improving the profile of Australian and regional taxonomic collections, such as the Australian national Herbarium and in addressing the deficiencies in government support for biological collections and the training of taxonomists. The establishment of the Centre for Plant Biodiversity Research and further active development of the herbarium should enhance the conservation of the nation's plant collections.

### BOTANICAL INFORMATION MANAGEMENT

A major priority for the Centre is to integrate the specimen databases of the herbaria which currently have different database applications. The database operations will be merged gradually to minimize disruption to existing users outside of the Centre and optimize access to botanical information.

Both participating organizations have access to the Internet, and electronic communication of botanical information is a major foundation for the Centre. Fibre optic cable is being laid to link the ANBG and CSIRO sites on Black Mountain, giving staff from both sites access to each other's database and information processing facilities. The Gopher and World Wide Web network information servers of the ANBG (Internet address 155.187.1012) now encompasses the Centre activities and will be greatly expanded with Centre programme information and access to selected Centre databases. This is a major component of the Centre's programme to deliver reliable

information to a wide range of users by the most efficient means.

The Centre is seen as a focus for the exchange of botanical information between Australian and international botanical institutions and will continue to be involved in the development and promotion of appropriate mechanisms such as the Herbarium Information Standards and Protocols for the Interchange of Data and to be involved in international biological database and information exchange effort.

In order that Australian herbaria gain some extra value from their computerized specimen databases the Centre has initiated a national project, using the continent-wide eucalypt herbarium specimen dataset. We are co-ordinating a collaborative project comprised of approximately 12 research projects or components, led by Australian scientists, including taxonomists, ecologists, ecophysiologicals, and statisticians. By using these data to test predictions and hypotheses in diverse fields such as phytogeography, climate change, conservation and phylogeny, the herbaria will capitalize on the usefulness and versatility of this large eucalypt dataset.

### PERSONNEL AND STRUCTURE

The Centre has been established initially with existing facilities from CSIRO and ANCA, and it is anticipated that this strong grouping of botanical research and progressive herbarium activities will help attract further external funding. Staff for the Centre are seconded from ANBG and the CSIRO Division of Plant Industry. This brings together a staff of about 80 people, with a number of other volunteers and researchers as associates. The Centre is administered by a Board, with Prof Derek Anderson (Deputy Vice-Chancellor of the University of Sydney) as Chairman, and Director, Dr Judy West ([judyw@pican.pi.csiro.au](mailto:judyw@pican.pi.csiro.au)) and Deputy Director, Mr Jim Croft ([jrc@anbg.gov.au](mailto:jrc@anbg.gov.au)).

Although the tasks of physically amalgamating the herbarium collections and people are somewhat daunting, it is very exciting to be part of such a significant new initiative.