

This research forms part of an ARC Linkage Project that is currently investigating Australian alpine reproductive ecology, focusing on the key demographic stages of seeds and seedlings. Work is funded by the Australian Research Council, the Australian National Botanic Gardens and the Friends of the ANBG, with support from NSW Parks.

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Aciphylla glacialis (Apiaceae), a dioecious perennial shrub endemic to the Australian alpine region. Photo: Gemma Hoyle

21 years of seed conservation in the WA Department of Environment and Conservation: achievements and future directions

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Introduction

South West Western Australia has a rich endemic flora that faces a number of threats including habitat fragmentation, changed hydrology, introduced pests and diseases, and climate change. The threats facing this biodiversity hotspot are increasing in type, severity and scale, demonstrated by the rising numbers of species threatened with extinction. In particular, the root-rot pathogen *Phytophthora cinnamomi* is a biological disaster that threatens the survival of many of the region's most unique plants.

To combat the erosion of genetic diversity of Western Australia's native flora the Department of Conservation and Land Management (now Department of Environment and Conservation - DEC) secured Commonwealth government funding in 1992 to establish a seed bank for

species susceptible to *Phytophthora* dieback and aerial canker. With this funding, the Threatened Flora Seed Centre (TFSC) was established. Standard seed bank conditions (low temperature (-20°C) and low moisture content (~5%rh)) were employed to provide the most appropriate and cost-effective conditions for the storage of seed from the large range of orthodox (desiccation tolerant) species in Western Australia impacted by the disease.

Targeted species conservation

The aim of the TFSC was to collect and conserve seeds that represented the genetic diversity of the State's rare, threatened and poorly known flora. The seed bank began life in a transportable building at the Western Australian Herbarium in Perth. As the scale of activities of the Centre

grew, so did the need for larger, more permanent facilities and in 2010 the new Western Australian Conservation Science Centre, incorporating the Western Australian Herbarium and Threatened Flora Seed Centre, was finally completed.

Initially the focus of the collecting activities of the TFSC was on species threatened by *Phytophthora* dieback disease and aerial canker, but later broadened to include those species most at risk in the wild, including species with low plant numbers, few populations or limited geographic range. Although in situ conservation is the primary focus of threatened species recovery actions, this may in itself be insufficient to ensure a species survival. In many cases where the habitat of threatened species is in immediate danger of destruction, and where on ground actions cannot guarantee species survival, the collection and maintenance of plant material from the wild becomes a necessity, acting as insurance. Banked seeds are available irrespective of season enabling their use whenever required.

Helping on ground conservation through seed use

For some West Australian species, dramatic declines in plant numbers and ongoing *in situ* threats have necessitated the translocation of material to new sites. Currently, DEC's seed collections support one of the world's largest and most diverse threatened species translocation programs, incorporating over 60 species across 85 sites.

In addition to species translocations, seeds have also been used in research providing information to assist on-ground conservation and management. Conservation geneticists have demonstrated just how important seed banking is in saving plant genetic diversity for future generations: seeds secured from now-extinct populations of the critically endangered *Banksia brownii* (Proteaceae) appear to be genetically distinct from plants in current extant populations. Banked seeds from these extinct populations have now been used to bolster genetic diversity of newly created populations. Banked seeds have also been used in studies aimed at determining the susceptibility of species to *Phytophthora* dieback disease; seedlings generated through routine germination testing have been used to test the susceptibility of 583 species to this virulent pathogen.

Partnerships

Over the past 21 years the Centre has been involved in many local, national and international partnerships that have contributed to its achievements. Since 2001, the Centre has been a participant in the Millennium Seed Bank Project (MSBP), an international seed conservation partnership managed by the Royal Botanic Gardens, Kew, UK. The aim of this project was to conserve 10% of the world's dryland flora, as seed, by 2010. Through its participation in this project the Centre was able to broaden the range of species targeted from just endangered species, to encompass all species of conservation significance



Endangered *Verticordia* in safe hands. Photo: Anne Cochrane

including poorly known species. Collections made for this project are duplicated at the Millennium Seed Bank as a safeguard against damage or loss of the collections housed at the TFSC.

During this time, other seed banks in Australia entered into the partnership coalescing firstly into the Australian Seed Conservation and Research network (AuSCaR), and later into the Australian Seed Bank Partnership (ASBP), a cohesive union of Australian seed banking partners and associates. The Australian Network for Plant Conservation (ANPC) is one such associate member, and for many years the Threatened Flora Seed Centre has been an active member of the ANPC contributing to *Plant Germplasm Conservation in Australia: Strategies and guidelines for developing, managing and utilising ex situ collections* (1996) and the guidelines update in 2009.

The achievements

The Threatened Flora Seed Centre has made considerable inroads into the collection and conservation of the State's rare, threatened and priority flora. A summary of some of the major achievements of the past 21 years include:

- comprehensive collections of good quality, genetically diverse seed (collections from 75% of threatened species have been banked and 10% of these used in translocation; in addition, collections from 25% of Western Australia's poorly known species have also been banked)
- collections banked from currently extinct wild populations
- effective germination / propagation protocols for many species previously unknown
- new populations and species range extensions discovered during seed collection work
- seed research that informs species management (e.g. disease research)
- raising awareness of seed conservation within the community.



Bree Phillips, DEC Conservation Officer, collecting seeds of the threatened *Jacksonia velveta*. Photo: Anne Cochrane



Threatened Flora Seed Centre staff in the facility's drying room. Photo: Anne Cochrane

The challenges

Seed conservation and sustainable utilisation of seed resources presents many challenges for the future. The large number of threatened species in WA (currently over 400) in addition to over 2000 poorly known species of conservation significance makes prioritising and collecting seed difficult. Accessing adequate quantities of seed is also not easy due to small population size and low fecundity of many threatened species. It has become clear that for many of these species harvest from the wild may not be sustainable and hence the need to establish seed production orchards from wild sourced seeds, so that additional seed resources can be acquired without further impacting on wild populations.

A further challenge is tackling seed germination issues for some families of the Western Australian flora. The inability to reliably produce plants from seed limits the effective use of this seed in species recovery.

Finally, although seed conservation is an effective and cost-efficient means of supporting species in the wild, sourcing the funding required for maintaining existing collections is often difficult. Ongoing commitment for collecting unrepresented species and improving the size and genetic diversity of species already in storage is also a challenge. Ultimately, we endeavour to be able to improve the conservation status of our most endangered species through our actions. We must strive to strengthen the commitment to plant conservation and to mobilise sufficient resources to give ourselves the best chance of minimising the loss of plant diversity for future generations.

Flora of Australia Online – a continental taxonomic resource for the future of Australian plant conservation

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Introduction

The Australian Biological Resources Study (ABRS) is a program of the Department of Sustainability, Environment, Water, Population and Communities. ABRS documents at a national level, the plants and animals that occur in Australia. ABRS facilitates, for the national view, the collection, description and classification of Australia's plants and animals. The taxonomic work is done by botanists and zoologists in the scientific community mainly

working in herbaria, museums and universities. ABRS documents and collates, then disseminates the information to the public by publishing species information on Australia's plants and animals.

The *Flora of Australia* book series is the largest series on plants produced by ABRS and has formed the basis for the *Flora of Australia Online* database. The online information is currently derived solely from the published *Flora of Australia* books.



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