Ex situ success: the role of the Australian National Botanic Gardens in native plant conservation

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In an ideal world all plants would be protected in situ in their natural habitat. However, in a less than ideal world, dramatic changes to habitat such as natural disaster, land clearing and climate change may make it impossible for a plant to survive in its natural range. An alternative is ex situ (off-site) conservation where viable plant parts such as seeds, spores, tissue or whole plants are collected from the wild and either cultivated or stored. In this way ex situ conservation serves as a safety net or insurance policy, with plant material conserved until reintroduction can be attempted.

Botanic gardens clearly play a critical role in ex situ conservation. Aplin (2008, p. 191) argues that they are the ‘greatest contributors of ex situ conservation, utilising methods such as seed banking, cryopreservation, tissue culture and the cultivation of plants’. The Australian National Botanic Gardens living collection currently features over 6000 species, over 60 000 individual plants and a seedbank comprising approximately 3000 taxa. Its contribution to plant conservation is exemplified in one case study of successful ex situ conservation and its potential involvement in a second.

Hakea pulvinifera—a success story

One of the ex situ propagation successes at the Gardens has been the endangered species Hakea pulvinifera. This species is represented in the wild by less than 150 plants on a slope above the Namoi River near Gunnedah, New South Wales. It is listed as endangered under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) and the New South Wales Threatened Species Conservation Act 1995 (NSW National Parks and Wildlife Service 2000).

Hakea pulvinifera is a root suckering shrub up to 2.2 m high with thick tessellated ‘cork-like’ bark, typically pointy Hakea leaves and creamy white flowers (Figure 1). The plants appear to be sterile with no fruiting or seed set recorded since the species was discovered in 1949. Instead, it appears to reproduce via root suckering.

It is likely that H. pulvinifera was never widespread or abundant prior to European settlement and we may be witnessing a natural extinction event. Given its low abundance and restricted range, it is highly susceptible to threats such as browsing by rabbits or macropods, trampling by stock or humans, invasion by Callitris glaucephylia (White Cypress Pine) and disease. Its response to fire is unknown.

To date, recovery actions have included surveying potential habitat for further populations, in situ monitoring and management of the population, and preliminary studies to gauge the level of genetic variation within the population. Since 1990 the Gardens has played its part in recovery by trialling propagation techniques, described in detail by McAuliffe (1996).

Initially nursery staff experienced difficulty striking cuttings and attempts were limited by the low quantity of suitable cutting material and slow growth rates. Over many years, the nursery trialled taking cuttings from different parts of the plant, at different times of the year, and using different mixtures of plant growth hormone.

After extensive trialling, a successful propagation technique was devised and more than 50 individuals are now in cultivation. The technique has included grafting cuttings onto the rootstock of the related and more vigorous Hakea salicifolia (Willow-leaved Hakea) to increase growth rates and hence the amount of material available. More recently the nursery has reverted to propagating the plant as cuttings without needing to graft.

The ex situ recovery focus for this plant has turned to securing a genetically representative population at the Gardens and, for this, it is necessary to know the level of genetic diversity in the wild population. If additional genetic variation is identified then further collections of cuttings...
will be undertaken. In this way the Gardens is helping fulfil one aim of the recovery plan, viz. to establish *ex situ* populations of the plant, to be maintained in perpetuity.

**Lepidium ginninderrense—a potential success story**

*Lepidium ginninderrense* (Ginninderra Peppercress) is not the most beautiful plant, but it is critically endangered and attracting attention from the ACT Government and the Gardens. This perennial herb from the Family Brassicaceae is only known from one population of about 2000 plants in an area 90 m by 30 m on the former Belconnen Naval Transmission Station in the suburb of Lawson in the Australian Capital Territory (ACT Government 2003). This is also the type locality.

Its habitat (Figure 2) is temperate grassland dominated by *Austrodanthonia* spp. and *Bothriochloa macra*. It is an inter-tussock species that benefits from grazing that suppresses introduced weeds. The plant’s home range is surrounded by suburbs and therein lies the key threat to its survival—urban infill and visitor or land management activities. It is listed as vulnerable under the EPBC Act and endangered under the Australian Capital Territory *Nature Conservation Act 1980*.

Unlike *Hakea pulvinifera*, this plant sets good quantities of seed which means there is potential for seed banking, *ex situ* conservation and translocation. In 2008 nursery staff at the Gardens successfully harvested seed from the wild population, grew plants to full maturity and collected more seed thus ensuring that the seed-to-seed cycle was viable.

Staff have since developed a proposal for the *ex situ* conservation of the plant based on seed orcharding. Briefly, seed orchards are a method of mass-multiplication of plants to produce large and sustainable crops of seed with minimal disturbance to the wild population. Cochrane and Barrett (2009) provide more information on the concept.

The Gardens’ proposal, prepared in collaboration with key stakeholders, comprises:

- establishing an *ex situ* seed orchard on-site,
- determining the planting density which encourages the greatest seed production, and
- counting seed set, both *in situ* and *ex situ*.

Using the Gardens’ expertise in seed banking, the project would establish the best conditions for seed storage, measure longevity of stored seed and compare viability and germination rates of *in situ* and *ex situ* seed collections. Other activities to support recovery would include devising methods for establishing a translocated population, raising public awareness via interpretation at the Gardens and associated media, and engaging community groups to participate in the conservation of this plant. If resources can be secured the Gardens has the expertise and facilities to undertake both orcharding and seed banking.

**Conclusion**

A key aim of the Australian National Botanic Gardens is to develop *ex situ* collections of plants and seed of rare or threatened taxa for use in recovery plans. *Hakea pulvinifera* and *Lepidium ginninderrense* exemplify the Gardens’ success in this field and its potential to contribute. In the future, we hope to be able to report that new populations of the latter have been established in safe habitats.

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**References**


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