

Conservation introduction of a threatened narrow range endemic species, *Banksia montana*, from the Stirling Range National Park, southern Western Australia

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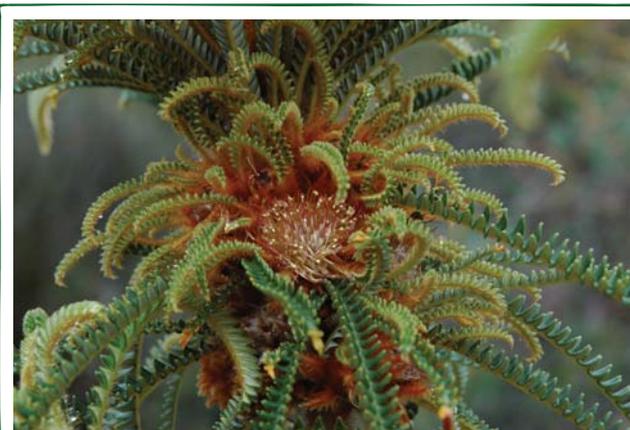
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Introduction

Banksia montana is a narrow range endemic listed as Endangered under the Australian Commonwealth Environment Protection and Biodiversity Conservation Act 1999 and Critically Endangered in Western Australia (WA) under IUCN (2001) criteria due to ongoing population decline. This species occurs in mountain habitat in the Stirling Range National Park near the south coast of WA. The primary threat to its ongoing survival in the wild is the introduced root pathogen *Phytophthora cinnamomi* (Phytophthora dieback). Grazing, inappropriate fire regimes and the interaction of fire and *Phytophthora* dieback have contributed to population decline (Moore, 2006) such that this species is now at very high risk of extinction (Barrett *et al.*, 2008). Based on its refugial mountain habitat, climate change is also a threat with anticipated increase in summer drought and subsequent fire occurrence in the region. Re-introduction is considered to be the recovery action most likely to significantly increase the number of individuals of this species. Unfortunately, a major barrier to recovery of the species has been the lack of disease-free 'critical habitat' within its historic range. In 2003, a

proposal was developed to establish this species in a secure site outside its known range. This paper provides a case-study of this introduction.



Close up of *Banksia montana* © A. Cochrane

Goals

- Goal 1: Create a secure population.
- Goal 2: Provide insurance against species extinction.

- Goal 3: Provide a source of material for future introductions (seed & cuttings).
- Goal 4: Provide a source of material for research purposes.

Success Indicators

- Indicator 1: New population established with survival of at least 40% of all plants planted beyond year 1.
- Indicator 2: New population established with at least 80% of surviving plants producing material for future re-introduction, research and *ex-situ* conservation.



Private property owner planting first *Banksia montana* at conservation introduction site 2003 © A. Cochrane

Project Summary

Feasibility: A member of the family Proteaceae, *Banksia montana* is an erect woody shrub to 2.5 m tall. The species is restricted to mountain habitat in the Stirling Range National Park and is characterised by a small number of populations, low total population size and a very small area of occupancy. *Banksia montana* is an obligate seeder, killed by fire and relies on seed storage in the canopy (serotiny) for its persistence. Plants of this species have a long primary juvenile period, with flowering in natural populations first recorded at nine years post-fire. This long juvenile period makes it particularly vulnerable to extinction from too-frequent fire. The species is highly susceptible to *Phytophthora* dieback and all known populations are infested with the pathogen. *Banksia montana* is currently known from 38 mature individuals in four small populations across several mountain peaks.

In Western Australia threatened species recovery is the responsibility of the Department of Environment and Conservation (DEC) and includes the implementation of actions such as seed conservation and subsequent species re-introduction as measures to safe guard species and prevent extinction (Cochrane *et al.*, 2011). Seed collection for *Banksia montana* began in the mid-1990s, with material collected from as diverse a parental source as possible. However, seed resources for this highly endangered species were limited by the size of known populations, with less than 45 mature individuals at the time of collection. Over 10 years, repeated seed collection trips were made to remote mountain locations to ensure sufficient material was conserved for any future recovery work.

Unfortunately, by 2000, the extent of *Phytophthora*-infestation in the Stirling Range was such that no suitable sites for re-introduction were available within the

historic range and habitat of the species. A search for introduction sites outside the species' range yielded a secure disease-free site in a privately owned vegetation remnant. The site was located away from the species' mountain-top habitat, in lowland vegetation, some 50 km south of natural populations. In 2002 a proposal for the anticipated introduction was developed and assessed by independent reviewers and detailed planning and consultation with private property owners, land managers and scientists preceeded any on ground works. When approval was granted, seeds were germinated at DEC's Threatened Flora Seed Centre and seedlings were transferred to the accredited disease-free nursery at the Botanic Gardens and Parks Authority, Perth, for cultivation until planting time.

Implementation: *Banksia montana* plantings commenced in 2003 with the establishment of 14 seedlings. Further plantings in 2004, 2005, 2009 and 2010 brought the total number of plants at the site to 136. Following planting, seedlings were protected from vertebrate grazing with wire cages and watered weekly. Plants were permanently labeled in order to track their origin, status and health over time. Disease hygiene was stringently controlled to ensure that *Phytophthora cinnamomi* was not inadvertently introduced to the site. Access was restricted to dry soil conditions and foot baths containing methylated spirits were used on property boundaries to ensure that infected soil containing the *Phytophthora* spores was not vectored via footwear.

Post-planting monitoring: Monitoring of individuals commenced at planting and continued on a six to twelve monthly basis. Data on survival, growth, reproduction and plant health were collected. Monitoring of the wild populations occurred at the same time as monitoring of the introduced plants providing essential baseline data for assessing the performance of the new population. By 2010 species survival was high (85%), with the number of mature individuals in the introduced population more than double the number of mature plants existing in the wild (115 versus 38).

The production of flowers and fruit at the introduction site occurred after only 3 - 4 years from planting. This is considerably earlier than flowering has been observed in the wild populations, most likely due to less extreme environmental conditions at the lowland site. As fruit production increased with plant maturity, it became apparent that many flowers and fruit were being predated at the early development stage by invertebrates. Subsequently, the site was used to trial invertebrate control to enable successful reproduction and to facilitate comparative research on invertebrate diversity between wild and introduced populations (Moir *et al.*, in press). Regardless, this early flowering and fruiting has allowed small quantities of seeds to be collected for *ex situ* conservation since 2010, providing further insurance against species loss. This introduction project was considered so successful that a second introduction site was established as further security for *B. montana*. Continued monitoring of the health and survival of this species will occur as a matter of course.

Major difficulties faced

- Severe limitations in selecting appropriate introduction site due to extent of *Phytophthora dieback* within the range of the species.
- Limited seed material available for propagation due to declining *in-situ* populations.
- Incidence of invertebrate predation (foliage and fruits).

Major lessons learned

- Capacity of restricted species to survive outside natural habitat shown though ability of species to be moved from montane to lowland situation.
- Capacity of species at introduction site to flower and fruit much earlier than in the wild due to milder lowland location which enhanced plant growth.
- Need for ongoing monitoring of plant growth and health, for example monitoring of invertebrate predation on foliage and fruits which could impact on reproductive output.

Success of project

Highly Successful	Successful	Partially Successful	Failure
√			

Reason(s) for success/failure:

- Detailed planning and consultation prior to on ground works.
- Successful collaboration between scientists and land managers who brought practical and technical skills to the project. In addition considerable input from volunteers and support from regional NGOs, Western Australian government and local industry.
- Capacity of species to survive and flourish outside known geographic range.
- Strict adherence to disease hygiene standards.

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