Threatened plant translocation case study:

Symonanthus bancroftii (Bancroft's Symonanthus), Solanaceae

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The species

- Low growing (~300 mm) perennial shrub.
- Endemic to SW Western Australia.
- Dioecious.

Threatening processes

- Habitat loss, fragmented remnant bushland.
- Weed competition.
- Predation of seedlings and young plants by feral rabbits.

Deciding to translocate

Symonanthus bancroftii was thought to be extinct in the wild with the last known sighting dating back to the 1940s. In 1997 a single (male) plant was found in an area previously used for road aggregate storage near the wheatbelt town of Ardath in south-west WA, followed by another (female) plant in 1998 after an intensive search. Both plants were tissue cultured (Panaia *et al.* 2000), and a third (female) plant was produced from *in vitro* germinated seed (harvested from an *ex situ* container collection of micropropagated original male and female plants grown in Kings Park) in 2001. It was considered that even with only three genotypes it was worth the risk of translocation, in the event that more plants may be found in the future, and information could be gleaned from a trial translocation would be worth the effort.

Aim of the translocation

The aim therefore was to re-establish two persistent *in situ* populations of several hundred individuals in protected sites in remnant habitats or reserves in the area thought to be the natural range of this species.

Translocation working group and key stakeholders

- Kings Park Science (KPS, formerly BGPA[1]) – to oversee development and implementation, the production of plants and ongoing monitoring and maintenance of translocation sites.
- Department of Biodiversity, Conservation and Attractions (DBCA, formerly CALM[2], DEC[3], DPaw[4]), Western Australia – Wheatbelt region – site selection, implementation and logistical support.
- Bruce Rock Shire.
- Bruce Rock LandCare group.
- WWF (World Wildlife Fund for nature).
- AFF (Australian Flora Foundation).
- Volunteers: local Bruce Rock community and Kings Park volunteers.
- Water Authority of WA.

BGPA[1]– Botanic Gardens and Parks Authority;
CALM[2] – Conservation and Land Management;
DEC[3] – Dept Environment and Conservation;
DPaW[4] – Dept Parks and Wildlife.

Biology and ecology

- Collection limited (<10 times) – last recorded collection in 1940s.
- Dioecious, produces small non-arillate seeds.
- Seeds highly viable, possess physiological dormancy and require smoke to germinate.
- Seed burial studies suggest seeds can survive many years in soil and remain viable.
- Insect pollinated (Ye *et al.* 2007).
- Capsules appear to mature and split, ejecting seeds.
- Recorded from open Wandoo (*Eucalyptus wandoo*) woodland only.
- Mediterranean climate with hot dry summers and cool wet winters.

Site selection

Ardath reserve (Figure 1a) was conveniently located, had good access, long term security and was the site where both rediscovered plants were found. A second site was also chosen (Nangeen Reserve) as this was the next closest (~ 30 km from Ardath) reserve in this region and within the postulated range of *S. bancroftii*. In addition, Nangeen reserve was fenced and regularly monitored by the State Government conservation agency at that time (CALM).

Translocation proposal

Translocation proposals were developed several months prior to planting using a template provided by DEC. These were assessed by independent reviewers to determine whether they met DEC's policies and guidelines. Written feedback was provided after the initial review process with revised proposals resubmitted for additional review and final approval (Taylor *et al.* 2006). An earlier draft Interim Recovery Plan (IRP) prepared in 2001 became the blueprint for proceeding with trial translocations beginning in 2002 at both Ardath and Nangeen sites.

Pre-translocation preparation, design, implementation and ongoing maintenance

Site Preparation:

Both sites were fenced (from 2002) to deter rabbits, irrigation water was provided via on-site tanks and in later trials (2004) both sites were ripped to 1 m to break up hard packed clay soil prior to planting.

Irrigation:

Irrigation lines were laid approximately 1 m apart (up to ~20 m long at Ardath and ~30 m long at Nangeen), translocated plants spaced along lines at ~2 m intervals, drippers (1 L per hr) placed near each plant, with irrigation twice weekly during the first two summers. Each site had two translocation sub-sites that were separate and independently irrigated. In 2007 permission was granted (WA Water Authority) to connect both sites to the local scheme water supply.

Implementation:

Micropropagated plants were produced via tissue culture at BGPA and grown in pots to about 4 months old, hardened off in full sun, then taken to translocation sites to be planted during winter 2002. Later translocations (2005, 2006, 2007 and 2008) were also undertaken using micropropagated plants though from 2006 onwards seedlings generated from *ex situ* collected seeds (Figure 1b) began to be increasingly utilised at the Ardath and later Nangeen translocation sites along with some micropropagated plants. The first translocations (prior to 2004) required a motorised post-hole auger to drill holes ~100–120 mm in diameter and 150-180 mm deep. Following ripping in 2004, digging holes for planting was then able to be done much more easily using hand trowels.

Ongoing maintenance:

Regular weed removal was required especially from August to October. Regular repairs and tank filling were needed for the irrigation system that at first (2002-2003) proved unreliable, and theft eventually resulted in the loss of one tank.

Subsequent actions

One site (Nangeen) has long-term (>20 yr) seed burial experiments (Figure 1c) still current with latest assessment after 6 yrs burial (S. R. Turner, unpublished results). The last major seed collection was done in 2012, however further collections are planned. The recent discovery of a new post-fire population of *S. bancroftii* in 2017 in a nearby reserve (G.J. and B. Keighery; pers. comm.) suggests that seeds can persist in the soil seed bank for many decades between major fire events and further searches in other reserves in the general area of occurrence of *S. bancroftii* may uncover new plants.

Outcomes

- WWF funding allowed the translocation sites to be prepared and translocations went ahead from 2002–2005.
- At the Ardath site approximately 30% of plants survived their first (2004/05) summer, followed by a greatly reduced mortality rate thereafter.
- By 2006 female plants were producing seeds. A study on reproductive biology was conducted on the founder populations at Ardath (Ye *et al.* 2007).
- AFF funding bids were successful in 2008 for several rare species projects, including the *S. bancroftii* project.
- Both translocated populations remain with ~80 plants still surviving across both sites.
- ~10,000 seeds were collected from translocated populations (stored at BGPA).
- Valuable scientific knowledge has been gained on many different facets of this species, as well as the development of general translocation principles – all of which will be invaluable for securing the newly found population and any future finds.
- Tissues cultures and cryostorage of key genotypes has been implemented to support long term *ex situ* germplasm storage as a back-up strategy.

Figure 1a. Ardath translocation site; 1b. Seedlings of *S. bancroftii* being raised at Kings Park and Botanic Garden for translocation; 1c. Seed burial experiment at Nangeen translocation site; 1d. Native butterflies visiting female plant of *S. bancroftii*; 1e. Translocated plants of *S. bancroftii*, male plant front, female plant behind. Photos: a, b, c, e Eric Bunn and d Giuseppe Messina

What we learned

Symonanthus bancroftii was difficult to initially establish in tissue culture until the correct protocols were devised, then micropropagation was successful (Panaia *et al.* 2000). Reliable irrigation was essential to maximise plant or seedling survival during summer in the first two years following transplanting to sites. Precocious flowering was observed after only 2-3 years growth, with pollinating insects frequenting both male and female plants (Figures 1d and e) and abundant seed was produced (Ye *et al.* 2007). Emerging evidence from seed burial experiments suggests that seeds of *S. bancroftii* germinate following after-ripening in soil in response to gibberellic acid or smoke (S.R. Turner, pers. comm.). Based on observations of translocated plants of both male and female *S. bancroftii,* if *S. bancroftii* is to be protected in the future from threats such as more frequent and intense drought (implicated in climate change models), weeds and feral animals, more needs to be known about its fire ecology and impacts on natural recruitment dynamics. In conclusion, the outlook for Bailey's Symonanthus has improved immeasurably since its rediscovery in 1997.

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References and further reading

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