Global Re-introduction Perspectives: 2010

Additional case-studies from around the globe

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Translocation of four rare ironstone endemic species onto a pre-mined area at Beenup in SW Australia

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Introduction

Four ironstone endemics (*Lambertia orbifolia* subsp. Scott River Plains) (Scott River round–leaf honeysuckle) (IRP 178), *Banksia nivea* ssp *uliginosa* (formerly *Dryandra nivea* ssp *uliginosa*)(swamp honeypot)(IRP 255), *Grevillea brachystylis* subsp. *australis* (short styled grevillea) and *Darwinia ferricola* (Scott River bell) (IRP 176), all shrubs, except Lambertia a small tree to 5 m high, are reseeder species and killed by fire. They are restricted in distribution to rare winter wet ironstone habitats generally between Tutunup and Augusta in south-western Australia. The translocation site is at Beenup near Augusta. All species are vulnerable as most of their habitat has been cleared for agriculture or mining and the remaining habitat is often severely impacted by weeds, changes in hydrology, heavy grazing pressure and many habitats are infected by the root pathogen Phytophthora. All species are listed as declared Rare Flora under the Western Australian *Wildlife Conservation Act* 1950 and all, except the Grevillea, have interim recovery plans (IRP). They are all listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation* Act 1999 (EPBC Act). This translocation is fully consistent with the aims and recommendations of the Convention on Biological Diversity that was ratified by Australia in June 1993.

Goals

- Goal 1: Reducing the threat of extinction by learning how to establish new populations of these threatened plants.
- Goal 2:Contribute to the knowledge base of rare and endangered species through genetic analysis and propagation research.
- Goal 3: Improve understanding of the biology/phenonlogy of the plants and cultural techniques.
- Goal 4: Increase in biodiversity of the site.
- Goal 5: Contribute a better understanding of post-mining rehabilitation.

Success Indicators

- Indicator 1: Identify levels of genetic variability within and amongst populations of three of the four species and consequently identify where propagation material can be sourced without compromising local genetic integrity.

***Left*: translocation site prepared with two soil types & *right*: a few months after planting with irrigation system © Bob Dixon**

- Indicator 2: Determine whether these species can be successfully propagated and grown on in a post mined situation.
- Indicator 3: Provide critical information on the biology of these species for management and conservation.
- Short-term success indicator: After one year 25% of the plants have survived.
- Long-term success indicator: Sustainability of the translocated populations by natural recruitment.

Project Summary

Feasibility stage: The translocation, a pilot study to see if rare species can be successfully established on pre-mined sites, is on an old mineral sand mine site previously covered in an 18 m clay stockpile. After removing the clay two soil types, brown sandy loam and grey sand with good seedbanks, were deposited on a site of approximately 0.2 ha to a depth of 30 cm over a solid ironstone base. The site was fenced to protect plants from grazing by kangaroos and rabbits and an irrigation system was installed but not fully utilized. Propagation material of the Darwinia and Banksia was sourced from two main areas, a local Nature Reserve and two local roadside populations (Governor Broome Road), the Grevillea was sourced from the mine site and the Lambertia from the Nature Reserve. Whilst seed was the preferred method of propagation we could not raise the Darwinia from seed and therefore had to propagate from softwood cuttings using a mixture of different clones. All species were planted on site, separating the nature reserve and roadside populations by the cental Lambertia planting, to evaluate any differences in survival and reproduction in relation to the genetic material used and different soil types. A genetic study on two of the four species, Lambertia had already been completed in another study and DNA could not be extracted from the Darwinia, indicated the following: Using AFLP on *Grevillea. brachystylis* subsp. *australis,* reasonably high levels of genetic variation were detected, but no significant genetic differentiation was detected among 5 populations found in remnant vegetation, revegetated areas or on a dam wall within the Beenup minesite ; *Dryandra nivea* ssp *uliginosa,* within the Beenup area there was weak or no significant genetic differentiation among populations, with the exception of

***Left*: *Lambertia orbifolia ssp.* growing with other indigenous species & *right*: a 6 m high *L. orbifolia* ssp. © Bob Dixon**

the Governor Broome Road and Nature Reserve centre populations, which were found to be significantly differentiated (Krauss & Alacs, 2003).

Implementation stage: No indigenous communities interested or involved in the land affected by the translocation have been identified. The Aboriginal Sites Register maintained by the Department of Indigenous Affairs does not list any significant aboriginal sites in the vicinity of translocated population. Phytosanitary guidelines for the translocation were strictly adhered to and were primarily aimed at reducing the risk of introducing diseases, particularly root pathogens, and weeds to the translocation site. No flowering plants were translocated, avoiding the risk of inter-species pollen transfer within the nursery and resulting hybrid seed of nursery origin.

Post-release monitoring: Monitoring of plant survival, pests and diseases, growth rates, flowering and seeding patterns began within a few months of planting. Due to the high cost of travel from Perth, our home base, the site was monitored twice a year in autumn and spring. Monitoring for the first two years indicated, lower than expected, plant losses under difficult growing conditions on this very wet, wind swept and open site. However, some deaths were attributed to phytophthora and pythium species, probably translocated onto the site via surface water flow before planting began. A program spraying phosphoric acid in spring and autumn, appeared to control these diseases and prevent large scale plant losses. Weeds, especially *Hypochaeris* species, though present in large numbers are not highly competitive on this site. A plant survey of the site when compared to the surrounding area with amended soil, that is, previously used for agriculture but seeded and planted with indigenous species indicated over 50% more species are present on the translocation site with good soil seedbanks. The monitoring program, in line with the translocation proposal, ceased in 2007. At this stage the project was performing far better than predicted with all plant species flowering and producing seed, although only the Grevillea was recruiting from the soil seedbank. However, a visit in November 2009 indicated, though we expected higher death rates due to increased competition from indigenous

species and cessation of the spraying program, the translocated plants were performing very well and all species were producing large numbers of viable seed. Seedlings are recruiting from the soil seedbank probably in large enough numbers to produce self sustaining populations of the Grevillea and Lambertia but in smaller numbers for the Darwinia and only one recruit has been recorded for the Banksia. The latter, even in natural populations, tends to only germinate after a major disturbance event such as fire.

Major difficulties faced

- Lack of knowledge of the biology of this species and cultural requirements.
- Unable to obtain DNA from *Darwinia ferricola.*
- Distance traveled and associated costs for site visits reduced opportunities to visit the site more frequently and lack of on-going funding for travel and monitoring.
- Having to cope with root pathogens.
- Site growing conditions for plants extreme e.g. bare soil and windy conditions sand-blasting plants.

Major lessons learned

- Rare plant species can be successfully established on previously mined areas with poor growing conditions.
- The Grevillea, though short lived in comparison to natural populations, produces large amounts of viable seed and natural recruits appear within two years of planting.
- *Darwinia ferricola* is able to re-propagate itself vegetatively. After wind blown sand covers most of the plant and it starts to senesce shoots form roots and they grow on producing flowers and seed (first time recorded for any Darwinia species).
- *Lambertia orbifolia* ssp Scott River Plains seed do not appear, despite windy conditions, to move far from the parent plants in the short term, seedlings are generally no more than 3 m away.
- Root pathogens such as phytophthora and pythium can be controlled on site, given the right treatment, and new recruits established.
- Close planting of small trees (Lambertia) on this site has not, as yet, resulted in high plant losses due to competition for moisture, nutrients and space.
- Rabbit proof fencing is critical for the first few years to establish plants as major grazing damage observed in other areas of the mine site.
- Essential to have good working relationship with sponsors (mine operators) and well trained volunteers are essential due to the volume of work and lack of resources.
- It was necessary to thin out some fast growing and highly competitive indigenous plants e.g. Acacia and Viminaria species to reduce competition on the rare species.
- This site will provide an excellent research facility for future generations of scientists and biologists to look at population dynamics and sustainability of populations.

Success of project

Highly Successful	**Successful**	Partially Successful	Failure
	√		

Reason(s) for success/failure:

- This was a well defined project, following translocation proposal guidelines, in association with mine site staff and Kings Park Volunteer Master Gardeners. It was underpinned by a research program based in Kings Park Science Directorate where new methods were constantly being developed on the propagation and biology of the species and research on genetic management. Guidelines were in place in the form of the Western Australian *Wildlife Conservation Act* 1950 and Interim Recovery Plans (except the grevillea) This translocation is fully consistent with the aims and recommendations of the Convention on Biological Diversity that was ratified by Australia in June 1993.
- This project also followed the Guidelines for the Translocation of Threatened Plants in Australia 2nd edition published by the Australian Network for Plant Conservation.
- All plants were raised in Kings Park Accredited Nursery (adheres to specific photosanitary regulations) which specializes in the cultivation of indigenous species.
- Plants monitored twice a year and ad hoc visits by mine staff reported any problems.
- High level of plant survival in such poor growing conditions.
- All species are now producing large amounts of viable seed.
- The use of phosphoric acid does not significantly affect the germability of *Grevillea brachystylis* ssp *australis* seed**,** using a standard cut test 98% of the seed was viable and ongoing germination experiments have produced germination rates up to 73% (6 weeks duration in a constant 18^0C).
- All species are recruiting from the soil seedbank indicating viable seed are being produced and conditions are suitable for germination and growing on.
- More time, e.g. at least 25 years, is required to determine if this site is naturally self-sustaining in the long term as most of these species are only expected to germinate en-mass after a disturbance event such as fire.

References

Krauss, S & Alacs, E. 2003. Population genetic analysis of the DRF *Dryandra nivea* subsp*. uliginosa* and *Grevillea brachystylis* subsp. *australis.* Unpublished report, commissioned by BHP Billiton Titanium Minerals Pty Ltd. BGPA Genetics Laboratory report No.20. Genetics Laboratory, Plant Science Directorate, Kings Park and Botanic Garden, Botanic Gardens and Parks Authority, West Perth, Western Australia.