GLOBAL RE-INTRODUCTION PERSPECTIVES

Re-introduction case-studies from around the globe

Edited by

Pritpal S. Soorae

RSG

Environment Agency ABU DHABI
RESEARCH • DEVELOPMENT • PROTECTION

DENVER ZOO

SSC
Species Survival Commission

IUCN
The World Conservation Union

Published by: IUCN/SSC Re-introduction Specialist Group

Citation: Soorae, P. S. (ed.) (2008) GLOBAL RE-INTRODUCTION PERSPECTIVES: re-introduction case-studies from around the globe. IUCN/SSC Re-introduction Specialist Group, Abu Dhabi, UAE. viii + 284 pp.

ISBN: 978-2-8317-1113-3

Cover photo: Clockwise starting from top-left:

- Formosan salmon stream, Taiwan
- Students in Madagascar with tree seedlings
- Virgin Islands boa

Produced by: IUCN/SSC Re-introduction Specialist Group

Printed by: Abu Dhabi Printing & Publishing Co., Abu Dhabi, UAE

Downloadable from: ***http://www.iucnsscrsg.org*** (downloads section)

Contact Details: Pritpal S. Soorae, Editor & RSG Program Officer
E-mail: ***psoorae@ead.ae***

Translocation of the Corrigin grevillea in south Western Australia

Bob Dixon[1] & Siegfried Krauss[2]

[1] - Manager Biodiversity & Extensions, Botanic Gardens & Parks Authority, Kings Park & Botanic Garden, Fraser Avenue, West Perth, Western Australia 6005, Australia (bdixon@bgpa.gov.au)
[2] - Senior Research Scientist (Conservation Genetics), Botanic Gardens & Parks Authority, Kings Park & Botanic Garden, Fraser Avenue, West Perth, Western Australia, 6005, Australia; Adjunct Senior Visiting Research Fellow, School of Plant Biology, University of Western Australia, Crawley, Western Australia, 6009, Australia (skrauss@bgpa.wa.gov.au)

Introduction

Grevillea scapigera (Proteaceae) is a prostrate, short-lived, fire-killed and disturbance opportunist shrub, germinating from the soil seedbank after soil disturbance or fire. It was known historically from a maximum of only 13 mainly degraded roadside populations, and the total number of known plants never exceeded 60. However, more than 95% of the natural habitat of ***G. scapigera*** has been cleared for agriculture. As of January 2008, only three wild plants are known to exist in highly disturbed, vulnerable and fragmented roadside sites. Three translocated populations of ***G. scapigera*** have been established close to the wheatbelt town of Corrigin, about 230 km south southeast of Perth, Western Australia, within the natural historical range of this species. The current status of ***Grevillea scapigera*** is declared as Rare Flora under the Western Australian Wildlife Conservation Act 1950 in September 1987, and ranked as Critically Endangered in 1995. The species is also listed as Endangered under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). International obligations - this translocation is fully consistent with the aims and recommendations of the Convention on Biological Diversity that was ratified by Australia in June 1993. It currently meets World Conservation Union (IUCN 2000) Red List Category 'CR' under criteria B1ab(i-v)+2ab(i-v); C2a(i) and D. However, it is not listed under the United Nations Environment Program World Conservation Monitoring Centre (UNEP-WCMC) Convention on International Trade in Endangered Species (CITES).

Grevillea scapigera **flowers have long scapes up to 30 cm long © S. Krauss**

Goals

- Goal 1: Establish at least three self-sustaining populations of ***Grevillea scapigera***.
- Goal 2: Maintain genetic diversity, and minimize inbreeding depression, within these populations in the long term.
- Goal 3: Ensure long term ***ex situ*** protection of this species by cryostorage and seedbanking.
- Goal 4: Create phytosanitary guidelines to protect the species from pests and diseases especially root pathogens and introduction of new weeds on site.
- Goal 5: Reclassification of the species from Critically Endangered to vulnerable or rare after self sustaining populations are established.

Success Indicators

- Indicator 1: Propagate by tissue culture hundreds of ramets of 10 genotypes of ***G. scapigera***, and establish ***in-situ***.
- Indicator 2: Successful reproduction (seed-set) ***in-situ***.
- Indicator 3: Recruitment of new plants from the soil seedbank.
- Indicator 4: Habitat enhancement, that is to improve the vegetation condition and to reduce the impact of weeds and feral animals.
- Indicator 5: Maintain genetic diversity.
- Indicator 6: Create public awareness.
- Indicator 7: Monitor the site on a regular basis.
- Indicator 8: Phytosanitary guidelines in place.
- Indicator 9: Long term ***ex-situ*** conservation through cryostorage and seed storage.

Project Summary

Feasibility stage: ***Grevillea scapigera*** occurs in flat country on sandy or gravelly, lateritic soils associated with low heath amongst tall shrubland. This species is a prostrate, spreading shrub, 5 - 10 cm high by up to 2 m across. Creamy white, sweetly-scented flowers are borne in unusual globular heads to 4 cm in diameter on scapes to 30 cm. Fruits are 1 - 1.5 cm long, sticky, slightly oblique and compressed, and contain two curved to oblique-navicular seeds. This project has not caused any adverse social and economic impacts as the translocation sites only cover 0.2 ha each, two are located in nature reserves and the other on an abandoned golf course. ***Grevillea scapigera*** is a flagship species and the floral emblem of Corrigin Shire therefore there is a great deal of community support for its protection.

Implementation stage: No indigenous communities interested or involved in the land affected by these translocations 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 populations. Phytosanitary Guidelines for the Translocation of ***G. scapigera*** were prepared and adhered to, the guidelines were primarily to reduce the risk of introducing diseases, particularly root pathogens, and weeds to the translocation sites. No flowering plants were translocated, avoiding the risk of inter-species pollen transfer within

the nursery and resulting hybrid seed of nursery origin. Ten clones representing 87% of the known genetic diversity of the species were used in the initial translocation. Additional genotypes have been added over time as new wild plants are found. Translocations using large numbers of plants, derived by tissue culture were begun in 1996, after pilot studies indicated translocation was feasible.

Volunteers admiring Corrigin grevillea in full flower: site 2 - October 2005 © B. Dixon

Post release monitoring stage: Monitoring began and continued every month following planting to record information on survival and growth rates, flowering patterns, numbers of flowers and seed produced as well as damage caused by pests such as rabbits, parrots and seed eating insects. Monitoring for the first two years indicated vast seasonal variations which may in part be due to the quality of the greenstock (plants) at time of planting, vagaries of the weather (lack of rainfall) and wide variation between clones (some clones were better survivors and also recorded better growth rates, flower and seed production). In 1996 when only two translocation sites were being used translocation survival rates (4%) were far lower than in pilot studies and in 1997 there were clear site advantages due to summer rainfall patterns e.g. one site experienced a total loss of 400 plants, whilst the other site had incredibly good survival rates and excellent summer growth rates (plants normally put on new growth in late spring). Following these poor results a battery operated trickle irrigation system was installed at one site in 1998 and when funding became available added to other sites. Irrigation when correctly used increased survival and growth rates, flowering and seed production, however the life span of irrigated plants was substantially reduced. The 1997, 1998 plantings and other isolated plants which were not included into the irrigation system did not grow as well and during drought years did not flower, however some of these plants are still surviving. To reduce plant production costs when large quantities of seed became available seedlings were grown and introduced to all sites.

Post-release monitoring of sites has been substantially reduced to twice a year, recording survivorship, pests, weeds, estimates of seed production and any new recruits of seedlings. With the difference in sites, i.e. degraded to good vegetation there was a wide variation in seed production the best site producing over 1,000,000 seed in 2006. Seed production in all sites as plants are aging is now receding and the total number of plants on all sites is just over 1,000. Genetic erosion between founders and offspring was assessed in 1999 at one translocated site. DNA fingerprinting techniques demonstrated poor genetic fidelity in the founding population (eight clones, not 10, were present, and 54% of

all plants were a single clone), and significant erosion of genetic variation (offspring were 22% more inbred and 20% less heterozygous than parents). Ultimately, the genetically effective population size of the founding translocated population was estimated to be two. Steps have been implemented to halt this genetic erosion in future generations, and the consequences for inbreeding depression are being assessed. Experiments to stimulate the soil seedbank indicated aerosol smoke produced seedlings far quicker than fire and or cultivation. Two sites are now producing a small number of natural recruits on a regular basis without stimulating the soil seedbank. Fifty year seed burial trials indicate after the first harvest, two years, seed stored on the surface (in shade cloth and fine stainless steel mesh) of the soil have higher viability rates than those buried at 5 cm..

Major difficulties faced

- Finding suitable translocation sites, with the correct soil and vegetation type, due to over 95% of the natural vegetation being cleared for agriculture in the Corrigin Shire.
- Raising plants, initial problems with tissue culture and growing on plants in a nursery situation due mainly to fungal attack in humid conditions.
- On site problems with watering plants, often due to high staff turnover, filling water tanks and watering on a regular basis.
- Managing pests, looper caterpillars and weevils which attack the developing seed and can destroy every seed on a single plant.
- Managing genetic variation and integrity, i.e. mis-labeling of tissue-cultured plants leading to a genetic erosion.
- Lack of knowledge of the biology of this species and cultural requirements.
- On-site smoke trials using tents to concentrate chemicals for stimulation of germination of the soil-stored seed.

Major lessons learned

- Network (contact people) on a regular basis to maintain professional and voluntary partnerships. Volunteers essential due to the volume of work and lack of resources.
- Rabbit proof fencing critical, with a minimum area of 0.2 ha to allow expansion of plantings and/or future inclusion of other rare species on site if desired.
- Irrigation systems significantly improved survival rates, increased growth rates, flowering and seed production, but can reduce the life span of plants.
- Large numbers of plants en-mass can lead to an increase in seed predation. It was essential to control these seed eating insects at the correct time, about 3 weeks before the seed were mature.
- Far more cost effective to use a site which is already well vegetated with indigenous species. Carefully clearing (skimming off the tops of woody shrubs etc.) sites leads to regeneration of these species at the same time as translocated plants are growing, reducing weed problems and leading to less intervention in the long-term.
- Important to monitor on a regular basis e.g. once a month at least for the first two years. This included checking on pests/diseases, fencing and maintaining

watering systems.

- Monitor genetic variation: mistakes do happen with labeling systems etc., to make sure you are getting genetic diversity sample off-spring. Genetic erosion was addressed by focusing planting effort on under represented genotypes with vegetatively propagated material. Moving to using seed increases genetic variation (more genotypes as all seed are outcrossed), but increases kinship relative to wild parents. Thus there is a genetic variation/kinship conflict between the use of original wild genotypes and the offspring of the translocation founders that requires careful management. Ultimately, the largest genetically effective population sizes possible are required at initiation to avoid concerns associated with genetic erosion.
- Maintain genetic stock for a long period in case of disaster e.g. cryostorage and seed for long-term storage.

Success of project

Highly Successful	**Successful**	Partially Successful	Failure
	√		

Reasons for success/failure:

- This was a well defined joint project with the Department of Environment and Conservation (formerly Conservation and Land Management) Corrigin Shire, the Bullaring community other local volunteers and Kings Park Master Gardeners. It was overseen by an advisory group Narrogin District Threatened Flora Recovery Team. It was underpinned initially by a detailed research program focused on the biology of the species, and subsequent research on genetic management.
- Guidelines were in place in the form of Wildlife Management Program No. 24, Corrigin Grevillea Recovery Plan now replaced by Interim Recovery Plan No. 224, Corrigin Grevillea (***Grevillea scapigera***) Interim Recovery Plan 2006 - 2010. This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity that was ratified by Australia in June 1993 The project also followed the Guidelines for the Translocation of Threatened Plants in Australia 2nd Edition and the Germplasm Conservation Guidelines for Australia (both published by the Australian Network for Plant Conservation)
- Regular funding provided predominantly by the Australian Government, through the Natural Heritage Trust scheme.
- This project was based on good science from its infancy, part of a PhD by M. Rossetto, balanced with good horticultural and field based skills involving many experts in their field.
- The program was based in Kings Park Science Directorate where new methods were constantly being developed to propagate and manage genetic resources.
- All plants were raised in Kings Park Accredited Nursery (adheres to specific photosanitary regulations) which specializes in the cultivation of indigenous

species.

- When germination of seed was impossible due to deep dormancy, genetic assessment identified ten clones that represented 87% of the known genetic diversity of the species, and these were used for translocation. New seedlings are occasionally found in natural populations, and this new genetic resource was cloned by tissue culture and later planted on site to increase genetic diversity.
- Research on seed dormancy identified optimal dormancy-breaking procedures.
- The adoption of new horticultural practices over time on the translocation sites e.g. introduction of an irrigation system increased survival rates.
- All translocation sites have delivered large quantities of seed into the soil seedbank, on one site an estimated 1,000,000 seed was produced in 2006.
- A good seedbank is already present in the soil, at least on one site, as this has been established by various soil core/germination experiments and on site activities to stimulate the germination of seed from the seedbank
- Natural recruitment of ***G. scapigera*** seedlings is occurring on two of the 3 translocation sites, this includes a site where competition from Cape weed ***Arctotheca calendula*** is prevalent.
- One site had the irrigation system removed two years ago and is very well vegetated with indigenous species and only a few annual weeds are present on site. ***Grevillea scapigera*** regeneration is also occurring on site
- Genetic erosion has been addressed by additional planting of under-presented clones. On-going monitoring is assessing genetic erosion in the F2 generation.
- Cryostored material has been through the tissue culture process with the plants going on to site and producing seed. Resulting seedlings from these plants have been planted out and are producing their own viable seed. This proves cryostorage is a suitable method of long term storage for this species.
- Original clones are in cryostorage and new clones are added when they become available.
- Large quantities of seed from the translocation sites are in storage.
- More time, e.g. at least 25 years, is required to determine if these sites are naturally self-sustaining in the long term. ***Grevillea scapigera*** is only expected to germinate en-mass after a disturbance event such as fire.