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Additional case-studies from around the globe

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Translocations of the critically endangered spiny daisy in the Mid-North of South Australia

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Introduction

The spiny daisy (*Acanthocladium dockeri*) is a low perennial shrub, with persistent woody stems, spine-tipped branches and small yellow flowers. The species is listed as critically endangered under the Commonwealth of Australia's Environment Protection and Biodiversity Conservation Act 1999 and is considered critically endangered under IUCN criteria (CRB1 and CRB2; IUCN 2001). The species was historically collected from western New South Wales (1860) and the South Australian Riverlands (1910). Despite searches of these areas in the 1990's, no populations were relocated and this unique daisy was thought to be extinct. In 1999, the species was re-discovered in the Mid-North region of South Australia and subsequent surveys found five naturally-occurring populations. All known

One year old translocated spiny daisy © SADEH

populations are located on degraded road reserves, in either remnant native grasslands (n=4) or semi-arid shrublands (n=1). Relatively little of the species' habitat remains in the Mid North region, with the majority of grasslands on low hills and plains having been cleared for agricultural production. Although the species flowers prolifically, it exhibits very low levels of seed-set, resulting in no seedlings being observed in the wild (Jusaitis, 2008). The plant does, however, display vigorous root-suckering. Genetic analysis has revealed that each known population is comprised of a single genotype (Jusaitis & Adams, 2005). The clonal nature of this species, its high level of endemicity and its status as the sole representative of the genus *Acanthocladium* (Asteraceae) makes the spiny daisy a priority species for conservation action.

Goals

- Goal 1: Safeguard each of the five known genotypes against extinction, thereby maintaining the species' genetic diversity.
- Goal 2: Determine appropriate methodologies for the successful establishment of new populations of the spiny daisy.
- Goal 3: Determine if the species' inability to set seed can be overcome through cross-pollination between genotypes.
- Goal 4: Increase public awareness of the conservation status of the spiny daisy.

Success Indicators

- Indicator 1: The establishment of at least one translocated population for each of the five known genotypes, ensuring that all genotypes exist at no less than two locations in the field (one natural occurrence site and an additional translocation site).
- Indicator 2: The completion of an experimental translocation to evaluate the effects of weed control, herbivore control and the use of tree guards on the establishment success of spiny daisy.
- Indicator 3: The completion of an experimental mixed-gene translocation (all five genotypes), to assess the potential for cross-pollination between genotypes.
- Indicator 4: The establishment of display populations in public gardens, for public education and raising awareness.

Project Summary

Translocations to increase probability of long-term survival of genotypes: To guard against the loss of genetic variability, translocated populations are being established for each genotype. These populations are spaced sufficiently apart to ensure no inter-breeding. Prior to the establishment of any new population, translocation plans (Vallee *et al.*, 2004) and site management plans are developed. The two primary success indicators for these translocations were i) a 70% survival rate, over the first 12 months and ii) a 50% survival after 5 years, with an increase in the population's area of occupancy. The spiny daisy readily propagates from cuttings, enabling the rapid production of tube stock. A translocated population of the "Yangya" genotype was established in 2006, as

part of the experimental planting trials (see below). In June 2007, a population of 24 individuals of the “Rusty Cab” genotype was established at a council reserve near Caltowie. The plants were watered once in summer 2008 and the survival rate over the first 12 months was 87.5%. A population of 24 individuals from the “Telowie” genotype was established in Mount Remarkable National Park in June 2008, representing the only population of this species on a conservation reserve. After 10 months, 71% survived, just within acceptable bounds. The majority of losses resulted from the drought conditions. The establishment of supplemental populations of the “Thornlea” and “Hart” genotypes is now a priority.

Assessment of techniques to improve success rate of translocations: Competition from environmental weeds and herbivory from the introduced white snail (*Cernuella virgata*) have been identified as key threatening processes for the spiny daisy (Clarke, Robertson & Pieck, 2007). A simple experiment was conducted to assess the extent to which these threatening processes would need to be mitigated, to allow for the successful establishment of a translocated population. A total of 400 individuals from the “Yangya” population were propagated (via. cuttings) and planted out along a roadside reserve containing a remnant native grassland community, in June 2006. A randomized block ANOVA design was used to assess the effects of weed and snail control (individually or together), tree guards and time on the growth and survivorship of individuals (20 plants per treatment block, four replicates). All plants were watered once during the summer months. Both survivorship and growth were monitored, on a six monthly basis, for 24 months. The plantings protected by tree guards (with no other site management) displayed significantly higher survival rates (78%) than any other treatment. Survival in other treatments was poor and ranged between 26% and 44%. Overall, survivorship was significantly higher in the first six months of the experiment, compared to the subsequent 18 months. The use of tree guards produced the only significantly positive growth rate, over the 24 months of monitoring.

We attribute the increased survival and growth of the plants with tree guards to the ability of the guards to protect plants from vertebrate grazing and moisture loss. Young spiny daisy shoots are particularly susceptible to grazing by feral European rabbits (*Oryctolagus cuniculus*) and brown hares (*Lepus capensis*). In contrast, weed control and snail baiting were of minimal benefit. This trial was conducted during a period of prolonged drought, highlighting both the hardiness of the spiny daisy and the effectiveness of tree guards at moisture retention. Logistics prevented the examination of the effects of weed and/or snail control, in combination with tree guards. However, the observed benefits of using tree guards alone suggested that any additional gains provided by weed or snail control may not be cost effective. This trial demonstrated that new populations can be established successfully without the need to undertake expensive site preparation works prior to translocations.

Field-based cross-pollination trial: With intra-population fertilization virtually non-existent, glasshouse and field-based trials have been undertaken to determine if cross-pollination will occur between plants from the five different

populations. Twenty-five individuals from each of the "Yangya", "Rusty Cab", "Thornlea" and "Hart" populations were planted at a road reserve near Caltowie in June 2007 (randomised block design with all possible combinations), in an attempt to induce sexual reproduction. Following its discovery in January 2007, an additional 50 individuals from the "Telowie" population were propagated and added to the trial in June 2008. All plants were protected with tree guards, which were removed after 12 months, to allow free cross-pollination to occur.

Members of the Biodiversity & Endangered Species Team (BEST) community group planting tubestock at translocation site © SADEH

During the October 2008 monitoring period, 17% of plants were mature enough to display flowers or buds. Although too early to be conclusive, there has been no indication of successful cross-pollination or seedling establishment so far. If no significant seed set is observed over the next monitoring season, this may suggest that the spiny daisy is incapable of inter-clonal cross-fertilization and, therefore restricted to five genotypes. As such, the species will have little adaptive plasticity in the face of changing environmental conditions and may be totally dependent on further translocations into areas of suitable climatic regimes.

Establishment of display populations: Translocated populations have been established at five public gardens for education purposes. These sites include three regional gardens and two accredited botanic gardens (Arid Lands Botanic Gardens and Australian National Botanic Gardens). Interpretative signage accompanies each translocated population. To date, these display populations have been established with only four of the five species' genotypes.

Major difficulties faced

- There is limited knowledge of the species ecology (e.g. historic range).
- The habitat of this species in the Mid North of South Australia is highly fragmented and degraded, resulting in difficulties in locating suitable translocation sites.
- The Mid North of South Australia has been in a prolonged drought since 2005. However, supplemental watering during the first summer after planting appears to have improved survival rates.
- The majority of translocations are conducted in degraded habitats, necessitating ongoing site management following establishment (weed and snail control).

- In the past, the sourcing of sufficient funding to undertake the translocations and ensure ongoing site management has been problematic. More recently, medium-term funding support for the project has been secured from Exetel, via the Foundation for Australia's Most Endangered Species (FAME).

Major lessons learned

- The spiny daisy is readily propagated from cuttings.
- The use of tree guards significantly increases the survival of translocants and negates the need for extensive site preparation works prior to translocations.
- Differences in both flowering time and intensity (between genotypes) further reduces the probability of successful cross-pollination.
- With only five known genotypes and an apparent inability to cross-pollinate, increasing the size of the gene pool appears unattainable.

Success of project

Highly Successful	**Successful**	Partially Successful	Failure
	√		

Reason(s) for success/failure:

- The spiny daisy is readily propagated and translocated to new sites, allowing for the establishment of numerous supplemental populations.
- Aside from the apparent inability to facilitate cross-pollination between the genotypes, the project is well advanced in achieving its targets.
- There has been good collaboration between all agencies involved.
- Careful planning for translocations and subsequent site management.
- A collective knowledge has developed of the difficulties this species may face from future climate change.
- Dedicated participants.

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