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The translocation of two critically endangered *Acacia* species

LEONIE MONKS[1] AND DAVID COATES[1]

[1]Science Division, W.A. Herbarium, Department of Conservation and Land Management,
Locked Bag 104, Bentley Delivery Centre, Western Australia 6983
Email: leoniem@calm.wa.gov.au; davidc@calm.wa.gov.au

SUMMARY

The successful recovery of critically endangered flora will rely increasingly on its translocation to secure sites where the amelioration of threats has been successful or where current threats such as weeds are absent. Translocations are both costly and time consuming and in many cases involve very small numbers of plants from critically endangered populations. Consequently it is important that effective, efficient methodologies are developed for the process and for monitoring success. Equally critical, as part of the same monitoring program, is the need to develop protocols for determining and predicting translocation success. Of the 28 *Acacia* species listed as threatened (Declared Rare Flora) 12 are critically endangered and all occur in agricultural areas where there has been extensive land clearing and habitat degradation. The Department of Conservation and Land Management has carried out 15 experimental translocations of critically endangered taxa as part of approved Interim Recovery Plans, including *Acacia aprica* and *Acacia cochlocarpa* subsp. *cochlocarpa*. Preliminary data are presented on the current status and success of experimental translocations of these two taxa of *Acacia*. Artificial watering and mulch had little effect on enhancing survival or growth of either taxon. Protection from grazing appears to be essential in ensuring translocation success. Continued monitoring is required to evaluate translocation success satisfactorily.

INTRODUCTION

A translocation is the deliberate transfer of plant material, such as seedlings, from one area to another for the purpose of conservation (Australian Network for Plant Conservation 1997). Translocations are rapidly becoming an important tool in the conservation of many critically endangered plants (Guerrant and Pavlik 1997). They can be undertaken to increase existing populations (augmentation), restore an extinct population (re-introduction) or establish a population where the species has not been recorded previously but where the habitat is similar to that of known populations (introduction) (Australian Network for Plant Conservation 1997). In an extreme case the translocation may be into an area where the species has never been recorded and where the habitat is different from that where the species occurs (conservation introduction) (Australian Network for Plant Conservation 1997).

Translocations should combine careful, detailed planning with a long-term commitment to monitoring. Planning involves decisions such as whether to translocate (will it assist the recovery of the species?); choice of propagule type (seed, seedling, cutting etc); evaluation of number and location of translocation sites (based on similarity to the natural sites, security of the site and absence of threatening processes), and design of the planting layout. A long-term commitment to maintaining and monitoring the translocation site is essential as the ultimate success will be determined only after many years (Sutter 1996).

Translocations with conservation objectives have been occurring for many years (Brookes 1981; Guerrant 1996; Ledig 1996; Mehrhoff 1996). In early translocations, however, there has been a lack of detailed records, a scientific approach, adequate control of threatening processes, long-term monitoring and a well-defined method of assessing the success or failure of the project. Coumbe and Dopson (2001) reviewed 335 translocations of 127 plant taxa in New Zealand between 1987 and 1999 and identified four aspects in which management of translocations could be improved: documentation, threat control, planned monitoring, and involvement of community groups.

Detailed records documenting every step of the translocation process are vital to ultimate success. A review of fifteen plant translocations undertaken for mitigation purposes in the USA found that many failed (Hall 1987). Lack of adequate documentation was a major factor in the failure of a third of the projects (Hall 1987). Very little value was gained from these projects because it was not known why they succeeded or failed. A good Western Australian example is the Mogumber Bell (*Darwinia carnea*), a critically endangered plant that occurs near Mogumber and Narrogin. It was propagated by a keen local horticulturist who in 1985 planted approximately 50 plants into a site believed to be the type locality for the species (Holland *et al.* 1997). Five years later a botanist visited the area and could not locate a single plant. A local farmer believed that sheep had eaten the plants, but nobody really knew what had happened (Holland *et al.* 1997). Later, when the species was translocated in the Narrogin area, the project had to start with virtually no background information despite the previous translocation. Pavlik (1996) believes that even a 'good solid failure' can be useful in learning about a species as long as detailed records are kept.

Even if adequate records have been kept, success or failure cannot be accurately assessed in many cases because of poor experimental design. A rigorous scientific approach should be used, including assessment of the suitability of the site, investigations into the species' biology and testing of different methodologies (Jusaitis 1997). Guerrant (2001) used this approach when translocating Western Lily (*Lilium occidentale*). He tested the accuracy of a computer model which suggested that larger founding plants had a greater chance of long-term survival than smaller ones. His experimental translocations showed that, over the first four years, bulbs had higher survival than directly seeded plants. Of the directly seeded plants, those grown from old seed survived better in the first year than those grown from new seed (although this trend reversed in the following years). The bulbs also grew significantly more than direct-seeded plants, although there was little difference between the two seed types. At least initially, it appeared that using bulbs was the more successful way of establishing Western Lily. In most cases many aspects of rare species biology are unknown, and learning this may prove crucial to the ultimate success of the translocation.

Critical to the outcome of translocations is the presence of threatening processes, or the potential effect of threatening processes, at the translocation site. Secure translocation sites should be chosen where threats are either not present or action has been taken to eliminate them. Mehrhoff (1996) cautioned against translocating plants into area where threats have not been adequately controlled. He stated: 'It makes little sense to spend considerable time and resources to propagate transplants and then send these valuable transplants on a near-certain "death-march" back into the wild if the threats endangering the species have not been eliminated or controlled'. Pavlik *et al.* (1993) showed that control of annual grasses with herbicides had a significant beneficial effect on the size and reproductive output of translocated *Amsinckia grandiflora*. The control of herbivores increased the half-life survival of a population of *Hieracium pilosella* by 57% (Davy and Jeffries 1981). Herbivores were also found to have had a significant negative effect on the survival of translocated seedlings of *Vella pseudocytisus* (Sainz-Ollero and Hernandez-Bermejo 1979). Seedlings planted in 'jiffy' pots appeared to attract rabbits, mice and moles, which then uprooted the plants. Even after the threats have been identified, it may be difficult to quantify their effect during the translocation. Threats that appear to have only a small impact on the natural population may mean the difference between the success or failure of the translocation. An experimental approach can again be used to evaluate their impact.

The goal of translocation is to establish resilient, self-sustaining populations that retain the genetic resources necessary to undergo adaptive evolutionary change (Guerrant 1996). No translocation project should be complete without some form of assessing whether the action has been worthwhile. A goal or series of goals should be programmed into the translocation project at the beginning so that there is some means by which the success or failure of the action can be assessed. Pavlik (1996) advocated short- and long-term goals. Short term goals should assess the ability of the new populations to establish, reproduce and disperse. Long-term goals should use the natural population as a benchmark, and assess the ability of the translocated population to integrate fully into an ecosystem and adapt to a changing environment through evolution or migration. Pavlik (1996) also distinguished between biological and project success. He defined biological success as the performance of translocated individuals, populations and groups of populations (metapopulations) in assuming appropriate functions in the ecosystem. Project success has a much broader definition by contributing to our knowledge of the threatened species or facilitating the development of new management techniques. Fiedler (1991) assessed 46 translocation projects in California and expressed concern that 33% of the projects lacked criteria and consistency in evaluating success.

Sutter (1996) considered monitoring to be the foundation of success in a good translocation program. The purposes of monitoring are to:

- ascertain the status of particular populations or species (Davy and Jefferies 1981);
- check the initial survival, growth and flower and seed production;
- check recruitment and seedling growth;
- check the results against a reference population (Pavlik 1996).

Monitoring should meet four criteria (Sutter 1996):

- it should detect real changes in the population with an acceptable level of precision;
- the data collection techniques must be usable by many people;
- data must be collected over a long enough period to detect long-term trends;
- it must be cost effective and uncomplicated so that it can continue over a long period.

TRANSLOCATIONS IN WESTERN AUSTRALIA

Western Australia is world-renowned for its high plant species diversity and endemism, with around 80% of the estimated 12,000 species in the State restricted to the south-west corner (Hopper *et. al.* 1996). As a result of extensive land clearing and habitat degradation, however, more than 2000 plant taxa in Western Australia are currently listed as rare and threatened (Buist *et al.* this proceedings), and most occur in the South-West.

Rare and threatened plant species in Western Australia are assessed and ranked according to the level of threat. Species that have a high probability of becoming extinct in the next five to ten years, if threatening processes are not abated, are ranked as critically endangered. Currently, 106 plant taxa are listed as critically endangered. One of the key recovery actions recommended for many of the critically endangered species in Western Australia is translocation, which is considered when populations are small and declining, and seem unlikely to persist beyond a few years. Translocations are also used when all or most populations of the threatened species occur in areas that are extremely vulnerable to destruction. Currently there are Interim Recovery Plans for 71 critically endangered species. Translocation is recommended for 51 species, and 25 of these are already under way (Table 1).

The south-west of Western Australia is also world renowned as the centre of *Acacia* species diversity, where 33% (397 species) of the 1200 species worldwide occur. This diversity coincides with the area of highest human impact, so many species are considered rare and poorly known (161 species) or threatened (29 species). Of the 29 threatened species, 12 are considered at such a high risk of extinction that they have been listed as critically endangered (see Buist *et al.* this proceedings).

In 1998, two *Acacia* taxa considered critically endangered were targeted for translocation in an effort to have at least one population of each in a secure site. The first (*Acacia aprica*) is a spreading, open shrub to 2 m tall with slightly zigzag branches, terete phyllodes, and golden, globular flowers from June to August. Only six populations with approximately 220 individuals remain in the wild. Five of these populations occur on narrow, degraded road verges and the sixth in remnant vegetation on private property. The second (*Acacia cochlocarpa* subsp. *cochlocarpa*) is a sprawling shrub to 0.7 m tall and up to 3 m wide. The phyllodes are linear, incurved and erect. The flower heads are golden, sessile, and cylindrical and occur from June to July. Only one population, of 125 individuals, is known on a narrow road verge, extending into the adjacent farmland. Threats to the survival of both taxa are similar and are listed as accidental destruction, weed encroachment, spray and fertiliser drift from adjoining agricultural areas and small population size (Stack and English 1999a and b).

TABLE 1
Summary of the status of plant translocations in Western Australia.

SPECIES	PRESENT CONSERVATION RANK	TRANSLOCATION STATUS
Acacia aprica	Critically endangered	Survival good, plants reproducing
Acacia cochlocarpa subsp. *cochlocarpa*	Critically endangered	Survival good, plants reproducing
Banksia cuneata	Critically endangered	Survival excellent, plants reproducing, second generation present
Brachysema papilio	Critically endangered	Survival good
Darwinia sp. *Williamson*	Critically endangered	Survival moderate
Darwinia carnea (Mogumber form)	Critically endangered	No plants survive
Darwinia carnea (Narrogin form)	Critically endangered	Survival good, plants reproducing
Daviesia bursarioides	Critically endangered	Survival reasonable, plantsreproducing
Dryandra ionthocarpa	Endangered	Survival reasonable
Eremophila nivea	Critically endangered	Survival poor, seed yet to germinate
Eremophila scaberula	Critically endangered	Seed yet to germinate
Eucalyptus rhodantha	Endangered	Survival very poor, a few plants flowering, no second generation
Grevillea calliantha	Critically endangered	Survival good, plants reproducing
Grevillea dryandroides	Critically endangered	No plants survive
Grevillea maccutcheonii	Critically endangered	Survival good, plants reproducing, second generation present
Grevillea scapigera	Critically endangered	Survival good, plants reproducing, second generation present
Lambertia echinata subsp. *echinata*	Critically endangered	Survival poor, plants reproducing
Lambertia echinata subsp. *occidentalis*	Critically endangered	Survival good, plants reproducing
Lambertia orbifolia subsp. *orbifolia*	Critically endangered	Survival excellent, plants reproducing, second generation present
Lasiopetalum pterocarpum	Critically endangered	Survial good, plants reproducing
Lechenaultia laricina	Endangered	Survival moderate, plants reproducing
Petrophile latericola	Critically endangered	Survial moderate
Rulingia sp. Trigwell Bridge	Critically endangered	Survival excellent, plants reproducing, second generation present
Verticordia fimbrilepis subsp. *fimbrilepis*	Critically endangered	Survival poor, plants reproducing
Verticordia spicata subsp. *squamosa*	Critically endangered	Seedling survial excellent, plants reproducing Seed yet to germinate

MATERIALS AND METHODS

Seed of *A. aprica* was sourced from a bulked collection from 60 plants in the largest population. Seed of *A. cochlocarpa* subsp. *cochlocarpa* was sourced from a bulk collection from 30 plants in the only known population. Seed of both species was pretreated by soaking overnight in near-boiling water, placed on agar plates and incubated at 15°C with 12 hours light and 12 hours dark until germination. At radical emergence germinants were transferred to the nursery at Kings Park, Botanic Gardens and Parks Authority, where they were grown in sterilised potting mix until ready for planting into the translocation site.

Translocation sites were selected by surveying areas around the natural populations, specifically targeting areas reserved for conservation purposes. Sites were evaluated for suitability based on similarity of soil type, associated vegetation type and structure to the natural populations. Sites were also evaluated for the presence of threatening processes. After a search of four reserves around Carnamah, one site was chosen for *A. aprica*, in a shire reserve. The site was in a disused gravel pit of red-brown gravelly clay loam, surrounded by eucalypt woodland. The gravel pit was deep-ripped prior to planting. Although weed invasion was evident in the surrounding woodland and had the potential to impact at the translocation site, the site was still considered the best of the few available in the surrounding highly cleared landscape. Two sites were chosen for *A. cochlocarpa* subsp. *cochlocarpa* in a nature reserve. Both sites were disused gravel pits, which were deep-ripped prior to planting. The soil type (red-brown clay loam) and surrounding vegetation (low scrubland) matched those of the natural population. None of the processes threatening the natural population was evident at the translocation sites.

In 1999, 180 plants of *A. aprica* were planted at the translocation site. Four blocks of 16 m x 5 m were measured. In one block 48 seedlings were planted, whilst the remaining blocks were each planted with 44 seedlings. Within each block, half the seedlings were assigned randomly to the mulched treatment, but the remainder were not mulched (Table 2). The mulch consisted of tree loppings ground into small (>10 cm) pieces and sterilised with methyl bromide to eliminate insect pests, weed seeds and other pathogens (e.g. *Phytophthora cinnamomi*). Each plant was then surrounded by a wire fence 90 cm in height (mesh dimension 4 cm), which was secured to the ground using two steel tent pegs 25 cm long. After planting each seedling was tagged with an individually numbered aluminium tag.

In 2000 the effects of grazing by kangaroos and rabbits on *A. aprica* seedlings were investigated. A total of 362 seedlings was planted at the translocation site. These were planted in five blocks with 72 seedlings in each block (with the exception of block 4 with 71 seedlings). Within each block half the seedlings were assigned randomly to the fenced treatments and the remainder were assigned to the unfenced treatment (Table 2). In the fenced treatment seedlings were planted in a block of four rows with seedlings planted at one metre intervals. Each block was surrounded by a fence of 16 m x 5 m in size (Table 2). Seedlings assigned to the unfenced treatment were planted around each fenced block, spaced c. 1 metre apart, each with an individually numbered aluminium tag.

In 1999 344 seedlings were raised of *A. cochlocarpa* subsp. *cochlocarpa*. These were assigned randomly to five blocks of 68 seedlings (except block five with 72 seedlings). Blocks measured 18 m x 5 m and seedlings were planted in four rows of 17 with 1 m between each seedling. One batch of 235 seedlings was 9 months old and one of 109 was 18 months old (Table 2). Half the plants in each age group were then assigned randomly to the watered treatment whilst the remaining plants were not watered (Table 2). Water was applied once a week, gravity-fed from a 4500 litre storage tank controlled by a solar-powered electronic valve system. But because there was little slope on site the gravity fed system could not deliver a precise quantity to each plant. Thus the watering treatment is simply defined as plants given water. Plants were watered from the start of December to the end of April to test whether watering over the first summer enhances survival. Each block of seedlings was surrounded by a wire fence (mesh dimension 4 cm) of 90 cm in height. Each seedling was tagged with an individually numbered aluminium tag.

In 2000, 370 seedlings of *A. cochlocarpa* subsp. *cochlocarpa* were raised to investigate the effects of grazing by kangaroos and rabbits. These were randomly assigned to one of five blocks (73 seedlings in block 1, 72 in block 2, 66 in block 3, 81 in block 4, 78 in block 5). Within each block seedlings were assigned to the fenced treatment (21 seedlings in block 1, 20 in block 2, 19 in block 3, 28 in block 4, 29 in block 5) and the remainder were assigned to the unfenced treatment (Table 2). In the fenced treatment seedlings were planted c. 1 m apart in a group of four rows. Each block was surrounded by a fence of 16 m x 5 m. For the unfenced treatment seedlings were planted c 1 m apart around each fenced block. Each seedling was tagged with an individually numbered aluminium tag.

Monitoring was undertaken at planting, approximately six months after planting and annually thereafter. Data included the number of surviving plants, height, width of the crown in two directions (for *A. cochlocarpa* subsp. *cochlocarpa* only), reproductive state, number of inflorescences and pods (although due to the time of flowering floral bud data were obtained only for *A. aprica*), whether second-generation plants were present and general health of the plants.

All growth and reproductive data were analysed for treatment and block effect using two- or three-way analysis of variance. One-way analysis of variance was used to test for treatment and block effect for survival data. Percentage data were arcsin transformed prior to analysis.

TABLE 2
Description of experimental treatments.

TREATMENT	DESCRIPTION OF TREATMENT
Younger plants	Seedlings planted after being grown in the nursery for nine months.
Older plants	Seedlings planted after being grown in the nursery for 18 months.
Control (not watered)	Plants not watered during summer.
Watered	Plants watered with c. 1 litre of water once a week .
Control (not mulched)	Plants not mulched.
Mulched	A layer of mulch, c. 2.5 cm deep and 1 m wide, placed around the plant.
Control (unfenced)	Plants not fenced.
Fenced	Plants surrounded by a wire fence (mesh dimension 4 cm) 90 cm high, secured to the ground using two 25 cm long steel tent pegs.

TABLE 3
Monitoring data for translocated *Acacia aprica* seedlings planted in 1999.

	2000		2001	
	MULCHED	UNMULCHED	MULCHED	UNMULCHED
% survival	88.7	92	88.7	87.5
Mean height (m)	0.90	0.95	0.93	0.99
Mean no. floral buds	78.5	70.4	N/A	N/A

RESULTS

Survival of *A. aprica* seedlings planted in 1999 was high over the two monitoring periods regardless of whether plants were mulched or unmulched (Table 3). There was no significant difference in survival ($P = 0.9716$), growth ($P = 0.3308$) or floral bud production ($P = 0.4561$) between the two treatments in 2000. There was also no significant difference at the 2001 monitoring period between mulched and unmulched plants in either survival ($P = 0.6901$), or growth ($P = 0.4566$). Block effect in 2001 was only significant for height ($P = 0.0203$) and number of buds ($P < 0.0001$).

More *A. aprica* seedlings survived when protected from herbivory (Table 4) although survival was not significantly enhanced ($P = 0.1021$). Growth was not significantly different between fenced and unfenced plants ($P = 0.9527$) (Table 4). There was no significant effect of block for height ($P = 0.2408$) or survival ($P = 0.7469$).

TABLE 4
Monitoring data for translocated *Acacia aprica* seedlings planted in 2000.

	FENCED	UNFENCED
% survival	62	38
Mean height (m)	0.57	0.57

In 2001 seedlings of *A. cochlocarpa* subsp. *cochlocarpa* that were not watered had a level of survival similar to those given water ($P = 0.3338$) (Table 5). There was also no difference in survival between those seedlings planted at 9 months compared to those planted at 18 months of age ($P = 0.7258$). There was a significant difference between differently aged seedlings for mean width ($P < 0.001$) in 2001, but no difference in plant height ($P = 0.1589$). No significant difference was shown between the watered and unwatered plants for either height ($P = 0.5184$) or width ($P = 0.2781$) in 2001. There was a clear

TABLE 5
Monitoring data for *Acacia cochlocarpa* subsp. *cochlocarpa* seedlings planted in 1999.

MONITORING PERIOD	TREATMENT	SEEDLING AGE	% SURVIVAL	MEAN HEIGHT (M)	MEAN WIDTH (M)	MEAN NO. BUD, FLOWERS AND FRUIT
2000	Control	9 months	93.8	0.28	0.50	37.1
	Control	18 months	87.0	0.32	0.96	77.2
	Water	9 months	96.8	0.26	0.51	50.1
	Water	18 months	100	0.30	0.95	101.7
2001	Control	9 months	92.2	0.32	0.65	N/A
	Control	18 months	88.2	0.33	1.04	N/A
	Water	9 months	93.1	0.27	0.77	N/A
	Water	18 months	96	0.34	1.07	N/A

difference between the ages in 2000 for the number of flowers (P = 0.0144). Again there were no significant differences between watered or unwatered plants (P = 0.0908) for the number of flowers. On average, however, watered plants produced more flowers than unwatered plants (Table 5). Significant differences between blocks were shown only for height (P = 0.0112), mean width (P = 0.0004) and number of buds (P < 0.0001).

Seedlings of *A. cochlocarpa* subsp. *cochlocarpa* had significantly greater survival when protected from herbivores (P = 0.0093), although canopy height (P = 0.5887) and width (P = 0.1760) were not significantly reduced by grazing (Table 6). There was no significant effect of block for height (P = 0. 4395) or survival (P = 0.8194).

TABLE 6
Monitoring data from June 2001 for *Acacia cochlocarpa* subsp. *cochlocarpa* seedlings planted in 2000.

	FENCED	UNFENCED
Percentage survival	74.6	30.7
Mean height (m)	0.26	0.27
Mean width (m)	0.34	0.30

DISCUSSION

Using an experimental approach to the translocation of *A. aprica* and *A. cochlocarpa* subsp. *cochlocarpa* has allowed us to investigate several techniques. Fencing seedlings immediately after planting clearly enhances success, as seedlings of both *Acacia* taxa were more likely to survive when protected from herbivores. Growth was not significantly reduced by grazing for either species. However, this is probably because plants that were not heavily grazed were the only ones to survive.

In environments where water is limited, leaf litter is believed to enhance seed germination and seedling survival by reducing evaporation of soil moisture from around the plant (Hamrick and Lee 1987; Enright and Lamont 1989; Facelli *et al.* 1999). In contrast in this study the use of mulch appeared to have little effect on the survival or growth of the translocated *A. aprica* seedlings. The reasons for this are unknown, but may be a result of age of founder plants. Seedlings were approximately 18 months of age when planted and the root system may have been sufficiently well developed to tap quickly into deeper water supplies. This may have reduced any effect of mulching.

The availability of water in the first summer after germination is often found to be one of the most important factors limiting seedling survival in Mediterranean climates (Lamont *et al.* 1993). However, in the case of the translocated *A. cochlocarpa* subsp. *cochlocarpa* seedlings there was very little difference in survival or growth between plants given water and those not watered. There are several possible reasons for this. The translocation site was formerly a gravel pit and there may have been little competition for the available water, reducing any effect from the watering treatment. Or, as mentioned previously, the founder plants may have been old enough to have reasonably well developed root systems which allowed them to establish quickly before the summer drought.

Long-term survival of translocated plants may be influenced by the age of the founding individuals. Guerrant (1996) used computer models to compare long-term survivorship between different aged founder groups for a range of long-lived perennial species. Death rates declined significantly as the age of the founder group increased and, after ten years, population size increased significantly as age of the founder group increased (Guerrant 1996). Initially there does not appear to be such a clear trend for *A. cochlocarpa* subsp. *cochlocarpa*. A significant difference was found in the first year growth between the two ages but this would appear to be a function of the size at planting. This difference reduced in the second year, indicating that 9-month-old plants are actually more vigorous than 18-month-old plants. In addition the 9-month-old plants appear healthier, greener and have a denser canopy than 18-month-old plants. Long term monitoring should enable the progress of the different aged seedlings to be followed and give a better idea of what is the ideal seedling age for translocation.

The preliminary results from this study indicate that a number of the techniques investigated to maximise seedling establishment, survival and growth are important for translocation success. Monitoring to date also shows that criteria for short-term success, particularly in seedling survival and reproductive capability, have been met. Many translocation projects have also reported such success in the short term (e.g. Olwell *et al.* 1987; Gordon 1996; Bowle and McBride 1996; Johnson 1996). For example, translocation of *Abronia umbellata* subsp. *breviflora* (Nyctaginaceae) appeared to be successful just two years after the initial planting (Kaye *et al.* 1999). Survival of the transplants was high, transplants flowered and produced viable seed, second generation plants were recorded and the experimental approach helped refine many translocation techniques.

The long-term and biological success criteria proposed by Pavlik (1996) have yet to be determined for these two acacias. It is not yet possible to determine whether the populations are self-sustaining or whether sufficient genetic diversity has been retained (Guerrant 1996). Even for annual species, authors have hesitated to evaluate long-term success (Brookes 1981; Guerrant and Pavlik 1997). For example, ten years after translocating the annual *Stephanomeria malheurensis* (Asteraceae), long-term monitoring is still recommended (Guerrant and Pavlik 1997). In one of the earliest documented conservation translocations, that of the sedge *Schoenus ferrugineus* (Cyperaceae), monitoring continued for over 30 years – but there was no evaluation of the long-term success (Brookes 1981). Despite indications that these two acacias can flower and set fruit after three years, they must be monitored for at least another three years before a realistic determination of the long-term success of the translocations can be made.

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