TRANSLOCATION WORKSHOP

Minutes from the Workshop on the Experimental Translocation of Critically Endangered Plants

Held at the Wildlife Research Centre on 5 May 1998

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TRANSLOCATION WORKSHOP

1. David Coates - Introduction

2. Anne Cochrane - The seed collection process and how that relates to the translocations

2.1 Objectives

- to develop a comprehensive seed based germplasm collection for Phytophthora susceptible rare and threatened plant taxa in WA with the initial aim of capturing between 75 and 80% of all genetic variation within each taxon.
- to utilise appropriate protocols for the medium and long term storage of seed from Phytophthora susceptible rare and threatened plant taxa in WA and maintain an integrated database on seed provenance and seed biology for each taxon. Where appropriate other rare and threatened taxa will be targeted.

2.2 Outcomes

- Storage of sufficient genetic resources (75 - 80%) of each taxon to ensure its successful re-introduction and establishment in the wild following extinction from natural populations.
- provision of seed material for biochemical, physiological and molecular research on rare and threatened plant taxa.
- provision of material for ex-situ propagation as required in recovery programs or for educational purposes.

2.3 Sampling Protocols

- What species to collect - Phytophthora susceptible species and rare and threatened WA flora.
- Number of populations per taxa - Depends on genetic variation, which usually isn't known.
  - Sample all populations if less than 5 populations in existence, or a maximum of 5 populations if there are more than 5 populations in existence.
- Number of source plants per population
  - random sampling approach, no bias toward colour, size, shape etc.
  - optimum sample size ranges between 10 and 50 plants per population.
  - include ecologically significant genotypes.
  - equal quantities of seed from each source plant to avoid bias.
  - aim for 1000 viable seed per population.
- Number of seed per source plant
  - ultimately depends on the survivability of propagules.
  - allow for excess seed for germination and moisture content testing and sub samples for monitoring.

2.4 Status of the seed collections

Currently there are:

- 567 accessions (collections) of DRF and priority flora in storage.
- This covers 18 families, 47 genera and 204 taxa.
- 37% of these accessions are from critically endangered taxa, 42% from the remaining DRF and 21% from priority flora.
- 66% (53 of 89) of all the critically endangered taxa have collections of seed stored.

Table 1. Material from TFSC used for translocation

Species	No. of individuals in population	No. of individuals sampled	Date of collection	No. of seed used	Mean % germination
Acacia aprica	100+ plants	60	Nov-96, Nov-97	475 seed	72%
Acacia cochlocarpa* subsp. *cochlocarpa	86 plants	11	Nov-96	600 seed	ongoing
Daviesia bursarioides	60+ plants	30	Oct-96, Nov-97	450 seed	55%
Grevillea calliantha	24 plants	24	Nov-95	275 seed	92%
Lambertia echinata* subsp. *echinata	3 plants	3	Jan-94, Jan-97	270 seed	76%
Lambertia echinata* subsp. *occidentalis	11 plants	6	Dec/Feb-97, Jan-98	120 seed	96%
Lambertia orbifolia	139 plants (~50% seedlings)	40	Feb-96	250 seed	92%

3. Leonie Monks - Brief overview of the proposed experimental translocations

3.1 Definitions

(from the "Guidelines for the Translocation of Threatened Plants in Australia" produced and published by the Australian Network for Plant Conservation).

Re-stocking: An attempt to increase population size or diversity by adding further individuals to an existing population.

Re-introduction: An attempt to establish a population in a site where it formerly occurred, but now is believed to be extinct.

Translocation (Introduction): An attempt to establish a population in a site where it is not previously known to have occurred, but is within the known distribution range and habitat type of the taxon.

Conservation Translocation (Introduction): An attempt to establish a population, for conservation purposes, in an area that is outside the known distribution range for the taxon, but which is appropriate habitat for the taxon.

3.2 Two main aims of the translocations

⇒ A conservation measure, to attempt to conserve the species by halting the decline in the number of individuals and to conserve the genetic diversity of the species.

⇒ To develop management protocols for the establishment of the species. We need to know what techniques increases the survival of translocated seedlings and therefore we need to set these translocations up as experiments and statistically test this. Information can be gathered to show that these establishment techniques (which may be costly and time consuming) are either essential (and we can therefore justify the cost and time involved), or not essential to significantly increase survival.

Table 2. The seven species to be translocated in 1998, the number of seedlings raised, type of translocation and experimental treatments to be tested.

Species	CALM District	No. of Seedlings	Type of Translocation	Experimental Treatments
Acacia aprica	Moora	1500 (seed)	Translocation	Control Watered Mulched Watered and Mulched
Acacia cochlocarpa* subsp. *cochlocarpa	Moora	1500 (seed)	Translocation	Control Watered Mulched Watered and Mulched
Daviesia bursarioides	Moora	205	Restocking	Control Watered Mulched Watered and Mulched
Grevillea calliantha	Moora	95	Translocation	Control Watered Shaded
Lambertia echinata* subsp. *echinata	Esperance	165	Restocking	Control Watered Mulched
Lambertia echinata* subsp. *occidentalis	South West Capes	66	Conservation Translocation	Control Mulched
Lambertia orbifolia	Albany	270	Conservation Translocation	Control Mulched Shaded Gro-cone

3.3 Experimental Design

- Plants have been raised at Kings Parks accredited nursery.
- Sites have been selected by matching, as closely as possible, vegetation type and structure and soil type. They are the closest site possible site with few threats.
- Seedlings will be planted in grids and the treatments will be randomly located to a row in the grid
- Grids will be randomly located throughout the site.
- Seedlings will be permanently tagged, the site mapped and a photo point set up, so that the seedlings will always be able to be located.
- Monitoring will take place after the first month and then every second month after that.
- Monitoring will include measurements of the heights and crown widths, reproductive state, number of inflorescences and follicles or pods and general health of the plants.
- Monitoring will also include the known populations so that we have some data to compare our translocated population to, and this will give us an indication of how successful we have been.

Table 3. Description of experimental design.

Treatment	Description of Experimental Treatments
Control	Plants not given any treatment.
Mulched	A layer of mulch is placed around the plant to see whether it enhances survival by increasing water retention.
Watered	Plants will be watered with a set amount of water once a week for 24 weeks from the start of November to the end of April to see whether watering over the first summer enhances survival.
Watered and mulched	A layer of mulch is placed around the plant and in addition plants will be watered with a set amount of water once a week for 24 weeks from the start of November to the end of April to see whether it is a combination of both watering and mulching that enhances survival.
Shaded	A circle of wire netting, approximately 1m in diameter and covered in shade cloth, is placed around the plant after planting to see whether survival is enhanced by the creation of a shaded environment around the plant.
Gro-cone	A Gro-cone is placed around the plant after planting to see whether it enhances survival by creating a sheltered environment around the plant

Example of Experimental Design

Site Diagram for Proposed Translocation of *Lambertia echinata* subsp. *echinata*

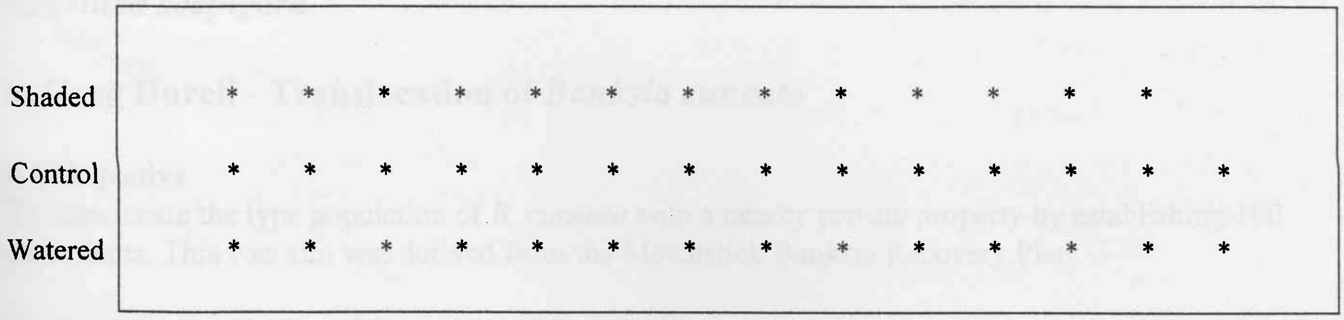
Replicate 1

Watered	*	*	*	*	*	*	*	*	*	*	*	*	*	
Control	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Shaded	*	*	*	*	*	*	*	*	*	*	*	*	*	*

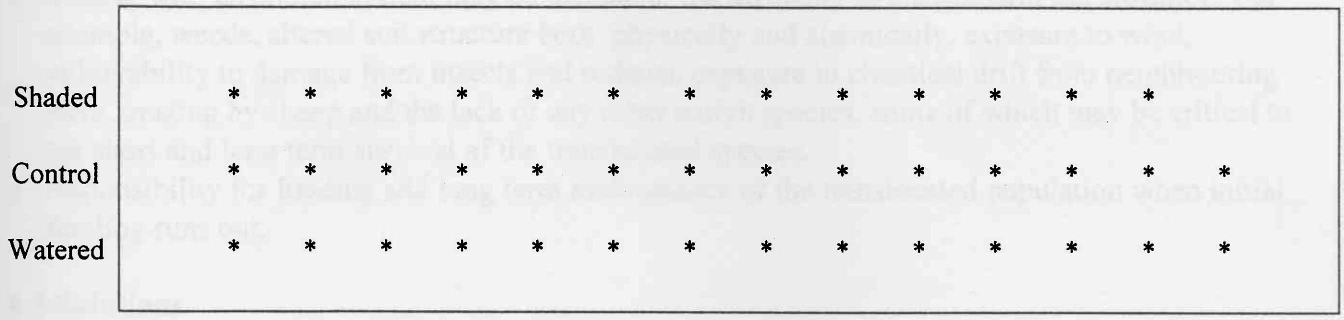
Replicate 2

Control	*	*	*	*	*	*	*	*	*	*	*	*	*	
Watered	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Shaded	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Replicate 3



Replicate 4



Scale: 2 m

4. Andrew Burbidge - CALM translocation policy and the IRP recovery process

Policy Statement 29. should be read prior to translocation.
(http://calmweb.calm.wa.gov.au/drb/edo/mab/pol.htm)

A translocation proposal should contain the following information:
1. Summary (one page maximum)
2. Name and affiliation of proponents
3. Background on the species former and present distribution, conservation status, biology and ecology
4. Description of the translocation, why it's being proposed and information on the translocation methods. This includes:
a). land status at the translocation site
b). why plants were chosen from a particular site and why the translocation site is the most appropriate.
c). why re-stocking, reintroduction or introduction is the most appropriate method of translocation.
d). an indication that the principles of conservation genetics have been considered
e). how threats have been addressed and abated.
f). post-translocation monitoring and a commitment to medium - long term monitoring
5. Information on the source and length of funding of the translocation project
7. Endorsement of the proponent's organisation
7. References
9. Any attachments that support the translocation proposal.

5. Kingsley Dixon - Issues associated with translocation and translocation of *Grevillea scapigera*

6. Greg Durell - Translocation of *Banksia cuneata*

6.1 Objective

To translocate the type population of *B. cuneata* onto a nearby private property by establishing 100 new plants. This was aim was derived from the Matchstick Banksia Recovery Plan.

6.2 Problems encountered in meeting this aim

- unrealistic objective based on short time frame
- dealing with an altered system may contribute to the difficulty in a successful translocation. For example, weeds, altered soil structure both physically and chemically, exposure to wind, vulnerability to damage from insects and rodents, exposure to chemical drift from neighbouring farm, grazing by sheep and the lack of any other native species, some of which may be critical to the short and long term survival of the translocated species.
- responsibility for funding and long term maintenance of the translocated population when initial funding runs out.

6.3 Solutions

- set realistic and achievable goals
- ensure the site is carefully selected to avoid many of the factors listed above
- if severely altered sites are to be used the following may need to be implemented

- fencing to exclude domestic and feral animals
- establishing of shelter belts prior to the translocation
- weed eradication program needs to be undertaken prior to the translocation
- techniques for long term weed control need to be developed
- the creation of a habitat dynamic enough to ensure the wellbeing of the translocated individuals, prior to the translocation.

6.4 Tips

- look for alternative strategies, be sure that translocation is the only available option.
- develop a realistic, achievable translocation.
- when the translocation begins, maintain good hygiene and use accredited nurseries for all plants.
- document success and failure.

6.5 Site Selection

- where possible, sites where the species was previously known to occur should be targeted first.
- otherwise sites of good quality, and similar vegetation, as close to the existing populations, should be considered.
- crown reserves should be favoured above private property, due to security of tenure.
- Reserves managed for the conservation of flora and fauna should be considered as potential translocation sites.

7. Kim Williams - Translocation of *Rulingia* sp. Trigwell Bridge

7.1 Site Selection

- Physical Attributes to be considered (Macro and Micro)

Macro: Slope, aspect, position in profile, soil structure and depth (soil manually probed in both summer and winter prior to planting)
Micro: shade, shelter, chemical analysis of soil

- Access for inspections and getting equipment onsite
- Vandalism – what precautions need to be implemented to minimise loss.
- Fire Protection
- Disease Protection

7.2 Establishment

- Planting Regime (timing, spacing, density, design, acclimatisation, planting, watering)

- 3 designs employed (cluster, herringbone, random) for future shelter of the plants. - min 6 weeks acclimatisation, plants held past the major frosts and into warming weather and growth rates (September) NB: only works if intention is to artificially water.
- Potting soil teased out from root system and mixed with onsite soil at time of planting to encourage roots to grow out away from the planting hole.
- Watering at time of planting: each plant received 10 litres, applied slowly,
- Plant early in the day to allow time for the roots to settle !!

- Mulch (material, quantity)

- Small, aged, woodchips (approx 30mm size) relatively sterile, bulky enough not to blow away, not contain any soil or growing medium component to support weed or fungal growth, easy to handle, good insulative properties, allow water to penetrate.
- Depth to approx 5 - 7cm and spread to 30cm radius around each plant.
- Suitable material is something that in time would break down into the soil and not be foreign to the site.

- Fencing (vertebrate and invertebrate control)

- Rabbit and roo fencing (edges buried), cages for bird protection (if required), potential to use flywire for insect control.

- Irrigation (equipment, design (head pressure calculation), calibration, frequency and quantity)

- 2000 and 4000 litre polycarbonate tanks, sized to fit on the back of large trailer or truck + can be easily manhandled, don't require any special pad preparation
- 19mm poly pipe, 4mm feeder tube, adjustable drippers (0-22 litres per hour), inline filters, brass gate valves, digital controlled, battery powered solenoid valves. (Nelson Brand, "SoloRain", model 8033 Remote Programmable Actuator)
- Head pressure, require a minimum of 2m height difference between tank outlet and first dippers.
- Drippers need to be calibrated, those at the bottom of the slope/line will work more efficiently than those at the top because of the greater pressure, thus the need to adjustable drippers. Test in the field.
- 2 drippers per plant on opposite sides to maximise the moisture penetration zone and thus root spread. Drippers placed partial under the cover of the mulch to minimise evaporation loss.
- either bury or pin down poly and feeder tube to prevent movement during hot weather.
- Starting Point: 8 litres of water per plant per week, delivered in 2 x 4 litres sessions over a 1 hour duration at night, 3 and 4 days apart.
- Water quality - be aware of salinity in farm supplies, chemicals in domestic town supplies, dieback, chemical residues in CALM fire equipment.

7.3 Monitoring

- Type - survival count fortnightly, 3 monthly measurements (height, min & max crown dimensions, flower/bud/seed pod count, total leaf count (on small plants), comments on insect grazing (sample min of 10 leaves per plant)
- Frequency - fortnightly for the 1st 3 months, then monthly until break of season, then 3 monthly.
- Analysis - growth rates, survival in relation to rainfall, growth/survival rate difference amongst plots in relation to treatments (mulching, watering, shade etc)
- Plant ID, field enumeration/marking - mark each plant with a year planted, plot number and plant number code, fixed either to plant or small stake alongside.

8. David Mitchell - Translocation of *Lechenaultia laricina*

8.1 Introduction

Lechenaultia laricina (Scarlet Lechenaultia) is an erect, bushy shrub (up to 50 cm high and 100 cm wide) with small, densely crowded fine leaves. Flower colour vary from scarlet to orange-red, and flowers cover the plant when in full flower. Flowering occurs from late October through to late December.

Apparently once common between Northam, Meckering and Meenaar, *L. laricina* is now known only in the Swan and Wheatbelt Regions with a range (55 km) extending from Spencers Brook to south-west of Beverley. It grows on sand or gravelly loam, usually in open eucalypt woodland (jarrah, marri, wandoo) over open scrub (recent larger finds have been associated with wetlands within the woodland).

8.2 Status

When first listed as DRF in 1987 there were only 5 populations known of 560 plants. There are now 7 known populations (12 subpops) with 1100 plants recorded in the Swan Region and one population of 40 plants in the Wheatbelt Region. The three largest populations totalling over 900 plants are found within 7km of each other in Wandoo Conservation Park.

Of the other populations, 4 are on road, rail, or shire reserve or private property, and all appear to be in decline. (Latest inspection of Population 5 in April 1998 showed the remaining 12 plants appear to have died). This decline is caused by road works, weed invasion and frequent burning of the unsecured populations. Also significant damage caused by locust damage (1990/91) and unseasonally dry summers over the last few years.

Lechenaultia laricina has been ranked as Endangered and under the IUCN category C2a – it has a small population size (<2500 mature plants) and continuing decline (any rate) and fragmented populations (all sub-populations <250 mature plants).

The dieback response is unknown. Wildfires and experimental burns have shown that it resprouts after fire and has reasonable seedling germination. Attempts to stimulate recruitment of this species at another site by smoke have failed. Disturbance opportunist (eg. Seedling regeneration from road grading). Weeds competition a problem for some populations. Life of seed in soil unknown, but may be long. *L. laricina* is well established in cultivation.

Known populations of *Lechenaultia laricina*

Pop No	Population	Land Status	Pop. 1985	Pop. 1990	Pop. 1995
1	Clackline - Spencers Brook Rd	Shire Reserve	50	25	1
2a	Cullen NR	Nature Reserve	1	2	0
2b	Road reserve adjacent to 2a	Road Reserve	10	132	96
3	Near Dobaderry Swamp	Cons. Park	383	383	483
4	Talbot Block, 1.3Km from Pop. 2	State Forest	3	3	3
5a	Spencers Brook – York Rd	Rail Reserve	50	0	10
5b	Spencers Brook – York Rd	Shire Reserve	50	53	9
7	Wandoo Cons. Park	Cons. Park	?	210	337
8	Wandoo Cons. Park	Cons. Park	?	91	91
9	Narrogin District	Private	?	?	40

8.3 The Translocation

The Wildlife Management program for the Northern Forest Region (Kelly et al. 1990) outlined management requirements which included establishment in conservation reserves. This Translocation Proposal was developed in liaison with staff within CALM especially Les Robson, and Kings Park and Botanic Gardens and the Swan Region Threatened Flora and Communities Recovery Team.

Cullen Nature Reserve (0.9 ha in size, 20 km west of York) was originally set aside for conservation of this species, however *Lechenaultia laricina* has not been recorded since 1990. The species is still found on the adjacent road reserve on Berry Brow Road which has been damaged in the past by roadworks and is at risk from future road works. Restocking from the roadside subpopulation into the Nature Reserve will provide plants of this population on a secure reserve and ensure a source of seed for future recruitment on the reserve.

The reserve was fenced to exclude rabbits, and rabbits within the reserve and adjacent road reserve were baited (and warrens fumigated). There was little weed growth on the reserve so weed control was not required prior to planting.

Kings Park and Botanic Garden propagated 143 plants from 8 clones (cuttings) from randomly selected individuals taken from the roadside population adjoining Cullen Nature Reserve.

In July 1997 when the plants were 10-18 cm high they were planted by hand within the reserve. Planting sites were chosen in gaps between existing vegetation to reduce competition from other plants and with afternoon summer shade. It was decided not to provide supplementary watering based on the suggestion that this does not really benefit the plants, but promotes a weak root system. We were willing to accept some mortality of plants. The plants did get some leaf and bark mulch from the immediate area placed around them.

Plants were monitored at week 2 after planting and at least 3 monthly intervals since then. The plants are inspected for survival and changes in condition, and in future flowering and seed set compared to other populations (including the road side subpopulation). Subsequent germination from seed or suckering from these translocated plants will also be assessed

The aim of the translocation is to have survival of up to 100 transplanted *Lechenaultia laricina* within the reserve and seed set of transplanted plants comparable to other populations.

8.4 Results

Date	Time since planting	Condition			
		Excellent	Good	Fair	Dead
25 July 1997	2 weeks	49	50	35	0
24 September 1997	2 months	18	54	60	2
1 December 1997	5 months	13	50	57	14
30 February 1998	7 months	0	0	20	114

1st inspection – 25 July 97 (2 weeks after planting)

The plants were greeted with an initial heavy rainfall 2 days after planting. However this was then followed by 12 successive days of cold nights (to –4°C) and frosts. The first inspection indicated that the 35 fair plants has some frost damage.

2nd inspection – 24 September 97 (2 months after planting)

This inspection continued to show the effects of the frost damage, although most affected plants had resprouted from stem base and rootstock. Grazing from rabbits was also observed (baiting within the fence followed).

3rd inspection – 1 December 97 (5 months after planting)

This inspection showed the influence of a dry October – November with very little rain falling in that period the plants suffering somewhat.

4th inspection – 3 February 98 (7 months after planting)

The last rainfall (of 5.1mm only) was in November 21 and at this time with 61 days without rain the majority of the plants had died and it was obvious that the remaining plants would do so as well. It was decided to water the remaining plants to see if they could survive through the rest of the summer with supplementary watering. The plants were given only about 1 litre each 2-3 weeks. We didn't consider that there was enough plants to experiment with watering some and not others (the result seemed obvious). In addition a small number of "dead" plants were watered to see if they would resprout from rootstock.

5th inspection - April 1998 (9 months after planting)

19 of the 20 plants that received water have survived and show significant improvement in condition. In addition 1 of the dead plants that were watered did resprout, and 1 other plant thought to be dead resprouted after rain.

8.5 Discussion

So this translocation was not spectacularly successful. Of the original 143 plants only 21 managed to survive to April (and without additional watering, they probably wouldn't have made it).

We have not yet done a detailed study of the factors that aided survival of the remaining plants, but shade seems to have a strong influence. And at the time of planting there was differences noticed in the level of soil moisture depending on position within the reserve. Again have not had time to look at any relationships here.

There is no doubt the weather was the main factor. There are usually summer thunderstorms which provide enough water to tide this species over. It is of note that most of the other populations observed over this period are showing the effect of drought. All the mature plants at Population 5 appears to have died this summer. Also of note is the very good response of this species to only light watering (1 litre each 2 weeks).

In total the area had 109 days without rain. In the November to March period York only received 2 falls of 5.1mm (21/11/97) and 7.0mm (10/03/98), while the long term averages for York for this period are 63.6 mm falling over 12.6 days. The months before November 1997 also had below average rainfall.

It would be useful to compare seedling survival to a natural regeneration event, but there are none of a comparable age – most populations are 10 years or more since last fire/disturbance.

There is to be expected high mortality of seedlings of this type of species. In which case a dry summer with 80–100 % mortality may be 'normal' in the long term scheme of things. Successful establishment of seedlings may be uncommon (only occurring in very wet years – but frequently enough to maintain the population).

We do not have many studies of 'natural' regeneration to compare (As a useful comparison see information on *Asterolasia nivea*). For this species and other disturbance opportunists, information on the seed biology (how long the seed remains viable in the soil etc.) is important. Such studies are needed to set realistic success criteria and appropriate establishment numbers, and also lets us know what is the best response to situations such as the decline of mature plants in several of the populations.

With these translocated populations, do we want to simulate natural regeneration? Or are we prepared to intervene and 'garden' the first generation?

For *Lechenaultia laricina* the plan is to translocate an additional 100 plants this year, with supplementary water to some or all. Carry on the ongoing monitoring of survival, flowering and seed set (compared to flowering and seed set on roadside and other populations).

8.6 *Asterolasia nivea* – Translocation

- In 1988, roadworks by MRD damaged the only known population of *Asterolasia nivea*, resulting in germination of 102 seedlings.
- In 1989, translocated 24 of these seedlings to the vegetated part of the road reserve (13 plants) and onto a nearby (within 5km) nature reserve (11 plants).
- Translocation carried out using a 15cm diameter cylinder pushed down to 35cm deep to get a good root mass. Seedlings were 4-20 cm high. Seedlings planted into a variety of microhabitats/climates.
- After care – supplemental watering and mulch, rabbit and insect netting, shade cloth.
- Problems – rabbits, insects (locusts), heat.

8.7 Results

Date	Translocated Pop.	Roadside Pop.
July 1989	24 (100%)	78 (100%)
August 1990	18 (75%)	68 (87%)
May 1991	13 (54%)	33 (42%)
July 1996	6 (25%)	? (?%)

The transplanted seedlings were affected by a dry summer in the first year as well as severe locust grazing in the summer of 1990. However the survival in the first two years is comparable to the 'natural' regeneration in the roadside population (remembering that this roadside population is on the exposed table drain and cut back of the road verge).

9. General Discussion

A discussion was held at the end of the workshop to allow workshop participants to raise concerns and discuss ideas on various aspects of translocation. Topics raised by workshop participants, included site selection, propagation, establishment technology, monitoring and management and criteria for success. The ideas listed below were comments and possible solutions suggested by the participants during the course of the discussion.

9.1 Site Selection

Do you translocate to a site where you may have negative impacts (for example a "pristine" Nature Reserve)?

- if alternative sites have been discounted.
- depends on whether the objective is to preserve the ecological community within the nature reserve or save just one rare species.
- research has shown that reserves that are disturbed the least are of higher conservation value. Therefore it would be better to avoid disturbing these places. We may lose a few species, but save a whole complex ecosystem.
- if nature reserves are not used then it becomes an exercise in restoration ecology, where a whole habitat may have to be created. This may be expensive and therefore fewer species can be targeted. Alternatively, if nature reserves are used then it becomes a translocation of just one species and the funding can be used to translocate several species.
- the use of disturbed area within nature reserves (such as gravel pits that have or are being rehabilitated) maybe a viable compromise between conserving the conservation values of the nature reserve and conserving the rare species

Another factor to consider in site selection may be to select a site that has been recently burnt. Numerous species recruit seedlings after fire, and so planting as close as possible after fire may take advantage of factors, such as reduced competition or increased nutrition from the ash bed.

How floristically similar do the sites have to be? Is there are set number of species the translocation site must have in common with the original site?

- based on research and survey data it becomes the best educated guess. Ultimately the site selection must be based on a combination of factors. These include soil, underlying geology, associated vegetation, vegetation structure, aspect, landform, height in the landscape, site security and site access.

9.2 Propagation

Genetic selection may begin in the nursery process. Those individuals which survive and/or thrive under nursery conditions are not necessarily those individuals which are best suited to surviving in conditions experienced in the natural populations.

Do you mix populations when translocating, if it is known that there is little genetic difference between original populations?

- if you know the long term history of the populations an educated guess can be made. For example if the two populations are at either end of the Whicher Range you can assume they may have been recently connected and therefore you may want to mix populations. If, however, one population is in the Whicher Range and one population is near Albany it is unlikely they were recently connected or had recent gene flow and therefore you may not want to mix them.

Are seed orchards a seed source we want to utilise?

- not needed if other germplasm storage methods are sufficient.
- can be a useful method of encouraging community involvement.
- land availability and location may be a problem
- some evidence to suggest that the resulting seed may be different from seed sourced from natural populations.
- cost involved with setting up and running such an orchard may be better spent on *in-situ* conservation measures

Can the present propagation facilities cope with the number of translocations?

- the consensus seems to be that we should deal with the situation as it arises.

9.3 Establishment Technology

If you water the translocations, should you also fertilise (ie. cultivate) the translocated seedlings?

- watering simply helps enhance the probability of recruitment occurring.
- there is some research to suggest that fertilising may have long term deleterious effects, therefore fertilising is probably not a good idea.
- some research suggests that individuals benefit from post fire ashbed microsites and water and nutrient run off from road verges, therefore fertilising is a good idea.
- if it is simply a gardening exercise, like some people suggest, then we may as well do everything possible to enhance survival - water, mulch, fertilise, shade, etc.

9.4 Monitoring and Management

- monitoring should be viewed in two parts - initial monitoring of survival of the translocated individuals and long term monitoring of the viability of the translocated population.
- monitoring may be able to be undertaken by District staff as part of the regular monitoring of the known populations. This may depend on the depth of information needed. Districts may be able to take full responsibility for the monitoring and management of the translocated population after the populations is considered viable.
- training of staff, in what is required from a monitoring program, is essential.
- continuity of the monitoring program is essential, and should be managed by the Recovery Team.

Is a translocated population still considered viable if it is not represented by live individuals, but is represented in the soil seed bank?
How do you monitor soil seed banks?

9.5 Criteria for Success

- milestones may be the most appropriate way of measuring success.
  eg - survived for 1 year
  survived for 2 years
  survived until seed produced
  hasn't become weedy
  hasn't had a negative impact on the habitat it was translocated into.

9.6 General Thoughts

- should we undertake translocation programs on short-lived species given the likelihood that there will be no natural recruitment events occurring in the life-time of the translocated individuals (for example those species from the Wheatbelt and Goldfields). There is potential for a lot of resources being spent, with little or no long term gains.

- if there are no live individuals of these short lived species, but they are represented in the seed bank for a long time then a translocation may still be considered successful. There is need for more research to be undertaken on the seed bank, especially longevity of the soil stored seed bank.