TRANSLOCATION PROPOSAL
Kamballup Dryandra,
Dryandra ionthocarpa A.S. George (PROTEACEAE)

1. SUMMARY

This species was first discovered by Peter Luscombe in 1987. It is named for the tuft of hairs at the top of the fruit, *ionthas* meaning 'shaggy' and *carpos* meaning 'a fruit'. It is a prostrate shrub to 60cm wide. The leaves are divided almost to the midrib, 8-25 cm long and 5-20 mm wide. The pink-mauve and yellow flowers are contained in a terminal inflorescence. Flowering occurs in September and October (George 1996).

D. ionthocarpa was listed as Declared Rare Flora in July 1989, and then ranked as Critically Endangered in September 1995. This ranking was due to the low numbers of individuals, the threat from a nearby mine, and the possibility of a disturbance event destroying the single known population (Kershaw *et al.* 1997).

A research project is currently investigating various aspects of the biology and ecology of *D. ionthocarpa*. Experimental burns showed that this species is killed by fire, regenerating entirely from seed. Seed viability is variable, ranging between 6 and 100% (A. Cochrane pers. comm.).

D. ionthocarpa is found growing in mallee-heath and is restricted to the spongolite soils of the Kamballup area. There are two subpopulations, 1a, with 682 individuals, and 1b, with 475 individuals, both are located on reserves vested in the Shire of Plantagenet.

The aim of this translocation proposal is to conserve the wild genetic stock of the species by establishing at least one more viable population of *D. ionthocarpa.* This will be achieved by translocating this species to another reserve. This translocation proposal outlines the need for translocation of the critically endangered *D. ionthocarpa*, the site selection process, the design of the translocation site and the provisions for monitoring. In addition it outlines the criteria for success or failure of this proposed translocation.

2. PROPONENTS

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3. BACKGROUND

3.1 History, Taxonomy and Status

This species was first discovered by Peter Luscombe in 1987. It is named for the tuft of hairs at the top of the fruit, *ionthas* meaning 'shaggy' and *carpos* meaning 'a fruit'. The species, although resembling the common prostrate *Dryandra nivea*, has been placed in a series all of its own within the genus due to the distinctiveness of the fruit. It is a prostrate shrub to 60 cm wide. The leaves are divided almost to the midrib, with 15-35 lobes on each side, 8-25 cm long and 5-20 mm wide. There are between 40 and 60 flowers within the terminal inflorescence. The perianth is 39-43 mm long, pink-mauve with a 7-8 mm long yellow limb. Flowering occurs in September and October. The fruit is 43-44 mm long with an apical tuft of long rusty hairs (George 1996).

D. ionthocarpa was listed as Declared Rare Flora in July 1989, and then ranked as Critically Endangered in September 1995. This ranking was due to the low numbers of individuals, the threat from a nearby mine, and the possibility of a disturbance event destroying the single known population (Kershaw *et al.* 1997).

In 1995 a Masters research project began which sought to investigate various aspects of the biology and ecology of *D. ionthocarpa*. Experimental burns as part of this project showed that this species is killed by fire, regenerating entirely from seed. Only small amounts of seed were found to be retained in the canopy after one year, and no seed was found to be stored in the soil after a year. It appears that postfire regeneration is reliant on the current years crop of seed. Seed viability is variable, ranging between 6 and 100% (A. Cochrane pers. comm.) and seed predation ranges between 31 and 98% of the total seed crop per plant (Monks in prep).

Experimental translocations were undertaken to test whether *D. ionthocarpa* could establish in different soil types (Monks in prep.). Survival after nine months was variable with the highest survival at site 8, a spongolite soil-type in a nearby nature reserve (table 1).

Table 1. Percentage survival of translocated *D. ionthocarpa* seedlings at eight sites after nine months.

Site	Soil type of site	Seed sourced from subpopulation 1a	Seed sourced from subpopulation 1b
1	Spongolite	7	27
2	Spongolite	36	67
3	Clay	0	20
4	Clay	14	67
5	Sandy loam	0	10
6	Sandy loam	7	53
7	Spongolite	0	3
8	Spongolite	50	87

Plant deaths observed in 1994 was initially thought to be caused by a plant disease, however tests for both *Phytophthora cinnamomi* and canker were negative. Further research has linked these plant deaths, and the bright orange colour of some plants foliage in summer, to water stress (Monks in prep.).

3.2 Distribution and Habitat

D. ionthocarpa is restricted to spongolite soils near Kamballup. It is found growing in mallee-heath with *Eucalyptus tetragona* (Beard 1979). Subpopulation 1a, with 682 individuals, is located on a Plantagenent Shire reserve (↑27607) vested for the purpose of Recreation. Subpopulation 1b, with 475 individuals, is located some 500m to the south of Subpopulation 1a, on a reserve (↑800) vested for the purpose of public utility.

4. THE TRANSLOCATION

4.1 The Need to Translocate

D. ionthocarpa is known from only one population, with two subpopulations, where there are approximately 1157 individuals. Research (Monks in prep) has shown that this species is susceptible to drought, with 40 plants dying over the summer of 1994/1995 (pers. obs.). It is probable that individuals will continue to succumb to drought, and as there is no seedling recruitment (Monks in prep.), it appears the population is in decline. Research has shown that a fire triggers recruitment, however, detrimental conditions, such as a drier than average summer drought, following such an event can result in the death of the seedlings (Monks in prep.).

This could result in a rapid decline in the number of individuals. As such translocation to another locality is considered a high priority. Translocation of this species is also considered desirable under the Interim Recovery Plan (Kershaw *et al.* 1997) and has been recommended as a management action as part of the research into this species (Monks in prep.)

4.2 Translocation Site Selection

An area on the western boundary of Reserve # has been identified by preliminary translocation (Monks in prep) as being a suitable habitat for this species. In August 1996, as part of a Masters research project, six translocation sites were established throughout the Kamballup Reserve and two within Reserve #. After nine months the highest survival and growth was at one of the sites within Reserve # (Table 1). As such this site is considered to be suitable habitat for this species.

As this species has not previously been recorded from this reserve this translocation can be considered an introduction under the definitions provided by Policy Statement 29 and the Guidelines for Translocation of Threatened Plants in Australia. A map of the proposed translocation site in relation to the known populations is shown in Appendix 1.

This reserve is only a short distance (6.5 km in a direct line) from the Kamballup populations and is *P. cinnamomi* free (M. Grant, pers. comm.). Strict hygiene procedures will be followed to prevent infection of the site during translocation planting and monitoring.

Both the translocation site and the known *D. ionthocarpa* populations have similar vegetation structure of Mid-Dense Low-Heath (using Muir's (1977) classification). Kershaw *et al.* (1997) lists this species as also occurring in open shrub mallee, however, whilst it is sometimes on the fringes of this habitat type, it never extends more than a few meters under the Eucalypt canopy (Monks in prep.). The translocation site has many associated species in common with the known populations, none of these are listed as rare or threatened. These are shown below in Table 2.

Table 2. Main associated species of *D. ionthocarpa* at the proposed translocation site within Reserve # compared to the associated vegetation at the known populations.

Main associated species of the original population of *D. ionthocarpa*	Main associated species of the proposed translocation site
Acacia assimilis	
Acacia sulcata var. planoconvexa	
Agonis spathulata	
Allocasurina microstachya	*Allocasurina microstachya*
Allocasurina trichodon	
Astroloma pallidum	
Beaufortia micrantha	
Borya sp.	
	Calothamnus ?huegelii
Daviesia dilatata	*Daviesia dilatata*
	Daviesia ?incrassata
Dryandra nivea	
Dryandra tenuifolia	*Dryandra tenuifolia*
Eucalyptus falcata	*Eucalyptus falcata*
Eucalyptus tetragona	*Eucalyptus tetragona*
	Hakea marginata
Isopogon buxifolius	*Isopogon buxifolius*
	Isopogon teretifolius subsp. *petrophiloides*
Melaleuca pentagona	*Melaleuca pentagona* subsp. *pentagona*
Petrophile squamata	*Petrophile squamata*
Petrophile teretifolia	
Verticordia chrysantha	
Verticordia pennigera	

Monks (in prep) indicates that the pollinators of this taxon are likely to be either small marsupials, such as honey possums, or birds, such as honeyeaters. It is difficult to assess whether these potential pollinators are likely to occur at the proposed translocation site. However *D. ionthocarpa* at its natural location produces large amounts of viable seed, which suggest the presence of pollinators, and it is therefore likely that in the nearby Reserve #, which has similar vegetation, the same pollinators will also be present.

The proposed translocation site has the same soil type as the known populations of sandy-loam over spongolite. Both sites are underlaid by a geological formation known as the Plantagenet Group which consists of siltstone and spongolite (Muhling and Brakel 1985).

The proposed translocation site was therefore chosen because the environmental attributes of climate, soil type, vegetation structure and associated vegetation are almost identical to the known Kamballup populations of this species and preliminary translocations show that this site is suitable.

4.3 Translocation Design

A total of 154 seedlings of *D. ionthocarpa* have been raised for this years translocation from seed collected from a bulk of 50 adult plants.

At the proposed translocation site four replicates of 24m x 4m each will be measured. Each replicate will be divided into a grid of 38 or 39 holes, arranged in three rows of 13 or in two rows of 13 with a third row of 12. A distance of 2m will be left between each hole (see Appendix two for site diagram).

A total of three treatments will be tested: control, shaded or watered (see Table 3). Treatments will be randomly assigned to one row in the grid (see Appendix two for site diagram).

Seedlings have been raised at the accredited nursery at Kings Park and Botanic Gardens and therefore are considered disease free. All equipment used during seedling planting will be maintained under strict disease hygiene. All effort will be taken to minimise the movement of soil into, out of, and within the site during translocation planting.

An irrigation system will be set up during planting out of the seedlings to water those plants assigned to the watering treatment (see Table 3). Water will be collected in tanks in-situ, or scheme water will be brought in, therefore, all water used will be considered disease free.

Table 3. Description of experimental treatments.

Treatment	Description of Treatment
Control	Plants not given any treatment.
Shaded	A circle of wire netting, approximately 1m in diameter 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.
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.

Each plant will be permanently tagged so that each individual will always be identifiable. A small cage of rabbit netting will be placed around each plant to prevent predation of the seedlings by large herbivores.

Monitoring of the translocated population will be undertaken every third month commencing at planting out of the seedlings. Strict disease hygiene measures will be followed during monitoring. Monitoring will include counting the number of surviving seedlings, height of the surviving seedlings, width of the crown of the surviving seedlings in two directions (so that crown volume can be calculated), reproductive state, number of inflorescences and follicles, whether second generation plants are present and general health of the plants. A set photo point will be allocated for each plot and a photo will be taken each time monitoring takes place.

Monitoring of the original population will also occur every third month in conjunction with monitoring of the translocated population. This will provide essential baseline data for assessing the performance of the

translocated population. Monitoring will include counting the number of individuals, height and crown width of the individuals, reproductive state, number of inflorescences and follicles and general health of the plants.

4.4 Source of Plants

Seed was collected under guidelines outlined in Appendix four. Seed has been sourced from population 1a and b from a bulk of 50 adult plants for planting at the translocation site in 1998. Seedlings have been raised at Kings Park and Botanic Gardens nursery after being germinated at both the Kings Park and Botanic Gardens and Threatened Flora Seed Centre.

4.5 Criteria for Success or Failure

Criteria for Success

- Short Term (2 years):

1. establishment of translocated seedlings
2. production of flowers and seed

- Long Term (5 years):

1. after two or more generations the number of individuals is sustained by natural recruitment. However, recruitment of further plants into the population will only follow a fire, therefore an alternate criteria of success will be the establishment of a canopy stored seed bank (at least 120 cones per plant (Monks in prep.)).
2. the production of guidelines for the establishment of future translocations of related species.
3. levels of genetic diversity in the existing population are currently being assessed and will be compared to levels of genetic diversity in the translocated population following the establishment of a canopy stored seed bank.

Criteria for Failure

- Short Term (2 years):

1. failure of translocated seedlings to establish
2. failure of plants to produce flowers and seed

- Long Term (5 years):

1. there is a significant decline in the size of the translocated population due to lack of natural recruitment

5. TIMETABLE

Time	Action
Nov 1998	Seeds put down for germination. Resulting seedlings raised at Kings Park and Botanic Gardens.
Jan 1999	Translocation site selected.
Feb 1999	Translocation proposal submitted for review and approval.
June 1999	Translocation of seedlings into Reserve #.
Sept 1999 – Jun 2000	Monitoring and maintenance of translocation site.
Dec 1999	Seeds collected.
Dec 1999	Second batch of seeds put down for germination. Resulting seedlings raised at Kings Park and Botanic Gardens.
Feb 2000	Translocation proposal for 2000 translocation submitted for review.
June 2000	Further translocation of seedlings into Reserve #.
Sept 2000 – Feb 2001	Monitoring and maintenance of translocation site.
Feb 2001	Final Report

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8. REFERENCES

Beard J.S. (1979) The vegetation of the Albany and Mount Barker areas, Western Australia. Map and explanatory notes, 1: 250,000 series. Vegmap Publications. Perth, Western Australia.

George (1996) New taxa and a new infrageneric classification in Dryandra R. Br. (Proteaceae: Grevilleoideae). *Nuytsia* 10 (3). pp 313-408.

Guidelines for the Translocation of Threatened Australian Plants. (1997) Produced by The Australian Network for Plant Conservation Translocation Working Group. Canberra, Australia.

Kershaw K., Holland E. and Brown A. (1997). Kamballup Dryandra (*Dryandra ionthocarpa*) interim recovery plan. In: Interim Recovery Plans 4-16 for Western Australian Critically Endangered Plants and Animals. Eds: Pryde J., Brown A. and Burbidge A. Department of Conservation and Land Management. Perth Western Australia.

Monks L.T. (in prep) Conservation biology of three threatened Dryandra's, *D. ionthocarpa*, *D. mimica* and *D. serra*. Master of Science Thesis. Curtin University of Technology. Perth, Western Australia.

Muhling P.C. and Brackel A.T. (1985) Mount Barker - Albany Western Australia 1:250 000 Geological Series - Explanatory Notes. Geological Survey of Western Australia. Perth, Western Australia.

Appendices One, Three and Four may be available on contacting the authors.

Appendix Two.

Site Diagram for Proposed Translocation of *Dryandra ionthocarpa*

There is a total of 154 seedlings of *Dryandra ionthocarpa* available.
These will be planted as shown in the diagram below, with one seedling at each point marked with an asterix (*).
The three treatments of control, watered and shaded will be assigned as per the diagram below.

Replicate 1

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

Replicate 2

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

Replicate 3

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

Replicate 4

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

Scale: 2 m