SCOTT RIVER DARWINIA

Darwinia sp. Scott River *(G.J.Keighery 3582)* WA Herbarium

RECOVERY PLAN

Robyn Luu & Val English

Australian Government

Government of Western Australia

Department of Environment and Conservation

FOREWORD

Interim Recovery Plans (IRPs) are developed within the framework laid down in WA Department of Conservation and Land Management (CALM) Policy Statements Nos. 44 and 50. Note: the Department of CALM formally became the Department of Environment and Conservation (DEC) in July 2006. DEC will continue to adhere to these Policy Statements until they are revised and reissued.

IRPs outline the recovery actions that are required to urgently address those threatening processes most affecting the ongoing survival of threatened taxa or ecological communities, and begin the recovery process.

DEC is committed to ensuring that Endangered taxa are conserved through the preparation and implementation of Recovery Plans or Interim Recovery Plans and by ensuring that conservation action commences as soon as possible and always within one year of endorsement of that rank by the Minister.

This Interim Recovery Plan will operate from July 2004 to June 2009 but will remain in force until withdrawn or replaced. It is intended that, if the taxon is still ranked Endangered (WA), this IRP will be reviewed after five years and the need for further recovery actions assessed.

This IRP was given regional approval on 16 July 2004 and was approved by the Director of Nature Conservation on 22 July 2004. The allocation of staff time and provision of funds identified in this Interim Recovery Plan is dependent on budgetary and other constraints affecting DEC, as well as the need to address other priorities.

This IRP has been updated with information contained herein accurate as at January 2008.

This IRP was prepared with financial support from the Australian Government and has been adopted as a National Recovery Plan under the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act* (EPBC Act).

ACKNOWLEDGMENTS

The following people have provided assistance and advice in the preparation of this Interim Recovery Plan:

Anne Cochrane	Senior Research Scientist, DEC's Science Division
Andrew Crawford	Technical Officer, DEC's Science Division
Neil Gibson	Senior Research Scientist, DEC's Science Division
Greg Keighery	Principal Research Scientist, DEC's Science Division
Graham McCutcheon	Volunteer with DEC's Blackwood District
Amanda Shade	Horticulturalist, Botanic Gardens and Park Authority
Andrew Webb	Nature Conservation Officer, DEC's Blackwood District

Thanks also to staff of the W.A. Herbarium for providing access to Herbarium databases and specimen information, and DEC's Wildlife Branch for assistance.

SUMMARY

Scientific Name:	*Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium	**Common Name:**	Scott River Darwinia
Family:	Myrtaceae	**Flowering Period:**	October to January
DEC Region:	South West	**DEC District:**	Blackwood
Shire:	Shire of Augusta Margaret River	**Recovery Team:**	South West Region Threatened Flora and Communities Recovery Team

Illustrations and/or further information: Brown, A., Thomson-Dans, C. and Marchant, N. (Eds). (1998) *Western Australia's Threatened Flora*. Department of Conservation and Land Management (CALM), Western Australia; Marchant, N.G. and Keighery, G.J. (In prep) A new species of *Darwinia* (Myrtaceae) from the Busselton-Augusta Region of Western Australia; Western Australian Herbarium (1998) FloraBase - Information on the Western Australian Flora. Department of Conservation and Land Management, Western Australia. http://www.calm.wa.gov.au/science/.

Current status: *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium was declared as Rare Flora under the Western Australian *Wildlife Conservation Act 1950* in October 1987 and is currently ranked as Endangered (EN) under World Conservation Union (IUCN 2001) Red List criteria B1a,b(i, ii, iii, iv, v)+2b(i, ii, iii, iv, v) due to the severe fragmentation of populations, and a continuing decline in the quality of habitat and the number of plants. The main threats are mineral exploration, grazing and trampling, dieback disease, changes to hydrology, weed invasion, road, track and firebreak maintenance activities and inappropriate fire regimes. The species is listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Habitat critical to the survival of the species, and important populations: The habitat critical to the survival of *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium includes the area of occupancy of important populations; areas of similar habitat surrounding important populations (ie these areas provide potential habitat for natural range extension and for allowing pollinators or biota essential to the continued existence of the species to move between populations); and additional occurrences of similar habitat that may contain important populations of the species or be suitable for future translocations; and the local catchment for the surface and groundwaters that provide the winter-wet habitat of the taxon. All known habitat and all populations are considered important for the long-term recovery and survival of the species.

Benefits to other species/ecological communities: All populations are located within occurrences of a Threatened Ecological Community (TEC), listed as Endangered in Western Australia. Other listed and priority flora also occur in the wider habitat of the populations. Recovery actions implemented to improve the quality or security of the habitat of these populations are likely to improve the status of the TEC in which the populations are located, as well as the rare and priority flora.

International Obligations: This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity, ratified by Australia in June 1993, and will assist in implementing Australia's responsibilities under that convention. The taxon is not listed under any specific international treaty, however, and therefore this IRP does not affect Australia's obligations under any other international agreements.

Role and interests of Indigenous people: Involvement of the Indigenous community is being sought through the advice of the Department of Indigenous Affairs to determine whether there are any issues or interests identified in the plan. A search of the Department of Indigenous Affairs Aboriginal Heritage Sites Register has identified that there are no sites of Aboriginal significance at or near *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium populations. Where no role is identified for the Indigenous community associated with this species in the development of the recovery plan, opportunities may exist through cultural interpretation and awareness of the species. Indigenous involvement in the implementation of recovery actions will be encouraged.

Social and economic impacts: The implementation of this recovery plan has the potential to have some limited social and economic impact, as some populations are located on private property. There are mineral exploration and extraction leases over the area of land containing Subpopulations 1b, 2d, 2e, 2f, 2g and 2j of *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium. Recovery actions refer to continued liaison between stakeholders with regard to these areas.

Affected Interests: Populations of *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium occur within the local government authority of the Shire of Augusta Margaret River. They occur on land managed by the Shire of Augusta Margaret River, DEC, and on land managed by private land owners.

Evaluation of the Plans Performance: DEC, in conjunction with the Recovery Team, will evaluate the performance of this IRP annually and the plan is to be reviewed within five years.

Habitat requirements: *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium is located in the Scott River Plains which occurs from east of Augusta to Walpole. The taxon occurs on red, sandy, shallow loams over ironstone, around winter wet areas near the coast.

Completed Recovery Actions: The following recovery actions have been implemented:

1. Most land managers have been notified of the location and threatened status of the taxon.
2. Declared Rare Flora (DRF) markers have been installed at Population 3.
3. Dashboard stickers and posters describing the significance of DRF markers have been produced and distributed.
4. Approximately 40 hectares of private property containing Subpopulation 2b of *Darwinia* sp. Scott River (G.J.Keighery 3582) WA Herbarium was purchased by DEC in 1991 and placed under the care, control and management of the Conservation Commission.
5. The Botanic Gardens and Park Authority (BGPA) have cultivated eight clones of *Darwinia* sp. Scott River (G.J.Keighery 3582) WA Herbarium, of which six clones (19 plants) are still alive.
6. A research proposal for conservation actions for four rare and endangered species at BHP Beenup Minesite, one of which was *Darwinia* sp. Scott River (G.J.Keighery 3582) WA Herbarium, was developed by the BGPA in 2003 (Dixon *et al*. 2003).
7. A genetic study of the taxon was undertaken by the BGPA in 2002. Two populations east of the mine site were sampled but DNA could not be extracted from the old leaves available, suggesting that young growth was required.
8. A Translocation Proposal aimed at re-introducing plants of *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium, *Dryandra nivea* subsp. *uliginosa*, *Grevillea brachystylis* subsp. *australis* and *Lambertia orbifolia* subsp. Scott River Plains was developed by the BGPA and BHP Billiton in 2003, in liaison with DEC staff. The translocation has been approved and completed except for monitoring components.
9. Staff from DEC's Blackwood District have produced a fire response plan for the reserves that contain Subpopulations 2b and 2e of *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium.
10. Approximately 105 seeds of *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium were collected from Subpopulation 1a in December 1995 and stored in DEC's TFSC at –18°C and 4°C. Other collections consisted of 201 seeds (2867 fruits) from Subpopulation 2e and 376 seeds (2508 fruits) from Subpopulation 1c in December 2002.
11. The South West Region Threatened Flora and Communities Recovery Team (SWTFCRT) is overseeing the implementation of this IRP and includes information on progress in its annual report to DEC's Corporate Executive and funding bodies.
12. Staff from DEC's Blackwood District regularly monitor populations of this taxon.

IRP Objective: The objective of this Interim Recovery Plan is to abate identified threats and maintain or enhance *in situ* populations to ensure the long-term preservation of the taxon in the wild.

Recovery criteria

Criteria for success: The number of individuals within populations and/or the number of populations have increased by ten percent or more over the five year period of the plan.

Criteria for failure: The number of individuals within populations and/or the number of populations have decreased by ten percent or more over the five year period of the plan.

Recovery actions

1. Coordinate recovery actions.	10. Develop and implement a kangaroo management strategy.
2. Map habitat critical to survival.	11. Undertake weed control.
3. Formally notify owners of land adjacent to roadside populations.	12. Monitor populations.
4. Install Declared Rare Flora markers.	13. Collect seed and cutting material.
5. Conduct further surveys.	14. Seek improved security for populations.
6. Fence populations on private property.	15. Promote awareness.
7. Monitor dieback disease.	16. Obtain biological and ecological information.
8. Maintain disease hygiene.	17. Continue the translocation process.
9. Develop and implement a fire management strategy.	18. Review the need for a full Recovery Plan.

1. BACKGROUND

History

The first known collection of *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium, housed at the Western Australian Herbarium, was made in 1980 by G. Keighery near the Scott River. Numerous surveys for the taxon and other Scott River Plains endemics have since been undertaken by botanists and staff from DEC's Blackwood District (Gibson *et al*. 2001; Keighery and Robinson 1992; Robinson and Keighery 1997). However, as the ironstone soils to which the species is endemic are highly restricted and have been massively impacted by land clearing, potential new populations are most likely to be located in a few small remnants that remain on private property.

A number of new populations were located during a survey undertaken by DEC staff and private consultants in 1989 on numerous private properties, following a notification to clear remnant vegetation and a mineral sands mining application. In 1990 a number of *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium plants on private property were illegally cleared and others were also under significant threat from clearing. Part of this area containing the taxon and other rare flora was therefore purchased in 1991 and is under the Care, Control and Management of the Conservation Commission. Currently, *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium is known from 3 populations consisting of around 12,000 plants.

Description

Darwinia sp. Scott River *(G.J.Keighery 3582)* WA Herbarium is a large, scrambling shrub, usually up to 1.5 m tall and has many branches. Its hairless, green leaves are 4 to 6 mm long, are linear to triangular in outline and crowded on the ends of branches. The main stems have only scattered leaves or are leafless. The inflorescence is 20 to 30 mm in diameter, and is a globular, usually erect head of 30 to 40 flowers at the ends of branches. The flowers extend beyond the yellowish-green linear floral bracts that are held in several layers. The brown floral tube is 3 mm long, and is ribbed and capped by small, triangular calyx lobes. The petals are about 1 mm long. The style is curved, 8 to 12 mm long and is often reddish (Brown *et al* 1998).

Darwinia sp. Scott River *(G.J.Keighery 3582)* WA Herbarium is closely related to *D. apiculata*, but differs in that it is a much larger plant, does not have apiculate leaves, has shorter involucral bracts, more flowers in the inflorescence and a longer style (Marchant and Keighery In prep).

Distribution and habitat

Darwinia sp. Scott River *(G.J.Keighery 3582)* WA Herbarium is located in the Scott River Plains which occurs from east of Augusta to Walpole. The taxon occurs on peaty sand over ironstone, around winter wet areas near the coast. Associated species include *Banksia littoralis*, *B. ilicifolia*, *B. grandis*, *Hakea prostrata*, *Xanthorrhoea preissii*, *Pimelea rosea*, *Isopogon formosus*, *Anthocercis littorea*, *Lysinema ciliatum*, *Melaleuca thymoides*, *Hibbertia stellaris*, *Viminaria juncea*, *Patersonia occidentalis*, *Lepidosperma* sp. (Obbens and Coates 1997).

Darwinia sp. Scott River *(G.J.Keighery 3582)* WA Herbarium is endemic to a Threatened Ecological Community (TEC) (English and Blyth 1999), the 'Scott River Ironstone Association' that is ranked as Endangered (WA). These ironstone soils are highly restricted in distribution. There is a total of 39 occurrences of this community covering 360 hectares, that are seasonal wetlands on ironstone on the Scott River Plain (Gibson *et al*. 2000).

Benefits to other species/ecological communities

Darwinia sp. Scott River *(G.J.Keighery 3582)* WA Herbarium is endemic to the 'Scott River Ironstone Association' TEC, which is listed as Endangered in Western Australia. Other listed and priority flora that also occur in the wider habitat of the populations include *Lambertia orbifolia* subsp. Scott River Plains (Endangered), *Dryandra nivea* subsp. *uliginosa* (Endangered), *Grevillea brachystylis* subsp. *australis* (Endangered), *Calothamnus* sp. Scott River (aff. *crassus*) (Priority 2), *Chordifex isomorphus* (Priority 4), *Loxocarya magna* (Priority 3), *Grevillea manglesioides* subsp. *ferricola* (Priority 2), *Hakea tuberculata* (Priority 3) and *Melaleuca incana* subsp. Gingilup (Priority 2) (Gibson *et al*. 2000). Recovery actions implemented to

improve the quality or security of the habitat of populations of *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium are likely to improve the status of the TEC in which the populations are located, as well as these other rare and priority flora.

International Obligations

This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity, ratified by Australia in June 1993, and will assist in implementing Australia's responsibilities under that Convention. The taxon is not listed under any specific international treaty, however, and therefore this IRP does not affect Australia's obligations under any other international agreements.

Role and interests of Indigenous people

Involvement of the Indigenous community is being sought through the advice of the Department of Indigenous Affairs to determine whether there are any issues or interests identified in the plan. A search of the Department of Indigenous Affairs Aboriginal Heritage Sites Register has identified that there are no sites of Aboriginal significance at or near *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium populations. Where no role is identified for the Indigenous community associated with this species in the development of the recovery plan, opportunities may exist through cultural interpretation and awareness of the species. Indigenous involvement in the implementation of recovery actions will be encouraged.

Social and economic impacts

The implementation of this recovery plan has the potential to have some limited social and economic impact, as some populations are located on private property. Areas on private land that are considered to be 'habitat critical' may be regarded as having potential for uses other than conservation by landholders. Approaches that may minimise this potential impact could include covenants, management agreements or land acquisition. There are mineral exploration and extraction leases over the area of land containing Subpopulations 1b, 2d, 2e, 2f, 2g and 2j of *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium. Recovery actions refer to continued liaison between stakeholders with regard to these areas.

Affected Interests

Populations of *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium occur within the local government authority of the Shire of Augusta Margaret River. They occur on land managed by the Shire of Augusta Margaret River, DEC, and on land managed by private land owners.

Evaluation of the Plan's Performance

DEC, in conjunction with the South West Region Threatened Flora and Communities Recovery Team will evaluate the performance of this Interim Recovery Plan annually and the plan is to be reviewed within five years. Any changes to management / recovery actions will be documented accordingly.

Habitat critical to survival, and important populations

The habitat critical to the survival of *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium includes the area of occupancy of important populations; areas of similar habitat surrounding important populations (ie these areas provide potential habitat for natural range extension and for allowing pollinators or biota essential to the continued existence of the species to move between populations); and additional occurrences of similar habitat that may contain important populations of the species or be suitable for future translocations; and the local catchment for the surface and groundwaters that provide the winter-wet habitat of the taxon. All known habitat and all population are considered important for the long-term recovery and survival of the species.

Biology and ecology

The genus *Darwinia*, which is distantly related to *Chamelaucium* (wax plants) and *Verticordia* (feather flowers), is endemic to south-western and south-eastern Australia. The bracts surrounding the inflorescence of *Darwinia* species is shaped like a bell and the common name refers to this feature.

A fire burnt through part of Subpopulation 1a in 1986. Adult plants were killed in the fire, and there was subsequent germination of seedlings. This indicates that fire acts as a stimulus for recruitment from seed.

A number of *Darwinia* species are cultivated for their ornamental bell-like flower heads. Propagation of *Darwinia* species is achieved through cuttings, as seed germination is often low even under generally favourable conditions (Turnbull and Doran 1987).

Darwinia sp. Scott River *(G.J.Keighery 3582*) WA Herbarium appears to be susceptible to the plant pathogen *Phytophthora cinnamomi* (dieback). Only two individuals were inoculated in experiments to test susceptibility, so there is insufficient evidence for this result to be conclusive (pers comm. C. Crane[1]).

Threats

Darwinia sp. Scott River *(G.J.Keighery 3582)* WA Herbarium was declared as Rare Flora under the Western Australian *Wildlife Conservation Act 1950* in October 1987 and is currently ranked as Endangered (EN) under World Conservation Union (IUCN 2001) Red List criteria B1a,b(i, ii, iii, iv, v)+2b(i, ii, iii, iv, v) due to the severe fragmentation of populations, and a continuing decline in the quality of habitat and the number of plants. The main threats are mineral exploration, grazing and trampling, dieback disease, changes to hydrology, weed invasion, road, track and firebreak maintenance activities and inappropriate fire regimes. The species is listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

- **Mineral exploration** and extraction leases exist over the area of land in which Subpopulations 1b, 2d, 2e, 2f, 2g and 2j of *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium occur.

- **Grazing and trampling** by stock (cattle) and kangaroos is a threat to all populations. Although it appears that *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium plants are not grazed, animals impact on the habitat by digging, trampling and breaking foliage when moving through the area or along the road reserves, as is the case with Subpopulations 1a and 1b, and Population 3, and perhaps by spreading dieback. Increased nutrient levels in the soil from droppings is also likely and may result in increased weed invasion. Grazing would have an impact on the establishment of young plants of *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium thereby limiting natural recruitment.

- **Dieback disease** is a threat to all populations of *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium. Dieback causes the roots to rot and results in susceptible plants dying of drought stress. Although testing of susceptibility to the disease is incomplete, the ironstone habitat that the taxon occurs in is highly susceptible to the disease. The presence of the disease has been confirmed at Population 1c. The populations are extremely vulnerable to dieback disease due to the wetland habitat and shallow soils.

- **Changes to hydrology** may in future become a threat to all populations. The Scott River Ironstone habitat is recognised as under high risk of increased salinity levels and inundation due to clearing of the catchments (Commonwealth of Australia 2001). Conversely, groundwater abstraction for agricultural, urban and other purposes may result in the lowering of the local groundwater levels. Adjacent land developments such as mining also have the potential to alter hydrological processes in the wetland habitat, and therefore to threaten the populations.

[1] Colin Crane, Senior Technical Officer, DEC's Science Division

- **Weed invasion** is a minor threat to most populations. Weeds suppress early plant growth by competing for soil moisture, nutrients and light. They also exacerbate grazing pressure and increase the fire hazard due to the easy ignition of high fuel loads that are produced annually by many weed species.

- **Road, track and firebreak maintenance activities** threaten Subpopulations 1a, 1b, 1c, 2d, 2f, 2g and 2j, and Population 3 and their habitat. Threats include grading, chemical spraying, construction of drainage channels and the mowing of roadside vegetation. Several of these actions also encourage weed invasion. Relevant authorities need to be informed of the location of populations so that appropriate protective measures can be implemented. Landowners also need be informed of the presence of the species to prevent possible damage due to grazing, crop maintenance, firebreak maintenance or other activities that may threaten the populations.

- **Inappropriate fire regimes** would affect the viability of the populations, as *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium appears to be an obligate seeder that germinates following fire. If this is the case, the soil seed bank would rapidly be depleted if fires recurred before regenerating or juvenile plants reached maturity and replenished the soil seed bank. However, occasional fires or other disturbances are likely to be required for the taxon to propagate from soil stored seed.

- **Powerline maintenance** is a potential threat to Subpopulation 1a. Disturbance during maintenance may encourage weed invasion and also directly damage plants. The relevant authority will be notified of the location of the population.

Summary of population information and threats

Pop. No. & Location	**Land Status**	**Year/No. plants**	**Habitat Condition**	**Threats**
1A. Northeast of Augusta	Shire Road Reserve	1980 60 1988 (10) 1989 600+ 1992 (60) 1993 833 (60) 1996 0	Moderate	Road maintenance, grazing (stock), inappropriate fire regimes, dieback disease, weeds, hydrological changes, powerline maintenance
1B. Northeast of Augusta	Private Property	1989 9325 1990 10,000	Healthy	Mining, grazing (stock, kangaroos), inappropriate fire regimes, hydrological changes, firebreak maintenance, dieback disease
1C. Northeast of Augusta	Shire Road Reserve	1996 100+ 1999 100+ 2002 100+	Moderate	Road maintenance, inappropriate fire regimes, grazing (stock), dieback disease, hydrological changes
2A. Northeast of Augusta	Private Property	1988 *1500 1989 *1500 1990 0		Cleared
2B. Northeast of Augusta	Nature Reserve	1988 *1500 1989 *1500 1990 108 1997 100+	Healthy	Mining, grazing (kangaroos), hydrological changes, inappropriate fire regimes, dieback disease
**2C. Northeast of Augusta	Private Property			
2D. Northeast of Augusta	Private Property	1990 3 [26 dead]	Poor	Mining, grazing (stock), inappropriate fire regimes, hydrological changes, firebreak maintenance, dieback disease, weeds
2E. Northeast of Augusta	Private Property	1989 1000 2000 100+ 2002 100+	Healthy	Mining, grazing (kangaroos), dieback disease, hydrological changes, inappropriate fire regimes
2F. Northeast of Augusta	Private Property	1990 361 [25 dead]	Poor	Mining, grazing (stock), inappropriate fire regimes, hydrological changes, firebreak maintenance, dieback disease, weeds
2G. Northeast of Augusta	Private Property	1990 485 [200 dead]	Poor	Mining, grazing (stock), inappropriate fire regimes, hydrological changes, firebreak maintenance, dieback disease, weeds

2H. Northeast of Augusta	Private Property	1989 1990	100+ 0		Cleared
2I. Northeast of Augusta	Private Property	1989 1990	150+ 0		Cleared
2J. Northeast of Augusta	Private Property	1990	[50 dead]	Poor	Mining, grazing (stock), inappropriate fire regimes, hydrological changes, firebreak maintenance, dieback disease, weeds
2K. Northeast of Augusta	Private Property	1990	0		Cleared
3. Northeast of Augusta	Shire Road Reserve	1989 1991 1995 1996 2003	20 0 6 0 0	Poor	Road maintenance, grazing (stock), dieback disease, weeds, hydrological changes

( ) = number of seedlings; *= total for subpopulations combined; ** Included in Subpopulation 2B

Guide for decision-makers

Section 1 provides details of current and possible future threats. Developments in the immediate vicinity of the population or within the defined habitat critical to the survival of *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium require assessment for the potential for a significant level of impact.

2. RECOVERY OBJECTIVE AND CRITERIA

Objectives

The objective of this Interim Recovery Plan is to abate identified threats and maintain or enhance *in situ* populations to ensure the long-term preservation of the taxon in the wild.

Criteria for success: The number of individuals within populations and/or the number of populations have increased by ten percent or more over the five year period of the plan.
Criteria for failure: The number of individuals within populations and/or the number of populations have decreased by ten percent or more over the five year period of the plan.

3. RECOVERY ACTIONS

Completed recovery actions

Land managers have been notified of the location and threatened status of *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium. The notification details the Declared Rare status of the taxon and the legal responsibility to protect it.

Declared Rare Flora (DRF) markers have been installed at Population 3. These serve to alert people working in the vicinity to the presence of DRF, and the need to avoid work that may damage plants or their habitat. Dashboard stickers and posters describing the significance of DRF markers have been produced and distributed.

Approximately 40 hectares of private property containing Subpopulation 2b of *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium was purchased by DEC in 1991 and is under the Care, Control and Management of the Conservation Commission. This area was then fenced to prevent access by stock.

The Botanic Gardens and Park Authority (BGPA) produced eight clones of *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium, with six clones (19 plants) still alive. The majority of the clones appeared to have been from cuttings, some of which were collected in 1994 (pers comm. A. Shade[2]).

[2] Amanda Shade, Horticulturalist, Botanic Gardens and Park Authority

A research proposal for conservation actions for four rare and endangered species at BHP Beenup Minesite, one of which was *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium, was developed by the BGPA in 2003 (Dixon *et al.* 2003). This proposal is a pilot study and aims to:

- Contribute to a better understanding of post-mining rehabilitation;
- Increase biodiversity within the site;
- Contribute to the knowledge base of rare and endangered species through genetic analysis and propagation research;
- Improve understanding of the phenology and cultural techniques for the plants; and
- Reduce the threat of extinction by learning how to establish new populations in post mining situations or pre-mined areas.

A genetic study was also undertaken by BGPA in 2002. Two populations east of the mine site were sampled. Unfortunately DNA could not be extracted as young growth was not available (Krauss and Alacs 2003).

A Translocation Proposal aimed at re-introducing plants of *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium, *Dryandra nivea* subsp. *uliginosa*, *Grevillea brachystylis* subsp. *australis* and *Lambertia orbifolia* subsp. Scott River Plains was developed in 2003 by the BGPA and BHP Billiton in liaison with DEC staff. Two hundred and forty eight plants grown from cuttings (fifteen clones taken from two populations) were planted in July 2003 on a previously mined area and surrounds. Soil type and irrigation were included as two variables in the experimental design. The site was also fenced to reduce the threat of grazing by rabbits and kangaroos. The translocation has been approved and completed except for monitoring components. Monitoring will include the number of surviving plants, height and width of crown, reproductive state, number of inflorescences and fruits, presence of second generation plants and general health of plants (Norrish 2003).

A fire response plan was produced for the reserves containing Subpopulations 2b and 2e of *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium by staff from DEC's Blackwood District.

Approximately 105 seeds of *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium were collected from Subpopulation 1a in December 1995 and stored in DEC's TFSC at –18°C and 4°C. The initial germination rate of the *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium seed, tested by the TFSC was 33%. Other collections consisted of 201 seeds (2867 fruits) from Subpopulation 2e and 376 seeds (2508 fruits) from Subpopulation 1c in December 2002. Germination has yet to be tested (unpublished data, A. Cochrane[3]).

Ongoing and future recovery actions

The South West Region Threatened Flora and Communities Recovery Team (SWTFCRT) is overseeing the implementation of this IRP and will include information on progress in their annual report to DEC 's Corporate Executive and funding bodies.

Staff from DEC's Blackwood District regularly monitor populations of this taxon.

Where populations occur on lands other than those managed by DEC, permission has been or will be sought from appropriate land managers prior to recovery actions being undertaken.

The following recovery actions are roughly in order of descending priority; however this should not constrain addressing any of the priorities if funding is available for 'lower' priorities and other opportunities arise.

1. Coordinate recovery actions

The South West Region Threatened Flora and Communities Recovery Team (SWRTFCRT) will continue to coordinate recovery actions for *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium and other Declared Rare Flora and Threatened Ecological Communities in their region. They will include information on progress in their annual report to DEC's Corporate Executive and funding bodies.

[3] Anne Cochrane, Senior Research Scientist, DEC's Threatened Flora Seed Centre

Action: Coordinate recovery actions
Responsibility: DEC (Blackwood District) through the SWRTFCRT
Cost: $2,100 per year.

2. Map habitat critical to survival

Although this habitat is identified in Section 1, the areas as described have not yet been fully mapped and will continue to be done under this action. If any additional populations are located, then habitat will also be determined and mapped for these locations.

Action: Map habitat critical to survival
Responsibility: DEC (Blackwood District, Species and Communities Branch (SCB)) through the SWRTFCRT
Cost: $2,000 in the first year

3. Formally notify owners of land adjacent to roadside populations

The adjacent land owners of Subpopulations 1a and 1c located on road reserves have been formally notified of the presence of *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium . Western Power has also been notified about the population located under its powerline on an access track.

Action: Formally notify owners of land adjacent to roadside populations
Responsibility: DEC (SCB)
Cost: $100 in first year.

4. Install Declared Rare Flora markers

Declared Rare Flora (DRF) markers are required for road reserve Subpopulations 1a and 1c. Their purpose is to alert people operating in the area to the presence of DRF and to help prevent habitat disturbance. This action has been completed.

Action: Install DRF markers
Responsibility: DEC (Blackwood District) through the SWRTFCRT
Cost: $500 in first year.

5. Conduct further surveys

Further surveys have been conducted for this taxon during its flowering period (October to January) in appropriate habitat, including on private lands wherever permission has been given. Volunteers from the local community, Wildflower Societies and Naturalist Clubs will be encouraged to be involved in surveys supervised by DEC staff. Areas considered suitable for translocation will also be noted.

Populations that have not been seen for a number of years will be resurveyed. In addition, the identity of a potential new population that was discovered by staff from DEC's Blackwood District in 2003 in a camping reserve near the Scott River will be verified.

Action: Conduct further surveys
Responsibility: DEC (Blackwood District) through the SWRTFCRT
Cost: $2,300 per year.

6. Fence populations on private property

Fencing may be required at Subpopulations 1b, 2d, 2f, 2g and 2j located on private land. Fenced areas will ideally include a buffer of surrounding habitat, to protect *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium from grazing and trampling by cattle. Funding assistance for this fencing may be obtained from various sources such as a covenanting scheme. This action in on-going and most subpopulations have now been fenced. Monitoring and review of the efficacy of fencing will be required once this action is implemented.

Action: Fence populations on private property
Responsibility: DEC (Blackwood District) through the SWRTFCRT

Cost: $11,500 in first year.

7. Monitor dieback disease

Not all populations have been checked for the presence of dieback. The disease is being mapped in the habitat of *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium and the spread and impact of the disease is being monitored.

Action: Monitor dieback disease
Responsibility: DEC (Blackwood District, Dieback Disease Coordinator) through the SWRTFCRT
Cost: $1,500 per year for monitoring and mapping.

8. Maintain disease hygiene

The ironstone habitat in which *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium occurs is inundated over the winter months, and this favours the establishment and spread of *Phytophthora* species. Many plant species in the ironstone community are presumed to be susceptible to this disease. Dieback hygiene (outlined in Department of Conservation and Land Management 2003) will therefore be followed for activities such as installation and maintenance of firebreaks and walking into the population in wet soil conditions. Purpose built signs advising of the dieback risk and high conservation values of the sites will be installed where required. This action is ongoing.

Action: Maintain disease hygiene
Responsibility: DEC (Blackwood District) through the SWRTFCRT
Cost: $800 per year

9. Develop and implement a fire management strategy

Darwinia sp. Scott River *(G.J.Keighery 3582)* WA Herbarium appears to be an obligate seeder that germinates following fire. Fire will be prevented from occurring in the habitat of populations, except where it is being used experimentally as a recovery tool. A fire management strategy has been developed that recommends fire frequency, intensity, season, and control measures.

Action: Develop and implement a fire management strategy
Responsibility: DEC (Blackwood District) through the SWRTFCRT
Cost: $2,500 in first year and $1,000 in subsequent years.

10. Develop and implement a kangaroo management strategy

A management strategy will be developed and implemented in areas where kangaroos are having an impact on populations of *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium by trampling and breaking foliage when moving through the area. The strategy will include a survey to determine kangaroo density, monitoring of impacts on the taxon, and recommendations to reduce the impact.

Action: Develop and implement a kangaroo management strategy
Responsibility: DEC (Blackwood District) through the SWRTFCRT
Cost: $2,000 in first year (cost of monitoring included under action 12).

11. Undertake weed control

Weed control is being undertaken in consultation with the land managers. Appropriate methods of weed control are found in Brown and Brooks (2002) and may include hand weeding or localised application of herbicide. All applications of weed control will be followed by a report on the method, timing and success of the treatment, and the effect on *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium and associated native plant species. It is anticipated that the regeneration of native species in the habitat will improve after weed competition is reduced.

Action: Undertake weed control
Responsibility: DEC (Blackwood District) through the SWRTFCRT
Cost: $1,000 per year.

12. Monitor populations

Annual monitoring of factors such as habitat degradation (including weed invasion and plant diseases), population stability (expansion or decline), pollination activity, seed production, recruitment, longevity and predation is being undertaken. All populations are being inspected annually with special attention given to any impacts from increased salinisation. In areas that are possibly under threat from salinisation, soil salinity and pH readings will be taken annually during winter.

Action: Monitor populations
Responsibility: DEC (Blackwood District) through the SWRTFCRT
Cost: $1,000 per year.

13. Collect seed and cutting material

Preservation of germplasm is essential to guard against extinction if wild populations are lost. Such collections are also needed to propagate plants for translocations. Seed is required from all populations to maximise the genetic diversity of the *ex situ* material. Cuttings will also be obtained to establish a living collection at the BGPA. Currently 722 seeds are stored at TFSC.

Action: Collect seed and cutting material
Responsibility: DEC (TFSC) and BGPA, through the SWRTFCRT
Cost: $4,600 in first year and $3,200 in second year.

14. Seek improved security for populations

Staff from DEC's Blackwood District will continue to liaise with land managers and landowners to help ensure that populations are not accidentally damaged or destroyed. Ways and means of improving the security of populations and their habitat will be investigated. For populations that occur on private property, this may include conservation covenants with a range of agencies, the Land for Wildlife scheme, or possibly acquisition. Input and involvement will also be sought from any Indigenous groups that have an active interest in areas that are habitat for *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium.

Action: Seek improved security for populations
Responsibility: DEC (Blackwood District) through the SWRTFCRT
Cost: $700 per year.

15. Promote awareness

The importance of biodiversity conservation and the need for the long-term protection of wild populations of this taxon are being promoted to the community through poster displays and the local print and electronic media. Formal links with local naturalist groups and interested individuals have been encouraged. An information sheet, that includes a description of the plant, its habitat, threats, recovery actions and photos will be produced.

A reply paid postal drop of a pamphlet that illustrates *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium and describes its distinctive features and habitat will be distributed to residents in Shires that contain possible habitat for the taxon. Postal drops aim to stimulate interest, provide information about threatened species and provide a name and number to contact if new populations are located by members of the community.

Action: Promote awareness
Responsibility: DEC (Blackwood District) through the SWRTFCRT
Cost: $2,100 in first year, $700 in second year and $600 in remaining years.

16. Obtain biological and ecological information

Improved knowledge of the biology and ecology of *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium will provide a better scientific basis for management of the wild populations. An understanding of the following is particularly necessary for effective management:

1. Soil seed bank dynamics and the role of various disturbances (including fire), competition, rainfall and grazing in germination and recruitment.
2. The pollination biology of the taxon, and the requirements of pollinators.
3. The reproductive strategies, phenology and seasonal growth of the taxon.
4. The population genetic structure, levels of genetic diversity and minimum viable population size.
5. The impact of salinity on *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium and its habitat.
6. Investigation of the impacts of dieback disease and control techniques on *Darwinia* sp. Scott River *(G.J.Keighery 3582)* WA Herbarium and its habitat.

This action is currently underway.

Action: Obtain biological and ecological information
Responsibility: DEC (Science Division, Blackwood District) through the SWRTFCRT
Cost: $21,000 per year for the first three years.

17. Continue the translocation process

As the number of extant plants is low and populations are not secure from threats Translocation Proposals will be developed and suitable translocation sites selected. This will be coordinated by the SWRTFCRT. Information on the translocation of threatened animals and plants in the wild is provided in DEC's Policy Statement No. 29 *Translocation of Threatened Flora and Fauna*. All translocation proposals require endorsement by the Director of Nature Conservation.

Action: Continue the translocation process
Responsibility: DEC (Blackwood District, Science Division) through the SWRTFCRT
Cost: $5,700 in the third year and $4,200 in the fifth year.

18. Review the need for a full Recovery Plan

At the end of the fourth year of the five-year term of this Interim Recovery Plan, the need for a revised IRP will be reviewed and further recovery actions considered.

Action: Review the need for a full Recovery Plan
Responsibility: DEC (SCB, Blackwood District) through the SWRTFCRT
Cost: $23,700 in the fifth year (if full plan required).

4. TERM OF PLAN

Western Australia

This Interim Recovery Plan will operate from July 2004 to June 2009 but will remain in force until withdrawn or replaced. If the taxon is still ranked Endangered (WA) after five years, this IRP will be reviewed and, if necessary, further recovery actions put in place.

Commonwealth

In accordance with the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) this adopted recovery plan will remain in force until revoked.

The recovery plan must be reviewed at intervals of not longer than 5 years.

5. REFERENCES

Atkins, K. (2008) *Declared Rare and Priority Flora List for Western Australia.* Department of Conservation and Land Management, Western Australia.

Brown, A., Thomson-Dans, C. and Marchant, N. (Eds). (1998) *Western Australia's Threatened Flora*. Department of Conservation and Land Management, Western Australia.

Brown, K. and Brooks, K. (2002) *Bushland weeds; a practical guide to their management*. Environmental Weeds Action Network (Inc), Western Australia.

Commonwealth of Australia (2001). *National Land and Water Resources Audit. Australian Dryland Salinity Assessment 2000: extent, impacts, processes, monitoring and management options*. Commonwealth of Australia, Canberra.

Department of Conservation and Land Management (1992) Policy Statement No. 44 *Wildlife Management Programs*. Perth, Western Australia.

Department of Conservation and Land Management (1994) Policy Statement No. 50 *Setting Priorities for the Conservation of Western Australia's Threatened Flora and Fauna*. Perth, Western Australia.

Department of Conservation and Land Management (1995) Policy Statement No. 29 *Translocation of Threatened Flora and Fauna* Perth, Western Australia.

Department of Conservation and Land Management (2003) *Phytophthora cinnamomi* and disease caused by it Volume 1 – Management Guidelines. Department of Conservation and Land Management, Western Australia.

Dixon, K.D., Dixon, B. and Krauss, S. (2003) Kings Park and Botanic Garden (BGPA) Science Directorate research proposal for the rescue of four rare and endangered species at BHP Beenup minesite. Botanic Garden and Parks Authority, Perth.

English, V. and Blyth, J. (1999) Development and application of procedures to identify and conserve threatened ecological communities in the South-west Botanical Province of Western Australia. *Pacific Conservation Biology* 5, 124-138.

Gibson, N., Keighery, G. and Keighery, B. (2000) Threatened plant communities of Western Australia. 1. The ironstone communities of the Swan and Scott Coastal Plains. *Journal of the Royal Society of Western Australia* 83, 1-11.

Gibson, N., Keighery, G.J. and Lyons, M.N. (2001) Vascular flora of Scott National Park, Camping Reserve 12951 and Gingilup Swamps Nature Reserve, Western Australia. *CALM Science* 3(4), 411-432.

Keighery, G. and Robinson, C. (1992) *A survey of Declared Rare flora and other plants in need of special protection of the Scott Plains.* A report to the Australia National Parks and Wildlife Service prepared by Department of Conservation and Land Managment.

Krauss, S. and Alacs, E. (2003) Population genetic analysis of the DRF *Dryandra nivea* subsp. *uliginosa* and *Grevillea brachystylis* subsp. *australis*. *BGPA Genetics Laboratory report* No. 16.

Marchant, N.G. and Keighery, G.J. (In prep) A new species of *Darwinia* (Myrtaceae) from the Busselton-Augusta Region of Western Australia.

Norrish, R. (2003) *Translocation proposal for four species of Declared Rare Flora from the Scott Coastal Plain Ironstone Communities to the BHP Billiton Beenup Rehabilitation Project*. GHD Pty Ltd, Bunbury.

Obbens, F.J. and Coates, D.J. (1997) Conservation Biology and Management of Endangered *Lambertia* Species. Department of Conservation and Land Management, Western Australia.

Robinson, C. and Keighery, G. (1997) Vegetation and flora of Scott National Park and adjacent recreation reserves. *The Western Australian Naturalist* 21(4), 213-233.

Turnbull, J. and Doran, J. (1987) Seed Development and Germination in the Myrtaceae. pp 46-57 *in* P. L. Langkamp (ed.) *Germination of Australian Native Plant Seed.* Inkata Press, Melbourne.

Western Australian Herbarium (1998) FloraBase – Information on the Western Australian Flora. Department of Conservation and Land Management, Western Australia. http://www.calm.wa.gov.au/science/

World Conservation Union (2001) *IUCN red list categories prepared by the IUCN Species Survival Commission, as approved by the 51st meeting of the IUCN Council*. Gland, Switzerland.

6. TAXONOMIC DESCRIPTION

Marchant, N.G. and Keighery, G.J. (In prep) A new species of *Darwinia* (Myrtaceae) from the Busselton-Augusta Region of Western Australia.

Darwinia sp. Scott River *(G.J.Keighery 3582)* WA Herbarium is a densely branched, round shrub, to 1 m tall x 1 m wide. Young branches slender, greenish-brown with prominent decurrent leaf bases. Leaves scattered, petioles 0.1 to 0.2 mm long. Lamina spreading to recurved when mature, linear-triquetrous, adaxial surface convex with slightly raised keel, 2.5 mm long, densely packed on young stems, 5-7-(9) mm on mature stems, apex acute, oil glands prominent. Flora leaves green, flattened, 5-9 mm long. Outer involucral bracts narrowly ovate, long acuminate, triquetrous, 4-7 mm long, flattened at base. Inner involucral bracts narrowly ovate, long acuminate, 5-7 mm long, green or greenish-red, adaxial surface deeply concave. Flowers 14-23. Bracteoles 2, cymbiform, ovate when spread, brown, scarious, 3-4 mm long, 1-2 mm wide, acuminate. Floral tubes obconical, 2-2.5 mm long, with 5 indistinct ribs, yellow green. Calyx lobes narrowly ovate, ± 2 mm long, entire, 1 mm wide, apex obtuse. Corolla lobes trullate-ovate, 3-3.5 mm long, 1-2 mm wide, acute entire, margins slightly involute. Stamens 10, filaments slightly dilated at base, fused to staminodes in lower half, 1/mm long. Staminodes 10, as long as staminal filaments, narrowly triangular, margins coarsely divided. Style straight or slightly curved inward, slightly dilated towards base, 12-15 mm long, end tapering to apex subtended by a ring of hairs ± 1 mm wide. Ovules 2. Fruit not seen.