INTERIM RECOVERY PLAN NO. 178

SCOTT RIVER LAMBERTIA

(*LAMBERTIA ORBIFOLIA* SUBSP. SCOTT RIVER PLAINS)

INTERIM RECOVERY PLAN

2004-2009

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Photograph: Andrew Webb

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FOREWORD

Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Conservation and Land Management (CALM) Policy Statements Nos. 44 and 50.

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.

CALM 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This Interim Recovery Plan will operate from July 2004 to June 2009 but will remain in force until withdrawn or replaced.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 this IRP will be reviewed after five years and the need for a full Recovery Plan will be 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 CALM, as well as the need to address other priorities.

Information in this IRP was accurate at July 2004.

ACKNOWLEDGMENTS

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

Anne Cochrane	Senior Research Scientist, CALM's Science Division
Andrew Crawford	Technical Officer, CALM's Science Division
Neil Gibson	Senior Research Scientist, CALM's Science Division
Greg Keighery	Principal Research Scientist, CALM's Science Division
Amanda Shade	Horticulturalist, Botanic Gardens and Park Authority
Bryan Shearer	Principal Research Scientist, CALM's Science Division
Amanda Spooner	Masters student, Edith Cowan University
Greg Voigt	A/Nature Conservation Program Leader, CALM's Blackwood District
Andrew Webb	Nature Conservation Officer, CALM's Blackwood District

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

SUMMARY

Scientific Name:	*Lambertia orbifolia* subsp. Scott River Plains (L.W. Sage 684)	**Common Name:**	Scott River Lambertia
Family:	Proteaceae	**Flowering Period:**	January to February
CALM Region:	South West	**CALM District:**	Blackwood
Shires:	Shire of Augusta Margaret River; Shire of Nannup	**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, 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: *Lambertia orbifolia* was declared as Rare Flora in November 1980 under the Western Australian *Wildlife Conservation Act* 1950. The species is also listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation* Act 1999. The subspecies was ranked as Endangered (EN) in 1999. It currently meets World Conservation Union (IUCN 2000) Red List Category Endangered (EN) under criteria B1ab(i,ii,iii,v)+2ab(i,ii,iii,v);C1+2a(i) 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, dieback disease, changes to hydrology, grazing, trampling, inappropriate fire regimes, weed invasion, road maintenance activities and plantation activities.

Critical habitat: The critical habitat for *Lambertia orbifolia* subsp. Scott River Plains comprises the area of occupancy of the known wild or translocated populations; similar habitat within 200 metres of known populations; remnant vegetation that surrounds or links populations; additional nearby occurrences of similar habitat that do not currently contain the taxon but may have done so in the past and may be suitable for translocations; and the local catchment for the surface and groundwaters that provide the winter-wet habitat of the taxon.

Habitat critical to the survival of the species, and important populations: Given that this taxon is listed as Endangered it is considered that all known habitat is habitat critical and all populations, inclulding translocated ones, are important populations.

Benefits to other species/ecological communities: All populations are located within occurrences of a Threatened Ecological Community (TEC) ranked 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 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: According to the Department of Indigenous Affairs Aboriginal Heritage Sites Register, no sites have been discovered near the *Lambertia orbifolia* subsp. Scott River Plains populations. Input and involvement will be sought from any indigenous groups that have an active interest in the areas that are habitat for *L. orbifolia* subsp. Scott River Plains, and this is discussed in the recovery actions.

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 1a, 1b, 1d, 1e, 3b, 4a and 4b, and Populations 2 and 5 of *Lambertia orbifolia* subsp. Scott River Plains. Recovery actions refer to continued liaison between stakeholders with regard to these areas.

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

Habitat requirements: *Lambertia orbifolia* subsp. Scott River Plains is located in the Scott River Plains that occurs from east of Augusta to Walpole. The taxon occurs on sandy ironstone soils or on grey sands over ironstone, and on shallow sands associated with ironstone, around winter wet areas near the coast.

Existing Recovery Actions: The following recovery actions have been or are currently being implemented:

1. Land managers have been notified of the location and threatened status of the taxon.
2. Declared Rare Flora (DRF) markers have been installed at Subpopulation 3a.
3. Dashboard stickers and posters describing the significance of DRF markers have been produced and distributed.
4. Approximately 40 hectares of private property containing populations of *Lambertia orbifolia* subsp. Scott River Plains was purchased by the Department of Conservation and Land Management (CALM) in 1991 and placed under the Care, Control and Management of the Conservation Commission.
5. The Botanic Gardens and Park Authority (BGPA) currently have *Lambertia orbifolia* subsp. Scott River Plains plants in their nursery grown from cuttings taken in May 1990.
6. A systematic study of *Lambertia* species, using morphological, biogeographical and, potentially, molecular data to elucidate the classification of this genus and to contribute to phylogenetic knowledge of the family is being undertaken as a Masters project through CALM's Science Division.
7. A research proposal for conservation actions for four rare and endangered species, including *Lambertia orbifolia* subsp. Scott River Plains, at BHP Beenup Minesite was developed by the BGPA in 2003.
8. A Translocation Proposal aimed at re-introducing plants of *Lambertia orbifolia* subsp. Scott River Plains was developed by the BGPA and BHP Billiton in 2003, in liaison with CALM staff. One hundred and forty plants from one population were planted in July 2003 on a previously mined area and surrounds.
9. A fire response plan has been produced for the reserves that contain Subpopulations 1c and 1e of *Lambertia orbifolia* subsp. Scott River Plains by staff from CALM's Blackwood District.
10. There have been several collections of seed from *Lambertia orbifolia* subsp. Scott River Plains made by the Threatened Flora Seed Centre (TFSC) and BGPA.
11. An Honours project on *Lambertia orbifolia* was undertaken by L. Sage from Curtin University in 1994.
12. Staff of Science Division and CALM's Blackwood District are undertaking a project on the intraspecific resistance to *Phytophthora cinnamomi* and the effectiveness of phosphite treatment in threatened *Lambertia*.
13. Staff of Science Division undertook research on the genetic structure and mating systems of *Lambertia orbifolia* between 1996 and 1997.
14. The South West Region Threatened Flora and Communities Recovery Team (SWRTFCRT) is overseeing the implementation of this IRP and will include information on progress in their annual report to CALM's Corporate Executive and funding bodies.
15. Staff from CALM'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 period of the plan's adoption under the EPBC Act.

Criteria for failure: The number of individuals within populations and/or the number of populations have decreased by ten percent or more over the period of the plan's adoption under the EPBC Act.

Recovery actions

1. Coordinate recovery actions.
2. Map critical habitat.
3. Formally notify owners of adjacent land.
4. Describe the subspecies.
5. Conduct further surveys.
6. Monitor dieback disease.
7. Maintain disease hygiene.
8. Fence Populations 1d, 3b, 4b and 5.
9. Stimulate the germination of soil-stored seed.
10. Develop and implement a fire management strategy.
11. Develop a kangaroo management strategy.
12. Undertake weed control.
13. Monitor populations.
14. Seek improved security for populations.
15. Promote awareness.
16. Obtain biological and ecological information.
17. Continue the translocation process.
18. Review the need for a full Recovery Plan.

1. BACKGROUND

History

C.A. Gardner described *Lambertia orbifolia* in 1964 from a collection made from the Narrikup area by K.R. Newbey in the same year. The specific name, derived from the Latin *orbis*, refers to the rounded leaves. The species was subsequently also located in the Scott River area some 200 km to the south-west. Due to this disjunction it was thought that plants from the two areas may represent two subspecies. In 1999 research was conducted and, based on differences found in the genetic structure between plants in the two areas (Byrne *et al*. 1999; Coates and Hamley 1999), *L. orbifolia* was split into two subspecies, these being *L. orbifolia* subsp. *orbifolia* ms and *L. orbifolia* subsp. Scott River Plains (L.W. Sage 684).

Numerous surveys for the taxon and other Scott River Plains endemics have been undertaken (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 extensively cleared, potential new populations are most likely to be located in a few small remnants on private property. A new population was located during a survey undertaken in 1989 on numerous private properties by CALM staff and private consultants. This followed a notification to clear remnant vegetation and a mineral sands mining application. In 1990 a number of *Lambertia orbifolia* subsp. Scott River Plains plants on private property were illegally cleared and others were also under significant threat from clearing. Part of this area that contains this taxon as well as other rare flora was therefore purchased in 1991 and placed under the Care, Control and Management of the Conservation Commission. Currently, *L. orbifolia* subsp. Scott River Plains is known from five populations consisting of around 611 plants.

Description

Lambertia orbifolia C.A. Gardner is an erect shrub or small tree, up to 4 m high with distinctive leaves that are held in opposite pairs or in whorls of three. The leaves, that are more or less circular or broadly elliptic, are 1.2 to 5 cm long and wide. Heads of four red flowers, each about 5 to 6 cm long, are surrounded by a whorl of overlapping bracts. Flowering occurs throughout the year, but is mainly between November and May (Brown *et al*. 1998).

Lambertia orbifolia subsp. Scott River Plains (L.W. Sage 684) can be distinguished from *Lambertia orbifolia* subsp. *orbifolia* by its longer inflorescence bracts and styles (pers comm. G. Keighery[1]).

Distribution and habitat

Lambertia orbifolia subsp. Scott River Plains is located in the Scott River Plains that occurs from east of Augusta to Walpole. The taxon occurs on sandy ironstone soils or on grey sands over ironstone, and on shallow sands associated with ironstone, around winter wet areas near the coast. Populations of the taxon further inland are located on ironstone uplands in dense shrub/heath. *Kunzea recurva*, *Hakea tuberculata*, *Calothamnus crassus* and sedges are also present (Obbens and Coates 1997; Sage and Lamont 1994). Associated species include *Banksia littoralis*, *B. ilicifolia*, *B. grandis*, *Hakea prostrata*, *H. varia*, *Xanthorrhoea preissii*, *X. brunonis*, *Pimelea rosea*, *Isopogon formosus*, *Anthocercis littorea*, *Lysinema ciliatum*, *Acacia pulchella*, *Persoonia elliptica*, *Hovea trisperma*, *Melaleuca thymoides*, *M. incana*, *Patersonia* sp., and *Lepidosperma squamatum*.

Lambertia orbifolia subsp. Scott River Plains is endemic to a threatened ecological community (TEC) (English and Blyth 1999), the 'Scott River Ironstone Association'. These ironstone soils are highly restricted in distribution, and there is a total of 39 occurrences of this wetland plant community covering 360 hectares on the Scott River Plain remaining (Gibson *et al*. 2000).

Habitat critical to the survival of the species, and important populations

Given that this taxon is listed as Endangered it is considered that all known habitat is habitat critical. In addition all populations are considered important to the survival of the taxon. Recovery actions include survey for further

[1] Greg Keighery, Principal Research Scientist, CALM's Science Division

populations that may lead to the identification of additional habitat critical.

Benefits to other species/ecological communities

Lambertia orbifolia subsp. Scott River Plains is endemic to the 'Scott River Ironstone Association' Threatened Ecological Community (TEC), that is listed as Endangered in Western Australia. Other listed and priority flora that occur in the wider habitat of the populations including *Darwinia ferricola* (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 *Lambertia orbifolia* subsp. Scott River Plains are likely to improve the status of the TEC in which the populations are located, as well as the 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

According to the Department of Indigenous Affairs Aboriginal Heritage Sites Register, no sites have been discovered near the *Lambertia orbifolia* subsp. Scott River Plains populations. Input and involvement will be sought from any indigenous groups that have an active interest in the areas that are habitat for *L. orbifolia* subsp. Scott River Plains, and this is discussed in the recovery actions.

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 1a, 1b, 1d, 1e, 3b, 4a and 4b, and Populations 2 and 5 of *Lambertia orbifolia* subsp. Scott River Plains. Recovery actions refer to continued liaison between stakeholders with regard to these areas.

Evaluation of the Plan's Performance

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

Critical habitat

Critical habitat is habitat identified as being critical to the survival of a listed threatened species or listed Threatened Ecological Community. Habitat is defined as the biophysical medium or media occupied (continuously, periodically or occasionally) by an organism or group of organisms or once occupied (continuously, periodically or occasionally) by an organism, or group of organisms, and into which organisms of that kind have the potential to be reintroduced (*Environment Protection and Biodiversity Conservation Act 1999*).

The critical habitat for *Lambertia orbifolia* subsp. Scott River Plains comprises:

- the area of occupancy of known wild or translocated populations;

- areas of similar habitat within 200 metres of known populations, ie. sandy ironstone soils or on grey sands over ironstone, around winter wet areas near the coast (these provide potential habitat for natural range extension);
- remnant vegetation that surrounds or links several populations (this is to provide habitat for pollinators or to allow them to move between populations);
- additional occurrences of similar habitat that do not currently contain the taxon but may have done so in the past (these represent possible translocation sites); and
- the local catchment for the surface and groundwaters that maintain the winter-wet habitat of the taxon (the plant community would be dependent on maintenance of the local hydrological conditions).

Biology and ecology

Lambertia orbifolia has populations in two widely separated areas (Narrikup and Scott River Plains). Research on the genetic structure and mating system of the species has shown that these populations have been isolated for quite some time and that this has led to independent evolution. The two forms are therefore recognised as distinct subspecies (Byrne *et al*. 1999; Coates 2000; Coates and Hamley 1999).

Results from an Honours project undertaken by L. Sage in 1994 have shown that *Lambertia orbifolia* subsp. Scott River Plains differs from *L. orbifolia* subsp. *orbifolia* (Narrikup) in aspects of flowering, plant longevity and follicle production. *L. orbifolia* subsp. Scott River Plains has more inflorescences, and this is possibly a reflection of the plants being larger. The taxon also had a greater number of mature follicles This is possibly a result of canker (*Cryptodiaporthe* sp., *Diplodina* sp.) killing branches and hence follicles at the Narrikup population. The taxon is an obligate re-seeder (non sprouter) and is nonserotinous (seed is continually being dehisced). Large quantities of seed do not appear to be stored within the soil but were found in the leaf litter. The main pollinator for the species appears to be honeyeaters (Obbens and Coates 1997; Sage and Lamont 1994).

Fires burnt through parts of Population 4 in autumn 1991 and Population 3a in 1995. The adult plants were killed by the fires that also appeared to act as a stimulus for recruitment from seed (Sage and Lamont 1994).

Like most other members of the genus, *Lambertia orbifolia* subsp. Scott River Plains is highly susceptible to the plant pathogen *Phytophthora cinnamomi* (dieback). Out of 211 individuals inoculated with the pathogen, 166 deaths (79%) occurred (pers comm. C.Crane[2]). However dieback disease only appears to be a threat where the plants occur in low scrub on very shallow, seasonally inundated soils over ironstone. This habitat is considered to be extremely favourable for the spread of the disease (Obbens and Coates 1997).

Threats

Lambertia orbifolia was declared as Rare Flora in November 1980 under the Western Australian *Wildlife Conservation Act 1950* and ranked as Critically Endangered (CR) in November 1998. The species is also listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation* Act 1999 (EPBC Act). Following the splitting of *Lambertia orbifolia* into two subspecies in September 1999, the subspecies Scott River Plains was ranked as Endangered (EN). It currently meets World Conservation Union (IUCN 2000) Red List Category Endangered (EN) under criteria B1ab(i,ii,iii,v)+2ab(i,ii,iii,v);C1+2a(i) 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 and mining, dieback disease, changes to hydrology, grazing, trampling, inappropriate fire regimes, weed invasion, road maintenance and plantation activities.

- **Mineral exploration** and extraction leases exist over the area of land in which Subpopulations 1a, 1b, 1d, 1e, 3b, 4a and 4b, and Populations 2 and 5 of *Lambertia orbifolia* subsp. Scott River Plains occur.

- **Dieback disease** is a threat to all populations of *Lambertia orbifolia* subsp. Scott River Plains. Dieback caused by the plant pathogen *Phytophthora* spp. causes the roots to rot and results in susceptible plants dying of drought stress. Testing has shown that the taxon is highly susceptible to the disease. The presence

[2] Colin Crane, Senior Technical Officer, CALM's Science Division

of the disease has been confirmed at Population 1e. Populations 2 and 3a are also extremely vulnerable to dieback disease due to the presence of 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 water level. Adjacent land developments such as mining also have the potential to alter hydrological processes, and therefore to threaten the populations.

- **Grazing and trampling** by stock (cattle) and kangaroos is a threat to Subpopulations 1c, 1d, 1e, 3b, 4a and 4b. Although it appears that larger *Lambertia orbifolia* subsp. Scott River Plains plants are not grazed, animals impact on the habitat by digging, trampling and breaking foliage and possibly spreading dieback disease when moving through the area. 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 *L. orbifolia* subsp. Scott River Plains thereby limiting natural recruitment.

- **Inappropriate fire regimes** would affect the viability of the populations, as *Lambertia orbifolia* subsp. Scott River Plains 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.

- **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 maintenance activities** threaten Subpopulation 3a. Threats include grading, chemical spraying, construction of drainage channels and the mowing of roadside vegetation. Several of these actions also encourage weed invasion.

- **Poor regeneration**, due to lack of appropriate disturbance threatens Populations 3b, 4 and 5 as very few young plants of *Lambertia orbifolia* subsp. Scott River Plains have been observed.

- **Plantation activities** threaten Population 5. Activities include fertiliser application, firebreak maintenance, tree harvesting and site preparation. In addition, competition for light, soil moisture and growing space will increase as the bluegum plantation matures.

Summary of population information and threats

Pop. No. & Location	Land Status	Year/No. plants	Condition	Threats
1A. Northeast of Augusta	Private Property	1985 33 1987 25 1990 33 1990 0		Cleared
1B. Northeast of Augusta	Private Property	1985 *375 1987 121 1988 300 1990 121 1990 0		Cleared
1C. Northeast of Augusta	Nature Reserve	1985 *375 1990 305 1997 35	Healthy	Grazing (kangaroos), hydrological changes, inappropriate fire regimes
1D. Northeast of Augusta	Private Property	1985 150 1990 174 2002 **4	Poor	Mining, grazing (stock), hydrological changes, inappropriate fire regimes,
1E. Northeast of Augusta	Private Property	1989 100 1990 100 1997 100+ 2000 26 [3 dead] 2003 126+	Healthy	Mining, dieback, inappropriate fire regimes, weeds, grazing (kangaroos), hydrological changes
2. Brennans Ford	Nature Reserve	1990 40 (2) [10 dead] 1991 40 (15) [5 dead] 1992 100+ 1993 60 1995 20 2003 14 (2) [3 dead]	Moderate	Mining, dieback, weeds, inappropriate fire regimes, hydrological changes
3A. Northeast of Augusta	Shire Road Reserve	1990 48 1993 68 1996 65 1995 40 1996 65 2000 40 (2) [2 dead] 2003 5 (16)	Poor	Road maintenance, dieback, inappropriate fire regimes, hydrological changes, weeds
3B. Northeast of Augusta	Private Property	1984 (1) 1993 0	Poor	Mining, grazing (cattle), weeds, hydrological changes, poor regeneration
4A. Adelaide Springs	Private Property	1991 40 1992 1000+ 1993 503 (5860) [385 dead] 1994 483 (5860) [399 dead] 1995 *1000+ 2003 100+ (10+) [25% dead]	Healthy	Mining, grazing (cattle), hydrological changes, dieback, inappropriate fire regimes, poor regeneration
4B. Adelaide Springs	Private Property	1992 40 1993 47 [15 dead] 2003 36 [16 dead]	Poor	Mining, grazing (cattle), hydrological changes, weeds, dieback, inappropriate fire regimes, poor regeneration
5. Snake Springs	Private Property	1991 10,000+ 1994 200+ (10) 1996 500+ 1998 100+	Poor	Mining, plantation activities, dieback, weeds, inappropriate fire regimes, hydrological changes, poor regeneration

( ) = number of seedlings.
*= total for subpopulations combined.
**Most plants were included in the counts for the Nature Reserve (Subpopulation 1c)

Guide for decision-makers

Section 1 provides details of current and possible future threats. Developments in the immediate vicinity of the populations or within the defined critical habitat of *Lambertia orbifolia* subsp. Scott River Plains require assessment. No developments should be approved unless the proponents can demonstrate that they will have no significant impact on the taxon, or its habitat or potential habitat, or the local surface or groundwater hydrology.

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 period of the plan's adoption under the EPBC Act.
Criteria for failure: The number of individuals within populations and/or the number of populations have decreased by ten percent or more over the period of the plan's adoption under the EPBC Act.

3. RECOVERY ACTIONS

Existing recovery actions

Land managers have been notified of the location and threatened status of the taxon. The notification details the Declared Rare status of *Lambertia orbifolia* subsp. Scott River Plains and the legal responsibility to protect it.

Declared Rare Flora (DRF) markers have been installed at Subpopulation 3a. 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 1c and Population 2 of *Lambertia orbifolia* subsp. Scott River Plains was purchased by CALM in 1991 and placed 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) currently have *Lambertia orbifolia* subsp. Scott River Plains plants in their nursery grown from cuttings taken in May 1990. The plants are in the early stages of decline, are over five metres high and producing viable seed (Norrish 2003).

A systematic study of the genus *Lambertia*, using morphological, biogeographical and, potentially, molecular data to elucidate the classification of this genus and to contribute to phylogenetic knowledge of the family is being undertaken as a Masters project through CALM's Science Division (pers comm. A. Spooner[3]). The following objectives have been set:

(i) to resolve the taxonomic issues within the group with particular reference to the threatened taxa, and
(ii) to examine the evolutionary relationships within the genus.

A research proposal for conservation actions for four rare and endangered species, including *Lambertia orbifolia* subsp. Scott River Plains, at BHP Beenup Minesite 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;

[3] Amanda Spooner, Masters student, Edith Cowan University

- 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.

As part of this research project, a Translocation Proposal aimed at re-introducing plants of *Lambertia orbifolia* subsp. Scott River Plains, *Dryandra nivea* subsp. *uliginosa*, *Darwinia ferricola* ms, and *Grevillea brachystylis* subsp. *australis* was developed by the BGPA and BHP Billiton in 2003. One hundred and forty plants of this taxon 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 has been produced by staff from CALM's Blackwood District for the reserves that contain Subpopulations 1c and 1e of *Lambertia orbifolia* subsp. Scott River Plains.

There have been several collections of seed from *Lambertia orbifolia* subsp. Scott River Plains. Approximately 2246 seeds were collected from Population 1e in January 1996 and February 1997; 287 seeds were collected from Population 2 in May 1993 and December 1995; 1061 seeds were collected from Population 3a in May and November 1993, and December 1995; 1159 seeds from Population 4 in May 1993, December 1995 and January 1996; and 1235 seeds from Population 5 in May 1993 and January 1996 and stored in CALM's TFSC at –18°C and 4°C. The TFSC test the viability of the seed initially, after one year in storage and then after five years in storage. The initial germination rate of *L. orbifolia* subsp. Scott River Plains seed was found to range from 77 to 100%; from 61 to 97% after one year in storage, and ranged from 82% to 100% after five years in storage (unpublished data, A. Cochrane[4]). A small amount of this seed was transferred to the BGPA in 1998 for storage.

An Honours project on *Lambertia orbifolia* was undertaken by L. Sage from Curtin University in 1994. The research objectives were to:

1. Assess plant size and population age structure.
2. Assess flowering and factors affecting seed production, viability and longevity.
3. Assess population recruitment patterns with particular reference to the impact of fire and plant disease.
4. Assess population health in relation to fungal pathogens and insect attack.

Staff of CALM's Science Division and Blackwood District are undertaking a project on the intraspecific resistance to *Phytophthora cinnamomi* and phosphite effectiveness in minimising dieback impact in threatened *Lambertia*. Seed that has been collected will be germinated and potting and testing will be undertaken in summer 2003/04 (pers comm. B. Shearer[5]).

Staff from CALM's Science Division undertook research on the genetic structure and mating systems of *Lambertia orbifolia* between 1996 and 1997.

The South West Region Threatened Flora and Communities Recovery Team (SWTFCRT) oversees the implementation of this IRP and includes information on progress in their annual reports to CALM's Corporate Executive and funding bodies.

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

Future recovery actions

Where populations occur on lands other than those managed by CALM, 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.

[4] Anne Cochrane, Senior Research Scientist, CALM's Threatened Flora Seed Centre
[5] Bryan Shearer, Principal Research Scientist, CALM's Science Division

1. Coordinate recovery actions

The South West Region Threatened Flora and Communities Recovery Team (SWRTFCRT) will continue to coordinate recovery actions for *Lambertia orbifolia* subsp. Scott River Plains and other Declared Rare Flora and Threatened Ecological Communities in their region. They will include information on progress in their annual reports to CALM's Corporate Executive and funding bodies.

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

2. Map critical habitat

It is a requirement of the EPBC Act that spatial data relating to critical habitat be determined for species listed under that Act. Although critical habitat is described in Section 1, the areas described have not yet been mapped and that will be done under this action. If any additional populations are located, then critical habitat will also be determined and mapped for those locations.

Action: Map critical habitat
Responsibility: CALM (Blackwood District, WATSCU) through the SWRTFCRT
Cost: $2,000 in the first year

3. Formally notify owners of adjacent land

The owners of land adjacent to Subpopulation 3a need to be formally notified of the presence of *Lambertia orbifolia* subsp. Scott River Plains.

Action: Formally notify owners of adjacent land
Responsibility: CALM (Wildlife Branch)
Cost: $100 in first year

4. Describe the subspecies

Research on the genetic structure and mating system of the species has shown that the two forms should be recognised and described as distinct subspecies. These sub-species need to be described.

Action: Describe the subspecies
Responsibility: CALM (Science Division) through the SWRTFCRT
Cost: $5,000 in first year

5. Conduct further surveys

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

Populations which have not been seen for a number of years will also be resurveyed.

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

6. Monitor dieback disease

The presence of dieback has been confirmed at Subpopulation 1e but it has not been confirmed at any other populations. The disease will be mapped and the spread and impact monitored. Dieback control options (such as phosphite spraying) will be assessed or investigated if detrimental impacts are observed.

Action: Monitor dieback disease
Responsibility: CALM (Blackwood District, Dieback Disease Coordinator) through the SWRTFCRT
Cost: $7,300 in the first, third and fifth years, plus $1,500 per year for monitoring and mapping

7. Maintain disease hygiene

The ironstone habitat in which *Lambertia orbifolia* subsp. Scott River Plains 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, including *L. orbifolia* subsp. Scott River Plains. Dieback hygiene (outlined in Department of Conservation and Land Management 2003) will therefore be adhered to 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.

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

8. Fence Populations 1d, 3b, 4b and 5

Agreement will be sought to fence Subpopulations 1d, 3b and 4b, and Population 5 on private land including a buffer of surrounding habitat, to protect *Lambertia orbifolia* subsp. Scott River Plains from grazing by cattle and impacts from bluegum plantation maintenance. Funding assistance for this fencing may be obtained from various sources such as a covenanting scheme.

Action: Fence Populations 1d, 3b, 4b and 5
Responsibility: CALM (Blackwood District) through the SWRTFCRT
Cost: $10,200 in first year.

9. Stimulate the germination of soil-stored seed

Burning, smokewater and soil disturbance may be effective in stimulating the germination of soil-stored seed. These trials will be conducted near existing populations (particularly Populations 4 and 5) in areas newly cleared of weeds, and/or in areas where *Lambertia orbifolia* subsp. Scott River plains was known to occur previously. After treatment, annual monitoring will include recording the time when flowering first occurs, seed is produced and the age at which of senescence is reached. This will enable formulation of a recommended interval time between disturbances to maintain populations.

Action: Stimulate the germination of soil-stored seed
Responsibility: CALM (Blackwood District) through the SWRTFCRT
Cost: $3,400 in first, second and third years.

10. Develop and implement a fire management strategy

Lambertia orbifolia subsp. Scott River Plains 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 will be developed that recommends fire frequency, intensity, season, and control measures.

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

11. Develop a kangaroo management strategy

A management strategy will be developed in areas where kangaroos are having an impact on populations of *Lambertia orbifolia* subsp. Scott River Plains by trampling and breaking foliage when moving through the area. The strategy will include a survey to determine animal density, monitoring of impacts on the taxon, and recommendations to reduce the impact.

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

12. Undertake weed control

Weed control will be 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 against weeds, and the effect on *Lambertia orbifolia* subsp. Scott River Plains and associated native plant species. It is anticipated that the regeneration of native species in the habitat will improve once weed competition is reduced.

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

13. 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 essential. All populations will be 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: CALM (Blackwood District) through the SWRTFCRT
Cost: $1,000 per year.

14. Seek improved security for populations

Staff from CALM's Blackwood District will continue to liaise with land managers and landowners to 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 *Lambertia orbifolia* subsp. Scott River Plains.

Action: Seek improved security for populations
Responsibility: CALM (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 will be promoted to the community through poster displays and the local print and electronic media. Formal links with local naturalist groups and interested individuals will also be encouraged. An information sheet, which 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 *Lambertia orbifolia* subsp. Scott River Plains 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: CALM (Blackwood District) through the SWRTFCRT
Cost: $2,100 in first year and $700 in second year and $600 in remaining years.

16. Obtain biological and ecological information

Improved knowledge of the biology and ecology of *Lambertia orbifolia* subsp. Scott River Plains 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, kangaroos), 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 *Lambertia orbifolia* subsp. Scott River Plains and its habitat.
6. Investigation of the impacts of dieback disease and control techniques on *Lambertia orbifolia* subsp. Scott River Plains and its habitat.

Action: Obtain biological and ecological information
Responsibility: CALM (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 a Translocation Proposal 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 CALM'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: CALM (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, a full Recovery Plan and/or further recovery will be assessed.

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

4. TERM OF PLAN

This Interim Recovery Plan will operate from July 2004 to June 2009 but will remain in force until withdrawn or replaced. After five years, the need to review this IRP or to replace it with a full Recovery Plan will be determined.

5. REFERENCES

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.

Byrne, M., MacDonald, B. and Coates, D. (1999) Divergence in the Chloroplast Genome and Nuclear rDNA of the Rare Western Australian Plant *Lambertia orbifolia* Gardner (Proteaceae). *Molecular Ecology* 8, 1789-1796.

Coates, D.J. (2000) Defining conservation units in a rich and fragmented flora: implications for the management of genetic resources and evolutionary processes in south-west Australian plants. *Australian Journal of Botany* 48, 329-339.

Coates, D.J. and Hamley, V.L. (1999) Genetic Divergence and the Mating System in the Endangered and Geographically Restricted Species, *Lambertia orbifolia* Gardner (Proteaceae). *Heredity* 83, 418-427.

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. Perth, 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 Gardens 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. *CALMScience* 3(4), 411-432.

Hnatiuk, R.J. (1995) Flora of Australia, *Elaeagnaceae, Proteaceae 1*, Volume 16, 425-436. CSIRO Australia.

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.

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.

Sage, L. and Lamont, B.B. (1994) Conservation biology of the rare and endangered species *Lambertia orbifolia*. Curtin University of Technology, 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/

World Conservation Union (2000) *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

Hnatiuk, R.J. (1995) Flora of Australia, *Elaeagnaceae, Proteaceae 1*, Volume 16, 425-436. CSIRO Australia.

Lambertia orbifolia **C.A. Gardner** is a shrub to 3 m tall, apparently lacking lignotubers. Branches erect, spreading or arching; young branches brown, villous to pilose. Leaves opposite or rarely in whorls of 3, sessile

or shortly petiolate; lamina orbicular, 15 to 20 mm diameter, obtuse slightly cordate and cupped, entire, glabrous. Conflorescence 4 to 6 flowered. Flowers zygomorphic. Perianth 40 to 50 mm long, red, dilated about middle, brown-hirsute; abaxial suture deepest. Hypogynous glands 4, free. Ovary densely brown-pilose; style glabrous above, sparsely pilose in lower half. Fruit asymmetric, 7 to 10 mm diameter, flattened; beak oblique; horns scarcely developed; sides smooth. Seeds 2, asymmetric, cuneate, c. 10 mm long, c. 6 mm wide, with a narrow wing from apex to base along one side.

SUMMARY OF RECOVERY ACTIONS AND COSTS

Recovery Action	Year 1			Year 2			Year 3			Year 4			Year 5		
	CALM	**Other**	**Ext.**	**CALM**	**Other**	**Ext.**	**CALM**	**Other**	**Ext.**	**CALM**	**Other**	**Ext.**	**CALM**	**Other**	**Ext.**
Coordinate recovery actions	1400	300	400	1400	300	400	1400	300	400	1400	300	400	1400	300	400
Map critical habitat	500		1500												
Formally notify owners of adjacent land	100														
Describe the subspecies	2500		2500												
Conduct further surveys	700	800	800	700	800	800	700	800	800	700	800	800	700	800	800
Monitor dieback disease	600		8200	300		1200	600		8200	300		1200	600		8200
Maintain disease hygiene	200		600	200		600	200		600	200		600	200		600
Fence Populations 1d, 3b, 4b and 5	200		10000												
Stimulate the germination of soil-stored seed	500		2900	500		2900	500		2900						
Develop and implement a fire management strategy	1400		1100	200		800	200		800	200		800	200		800
Develop a kangaroo management strategy	1500		500												
Undertake weed control	500		500	500		500	500		500	500		500	500		500
Monitor populations	500		500	500		500	500		500	500		500	500		500
Seek improved security for populations	500		200	500		200	500		200	500		200	500		200
Promote awareness	600		1500	600		100	600			600			600		
Obtain biological and ecological information	10800		10200	10800		10200	10800		10200						
Continue the translocation process							2400		3300				2000		2200
Review the need for a full Recovery Plan													15300		8400
Total	22500	1100	41400	16200	1100	18200	18900	1100	28400	4900	1100	5000	22500	1100	22600
Yearly Total		**65,000**			**35,500**			**48,400**			**11,000**			**46,200**	

NHT = External funding (funding to be sought), Other = funds contributed by NHT, in-kind contribution and BGPA.

Total CALM:	$85,000
Total Other:	$5,500
Total External Funding:	$115,600
TOTAL COSTS:	**$206,100**