

INTERIM RECOVERY PLAN NO. 173

SCOTT RIVER BORONIA

(*BORONIA EXILIS*)

INTERIM RECOVERY PLAN

2004-2009

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Photograph: Diana Papenfus

July 2004

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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 replaces number 41 Scott River *Boronia* (*Boronia exilis*) (R. Evans *et al.* 1999).

This Interim Recovery Plan will operate from July 2004 to June 2009 but will remain in force until withdrawn or replaced.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
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:	<i>Boronia exilis</i> Paul G. Wilson	Common Name:	Scott River Boronia
Family:	Rutaceae	Flowering Period:	September
CALM Region:	South West	CALM 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, 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/>; Wilson, P. G. (1998) New names and new taxa in the genus *Boronia* (Rutaceae) from Western Australia, with notes on seed characters. *Nuytsia* 12, 119-154.

Current status: *Boronia exilis* was declared as Rare Flora in November 1997 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. It currently meets World Conservation Union (IUCN) Red List Category Endangered (EN) under criterion B1ab(i,ii,iii,v)+2ab(i,ii,iii,v) (IUCN 2000) due to the fragmentation of populations, and a continuing decline in the quality of habitat and the number of plants. The main threats are mineral exploration, changes to hydrology, inappropriate fire regimes, road maintenance activities, grazing and trampling, weed invasion, and dieback disease.

Critical habitat: The critical habitat for *Boronia exilis* 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, including translocated ones, are important populations.

Benefits to other species/ecological communities: Some 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, there is a registered site (artefact Brennan Ford/Scott River) known from the vicinity of a population of *Boronia exilis*. Input and involvement will be sought from any indigenous groups that have an active interest in areas of the taxon, and this is discussed in the recovery actions.

Social and economic impacts: The implementation of this recovery plan has the potential to have some 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 Populations 1, 3 and 4 of *Boronia exilis*. 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: *Boronia exilis* is located on seasonally wet heath or sedgeland on grey silty sand, over ironstone.

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 1b.
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 *Boronia exilis* 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 owner of the mineral lease has erected a fence around the ironstone community that is thought to contain Population 4.
6. A fire response plan has been produced by staff from CALM's Blackwood District for the reserves that contain Populations 3 and 4 of *Boronia exilis*.
7. There have been several collections of seed and cuttings from *Boronia exilis* made by the Threatened Flora Seed Centre (TFSC) and BGPA.
8. 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.
9. 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. Confirm existing populations and conduct further surveys.
4. Install DRF markers.
5. Formally notify land owners.
6. Monitor dieback disease.
7. Maintain disease hygiene.
8. Develop and implement a fire management strategy.
9. Develop a kangaroo management strategy.
10. Undertake weed control.
11. Monitor populations.
12. Collect seed and cutting material.
13. Liaise with land managers.
14. Seek improved security for populations.
15. Promote awareness.
16. Obtain biological and ecological information.
17. Include general recommendations for taxon in Management Plan for Park.
18. Review the need for a full Recovery Plan.

1. BACKGROUND

History

The first known collection of *Boronia exilis* was made in 1881 by Miss Bunbury, from ‘Port Augusta near Geographe Bay’, and is housed at the National Herbarium of Victoria. *B. exilis* was not collected again until 1965, when A. C. Beaglehole surveyed east of Karridale. Neither population has been relocated, despite searching. During searching of the Scott River area in 1996, D. Papenfus was only able to locate the taxon at one site, which now represents Subpopulation 1c. The species was then thought to exist in four other populations however, these populations have not been relocated since the initial collections.

In 1990 Mattiske Consulting Pty Ltd completed a flora and vegetation survey for a mine site in the Scott River area (Mattiske Consulting Pty Ltd 1996a; 1996b). During this survey a specimen of *Boronia exilis* was collected (Population 4). This collection was not relocated for a number of years. Then in 1999, surveys by CALM’s Blackwood District located three populations and two subpopulations. Currently, *Boronia exilis* is known from four populations consisting of around 2,370 plants.

Description

Boronia exilis is thought to be part of the *Boronia juncea* complex but is taller and has pale pink/white flowers. *B. exilis* is an erect slender-stemmed perennial to approximately 1 m high. Its upper leaves are slender and almost round in cross-section, to 1.5 cm long. The pink flowers are borne in clusters of 3 to 9 at the end of branches. Each flower has four 4 mm long deep red, woolly sepals and four broadly ovate pink petals to 7 mm long. The specific name *exilis* is Latin and means slender and weak, referring to the stems of this species. *B. exilis* is similar to *B. juncea*, and particularly to the *Boronia juncea* subsp. *laniflora*. It is most easily distinguished by its strongly fringed staminal filaments, which in *B. juncea* are hairless (Wilson 1998).

Distribution and habitat

Boronia exilis occurs in the Scott River area. The taxon is found in seasonally wet heath or sedgeland on grey silty sand, over ironstone. The habitat at Population 4 is described as low *Banksia attenuata*, *B. ilicifolia* and *Eucalyptus marginata* woodland, mixed Proteaceae and Myrtaceae scrub, and low sedgeland with pockets of low open Proteaceae / Myrtaceae heath (Williams *et al.* 2001).

Some populations of *Boronia exilis* are located in 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). This IRP will be implemented in conjunction with the draft IRP for the Scott River Ironstone Association (Luu and English 2004).

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

Given that this taxon is listed as Critically 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 populations that may lead to the identification of additional habitat critical.

Benefits to other species/ecological communities

Some populations of the *Boronia exilis* occur in 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 include *Lambertia orbifolia* subsp. *Scott River Plains* (Endangered under both the *Wildlife Conservation Act* 1950 and *Commonwealth Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act)), *Darwinia ferricola* (Endangered under both the *Wildlife Conservation Act* 1950 and EPBC Act), *Dryandra nivea* subsp. *uliginosa* (Endangered under both the *Wildlife Conservation Act* 1950 and the EPBC Act), *Grevillea brachystylis* subsp. *australis* (Endangered under the *Wildlife Conservation Act* 1950 and Vulnerable under the EPBC Act), *Calothamnus* sp. *Scott River* (aff. *crassus*) (Priority 2), *Chordifex isomorphus* (Priority 4), *Loxocarya magna* (Priority 3), *Grevillea manglesioides* subsp. *ferricola* (Priority 2),

and *Hakea tuberculata* (Priority 3) (Gibson *et al.* 2000). Recovery actions implemented to improve the quality or security of the habitat of populations of *Boronia exilis* 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, there is a registered site (artefact Brennan Ford/Scott River) known from the vicinity of a population of *Boronia exilis*. Input and involvement will be sought from any indigenous groups that have an active interest in areas of the taxon, 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 Populations 1, 3 and 4 of *Boronia exilis*. 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 (EPBC Act).

The critical habitat for *Boronia exilis* comprises:

- the area of occupancy of known wild or translocated populations;
- areas of similar habitat within 200 metres of known populations, ie. seasonally wet heath or sedgeland on grey silty sand, over ironstone, around winter wet areas near the coast (these provide potential habitat for natural range extension);
- remnant vegetation that surrounds or links 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

While the biology of the commercially-grown *Boronia megastigma* is well researched, the biology of many other *Boronia* species is poorly known. Most species are easily grown from seed. They require a presowing

treatment of soaking seed in hot water for 12-24 hours then immersion in running water for over one week. This suggests a chemical inhibition to germination. *Boronia* species also strike readily from cuttings taken from firm young growth (Elliot and Jones 1982). *Boronia* species are also thought to be sensitive to waterlogging and diseases that commonly result from waterlogging, and *Boronia exilis* grows in an area that is seasonally inundated. *Boronia* seeds have an elisasome (an extension from the seed) that is normally associated with ant dispersal. Many species are also very fragrant and are pollinated by moths and other insects.

Part of Population 1 and its habitat was burnt in a fire in 1994, and in 1996 survey indicated low numbers of plants of *Boronia exilis*. This suggests that adult plants are killed by fire and that the fire did not stimulate germination. Further research is needed to determine the limiting factor in regeneration. *Boronia exilis* is also thought to be sensitive to *Phytophthora cinnamomi* infection (pers comm. B. Shearer¹), and appears to be closely associated with a specific habitat type. This apparent close association with low-lying heath / sedgeland on restricted ironstone soils suggests that the species is naturally rare.

Threats

Boronia exilis was declared as Rare Flora in November 1997 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). It currently meets World Conservation Union (IUCN 2000) Red List Category Endangered (EN) under criterion B1ab(i,ii,iii,v)+2ab(i,ii,iii,v) due to the fragmentation of populations, and a continuing decline in the quality of habitat and the number of plants. The main threats are mineral exploration, changes to hydrology, inappropriate fire regimes, road maintenance activities, grazing and trampling, weed invasion, and dieback disease.

- **Mineral exploration** and extraction leases exist over the area of land in which Populations 1, 3 and 4 of *Boronia exilis* occur.
- **Changes to hydrology** may in future become a threat to all populations. The Scott River Ironstone habitat, in which a number of populations occur, 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.
- **Inappropriate fire regimes** would affect the viability of the populations, as field evidence suggests that adult plants are killed by fire and recruitment is not stimulated by burning. 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.
- **Road maintenance activities** threaten Subpopulations 1a, 1b and 1c. Threats include grading, chemical spraying, construction of drainage channels and the mowing of roadside vegetation. Several of these actions also encourage weed invasion.
- **Grazing and trampling** by kangaroos is a threat to Population 3. Although it is not certain whether *Boronia exilis* plants are being 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 are also likely and may result in increased weed invasion. Grazing would have an impact on the establishment of young plants of *B. exilis* thereby limiting natural recruitment.
- **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.

¹ Bryan Shearer, Principal Research Scientist, CALM's Science Division

- **Dieback disease** is a potential threat to all populations of *Boronia exilis*. Dieback caused by the plant pathogen *Phytophthora* spp. causes the roots to rot and results in susceptible plants dying of drought stress. The response of *Boronia exilis* to *Phytophthora* spp. is as yet unknown, but it is thought to be susceptible (pers. comm. B. Shearer). The habitat in which the taxon occurs is highly susceptible as it is very wet and associated with very shallow soils. The disease has been confirmed at Population 4.

Summary of population information and threats

Pop. No. & Location	Land Status	Year/No. plants	Condition	Threats
1A. NE of Augusta	Shire road reserve	1996 100	Habitat is healthy	Mining, hydrological changes, inappropriate fire regimes, road maintenance activities, weed invasion and disease.
1B. NE of Augusta	Shire reserve	1999 1000+	Healthy	Mining, hydrological changes, inappropriate fire regimes, road maintenance activities, weed invasion and disease.
1C. NE of Augusta	Shire reserve	Unknown	Habitat is healthy	Mining, hydrological changes, inappropriate fire regimes, road maintenance activities, weed invasion and disease.
1D. NE of Augusta	Shire Reserve	1999 1000+	Healthy	Mining, hydrological changes, inappropriate fire regimes and disease.
2. NE of Augusta	National Park	1999 50-100	Healthy	Hydrological changes, inappropriate fire regimes, weed invasion and disease.
3. NE of Augusta	Nature Reserve	Unknown	Unknown	Mining, hydrological changes, inappropriate fire regimes, grazing and trampling, weed invasion and disease.
4. NE of Augusta	Private property	1999 50-70	Healthy	Mining, hydrological changes, inappropriate fire regimes, weed invasion and disease.
5. NE of Augusta	State Forest	Unknown	Unknown	Hydrological changes, inappropriate fire regimes and disease.
6. NE of Augusta	Shire Reserve	1999 50-100	Healthy	Hydrological changes, inappropriate fire regimes and disease.

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 *Boronia exilis* 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 *Boronia exilis* and the legal responsibility to protect it.

Declared Rare Flora (DRF) markers have been installed at Population 1b. 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 Population 3 of *Boronia exilis* 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 owner of the mineral lease has erected a fence around the ironstone community that is thought to contain Population 4.

A fire response plan has been produced by staff from CALM's Blackwood District for the reserves that contain Populations 3 and 4 of *Boronia exilis*.

Forty-six cuttings from Population 1d, 43 from Population 6, and 20 from Population 2 were collected in 1999 by Botanic Gardens and Parks Authority. The species had a very poor strike rate with only 16 plants surviving. These have all since died (pers comm. A.Shade²).

There have been several collections of seed from *Boronia exilis*. Approximately 94 seeds were collected from Population 1b and 93 seeds from Population 1c in October 1999; and 335 seeds were collected from Population 1 in December 2001 and stored in CALM's (Threatened Flora Seed Centre (TFSC) at -18°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 *B. exilis* seed was found to range from 13 to 88%. The germination after five years in storage has not yet been tested (unpublished data, A. Cochrane³).

The South West Region Threatened Flora and Communities Recovery Team (SWRTFCRT) 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.

1. Coordinate recovery actions

The South West Region Threatened Flora and Communities Recovery Team (SWRTFCRT) will continue to coordinate recovery actions for *Boronia exilis* 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

² Amanda Shade, Botanic Gardens and Park Authority

³ Anne Cochrane, Senior Research Scientist, CALM's Threatened Flora Seed Centre

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. Confirm existing populations and conduct further surveys

There are three populations of *Boronia exilis* that are yet to be confirmed. Accurate documentation of population locations, plant numbers, condition of habitat and distribution is essential. This action will be implemented during the species flowering period (September) and will be conducted in conjunction with surveys for additional populations. It is also essential that specimens are taken to confirm each population, and then lodged with the WA Herbarium for future reference.

Surveys for additional populations will be undertaken during the species' flowering period in likely habitat such as the vegetation on the Scott Ironstone soil type as described by Tille and Lantzke (1990). Local volunteers such as members of naturalists clubs and wildflower societies will be encouraged to be involved in surveys supervised by CALM staff.

Action: Confirm existing populations and conduct further surveys
Responsibility: CALM (Blackwood District) through the SWRTFCRT
Cost: \$2,300 per year

4. Install Declared Rare Flora markers

Declared Rare Flora (DRF) markers are required for both 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.

Action: Install DRF markers
Responsibility: CALM (Blackwood District) through the SWRTFCRT
Cost: \$600 in first year

5. Formally notify land owners

The owners of land containing Population 4 and Subpopulation 1d need to be formally notified of the presence of *Boronia exilis*.

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

6. Monitor dieback disease

The presence of dieback disease has been confirmed within the habitat of Population 4 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 *Boronia exilis* 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 adhered to for activities such as installation and maintenance of firebreaks and walking into the population in wet soil conditions.

Action: Maintain disease hygiene
Responsibility: CALM (Blackwood District) through the SWRTFCRT
Cost: \$400 per year

8. Develop and implement a fire management strategy

Very few adult or juvenile *Boronia exilis* plants were located in a survey in 1996 despite a fire in a population in 1994. This suggests that fire kills adult plants and does not stimulate germination. 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

9. Develop a kangaroo management strategy

A management strategy will be developed in areas where kangaroos are having an impact on populations of *Boronia exilis* 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 11)

10. 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 *Boronia exilis* 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

11. 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 or water logging. 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

12. Collect seed and cutting material

Preservation of germplasm is essential to guard against extinction if wild populations are lost. Such collections are also needed for 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.

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

13. Liaise with land managers

Staff from CALM's Blackwood District will continue to liaise with the Shire and landowners to ensure that populations are not accidentally damaged or destroyed. Input and involvement will also be sought from any indigenous groups that have an active interest in areas that are habitat for *Boronia exilis*.

Action: Liaise with land managers
Responsibility: CALM (Blackwood District) through the SWRTFCRT
Cost: \$800 per year

14. Seek improved security for populations

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. In particular CALM will negotiate to have the Shire reserve that contains Population 1 declared a Class A reserve for the purpose of 'Conservation of Flora and Fauna' under the care, control and management of the Conservation Commission.

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, that includes a description of the plant, its habitat, threats, recovery actions and photos will be produced.

Action: Promote awareness
Responsibility: CALM (Blackwood District) through the SWRTFCRT
Cost: \$1,300 in first year; and \$600 in remaining years

16. Obtain biological and ecological information

Improved knowledge of the biology and ecology of *Boronia exilis* 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 salinisation or increased water logging on *Boronia exilis* and its habitat.
6. Investigation of the impacts of dieback disease and control techniques on *Boronia exilis* 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. Include recommendations for taxon in Management Plan for Park

The general management recommendations for *Boronia exilis* will be included in the Management Plan for the Scott National Park when it is produced. This will include recommendations on dieback and weed control, fire management and monitoring.

Action: Include management recommendations in Management Plan for Park
Responsibility: CALM (Blackwood District) through the SWRTFCRT
Cost: \$500 in the first 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.
- 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 (2003) *Phytophthora cinnamomi* and disease caused by it Volume 1 – Management Guidelines. Perth, Western Australia.
- Elliot, W. R. and Jones, D. L. (1982) *Encyclopaedia of Australian Plants Suitable for Cultivation 2*: pp. 334. Lothian Publishing Co., Melbourne.
- 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.
- Evans, R., Stack, G. and English, V. (1999) *Boronia exilis* Interim Recovery Plan No 41, 1999 – 2002. Department of Conservation and Land Management, Perth.
- 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.
- Luu, R. and English, V. (2004) Scott River Ironstone Association Draft Interim Recovery Plan. Department of Conservation and Land Management, Perth.
- Mattiske Consulting Pty Ltd. (1996a) *Flora and vegetation on Beenup lease area*. Report prepared for BHP Titanium Minerals Pty Ltd. BHP006/241/96.
- Mattiske Consulting Pty Ltd. (1996b) *Flora and vegetation of Scott National Park and adjoining camping reserve A12951*. Report prepared for BHP Titanium Minerals Pty Ltd. BHP006/242/96.
- Tille, P. J. and Lantzke, N. C. (1990) South West Capes – Margaret River – Augusta land capability study; methodology and results Volume 2 Appendices. Technical Report 109. Division of Resource Management. Western Australian Department of Agriculture, Perth.
- 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/>
- Williams, K., Horan, A., Wood, S. and Webb, A. (2001) *Declared rare and poorly known flora in the Central Forest Region*. Wildlife Management Program #33. Department of Conservation and Land Management, Perth.
- Wilson, P. G. (1998) New names and new taxa in the genus *Boronia* (Rutaceae) from Western Australia, with notes on seed characters. *Nuytsia* 12, 119-154.
- 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

- Wilson, P. G. (1998) New names and new taxa in the genus *Boronia* (Rutaceae) from Western Australia, with notes on seed characters. *Nuytsia* 12, 119-154.

Boronia exilis

Erect slender-stemmed *perennial* c. 1 m high. Branches glabrous; internodes 2-5 cm long. *Lower leaves* caducous, not seen; medial and upper leaves slender, semiterete, channeled above, 1-1.5 cm long, much shorter than internodes, glabrous or sparsely woolly on midrib, caducous. *Flowers* 3-9 in terminal umbelliform cymes; bracts elliptic, c. 5 mm long, woolly ciliate, caducous; pedicels 5-12 mm long, somewhat woolly; bracteoles basal, scarious, caducous. *Sepals* oblong-elliptic, acute, c. 4 mm long, dark red, woolly on both surfaces, densely woolly ciliate, deciduous in fruit. *Petals* broadly obovate, with broad claw, c. 7 mm long, rounded at apex, sparsely woolly on midrib and within, pink. *Staminal filaments* terete above, flattened towards base, glandular-verrucose at swollen apex, prominently hirsute ciliate; anthers subapically affixed, c. 1.2 mm long, shortly white-apiculate. *Disc* cushion-shaped, glabrous. *Ovary* glabrous; style terete, glabrous, c. 1.5 mm long; stigma minute.

Distribution. Known only from the Scott River area, extreme south west of Western Australia.

Habitat. Growing in seasonally wet heath.

Etymology. The Latin word *exilis*, meaning slender and weak, refers to the slender stems of the species.

Notes. The species is similar to *Boronia juncea* particularly to the subsp. *laniflora*; it differs most obviously from that species in having strongly ciliate staminal filaments (in *B. juncea* they are glabrous).

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												
Confirm existing populations and conduct further surveys	700	800	800	700	800	800	700	800	800	700	800	800	700	800	800
Install DRF markers	200		400												
Formally notify land owners	100														
Monitor dieback disease	600		8200	300		1200	600		8200	300		1200	600		8200
Maintain disease hygiene	200		200	200		200	200		200	200		200	200		200
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
Collect seed and cutting material	1400		3200	1400		1800	1400		1800						
Liaise with land managers	500		300	500		300	500		300	500		300	500		300
Seek improved security for populations	500		200	500		200	500		200	500		200	500		200
Promote awareness	600		700	600			600			600			600		
Obtain biological and ecological information	10800		10200	10800		10200	10800		10200						
Include general recommendations for taxon in Management Plan for Park	500														
Review the need for a full Recovery Plan													15300		8400
Total	21900	1100	28700	17600	1100	16900	17900	1100	23900	5400	1100	4900	21000	1100	20300
Yearly Total		51,700			35,600			42,900			11,400			42,400	

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

Total CALM: \$83,800
 Total Other: \$5,500
 Total External Funding: \$94,700
TOTAL COSTS: \$184,000

