INTERIM RECOVERY PLAN NO. 67

NARROW CURVED-LEAF GREVILLEA

(*GREVILLEA CURVILOBA* SUBSP. *INCURVA*)

INTERIM RECOVERY PLAN

2000-2003

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Photograph: A. Brown

June 2000

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Natural Heritage Trust
Helping Communities Helping Australia

Department of Conservation and Land Management

THE GOVERNMENT OF WESTERN AUSTRALIA

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 Critically 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This Interim Recovery Plan will operate from June 2000 to May 2003 but will remain in force until withdrawn or replaced. It is intended that, if the taxon is still Critically Endangered this IRP will be replaced by a full Recovery Plan after three years.

This IRP was approved by the Director of Nature Conservation on 20 August 2000. The 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 June 2000.

SUMMARY

Scientific Name: ***Grevillea curviloba*** subsp. ***incurva***
Family: Proteaceae
CALM Regions: Midwest and Swan
Shires: Swan, Chittering and Gingin
Common Name: Narrow curved-leaf grevillea
Flowering Period: September to October
CALM Districts: Perth, Mundaring and Moora
Recovery Teams: Swan Region Threatened Flora and Communities Recovery Team (SRTFCRT); Moora District Threatened Flora Recovery Team (MDTFRT).

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; Olde, P.M. and Marriott, N.R. (1993). New species and taxonomic changes in *Grevillea* (Proteaceae: Grevilleoideae) from south-west Western Australia. *Nuytsia*, 9 (2): 237-304; Olde, P. M. and Marriott, N. R. (1995). *The Grevillea Book* 2: 108-109. Kangaroo Press, Kenthurst N.S.W.

Current status: *Grevillea curviloba* subsp. *incurva* was declared as Rare Flora in July 1998 and was ranked in December 1999 as Critically Endangered (CR) under World Conservation Union (IUCN) Red List criterion B1 + 2bc (IUCN 1994). This is due to the severe fragmentation of populations and a decline in the area and quality of habitat. Threats include weeds, accidental destruction from road, track and rail maintenance, rabbit warren construction, fire, chemical drift and, possibly, impacts of the plant pathogen *Phytophthora* spp. (dieback) on the habitat.

Habitat requirements: *Grevillea curviloba* subsp. *incurva* is confined to an area between Muchea and Badgingarra and grows in open heath in winter-wet areas on sand over limestone, or over ironstone at sites with a high water table. It is associated with the 'shrublands and woodlands on Perth to Gingin Ironstone' ('Northern Ironstone') and the 'Shrublands and Woodlands on Muchea Limestone' communities. These are both threatened ecological communities (English and Blyth 2000a, 2000b).

Critical habitat: The critical habitat for *Grevillea curviloba* subsp. *incurva* comprises the area of occupancy of the known populations; areas of Muchea Limestone or the Perth to Gingin Ironstone with remnant vegetation within 200 metres of known populations; the local catchment for the surface and ground waters that provide the wetland habitat of the subspecies; corridors of remnant vegetation that link populations; additional occurrences of the ecological communities 'Shrublands and Woodlands on Muchea Limestone of the Swan Coastal Plain' and 'Shrublands and Woodlands of the Perth to Gingin Ironstone' that do not currently contain the subspecies.

Existing Recovery Actions: The following recovery actions have been or are currently being implemented:
1. Most land managers have been informed of the subspecies location and the associated legal obligations.
2. Declared Rare Flora (DRF) markers have been installed at most road and rail reserve populations.
3. Dashboard stickers and posters that illustrate DRF markers and describe their purpose have been produced and distributed.
4. A poster that provides a description and information about threats and recovery actions has been produced for the subspecies.
5. An area of 10.9 hectares of land containing Subpopulations 3a and 3c of *Grevillea curviloba* subsp. *incurva* was acquired by CALM in 1996. Another area of 55 hectares containing the 'Northern Ironstone' community was purchased in 1999 by CALM with financial support from the Natural Heritage Trust. Population 13 is located on the adjacent road verge and the subspecies may regenerate within the block in future.
6. Approximately 2,575 seeds were collected by CALM's Threatened Flora Seed Centre (TFSC) in 1996 and 1998.
7. The Botanic Gardens and Parks Authority (BGPA) has experimented with, but had little success in, growing plants from cuttings. Only one plant was propagated from twelve cuttings, and one from fifteen cuttings.
8. The Swan Region Threatened Flora and Communities Recovery Team and Moora District Threatened Flora Recovery Team are overseeing the implementation of this IRP.

9. CALM staff from the Mundaring, Perth and Moora District Office's regularly monitor the populations.

IRP Objective: The objective of this Interim Recovery Plan is to abate identified threats and maintain and/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.
Criteria for failure: The number of individuals within populations and/or the number of populations have decreased.

Recovery actions
1. Coordinate recovery actions.
2. Notify and liaise with relevant land managers.
3. Reposition or install Declared Rare Flora markers.
4. Undertake weed control.
5. Fence Population 17.
6. Develop and implement a fire management strategy.
7. Monitor populations.
8. Control rabbits.
9. Conduct further surveys.
10. Collect seed and cutting material.
11. Obtain biological and ecological information.
12. Start translocation process.
13. Promote awareness.
14. Write full Recovery Plan.

1. BACKGROUND

History

The first collection of *Grevillea curviloba* subsp. *incurva*, housed at the WA Herbarium, was made by H. Steedman in 1927 near Muchea. Further collections have since been made near Muchea. In 1960 a collection was made near Badgingarra by L. Steenholm, but the specimen that was lodged at the WA Herbarium has not been relocated. In 1992, a consultant located a single plant at a mining rehabilitation site south of Eneabba. This population was relocated in 2000 and it is highly likely that plant was brought in with seed for rehabilitation as the plant was located on a rehabilitation track and there were no other plants of the subspecies present. Another five plants were also located north of Eneabba in 1997 by a consultant. Despite numerous searches, these plants have not been relocated. This is probably due to inaccurate locational information.

Description

The scientific name for the subspecies *incurva* is derived form the latin '*incurvus*', meaning curved inwards. This refers to the narrow leaf lobes, which curve strongly inwards. The names *Grevillea biternata* and *G. tridentifera* have been incorrectly used for this subspecies (Olde and Marriott 1995).

Grevillea curviloba subsp. *incurva* grows as a vigorous, sprawling shrub to 2.5 metres high and wide, with greyish-green leaves. The leaves are 1.8 to 5.2 centimetres long with 3 to 5 strongly incurved, weakly pungent, narrowly-linear lobes, 7 to 20 millimetres long. Inflorescences occur on short stalks and are 1 to 3 centimetres long by 3 centimetres wide. They usually occur in the leaf axils. Individual flowers are creamy white, 7 to 10 millimetres long and 0.5 millimetres across. Flowering occurs from September to October. The subspecies differs from *G. curviloba* subsp. *curviloba* in having prominently incurved, narrowly linear leaf lobes, 0.8 to 1.2 millimetres wide (Brown *et al*. 1998; Olde and Marriott 1995).

The habit of this subspecies ranges from prostrate to erect. There appears to be a continuum in the leaf morphology between the two subspecies and the taxonomy of the two subspecies may be reviewed (personal communication, G. Keighery[1]).

[1] Greg Keighery, Principal Research Scientist, CALMScience

Distribution and habitat

Grevillea curviloba subsp. *incurva* is thought to be confined to an area between Muchea and Badgingarra and grows in open heath in winter-wet sites on sand over limestone, or over ironstone at sites with a high water table (Olde and Marriott, 1995). It is associated with and the 'Shrublands and woodlands of the Perth to Gingin Ironstone' ('Northern Ironstone community') and the 'Shrublands and Woodlands of the Muchea Limestone' ('Muchea Limestone community') which are both threatened ecological communities (English and Blyth 2000a, 2000b).

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 (a) occupied (continuously, periodically or occasionally) by an organism or group of organisms; or (b) once occupied (continuously, periodically or occasionally) by an organism, or group of organisms, and into which organisms of that kind that the potential to be reintroduced. (sections 207A and 528 of Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)).

The critical habitat for *Grevillea curviloba* subsp. *incurva* comprises:

- the area of occupancy of the known populations,
- areas of Muchea Limestone or the Perth to Gingin Ironstone with remnant vegetation within 200 metres of known populations (these provide potential habitat for natural range extension),
- the local catchment for the surface and ground waters that provide the wetland habitat of the subspecies (the subspecies occurs in seasonal wetland areas and is dependent on maintenance of local hydrology),
- corridors of remnant vegetation that link populations (these are necessary to allow pollinators to move between populations and are usually road and rail verges),
- additional occurrences of the ecological communities 'Shrublands and Woodlands on Muchea Limestone of the Swan Coastal Plain' and 'Shrublands and Woodlands of the Perth to Gingin Ironstone' that do not currently contain the subspecies (these represent possible translocation sites).

Biology and ecology

While the biology of many grevillea species is well researched, the biology of *Grevillea curviloba* subsp. *incurva* is poorly known. Like many other grevilleas, the subspecies regenerates from soil-stored seed, but has also been observed to resprout from root stock, after fire or loss of foliage by other means such as grazing and slashing. It is pollinated by insects, possibly native bees or wasps (Olde and Marriott, 1995).

Grevillea curviloba subsp. *incurva* has been cultivated by the horticultural industry. It forms a dense attractive ground cover and is therefore planted extensively throughout the Perth metropolitan area, particularly in rehabilitation areas. According to Olde and Marriott (1995) it can be easily grown from cuttings, however, this was not the case when the Botanic Gardens and Parks Authority (BGPA) experimented recently with propagating the subspecies using this method.

Threats

Grevillea curviloba subsp. *incurva* was declared as Rare Flora in July 1998 and was ranked in December 1999 as Critically Endangered (CR) under World Conservation Union (IUCN) Red List criterion B1 + 2bc (IUCN 1994). This is due to the severe fragmentation of populations and a decline in the area and quality of habitat. The main threats include weeds, accidental destruction from road, track and rail maintenance, rabbit warren construction, fire, chemical drift and, possibly, impacts of the plant pathogen *Phytophthora* spp. (dieback disease) on the habitat.

- Habitat degradation by **weed invasion** appears to be one of the greatest threats to the viability of all 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, which are produced annually by many grass weed species.

- **Road, track and rail maintenance activities** threaten *Grevillea curviloba* subsp. *incurva* and its habitat. Numerous road and rail populations have been damaged or destroyed by grading and burning. Other threats include actions such as road widening, spraying of chemicals, constructing drainage channels and mowing the roadside vegetation to improve visibility. These disturbance events also often encourage weed invasion into adjacent habitat, as well as causing damage to actual plants.

- **Grazing** of *Grevillea curviloba* subsp. *incurva* seedlings by kangaroos (*Macropus fuliginosus*) has had an impact on Population 17. Grazing may have an impact on the establishment of *Grevillea curviloba* subsp. *incurva* seedlings thereby limiting natural recruitment.

- **Rabbit (*Oryctolagus cuniculus*) warren construction** at Populations 8 and 11 disturbs the soil around *Grevillea* plants. Increased nutrient levels from rabbit droppings and the introduction of weeds also have the potential to impact on the habitat of the subspecies. Grazing by rabbits may have an impact on the establishment of *Grevillea curviloba* subsp. *incurva* seedlings thereby limiting natural recruitment.

- **Inappropriate fire** may affect the viability of populations, as seeds of *Grevillea curviloba* subsp. *incurva* probably germinate 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, it is likely that occasional fires are needed for reproduction of this subspecies. In addition, the subspecies appears to regenerate well from root stock following fire. Further investigation is required and will be addressed in management action 11.

- **Chemical drift** from herbicide and fertiliser applications from adjacent farmland may affect the subspecies' growth and survival.

- **Dieback disease** is a possible threat to the habitat of all populations. Dieback (*Phytophthora* spp.) is a pathogen that causes the roots to rot and results in the plant dying of drought stress. *Grevillea curviloba* subsp. *incurva* populations are inundated over the winter months. These conditions are likely to be favourable for the establishment and spread of *Phytophthora* species. Although testing by CALMScience staff has found that *Grevillea curviloba* susbp. *incurva* is not susceptible to this pathogen (C. Crane[2], pers comm.), the habitat may be susceptible and the pathogen has the potential to indirectly impact on the subspecies. The spread or amplification of the disease into the area should therefore be prevented.

[2] Colin Crane- Senior Technical Officer, CALMScience

Summary of population information and threats

Pop. No., Location, (CALM District)	Land Status	Year/No. plants (No. of seedlings)	Habitat Condition	Threats
1. Perth (Perth)	Unknown	1978 ?	-	Cultivated population
2. Muchea (Perth)	Shire road reserve	1992 3 2000 30(10)	Moderate	Road maintenance activities, weed invasion, fire, dieback disease
3A. Muchea (Perth)	Nature Reserve	2000 150	Moderate	Weed invasion, fire, dieback disease
3B. Muchea (Perth)	Nature Reserve	1999 12 2000 80	Moderate	Road maintenance activities, weed invasion, fire, dieback disease
3C. Muchea (Perth)	Nature Reserve	2000 110(60)	Healthy	Weed invasion, fire, dieback disease
3D. Muchea (Perth)	Nature Reserve	2000 20	Healthy	Weed invasion, fire, dieback disease
4A. Muchea (Mundaring)	MRWA road reserve	1996 7(3)	Poor	Road maintenance activities, weed invasion, fire, dieback disease
4B. Muchea (Mundaring)	Westrail rail reserve	1996 0(2)	Poor	Rail maintenance activities, weed invasion, fire, dieback disease
4C. Muchea (Mundaring)	Westrail rail reserve	1996 49(30)	Poor	Rail maintenance activities, weed invasion, fire, dieback disease
5A. Muchea (Mundaring)	MRWA road reserve	1996 3(2)	Poor	Road maintenance activities, weed invasion, fire, dieback disease
5B. Muchea (Mundaring)	Westrail rail reserve	1996 18(23)	Poor	Rail maintenance activities, weed invasion, fire, dieback disease
6. Muchea (Mundaring)	MRWA road reserve	1996 9(3)	Poor	Road maintenance activities, weed invasion, fire, dieback disease
7A. Muchea (Mundaring)	MRWA road reserve	1996 82	Poor	Road maintenance activities, weed invasion, fire, dieback disease
7B. Muchea (Mundaring)	Westrail rail reserve	1999 20+	Poor	Rail maintenance activities, weed invasion, fire, dieback disease
7C. Muchea (Mundaring)	Western Power	1996 23	Poor	Power line maintenance activities, weed invasion, fire, dieback disease
7D. Muchea (Mundaring)	MRWA road reserve	1996 3(3)	Poor	Road maintenance activities, weed invasion, fire, dieback disease
7E. Muchea (Mundaring)	Westrail rail reserve	1996 1	Poor	Rail maintenance activities, weed invasion, fire, dieback disease
8A. Muchea (Mundaring)	Westrail rail reserve	1996 8 1999 43+	Poor	Rail maintenance activities, weed invasion, rabbit warren construction, fire, dieback disease
8B. Muchea (Mundaring)	Westrail rail reserve	1996 1	Poor	Rail maintenance activities, weed invasion, rabbit warren construction, fire, dieback disease
9A. Muchea (Mundaring)	Westrail rail reserve	1996 2	Poor	Rail maintenance activities, weed invasion, fire, dieback disease
9B. Muchea (Mundaring)	Westrail rail reserve	1996 29	Poor	Rail maintenance activities, weed invasion, fire, dieback disease
9C. Muchea (Mundaring)	MRWA road reserve	1996 27	Poor	Road maintenance activities, weed invasion, fire, dieback disease
9D. Muchea (Mundaring)	Westrail rail reserve	1996 50	Poor	Rail maintenance activities, weed invasion, fire, dieback disease

Cont..

Pop. No., Location, (CALM District)	Land Status	Year/No. plants (No. of seedlings)	Habitat Condition	Threats
10A. Muchea (Mundaring)	MRWA road reserve	1996 1	Poor	Road maintenance activities, weed invasion, fire, dieback disease
10B. Muchea (Mundaring)	Westrail rail reserve	1996 2	Poor	Rail maintenance activities, weed invasion, fire, dieback disease
11A. Muchea (Mundaring)	MRWA road reserve	1996 18	Poor	Road maintenance activities, weed invasion, fire, dieback disease
11B. Muchea (Mundaring)	Westrail rail reserve	1996 70 1999 50+	Poor	Rail maintenance activities, weed invasion, rabbit warren construction, fire, dieback disease
12A. Muchea (Perth)	Shire road reserve	1990 30 2000 50(20)*	Moderate	Road maintenance activities, weed invasion, fire, dieback disease
12B. Muchea (Perth)	Westrail rail reserve	1990 30 2000 50(20)*	Moderate	Rail maintenance activities, weed invasion, fire, dieback disease
13. Gingin (Perth)	Shire road reserve	1996 2 2000 35	Poor	Road maintenance, weed invasion, dieback disease
14. Eneabba (Moora)	Unallocated Crown Land	1992 1 2000 1	-	Cultivated population
15. Eneabba (Moora)	Nature Reserve	1997 5	Moderate	Mining, weed invasion, fire, dieback disease
16A. Muchea (Perth)	Shire Road Reserve	2000 46 (49)*	Moderate	Road maintenance, weed invasion, dieback disease
16B. Muchea (Perth)	Shire Reserve	2000 46 (49)*	Moderate	Weed invasion, dieback disease
17. Ellenbrook (Perth)	Unallocated Crown Land	2000 2	Disturbed	Weed invasion, grazing, fire, dieback disease

Note: * = total for subpopulations combined.

Guide for decision-makers

Section 1 provides details of current and possible future threats. Developments in the immediate vicinity of any of the populations or within the defined critical habitat of *Grevillea curviloba* subsp. *incurva* require assessment. No developments should be approved unless the proponents can demonstrate that they will have no significant impact on the subspecies, its habitat or potential habitat, or on the local hydrology.

2. RECOVERY OBJECTIVES AND CRITERIA

Objectives

The objective of this Interim Recovery Plan is to abate identified threats and maintain and/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.
Criteria for failure: The number of individuals within populations and/or the number of populations have decreased.

3. RECOVERY ACTIONS

Existing recovery actions

Most appropriate people have been made aware of the existence of this taxon and its locations. Local Shires, Main Roads Western Australia and Westrail have been formally notified of the presence of the *Grevillea curviloba* subsp. *incurva* populations on their lands. These notifications detailed the Declared Rare status of the taxon and the associated legal responsibilities.

Declared Rare Flora (DRF) markers have been installed at most road and rail verge populations. These alert people working in the area to the presence of significant flora, helping to prevent accidental damage during

maintenance operations. Awareness of the significance of these markers is being promoted to relevant bodies such as Shires. To this end, dashboard stickers and posters have been produced and distributed. These illustrate DRF markers, inform of their purpose and provide a contact telephone number to use if such a marker is encountered.

An A4 sized poster, which provides a description of the subspecies and information about threats and recovery actions, has been developed for *Grevillea curviloba* subsp. *incurva*. It is hoped that the poster will result in the discovery of new populations.

An area of 10.9 hectares of land containing Subpopulations 3a and 3c of *Grevillea curviloba* subsp. *incurva* and an occurrence of the threatened 'Muchea Limestone' ecological community was acquired by CALM in 1996. Another area of 55 hectares containing an occurrence of the threatened 'Northern Ironstone' community was purchased in 1999 by CALM, with financial assistance from the Natural Heritage Trust. The block was previously grazed, and although no plants of *G. curviloba* subsp. *incurva* are currently found within the block, Population 13 is located on the adjacent road verge. Since the area is no longer being grazed, plants may appear once the area has been left to rehabilitate.

Approximately 2,575 seeds were collected by CALM's Threatened Flora Seed Centre (TFSC) in 1996 and 1998. Initially the germination rate ranged from 60% to 97%, and after one year in storage it ranged from 33% to 80%.

The Botanic Gardens and Parks Authority has had little success with growing the subspecies from cuttings, despite the ease of achieving propagation by this method reported by Olde and Marriott (1995). Only one plant was successfully propagated from twelve cuttings and one from fifteen cuttings, in experiments by the BGPA using material collected from wild populations.

The Swan Region Threatened Flora and Communities Recovery Team (SRTFCRT) and Moora District Threatened Flora Recovery Team (MDTFRT) are overseeing the implementation of this IRP and will include information on progress in their annual reports to CALM's Corporate Executive and funding bodies.

Staff from CALM's Mundaring, Perth and Moora District Offices regularly monitor the populations.

Future recovery actions

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

1. Coordinate recovery actions

The SRTFCRT and MDTFRT will continue to oversee the implementation of recovery actions for *Grevillea curviloba* subsp. *incurva* and will include information on progress in annual reports to CALM's Corporate Executive and funding bodies.

Action: Coordinate recovery actions
Responsibility: CALM (Perth, Mundaring and Moora Districts) through the SRTFCRT and MDTFRT
Cost: $5,900 per year

2. Notify and liaise with relevant land managers

Managers of land at Population 2 and Subpopulations 3b, 16a and 16b; and owners of property adjacent to populations need to be officially notified of the presence of DRF. Staff from CALM's Perth, Mundaring and Moora Districts will continue to liaise with relevant landowners to ensure the populations are not damaged or destroyed accidentally.

Due to the potential susceptibility of the habitat of the subspecies to dieback caused by *Phytophthora* spp., the need for the application of dieback hygiene procedures will be included in information provided. This will stress the need to restrict the movement of soil into the habitat of the populations.

Action: Notify and liaise with relevant land managers
Responsibility: CALM (Perth, Mundaring and Moora Districts) through the SRTFCRT and MDTFRT
Cost: $600 per year

3. Reposition or install Declared Rare Flora markers

Recent road works in areas containing populations of *Grevillea curviloba* subsp. *incurva* have resulted in the removal and repositioning of Declared Rare Flora (DRF) markers. Therefore, the requirement of Declared Rare Flora (DRF) markers at all populations should be assessed and markers installed or repositioned as necessary. Their purpose is to alert people operating in the area (eg, Shire staff and contractors, Bushfire Brigade and so on) to the presence of DRF to help prevent accidental damage.

Action: Reposition or install Declared Rare Flora markers
Responsibility: CALM (Perth, Moora and Mundaring Districts) through the SRTFCRT
Cost: $600 in first year

4. Undertake weed control

Weeds are a major threat to all populations. The following actions will be implemented:

1. Selection of appropriate herbicides after determining which weeds are present.
2. Control invasive weeds by hand removal or spot spraying around *Grevillea curviloba* subsp. *incurva* plants when weeds first emerge.
3. Schedule weed control to include spraying at other threatened flora populations within the districts.

The tolerance of associated native plant species to herbicides at the sites of *Grevillea curviloba* subsp. *incurva* is not known and weed control programs will be undertaken in conjunction with research.

Action: Undertake weed control
Responsibility: CALM (Perth, Mundaring and Moora Districts) through the SRTFCRT and MDTFRT
Cost: $800 per year

5. Fence Population 17

Kangaroos are grazing seedlings at Population 17. A fence will be erected around the population including a buffer of surrounding habitat.

Action: Fence Population 17
Responsibility: CALM (Perth District) through the SRTFCRT and relevant land manager
Cost: $1,700 in the first year

6. Develop and implement a fire management strategy

A fire management strategy that defines fire control measures, and fire frequency and timing will be developed in consultation with relevant authorities and land managers.

Action: Develop and implement a fire management strategy
Responsibility: CALM (Perth, Mundaring and Moora Districts) through the SRTFCRT and MDTFRT
Cost: $2,400 in first year and $1,000 in subsequent years

7. Monitor populations

Monitoring of factors such as weed invasion, habitat degradation (including the impact of dieback), population stability (expansion or decline), pollinator activity, seed production, recruitment, and longevity is essential. The populations will be inspected annually.

Action: Monitor populations
Responsibility: CALM (Perth, Mundaring and Moora Districts) through the SRTFCRT and MDTFRT
Cost: $1,800 per year

8. Control rabbits

Disturbance by rabbits will be monitored at Populations 8 and 11, and if necessary numbers will be controlled through baiting or alternative methods.

Action: Control rabbits
Responsibility: CALM (Mundaring District) through the SRTFCRT
Cost: $700 per year

9. Conduct further surveys

Further surveys will be conducted during the subspecies' flowering period (September to October). Local volunteers such as members of naturalists clubs and wildflower societies will be encouraged to be involved in surveys supervised by CALM staff.

Action: Conduct further surveys
Responsibility: CALM (Perth, Mundaring and Moora Districts) through the SRTFCRT and MDTFRT
Cost: $2,400 per year

10. Collect seed and cutting material

A quantity of seed has been collected from eight populations. Additional seed will be collected as required. Germination testing will be carried out as necessary. Cuttings will also be collected to establish a living collection of genetic material at the BGPA.

Action: Collect seed and cutting material
Responsibility: CALM (Perth, Mundaring and Moora Districts, Threatened Flora Seed Centre) and BGPA, through the SRTFCRT and MDTFRT
Cost: $3,300 per year

11. Obtain biological and ecological information

Increased knowledge of the biology and ecology of the subspecies will provide a scientific basis for management of *Grevillea curviloba* subsp. *incurva* in the wild. Investigations will include:

1. Study of the soil seed bank dynamics and the role of various factors including disturbance, competition, rainfall, grazing in recruitment and seedling survival.
2. Determination of reproductive strategies, phenology and seasonal growth.
3. Investigation of the mating system and pollination biology.
4. Investigation of population genetic structure, levels of genetic diversity and minimum viable population size.
5. Investigation of the impacts of dieback disease and control techniques on *Grevillea curviloba* subsp. *incurva* and its habitat.

Action: Obtain biological and ecological information
Responsibility: CALM (Perth, Mundaring and Moora Districts, CALMScience) through the SRTFCRT and MDTFRT
Cost: $17,000 per year

12. Start translocation process

If Population 13 does not naturally regenerate in the reserve adjacent to the population, a translocation will be undertaken, as the number of extant plants secure from threats such as weed invasion and clearing is low.

Although translocations are generally undertaken under full Recovery Plans, it is possible to develop a translocation proposal and start propagating plants within the time frame of an Interim Recovery Plan. This will be coordinated by the SRTFCRT. Information on the translocation of threatened animals and plants in the wild is provided in CALM Policy Statement No. 29 *Translocation of Threatened Flora and Fauna.* All translocation proposals require endorsement by the Director of Nature Conservation.

Action: Start translocation process
Responsibility: CALM (CALMScience, Perth and Mundaring Districts) through the SRTFCRT
Cost: $4,600 in third year

13. Promote awareness

The importance of biodiversity conservation, the preservation of Critically Endangered species generally and the existence of *Grevillea curviloba* subsp. *incurva* in particular will be promoted to the public. Formal links with local naturalist groups and interested individuals will also be encouraged.

An information sheet for *Grevillea curviloba* subsp. *incurva* has been produced and distributed (see existing recovery actions). CALM will also produce a mail-out information flier for distribution in the Muchea and Eneabba areas. These fliers are aimed at local residents to provide information and a contact if they locate the subspecies.

Action: Promote awareness
Responsibility: CALM (Perth, Mundaring and Moora Districts) through the SRTFCRT and MDTFRT
Cost: $800 per year

14. Write full Recovery Plan

At the end of the three-year term of this Interim Recovery Plan, the need for further recovery will be assessed. If the subspecies is still ranked Critically Endangered, a full Recovery Plan will be developed to describe action required for long-term maintenance. A Recovery Plan will be prepared with the benefit of knowledge gained over the time frame of this Interim Recovery Plan.

Action: Write full Recovery Plan
Responsibility: CALM (WATSCU, Perth, Mundaring and Moora Districts) through the SRTFCRT and MDTFRT
Cost: $18,100 in third year

4. TERM OF PLAN

This Interim Recovery Plan will operate from June 2000 to May 2003 but will remain in force until withdrawn or replaced. It is intended that, if the taxon is still ranked Critically Endangered, this IRP will be replaced by a full Recovery Plan after three years.

5. ACKNOWLEDGMENTS

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

Tracey Bolland	Iluka Resources Ltd
John Carter	District Operations Officer, CALM Mundaring District
Anne Cochrane	Manager, CALM Threatened Flora Seed Centre
Colin Crane	Senior Technical Officer, CALMScience
Jane Elkington	Previously Consultant to Iluka Resources Ltd
Rebecca Evans	Conservation Officer, CALM Swan Region
Greg Keighery	Principal Research Scientist, CALMScience
Stephen King	Field Officer, CALM Perth District
David Mitchell	Program Leader Nature Conservation, CALM Swan Region
Lyndon Mutter	Program Leader Nature Conservation, CALM Perth District

Sue Patrick	Senior Research Scientist, CALM WA Herbarium
Amanda Shade	Horticulturalist, Botanic Gardens and Parks Authority
Gillian Stack	Technical Officer, CALM Swan Region
Alan Tinker	Western Flora Caravan Park
Alan Wright	Forest Ranger, CALM Jarrahdale District

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7. TAXONOMIC DESCRIPTION

Olde, P.M. and Marriott, N.R. (1993). New species and taxonomic changes in *Grevillea* (Proteaceae: Grevilleoideae) from south-west Western Australia. *Nuytsia*, 9 (2): 237-304.

Grevillea curviloba subsp. *incurva* has leaves 1.8 to 5.2 cm long, secund, tripartite to bipinnatisect, the first lobe arising 6 to 32 mm from the leaf base, with three to five narrow-linear primary lobes, sometimes the lower lobes bi- or trisect; ultimate lobes 7 to 20 mm long, 0.8 to 1.2 mm wide, strongly incurved, narrow-linear to subulate, weakly pungent; lower surface bisulcate, the lamina either obscured by the margin or almost so; pistil 4 to 6.5 mm long.