

INTERIM RECOVERY PLAN NO. 183

RED SNAKEBUSH
(HEMIANDRA GARDNERI)
INTERIM RECOVERY PLAN
2004-2009

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Photograph: Emma Holland

September 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 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 IRP results from a review of, and replaces, IRP No.8 *Hemiandra gardneri* (Holland, Kershaw and Brown, 1996). This IRP will operate from September 2004 to August 2009 but will remain in force until withdrawn or replaced.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 reviewed after five years and the need for a full Recovery Plan assessed.

This IRP was given regional approval 12 October, 2004 and approved by the Director of Nature Conservation 24 December, 2004. The allocation of staff time and provision of funds identified in this IRP is dependent on budgetary and other constraints affecting CALM, as well as the need to address other priorities.

Information in this IRP was accurate as at September 2004.

ACKNOWLEDGMENTS

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

Anne Cochrane	Manager, CALM's Threatened Flora Seed Centre
Barry Conn	Manager, Plant Diversity Section, National Herbarium of New South Wales
Susan Patrick	Senior Research Scientist, Western Australian Herbarium
Amanda Shade	Horticulturalist, Botanic Gardens and Parks Authority

Thanks also to the 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>Hemiandra gardneri</i>	Common Name:	Red Snakebush
Family:	Lamiaceae	Flowering Period:	September-January
CALM Region:	Midwest	CALM District:	Moora
Shires:	Moora, Coorow, Dandaragan	Recovery Team:	Moora District Threatened Flora 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; Patrick, S. and Brown, A. (2001) *Declared Rare and Poorly Known Flora in the Moora District*, Department of Conservation and Land Management, Western Australia; Leigh, J., Boden, R. and Briggs, J. (1984) *Extinct and Endangered Plants of Australia*, The Macmillan Company of Australia, Melbourne.

Current status: *Hemiandra gardneri* was declared as Rare Flora in September 1987 and is ranked as Critically Endangered (CR) under the *Wildlife Conservation Act 1950* according to Red List (IUCN 2000) criterion B1ab (i, ii, iii, iv, v), due to the severe fragmentation of populations, and the continuing decline in the area, extent and quality of habitat and number of mature individuals and of populations. *H. gardneri* is listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The main threats are road, rail, fence and firebreak maintenance, weeds, rabbits, edge effects and poor recruitment.

An Interim Recovery Plan was developed for this species in 1996 (Holland *et al.* 1996). Information collected since that plan was completed has been incorporated into this plan and this document now replaces Holland *et al.* (1996).

Description: *Hemiandra gardneri* is a prostrate perennial shrub that forms a mat up to 15 cm high and 2 m in diameter. Its primary stems are usually up to 40 cm long. The leaves are up to 20 cm long and 5 mm wide, with a sharp point and three raised veins on the lower surface. Both leaves and calyx are covered with short hairs, giving the plant a grey appearance. The dark red to pink flowers are clustered towards the end of the stems. The calyx is bell shaped, two lipped and 5 mm long. The corolla tube is 14 mm long, with inserted stamens and anthers protruding a short way from the corolla mouth. This species was first thought to be a variety of *Hemiandra pungens* but is distinguished by the velvety hairs on the leaves and calyx, shortly protruding anthers, and characters of the corolla (Leigh *et al.* 1984; Brown *et al.* 1998).

Habitat requirements: Five populations of *Hemiandra gardneri* are clustered over a range of approximately 15 km between Watheroo and Gunyidi. A sixth population occurs approximately 40 km to the north west and another some 90 km to the west. It is found in deep yellow to yellow-white sand on sandplains and hills. It is most abundant in open areas under low woodland of *Banksia prionotes*, *B. attenuata*, *Xylomelum angustifolium*, *Actinostrobilus pyramidalis*, *Jacksonia eremodendron*, *Conospermum stoechadis* and *Verticordia* species, occasionally with low sedges and grasses.

Critical habitat: The critical habitat for *Hemiandra gardneri* comprises the area of occupancy of the known populations (wild and future translocated populations); similar habitat within 200 metres of known populations; corridors of remnant vegetation that link populations and additional nearby occurrences of similar habitat that do not currently contain the species but may have done so in the past and may be suitable for translocations.

Habitat critical to the survival of the species, and important populations: Given that this species is listed as Critically Endangered, it is considered that all known habitat for wild and future translocated populations is habitat critical to its survival, and that all wild and translocated populations are important populations.

Benefits to other species or ecological communities: There are no other known listed threatened species or ecological communities in the habitat of *Hemiandra gardneri*. However, recovery actions such as weed control will also protect the ecological communities in which the populations are located.

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. *Hemiandra gardneri* is not specifically listed under any international treaty, and therefore this plan does not affect Australia's obligations under any other international agreements.

Role and interests of indigenous people: The Aboriginal Sites Register maintained by the Department of Indigenous Affairs does not list any significant sites in the vicinity of these populations. Implementation of recovery actions under this plan will include consideration of the role and interests of indigenous communities in the region, and this is discussed in the recovery actions.

Social and economic impact: The implementation of this recovery plan has the potential to have some limited social and economic impact, where populations are located on private property or on other lands not reserved for conservation. Recovery actions refer to continued liaison between stakeholders with regard to these areas.

Evaluation of the plan's performance: The Department of Conservation and Land Management will evaluate the performance of this IRP in conjunction with the Moora District Threatened Flora Recovery Team. In addition to annual reporting on progress with listed actions and comparison against the criteria for success and failure, the plan is to be reviewed within five years of its implementation.

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

1. Extensive surveys were conducted in 1981 to determine the regional distribution of this species.
2. Relevant land managers have been made aware of the location and threatened status of the species.
3. Declared Rare Flora markers are in place for all roadside populations (Populations 1, 2a and 5a) and rail reserve populations (Populations 3, 4a and 4b), however some will require repositioning to reflect changes in population boundaries.
4. Approximately 880 seeds were collected from Population 3 in 1996 and 1997 and are stored in CALM's Threatened Flora Seed Centre at -18°C.
5. The Botanic Gardens and Parks Authority (BGPA) have had limited success with propagation by cuttings and grafts. There are currently no live plants at the BGPA.
6. An information sheet that describes and illustrates the species has been printed.
7. Staff from CALM's Moora District regularly monitor populations of the species.
8. The Moora District Threatened Flora Recovery Team is overseeing the implementation of this IRP.

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

Recovery criteria

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

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

Recovery actions

1. Coordinate recovery actions
2. Map critical habitat
3. Monitor populations
4. Reposition Declared Rare Flora markers
5. Liaise with relevant land managers
6. Implement weed control
7. Conduct disturbance trials
9. Collect seed
10. Conduct further surveys
11. Develop and implement a fire management strategy
12. Undertake and monitor translocation
13. Promote awareness
14. Obtain biological and ecological information
15. Review the need for a full Recovery Plan

1. BACKGROUND

History

Hemiandra gardneri was first collected from the Watheroo area in 1926 by C.A. Gardner, and was described by O.H. Sargent in 1927.

In 1981 the species was known from two populations, south of Gunyidi and north of Watheroo (Millar 1982). Comprehensive surveys for the species were conducted in November and December 1981 by M.A. Burgman, and resulted in four new areas being located north of Watheroo, with a total of 2206 plants being recorded. The location of herbarium specimens suggests that this species was far more widespread before much of the land in its range was cleared for agriculture. Historically, collections have been made from Wubin (1959), Marchagee (1966), and near Jurien Bay (1978), but these populations have not been relocated recently (CALM 2003 onwards).

An Interim Recovery Plan (IRP) was developed for the species in 1996 (Holland *et al.* 1996). Information collected since that plan was completed has been incorporated into this plan and this document now replaces Holland *et al.* (1996).

There are currently seven populations known from the Watheroo, Coorow and Jurien Bay areas. Most of these occur on narrow linear areas of remnant vegetation, and none occur on secure tenure. Plant numbers are in decline, from approximately 2,200 in 1982 to approximately 840 in 1999, and with potentially greater decline since as a result of several consecutive dry years.

Description

Hemiandra gardneri is a prostrate perennial shrub that forms a mat up to 15 cm high and 2 m in diameter. Its primary stems are usually up to 40 cm long. The leaves are up to 20 cm long and 5 mm wide, with a sharp point and three raised veins on the lower surface. Both leaves and calyx are covered with short hairs, and give the plant a grey appearance. The dark red to pink flowers are clustered towards the end of the stems. The calyx is bell shaped, two lipped and 5 mm long. The corolla tube is 14 mm long, with inserted stamens and anthers protruding a short way from the corolla mouth. This species was first thought to be a variety of *Hemiandra pungens* but is distinguished by the velvety hairs on the leaves and calyx, shortly protruding anthers and characters of the corolla (Leigh *et al.* 1984; Brown *et al.* 1998).

Distribution and habitat

Five populations of *Hemiandra gardneri* are clustered over a range of approximately 15 km between Watheroo and Gunyidi, occurring on Shire and Main Roads Western Australia road reserves, rail reserve and private property. A sixth population occurs on private property approximately 40 km to the north west, and a seventh occurred in National Park some 90 km to the west. This last population has not been relocated since the original specimen was collected in 1978. The species is found in deep yellow to yellow-white sand on sandplains and hills. It is most abundant in open areas under low woodland of *Banksia prionotes*, *B. attenuata*, *Xylomelum angustifolium*, *Actinostrobos pyramidalis*, *Jacksonia eremodendron*, *Conospermum stoechadis* and *Verticordia* species, occasionally with low sedges and grasses.

Biology and ecology

Sargent (1927) discussed corolla characteristics and the possibility of the flowers being bird pollinated. Burgman stated in 1983 that seed set was adequate in natural populations, with seedlings making up 16.3 % of the total number of plants in the populations studied. However, A. Cochrane¹ noted in 1996 that plants had flowered profusely without setting much seed. *Hemiandra gardneri* seedling recruitment is concentrated on open disturbed or cleared areas. However, the mechanisms involved in the response of this species to disturbance are not fully understood. Seedlings appear to compete poorly with native vegetation that is mid-dense or dense (Burgman 1983).

¹ Anne Cochrane, Manager, CALM's Threatened Flora Seed Centre

The response of *Hemiandra gardneri* to fire is unknown, but as reproduction appears to be stimulated by disturbance, it is likely that an appropriate disturbance regime (such as fire) is desirable and perhaps necessary for its long term survival.

Most species of the Mint family (Lamiaceae) are grown easily from cuttings, though they often develop poor root systems. Seed germination would be required to overcome this problem (B. Conn² personal communication 1996). *H. gardneri* has been cultivated by the nursery trade in Western Australia (Burgman and Hopper 1982).

Threats

Hemiandra gardneri was declared as Rare Flora in September 1987 and is ranked as Critically Endangered (CR) under the *Wildlife Conservation Act 1950* according to Red List (IUCN 2000) criterion B1ab (i, ii, iii, iv, v) due to the severe fragmentation of populations, and the continuing decline in the area, extent and quality of habitat and number of mature individuals. *H. gardneri* is listed as Endangered under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Almost all populations are restricted to narrow road and rail reserves with high perimeter to area ratios. This results in virtually the whole habitat being subjected to edge effects from management of the adjacent land (Lynch 1987; Saunders *et al* 1987; Taylor 1987). Effects include increased weed invasion, wind speed and fertiliser runoff, modified hydrology and altered disturbance regimes, including fire. The fragmentation of the corridors, combined with edge effects, results in the vegetation being subject to a high level of threat. The main threats are road, rail, fence and firebreak maintenance, weeds, rabbits, edge effects and poor recruitment.

- **Road, rail, fence and firebreak maintenance** threaten all road and rail reserve populations and most populations on private property (Populations 1, 2a, 2b, 3, 4a, 4b, 5a and 5b). Threats include grading, chemical spraying, construction of drainage channels, machinery operations and the mowing of road or rail reserve vegetation. Several of these actions also encourage weed invasion.
- **Weed invasion and competition** is a threat to all populations, with Populations 1 and 2a particularly affected. Weeds suppress plant growth and recruitment 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.
- **Rabbits** (*Oryctolagus cuniculus*) are impacting on *Hemiandra gardneri* plants and habitat at Populations 2b and 4 through grazing, warren construction, increased nutrient levels from their droppings and introduction of weeds. The rigid and sharply pointed leaves of mature *H. gardneri* plants appear to be able to tolerate a fairly high level of grazing, possibly as an adaptation for seed dispersal. However, seedlings and immature plants have softer leaves and hence are more completely grazed (B. Conn personal communication), thereby limiting the establishment of *H. gardneri* seedlings and their recruitment into the population. In addition, grasshopper numbers were high at Population 2b in 1999, and they have the potential to impact the habitat, however, insect populations can fluctuate widely, and this threat is unlikely to be enduring.
- **Edge effects** severely affect narrow linear populations such as those on road and rail reserves by exposure to influences from adjacent cleared land. In addition to the proximity of a weed seed source, effects include increased wind speed, fertiliser and herbicide spray drift and runoff, modified hydrology and altered disturbance regimes, including fire.
- **Poor recruitment** is apparent at most populations with no seedling plants recently observed. This seems most likely to be due to an absence of germination triggers, or grazing of germinants, as seed viability is known to be high at times.
- **Inappropriate fire regimes** may affect the viability of populations, as seeds of *H. gardneri* 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

² Dr. Barry Conn, Manager, Plant Diversity Section, National Herbarium of New South Wales

likely that occasional fires are needed for reproduction of this species. An additional consideration is the role of fire in causing increased weed invasion.

- **Drought stress** is not a direct human-associated impact, but is a potential threat to all populations, as this area has experienced several dry years (2000-2003) since it was last monitored. Typically these plants grow in open, unshaded areas of their sandy habitat, which are likely to dry out quickly and thoroughly.
- **Flooding** or heavy waterlogging of the soil has been noted at Populations 2b (1999), 4b (1999) and 5a (1988). If the presence of surface water was sustained for a sufficient length of time, it is possible that plants could be affected. However, the presence of surface water seems to be infrequent, and may be associated with cyclonic rains.

Summary of population information and threats

Pop. No. & Location	Land Status	Year/No. plants	Condition	Threats
1. N of Watheroo	Shire road reserve	1982 8 1995 15 (1) 1999 10	Moderate	Road, rail and firebreak maintenance, weeds, inappropriate fire
2a. N of Watheroo	MRWA road reserve	1982 31 1991 10 1995 4 1999 9	Poor	Fence, road and firebreak maintenance, weeds, rabbits, inappropriate fire
2b. N of Watheroo	Private property	1982 738 1991 1 1995 58 1999 161	Moderate	Firebreak maintenance, weeds, rabbits, flooding, inappropriate fire
3. N of Watheroo	Railway reserve	1982 1 196 1995 538 (5) 1999 704	Moderate	Rail and firebreak maintenance, weeds, rabbits, inappropriate fire
4a. N of Watheroo	Railway reserve	1982 222 1999 14	Moderate	Rail and firebreak maintenance, weeds, inappropriate fire
4b. N of Watheroo	Railway reserve	1982 2 1995 1 1999 0	Moderate	Rail and firebreak maintenance, weeds, rabbits, flooding, inappropriate fire
5a. N of Watheroo	Shire road reserve	1982 7 1995 43 (2)	Moderate	Road, rail and firebreak maintenance, weeds, flooding, inappropriate fire
5b. N of Watheroo	Private property	1982 2	Poor	Firebreak maintenance, weeds, inappropriate fire
6. W of Coorow	Private property	1990 1	Unknown	Unknown
7* SE of Green Head	National Park	1978 1+	Unknown	Unknown

Numbers in brackets = number of juveniles.

* Population 7 is known only from a Herbarium specimen.

Guide for decision-makers

Section 1 provides details of current and possible future threats. Any on-ground works (clearing, firebreaks, roadworks etc) in the immediate vicinity of *Hemiandra gardneri* will require assessment. On-ground works should not be approved unless the proponents can demonstrate that they will not have an impact on the species, or on its habitat or potential habitat.

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).

Hemiandra gardneri is listed as Critically Endangered, and as such it is considered that all known habitat for wild and translocated populations is critical habitat. This includes:

- the area of occupancy of wild and translocated populations;

- areas of similar habitat within 200 metres of known populations, i.e. deep yellow sand in low *Banksia* woodland (these provide potential habitat for natural range extension);
- corridors of remnant vegetation that link populations (these are necessary to allow pollinators to move between populations and are usually road and rail verges); and
- additional occurrences of similar habitat that do not currently contain the species but may have done so in the past (these represent possible translocation sites).

Benefits to other species or ecological communities

There are no other known listed threatened species or ecological communities in the habitat of *H. gardneri*. However, recovery actions such as weed control will also help to protect the ecological community in which the populations are located.

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. *Hemiandra gardneri* is not listed under any specific international treaty, and therefore this plan does not affect Australia's obligations under any other international agreements.

Role and interests of indigenous people

The Aboriginal Sites Register maintained by the Department of Indigenous Affairs does not list any significant sites in the vicinity of these populations. Implementation of recovery actions under this plan will include consideration of the role and interests of indigenous communities in the region, 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 where populations are located on private property or in other areas that are not conservation reserves. Recovery actions refer to continued liaison between stakeholders with regard to these areas.

Evaluation of the plan's performance

CALM will evaluate the performance of this IRP in conjunction with the Moora District Threatened Flora Recovery Team. In addition to annual reporting on progress with listed actions and comparison against the criteria for success and failure, the plan is to be reviewed within five years of its implementation.

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 species in the wild.

Criteria for success:

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

Criteria for failure:

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

3. RECOVERY ACTIONS

Existing recovery actions

Extensive surveys were conducted in 1981 to determine the distribution of this species, and several additional populations were located (Burgman 1983).

All relevant land managers have been notified of the location and threatened status of the species. The notification details the Declared Rare status of *Hemiandra gardneri* and the associated legal obligations.

Declared Rare Flora markers have been installed at all roadside populations (Populations 1, 2a and 5a). Westrail markers are in position along the railway reserve (Populations 3, 4a and 4b). These alert road and rail maintenance workers to the presence of each population, and enable them to take appropriate care, although these markers need repositioning at Populations 1a, 3 and 4a to reflect changes in population boundaries. In addition, Westrail has installed fencing at Populations 3 and 4a. Population 2b is located in remnant vegetation on private property, and is adequately fenced from stock.

Seed was collected by Threatened Flora Seed Centre (TFSC) staff in November 1996 and November 1997 from Population 3. In 1996 it was noted that plants had flowered profusely but had not set much seed. Approximately 880 seeds obtained from approximately 1800 fruits are now stored in CALM's TFSC at -18°C . The germination rate of this seed has ranged from 50-100% initially, and 51-80% after 1 year in storage (unpublished data A. Cochrane³).

Approximately 300 *Hemiandra gardneri* cuttings were propagated at the Botanic Gardens and Parks Authority (BGPA; then Kings Park and Botanic Gardens) in 1987, and trialed using a variety of hormone strengths. Only five cuttings produced roots, two of which were planted out, but soon died. The remaining three survived longer in pots. Additional material was grafted onto *Westringia dampieri* stock in September 1997. Of the three plants that resulted, two lived for 4 years, and the third for 5 years. BGPA currently has no live plants (A. Shade⁴, personal communication 2004).

A double-sided information sheet has been printed, and includes a description of *Hemiandra gardneri*, its habitat, threats, recovery actions and photos. This has been distributed to community members through local libraries, wildflower shows and other avenues. It is hoped that this may result in the discovery of new populations, and raise community awareness of the value of native flora.

Staff from CALM's Moora District regularly monitor all populations of this species.

The Moora District Threatened Flora Recovery Team is overseeing the implementation of this IRP and will include information on progress in an annual report to CALM's Corporate Executive and funding bodies.

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, influenced by their timing over the life of the Plan. 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 Moora District Threatened Flora Recovery Team will continue to coordinate recovery actions for *Hemiandra gardneri* and other Declared Rare Flora in their District. They will include information on progress in their annual reports to CALM's Corporate Executive and funding bodies.

³ Anne Cochrane, Manager, CALM's Threatened Flora Seed Centre

⁴ Amanda Shade, Horticulturalist, Botanic Garden and Parks Authority

Action: Coordinate recovery actions
Responsibility: CALM (Moora District) through the MDTFRT
Cost: \$2,300 per year

2. Map critical habitat

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

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

3. Monitor populations

Annual monitoring of factors such as habitat degradation (including weed encroachment, salinity and plant diseases such as *Phytophthora cinnamomi*), population stability (expansion or decline), pollinator activity, seed production, recruitment, longevity and predation is essential. The visibility of DRF markers will also be monitored to ensure they remain effective, and have not faded or been covered by vegetation.

Action: Monitor populations
Responsibility: CALM (Moora District) and relevant land managers through the MDTFRT
Cost: \$2,000 per year

4. Reposition Declared Rare Flora markers

Monitoring in 1999 indicated that the population boundaries of Populations 1a, 3 and 4a had changed since the Declared Rare Flora (DRF) markers were initially installed. These markers will be repositioned during monitoring in the flowering period to ensure that all plants are contained within the markers. This will assist road maintenance workers to avoid accidental damage to the plants or their habitat.

Action: Reposition DRF markers
Responsibility: CALM (Moora District) through the MDTFRT
Cost: \$300 in first year

5. Liaise with relevant land managers

Staff from CALM's Moora District will continue to liaise with relevant land managers and landowners to ensure that populations are not accidentally damaged or destroyed. Input and involvement will also be sought from any Aboriginal groups that have an active interest in areas that are habitat for *Hemiandra gardneri*.

Action: Liaise with relevant land managers
Responsibility: CALM (Moora District) through the MDTFRT
Cost: \$1,500 per year

6. Implement weed control

All populations are affected by weeds to varying degrees, with Populations 1 and 2a being particularly affected. Weeds impact on *Hemiandra gardneri* by competing for resources, degrading habitat, exacerbating grazing pressure, and increasing the risk and severity of fire. Recruitment is likely to be more affected than adult plants. Weed control will be undertaken in consultation with the land managers. This will be by hand weeding or application of herbicide during the appropriate season to minimise the effect of herbicide on the species and the surrounding native vegetation. All applications of weed control will be followed by a report on the method, timing and success of the treatment against weeds, the effect on *H. gardneri* and associated native plant species. Copies will be retained at the district and sent to Wildlife Branch.

Annual weed spraying will be much more effective if action can be taken to reduce the influx of new weed seed each year. Many populations occur on narrow strips of vegetation heavily affected by edge effects. In consultation with relevant land managers, efforts will be made to reduce weed seed movement into those areas. This may involve planting of quick-growing, dense vegetation along the edges of these populations, or the use of shadecloth barriers, following earlier trials by Obbens (1997), may be tried.

Action: Implement weed control
Responsibility: CALM (Moora District) through the MDTFRT; relevant land managers
Cost: \$1,700 per year

7. Conduct disturbance trials

Different methods of disturbance will be trialled to determine optimal methods of stimulating regeneration of this species. These will include soil disturbance with and without use of smoke water, and conditions permitting, fire. Follow-up weed control will be undertaken as necessary. Monitoring of all trials will detail the response of associated habitat as well as the response of *Hemiandra gardneri*, and will also record any negative impacts such as the level of weed invasion and the weed species involved. Monitoring of regeneration will continue for at least three years, and monitoring of *H. gardneri* recruitment will continue as for all populations.

Local population extinction can occur if disturbance events are absent for longer than the lifespan of the plants and the viability of soil-stored seed because the populations are so fragmented the chance of re-establishment from propagules from other populations is greatly reduced. An appropriate disturbance regime will be developed and used as a management tool to stimulate regeneration to help prevent the loss of individual populations (see also recovery action 10).

Action: Conduct disturbance trials
Responsibility: CALM (Moora District) through the MDTFRT
Cost: \$2,900 in second and fourth years

8. Collect seed

It is necessary to store germplasm as a genetic resource, ready for use in translocations and as an *ex situ* genetic 'blueprint' of the species. The germplasm stored will be limited to seed, as earlier work with cuttings has not been particularly successful. Some seed has been collected from Population 3 but additional collections are required from all populations to maintain adequate representation of the remaining genetic diversity.

Action: Collect seed
Responsibility: CALM (TFSC, Moora District) through the MDTFRT
Cost: \$2,500 per year

9. Conduct further surveys

Further surveys will be conducted by CALM staff during the species' flowering period (September - January), particularly following disturbance such as fire. Volunteers will be encouraged to be involved in these surveys. Records of areas surveyed will be sent to Wildlife Branch and retained at the districts, even if *Hemiandra gardneri* is not located. If new populations are discovered, these will be vouchered with a specimen at the Western Australian Herbarium. If possible extra material will be sent to Dr Barry Conn at the National Herbarium of New South Wales, as he is reviewing this genus.

Action: Conduct further surveys
Responsibility: CALM (Moora District) through the MDTFRT
Cost: \$1,200 per year

10. Develop and implement a fire management strategy

Little is known of the effects of fire on *H. gardneri*. However, as it is a disturbance opportunist it is likely to require occasional fire for recruitment. Frequent fire may prevent the accumulation of sufficient soil-stored seed for recruitment to occur, and also promotes the introduction and proliferation of weed species. Fire should therefore 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 in consultation with land managers to determine fire control measures and fire frequency.

Action:	Develop and implement a fire management strategy
Responsibility:	CALM (Moora District) with relevant land managers through the MDTFRT
Cost:	\$3,000 in first year, and \$2,200 in subsequent years

12. Undertake and monitor translocation

Translocation will help to ensure the long-term conservation of this species, as most existing populations occur in narrow linear reserves subject to many threats, such as weed competition and maintenance works. A translocation proposal will be developed and suitable translocation sites, preferably in conservation estate, will be selected. The propagation of plants in readiness for translocation will also be undertaken, and when appropriate, these will be planted in accordance with the approved translocation proposal. Information on the translocation of threatened plants and animals in the wild is provided in CALM's Policy Statement No. 29 *Translocation of Threatened Flora and Fauna*. All translocation proposals require endorsement by CALM's Director of Nature Conservation.

Monitoring of the translocation is essential and will be undertaken according to the timetable developed for the Translocation Proposal.

Action:	Undertake and monitor translocation
Responsibility:	CALM (Moora District, TFSC) and BGPA through the MDTFRT
Cost:	\$23,200 in second, third, fourth and fifth years

13. Promote awareness

The importance of biodiversity conservation and the need for the long-term protection of wild populations of this species 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. The information sheet (that includes a description of the plant, its habitat, threats, recovery actions and photos) will continue to be distributed to the public through CALM's Moora District office and at the offices and libraries of the Shires of Moora, Coorow and Dandaragan. Where appropriate a strategic mail drop of information sheets will be undertaken. Such information distribution may lead to the discovery of new populations.

Action:	Promote awareness
Responsibility:	CALM (Moora District) through the MDTFRT
Cost:	\$1,900 in first year, and \$1,300 per year subsequently

14. Obtain biological and ecological information

Improved knowledge of the biology and ecology of *H. gardneri* will provide a scientific basis for its management in the wild. An understanding of the following is necessary for effective management:

1. Soil seed bank dynamics, including seedbank location and viability.
2. The role of various disturbances (including fire), competition, rainfall and grazing in germination and recruitment.
3. The pollination biology of the species.
4. The requirements of pollinators.
5. The reproductive strategies, phenology and seasonal growth of the species.
6. The population genetic structure, levels of genetic diversity and minimum viable population size.

Action:	Obtain biological and ecological information
Responsibility:	CALM (Science Division, Moora District) through the MDTFRT
Cost:	\$14,000 per year in the second, third and fourth years

16. Review the need for a full Recovery Plan

At the end of the fourth year of its five-year term this Interim Recovery Plan will be reviewed and the need for further recovery actions will be assessed. If the species is still ranked as Critically Endangered at that time a full Recovery Plan may be required.

Action:	Review the need for further recovery actions and/or a full Recovery Plan
Responsibility:	CALM (WATSCU, Moora District) through the MDTFRT
Cost:	\$20,300 in the fifth year (if full Recovery Plan required)

4. TERM OF PLAN

This Interim Recovery Plan will operate from September 2004 to August 2009 but will remain in force until withdrawn or replaced. If the taxon is still ranked Critically Endangered after five years, the need to review this IRP or to replace it with a full Recovery Plan will be determined.

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6. TAXONOMIC DESCRIPTION

The original taxonomic description is: Sargent, O.H. (1927) Notes on the genus *Hemiandra*. *The Journal of Botany* **65**:175. The following description in English is extracted from: Leigh, J., Boden, R. and Briggs, J. (1984) *Extinct and Endangered Plants of Australia*, p 233. The Macmillan Company of Australia, Melbourne.

Hemiandra gardneri

Prostrate, hairy or sometimes hairless shrub to 1 m in diameter. *Leaves* are light-green or greyish-green, opposite, oblanceolate, stiff, 2 cm long and 5 mm wide, rather congested and pointed. *Flowers* are usually dark brick-red but ranging from orange to pinkish-mauve, borne singly in the leaf axils and clustered towards the ends of the stems. Individual flowers are bell-shaped, with the lower part of the corolla tubular, about 1.4 cm long, the upper part spreading and divided into 2 lips and 2 large lateral lobes as long as the lips. The upper lip is divided into 2 short lobes and the lower lip is also 2-lobed with each lobe having 3 distinct teeth. The calyx is narrowly bell-shaped and opens into 2 lips, the upper lip being 3-lobed.

Fruit has not been described. *Flowering* September and October.

Derivation: gardneri named after Charles Austin Gardner (1896-1970), Government Botanist in Western Australia 1929-1960. As a conservationist he was instrumental in persuading the government to proclaim 5 extensive flora reserves in Western Australia.

Habitat: Usually open heath on deep yellow sand with mallee scrub nearby and associated with *Banksia*, *Hakea*, *Grevillea*, *Verticordia* (Feather Flower) and *Isopogon* (Drumstick) species.

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	1,800	500		1,800	500		1,800	500		1,800	500		1,800	500	
Map critical habitat	1,500		500												
Monitor populations	1,300		700	1,300		700	1,300		700	1,300		700	1,300		700
Reposition DRF markers	100		200												
Liaise with land managers	800		700	800		700	800		700	800		700	800		700
Implement weed control	700		1,000	700		1,000	700		1,000	700		1,000	700		1,000
Conduct disturbance trials				1,800		1,100				1,800		1,100			
Collect seed	1,000		1,500	1,000		1,500	1,000		1,500	1,000		1,500	1,000		1,500
Conduct further surveys	500	400	300	500	400	300	500	400	300	500	400	300	500	400	300
Develop and implement a fire management strategy	1,200	1,300	500	1,200	300	700	1,200	300	700	1,200	300	700	1,200	300	700
Undertake translocation				11,500		11,700	12,300		10,900	12,300		10,900	12,300		10,900
Promote awareness	1,100		800	1,100		200	1,100		200	1,100		200	1,100		200
Obtain biological and ecological information				6,000		8,000	6,000		8,000	6,000		8,000			
Review the need for a full Recovery Plan													11,200		9,100
Total	10,000	2,200	6,200	27,700	1,200	25,900	26,700	1,200	24,000	28,500	1,200	25,100	31,900	1,200	25,100
Yearly Total		18,400			54,800			51,900			54,800			58,200	

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

Total CALM: \$124,800
 Total Other: \$7,000
 Total External Funding: \$106,300
Total Costs: \$238,100

