INTERIM RECOVERY PLAN NO. 166

SPIRAL FLAG

(*PATERSONIA SPIRAFOLIA*)

INTERIM RECOVERY PLAN

2004-2009

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Photograph: Diana Papenfus

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Natural Heritage Trust
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DEPARTMENT OF Conservation AND LAND MANAGEMENT
Conserving the nature of WA

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This Interim Recovery Plan will operate from June 2004 to May 2009 but will remain in force until withdrawn or replaced.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 further recovery actions assessed.

This IRP was given regional approval on 4 June, 2004 and was approved by the Director of Nature Conservation on 22 June, 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 in June 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
Mike Lyons	Research Scientist, CALM’s Science Division
Amanda Shade	Horticulturalist, Botanic Garden 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:	*Patersonia spirafolia*	**Common Name:**	Spiral Flag
Family:	Iridaceae	**Flowering Period:**	October-November
CALM Region:	Midwest	**CALM District:**	Moora
Shire:	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; G.J. Keighery (1990) *Patersonia spirafolia* (Iridaceae), a new species from south-western Australia. *Nuytsia* 7(2), 137-139.

Current status: *Patersonia spirafolia* was declared as Rare Flora in November 1997 under the *Wildlife Conservation Act* 1950. *Patersonia spirafolia* is also listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act). It currently meets World Conservation Union (IUCN) Red List category Endangered under criteria B1ab(iii,v)+2ab(iii,v);C2a(ii)b (IUCN 2000) as there are only five populations, with over 95% of plants in one population, the number of adult plants fluctuates widely, and there is continuing decline in the quality of habitat. The main threats are road, powerline and firebreak maintenance, disease, inappropriate fire regimes and poor recruitment.

Description: *Patersonia spirafolia* is a perennial herb to 50 cm tall, with a spreading woody rootstock producing a tussock to 40 cm across. The leaves are linear, up to 20 cm long and 5 mm wide, and spirally twisted. The brown leaf margins have fringes of soft hairs that point towards the centre of the leaf. The scape is up to 25 cm long**,** 1-2 mm wide and reddish-green. The spathe (a leaf-like structure enveloping the inflorescence) is brown, lanceolate in shape and up to 26 mm long with thin, almost transparent margins. The flowers have three broad spreading blue-violet sepals to 19 mm long and 14 mm wide, and three upright blue-violet petals about 1 mm long. The seed capsule is roughly egg-shaped and up to 3 cm long. (Keighery 1990; Patrick and Brown 2001).

Habitat requirements: *Patersonia spirafolia* is currently known over a range of less than 10 km, south west of Badgingarra. It is found on lateritic ridges and slopes or sand over laterite in low heath with *Allocasuarina humilis*, *Gastrolobium spinulosum*, *Daviesia* species, *Xanthorrhoea preissii* and *Patersonia occidentalis*.

Critical habitat: The critical habitat for *Patersonia spirafolia* comprises the area of occupancy of the known 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 Endangered, it is considered that all known habitat for wild and 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: *Daviesia chapmanii* (Priority 4) and *D. epiphyllum* (Priority 3) both grow in the habitat of *Patersonia spirafolia*, and are listed on CALM's Priority Flora list (Atkins 2003). Recovery actions such as maintaining dieback hygiene at *Patersonia spirafolia* populations will also protect the habitat 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. However, as *Patersonia spirafolia* is not specifically listed under any international agreement, the implementation of other international environmental responsibilities is not affected by this plan.

Role and interests of indigenous people: Indigenous communities interested or involved in the regions affected by this plan have not yet been identified. The Aboriginal Sites Register maintained by the Department of Indigenous Affairs does not list any significant sites in the vicinity of these populations. However, not all significant sites are listed on the Register. Input and involvement will be sought from any indigenous groups that have an active interest in the areas that are habitat for *Patersonia spirafolia*, and this is discussed in the recovery actions.

Social and economic impact: The implementation of this plan is unlikely to cause significant adverse social and economic impact as populations exist in a National Park and on road reserves. However, recovery actions will involve liaison and cooperation with all stakeholders.

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. Relevant land managers have been made aware of the location and threatened status of the species.
2. Markers are in place at all roadside populations.
3. Liaison with relevant land managers ensures awareness of the significance of these markers.
4. The Botanic Garden and Parks Authority currently hold 3 plants in the nursery.
5. The presence of *Phytophthora cinnamomi* has been confirmed in the vicinity of Population 5.
6. An inactive gravel pit near Population 5 has been ripped and there is some regeneration of associated species.
7. A protection burn was undertaken near Population 1 in September 2001. This area was burnt in a wildfire in December 2002, and the regeneration is being monitored.
8. An information sheet that describes and illustrates the species has been prepared and will be printed in the near future.
9. A handbook of Declared Rare Flora occurring on roadsides in the Shire of Dandaragan has been produced and is being distributed. The book includes information on this taxon.
10. Staff from CALM's Moora District have trained members of the West Midlands Natural Resource Management Group in survey techniques and identification of this species.
11. Staff from CALM's Moora District regularly monitor populations of the species.
12. The Moora District Threatened Flora Recovery Team is overseeing the implementation of this IRP and will include information on progress in annual reports to CALM's Corporate Executive and funding bodies.

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 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. Liaise with relevant land managers
4. Maintain dieback hygiene
5. Assess dieback susceptibility
6. Monitor populations
7. Conduct further surveys
8. Develop and implement a fire management strategy
9. Collect seed
10. Promote awareness
11. Obtain biological and ecological information
12. Review the need for a full Recovery Plan

1. BACKGROUND

History

The first collection of *Patersonia spirafolia* was made in 1984 from the Badgingarra area by G.J. Keighery, and the taxonomic description was published in 1990. *P. spirafolia* was declared to be Rare Flora in November 1997 under the *Wildlife Conservation Act* 1950 after additional surveys confirmed the rarity of this species. Two additional populations on road reserves have been located since then. Population 4 was discovered in April 2001, and Population 5 in April 2003. All five populations occur within the Badgingarra area. Of the five populations, four contain fewer than twenty plants, and all but one are on road reserves.

Population 3, that contained six plants in 1996, was graded during road maintenance in 1997, before the species was declared as Rare Flora and before the shire was aware of this population. Regeneration monitoring recorded six plants there in 2003, suggesting all individuals successfully resprouted.

Populations 1 and 5 were burnt in a wildfire in December 2002. Since then, Population 5 has regenerated well in its relatively sandy habitat. Only one unburnt plant has since been seen at Population 1 since the fire, and there is concern that the plants' rhizomes may have been killed during the fire by the heat from the massive laterite underneath this population. Monitoring will occur after the rains in winter 2004, and it is hoped that more plants may have regenerated after this second post-fire winter season.

Description

Patersonia spirafolia is a perennial herb to 50 cm tall, with a spreading woody rootstock producing a tussock to 40 cm across. The leaves are linear, up to 20 cm long and 5 mm wide, and spirally twisted. The brown leaf margins have fringes of soft hairs that point towards the centre of the leaf. The scape is up to 25 cm long**,** 1-2 mm wide and reddish-green. The spathe (a leaf-like structure enveloping the inflorescence) is brown, lanceolate in shape and up to 26 mm long with thin, almost transparent margins. The flowers have three broad spreading blue-violet sepals to 19 mm long and 14 mm wide, and three upright blue-violet petals about 1 mm long. The seed capsule is roughly egg-shaped and up to 3 cm long (Keighery 1990; Patrick and Brown 2001).

Patersonia spirafolia is grouped with other Western Australian species of *Patersonia* which form tussocks, namely *P. inaequalis* and *P. drummondii.* It differs from *P. inaequalis* in having purple flowers and brown spathes, and from *P. drummondii* in the short appressed hairs on the leaf margins and in the shorter spathes, which are brown when flowering occurs (Keighery 1990).

Distribution and habitat

Patersonia spirafolia is currently known over a range of less than 10 km south west of Badgingarra. A total of 465 plants are known from 5 populations. The largest of these (437 plants) is on a road reserve near a National Park. The population in National Park was burnt over a year ago and is yet to regenerate, while the others are on road reserves and are still in reasonably good condition. The species is found on lateritic ridges and slopes, or sand over laterite in low species-rich heath. Associated species include *Allocasuarina humilis, Gastrolobium spinosum, Daviesia chapmanii, D. epiphyllum, Xanthorrhoea preissii, Mesomelaena stygia, M. tetragona* and *Patersonia occidentalis.*

Biology and ecology

Patersonia spirafolia produces a rootstock that is a spreading woody rhizome, forming a tussock to 40 cm across. This has enabled the plant to regrow after being graded at Population 3, and after fire at Population 5. No germination of seed was noted after either event.

High levels of seed abortion and seed predation by insects have been observed. The causes of seed abortion are unknown. A germination trial conducted at CALM's Threatened Flora Seed Centre (TFSC) obtained 20% germination using a growth hormone (gibberellic acid), and noted that it took one month before any germination was observed, and another month for germination to be complete.

Threats

Patersonia spirafolia was declared as Rare Flora in November 1997 under the *Wildlife Conservation Act* 1950. *P. spirafolia* is also listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act). It currently meets Red List (IUCN 2000) Category Endangered (EN) under criteria B1ab(iii,v)+2ab(iii,v) and C2a(ii)b as there are only five populations, with over 95% of plants in one population, the number of adult plants fluctuates widely, and there is continuing decline in the quality of habitat. Two new populations have been located and the total number of known mature plants has increased recently, but the species is still threatened because the plants are largely concentrated in one population on a road reserve, and there is likely to be a continuing decline in the quality of habitat as a consequence of dieback present at this largest population. The main threats are road, powerline and firebreak maintenance, disease, inappropriate fire regimes and poor recruitment.

- **Road, powerline or firebreak maintenance** threaten all populations. Threats include grading, chemical spraying, construction of drainage channels and the mowing of roadside vegetation. Several of these actions also encourage weed invasion.

- **Disease** could be a serious threat to Population 5. The presence of *Phytophthora cinnamomi* has been confirmed in the area. This plant pathogen (dieback) causes the roots to rot and can result in death from drought stress. The susceptibility of *Patersonia spirafolia* to this pathogen is unknown. The species may not be susceptible as it is thought to have the ability to grow new roots annually, which could replace those affected. However many of the components of the species-rich heath habitat that occurs at this site are characteristically susceptible to the disease and changes in the structure of the habitat caused by dieback may then impact on the *P. spirafolia* population. This may include impacts such as opening up the canopy, and altering levels of shade and humidity.

- **Inappropriate fire regimes** may affect the viability of populations. *P. spirafolia* resprouts from a rhizome following fire or physical removal of above-ground parts. Although regeneration appears to be vigorous at Population 5, there is concern that the rhizome of plants at Population 1 may not have survived the intense fire that occurred in December 2002. The location of the rhizomes in rock crevices would have exposed them to high temperatures in addition to the burning of above-ground parts. The effect of fire on germination is unknown, but no germination was noted following the 2002 fire. Frequent fire is also likely to degrade the supporting ecological community, altering species composition as well as fostering weed invasion and erosion.

- **Poor recruitment** is apparent at all populations with no juvenile plants recently observed. This may be due to low levels of viable seed production or may be related to an absence of germination triggers.

Summary of population information and threats

Pop. No. & Location	Land Status	Year/No. plants	Condition	Threats
1. SW of Badgingarra	National Park	1996 200+ 2003 1	Burnt 12.02	Firebreak maintenance, inappropriate fire regimes
2. SW of Badgingarra	Main Roads WA (MRWA) road reserve	1996 2 2003 4	Healthy	Road maintenance, inappropriate fire regimes
3. SW of Badgingarra	Shire road reserve	1996 6 1997 0 2000 3 2001 7 2003 6	Moderate	Road maintenance, inappropriate fire regimes
4. SW of Badgingarra	MRWA road reserve	2003 17	Moderate	Road and powerline maintenance, inappropriate fire regimes
5. SW of Badgingarra	Shire road reserve	2003 20 2004 437	Healthy	Road maintenance, dieback, inappropriate fire regimes

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 *Patersonia spirafolia* 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).

Patersonia spirafolia is listed as Endangered, and it is therefore considered that all known habitat for wild and translocated populations is critical habitat. This includes:

- the area of occupancy of populations;
- areas of similar habitat within 200 metres of populations, i.e. sand over laterite in low species-rich heath (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

Daviesia chapmanii (Priority 4) and *D. epiphyllum* (Priority 3) are both associated with *Patersonia spirafolia*, and are listed on CALM's Priority Flora list (Atkins 2003). Recovery actions such as maintaining dieback hygiene at *Patersonia spirafolia* populations will also help to conserve 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. However, as *Patersonia spirafolia* is not specifically listed under any international agreement, the implementation of other international environmental responsibilities is not affected by this plan.

Role and interests of indigenous people

Indigenous communities interested or involved in the regions affected by this plan have not yet been identified. The Aboriginal Sites Register maintained by the Department of Indigenous Affairs does not list any significant sites in the vicinity of these populations. However, not all significant sites are listed on the Register. Input and involvement will be sought from any indigenous groups that have an active interest in the areas that are habitat for *Patersonia spirafolia*, and this is discussed in the recovery actions.

Social and economic impacts

The implementation of this plan is unlikely to cause significant adverse social or economic impact as populations exist in National Park and on road reserves. However, recovery actions will involve liaison and cooperation with all stakeholders.

Evaluation of the plan's performance

CALM will evaluate the performance of this IRP in conjunction with the Moora District Threatened Flora and Communities 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 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

All relevant land managers have been notified of the location and threatened status of the species, including private property owners who live adjacent to road reserve populations. Western Power has also been notified as they have operations near Population 4. The notification details the Declared Rare status of *P. spirafolia* and associated legal obligations.

Declared Rare Flora (DRF) markers have been installed at Populations 2, 3, 4 and 5. These alert maintenance workers to the presence of each population, and help to ensure that people working in the area take appropriate care. CALM staff from Moora District liaise with Western Power at both operational and managerial levels to ensure that they are familiar with the purpose and location of DRF markers as well as their location at Population 5, next to an access track used by their contractors. The Shire of Dandaragan and CSR Emolium (Main Roads WA consultants) are also aware of these markers and their meaning.

There are currently three *P. spirafolia* plants in the Botanic Gardens and Parks Authority (BGPA) Nursery. BGPA records indicate that another three individuals were planted into the Botanic Gardens, although these couldn't be located recently, and may have died (A. Shade[1], pers. comm.). These plants were all grown from seed collected from Population 1 in January 1997 by CALM's Threatened Flora Seed Centre (A. Cochrane[2], pers. comm.).

The presence of *Phytophthora cinnamomi* has been tested and confirmed in the vicinity of Population 5. Strict dieback hygiene is practiced in this area by CALM and Shire staff.

An inactive gravel pit occurs in the habitat of Population 5. This has been ripped, and some regeneration of heath species is occurring.

A protection burn was carried out near Population 1 in September 2001. Early protection burning was carried out around the main population, and then a buffer burn was carried out along parts of the northern edge of the National Park. Unfortunately, the plants excluded from this burning operation were burnt in a wildfire in December 2002. Little regeneration was noted in April 2003, but post-fire regeneration will continue to be monitored. Population 5 was burnt in the same fire, and regeneration at that site was vigorous when monitored in August 2003. However, Population 1 occurred in crevices in virtual caprock in many places, and would have been exposed to much hotter temperatures.

A double-sided information sheet has been prepared, and includes a description of *P. spirafolia*, its habitat, threats, recovery actions and photos. This will be printed, and distributed to the general public through local libraries, wildflower shows and other avenues. It is hoped that this may result in the discovery of new populations, as well as encourage awareness of rare flora and native vegetation generally.

Patersonia spirafolia also appears in a handbook that lists Declared Rare Flora that occur on roadsides in the Shire of Dandaragan (Smith and Broun 2003). The handbook was produced by the West Midlands Natural Resource Management Group (WM NRM Group), with funding through the World Wide Fund for Nature's Threatened Species Network Community Grant scheme, and in partnership with staff from CALM's Moora District. Through this project, staff and associates of the WM NRM Group have been trained in survey techniques and identification of this species and other Rare Flora in the area.

Staff from CALM's Moora District regularly monitor all populations of this species. Population 5 was surveyed in 2004 with the assistance of a number of community members, including many from the Jurien Bay Regional Herbarium.

[1] Amanda Shade, Horticulturalist, Botanic Garden and Parks Authority
[2] Anne Cochrane, Manager, CALM's Threatened Flora Seed Centre

The Moora District Threatened Flora and Communities Recovery Team is overseeing the implementation of this IRP and will include information on progress in its 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; 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 coordinate recovery actions for *P. spirafolia* and other Declared Rare Flora in the district. They will include information on progress in their annual report to CALM's Corporate Executive and funding bodies.

Action: Coordinate recovery actions
Responsibility: CALM (Moora District) through the MDTFRT
Cost: $1,500 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. 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 indigenous groups that have an active interest in areas that are habitat for *Patersonia spirafolia*.

Action: Liaise with relevant land managers
Responsibility: CALM (Moora District) through the MDTFRT
Cost: $1,400 per year

4. Maintain dieback hygiene

Phytophthora cinnamomi (dieback) is known to occur in the vicinity of Population 5. Standard dieback hygiene practices will be followed to minimise the spread and impact of this disease. The susceptibility of *Patersonia spirafolia* is unknown. However, many components of the species-rich heath in which this species occurs are typically susceptible to the disease. Changes in vegetation structure such as alterations to canopy cover are likely to impact this species by changing localised characteristics of temperature, humidity and shading. Degradation of the community may also reduce pollinator availability and increase weed competition.

Action: Maintain dieback hygiene
Responsibility: CALM (Moora District) through the MDTFRT
Cost: $500 per year

5. Assess dieback susceptibility

The susceptibility of this species to dieback is unknown. It is anticipated to be low due to a suspected ability to produce new roots annually, but testing will confirm the actual level of threat to this species.

Action: Assess dieback susceptibility
Responsibility: CALM (Science Division), BGPA through the MDTFRT

Cost: $1,000 in second year

6. Monitor populations

Annual monitoring of factors such as habitat degradation (including plant diseases such as *Phytophthora cinnamomi*, weed invasion and salinity), population stability (expansion or decline), pollination 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 growth. Populations 1 and 5 were burnt by wildfire in December 2002. Monitoring for regeneration is necessary at these populations. The condition of Population 1 is of particular interest, as the presence or absence of several hundred plants on secure conservation tenure dramatically affects the conservation status of the species.

Action: Monitor populations
Responsibility: CALM (Moora District) through the MDTFRT
Cost: $1,400 per year

7. Conduct further surveys

Further surveys by CALM staff and community volunteers are a high priority for this species, as extensive areas of suitable habitat occur within National Park and on private property. Surveys will be concentrated in the flowering period of the species (October-November). Records of areas surveyed will be sent to Wildlife Branch and retained at the districts, even if *Patersonia spirafolia* is not located.

Action: Conduct further surveys
Responsibility: CALM (Moora District) through the MDTFRT
Cost: $2,000 per year

8. Develop and implement a fire management strategy

It is thought likely that fire destroys above ground parts of the plant, and that regeneration occurs from the rhizome of mature plants as well as from seed. Frequent fire may prevent the accumulation of sufficient soil-stored seed for recruitment to occur. Fire also promotes the introduction and proliferation of weed species. Frequent fire should therefore be prevented from occurring in the habitat of populations if possible. Occasional fire may be employed with care when it is being used for necessary fuel reduction in the National Park, or experimentally as a recovery tool. A fire management strategy will be developed in consultation with land managers to determine fire control measures and a recommended fire frequency and intensity.

Action: Develop and implement a fire management strategy
Responsibility: CALM (Moora District) through the MDTFRT
Cost: $2,500 in first year, and $1,700 in subsequent years

9. 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 include seed and live plants in cultivation. A very small quantity of seed was collected from Population 1, and this was germinated and given to BGPA Nursery to grow on, and resulted in six plants. No seed has yet been placed in storage, and collections are required from all populations to maintain adequate representation of the genetic diversity of this taxon. The patterns of viability that emerge from standard tests on seed collected may indicate the need for other recovery actions. For example, if viability is consistently low, it may be appropriate to conduct some hand pollination trials. Germinants produced during viability testing will be grown on to increase the living collection at BGPA.

Action: Collect seed
Responsibility: CALM (TFSC, Moora District) through the MDTFRT
Cost: $2,700 per year

10. 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. An information sheet will be printed that includes a description of the plant, its habitat, threats, recovery actions and photos.

This will be distributed to the public through CALM's Moora District office and at the office and library of the Shire of Dandaragan. Such information distribution may lead to the discovery of new populations.

Action: Promote awareness
Responsibility: CALM (Moora District) through the MDTFRT
Cost: $1,700 in first year, and $1,100 per year thereafter

11. Obtain biological and ecological information

Improved knowledge of the biology and ecology of *P. spirafolia* 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: $12,000 per year in the second, third and fourth years

12. 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 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 June 2004 to May 2009 but will remain in force until withdrawn or replaced. If the taxon is still ranked Endangered after five years, the need to review this IRP or to replace it with a full Recovery Plan will be determined.

5. REFERENCES

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6. TAXONOMIC DESCRIPTION

Excerpt from: Keighery, G.J. (1990) *Patersonia spirafolia* (Iridaceae), a new species from south-western Australia. *Nuytsia* 7(2), 137-139.

Patersonia spirafolia

Rootstock a spreading woody rhizome, forming a tussock to 40 cm across, producing 2-15 slender, erect, leafy, woody stems to 30 cm, covered by leaf bases. *Leaves* linear, spirally twisted, 50-200 x 3-5 mm, biconvex with minute grooves; margins brown, with silky, appressed hairs pointing to the middle; base brown, scarious, glabrous. *Scape* 150-250 x 1-2 mm, glabrous, reddish-green. *Spathe* lanceolate (longest 24-26 mm, shortest 21-22 mm), brown, glabrous; margins scarious, almost transparent. *Involucre* slightly gaping; inner bracts exposed, 7-9 mm wide. *Flowers* sessile, fugacious, each with a scarious bracteole, diurnal; floral tube filiform, 11-16 mm long, sparsely hairy at ovary summit, included in the bracts. *Sepals* free, rhomboid, spreading, 16-19 mm x 8-14 mm, blue-violet. *Petals* erect, blue-violet, c. 1 mm long; apex acute. *Stamens* inserted at apex of floral tube; filaments 2-4 mm long, white, connate. *Anthers* connective triangular, basifixed, yellow; 7-8 mm long, dehiscing by slits. *Style* filiform, narrowed towards base, c. 10 mm long; stigmatic lobes 3, equal, flattened, free, papillose on upper surface. *Ovary* pubescent. *Capsule* ovoid-oblong, 1.5-3 cm long. *Seed* not seen.

Notes: Occurs on low hills in and around Badgingarra National Park, along the Gardner Range.

Habitat: Grows in low, species-rich heath in sand over laterite.

Flowering period: October to November.

Discussion: Patersonia spirafolia belongs with those Western Australian species of *Patersonia* which form tussocks, comprising *P. inaequalis* and *P. drummondii*. It differs from *P. inaequalis* in having purple flowers and brown spathes; it differs from *P. drummondii* in the short appressed hairs on the leaf margins and the shorter spathes, which are brown when flowering occurs.

Etymology: The specific epithet refers to the spirally twisted leaves.

SUMMARY OF RECOVERY ACTIONS AND COSTS (not for publication)

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	1,000	500		1,000	500		1,000	500		1,000	500		1,000	500	
Map critical habitat	1,500		500												
Liaise with land managers	700		700	700		700	700		700	700		700	700		700
Maintain dieback hygiene	500			500			500			500			500		
Assess dieback susceptibility				500	500										
Monitor populations	800		600	800		600	800		600	800		600	800		600
Conduct further surveys	500	1,000	500	500	1,000	500	500	1,000	500	500	1,000	500	500	1,000	500
Develop and implement a fire management strategy	1,000	1,000	500	800	400	500	800	400	500	800	400	500	800	400	500
Collect seed	1,000		1,700	1,000		1,700	1,000		1,700	1,000		1,700	1,000		1,700
Promote awareness	1,100		600	1,100			1,100			1,100			1,100		
Obtain biological and ecological information				5,000		7,000	5,000		7,000	5,000		7,000			
Review the need for a full Recovery Plan													11,200		9,100
Total	8,100	2,500	5,100	11,900	2,400	11,000	11,400	1,900	11,000	11,400	1,900	11,000	17,600	1,900	13,100
Yearly Total		**15,700**			**25,300**			**24,300**			**24,300**			**32,600**	

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

Total CALM: $60,400
Total Other: $10,600
Total External Funding: $51,200
Total Costs: $122,200