

INTERIM RECOVERY PLAN NO. 260

KEIGHERY'S MACARTHURIA

(Macarthuria keigheryi)

INTERIM RECOVERY PLAN

2008-2013



April 2008

Department of Environment and Conservation
Kensington



Australian Government



Department of
Environment and Conservation

Our environment, our future



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. Note: the Department of CALM formally became the Department of Environment and Conservation (DEC) in July 2006. DEC will continue to adhere to these Policy Statements until they are revised and reissued.

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.

DEC is committed to ensuring that threatened taxa and threatened ecological communities are conserved through the preparation and implementation of Recovery Plans (RPs) or IRPs, and by ensuring that conservation action commences as soon as possible and, in the case of Critically Endangered (CR) taxa, always within one year of endorsement of that rank by the Minister.

This IRP will operate from April 2007 to March 2012 but will remain in force until withdrawn or replaced. It is intended that, if the taxon is still ranked Endangered, this IRP will be reviewed after five years and the need for a further recovery actions assessed.

This IRP was approved by the Director of Nature Conservation on 30 April 2008. The allocation of staff time and provision of funds identified in this IRP is dependent on budgetary and other constraints affecting DEC, as well as the need to address other priorities.

Information in this IRP was accurate in April 2008.

This IRP was prepared with financial support from the Australian Government to be adopted as a National Recovery Plan under the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

IRP PREPARATION

This IRP was prepared by Simon Cherriman¹, Nicole Willers² and David Mitchell³

¹ Project Officer, DEC Swan Region, 20 Dick Perry Ave Bentley, WA, 6102.

² Flora Conservation Officer, DEC Swan Region, 20 Dick Perry Ave Bentley, WA, 6102.

³ Regional Leader, Nature Conservation, DEC Swan Region, 20 Dick Perry Ave Bentley, WA, 6102.

ACKNOWLEDGMENTS

The following people have provided assistance and advice in the preparation of this IRP:

Monica Batista	Project Officer, Species and Communities Branch, DEC
Andrew Brown	Threatened Flora Coordinator, Species and Communities Branch, DEC
Vanessa Clarke	Flora Conservation Officer, Swan Region, DEC
Craig Douglas	Project Officer, Species and Communities Branch, DEC
Val English	Acting Principal Ecologist, Species and Communities Branch, DEC
Greg Keighery	Principle Research Scientist, Science Division, DEC
Amanda Shade	Horticulturalist, Botanic Garden and Parks Authority
Bryan Shearer	Principal Research Scientist, Biodiversity Conservation Group, DEC
Greg Woodman	Director, Woodman Environmental Consultancy

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

Cover photograph by Greg Keighery.

CITATION

This IRP should be cited as:

Department of Environment and Conservation (2008). Keighery's *Macarthuria* (*Macarthuria keigheryi*) Interim Recovery Plan 2008-2013. Interim Recovery Plan No. 260. Department of Environment and Conservation, Perth, Western Australia.

SUMMARY

Scientific Name:	<i>Macarthuria keigheryi</i>	Common Name:	Keighery's Macarthuria
Family:	Molluginaceae	Flowering Period:	September – December, February – March
DEC Region:	Swan and Midwest	DEC District:	Swan Coastal and Moora
Shire:	Swan, Kalamunda and Dandaragan	Recovery Team:	Swan Region and Moora District Threatened Flora and Communities Recovery Teams (SRTFCRT, MDTFCRT)
City:	Belmont and Canning		

Illustrations and/or further information: Atkins, K. (2008) *Declared Rare and Priority Flora List for Western Australia*, Department of Environment and Conservation, Western Australia; Brown, A., Thomson-Dans, C. and Merchant, N. (Eds) (1998) *Western Australia's Threatened Flora*, Department of Conservation and Land Management, Western Australia; Threatened Ecological Community database (2007) Department of Environment and Conservation, Western Australia; Declared Endangered Flora Database (2007) Department of Environment and Conservation, Western Australia; Close, D. & Dixon, K. (2005) *Research Plan for Conservation of Nationally Threatened Conospermum undulatum and Macarthuria keigheryi on Westralia Airports Corporation Bushland*, Kings Park and Botanic Gardens, Western Australia; *Bush Forever Volume 2 Directory of Bush Forever Sites* (2000) Department of Environmental Protection, Perth Western Australia; Evans, R., Willers, N., and Mitchell, D. (2003) Threatened flora of Swan Region. Unpublished report to the Department of Conservation and Land Management and Environment Australia; Keighery, B. (2001) Conservation Category Wetlands in Bush Forever Site 283 East of McDowell Street, Department of Conservation and Land Management, Western Australia; Lepschi B. J. (1996) A Taxonomic revision of *Macarthuria*. *Nuytsia* 11(1). 12-13; IUCN (2001) IUCN Red List Categories prepared by the IUCN Species Survival Commission, as approved by the 51st meeting of the IUCN Council. Gland, Switzerland; Western Australian Herbarium (2007) FloraBase -Information on the Western Australian Flora. Department of Environment and Conservation, Western Australia. <http://www.calm.wa.gov.au/science/>.

Current status: *Macarthuria keigheryi* was declared as Rare Flora under the Western Australian *Wildlife Conservation Act 1950* in 1997 and is currently ranked as Endangered (EN) under World Conservation Union (IUCN 2001) Red List criterion B2ab(iii) as the area of occupancy is less than 500 km², populations are severely fragmented and there is a continuing decline in the quality of habitat. Threats include: urban development and clearing, mining, fragmentation of populations, weeds, grazing by rabbits, road maintenance and construction, inappropriate fire, firebreak maintenance, and other impacts of development.

Description: *Macarthuria keigheryi* is a small erect subshrub to 40 cm tall with hairy, bright yellow to green stems. The leaves are present mainly at the base of the stems and on young growth. They are narrowly obovate to elliptic in shape, 2.7 - 11.5 mm long and 0.7 - 3.5 mm broad. The flowers have five sepals that are hairy on the outside. The outer sepals are green, the inner are partly white and membranous. The five petals are narrow, dying early. There are eight stamens joined at the base. The style is small, divided into three. The seeds are normally round, black and shiny. *Macarthuria keigheryi* is distinguished from other members of the genus by a dense covering of golden hairs on the stems and leaves. Additional details are available in the taxonomic description provided in Section 6.

Habitat requirements: *Macarthuria keigheryi* is currently known from six populations over a range of approximately 160 km. However, plants have not been recorded in two of these populations during recent surveys. One isolated population (recorded in 1991 and last surveyed in 1996) occurs in the Cooljarloo area (Department of Environment and Conservation (DEC) Midwest Region, Moora District) west of Dandaragan. The other five are all within a 5 km radius of Welshpool and Kewdale in the Perth metropolitan area. The species is found in low-lying winter-wet damp, grey/white sands and grows in open patches with low tree canopy cover among heathland, jarrah (*Eucalyptus marginata*) and *Allocasuarina/Banksia* woodland at Welshpool and Kewdale; and *Banksia/Eucalyptus* woodland at the Dandaragan population. Associated species include *Kingia australis*, *Banksia attenuata*, *B. menziesii*, *Eremaea pauciflora*, *Nuytsia floribunda*, *Melaleuca seriata*, *Patersonia occidentalis* and *Alexgeorgea nitens* in the Welshpool/Kewdale area and *B. menziesii*, *B. attenuata*, *Eucalyptus tottiana* and *Nuytsia floribunda* in the Cooljarloo area (Brown *et al* 1998; Keighery 2001; Atkins 2006).

Habitat critical to the survival of the species, and important populations: Habitat critical to the survival of the species includes the area of occupancy of all known populations, areas of similar habitat surrounding known populations (low-lying winter wet damp sands with *Banksia* and *Kingia australis* heathland or *Banksia* woodland) that provide potential habitat for natural range extension), remnant vegetation that surrounds and links populations (necessary to allow pollinators to move between populations), the local catchment of the surface and possibly ground waters that maintain the habitat of the species and additional occurrences of similar habitat that may contain the species or be suitable for future translocations.

Given that this species is listed as Endangered and is known from just six populations, it is considered that all known habitat for wild and any future translocated populations is habitat critical to its survival, and that all wild and any future translocated populations are important populations.

Benefits to other species or ecological communities: Recovery actions implemented to improve the quality or security of habitat of *Macarthuria keigheryi* will also protect the threatened flora species *Conospermum undulatum* (Vulnerable), the Priority species *Haloragis tenuifolia* (P3) and three Threatened Ecological Communities (TEC's) - (*Banksia attenuata* woodland over species-rich dense shrublands Swan Coastal Plain (SCP) community type 20a (Endangered), *Corymbia calophylla* and *Kingia australis* woodlands on heavy soils SCP community type 3a (Critically Endangered) and *Corymbia calophylla* and *Eucalyptus marginata* woodlands on sandy clay soils SCP community type 3b (Vulnerable).

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. *Macarthuria keigheryi* 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: Involvement of the Indigenous community is being sought through the *South West Aboriginal Land and Sea Council (SWALSC)* and the *Department of Indigenous Affairs* to assist in the identification of cultural values for land occupied by *Macarthuria keigheryi*, or groups with a cultural connection to land that is important for the species' conservation and to determine whether there are any issues or interests identified in the plan. A search of the Department of Indigenous Affairs Aboriginal Heritage Sites Register has identified that there are 34 artifact sites in the vicinity of populations of the species covered by this IRP. Where no role is identified for the indigenous community associated with this species in the development of the recovery plan, opportunities may exist through cultural interpretation and awareness of the species. Indigenous involvement in the implementation of recovery actions will be encouraged.'

Continued liaison between DEC and the indigenous community will identify areas in which collaboration will assist implementation of recovery actions.

Social and economic impact: One population of *Macarthuria keigheryi* occurs on Commonwealth airport land and negotiations will continue with the current land managers in regards to the future management of this population. The Midwest population occurs within an area subject to a mining exploration lease. In this regard, the implementation of this IRP has the potential to have some social and economic impact. Recovery actions include continued liaison between stakeholders with regard to these areas.

Affected interests: Stakeholders potentially affected by the implementation of this plan include Westralia Airports Commission, Tiwest, Empire Oil and Gas, WA Planning Commission, Shires of Swan, Kalamunda and Dandaragan, Cities of Belmont and Canning, Conservation Commission and DEC.

Evaluation of the plan's performance: DEC will evaluate the performance of this IRP in conjunction with the Moora District and Swan Region Threatened Flora and Communities Recovery Teams. 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.

Completed Recovery Actions: The following recovery actions have been completed:

1. Relevant land managers have been notified of the presence and threatened status of *Macarthuria keigheryi*.
2. A survey conducted by staff from the former Department of Environmental Protection (DEP) located a sixth population in a 'Bush Forever' site.
3. Numerous surveys have been conducted in areas of suitable habitat in the Dandaragan and Welshpool areas by staff from DEC.
4. A detailed research project on the biology of *Macarthuria keigheryi* and *Conospermum undulatum* was conducted by the Botanic Gardens and Parks Authority (BGPA) in 2005.
5. 164 plants are currently being maintained in cultivation at BGPA.

Ongoing and future recovery actions

6. Staff from DEC's Moora and Swan Coastal Districts regularly monitor all populations of this species.
7. The Moora District Threatened Flora and Swan Region Threatened Flora and Communities Recovery Teams are overseeing the implementation of this IRP and will include information on progress in an annual report to DEC's Corporate Executive and funding bodies.

IRP objective: The objective of this IRP 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 populations have increased and/or number of individuals within populations have increased by ten percent or more over the term of the plan.

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

Recovery actions

1. Coordinate recovery actions
2. Liaise with relevant land managers
3. Increase rabbit control
4. Monitor populations
5. Install fencing if required
6. Develop and implement a fire management strategy
7. Implement weed control
8. Conduct further surveys
9. Improve security of tenure
10. Map habitat critical to survival
11. Start the translocation process if necessary
12. Review this plan and assess the need for further recovery actions

1. BACKGROUND

History

The type specimen of *Macarthuria keigheryi* was collected from the Cataby area by B. Keighery in 1989. Surveys conducted by T. Griffin in the 1980's, followed by the 1990-1994 floristic survey of the southern Swan Coastal Plain and the 1992 survey of remnant vegetation of the eastern side of the Swan Coastal Plain failed to find more populations. A Western Australian Herbarium botanist then found 1 plant in the Cataby area (Population 1) in 1991 but a subsequent survey in 1996 was unsuccessful in relocating the plant.

During a taxonomic revision of the genus, a 1976 specimen from Kewdale was determined to be *Macarthuria keigheryi*. The former Department of Environmental Protection (DEP) discovered the population during the Systems Six reserve system review in 1995. Populations 4 and 6 were discovered during a survey conducted by staff from the DEP when surveying 'Bush Forever' sites. Both these populations and a large Midwest population were discovered in areas regenerating post-fire, which suggested that *Macarthuria keigheryi* is fire responsive.

Macarthuria keigheryi is thought to be rare due to clearing of its winter wet swamp habitat for urban development and agricultural use.

Research was conducted on the species for Westralia Airports Corporation by Dr Dugald Close from the Botanical Gardens and Parks Authority (BGPA). Further surveys and research may be required to provide more information that will aid future management.

Description

Macarthuria keigheryi is a small erect subshrub to 40 cm tall with hairy, bright yellow to green stems. The leaves are present mainly at the base of the stems and on young growth. They are narrowly obovate to elliptic in shape, 2.7 - 11.5 mm long and 0.7 - 3.5 mm broad. The flowers have five sepals that are hairy on the outside. The outer sepals are green, the inner are partly white and membranous. The five petals are narrow, dying early. There are eight stamens joined at the base. The style is small, divided into three. The seeds are normally round, black, and shiny.

Macarthuria keigheryi is distinguished by the dense covering of golden hairs on its stems and leaves and the large number of flowers (up to 25) in the dense headed inflorescence. Flowering occurs from September to December and from February to March. Two other species of *Macarthuria* (*M. australis* and *M. apetala*) grow with *M. keigheryi* but neither have hairy stems (Lepschi 1996).

Distribution and habitat

Macarthuria keigheryi is currently known from six populations over a range of approximately 160 km. However, plants have not been recorded in two of these populations during recent surveys. One isolated population (Population 1) which was recorded as having extant plants in 1996 and then rediscovered in 2006 with over 10,000 plants, occurs west of Dandaragan (Greg Woodman pers. comm.), while the other five are within a 5 km radius at Welshpool and Kewdale, south-east of Perth. Approximately 10,070 plants are currently known with less than 1% of the total population occurring within the Swan Coastal Plain. The Perth populations occur on a number of different of land tenures with two (Populations 4 and 6) on land managed by the Department for Planning and Infrastructure (DPI). Long term plans for a road reserve is a threat to both these populations.

Macarthuria keigheryi prefers low-lying, winter wet, damp grey/white sands, and at Welshpool and Kewdale it grows in open patches with low tree canopy cover among heathland and jarrah-*Banksia* woodland. It grows with *Kingia australis*, *Banksia attenuata*, *B. menziesii*, *Eremophila pauciflora*, *Nuytsia floribunda*, *Melaleuca seriata*, *Patersonia occidentalis* and *Alexgeorgea nitens*. At the Cooljarloo population, west of Dandaragan, it grows in *Banksia* woodland with *Banksia menziesii*, *B. attenuata*, *Eucalyptus tottiana*, *Nuytsia floribunda* and other wetland species (Brown *et al* 1998; Keighery 2001; Atkins 2004).

Macarthuria keigheryi is known from four Bush forever sites: Tomah Road Bushland, Wattle Grove (283), Dundas Road Bushland, Forrestdale (319), Perth Airport and Adjacent Bushland (386) and McDowell St Bushland, Welshpool (424) and, as such, is warranted some protection under this scheme (Department of Environmental Protection 2000).

Summary of population land vesting, purpose and tenure

Pop. No. & Location	DEC District	Shire	Vesting	Purpose	Manager
1. Cooljarloo, west of Dandaragan	Moora	Dandaragan	Unvested Crown Land	Unvested Crown Land	State of WA; Tiwest and Empire Oil and Gas
2. Kewdale	Swan Coastal	Canning	Unknown	Unknown	-
3a. Forrestfield	Swan Coastal	Kalamunda	Conservation Commission of Western Australia	Conservation of Flora and Fauna (Nature Reserve)	DEC
3b. Forrestfield	Swan Coastal	Kalamunda	Conservation Commission of Western Australia	Conservation of Flora and Fauna (Nature Reserve)	DEC
4. Queens Park	Swan Coastal	Canning	WAPC	Conservation Park	WAPC
5a. Perth Airport	Swan Coastal	Belmont	Commonwealth of Australia	Airport	Westralia Airports Corporation Pty Ltd
5b. Perth Airport	Swan Coastal	Belmont	Commonwealth of Australia	Airport	Westralia Airports Corporation Pty Ltd
5c. Perth Airport	Swan Coastal	Belmont	Commonwealth of Australia	Airport	Westralia Airports Corporation Pty Ltd
6. Queens Park	Swan Coastal	Canning	WAPC	Conservation Park	WAPC

Biology and ecology

Macarthuria keigheryi dies back to rootstock during the summer (Brown *et al* 1998). An increase of plant numbers was observed following firebreak maintenance (Population 1) and Departmental file records show that the largest *M. keigheryi* populations were recorded following fire, suggesting that the species may be fire/disturbance responsive. The flowers are sweet smelling and attract small insects including native bees, flies and wasps. Fruiting occurs between December and February with seed gathered and dispersed by ants. The species has not been tested for resistance to dieback disease caused by the fungus *Phytophthora cinnamomi* (Bryan Shearer, pers. comm. 2006).

A detailed research project conducted by Dr Dugald Close (BGPA) for Westralia Airports Corporation in 2005 revealed that stems of older *Macarthuria keigheryi* plants grow horizontally, become buried in the surface of the soil and give rise to new shoots from buds on the upper surface of the stem. Seed appears to persist for long periods in the soil seedbank and germinates in response to disturbance (Close and Dixon 2005).

The species is easily propagated by cuttings with results from BGPA showing a 70-80% strike rate. Currently 164 plants are being maintained in cultivation at the Kings Park research nursery. Following 3-4 months of vegetative growth under conditions of daily irrigation, plants flowered, attracted a range of insect pollinators and set seed at a success rate well above that of wild populations. This means that plants raised from cuttings could represent the full genetic diversity of a wild population and be used as a seed orchard. Seeds can be periodically harvested and stored long-term in the Kings Park seed store (and potentially DEC's Threatened Flora Seed Centre (TFSC)).

Macarthuria keigheryi is highly susceptible to grazing. Studies at Population 5 have shown that exposed plants were browsed by rabbits to soil level whilst plants growing among wood debris or within clumps of unpalatable vegetation were untouched. When plants were protected with cages rapid shoot growth was noted (Close and Dixon 2005). Seed predation by ants appears to be a natural ecological process and this is not thought to be a factor in rarity or population decline, given similar levels of seed predation occurred in the common species *Macarthuria australis* and *Gompholobium tomentosum* (Close and Dixon 2005).

Threats

Macarthuria keigheryi was declared as Rare Flora 1997 and ranked as Endangered (EN) in October 2002. It currently meets World Conservation Union (IUCN) Red List category 'EN' under criterion B2ab(iii) (IUCN 2001), as the area of occupancy is less than 500 km², populations are severely fragmented and there is a continuing decline in the quality of habitat. No new populations have been recently found and the total number of known mature plants has

decreased since this species was last ranked. Unless remedial action is taken, there will be a continuing decline in the area, extent and quality of habitat and in the number of mature individuals. The main threats are clearing, inappropriate fire regimes, road and firebreak maintenance and construction, weeds, grazing, and other impacts of development.

- **Clearing** of bushland is continuing in the Perth metropolitan area, especially in commercial areas around Kewdale and Welshpool where most populations occur. This threatens the long-term survival of the species as plants are impacted by clearing of supporting habitat and there is a reduction in habitat suitable for translocation.
- **Mining** exploration and mine development are likely to impact on population 1. Both Tiwest and Empire Oil and Gas have exploration leases over the area in which Population 1 occurs. They have engaged a consultant to survey for this species on their exploration leases and it is likely an application to take will need to be progressed for these companies to continue their operations.
- **Inappropriate fire regimes** may affect the viability of populations. As seed germinates in response to disturbance such as fire (Close and Dixon 2005) the soil seed bank would rapidly be depleted if fires recurred before regenerating or juvenile plants reached maturity. However, occasional fires may be required for reproduction of this species. An additional consideration is the role of fire in facilitating weed invasion. Many populations have weeds that are currently restricted to the edges of the habitat but are likely to invade further into the habit post-fire.
- **Road and firebreak maintenance** threatens all road reserve populations and populations on Commonwealth lands. Threats include grading, chemical spraying, and the slashing/mowing of roadside vegetation. These actions also encourage weed invasion.
- **Weeds** are currently a significant threat to Populations 3-6. Weeds compete with seedlings and adult plants for soil nutrients, light resources and space and could dramatically increase in numbers if a fire or other disturbance occurred in the area of populations. Weeds also exacerbate grazing pressure and increase the fire hazard due to the easy ignition of high fuel loads that are produced annually by many weed species.
- **Grazing** by rabbits and possibly kangaroos is thought to be a major problem in the Perth International Airport, Forrestfield and Kewdale populations. Soil disturbance, the grazing of associated species and the addition of nutrients are other detrimental effects of animal grazing in areas inhabited by the species.

Summary of population information and threats

Pop. No. & Location	Land status	Year	No. plants	Condition	Threats
1. Cooljarloo, west of Dandaragan	Unvested Crown Land	1988	abundant	Healthy	Mine development, firebreak maintenance, future road construction
		1991	1		
		1996	0		
		2006	10,000 (est.)		
2. Kewdale	Unknown	Unknown		Unknown	Unknown
3a. Forrestfield	Conservation of Flora and Fauna (Nature Reserve)	1996	150	Poor	Weeds, road maintenance
		2002	150		
		2006	0		
3b. Forrestfield	Conservation of Flora and Fauna (Nature Reserve)	1996	150	Poor	Weeds, road maintenance
		2002	150		
		2006	0		
4. Queens Park	Conservation Park	1996	Unknown	Moderate	Weeds
		2002	5		
		2006	0		
5a. Perth Airport	Airport	1998	9	Not found	Road construction and maintenance, grazing
		2002	1		
		2004	0		
5b. Perth Airport	Airport	2001	1	Not found	Road construction and maintenance, grazing
		2004	0		
5c. Perth Airport	Airport	2001	1	Moderate	Grazing and weeds
		2005	61		
6. Queens Park	Conservation Park	2002	7	Moderate	Weeds, road construction, changes in hydrology

Numbers in brackets = number of juveniles. * = total for both subpopulations combined.

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 *Macarthuria keigheryi* 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.

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

Habitat critical to the survival of the species includes the area of occupancy of all known populations, areas of similar habitat surrounding all known populations (i.e. low-lying winter wet damp sands with *Banksia* and *Kingia australis* heathland or *Banksia* woodland) that provide potential habitat for natural range extension, remnant vegetation that surrounds and links populations (this is necessary to allow pollinators to move between populations), the local catchment of the surface and possibly ground waters that maintain the habitat of the species and additional occurrences of similar habitat that may contain the species or be suitable for future translocations.

Given that this species is listed as Endangered and is only known from six populations, it is considered that all known habitat for wild and future translocated populations is habitat critical to its survival, and that all wild and future translocated populations are important populations.

Benefits to other species or ecological communities

Recovery actions implemented to improve the quality or security of habitat of *Macarthuria keigheryi* will also protect the threatened flora species *Conospermum undulatum* (Vulnerable), the Priority species *Haloragis tenuifolia* (P3) and three TECs (see table below).

Threatened Ecological Communities occurring in the habitat of *Macarthuria keigheryi*

Community Identifier	Community Name	Location	Threatened Status (WC Act)
SCP20a	<i>Banksia attenuata</i> woodland over species-rich dense shrublands	Swan Coastal Plain	Endangered
SCP3a	<i>Corymbia calophylla</i> - <i>Kingia australis</i> woodlands on heavy soils	Swan Coastal Plain	Critically Endangered
SCP3b	<i>Corymbia calophylla</i> - <i>Eucalyptus marginata</i> woodlands on sandy clay soils	Swan Coastal Plain	Vulnerable

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. *Macarthuria keigheryi* 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

Involvement of the Indigenous community is being sought through *the South West Aboriginal Land and Sea Council (SWALSC) and the Department of Indigenous Affairs* to assist in the identification of cultural values for land occupied by *Macarthuria keigheryi*, or groups with a cultural connection to land that is important for the species' conservation and to determine whether there are any issues or interests identified in the plan. A search of the Department of Indigenous Affairs Aboriginal Heritage Sites Register has identified that there are 34 artifact sites in the vicinity of populations of the species covered by this IRP. Where no role is identified for the indigenous community associated with this species in the development of the recovery plan, opportunities may exist through cultural interpretation and awareness of the species. Indigenous involvement in the implementation of recovery actions will be encouraged.'

Continued liaison between DEC and the indigenous community will identify areas in which collaboration will assist implementation of recovery actions.

Social and economic impact

The implementation of this interim recovery plan (IRP) has the potential to have some social and economic impact as one population of *Macarthuria keigheryi* occurs on Commonwealth Airport land. Negotiations will continue with the land managers in regards to its future management.

Affected interests

Stakeholders potentially affected by the implementation of this plan include Westralia Airports Corporation, Shires of Swan, Kalamunda and Dandaragan, Cities of Belmont and Canning, Ministry for Planning, Conservation Commission and DEC.

Evaluation of the plan's performance

DEC will evaluate the performance of this IRP in conjunction with the Moora and Swan Region Threatened Flora and Communities Recovery Teams. 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 IRP 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 populations have increased and/or the number of individuals within populations have increased by ten percent or more over the term of the plan.

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

3. RECOVERY ACTIONS

Completed recovery actions

Relevant land managers have been notified of the location and threatened status of *Macarthuria keigheryi*. The notification details the Declared Rare status of the species and associated legal obligations.

A survey conducted by staff from the former Department of Environmental Protection located a sixth population in a Bush Forever site.

A detailed research project was conducted for Westralia Airports Corporation by staff from BGPA in 2005. The project provided information on the genetic diversity, seed production rates, seed dormancy, propagation by cuttings and ecological factors limiting the distribution, establishment and survival of *Macarthuria keigheryi*.

One hundred and sixty four plants are currently being maintained in cultivation at the Kings Park nursery.

Ongoing and future recovery actions

Staff from DEC's Moora and Swan Coastal Districts regularly monitor all populations of this species.

The Moora District and Swan Region Threatened Flora and Communities Recovery Teams are overseeing the implementation of this IRP and will include information on progress in its annual report to DEC's Corporate Executive and funding bodies.

Where populations occur on lands other than those managed by DEC, 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 term 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 and Swan Region Threatened Flora and Communities Recovery Teams will coordinate recovery actions for *Macarthuria keigheryi* and other Declared Rare Flora in their districts. They will include information on progress in their annual report to DEC's Corporate Executive and funding bodies.

Action: Coordinate recovery actions
Responsibility: DEC (Moora and Swan Coastal Districts) through the MDTFCRT and SRTFCRT.
Cost: \$2,800 per year

2. Liaise with relevant land managers

Staff from DEC's Moora and Swan Coastal Districts will continue to liaise with relevant land managers and landowners to ensure that populations are not accidentally damaged or destroyed and so that current threats are addressed. Thirty-four significant sites that occur in the vicinity of *Macarthuria keigheryi* are listed on the Aboriginal Sites Register maintained by the Department of Indigenous Affairs. The custodians of these areas will be identified, and their input and involvement will be sought in the management of populations in this area.

Action: Liaise with relevant land managers
Responsibility: DEC (Moora and Swan Coastal Districts) through the MDTFCRT and SRTFCRT
Cost: \$1,700 per year

3. Increase rabbit control

Population 5 is severely affected by rabbit grazing and baiting is being carried out twice a year by WAC. However, it is not currently achieving a significant reduction in rabbit numbers and DEC staff will liaise with WAC to increase their rabbit baiting control program to four times per year.

Action: Increase rabbit control
Responsibility: DEC (Swan Coastal District) and Westralia Airports Corporation through the SRTFCRT
Cost: \$1,400 per year

4. Monitor populations

Annual monitoring of factors such as habitat degradation (including firebreak maintenance, weed invasion and grazing), 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.

Action: Monitor populations
Responsibility: DEC (Moora and Swan Coastal Districts) through the MDTFCRT and SRTFCRT
Cost: Total \$2,100 in years 1, 3 and 5

5. Install fencing if required

Fencing may be required for some populations of *Macarthuria keigheryi* in the Swan Coastal District to protect the species from grazing (Population 5) and accidental destruction (Populations 3). Liaison with land managers will be undertaken by DEC district staff to determine the need for fencing, and the most appropriate size and type of fencing.

Action: Install fencing if required

Responsibility: DEC (Swan Coastal District) through the SRTFCRT

Cost: \$11,300 in year 3

6. Develop and implement a fire management strategy

It appears that *Macarthuria keigheryi* is able to use both vegetative and sexual reproduction. Research by BGPA at PIA suggests the species can reproduce by asexual (vegetative) reproduction and Departmental file records show that the two largest populations (Dandaragan and Kewdale) were discovered post-fire, suggesting germination of soil-stored seed. Frequent fire may however, prevent the accumulation of sufficient soil-stored seed for recruitment to occur. Fire also promotes the introduction and proliferation of weed species. Fire should therefore be prevented from occurring frequently in the area 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, and will include recommendations on prescription fire frequency and intensity; precautions to prevent fire; a strategy for reacting to wild fire; and the need, method of construction, and maintenance of firebreaks. Experimental control burns should be prioritised for those populations in the Swan Region that no longer support extant plants. Post-fire weeds and herbivory will need to be managed.

Action: Develop and implement a fire management strategy; undertake experimental controlled burns

Responsibility: DEC (Moora and Swan Coastal Districts) and relevant land managers through the MDTFCRT and SRTFCRT

Cost: \$3,400 in year 1 and \$3,100 per year in years 2-5

7. Implement weed control

The current level of threat from weeds is significant at Populations 3-6, and low in other populations. Weeds impact on *Macarthuria keigheryi* by competing for resources, degrading habitat, exacerbating grazing pressure, and increasing the risk and severity of fire. Recruitment is also likely to be affected. Weed control will be undertaken in consultation with the land managers by hand weeding or careful localised application of herbicide to minimise its effect on the species and 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, and the effect on *Macarthuria keigheryi* and associated native plant species. Copies will be retained at the district and sent to SCB. Should a fire occur in the area of any population, post-fire weed control would be a priority to prevent the expansion and proliferation of weeds.

Action: Implement weed control

Responsibility: DEC (Swan Coastal District) and relevant land managers, through the SRTFCRT

Cost: \$1,800 per year

8. Conduct further surveys

Further surveys by DEC staff and community volunteers (Naturalist Club and Wildflower Society), in areas identified as suitable habitat, will be conducted during the species flowering period (September-December and February-March). Records of areas surveyed will be sent to SCB and copies retained at the districts, even if *Macarthuria keigheryi* is not found.

Action: Conduct further surveys

Responsibility: DEC (Moora and Swan Coastal Districts) through the MDTFCRT and SRTFCRT

Cost: \$3,600 in years 2 and 3

9. Improve security of tenure

Ways and means of improving the security of populations and their habitat will be investigated. Populations 3-6 occur on Bush Forever sites and these plants are provided protection under this scheme (DEP 2000). Transfer of vesting from the Department for Planning and Infrastructure to DEC would improve both security of tenure and associated management. Means of improving security of populations on Commonwealth should be investigated.

Action: Improve security of tenure

Responsibility: DEC (Moora and Swan Coastal Districts) through the MDTFCRT and SRTFCRT
Cost: \$900 in year 2 and \$1,500 in years 3 and 4

10. Map habitat critical to survival

It is a requirement of the EPBC Act that spatial data relating to habitat critical to the survival of the species be determined. Although this 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, their habitat will also be determined and mapped.

Action: Map habitat critical to survival
Responsibility: DEC (Moora and Swan Coastal Districts, SCB) through the MDTFCRT and SRTFCRT
Cost: \$3000 in year 1

11. Start the translocation process if necessary

Translocation may be desirable for the conservation of this species if attempts to stimulate regeneration are not successful. The total number of extant plants is low and the number of juvenile plants very low in most populations and no populations are secure from threats. If deemed necessary, a translocation proposal will be developed and suitable translocation sites selected. This will be coordinated by the MDTFCRT and SRTFCRT. Information on the translocation of threatened plants and animals in the wild is provided in DEC's Policy Statement No. 29 *Translocation of Threatened Flora and Fauna*. All translocation proposals require endorsement by DEC's Director of Nature Conservation. Monitoring of translocations is essential and will be included in the timetable developed for the Translocation Proposal.

Action: Start the translocation process if necessary
Responsibility: DEC (Moora and Swan Coastal Districts) through the MDTFCRT and SRTFCRT
Cost: \$8,100 in year 5

12. Review the assess need for further recovery actions

At the end of the fifth year, this IRP will be reviewed and the need for further recovery actions assessed.

Action: Review the plan and assess the need for further recovery actions
Responsibility: DEC (Moora and Swan Coastal Districts) through the MDTFCRT and SRTFCRT
Cost: \$200 in year 5

Summary of recovery actions

Recovery Actions	Priority	Responsibility	Completion date
Coordinate recovery actions	High	DEC (Moora & Swan Coastal District) through the MDTFCRT & SRTFCRT	Ongoing
Liaise with relevant land managers	High	DEC (Moora & Swan Coastal District) through the MDTFCRT & SRTFCRT	Ongoing
Increase rabbit control	High	DEC (Swan Coastal District) and Westralia Airports Corporation through the SRTFCRT	Ongoing
Monitor populations	High	DEC (Moora & Swan Coastal District) through the MDTFCRT & SRTFCRT	2009
Install fencing if required	High	DEC (Swan Coastal District) through the SRTFCRT	2007 & ongoing
Develop and implement a fire management strategy	High	DEC (Moora and Swan Coastal Districts) and relevant land managers through the MDTFCRT and SRTFCRT	2008 (Swan Region)
Implement weed control	Medium	DEC (Swan Coastal District) through the SRTFCRT	Ongoing
Conduct further surveys	Medium	DEC (Moora and Swan Coastal Districts) and relevant land managers through the MDTFCRT and SRTFCRT	Ongoing
Improve security of tenure	Medium	DEC (Moora and Swan Coastal Districts) and relevant land managers through the MDTFCRT and SRTFCRT	Ongoing
Map habitat critical to survival	Medium	DEC (Moora and Swan Coastal Districts) and relevant land managers through the MDTFCRT and SRTFCRT	2012
Start the translocation process if necessary	Low	DEC (Moora and Swan Coastal Districts) and relevant land managers through the MDTFCRT and SRTFCRT	To be determined

Review this plan and assess the need for further recovery actions	Low	DEC (Moora and Swan Coastal Districts) and relevant land managers through the MDTFCRT and SRTFCRT	2012
---	-----	---	------

4. TERM OF PLAN

Western Australia

This IRP will operate from April 2007 to March 2012 but will remain in force until withdrawn or replaced. If *Macarthuria keigheryi* is still ranked Endangered after five years, the need for further recovery actions will be determined.

Commonwealth

In accordance with the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) this adopted recovery plan will remain in force until revoked.

The recovery plan must be reviewed at intervals of not longer than 5 years.

5. REFERENCES

- Atkins, K. (2008) *Declared Rare and Priority Flora List for Western Australia*. Department of Environment and Conservation, Western Australia.
- Brown, A., Thomson-Dans, C. and Marchant, N. (Eds). (1998) *Western Australia's Threatened Flora*. Department of Conservation and Land Management, Western Australia.
- Department of Conservation & Land Management (2004) *Threatened Ecological Community database*. Perth, Western Australia.
- Department of Conservation & Land Management (2001) *Threatened Flora Database (DEFL)*. Wildlife Branch, Department of Conservation & Land Management, Western Australia. Accessed 2004.
- Close, D. & Dixon, K. (2005) *Research Plan for Conservation of Nationally Threatened *Conospermum undulatum* and *Macarthuria keigheryi* on Westralia Airports Corporation Bushland*. Kings Park Botanic Gardens and Parks Authority, Western Australia.
- Department of Environmental Protection (2000). *Bush Forever Volume 2 Directory of Bush Forever Sites*, Department of Environmental Protection, Perth WA.
- Evans, R., Willers, N. and Mitchell, D. (2003) Threatened Flora of Swan Region. Unpublished report to the Department of Conservation and Land Management, and Environment Australia.
- World Conservation Union (2001) *IUCN Red List Categories prepared by the IUCN Species Survival Commission, as approved by the 51st meeting of the IUCN Council*. Gland, Switzerland.
- Keighery, B. (2001). Conservation Category Wetlands in Bush Forever Site 28 East of McDowell Street. WA Department of Conservation and Land Management - Wildlife Conservation Flora - *Macarthuria keigheryi*. 1998F003682. 84-86.
- Lepschi B. J. (1996). A taxonomic revision of *Macarthuria*. *Nuytsia* 11(1). 12-13.
- Patrick, S. and Brown, A. (2001) *Declared Rare and Poorly Known Flora in the Moora District*. Department of Conservation and Land Management, Western Australia.
- Western Australian Herbarium (1998-) *FloraBase – The Western Australian Flora*. Department of Conservation and Land Management, Western Australia. <http://florabase.calm.wa.gov.au/> Accessed 2007.

6. TAXONOMIC DESCRIPTION

Lepschi B. J. (1996)

Erect **subshrub** to 40 cm tall. Stems terete, green, ageing yellowish-green in life: all vegetative parts and outer whorl of sepals hairy with more or less coarse, short, spreading, simple hairs (i.e. hirsute). **Leaves** sessile to obscurely petiolate, present mainly towards the base of the stems on young growth, becoming progressively reduced further up the stems; lamina obovate to very narrowly obovate or narrowly to very narrowly elliptic, 2.7-11.5 mm long, 0.7-3.5 mm broad; base cuneate to narrowly cuneate; apex shortly acuminate to narrowly acute. **Inflorescence** 1-25 (30) flowers in somewhat condensed cymes, becoming more diffuse in fruit, inserted terminally (or laterally) on the stems. **Bracts** rounded - triangular to triangular subulate, 1.2-4 mm long,

herbaceous with a narrow scarious margins, the herbaceous (inner 2 scarious, glabrous) with a scarious margins, the herbaceous portion hirsute, green, aging golden-yellow in life. **Petals** usually present (though sometimes absent), very narrowly obvolute to narrowly elliptic, 2-2.5 mm long, occasionally obscurely clawed. **Staminal** ring about one-third to half as long as the ovary; free branches 0.7-0.8mm long, stigma at apex. **Fruit** ovoid to more or less globular, 2.5-3 mm long. **Seeds** dark brown to almost black faintly reticulate-areolate to appear almost smooth, shiny broadly comma-shaped, 1.03-1.4mm long, and arils large.

