MEELUP MALLEE

(*EUCALYPTUS PHYLACIS*)

INTERIM RECOVERY PLAN

2004-2009

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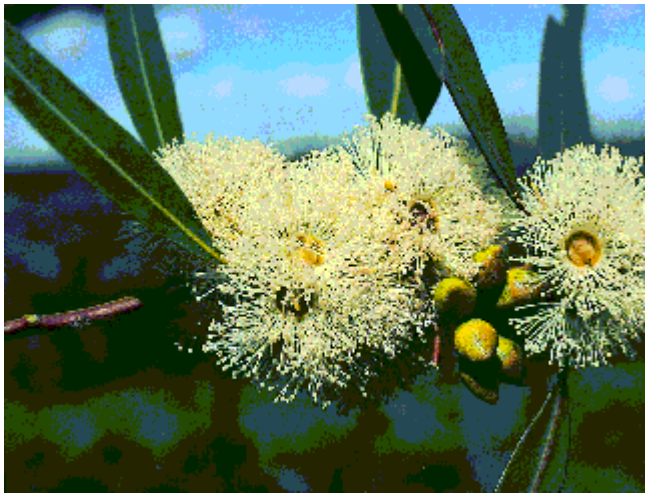

Photograph: A. Brown

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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 Interim Recovery Plan results from a review of, and replaces, No.104 *Eucalyptus phylacis* (Phillimore *et al*, 2002). This Interim Recovery Plan will operate from July 2004 to June 2009 but will remain in force until withdrawn or replaced. It is intended that, 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 on 16 July 2004 and was approved by the Director of Nature Conservation on 22 July 2004. The allocation of staff time and provision of funds identified in this Interim Recovery Plan is dependent on budgetary and other constraints affecting CALM, as well as the need to address other priorities.

Information in this IRP was accurate as at July 2004.

ACKNOWLEDGMENTS

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

Eric Bunn	Research Botanist, Botanic Garden and Parks Authority
Anne Cochrane	Research Scientist, CALM's Threatened Flora Seed Centre
Frank Podger	Forest Pathologist
Richard Robinson	Research Scientist, CALM's Science Division, Manjimup
Peter Scott	Honors Student, Murdoch University
Andrew Webb	Nature Conservation Officer, CALM's Blackwood District
Kim Williams	Program Leader Nature Conservation, CALM's South West Region

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

SUMMARY

Scientific Name:	*Eucalyptus phylacis*	**Common Name:**	Meelup Mallee
Family:	Myrtaceae	**Flowering Period:**	February-March
CALM Region:	South West Region	**CALM District:**	Blackwood
Shire:	Busselton	**Recovery Team:**	South West Region Threatened Flora and Communities Recovery Team (SWRTFCRT)

Illustrations and/or further information: Brooker, M.I.H. and Kleinig, D.A. (1990) *Field Guide to Eucalypts*. Volume 2, South-western and Southern Australia. Inkata press, Melbourne and Sydney; Brown, A., Thomson-Dans, C. and Marchant, N. (Eds). (1998) *Western Australia's Threatened Flora*. Department of Conservation and Land Management, Western Australia; Hill, K.D. and Johnson, L.A.S. (1992) Systematic studies in the eucalypts. 5. New taxa and combinations in *Eucalyptus* (Myrtaceae) in Western Australia, *Telopea* 4(4), 561-634.

Current status: *Eucalyptus phylacis* was declared as Rare Flora in September 1987 under the Western Australian *Wildlife Conservation Act 1950* and is currently ranked as Critically Endangered (CR). The species is also listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation* Act 1999 (EPBC Act). It currently meets World Conservation Union (IUCN 2000) Red List Category Critically Endangered (CR) under criterion D as there are less than 50 mature individuals in the wild. The main threats are insect damage, aerial canker, and inappropriate fire regimes. Road maintenance activities, poor genetic diversity, and poor regeneration are minor threats to the population.

Description: *Eucalyptus phylacis* is a mallee or small tree to 5 m tall with distinctive coarse, non-fibrous, loose, rough bark overlying thick, corky bark. It is related to *E. decipiens* but differs in its non-emarginate juvenile leaves, larger buds and fruit, and broadly conical opercula (Brooker and Kleinig 1990). The juvenile leaves are almost round and entire. Adult leaves are concolorous, faintly glossy and blue-grey green. The inflorescence is axillary, with white flowers (Brown *et al*. 1998).

Habitat requirements: *Eucalyptus phylacis* is found on the crest of a near-coastal ridge, growing in loamy granitic and lateritic soils. Habitat consists of open low woodland of *E. calophylla* and *E. marginata* over low scrub of *Acacia extensa*, *Xanthorrhoea preissii*, *X. gracilis*, *Hakea lissocarpha*, *Melaleuca* sp. and *Allocasuarina humilis*.

Critical habitat: The critical habitat for *Eucalyptus phylacis* is the remnant vegetation in which it occurs, areas of similar habitat i.e. loamy granitic and lateritic soils in open low woodland of *Eucalyptus calophylla* and *E. marginata*, within 200 metres of the known population, corridors of remnant vegetation that link subpopulations, and additional 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 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 threatened flora or communities in the habitat of *Eucalyptus phylacis*. However, recovery actions implemented to improve the quality or security of the habitat of *Eucalyptus phylacis* will also improve the status of remnant vegetation in which it is 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. The taxon is not listed under any specific international treaty, however, and therefore this IRP does not affect Australia's obligations under any other international agreements.

Role and interests of indigenous people: According to the Department of Indigenous Affairs Aboriginal Heritage Sites Register, no sites have been discovered near the *Eucalyptus phylacis* population. Input and involvement will be sought from any indigenous groups that have an active interest in the areas that are habitat for *E. phylacis*, and this is discussed in the recovery actions.

Social and economic impact: The implementation of this recovery plan is unlikely to cause significant adverse social and economic impact. Recovery actions will involve liaison and cooperation with all stakeholders.

Evaluation of the Plan's Performance: The Department of Conservation and Land Management (CALM), in conjunction with the South West Region Threatened Flora and Communities Recovery Team (SWRTFCRT) will evaluate the performance of this IRP. In addition to annual reporting on progress and evaluation against the criteria for success and failure, the plan will be reviewed following five years of implementation.

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

1. The Shire of Busselton has been formally notified of the presence and threatened nature of the population of *Eucalyptus phylacis* on land they manage.
2. Declared Rare Flora (DRF) markers have been installed at Subpopulation 1a. These alert workers of the presence of threatened flora and help prevent accidental damage during maintenance operations.
3. Dashboard stickers and posters, including an illustration, information on the purpose of DRF markers, and a contact telephone number have been produced and distributed.
4. A poster has been produced that provides a description of *Eucalyptus phylacis*, and information about threats and recovery actions.
5. In January 1996, *Eucalyptus phylacis* trees were injected with an insecticide, dimethylate, to control borers.
6. In February 1996, a car park immediately adjacent to *Eucalyptus phylacis* was removed by ripping. Rehabilitation was then undertaken in 1997 by the Meelup Regional Park Management Committee (MRPMC).
7. In 1996 samples of *Eucalyptus phylacis* were tested for fungus, and *Botryosphaeria* and *Cytospora* cankers were identified.
8. *Eucalyptus phylacis* material was collected for tissue culture by Botanic Garden and Parks Authority (BGPA) in 1996, 1999 and 2001; and successfully propagated in 2001.
9. In June 2001, damaged limbs on one *Eucalyptus phylacis* tree were removed to simulate fire. The stem was sprayed with sealant to prevent infestation by fungus. Preliminary results from the trial are promising in the management of aerial canker.
10. Volunteers from the MRPMC are undertaking twice yearly monitoring of the health of eight ramets of *Eucalyptus phylacis*.
11. A fire response strategy for the area containing *Eucalyptus phylacis* has been prepared and incorporated into the Blackwood District's Fire Control Working Plan.
12. An article about cloning of *Eucalyptus phylacis* through tissue culture was placed in a magazine and a newsletter by Botanic Gardens and Parks Authority (BGPA).
13. In 2003, a Murdoch University Honors student completed a study entitled "The Analysis and Identification of possible causal agents of canker formation in *Eucalyptus phylacis* (Meelup Mallee) from Cape Naturaliste in the south west of Western Australia".
14. A small amount of seed collected by CALM's Threatened Flora Seed Centre in 2003 germinated.
15. The South West Region Threatened Flora and Communities Recovery Team (SWRTFCRT) is overseeing the implementation of this IRP.
16. Staff from CALM's Blackwood District office regularly monitor the population.

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

Recovery criteria

Criteria for success: The number of individuals within populations and/or the number of populations have been maintained or increased 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 over the period of the plan's adoption under the EPBC Act.

Recovery actions

1. Coordinate recovery actions.	9. Test for *Phytophthora* sp. resistance.
2. Map critical habitat.	10. Implement disease hygiene measures.
3. Develop and implement a coppice treatment strategy.	11. Monitor population.
4. Develop and implement a strategy to control insect borers and canker pathogens.	12. Liaise with relevant land managers.
5. Develop and Implement an Emergency Response Plan.	13. Obtain biological and ecological information.
6. Collect seed.	14. Promote awareness.
7. Undertake genetic testing of seedlings.	15. Conduct further surveys.
8. Develop a cryostorage protocol for long term storage of tissue cultured shoot apices.	16. Review the need for a full Recovery Plan

1. BACKGROUND

History

Eucalyptus phylacis was originally discovered by Neville Marchant from CALM's Western Australian Herbarium in 1981. The original collection was then made by K.H. Rechinger in 1982. Further collections have since been made but are all from the same location.

Eucalyptus phylacis is currently known from a single clonal population, which comprises around 27 ramets (individual plants within the clone) over a range of around 0.09 hectares. Due to past road maintenance activities the population is split into 4-5 fairly distinct groups (3-4 on the eastern side of the road and a single plant on the western side). The restricted geographic distribution of the population makes the species highly vulnerable to any localised event which could bring about the extinction of the species in the wild.

An Interim Recovery Plan was developed for the species in 2002 (Phillimore *et al*. 2002). Information collected since that plan was completed has been incorporated into this plan and this document now replaces IRP No.104 *Eucalyptus phylacis* (Phillimore *et al*. 2002).

Description

Eucalyptus phylacis is a mallee or small tree to 5 m tall with distinctive coarse, non-fibrous, loose, rough bark overlying thick, corky bark. It is related to *E. decipiens* but differs in its non-emarginate juvenile leaves, larger buds and fruit, and broadly conical opercula (Brooker and Kleinig 1990). The juvenile leaves are almost round and entire. Adult leaves are concolorous, faintly glossy and blue-grey green. The inflorescence is axillary, with white flowers (Brown *et al*. 1998).

Distribution and habitat

Eucalyptus phylacis is endemic to the Meelup area of Western Australia. It is found on the crest of a near-coastal ridge, growing in loamy granitic and lateritic soils. Habitat consists of open low woodland of *E. calophylla* and *E. marginata* over low scrub of *Acacia extensa*, *Xanthorrhoea preissii*, *X. gracilis*, *Hakea lissocarpha*, *H. trifurcata*, *Gastrolobium spinosum*, *Melaleuca systena*, *Calothamnus sanguineus* and *Allocasuarina humilis*.

Originally the population was larger, but prior to its discovery a scenic lookout was placed in the middle of the population destroying an unknown number of ramets. Since the significance of the species has become known, the lookout has been moved and the original site rehabilitated (Robinson and Spencer in prep).

Biology and ecology

Eucalyptus phylacis was originally thought to be a hybrid, as it had not produced any viable seed even though it flowers abundantly. Extensive searches throughout the region have, however, failed to find a second parent taxon that may have hybridised with *E. decipiens* which is a close relative of *E. phylacis*. It is possible that the other parent species is now extinct. No genotypic differences were detected in a sample of 20 *E. phylacis* ramets studied. This suggests that they are all from the same clone. If *E. phylacis* is indeed a hybrid, and no new populations are located, then the criteria for success that considers increasing the number of individuals may not be achievable as any additional 'individuals' produced from parent material will be clonal. Material that is clonal in origin cannot be considered as representing 'individuals' as it is genetically identical to the parent.

The distance between the mallee ramets suggests that the plant is very old, possibly more than 6380 years (Rossetto *et al*. 1999), and as old as 6660 years (Scott 2003). This indicates that it is potentially one of the oldest eucalypts on record.

Bark borers and fungal pathogens (canker) are damaging *Eucalyptus phylacis* trees. Bark splitting is evident on a high proportion of main branches. Smaller splits occur on younger branches. The proportion of open splitting was

found to be greater on stems that were more than 5 cm in diameter (Scott 2003). Borers and termites may be a secondary consequence of pathogens causing branch and stem cracks (personal communication F. Podger[1]). Alternative views suggest that diseases such as canker, and dieback caused by the plant pathogen *Phytophthora cinnamomi*, are secondary and invade unhealthy trees after borers. Whichever view is correct, nearly every stem of the plants has become infected since canker was noted in 1995. In a comprehensive study by P. Scott in 2003, 17 different species of fungi were isolated on *E. phylacis*. The main types were *Cytospora eucalylocoda* (34%), *Botryosphaeria sp.* (32%), *Endotheilla* (4%) and *Ravostrama* (4%) (Scott 2003).

It appears that *Eucalyptus phylacis* resprouts following fire, as vigorous coppice growth occurred at the base of a tree burnt in 1985 (personal communication R. Robinson[2]). Recent fire simulation through removal of damaged stems followed by ash treatment has also resulted in vigorous coppice growth. As healthy vigorous plants are more resistant to pathogen attack and canker diseases are more common in stressed and ageing individuals (Old and Davison 2000), it is anticipated that the coppice will be resistant to infection and canker development (Robinson and Spencer in prep). Future monitoring will determine whether this is the case, but after two years all stems are canker free.

Until recently it appeared that *Eucalyptus phylacis* did not produce much viable seed, despite prolific flowering. However in September 2003, a small number of fruits and six seeds were collected. Three of these seeds have since germinated (personal communication A. Cochrane[3]) The morphology and genetics of these plants will be investigated as the plants develop.

In vitro establishment of vegetative material (shoot and node material) of *Eucalyptus phylacis* has proved difficult. Analysis of this material by Botanic Garden and Parks Authority (BGPA) has revealed that it contains higher levels of phenolic compounds in the stems and leaves compared to other eucalypt species. This may be hampering the establishment of *in vitro* cultures. Nevertheless, this problem has recently been overcome and young shoot material has been produced (personal communication E. Bunn[4]). Three plants are currently growing in pots at the nursery at the Botanic Parks and Garden Authority and more work is planned for 2004.

Threats

Eucalyptus phylacis, formerly known as *Eucalyptus* sp. (Cape Naturaliste) Rechinger K.H., was declared as Rare Flora in September 1987 under the Western Australian *Wildlife Conservation Act 1950* and is currently ranked as Critically Endangered (CR). The species is also listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation* Act 1999 (EPBC Act). It currently meets World Conservation Union (IUCN 2000) Red List Category Critically Endangered (CR) under criterion D as the population size is estimated to be fewer than 50 mature individuals. The main threats are insect damage, aerial canker, and inappropriate fire regimes. Poor genetic diversity, poor regeneration, and road maintenance activities are also minor threats to the population.

- **Insect damage** caused by *Phoracantha* sp. (Cerambycidae) (Longicorn or Longhorn beetles) and borers have caused stress damage to *Eucalyptus phylacis* stems in the past. All stems are affected on some trees, while only one or two stems are affected on others. The beetle larvae damage has caused extensive fissures in the bark that has introduced a secondary fungal pathogen.

- **Aerial canker** is a major threat to the *Eucalyptus phylacis* population. Stem death is evident, and *Cytospora eucalylocoda, Botryosphaeria sp., Endotheilla,* and *Ravostrama* aerial canker fungi have been isolated from cankers. Dieback disease is present in the park in which the species occurs, but it has not been determined if the habitat of *E. phylacis* or the plants themselves are infected with the disease.

[1] Frank Podger, Forest Pathologist
[2] Dr Richard Robinson, Research Scientist, CALM's Science Division
[3] Anne Cochrane, Research Scientist, CALM's Threatened Flora Seed Centre
[4] Eric Bunn, Research Botanist, BGPA

- **Inappropriate fire regimes** would impact on the viability of the population. It is likely that occasional fires are required for regeneration as with other mallee eucalypt species. However a large fire could be catastrophic for this species. An unknown number of ramets in the population were determined to have been burnt in 1985, and it is likely that the remaining ramets have not been burnt during the last 40 years.

- **Poor genetic diversity,** is indicated as all known wild and micropropagated plants originate from the one clone. The genetics and adult morphology of the most recent plants germinated from seed in 2003 are unknown. Limited genetic diversity would restrict the species' capacity to adapt to changes in its environment.

- **Poor regeneration**, probably due to lack of fertile propagules, and/or appropriate disturbance, threatens the population as very little regeneration of *Eucalyptus phylacis* has been observed. Bark splits and limb deaths are common, and the plants are old and senescing. The species is suspected to be a hybrid and to date has produced few viable seeds. The main method of regeneration of *Eucalyptus phylacis* is through resprouting. Lack of other regeneration threatens the health and resilience of the species.

- **Road maintenance activities** may threaten the *Eucalyptus phylacis* plants along the road verge. Threats include actions such as grading of road reserves and access tracks, spraying of chemicals, constructing drainage channels and slashing or completely removing the roadside vegetation to improve visibility. These disturbance events also often encourage weed invasion into adjacent habitat, as well as causing damage to actual plants.

Summary of population information and threats

Pop. No. & Location	Land Status	Year/No. ramets	Condition	Threats
1A. W of Busselton	Shire Road Reserve	1986 6 1988 5 1990 5 1991 5 1993 5 1995 6 1996 6 2000 *27 2001 *27 2002 *27 2003 *27	Moderate/ Poor	Insect damage, aerial canker, inappropriate fire regimes, poor genetic diversity, poor regeneration, road maintenance activities
1B. W of Busselton	Conservation and Recreation Reserve	1986 13 1988 13 1990 13 1991 13 1993 13 1995 13 2000 *27 2001 *27 2002 *27 2003 *27	Moderate	Insect damage, aerial canker, inappropriate fire regimes, poor genetic diversity, poor regeneration.

* = total for subpopulations a and b combined.

Guide for decision-makers

Section 1 provides details of current and possible future threats. Developments in the immediate vicinity of any of the populations or within the defined critical habitat of *Eucalyptus phylacis* require assessment. No developments should be approved unless the proponents can demonstrate that they will have no significant impact on the species, its habitat or potential habitat, the local surface water hydrology, or have the potential to spread or amplify any disease such as *Phytophthora cinnamomi* or aerial canker.

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 (*Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)).

Eucalyptus phylacis 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 the known population,
- areas of similar habitat ie. loamy granitic and lateritic soils in open low woodland of *Eucalyptus calophylla* and *E. marginata*, within 200 metres of the known population (these provide potential habitat for natural range extension),
- corridors of remnant vegetation that link subpopulations (these are necessary to allow pollinators to move between subpopulations, and consist of road reserves),
- additional occurrences of similar habitat ie. loamy granitic and lateritic soils in open low woodland of *E. calophylla* and *E. marginata*, that do not currently contain the species (these represent possible translocation sites).

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 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 threatened flora or communities in the habitat of *Eucalyptus phylacis*. However, recovery actions implemented to improve the quality or security of the habitat of *Eucalyptus phylacis* will also improve the status of remnant vegetation in which it is 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. The taxon is not listed under any specific international treaty, however, and therefore this IRP does not affect Australia's obligations under any other international agreements.

Role and interests of indigenous people

According to the Department of Indigenous Affairs Aboriginal Heritage Sites Register, no sites have been discovered near the *Eucalyptus phylacis* population. Input and involvement will be sought from any indigenous groups that have an active interest in the areas that are habitat for *E. phylacis*, and this is discussed in the recovery actions.

Social and economic impacts

The implementation of this recovery plan is unlikely to cause significant adverse social or economic impact. Recovery actions will involve liaison and cooperation with all stakeholders including the Shire of Busselton.

Evaluation of the Plan's Performance

CALM, in conjunction with the South West Region Threatened Flora and Communities Recovery Team will evaluate the performance of this IRP. In addition to annual reporting on progress and evaluation against the criteria for success and failure, the plan will be reviewed following five years of implementation.

2. RECOVERY OBJECTIVE AND CRITERIA

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

Criteria for success: The number of individuals within populations and/or the number of populations have been maintained or 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

The Shire of Busselton has been formally notified of the presence and threatened nature of the population of *Eucalyptus phylacis* on and adjacent to land that they manage. The notification details the Declared Rare status of the taxon and the associated legal responsibilities.

Declared Rare Flora (DRF) markers have been installed at Subpopulation 1a. These alert workers to the presence of threatened flora and help to prevent accidental damage during maintenance operations. An awareness of the markers is being promoted to relevant bodies such as Shires through dashboard stickers and posters. These illustrate DRF markers, inform of their purpose and provide a contact telephone number if such a marker is encountered.

An A4 sized poster, that provides a description of the species and information about threats and recovery actions, has been developed for *Eucalyptus phylacis*. It is hoped that the information provided in the poster will result in the discovery of new populations.

In January 1996, *Eucalyptus phylacis* trees were injected with an insecticide, dimethylate, in an attempt to control borers. An inspection of the trees was carried out in June 1997 and all appeared healthy except for the death of an old heavily borer damaged stem.

In February 1996, the car park adjacent to the population of *Eucalyptus phylacis* was removed by ripping. In June 1997, rehabilitation was undertaken by the Meelup Regional Park Management Committee (MRPMC) on the old car park site. Debris accumulated under the trees and from the road verge was raked out and spread over the site, and weeds were controlled using Roundup.

In 1996 samples of *Eucalyptus phylacis* were tested for fungus by CALM's Science Division Vegetation Health Service, and *Botryosphaeria* and *Cytospora* cankers were identified.

Eucalyptus phylacis material was collected by BGPA in 1996, 1999 and 2001 for tissue culture. In 2001, attempts at propagation were successful with a number of shoots growing on material collected (personal communication E. Bunn). There are currently three plants which are approximately twelve centimeters high growing in pots at BGPA. The BGPA is maintaining current tissue cultures and continuing to propagate new cultures of *E. phylacis.*

An experiment designed to simulate regeneration following fire was undertaken by CALM staff in June 2001 in response to increased canker activity causing tree limb death and decline of foliage health. The worst affected ramet (individual group of stems) was coppiced and the cut surfaces sealed to prevent fungal infection. The stems

were analysed for canker and other organisms, and age dated by counting growth rings. Residual material was burnt off site, and distributed around the stump. The coppiced plant was then fenced to prevent grazing during regeneration. A paper entitled "Coppice treatment gives hope to rare and endangered mallee eucalypt in the south-west of Western Australia" by Dr R Robinson and M. Spencer is now being completed.

A monitoring program has been devised to measure health and growth of *Eucalyptus phylacis*. Eight ramets with approximately seven stems each have been tagged and data including stem diameter at a height of 1.3m off the ground, the number, size and state of splits or lesions in the bark at various heights, any insect activity, and stem and leaf health are recorded twice a year. This is done in January/February, and in August by volunteers from the MRPMC.

A fire response strategy for the area containing *Eucalyptus phylacis* has been prepared and incorporated into the Blackwood District's Fire Control Working Plan.

An article on cloning of *Eucalyptus phylacis* through tissue culture was placed in 'Switched On', the Western Power Newsletter in March/April 1998 and in the 'Friends of Kings Park Magazine', in the winter 2000 issue (Bunn 2000).

In 2003 Peter Scott, an Honors Student at Murdoch University, completed a study entitled "The Analysis and Identification of possible causal agents of canker formation in *Eucalyptus phylacis* (Meelup Mallee) from Cape Naturaliste in the south west of Western Australia". The results of this study indicate that stems of *Eucalyptus phlacis* larger than 5cm have more open splitting in the stems and more canker damage than smaller stems.

Until recently it appeared that *Eucalyptus phylacis* did not produce much seed, despite prolific flowering. However in September 2003, a small number of fruits were collected by staff from CALM's Threatened Flora Seed Centre (TFSC) and these contained six seeds. Three of these seeds have since germinated (personal communication A. Cochrane).

The South West Region Threatened Flora and Communities Recovery Team (SWRTFCRT) is overseeing the implementation of this IRP and will include information on progress in its annual report to CALM's Corporate Executive and funding bodies.

Staff from CALM's Blackwood District office regularly monitor the population.

Future recovery actions

Where populations occur on lands other than those managed by the Department, permission has been or will be sought from the 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 SWRTFCRT will continue to coordinate the implementation of recovery actions for *Eucalyptus phylacis* and will include information on progress in their annual report to CALM's Corporate Executive and funding bodies.

Action: Coordinate recovery actions
Responsibility: CALM (South West Region) through the SWRTFCRT
Cost: $2,000 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 (Blackwood District, WATSCU) through the SWRTFCRT
Cost: $500 in the first year.

3. Develop and implement a coppice treatment strategy

The future of the known *Eucalyptus phylacis* population depends on rejuvenating the health and vigor of the stand. A program of gradual coppice treatment, where one or two individuals are coppiced in spring as plant health and conditions determine, will be developed in consultation with stakeholders and land managers.

Action: Develop and implement a coppice treatment strategy
Responsibility: CALM (Blackwood District, Science Division, WATSCU, BGPA) through the SWRTFCRT
Cost: $1,200 in first year, $200 in following years.

4. Develop and implement a strategy to control insect borers and canker pathogens

A strategy will be developed and implemented to treat insect borers and cankers. Application of insecticides and fungicides will be trialed and monitored to determine effectiveness.

Action: Develop and implement a strategy to control insect borers and canker pathogens
Responsibility: CALM (Blackwood District) through the SWRTFCRT
Cost: $1,200 in first year and $600 in subsequent years.

5. Develop and Implement an Emergency Response Plan

Fire or techniques that simulate fire appear to stimulate a regeneration response in *Eucalyptus phylacis.* However too frequent fire is likely to deplete the mallee root storage, and lead to habitat degradation including an increase in weed invasion. A Fire Control Working Plan has been developed for the Blackwood District but an Emergency Response Plan is required for *Eucalyptus phylacis*. Other fire fighting agencies will be informed of appropriate responses to fire threatening this site. Firebreaks will continue to be maintained.

Action: Develop and Implement an Emergency Response Plan
Responsibility: The Department (Blackwood District) through the SWRTFCRT
Cost: $1,100 per year.

6. Collect seed

Due to the unprecedented germination of three seeds collected in 2003, the collection of seed will be resumed.

Action: Collect seed
Responsibility: CALM (TFSC) and BGPA, through the SWRTFCRT
Cost: $500 per year.

7. Undertake genetic testing of seedlings

Morphological and genetic testing of the three seedlings produced in 2003, as well as any future seedlings produced, will help determine whether the seed was produced from *Eucalyptus phylacis* self pollinating, or if the seed was produced from outcrossing with another species.

Action: Undertake genetic testing of seedlings
Responsibility: CALM (TFSC, Science Division) through the SWRTFCRT
Cost: $1,000 per year.

8. Develop a cryostorage protocol for long term storage of tissue cultured shoot apices

BGPA is currently maintaining tissue cultures of *E. phylacis* and developing a cryostorage protocol for long term storage of tissue cultured shoot apices. This will ensure that viable genetic material is maintained regardless of the fate of the parent stock in the wild.

Action: Develop a cryostorage protocol for long term storage of tissue cultured shoot apices
Responsibility: BGPA through the SWRTFCRT
Cost: $8000 in first and second years

9. Test for *Phytophthora* sp. resistance

Testing to determine the resistance of *Eucalyptus phylacis* to *Phytophthora* sp. will be carried out on some of the clones held by BGPA or on material that is cultured in future.

Action: Test for *Phytophthora* sp. resistance
Responsibility: CALM (TFSC, Dieback Disease Coordinator), through the SWRTFCRT
Cost: $300 in first year.

10. Implement disease hygiene measures

Dieback is present in the park in which the species occurs but it is not known if the site that contains *Eucalyptus phylacis* or the plants themselves are infected with the disease. Many flora species in the plant community are presumed susceptible to this disease, however. It is necessary to maintain disease hygiene measures to reduce the likelihood of introducing or amplifying the impacts of disease. Dieback hygiene (outlined in Department of Conservation and Land Management 2003) will therefore be adhered to for activities such as installation and maintenance of firebreaks and walking into the population in wet soil conditions. If *E. phylacis* is shown to be susceptible to *Phytophthora* sp., the entire population will be fenced to prevent the transfer of infected soils.

Action: Implement disease hygiene measures
Responsibility: CALM (Blackwood District) through the SWRTFCRT
Cost: $3,200 in the first year.

11. Monitor population

Monitoring of factors such as insect and canker damage, weed invasion, habitat degradation, population health and stability (expansion or decline), pollinator activity, seed production, recruitment, and longevity is essential. The population will be inspected annually.

Action: Monitor population
Responsibility: CALM (Blackwood District) through the SWRTFCRT
Cost: $1,400 per year.

12. Liaise with relevant land managers

The Shire of Busselton has been officially notified of the occurrence of the species. Staff from CALM's Blackwood District will continue to liaise with the current land managers, including the Meelup Regional Park Management Committee, to help ensure continued awareness of the population, and that it is not damaged or destroyed accidentally. Input and involvement will also be sought from any indigenous groups that have an active interest in areas that are habitat for *Eucalyptus phylacis*.

Action: Liaise with relevant land managers
Responsibility: CALM (Blackwood District) through the SWRTFCRT
Cost: $1,200 per year.

13. Obtain biological and ecological information

Increased knowledge of the biology and ecology of the species will provide a scientific basis for management of *Eucalyptus phylacis* in the wild. Investigations will include:

1. A study of the effect of disturbance (such as coppicing and fire), competition, rainfall and grazing on stem production.
2. Determining reproductive strategies, phenology and seasonal growth.
3. Determining time when flowering first occurs following disturbance, and the age at which stem splitting and senescence is reached.

Action: Obtain biological and ecological information
Responsibility: CALM (Science Division, Blackwood District) through the SWRTFCRT
Cost: $10,000 per year.

14. Promote awareness

The importance of biodiversity conservation and the need for the long-term protection of *Eucalyptus phylacis* in the wild will be promoted to the public through the local print, electronic media and poster displays. Formal links with local naturalist groups and interested individuals will continue to be encouraged.

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

Action: Promote awareness
Responsibility: CALM (Blackwood District, Strategic Development and Corporate Affairs) through the SWRTFCRT
Cost: $900 per year.

15. Conduct further surveys

No new populations of *Eucalyptus phylacis* have been located in surveys of the Leeuwin/Naturaliste Ridge and surrounding areas of remnant vegetation. However, it is speculated that *E. phylacis* is a hybrid of *E. decipiens*. Therefore areas that contain *E. decipiens* provide likely search areas. Interested groups such as the Meelup Regional Park Management Committee, Wildflower Society members and Naturaliste's Clubs will be encouraged to be involved in further surveys supervised by CALM's staff. These will be conducted during the species' flowering period (February to March).

Action: Conduct further surveys
Responsibility: CALM (Blackwood District) through the SWRTFCRT
Cost: $2,400 per year.

16. Review the need for a full Recovery Plan

At the end of the fourth year of the five-year term of this Interim Recovery Plan, the need for further recovery will be assessed. If the taxon is still classified as threatened at that time the need for further recovery actions, a full Recovery Plan or to update this IRP will be assessed.

Action: Review the need for a full Recovery Plan
Responsibility: CALM (WATSCU, Blackwood District) through the SWRTFCRT
Cost: $15,000 in the fifth year (if full Recovery Plan is required)

4. TERM OF PLAN

This Interim Recovery Plan will operate from July 2004 to June 2009 but will remain in force until withdrawn or replaced. If the taxon is still ranked Critically Endangered, this IRP is likely to be replaced by a full Recovery Plan after five years.

5. REFERENCES

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6. TAXONOMIC DESCRIPTION

Hill, K.D. and Johnson, L.A.S. (1992) Systematic studies in the eucalypts. 5. New taxa and combinations in *Eucalyptus* (Myrtaceae) in Western Australia, *Telopea* 4(4), 561-634.

Tree to 5 m. *Bark* persistent on trunk and large branches, rough, coarsely flaky, light grey-brown; outer branches smooth. *Juvenile leaves* disjunct, blue-grey, ovate to orbicular, to 5 cm long, 4 cm wide. *Adult leaves* disjunct, lanceolate to broad lanceolate, acute or acuminate, falcate, dull, 6-13 cm long, 11-30 mm wide; petioles channeled above, 7-16 mm long; lateral veins at 30-45° to midrib, ± closely spaced, regular, densely reticulate between; intramarginal vein distinct, 0.5-1.5 mm from margin. *Umbellasters* axillary, 7-11 flowered; peduncles terete, 7-11 mm long; pedicels terete, 1-2 mm long. *Mature buds* ovoid, 8-10 mm long, 4-5 mm diam.; calyptra conical, convex, obtuse, ± as long as hypanthium. *Fruits* cup-shaped or hemispherical, 3-4 locular, 5-7 mm long, 7-9 mm diam.; calyptra scar raised, angled incurved at c. 45°, c. 0.5 mm wide; disc ± flat, convex, 1.5-2.0 mm wide (with distinctive radial cracks crossing disc, scar and hypanthium caused by subsequent internal growth of fruit); style persistent, frequently remaining attached to one valve in open fruits; valves enclosed at base, vertically exserted, triangular.

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	1000	1000		1000	1000		1000	1000		1000	1000		1000	1000	
Map critical habitat	100		400												
Develop and implement a coppice treatment strategy to improve health of existing stand	800		400	100		100	100		100	100		100	100		100
Develop and implement a strategy to control insect borers and canker pathogens	800		400	200		400	200		400	200		400	200		400
Develop and Implement an Emergency Response Plan	300		800	300		800	300		800	300		800	300		800
Collect seed	200		300	200		300	200		300	200		300	200		300
Undertake genetic testing of seedlings	500		500	500		500	500		500	500		500	500		500
Develop a cryostorage protocol for long term storage		8000			8000										
Test for *Phytophthora* sp. resistance	200		100												
Implement disease hygiene measures	800		2400												
Monitor population	900		500	900		500	900		500	900		500	900		500
Liaise with relevant land managers	1200			1200			1200			1200			1200		
Obtain biological, and ecological and genetic	5000		5000	5000		5000	5000		5000	5000		5000	5000		5000
Promote awareness	900			900			900			900			900		
Conduct further surveys	1000	500	900	1000	500	900	1000	500	900	1000	500	900	1000	500	900
Review the need for a full Recovery Plan													5000		10000
Total	**13700**	**9500**	**11700**	**11300**	**9500**	**8500**	**11300**	**1500**	**8500**	**11300**	**1500**	**8500**	**16300**	**1500**	**18500**
Yearly Total	**34900**			**29300**			**21300**			**21300**			**36300**		

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

Total CALM: $63,900
Total Other: $23,500
Total External Funding: $55,700
Total Costs: $143,100

Australian Government

Department of the Environment and Heritage

ADDENDUM

Meelup Mallee (*Eucalyptus phylacis*) Interim Recovery Plan 2004-2009

In adopting this plan under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), the Minister for the Environment and Heritage has approved the addition of the following information.

Critical Habitat

The plan identifies critical habitat as including areas located a set distance around known populations which contain habitat similar to that in which the species occurs, as well as areas that do not currently contain the species but may have done so in the past. These areas identified in the plan do not represent areas of critical habitat as defined under section 207A of the EPBC Act, nor do they represent habitats that are critical to the survival of the species identified pursuant to Section 270(2)(d) of the EPBC Act. Habitats identified in Section 270(2)(d) are limited to the area of occupancy of known populations.