INTERIM RECOVERY PLAN NO. 104

MEELUP MALLEE

(*EUCALYPTUS PHYLACIS*)

INTERIM RECOVERY PLAN

2002-2007

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Photograph: A. Brown

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Government of Western Australia

DEPARTMENT OF Conservation AND LAND MANAGEMENT
Conserving the nature of WA

FOREWORD

Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Conservation and Land Management (the Department) 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.

The Department is committed to ensuring that Critically Endangered taxa are conserved through the preparation and implementation of Recovery Plans or Interim Recovery Plans and by ensuring that conservation action commences as soon as possible and always within one year of endorsement of that rank by the Minister.

This Interim Recovery Plan will operate from March 2002 to February 2007 but will remain in force until withdrawn or replaced. It is intended that, if the taxon is still ranked Critically Endangered, this IRP will be replaced by a full Recovery Plan after five years.

This IRP was approved by the Acting Director of Nature Conservation on 24 September, 2002. The provision of funds identified in this Interim Recovery Plan is dependent on budgetary and other constraints affecting the Department, as well as the need to address other priorities.

Information in this IRP was accurate at March 2002.

SUMMARY

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

Illustrations and/or further information: Brown, A., Thomson-Dans, C. and Marchant, N. (Eds). (1998) *Western Australia's Threatened Flora*. Department of Conservation and Land Management, Western Australia; 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; 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 to be Rare Flora in July 1992 and ranked as Critically Endangered (CR) in September 1995. It currently meets World Conservation Union (IUCN 2000) Red List Category 'CR' under criteria D as there are less than 50 mature individuals. The main threats are poor genetic diversity, poor regeneration, insect damage, aerial canker, inappropriate fire regimes and road maintenance activities.

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 ie. 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 ie. loamy granitic and lateritic soils in open low woodland of *E. calophylla* and *E. marginata*, that do not currently contain the species.

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 or adjacent to their land.
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.
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 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.
10. A monitoring program is being implemented for *Eucalyptus phylacis* to measure the health of the species.
11. An article about cloning of *Eucalyptus phylacis* through tissue culture was placed in a magazine and a newsletter.
12. The South West Region Threatened Flora and Communities Recovery Team (SWRTFCRT) is overseeing the implementation of this IRP.
13. Staff from the Department'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 increased.
Criteria for failure: The number of individuals within populations and/or the number of populations have decreased.

Recovery actions

1. Coordinate recovery actions.
2. Stimulate and monitor regeneration.
3. Develop and implement a strategy to control insect borers and canker pathogens.
4. Collect germplasm.
5. Continue to rehabilitate habitat.
6. Implement disease hygiene measures.
7. Develop and implement a fire management strategy.
8. Liaise with relevant land managers.
9. Monitor population.
10. Promote awareness.
11. Conduct further surveys.
12. Obtain biological and ecological information.
13. Propagate plants for translocation.
14. Develop and implement a translocation proposal.

1. BACKGROUND

History

Eucalyptus phylacis was originally discovered by N. Marchant from the Department of Conservation and Land Management's (the Department's) Western Australian Herbarium in 1981. The original collection was then made by K.H. Rechinger in 1982. Further collections have since been made. Prior to being formally named it was known as *Eucalyptus* sp. Cape Naturaliste.

Eucalyptus phylacis is currently known from a single population, which comprises around 27 ramets (groups of stems) over a range of around 30m. The population is represented by a single clone, rather than a number of individual plants. The extremely localised nature of the population makes the species vulnerable to any localised event which could bring about the extinction of the species in the wild.

Description

Eucalyptus phylacis is a mallee or small tree to 5 m 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*.

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 that have the potential to be reintroduced. (Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999).

The critical habitat for *Eucalyptus phylacis* comprises:

- 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).

Biology and ecology

Eucalyptus phylacis was originally thought to be a hybrid, as it does not produce 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*. No genotypic differences were detected in a sample of 20 *E. phylacis* ramets studied. This suggests that they are all from the same clone. The distance between the mallee ramets also suggests that the plant is very old, possibly more than 6380 years. This indicates that it is potentially one of the oldest eucalypts on record (Rossetto *et al*. 1999).

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. Borers and termites may be a secondary consequence of pathogens causing branch and stem cracks (personal communication F. Podger[1]).

[1] Frank Podger, Forest Pathologist

Alternate views suggest that diseases such as canker, and dieback caused by the plant pathogen *Phytophthora cinnamomi*, are secondary and invade unhealthy trees after borers. Regardless, nearly every stem of many of the trees have become infected since canker was noted in 1995.

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, which may be hampering the establishment of *in vitro* cultures. Nevertheless, this has recently been overcome and young shoot material has been produced (personal communication E. Bunn[2]).

It appears that *Eucalyptus phylacis* resprouts following fire, as vigorous coppice growth occurred at the base of a tree burnt in a fire in 1985. Recent fire simulation through removal of damaged stems followed by ash treatment has also resulted in vigorous growth.

Threats

Eucalyptus phylacis was declared as Rare Flora in July 1992 and ranked as Critically Endangered (CR) in September 1995. It currently meets World Conservation Union (IUCN 2000) Red List Category 'CR' under criterion D as there are less than 50 mature individuals. The main threats are poor genetic diversity, poor regeneration, insect damage, aerial canker, inappropriate fire regimes and road maintenance activities.

- **Poor genetic diversity** is indicated as all known plants originated from the one clone. Limited genetic diversity would restrict the species' capacity to adapt to changes in its environment.

- **Poor regeneration**, probably due to lack of appropriate disturbance, threatens most populations as very little regeneration of *Eucalyptus phylacis* has been observed. Bark splits and limb deaths are present, and the plants are old and senescing. As the species produces no viable seed, and is likely to only be capable of regenerating through resprouting. This lack of regenerative capacity threatens the species as it reduces the species' ability to adapt to change.

- **Insect damage** caused by *Phoracantha* sp. (Cerambycidae) (Longicorn or Longhorn beetles) is causing stress to *Eucalyptus phylacis* trees. 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. Limb death is evident, with *Botryosphaeria* and *Cytospora* aerial cankers being identified. 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. Until recently it has not been possible to propagate young *E. phylacis* plants, therefore testing for dieback has not been possible.

- **Inappropriate fire regimes** would impact on the viability of the population. It is likely that occasional fires are required for regeneration.

- **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

[2] Eric Bunn, Research Botanist, BGPA

Pop. No. & Location	Land Statu`s	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	Moderate/ Poor	Poor genetic diversity, poor regeneration, insect damage, aerial canker, inappropriate fire regimes, 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	Moderate	Poor genetic diversity, poor regeneration, insect damage, aerial canker, inappropriate fire regimes

* = 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.

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 increased.

Criteria for failure: The number of individuals within populations and/or the number of populations have decreased.

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 or adjacent to their land. 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 of the presence of threatened flora and help prevent accidental damage during maintenance operations. An awareness of the markers is being promoted to relevant bodies such as Shire's 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 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. Trees injected were mapped to allow for monitoring of the progress. An inspection of the trees

was carried out in June 1997 and all appeared healthy except from one death of an old heavily borer damaged tree.

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 vegetation as well as from the road verge were raked out and spread over the site, and weeds were controlled using Roundup.

In 1996 samples of *Eucalyptus phylacis* were tested for fungus by the Vegetation Health Service at Curtin University of Technology, 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 were successful with a number of shoots growing on material collected (pers comm. E. Bunn).

Research designed to simulate regeneration following fire was undertaken in June 2001 by staff from the Department 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 by the Vegetation Health Unit, and age dated. Residual material was burnt off site, and distributed around the stump. The site was then fenced to prevent grazing during regeneration.

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.

An article about 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).

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 the Department's Corporate Executive and funding bodies.

Staff from the Department'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.

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 the Department's Corporate Executive and funding bodies.

Action: Coordinate recovery actions
Responsibility: The Department (South West Region) through the SWRTFCRT
Cost: $700 per year.

2. Stimulate and monitor regeneration

Fire has proved to be an effective method in stimulating coppice growth of *Eucalyptus phylacis* and initial results indicate techniques that simulate fire can provide similar regeneration responses. Plant regrowth, including time when flowering first occurs following disturbance, and the age at which senescence is reached will be monitored. This will enable the appropriate time interval between disturbances such as fire to be determined.

Action: Stimulate and monitor regeneration

Responsibility: The Department (Blackwood District) through the SWRTFCRT
Cost: $2,100 in first and second years, $600 thereafter.

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

A strategy to treat insect borers and cankers will be developed and implemented. Insecticide injections may be effective in controlling borers. This and other methods will be trialed and monitored to determine effectiveness.

Action: Develop and implement a strategy to control insect borers and canker pathogens
Responsibility: The Department (Blackwood District) through the SWRTFCRT
Cost: To be determined

4. Collect germplasm

Preservation of germplasm is essential to guard against extinction if the wild population is lost. As it is not possible to collect viable seed, other methods of germplasm storage will be used. These may involve living collections from cuttings or storage of tissue culture material.

Action: Collect germplasm
Responsibility: BGPA, through the SWRTFCRT
Cost: $1,100 in first and second years.

5. Continue to rehabilitate habitat

Rehabilitation of the old car park immediately adjacent to *Eucalyptus phylacis* will be continued. The area will be brushed with plant species endemic to the site.

Action: Continue to rehabilitate habitat
Responsibility: The Department (Blackwood District) through the SWRTFCRT
Cost: $2,500 in first and second years.

6. 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. Access to the area will be restricted, especially when the soil is moist. A sign advising of the disease risk will be posted at the site.

Action: Implement disease hygiene measures
Responsibility: The Department (Blackwood District) through the SWRTFCRT
Cost: $1,400 in the first year.

7. Develop and implement a fire management strategy

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 management strategy will be developed to determine fire control measures and fire frequency.

Action: Develop and implement a fire management strategy
Responsibility: The Department (Blackwood District) through the SWRTFCRT
Cost: $2,400 in first year and $1,000 in subsequent years.

8. Liaise with relevant land managers

The Shire of Busselton has been officially notified of the occurrence of the species. Staff from the Department's South West Capes District will continue to liaise with the current land managers, including the Meelup Regional Park Management Committee, to ensure the population is not damaged or destroyed accidentally.

Action: Liaise with relevant land managers

Responsibility: The Department (Blackwood District) through the SWRTFCRT
Cost: $1,200 per year.

9. Monitor population

Monitoring of factors such as 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 twice a year, in winter and summer.

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

10. 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 also 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: The Department (Blackwood District, Strategic Development and Corporate Affairs) through the SWRTFCRT
Cost: $900 per year.

11. 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 subspecies of *E. decipiens*. Therefore areas that contain *E. decipiens* provide likely search areas. Further surveys, supervised by the Department's staff and with assistance of local volunteers and wildflower society members, will be conducted during the species flowering period (February to March).

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

12. 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 fire), competition, rainfall and grazing on stem production.
2. Determining reproductive strategies, phenology and seasonal growth.
3. Investigation of the susceptibility to dieback
4.

Action: Obtain biological and ecological information
Responsibility: The Department (Science Division, Blackwood District) through the SWRTFCRT
Cost: $10,000 for first, second and third years.

13. Propagate plants for translocation

Due to the Critically Endangered status of *Eucalyptus phylacis* the propagation of plants in readiness for translocation is essential. Material will be collected and once a method for *in vitro* propagation is established by the Botanic Gardens and Parks Authority (BGPA), planting may occur.

Action: Propagate plants for translocation
Responsibility: The Department (Blackwood District) and the BGPA through the SWRTFCRT

Cost: $1,500 in first and second years.

14. Develop and implement a Translocation Proposal

Although translocations are generally undertaken under full Recovery Plans, the many threats to the wild population of this species indicates the need for a translocation proposal within the time frame of this IRP. This will be coordinated by the SWRTFCRT. Information on the translocation of threatened animals and plants in the wild is provided in the Department's Policy Statement No. 29 *Translocation of Threatened Flora and Fauna*. All translocation proposals require endorsement by the Director of Nature Conservation.

Monitoring of the translocation is essential and will be undertaken according to the timetable set out in the Translocation Proposal.

Action: Develop and implement a Translocation Proposal
Responsibility: The Department (Science Division, Blackwood District) through the CFRTFCRT
Cost: $14,200 in first year, $6,000 in second and third years, $2,000 per year thereafter.

4. TERM OF PLAN

This Interim Recovery Plan will operate from March 2002 to February 2007 but will remain in force until withdrawn or replaced. It is intended that, if the taxon is still ranked Critically Endangered, this IRP will be replaced by a full Recovery Plan after five years.

5. 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
Frank Podger	Forest Pathologist
Andrew Webb	Technical Officer, the Department's Science Division
Kim Williams	Program Leader Nature Conservation, the Department's South West Region

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

6. REFERENCES

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7. 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.