INTERIM RECOVERY PLAN NO. 182

CADDA ROAD MALLEE

(*EUCALYPTUS BALANITES*)

INTERIM RECOVERY PLAN

2004-2009

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Photograph: G. Broun

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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This Interim Recovery Plan will operate from May 2004 to April 2009 but will remain in force until withdrawn or replaced.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 30 August, 2004 and was approved by the Director of Nature Conservation on 24 September, 2004. The provision of funds and personnel identified in this Interim Recovery Plan is dependent on budgetary and other constraints affecting CALM, as well as the need to address other priorities.

Information in this IRP was accurate in May 2004.

ACKNOWLEDGMENTS

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

Alan Wright	Nature Conservation Officer, Perth Hills District, CALM
Steve Hopper	Chief Executive Officer, Botanical Gardens and Parks Authority
Andrew Crawford	Technical Officer, CALM Science Division
Dave Mitchell	Program Leader Nature Conservation, CALM's Swan Region
Leigh Sage	Conservation Officer, CALM's Swan Coastal District
Luke Sweedman	Seed Collector, Botanical Gardens and Parks Authority
Corrine Gaskin	Environmental Officer, City of Armadale
Ron Van Delft	Planner, City of Armadale

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

SUMMARY

Scientific Name:	*Eucalyptus balanites* P.M.Grayling & Brooker	**Common Name:**	Cadda Road Mallee
Family:	Myrtaceae	**Flowering Period:**	October–February
CALM Regions:	Midwest and Swan Regions	**CALM Districts:**	Moora and Swan Coastal
Local Government Authorities:	Shire of Dandaragan and City of Armadale	**Recovery Teams:**	Moora District Threatened Flora Recovery Team (MDTFRT) and Swan Region Threatened Flora and Communities Recovery Team (SRTFCRT)

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*; Grayling P.M. & Brooker M.I.H. (1992) Four new species of Eucalyptus (Myrtaceae) from Western Australia. *Nuytsia* 8(2). 209-218; Graying, P. (1989) *An investigation into the taxonomy, reproductive biology and hybridity in four taxa of Eucalyptus of extreme rarity*; FloraBase - Information on the Western Australian Flora. Department of Conservation and Land Management, Western Australia. http://www.calm.wa.gov.au/science/.

Current status: *Eucalyptus sp.* E. Nambung was declared as Rare Flora in September 1987 under the Western Australian *Wildlife Conservation Act 1950*. Renamed as *E. balanites* by P.M.Grayling and Brooker in 1992, the species was ranked as Endangered (EN) in September 1999. It is currently ranked as Critically Endangered (CR) under World Conservation Union (IUCN) criterion D (IUCN 2000) as there are less than 50 mature individuals known. The species is also listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation* Act 1999 (EPBC Act). Threats include inappropriate fire regimes, lack of recruitment, dieback disease, recreational use, weeds, and critically small population size.

Description: *Eucalyptus balanites* is an erect, robust tree mallee, 5-8 metres tall and to 15 metres wide. It is a sprawling tree with rough flaky grey bark up to the branchlets. Seedling leaves are opposite for 6-10 pairs, petiolate, oblong to elliptical, to 4.5 x 2.5 cm and dull green. Juvenile leaves are alternating, petiolate, elliptical, to 6.3 x 3.5 cm and dull green. Adult leaves are alternating, petiolate, lanceolate, to 10 x 2 cm, green, dull or slightly glossy, side veins very numerous. Inflorescences are unbranched, 11-flowered, and 1-2 cm long. Stamens are inflexed, all fertile, cream; and anthers are versatile. The style is twisted near the base. The fruit is very shortly pedicellate and hemispherical, usually with four slightly exserted valves. The seed is dark grey with longitudinal grooves. Flowers can be seen from October to February (Grayling and Brooker 1992). Recent studies suggest *E. balanites* may be a hybrid of salmon white gum (*E. lane-poolei*) and limestone marlock (*E. decipiens*), or that the species may be a 'good' species and the Badgingarra population contains some *E. balanites* x *E. lanepoolei* hybrids (Grayling 1989).

Habitat requirements: *Eucalyptus balanites* is found on light coloured sandy soils over laterite. Habitat consists of gently sloping heathlands; open mallee woodland over shrubland (Population 2) or heathland with emergent mallees (Population 1).

Critical habitat: The critical habitat for *Eucalyptus balanites* is the remnant vegetation in which it occurs, areas of similar habitat i.e. light coloured sandy soils with much surface laterite within 200 metres of the known population, and additional occurrences of similar habitat i.e. light coloured sandy soils with surface laterite in open mallee woodland over shrubland or heathland with emergent mallees, 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: At Badgingarra National Park (Population 1) *Eucalyptus balanites* occurs in conjunction with *Chordifex chaunocoleus* (P4) and *Hypocalymma serrulatum* (P3). Population 2 occurs in an occurrence of the Threatened Ecological Community (TEC) *Eucalyptus calophylla - Kinga australis* woodlands on heavy soils, listed as Endangered under the EPBC Act. The Priority 3 taxon *Synaphea acutiloba* also occurs in this reserve. Recovery actions implemented to improve the quality of the habitat of *Eucalyptus balanites* will also improve the status of the TEC in which it is located as well as the Priority species that co-occur.

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 balanites* populations. However the Yued Land Claimants are active in the area. Input and involvement will be sought from any indigenous groups that have an active interest in the areas that are habitat for *E. balanites*, 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 or economic impact as both populations are located on reserves. However, recovery actions will involve liaison and cooperation with all stakeholders.

Evaluation of the Plan's Performance: CALM, in conjunction with the Moora District Threatened Flora Recovery Team (MDTFRT) and Swan Region Threatened Flora and Communities Recovery Team (SRTFCRT) 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 Dandaragan, the City of Armadale and the Wallangara Riding and Pony Club have been formally notified of the presence and threatened nature of the populations of *Eucalyptus balanites* on or adjacent to their land.
2. Dashboard stickers and posters that include information on the purpose of DRF markers, an illustration of the markers and a contact telephone number have been produced and distributed.
3. Seed was collected by the Botanic Gardens and Parks Authority (BGPA) from Popualtion 1 in 1991 and 1994.
4. 108 seeds were collected from Population 2 in January 1998 by CALM's Threatened Flora Seed Centre (TFSC) and is currently in cold storage.
5. Declared Rare Flora (DRF) markers have been installed at Population 1.
6. Staff from CALM's Moora and Swan Coastal District monitor the populations.
7. A Bush Management Plan has been produced for the bushland that contains the taxon in the City of Armadale.
8. The MDTFRT and SRTFCRT are overseeing the implementation of this IRP.

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 by ten percent or more over the period of the plan's adoption under the EPBC Act.

Criteria for failure: The number of individuals within populations and/or the number of populations have decreased by ten percent or more over the period of the plan's adoption under the EPBC Act.

Recovery actions

1. Coordinate recovery actions
2. Map critical habitat
3. Develop and implement a fire management strategy
4. Clarify genetics
5. Obtain biological and ecological information
6. Manage dieback disease
7. Collect seed and conduct germination testing
8. Conduct further surveys
9. Liaise with land managers
10. Monitor populations
11. Continue to rehabilitate habitat
12. Promote awareness
13. Begin the Translocation Process
14. Review the need for a full Recovery Plan

1. BACKGROUND

History

Eucalyptus sp. (*E.* Nambung) was originally discovered by M.I.H. Brooker in Badgingarra National Park in February 1985. There was a nomenclature change to *Eucalyptus balanites* in 1992 when the species was formally described. It is still unclear as to whether this species is a hybrid between salmon white gum (*E. lane-poolei*) and limestone marlock (*E. decipiens*) as has been suggested (Grayling 1989). Although some work has been carried out to test this hypothesis, no conclusive results were obtained.

Eucalyptus balanites was previously only known from Badgingarra National Park, however in 1997 another single plant was discovered in bushland in the City of Armadale. Other populations could occur in the Swan Region however it is not certain whether the plant at Armadale is a naturally occuring population or has been planted.

Description

Eucalyptus balanites is an erect, robust tree mallee, 5-8 metres tall and up to 15 metres wide. It is a sprawling tree with rough flaky grey bark up to the branchlets. Seedling leaves are opposite for 6-10 pairs, petiolate, oblong to elliptical, to 4.5 x 2.5 cm and dull green. Juvenile leaves are alternating, petiolate, elliptical, to 6.3 x 3.5 cm and dull green. Adult leaves are alternating, petiolate, lanceolate to 10 x 2 cm, green, dull or slightly glossy; with very numerous side veins. Inflorescences are unbranched, 11-flowered, and 1-2 cm long. Stamens are inflexed, all fertile, cream; and anthers are versatile. The style is twisted near the base. The fruit is very shortly pedicellate and hemispherical, usually with four slightly exserted valves. The seed is dark grey with longitudinal grooves. Flowers can be seen from October to February (Grayling and Brooker 1992).

Eucalyptus decipiens is closely related to *E. balanites*. *E. balanites* differs in its loose, rough bark, the elliptical juvenile leaves, which are rarely emarginate, the acorn-like buds with the usually rounded opercula, the globoid anthers, and the usually cupular fruit (Grayling and Brooker 1992). *E. decipiens* has heart-shaped juvenile leaves, spindle-shaped buds with a pointed, conical or beaked cap and rough bark over part or all of the trunk (Brown *et al.* 1998). The species may be a hybrid with E. *decipiens* and *E. lane-poolei* as the most likely parents, but if so there is no significant segregation in the seedlings and it appears to be stabilized (Grayling 1989).

The Swan Region population (Population 2) of *Eucalyptus balanites* is taller, and more spreading in growth habit than the Moora District population. However, there is likely to be some variations in growth habits between, and even within populations, due to the taxon being a possible hybrid. However, Population 1 consists of at least two genetically distinct individuals (Grayling 1989).

Distribution and habitat:

Eucalyptus balanites is known from two disjunct populations separated by about 210 kilometres. Population 1 in Badgingarra National Park contains 25 clumps or plants. Population 2 occurs in bushland in the City of Armadale and consists of a single plant. Seven of the eight collections of *E. balanites* held in the WA Herbarium are from the Badgingarra population (Population 1).

Eucalyptus balanites grows on light coloured sandy soils with much surface laterite. It grows in gently sloping heathlands; open low mallee woodland B over dense heath B shrubland (Population 2) or heathland with emergent mallees (Population 1). Associated species include; *Allocasuarina humilis*, *Adenanthos sp*., *Banksia candolleana*, *B. menziesii*, *Calothamnus sanguineus*, *Chordifex chaunocoleus* (P4), *Corymbia calophylla*, *Dasypogon bromeliifolius*, *Daviesia speciosa*, *Dryandra bipinnatifida*, *Dryandra nivea*, *E. lane-poolei*, *E. marginata*, *Eremaea sp*., *Grevillea wilsonii*, *Hakea conchifolia*, *Haemodorum laxum*, *Hakea flabellifolia*, *Hypocalymma serrulatum* (P3), *Kingia australis*, *Lambertia multiflora*, *Leucopogon sp*., *Lomandra sp*., *Macropidia fuliginosa*, *Nuytsia floribunda*, *Petrophile linearis*, and *Xanthorrhoea gracilis.*

Biology and ecology

Studies were carried out by Grayling (1989) to test the hybrid origin of *Eucalyptus balanites*. The shape and size of the buds, the occurrence of the Badgingarra population on the edge of a relatively large population of *E lanepoolei*, the operculum of *E. balanites* being intermediate in shape between the obconical, elongated operculum of *E. decipiens*, and the hemispherical operculum of *E. lanepoolei* aroused a suspicion that the taxon may be of hybrid origin. An extreme shortage in the number of seeds for this species (only seeds from one plant were used in the enzyme study) precluded the thorough isoenzyme investigation, however the results from the limited number of enzyme assays carried out suggest that *E. balanites* may be a hybrid of salmon white gum (*E. lane-poolei*) and limestone marlock (*E. decipiens*). Pollen fertility measurements were also carried out from three clusters of stems from the *E. balanites* population. One cluster had high pollen fertility (40%) while the other two clusters had very low pollen fertility (2.2% and 3.2%). This may suggest that *E. balanites* may be a 'good' species and that the Badgingarra population may contain some *E. balanites* x *E. lane-poolei* hybrids. A small number of seedlings were grown from both *E. balanites* and *E. lane-poolei*. The glabrous seedlings of *E. balanites* were easily distinguished from the glaucous seedlings of *E. lane-poolei*. However one seed from *E. balanites* produced a plant with glaucous leaves. This could indicate that either *E. balanites* is a species able to hybridize with *E. lane-poolei*, or that it is a hybrid, and that one seedling was a backcross (F2) with *E. lane-poolei.*

Eucalyptus balanites produces few mature fruits or fertile seeds (Brown *et al*. 1998). The vast majority of buds are shed before they develop into fruits. Some remain on the tree, but become dry and hard soon after flowering (Grayling 1989). The degree of pollen fertility is low and highly variable between plants (2-40%), and relative to the number of flowers produced, the fruit-set is extremely low. Although the normal number of flowers per inflorescence is eleven, it is extremely rare to find more than one mature fruit per peduncle. It appears the plants have a mechanism whereby developing fruits devoid of at least one healthy embryo are dropped, perhaps in order to preserve energy (Grayling 1989). Observations of the contents of mature fruits have shown that each fruit contains a single fully-formed seed coat which in 60% of cases, contains no embryo (Grayling 1989).

There has been no natural seedling recruitment observed in the field at either population. This may be due to low seed production and reflects the high level of disturbance around the site at Population 2, or heavy grazing by kangaroos at Population 1 (Hockey 1996). Further research into the factors governing seed set and germination is required.

Field observations indicate that the taxon is sensitive to extreme fire behaviour, but may respond favourably to mild fire behaviour. A prescribed burn in Badgingarra National Park in 1997 resulted in the accidental burning of part of the *Eucalyptus balanites* population. Those individuals that experienced the extreme fire only coppiced in the following season, with no other regeneration observed. The trees that experienced more mild fire behaviour displayed re-shooting on stems and branches exceeding 25mm, and prolific shooting from the stump/trunk bases. Too frequent fire is therefore likely to deplete the mallee root storage and lead to habitat degradation including an increase in weed invasion. Wildfires also occurred in the Badgingarra area in the late 1980s and again in December 2002.

The susceptibility of *Eucalyptus balanites* to dieback disease (caused by *Phytophthora* spp.) is unknown and requires research.

Threats

Eucalyptus sp. E. Nambung was declared as Rare Flora in September 1987 under the Western Australian *Wildlife Conservation Act 1950*. Renamed as *E. balanites* by P.M.Grayling and Brooker in 1990, the species was ranked as Endangered (EN) in September 1999. It is currently ranked as Critically Endangered (CR) under World Conservation Union (IUCN) criterion D (IUCN 2000) as there are less than as 50 mature individuals known. The species is also listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation* Act 1999 (EPBC Act). Threats include inappropriate fire regimes, lack of recruitment, dieback disease, recreational use, weeds, and critically small population size.

- **Inappropriate fire regimes:** While *Eucalyptus balanites* may respond favourably to mild fire behaviour, field observations indicate that the taxon is sensitive to extreme fire behaviour, and too frequent fire is also likely to be detrimental. There is concern that the frequency of hotter burns at Population 1 may have depleted the soil seed stores (G. Broun[1] pers. comm.).

- **Lack of recruitment:** Seedling recruitment does not appear to be occurring at either population and the reasons for this need to be examined. Seed viability and recent germination trails indicate germination rates are low (Grayling 1989) but good germination has been reported recently under controlled conditions (Fryer 1993). Given this contradiction, and the fact that there have been few seed collections or germination testing carried out, further testing is required.

- **Dieback disease:** The susceptibility of *Eucalyptus balanites* to dieback disease caused by *Phytophthora* spp. is yet to be tested. The habitat of *E. balanites* in Population 2 may be affected by dieback disease, and dieback has been identified in the habitat of Population 2. This threat is amplified by evidence of soil disturbance, largely due to the frequent use of tracks near the plant by horse riders.

- **Recreational use** of the habitat surrounding Population 2 is causing considerable disturbance. The area is frequently used by horse riders and there are an excessive number of tracks. This increases the risk from other threats such as fire, weed invasion, grazing and introduction of diseases.

- **Weeds** are currently a minor threat to Population 2, but would compete with any seedlings that germinated at the site. They could also dramatically increase if a fire was to occur or if other disturbance occurs in the area. The habitat of Population 1 does not appear to be threatened by weeds.

- **Critically small population size** means that all individuals of the species are likely to be affected by any single catastrophe that occurs, such as disease or a severe weather or fire event.

Summary of population information and threats

Pop. No & Location.	Land Status	Year / No. plants	Condition	Threats
1. Badgingarra NP	National Park	1988 18 1991 10 clumps 1992 12 1994 25 1996 25 2003 25 clumps	Healthy	Inappropriate fire regimes, lack of recruitment
2. Armadale	Shire Reserve	1997 1 2002 1	Healthy	Inappropriate fire regimes, lack of recruitment, dieback disease, recreational use, weeds, critically small population size

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 balanites* 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, or have the potential to spread or amplify diseases including *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

[1] Gina Broun: Conservation Officer (Flora) CALM's Moora District

(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 (EPBC Act).

Eucalyptus balanites 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 populations,
- areas of similar habitat i.e. light coloured sandy soils with much surface laterite in open mallee woodland over shrubland or heathland with emergent mallees, within 200 metres of the known populations (these provide potential habitat for natural range extension); and
- additional occurrences of similar habitat i.e. light coloured sandy soils with much surface laterite in open mallee woodland over shrubland or heathland with emergent mallees, that do not currently contain the species but may have done so in the past (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 future translocated populations is habitat critical to its survival, and that all wild and translocated populations are important populations.

Benefits to other species or ecological communities

At Badgingarra National Park (Population 1) *Eucalyptus balanites* occurs in conjunction with the Priority flora *Chordifex chaunocoleus* (P4) and *Hypocalymma serrulatum* (P3). Recovery actions implemented to improve the quality or security of the habitat of *E. balanites* will also improve the status of remnant vegetation in which it is located.

Population 2 is part of the Threatened Ecological Community (TEC) *Eucalyptus calophylla - Kingia australis* woodlands on heavy soils, listed as Critically Endangered in Western Australia and Endangered under the EPBC Act. The Priority 3 taxon *Synaphea acutiloba* also occurs in this reserve. This community and the Priority species will benefit from actions implemented under this IRP that help to improve the quality of the habitat.

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 balanites* populations. However the Yued Land Claimants are active in the area. Input and involvement will be sought from any indigenous groups that have an active interest in the areas that are habitat for *E. balanites*, 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 as both populations are located in reserves. Recovery actions will involve liaison and cooperation with all stakeholders.

Evaluation of the Plan's Performance

CALM, in conjunction with the Moora District Threatened Recovery Team (MDTFRT) and Swan Region Threatened Flora and Communities Recovery Team (SRTFCRT) 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 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 Dandaragan, the City of Armadale and the Wallangara Riding and Pony Club have been formally notified of the presence and threatened nature of the *Eucalyptus balanites* 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 Population 1. Although the plants are inside the National Park they are close to the road reserve. The markers 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 groups through dashboard stickers and posters and Dandaragan Shire membership on the MDTFRT. The promotional materials illustrate DRF markers, inform of their purpose and provide a contact telephone number if such a marker is encountered.

Seed was collected from Population 1 in 1991 and 1994 by the Botanic Garden and Park Authority (BGPA). There is no record of propagations from the 1991 collection, but a record exists of one plant grown in 1993 and planted in the Botanic Gardens at Kings Park. Of the seed collected in 1994, 8.35g is currently in cold storage. Two propagation trials were conducted in January 1997 (17 seeds sown, no germination); and November 2001 (14 seeds sown, no germination).

Seed was collected from Population 2 in January 1998 by CALM's Threatened Flora Seed Centre (TFSC). 108 seeds were collected however no germination test was conducted on this accession due to the low seed numbers.

In 2003, a Management Plan for the bushland containing Population 2 was developed by the City of Armadale. This include consideration of fire, weed and disease management of the area that contains *Eucalyptus balanites* (Population 2).

The Moora District Threatened Flora and Communities Recovery Team (MDTFRT) and Swan Region Threatened Flora and Communities Recovery Team (SRTFCRT) are overseeing the implementation of this IRP and will include information on progress in their annual reports to the CALM's Corporate Executive and funding bodies.

Staff from the CALM's Moora and Swan Coastal Districts monitor the populations and continue to liaise with relevant land managers.

Future recovery actions

Where populations occur on lands other than those managed by CALM, 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 MDTFRT and SRTFCRT will continue to coordinate the implementation of recovery actions for *Eucalyptus balanites* and will include information on progress in their annual reports to CALM's Corporate Executive and funding bodies.

Action: Coordinate recovery actions
Responsibility: CALM (Moora and Swan Coastal Districts) through the MDTFRT and SRTFCRT
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 (Moora and Swan Coastal Districts) through the MDTFRT and SRTFCRT
Cost: $800 in the first year.

3. Develop and implement a fire management strategy

As fire response is not well understood, no planned burns will occur in the habitat of either population until a fire management strategy has been developed. A fire management strategy will include recommendations on; prescription fire frequency and intensity; precautions to prevent fire and a strategy for reacting to wild fire; and the need, method of construction, and maintenance of firebreaks.

Within the standard operating procedures of CALM's Moora District, buffer fire breaks adjacent to Population 1 will be maintained as a protective measure. This population is excluded from burn prescriptions and every effort is made to protect the population in the event of wildfire.

A fire management strategy was developed for the area that contains Population 2 by the City of Armadale in April 2003, however is has not been implemented as a result of funding constraints.

Action: Develop and implement a fire management strategy
Responsibility: CALM (Moora and Swan Coastal Districts), in consulation with the City of Armadale, through the MDTFRT and SRTFCRT
Cost: $2,500 in first year and $1,000 in subsequent years.

4. Clarify genetics of the taxon

Further genetic work is required to clarify if *Eucalyptus balanites* is of hybrid origin, as the results to date have been inconclusive. The results of this genetic work will influence the priority allocated to future recovery work on the taxon.

Action: Clarify genetics of the taxon
Responsibility: CALM (Science Division, Moora and Swan Coastal Districts) through the MDTFRT and SRTFRT
Cost: $20,000 in the first year.

5. Obtain biological and ecological information

Improved knowledge of the biology and ecology of *Eucalyptus balanites* will provide a better scientific basis for management of the wild populations. An understanding of the following is particularly necessary for effective management:

1. Soil seed bank dynamics and the role of various disturbances (including fire), competition, rainfall and grazing in germination and recruitment.
2. The pollination biology of the species and the requirements of pollinators.
3. The reproductive strategies, phenology and seasonal growth of the species.

Action: Obtain biological and ecological information
Responsibility: CALM (Science Division, Moora and Swan Coastal Districts) through the MDTFRT and SRTFRT
Cost: $20,800 per year for the first three years.

6. Manage dieback disease

Eucalyptus balanites will be tested for susceptibility to dieback disease (caused by *Phytophthora* spp.).

Disease hygiene measures, as outlined in CALM's management guidelines for the disease (CALM 2003), will be applied at Population 2. Hygiene measures will primarily involve restricting access to the area, especially when the soil is wet. Signs advising of the dieback disease risk will be posted at the site, and fencing will be erected to exclude horses from the area. The need for dieback disease treatment of the site will also be assessed through evaluation of the impact of the disease on the habitat and, specifically, on *E. balanites*.

Population 1 will be protected from infection by *Phytophthora* spp by adhering to CALM's standard measures for the prevention of the spread of dieback in conservation estate. A known infestation of *P. cinnamomi* occurs within 10km of the population.

Action: Manage dieback disease
Responsibility: CALM (Science Division, Moora and Swan Coastal Districts), through the MDTFRT and SRTFCRT
Cost: $3,200 in the first year, $800 in the second and third years

7. Collect seed and conduct germination testing

Some seed has been collected from this taxon by CALM's TFSC however additional collections will be made from both populations and further germination tests conducted.

Action: Collect seeds and conduct germination testing
Responsibility: CALM (TFSC), through the MDTFRT and SRTFCRT
Cost: $3,200 per year for the first three years.

8. Conduct further surveys

Further surveys will be conducted during the taxon's flowering period (October to February). Members of community groups such as local Naturalists Clubs and Wildflower Societies will be encouraged to be involved in surveys supervised by CALM staff.

Action: Conduct further surveys
Responsibility: CALM (Moora and Swan Coastal Districts, Science Division), through the MDTFRT and SRTFCRT)
Cost $2,400 per year.

9. Liaise with land managers

Staff from CALM's Swan Coastal District will continue to liaise with the City of Armadale and the Wallangara Riding and Pony Club (Inc.) to ensure Population 2 is not accidentally damaged or destroyed, and that the impacts of recreation, in particular, are minimised. The City of Armadale has produced a Management Plan for the bushland containing Population 2, and CALM has already has provided input into this plan. Liaison will continue with the City of Armadale (and the Wallangara Pony Club that utilises the reserve) during implementation of this plan to ensure that any clearing in the reserve does not impact the taxon, and that any track closures required to protect the population are implemented. Input and involvement will also be sought from any indigenous groups that have an active interest in areas that are habitat for *Eucalyptus balanites*.

Action: Liaise with land managers
Responsibility: CALM (Moora and Swan Coastal District), and the City of Armadale, through the MDTFRT and SRTFCRT
Cost: $1,200 per year

10. Monitor populations

Monitoring of factors such as weed invasion, habitat degradation, population stability (expansion or decline), pollinator activity, seed production, recruitment, and longevity is essential. The populations will be inspected annually and Rare Flora Report Forms completed.

The following will be monitored at both populations:
1. Seedlings, evidence of recruitment
2. Evidence of dieback disease
3. Population condition
4. Level of weed invasion

In addition, at Population 2 the following specific monitoring is required:
1. Impact of recreational activities
2. Impact/effect of any recovery actions implemented, such as fencing, weed control etc.

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

11. Continue to rehabilitate habitat

Rehabilitation of the horse tracks immediately adjacent to *Eucalyptus balanites* (Population 2) will be implemented. The area will be brushed with plant species endemic to the site.

Action: Continue to rehabilitate habitat
Responsibility: CALM (Swan Coastal District) in consultation with the City of Armadale, through the SRTFCRT
Cost: $2,500 in first and second years.

12. Promote awareness

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

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

Due to the potential susceptibility of the species' habitat 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 Pony Club. This will stress the need to restrict the movement of soil into the habitat of the population.

Action: Promote awareness
Responsibility: CALM (Swan Coastal and Moora Districts), Strategic Development and Corporate Affairs through the MDTFRT and SRTFRT
Cost: $1,500 in first year and $500 per year after that.

13. Begin the translocation process

Translocation may be essential for the long-term conservation of *Eucalyptus balanites*, as the total number of extant plants is quite low and the area inhabited by the taxon quite small, and prone to disturbance and wildfire. Although translocations are generally undertaken under full Recovery Plans, it is possible to develop a translocation proposal and start propagating plants within the three-year time frame of an Interim Recovery Plan. Seed will need to be taken and propagated at the BGPA for planting the following year.

Alternatively vegetative material may be taken for in-vitro cultivation of the species given its poor germination to date. In this case, the clones would be grown at the BGPA and planted once they reach a suitable size, after two to three years. Information on the translocation of threatened animals and plants in the wild is provided in CALM 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 that will be developed for the Translocation Proposal.

Action: Begin the translocation process
Responsibility: CALM (Science Division, Moora and Swan Coastal Districts) through the MDTFRT and SRTFRT
Cost: $2,100 in first and second years, $13,800 in third year, $7,300 in fourth year and $4,500 in fifth year.

14. Review the need for a full Recovery Plan

This Interim Recovery Plan will operate from May 2004 to April 2009 at which time it will be reviewed and the need for further recovery actions assessed. It will, however, remain in force until withdrawn or replaced and if the species is still ranked as Critically Endangered at that time, a full Recovery Plan may be required.

Action: Review the need for a full Recovery Plan
Responsibility: CALM (WATSCU, Moora District, Swan Coastal District) through the MDTFRT and SRTFRT
Cost: $15,000 in the fifth year (if full Recovery Plan is required)

4. TERM OF PLAN

This Interim Recovery Plan will operate from May 2004 to April 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 replaced by a full Recovery Plan after five years.

5. REFERENCES

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6. TAXONOMIC DESCRIPTION

Taxonomic Description *Eucalyptus balanites*

Grayling, P. M. and Brooker, M. I. H. (1992).

Erect mallee to 5 m tall with pale grey to yellowish, thin, flaky, rough bark to small branches. Cotyledons bisected. Seedlings leaves opposite for 6-10 pairs, petiolate, oblong to elliptical, to 4.5x2.5 cm, green, dull. Juvenile leaves alternating, petiolate, elliptical, rarely emarginate, to 6.3x3.5 cm, green, dull. Adult leaves alternating, petiolate, lanceolate to narrowly lanceolate, to 10x2 cm, green, concolorous, dull or slightly glossy; side veins very numerous; reticulation dense with numerous, irregular, intersectional oil glands. Inflorescences axillary, unbranched, 11-flowered, peduncles terete, 1-2 cm long. Buds on short stout pedicels, ovoid, to 1x0.7 cm; outer operculum shed early in bud development; inner operculum hemispherical, less often obtusely conical, apiculate, narrower than hypanthium or constricted at join; hypanthium obconical to cupular, commonly with two longitudinal ridges extending to pedicel. Stamens inflexed, all fertile; anthers versatile, basifixed, globoid, opening by broad lateral slits; filaments white. Style twisted near base. Ovules in 4 vertical rows. Fruit very shortly pedicellate, hemispherical, less often cupular, to 0.9x0.9 cm; rim thick, disc annular, valves usually 4, slightly exserted. Seed dark grey, compressed-ovoid, with very shallow reticulum, with longitudinal grooves.

SUMMARY OF RECOVERY ACTIONS AND COSTS (not for publication)

Recovery Action	Year 1			Year 2			Year 3			Year 4			Year 5		
	CALM	**Other**	**Ext.**	**CALM**	**Other**	**Ext.**	**CALM**	**Other**	**Ext.**	**CALM**	**Other**	**Ext.**	**CALM**	**Other**	**Ext.**
Coordinate recovery actions	1000	1000		1000	1000		1000	1000		1000	1000		1000	1000	
Map critical habitat	300		500												
Develop and implement a fire management strategy	1400		1100	200		800	200		800	200		800	200		800
Clarify genetics	10000		10000												
Obtain biological and ecological information	10800		10000	10800		10000	10800		10000						
Manage dieback disease	800		2400	400		400	400		400						
Collect seed and conduct germination testing	1400		1800	1400		1800	1400		1800						
Conduct further surveys	1000	500	900	1000	500	900	1000	500	900	1000	500	900	1000	500	900
Liaise with land managers	1200			1200			1200			1200			1200		
Monitor populations	900		500	900		500	900		500	900		500	900		500
Continue to rehabilitate habitat	500	500	1500	500	500	1500									
Promote awareness	500		1000	200		300	200		300	200		300	200		300
Begin the translocation process	300		1800	300		1800	3000		10800	3000		4300	2400		2100
Review the need for a full Recovery Plan													5000		10000
Total	**30100**	**2000**	**31500**	**17900**	**2000**	**18000**	**20100**	**1500**	**25500**	**7500**	**1500**	**6800**	**11900**	**1500**	**14600**
Yearly Total		**43600**			**37900**			**47100**			**15800**			**28000**	

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

Total CALM: $87,500
Total Other: $8,500
Total External Funding: $96,400
Total Costs: $192,400