INTERIM RECOVERY PLAN NO. 164

DANDARAGAN MALLEE (*EUCALYPTUS DOLOROSA*)

INTERIM RECOVERY PLAN

2004-2009

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Photograph: S.D. Hopper

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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This Interim Recovery Plan will operate from June 2004 to May 2009 but will remain in force until withdrawn or replaced.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 4 June, 2004 and was approved by the Director of Nature Conservation on 22 June, 2004. The allocation of staff time and provision of funds identified in this Interim Recovery Plan is dependent on budgetary and other constraints affecting CALM, as well as the need to address other priorities.

Information in this IRP was accurate in May 2004.

ACKNOWLEDGMENTS

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

Eric Bunn	Senior Research Scientist (Propagation Science), Botanic Garden and Parks Authority
Rebecca Carter	Regional Leader, Nature Conservation, CALM’s Moora District
Andrew Crawford	Technical Officer, CALM's Threatened Flora Seed Centre
Amanda Shade	Horticulturalist, Botanic Garden and Parks Authority

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

SUMMARY

Scientific Name:	*Eucalyptus dolorosa*	**Common Name:**	Dandaragan Mallee
Family:	Myrtaceae	**Flowering Period:**	February - March
CALM Region:	Midwest	**CALM District:**	Moora District
Shire:	Dandaragan	**Recovery Team:**	Moora District Threatened Flora and Communities Recovery Team

Illustrations and/or further information: Brown, A., Thomson-Dans, C. and Marchant, N. (Eds) (1998) *Western Australia's Threatened Flora*. Department of Conservation and Land Management, Western Australia; Brooker, M.I.H. and Hopper, S.D. (1993) New series, subseries, species and subspecies of *Eucalyptus* (Myrtaceae) from Western Australia and from South Australia. *Nuytsia* 9(1), 1-68; Rossetto, M., Jezierski, G., Hopper, S.D. and Dixon, K.W. (1999) Conservation genetics and clonality in two critically endangered eucalypts from the highly endemic south-western Australian flora. *Biological Conservation* 88, 321-331.

Current status: *Eucalyptus dolorosa* was declared as Rare Flora in July 1989, and is currently ranked as Critically Endangered under the *Wildlife Conservation Act* 1950. *E. dolorosa* is listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act). It currently meets World Conservation Union (IUCN) Red List Category 'CR' under criterion D (IUCN 2000) as it is only known from few individuals in a single population. The main threats are inappropriate fire regimes, lack of recruitment and restricted distribution.

Description: *Eucalyptus dolorosa* is a low mallee to 2.5 m tall with stout stems and rough grey bark on the older stems. The juvenile leaves are broadly falcate, and light bluish-grey in colour. The adult leaves are slightly glossy and green, lanceolate to falcate, and measure 10 x 2 cm. They have a moderately dense vein network and numerous oil glands. The inflorescences are axillary, but are clustered at the leafless ends of branchlets, appearing to be terminal. There are 7 flowers in each. The buds have pedicels up to 1 cm long and are rhomboid in shape, 9 x 6 mm with a slightly beaked operculum. The stamens are very numerous. The fruits have stalks to 7 mm long, and are cup-shaped to globose, measure 1 x 1.4 cm, and have four valves. The seeds are brown, pyramidal and winged (Patrick and Brown 2001)

Habitat requirements: *Eucalyptus dolorosa* is currently known from a single population west of Dandaragan. It is confined to lateritic breakaway slopes and a summit in mallee heath over low scrub, amongst massive ironstone blocks (Brown *et al*. 1998).

Critical habitat: The critical habitat for *Eucalyptus dolorosa* comprises the area of occupancy of the known population; similar habitat within 200 metres of the known population; and additional nearby occurrences of similar habitat that do not currently contain the species but may have done so in the past and may be suitable for translocations.

Habitat critical to the survival of the species, and important populations: Given that this species is listed as 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: The habitat supporting *Eucalyptus dolorosa* is highly species rich, and contains a number of threatened and Priority flora species. The following threatened species occur on the same lateritic hill as *E. dolorosa*: *Acacia forrestiana* (DRF, Vulnerable under *Wildlife Conservation Act* and EPBC Act); *Grevillea synapheae* subsp. A Flora of Australia, *Lasiopetalum miseryense* and *Melaleuca clavifolia* (Priority 1); *Boronia scabra* subsp. *condensata*, *Eucalyptus abdita* and *Stylidium aeonioides* (Priority 2); *Beaufortia eriocephala* and *Gastrolobium axillare* (Priority 3); and *Asterolasia drummondii* (Priority 4). Recovery actions such as protecting the *E. dolorosa* population from frequent fire will protect the ecological community in which the populations are located.

International obligations: This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity, ratified by Australia in June 1993, and will assist in implementing Australia's responsibilities under that Convention. However, as *Eucalyptus dolorosa* is not specifically listed under any international agreement, the implementation of other international environmental responsibilities is not affected by this plan.

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

Social and economic impact: The only known population of *Eucalyptus dolorosa* occurs on private land and negotiations will continue with regard to the future management of this population. The landholders are very supportive of managing this area of remnant vegetation for conservation.

Evaluation of the plan's performance: The Department of Conservation and Land Management in conjunction with the Moora District Threatened Flora and Communities Recovery Team will evaluate the performance of this IRP. In addition to annual reporting on progress with listed actions and comparison against the criteria for success and failure, the plan is to be reviewed within five years of its implementation.

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

1. Relevant land managers have been made aware of the location and threatened status of the species. A cooperative relationship has been established between CALM and the land managers.
2. Some seed was collected from the population in 2003, and is stored in CALM's Threatened Flora Seed Centre. The viability of this seed is not yet known.
3. The Botanic Garden and Parks Authority currently hold 0.7g seed, 12 plants in the nursery, and 2 plants in the Botanic Gardens. Initial propagation attempts from seed and cuttings have been unsuccessful, but a number of plants have been successfully produced from tissue culture.
4. DNA research has been conducted, and established that *E. dolorosa* is not a hybrid.
5. An information sheet that describes and illustrates the species has been prepared and will be printed in the near future.
6. Staff from CALM's Moora District regularly monitor this species.
7. The Moora District Threatened Flora Recovery Team is overseeing the implementation of this IRP and will include information on progress in an annual report to CALM's Corporate Executive and funding bodies.

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

Recovery criteria

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

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

Recovery actions

1. Coordinate recovery actions
2. Map critical habitat
3. Liaise with land managers
4. Develop and implement a fire management strategy
5. Monitor population
6. Collect seed
7. Conduct further surveys
8. Propagate translocates from tissue culture
9. Undertake and monitor translocation
10. Promote awareness
11. Obtain biological and ecological information
12. Review the need for a full Recovery Plan

1. BACKGROUND

History
The first collection of *Eucalyptus dolorosa* was made in 1987 by M.I.H. Brooker. It has only ever been known from the slopes and summit of a single lateritic hill in the Dandaragan area. This area was burnt in 1978, and although the population flowered every year after its discovery in 1987, it didn't produce fruit until 1991. The area was fenced from stock in the late 1980s, protecting this species and a number of other threatened and Priority species that also occur in this area of remnant mallee heath. Plants occur in eight clumps, all of which are in good health. Brooker and Hopper (1993) noted that this species persists in a refugial site, and suggested that *E. dolorosa* is probably a relict species, barely surviving extinction as a consequence of a drying climate in the late Pleistocene period.

Description
Eucalyptus dolorosa is a low mallee to 2.5 m tall with stout stems and rough grey bark on the older stems. The juvenile leaves are broadly falcate, and light bluish-grey in colour. The adult leaves are slightly glossy, green in colour, lanceolate to falcate, measuring 10 x 2 cm. They have a moderately dense vein network and numerous oil glands. The inflorescences are axillary, but are clustered at the leafless ends of branchlets, appearing to be terminal. There are 7 flowers in each. The buds have pedicels up to 1 cm long and are rhomboid in shape, 9 x 6 mm with a slightly beaked operculum. The stamens are very numerous. The fruits have stalks to 7 mm long, and are cup-shaped to globose, measure 1 x 1.4 cm, and have four valves. The seeds are brown, pyramidal and winged (Patrick and Brown 2001)

This species is distantly related to *Eucalyptus lateritica* and *E. todtiana*, differing in its small falcate leaves, apparently terminal inflorescences, long pedicels, and glaucous juvenile leaves. The winged seed places this species in a group which includes *E. buprestium*, *E. erectifolia* and *E. johnsoniana*.

Distribution and habitat
Eucalyptus dolorosa is known from a single population west of Dandaragan. It is confined to lateritic breakaway slopes and a summit in mallee heath over low scrub, amongst massive ironstone blocks. Associated species include *Eucalyptus arachnaea*, *E. gittinsii*, *E. pluricaulis*, *E. abdita*, *Hakea lissocarpha*, *H. obliqua*, *H. undulata*, *Calothamnus quadrifidus*, *Melaleuca radula*, *Acacia pulchella*, *Scholtzia* sp. and *Eremaea asterocarpa* (Patrick and Brown 2001).

Biology and ecology
Eucalyptus species are typically highly adapted to surviving fires, which are a regular occurrence in many Australian habitats. Seedlings tend to be slow-growing, as much energy is channeled into the production of a lignotuber. After fire has removed or damaged above-ground parts of an established plant, a number of replacement stems are initiated from the lignotuber, producing the mallee form. Fire often also stimulates germination of *Eucalyptus* seed.

The only known population of *E. dolorosa* was burnt in 1978. It regenerated and was flowering in 1987, the year of its discovery. Flowers may also have been produced prior to this time. However, no fruit was produced until 1991, some twelve years after fire. It doesn't tend to produce a lot of flowers or fruit at once, producing small quantities somewhat sporadically. Some seed has been collected, but the viability of that seed has not yet been assessed.

Threats
Eucalyptus dolorosa was declared as Rare Flora under the *Wildlife Conservation Act* 1950 in July 1989. It currently meets Critically Endangered (CR) under World Conservation Union (IUCN) Red List criterion D (IUCN 2000), as there is only one population that contains very few plants. *E. dolorosa* is listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act). The main threats are inappropriate fire regimes, lack of recruitment and restricted distribution.

- **Inappropriate fire regimes** may affect the viability of the population, as *E. dolorosa* is thought to resprout following fire. If this is the case, the lignotubers may be depleted if fires recur before they can build up resources again. Frequent fire is also likely to degrade the supporting ecological community, altering species

composition as well as fostering weed invasion and erosion. This species is likely to need fire for recruitment of new individuals, but the long lifespan of *Eucalyptus* species suggests that there is no urgent need for fire in the short to mid-term (C. Yates[1], pers. comm.).

- **Lack of recruitment** is apparent with no juvenile plants observed. Only small quantities of seed tend to be produced at any one time. The lack of recruitment may be due to poor seed viability, an absence of germination triggers or possibly poor seedling survival.
- **Highly restricted distribution** 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.
- **Weed invasion** could become a threat to the population only under specific post-fire conditions. Although it remains almost entirely weed-free at present, it is possible that weed invasion may increase after fires and this will need to be monitored.

Summary of population information and threats

Pop. No. & Location	Land Status	Year/No. plants	Condition	Threats
1. WSW of Dandaragan	Private property	1988 8 clumps 1991 ca. 20 1992 ca. 25 2000 ca 8 clumps 2003 ca 8 clumps	Healthy	Too frequent fire, lack of recruitment

Guide for decision-makers

Section 1 provides details of current and possible future threats. Any on-ground works (clearing, firebreaks, roadworks etc) in the immediate vicinity of *E. dolorosa* will require assessment. On-ground works should not be approved unless the proponents can demonstrate that they will not have an impact on the species, or on its habitat or potential habitat.

Critical habitat

Critical habitat is habitat identified as being critical to the survival of a listed threatened species or listed threatened ecological community. Habitat is defined as the biophysical medium or media occupied (continuously, periodically or occasionally) by an organism or group of organisms or once occupied (continuously, periodically or occasionally) by an organism, or group of organisms, and into which organisms of that kind have the potential to be reintroduced (*Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)).

Eucalyptus dolorosa 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 known (wild and translocated) populations;
- areas of similar habitat within 200 metres of populations, i.e. mallee heath over low scrub on lateritic breakaway slopes and summits with massive ironstone (these provide potential habitat for natural range extension);
- additional occurrences of similar habitat that do not currently contain the species but may have done so in the past (these represent possible translocation sites).

Benefits to other species or ecological communities

The habitat supporting *Eucalyptus dolorosa* is highly species rich, and contains a number of threatened and Priority flora species. The following species occur on the same lateritic hill as *E. dolorosa*: *Acacia forrestiana* (DRF, ranked Vulnerable under the Wildlife Conservation Act and the EPBC Act); *Grevillea synapheae* subsp. A Flora of Australia, *Lasiopetalum miseryense* and *Melaleuca clavifolia* (Priority 1); *Boronia scabra* subsp. *condensata*, *E. abdita* and *Stylidium aeonioides* (Priority 2); *Beaufortia eriocephala* and *Gastrolobium axillare* (Priority 3); and *Asterolasia drummondii* (Priority 4). Recovery actions such as protecting *E. dolorosa* populations from frequent fire will also help to conserve the ecological community in which the populations are located.

International obligations

This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity, ratified by Australia in June 1993, and will assist in implementing Australia's responsibilities under that

[1] Dr Colin Yates, Senior Research Scientist (Ecology), CALM's Science Division

Convention. However, as *E. dolorosa* is not specifically listed under any international agreement, the implementation of other international environmental responsibilities is not affected by this plan.

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

Social and economic impacts
The only population of *Eucalyptus dolorosa* occurs on private land and negotiations will continue with regard to the future management of this population. The landholders are very supportive of managing this area of remnant vegetation for conservation.

Evaluation of the plan's performance
CALM will evaluate the performance of this IRP in conjunction with the Moora District Threatened Flora and Communities Recovery Team. In addition to annual reporting on progress with listed actions and comparison against the criteria for success and failure, the plan is to be reviewed within five years of its implementation.

2. RECOVERY OBJECTIVE AND CRITERIA

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

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

3. RECOVERY ACTIONS

Existing recovery actions
All relevant land managers have been notified of the location and threatened status of *Eucalyptus dolorosa*. The notification details the Declared Rare status of the species and associated legal obligations. A cooperative relationship has been established between CALM and the land managers.

Some seed was collected from *E. dolorosa* on two occasions in 2003, but the quantity and viability of that seed is unknown as yet, as the collections have not yet been processed. Both collections are stored at CALM's Threatened Flora Seed Centre (TFSC).

Initial attempts have been made to propagate this species from seed and cuttings at the Botanic Garden and Parks Authority (BGPA) nursery, but these have been unsuccessful. A number of plants have been propagated from tissue culture material by the BGPA research team. There are two *Eucalyptus dolorosa* plants in BGPA's Botanic Garden, and 12 in the Nursery, that are destined for planting into the Garden. These plants are from two genetic lines (A. Shade[2], pers. comm.). BGPA also hold 0.7 g of seed collected in 1991.

DNA research has established that *Eucalyptus dolorosa* is not a hybrid (Rossetto *et al*. 1999). They found that the overall genetic variability within *E. dolorosa* was 16%, and the within-stand variability ranged from 14% to zero. Interestingly, the greatest genetic diversity was not found in the stand of most numerous stems, but in a smaller stand. A total of 12 distinct genotypes were detected from five discrete clumps. Genetic testing of a small number of seedlings provided evidence of outcrossing pollination.

[2] Amanda Shade, Horticulturalist, Botanic Garden and Parks Authority

A double-sided information sheet has been prepared, and includes a description of *Euclyptus dolorosa*, its habitat, threats, recovery actions and photos. This will be printed, and then distributed to community members through local libraries, wildflower shows and other avenues. It is hoped that this may result in the discovery of new populations.

Staff from CALM's Moora District regularly monitor this species.

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

Future recovery actions

Where populations occur on lands other than those managed by CALM, permission has been or will be sought from appropriate land managers prior to recovery actions being undertaken. The following recovery actions are roughly in order of descending priority; however this should not constrain addressing any of the priorities if funding is available for 'lower' priorities and other opportunities arise.

1. Coordinate recovery actions

The Moora District Threatened Flora and Communities Recovery Team will coordinate recovery actions for *E. dolorosa* and other Declared Rare Flora in their district. They will include information on progress in their annual report to CALM's Corporate Executive and funding bodies.

Action: Coordinate recovery actions
Responsibility: CALM (Moora District) through the MDTFCRT
Cost: $1,000 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 District, WATSCU) through the MDTFCRT
Cost: $2,000 in the first year

3. Liaise with land managers

Staff from CALM's Moora District will continue to liaise with relevant land managers to ensure that populations are not accidentally damaged or destroyed. The possibility of improving the security of the population and its habitat will be discussed, to provide protection in case there is a change in landholder. This may include seeking to set up a conservation covenant through one of a range of agencies, or registration through the Land for Wildlife scheme. Input and involvement will also be sought from any indigenous groups that have an active interest in areas that are habitat for *Eucalytpus dolorosa*.

Action: Liaise with land managers
Responsibility: CALM (Moora District) through the MDTFCRT
Cost: $700 per year

4. Develop and implement a fire management strategy

Adult mallee eucalypts typically resprout from lignotubers after fire, producing multiple stems that usually flower more quickly than a juvenile growing from seed. Fire also often stimulates germination of seed in eucalypts. Therefore, although eucalypts are well adapted to fire, frequent fires may prevent the accumulation of sufficient soil-stored seed for a new wave of germination, kill fire-stimulated seedlings before they can recruit into the population, and deplete the lignotuber of existing adults. Fire also promotes the introduction and proliferation of weed species. Fire should therefore be prevented from occurring in the area of populations, except where it is being used experimentally as a recovery tool. A fire management strategy will be developed in consultation with land managers to determine appropriate fire control measures, and a recommended fire frequency and intensity.

Action: Develop and implement a fire management strategy
Responsibility: CALM (Moora District) through the MDTFCRT

Cost: $2,500 in first year, and $1,700 in subsequent years

5. Monitor population

Annual monitoring of factors such as habitat degradation (including plant diseases such as *Phytophthora cinnamomi* and weed invasion), population stability (expansion or decline), pollination activity, seed production, recruitment, longevity and predation is highly desirable.

Detailed monitoring of a selection of individual stems will be undertaken to track the health and longevity of the species, and record flower and fruit timing and abundance. This will be carried out twice each year, at expected time of flowering and expected time of seed set. [0]This monitoring regime will be implemented in a way that minimises potential damage to the habitat from additional visitation and disturbance. This will include monitoring during dry soil conditions to prevent erosion, maintaining dieback hygiene, and selecting stems at the extremities of the population for more detailed data collection.

A monitoring plot will be established around some stems, to record the occurrence of any seedlings. This information will help to clarify the causes of the lack of recruitment, and possible solutions. For example if flowers are produced but little seed is set, the possible causes such as non-viable pollen or lack of pollinators can be investigated. If pollinators are absent, periodic hand pollination may promote seed set.

Action: Monitor population
Responsibility: CALM (Moora District) through the MDTFCRT
Cost: $1,300 per year

6. Collect seed

It is necessary to store germplasm as a genetic resource, ready for use in translocations and as an *ex situ* genetic 'blueprint' of the species. The germplasm stored will include live plants in cultivation, seed and tissue culture material. Fourteen plants are currently in cultivation at BGPA. Some seed has been collected from the population but additional collections are required to maintain adequate representation of the genetic diversity of this taxon. The patterns of viability that emerge from standard tests on seed collected may indicate the need for other recovery actions such as hand pollination.

Action: Collect seed
Responsibility: CALM (TFSC, Moora District) through the MDTFCRT
Cost: $2,200 in the first, third and fifth years

7. Conduct further surveys

Community volunteers will be encouraged to be involved in further surveys supervised by CALM staff to be conducted during the flowering period of the species (February-March). Records of areas surveyed will be sent to Wildlife Branch and retained at the districts, even if *E. dolorosa* is not found. Note will be made of any habitat suitable for translocation.

Action: Conduct further surveys
Responsibility: CALM (Moora District) through the MDTFCRT
Cost: $2,500 per year in the first, third and fifth years

8. Propagate translocates from tissue culture

Rossetto *et al.* (1999) found 12 distinct genetic lines of *E. dolorosa*. These will be introduced to tissue culture, and plantlets suitable for translocation will eventually be produced from that material. It is essential that the genetic diversity of these translocates is maximised. It is envisaged that production of translocates should be possible over a three to four year time frame. It is possible that some economies of scale may be achieved during this resource-intensive recovery action if other rare eucalypt species, for example *E. impensa* and *E. leprophloia* are included in the propagation program.

Action: Propagate translocates from tissue culture
Responsibility: BGPA (through the MDTFCRT)
Cost: $18,100 in second year, $15,900 in third year and $7,500 in the fourth and fifth years

9. Undertake and monitor translocation

Translocation is essential for the conservation of this species, as the species is highly vulnerable to localised threats including disease and inappropriate fire regimes. A translocation proposal will be developed and suitable translocation sites selected. Propagation of plants will occur from tissue culture and from seed. Plants previously propagated from tissue culture have been more vigorous than those grown from seed, and can ensure that all genotypes currently present in the population can be included in the translocation. Seedlings examined have

been found to be strongly outcrossed (Rossetto *et al.* 1999), and so will add to the genetic pool of the translocated population. These will be planted in accordance with CALM's Policy Statement No. 29 *Translocation of Threatened Flora and Fauna*. All Translocation Proposals require endorsement by CALM's Director of Nature Conservation.

Monitoring of the translocation is essential and will be undertaken according to the timetable developed for the Translocation Proposal.

Action: Undertake and monitor translocation
Responsibility: CALM (Moora District, TFSC) and BGPA through the MDTFCRT
Cost: $14,800 in the fourth year and $12,500 in the fifth year

10. Promote awareness

The importance of biodiversity conservation and the need for the long-term protection of wild populations of this species will be promoted to the community through poster displays and the local print and electronic media. Formal links with local naturalist groups and interested individuals will also be encouraged. An information sheet has been developed, and this includes a description of the plant, its habitat, threats, recovery actions and photos. This will be printed and distributed to the public through CALM's Moora District office and at the office and library of the Shire of Dandaragan. Such information distribution may lead to the discovery of new populations.

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

11. Obtain biological and ecological information

Improved knowledge of the biology and ecology of *E. dolorosa* will provide a scientific basis for its management in the wild. An understanding of the following is necessary for more effective management:

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

Action: Obtain biological and ecological information
Responsibility: CALM (Science Division, Moora District) through the MDTFCRT
Cost: $12,000 per year in the second, third and fourth years

12. Review the need for a full Recovery Plan

At the end of the fourth year of its five-year term this Interim Recovery Plan will be reviewed and the need for further recovery actions will be assessed. If the species is still ranked as Critically Endangered at that time a full Recovery Plan may be required.

Action: Review the need for further recovery actions and/or a full Recovery Plan
Responsibility: CALM (WATSCU, Moora District) through the MDTFCRT
Cost: $20,300 in the fifth year (if full Recovery Plan required)

4. TERM OF PLAN

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

5. REFERENCES

Brooker, M.I.H. and Hopper, S.D. (1993) New series, subseries, species and subspecies of *Eucalyptus* (Myrtaceae) from Western Australia and from South Australia. *Nuytsia* 9(1), 1-68.

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6. TAXONOMIC DESCRIPTION

Excerpt from: Brooker, M.I.H. and Hopper, S.D. (1993) New series, subseries, species and subspecies of *Eucalyptus* (Myrtaceae) from Western Australia and from South Australia. *Nuytsia* 9(1), 1-68.

Eucalyptus dolorosa

Mallee to 2.5 m tall with thin, outer grey and inner yellowish, rough bark on older stems. *Juvenile leaves* petiolate, alternating, broadly falcate, to 11 x 4.5 cm, dull, conspicuously light bluish grey. *Adult leaves* petiolate, alternating, lanceolate or rarely falcate, up to 10 x 2 cm, concolorous, slightly glossy, green; side veins seen to be linked with the midrib; reticulation moderately dense with finite tertiary and incomplete quaternary veining; oil glands numerous, several per areole, island. *Inflorescences* axillary and unbranched usually clustered at the leafless ends of branchlets; peduncles more or less terete, up to 1.5 cm long with 7 flowers. *Buds* on long pedicels up to 1 cm long, rhomboid, up to 0.9 x 0.6 cm, with a single slightly beaked operculum. *Stamens* very numerous (c. 300 per bud), variously flexed, all fertile; anthers dorsifixed, versatile, oblong, dehiscing by longitudinal slits, with a prominent terminal gland. *Style* glandular; stigma apparently lobed. *Flowers* white. *Ovules* in 2 vertical rows. *Fruit* on pedicels to 0.7 cm long, cupular to truncate-globose and slightly contracted at the rim, wider than long, to 1 x 1.4 cm; valves 4, to rim level. *Seed* brown, pyramidal, winged, with terminal hilum.

Distribution: Mt Misery, between Cataby and Dandaragan, Western Australia, where it occurs within a hectare including the flat mesa top and the southern slope in 5 or 6 clumps, each consisting of several apparent individuals.

Flowering period: March.

Etymology: The specific epithet simply alludes to the only known occurrence of this species, *viz.* Mt Misery (Latin, *dolorosus* – sorrowful).

Notes: E. dolorosa persists on a refugial site similar to species such as *E. suberea* and *E. lateritica* in Mt Lesueur National Park. It is probable that *E. dolorosa* is a relict species barely surviving extinction due to drying climate in the late Pleistocene.

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	500	500		500	500		500	500		500	500		500	500	
Map critical habitat	1,500		500												
Liaise with land managers	500		200	500		200	500		200	500		200	500		200
Develop and implement a fire management strategy	1,000	1,000	500	600	600	500	600	600	500	600	600	500	600	600	500
Monitor population	700		600	700		600	700		600	700		600	700		600
Collect seed	800		1,400				800		1,400				800		1,400
Conduct further surveys	800	800	900				800	800	900				800	800	900
Propagate translocates from tissue culture					7,000	11,100		7,000	8,900		2,800	4,700		2,800	4,700
Undertake and monitor translocation										6,900		7,900	7,400		5,100
Promote awareness	1,100		600	1,100			1,100			1,100			1,100		
Obtain biological and ecological information				5,000		7,000	5,000		7,000	5,000		7,000			
Review the need for a full Recovery Plan													11,200		9,100
Total	6,900	2,300	4,700	8,400	8,100	19,400	10,000	8,900	19,500	15,300	3,900	20,900	23,600	4,700	22,500
Yearly Total		**13,900**			**35,900**			**38,400**			**40,100**			**50,800**	

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

Total CALM: $64,200
Total Other: $27,900
Total External Funding: $87,000
Total Costs: $179,100