INTERIM RECOVERY PLAN NO. 267

CUNDERDIN DAVIESIA

(*Daviesia cunderdin*)

INTERIM RECOVERY PLAN

2008-2013

April 2008

Department of Environment and Conservation
Kensington

Australian Government

Government of Western Australia

Department of Environment and Conservation
Our environment, our future

FOREWORD

Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Conservation and Land Management (CALM) Policy Statements Nos. 44 and 50. Note: the Department of CALM formally became the Department of Environment and Conservation (DEC) in July 2006. DEC will continue to adhere to these Policy Statements until they are revised and reissued.

IRPs outline the recovery actions that are required to urgently address those threatening processes most affecting the ongoing survival of threatened taxa or ecological communities, and begin the recovery process.

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

This IRP replaces IRP No.37 (1999-2002), prepared by Rebecca Evans and Andrew Brown.

This IRP will operate from April 2008 to March 2013 but will remain in force until withdrawn or replaced. It is intended that, if the taxon is still ranked CR, this IRP will be reviewed after five years and the need for further recovery actions assessed.

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

Information in this IRP was accurate in April 2008.

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

IRP PREPARATION

This IRP was prepared by Craig Douglas[1], Wendy Johnston[2] and David Jolliffe[3]

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ACKNOWLEDGMENTS

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

Bob Dixon	Manager of Biodiversity and Extensions, Botanic Gardens and Parks Authority
Bob Elkins	Technical Assistant, Botanic Gardens and Parks Authority
Amanda Shade	Assistant curator of displays and development, Botanic Gardens and Parks Authority
Andrew Crawford	Technical Officer, DEC's Threatened Flora Seed Centre
Joel Collins	Former Flora Conservation Officer, Avon Mortlock District, DEC.
Andrew Brown	Threatened Flora Coordinator, Species and Communities Branch, DEC

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

Cover photograph by Andrew Brown.

CITATION

This IRP should be cited as:

Department of Environment and Conservation (2008). Cunderdin Daviesia (*Daviesia cunderdin*) Interim Recovery Plan 2008-2013. Interim Recovery Plan No. 267. Department of Environment and Conservation, Perth, Western Australia.

SUMMARY

Scientific Name:	***Daviesia cunderdin***	**Common Name:**	Cunderdin Daviesia
Family:	Papilionaceae	**Flowering Period:**	April - June
DEC Region:	Midwest	**DEC District:**	Avon Mortlock
Shire:	Cunderdin	**Recovery Team:**	Avon Mortlock District Threatened Flora Recovery Team

Illustrations and/or further information: Atkins, K. (2008) *Declared Rare and Priority Flora List for Western Australia.* Department of Environment and Conservation, Western Australia; Brown, A., Thomson-Dans, C. and Marchant, N. (1998). *Western Australia's Threatened Flora*. Department of Conservation and Land Management. pp 80; DEC (2007) *Western Australian Herbarium FloraBase 2 – Information on the Western Australian Flora*. Department of Environment and Conservation, Western Australia. Accessed 2007. http://www.calm.wa.gov.au/science/

Analysis of outputs and effectiveness of Interim Recovery Plan (IRP) 37 (1999-2002) prepared by R. Evans and A. Brown.

The criterion for success in the previous plan (the number of individuals within populations and/or the number of populations have increased over the term of the plan) has been met, as follows.

The number of known populations in the wild has increased from one to two with the establishment of a translocated population. The number of plants in the natural population has increased from 5 in 1999 to 9 in 2007 and there are a further 13 plants in a translocated population.

Actions carried out in the previous plan include:

Action 2 Implement weed control. A weed control strategy has been implemented.
Action 4 Collect seed and cutting material. DEC's Threatened Flora Seed Centre (TFSC) and the Botanic Gardens and Parks Authority (BGPA) hold seed and the BGPA have plants growing in their rare flora gardens.
Action 5 Develop a fire management strategy. Control burns and monitoring has provided enough information for a fire management strategy to be developed.
Action 6 Stimulate germination of soil stored seed. Germination of soil stored seed was achieved through control burns around dead plants.
Action 8 Promote awareness. A two-sided poster has been distributed to relevant authorities, schools, libraries and other institutions.
Action 10 Research into biology and ecology. Research has been conducted into seed viability, soil seed bank dynamics, factors affecting germination and survival of seedlings.
Action 11 Develop a translocation proposal. A translocation plan was completed in 2004 and a translocated population established.

Actions 4, 5, 6, 8 and 10 and other recovery actions included in the previous plan are ongoing and are included in this revised plan.

New recovery actions included in this plan are:

Action 3 Liaison with relevant land mangers
Action 5 Develop and implement fire and disturbance trials
Action 7 Undertake translocation

Current status: *Daviesia cunderdin* was declared as Rare Flora under the Western Australian *Wildlife Conservation Act 1950* in 1997 and is currently ranked as Critically Endangered (CR) under World Conservation Union (IUCN 1994) Red List criteria B1+2c, e; C2b; D due to the species being confined to a single population containing fewer than 50 plants and, until recently, a continuing decline in the number of plants and quality of habitat. The main threats are road maintenance, weed invasion, inappropriate fire regimes, exposure to wind, senescence, high germinant mortality, chemical spraying, firebreak and fence maintenance, grazing and rabbit burrowing. The species is listed as Endangered (EN) under the *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act).

Daviesia cunderdin is known from two populations - one natural (9 plants) and one translocated (13 plants) - in DEC's Avon Mortlock District.

Description: *Daviesia cunderdin* is an erect shrub 1.6 m high by 1.5 m wide when mature. The phyllodes (flattened leaf stalks that resemble leaves) are up to 4 mm long and have a sharp tip. *D. cunderdin* produces large red pea flowers in Autumn and Winter (Brown 1998). *Daviesia cunderdin* differs from *Daviesia cardiophylla*, *Daviesia euryloba* and

Daviesia umbonata in having larger flowers to 18 mm across that are completely red, rather than yellow and red (Brown 1998).

Habitat requirements: *Daviesia cunderdin* occurs on lateritic sandy clay, previously supporting undifferentiated kwongan communities with *Allocasuarina campestris* thickets and *Eucalyptus loxophleba* and *Eucalyptus salmonophloia* woodlands.

Habitat critical to the survival of the species, and important populations: Given that *Daviesia cunderdin* is ranked as CR, it is considered that all known habitat for wild and translocated populations is critical to the survival of the species, and that all wild and translocated populations are important populations. Habitat critical to the survival of *D. cunderdin* includes the area of occupancy of extant populations, areas of similar habitat (i.e. *Daviesia cunderdin* occurs on lateritic sandy clay, previously supporting undifferentiated kwongan communities with *Allocasuarina campestris* thickets and *Eucalyptus loxophleba* and *E. salmonophloia* woodlands) surrounding important populations (this is necessary to allow access for pollinators and protect the natural microclimate in which plants occur) and additional occurrences of similar habitat that may contain the species or be suitable for future translocations.

Benefits to other species or ecological communities: Recovery actions implemented to improve the quality or security of habitat for *Daviesia cunderdin* will also improve the status of remnant associated vegetation dominated by *Allocasuarina campestris*, *Eucalyptus loxophleba* and *Eucalyptus salmonophloia*.

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. *Daviesia cunderdin* is not listed under any specific international treaty however, and therefore this IRP does not affect Australia's obligations under any other international agreements.

Indigenous consultation: According to the Department of Indigenous Affairs Aboriginal Heritage Sites Register, no sites of Aboriginal significance are known at or near populations of the species covered by this IRP. However, the involvement of the Indigenous community is currently being sought to determine whether there are any issues or interests identified in the Plan. If no role is identified for indigenous communities in the recovery of this species, opportunities may exist through cultural interpretation and awareness of the species.

The advice of the South West Aboriginal Land and Sea Council (SWALSC) and Department of Indigenous Affairs is being sought to assist in the identification of potential indigenous management responsibilities for land occupied by threatened species, or groups with a cultural connection to land that is important for the species' conservation.

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

Social and economic impact: The implementation of this recovery plan is unlikely to cause significant adverse social and economic impacts. However, as one population of *Daviesia cunderdin* occurs adjacent to private land and another on private land the protection of this species may potentially affect farming activities. Management of the roadside adjacent to the natural population will need to ensure the protection of the *Daviesia cunderdin* plants and habitat.

Affected interests: Stakeholders potentially affected by the implementation of this plan include owners of private property and the Shire of Cunderdin.

Evaluation of the plan's performance: The Department of Environment and Conservation, in conjunction with the Avon Mortlock District Threatened Flora Recovery Team (AMDTFRT) 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.

Completed Recovery Actions

1. Land managers including owners of private property and Shires with populations on land they manage have been made aware of the threatened nature of this species, its location and their legal obligations to protect it.
2. Declared Rare Flora (DRF) markers have been installed at Population 1.
3. A translocation proposal has been prepared and planting undertaken at one of the designated sites.
4. Fencing of plants at the translocation site has been undertaken.
5. Prescribed burns of dead plants were undertaken in 1998 and 2000 to promote germination of soil-stored seed.
6. Smoke water treatments were applied to plots in 2000.
7. Intensive survey of habitat suitable for *Daviesia cunderdin* was conducted in 1995 and 1996.
8. An A4 poster describing and picturing the species, and describing its location, history, and threats has been published and distributed to local land owners, relevant authorities and volunteer organizations, libraries and schools.

9. Weed control is undertaken regularly using the herbicide.
10. DEC's Threatened Flora Seed Centre (TFSC) and the Botanic Gardens and Parks Authority (BGPA) have seed in storage.
11. BGPA has approximately ten plants in the botanic gardens.
12. BGPA have propagated plants from cuttings and seed for planting at the translocation site.
13. DEC's TFSC and BGPA have conducted seed germination trials.

Ongoing and future recovery actions

1. The AMDTFRT is overseeing the implementation of this IRP and will include information on progress in their annual report to DEC's Corporate Executive and funding bodies.
2. Staff from DEC's Avon Mortlock District office regularly monitor populations.

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

Recovery criteria
Criteria for success: The number of populations have increased and/or the number of mature individuals have increased by fifty percent or more over the term of the plan.
Criteria for failure: The number of populations have decreased and/or the number of mature individuals have decreased by fifty percent or more over the term of the plan.

Recovery actions

1. Coordinate recovery actions
2. Monitor populations
3. Liaise with relevant land managers
4. Undertake weed control
5. Develop and implement fire and disturbance trials
6. Develop and implement a fire management strategy
7. Undertake further translocation
8. Purchase land bordering the natural population
9. Revegetate road verge habitat
10. Collect seed
11. Obtain biological and ecological information
12. Promote awareness
13. Conduct further surveys
14. Review the plan and need for further recovery actions

1. BACKGROUND

Analysis of outputs and effectiveness of Interim Recovery Plan (IRP) 37 (1999-2002) prepared by R. Evans and A. Brown.

The criterion for success in the previous plan (the number of individuals within populations and/or the number of populations have increased over the term of the plan) has been met, as follows.

The number of known populations in the wild has increased from one to two with the establishment of a translocated population. The number of plants in the natural population has increased from 5 in 1999 to 9 in 2007 and there are a further 13 plants in a translocated population.

Actions carried out in the previous plan include:

Action 2 Implement weed control. A weed control strategy has been implemented.
Action 4 Collect seed and cutting material. DEC's Threatened Flora Seed Centre (TFSC) and the Botanic Gardens and Parks Authority (BGPA) hold seed and the BGPA have plants growing in their rare flora gardens.
Action 5 Develop a fire management strategy. Control burns and monitoring has provided enough information for a fire management strategy to be developed.
Action 6 Stimulate germination of soil stored seed. Germination of soil stored seed was achieved through control burns.
Action 8 Promote awareness. A two-sided poster has been distributed to relevant authorities, schools, libraries and other institutions.
Action 10 Research into biology and ecology. Research has been conducted into seed viability, soil seed bank dynamics, factors affecting germination and survival of seedlings.
Action 11 Develop a translocation proposal. A translocation plan was completed in 2004 and a translocated population established at one of the chosen sites.

Actions 4, 5, 6, 8 and 10 and other recovery actions included in the previous plan are ongoing and are included in this revised plan.

New recovery actions included in this plan are:

Action 3 Liaison with relevant land mangers
Action 5 Develop and implement fire and disturbance trials
Action 7 Undertake translocation

History

Daviesia cunderdin was first collected from its current location by Neville Marchant and Joanna Seabrook in 1993 and described by Michael Crisp and Gregory Chandler in 1997.

Daviesia cunderdin is known from one natural population in the central Wheatbelt of Western Australia. Thirteen plants have been established in a translocated population.

Description

Daviesia cunderdin is an erect shrub 1.6 m high by 1.5 m wide when mature. The phyllodes (flattened leaf stalks that resemble leaves) are up to 4 mm long and have a sharp tip. *D. cunderdin* produces large red pea flowers in Autumn and Winter (Brown 1998). *Daviesia cunderdin* differs from *Daviesia cardiophylla*, *Daviesia euryloba* and *Daviesia umbonata* in having larger flowers to 18 mm across that are completely red, rather than yellow and red (Brown 1998).

Distribution and habitat

Daviesia cunderdin is confined to the central Wheatbelt of Western Australia in the Shire of Cunderdin.

Habitat is lateritic sandy clay with *Allocasuarina campestris*, *Eucalyptus loxophleba* and *Eucalyptus salmonophloia*. Other native species associated with *Daviesia cunderdin* include *Acacia acuminata*, *Acacia volubilis*, *Allocasuarina humilis*, *Dianella revoluta*, *Dryandra fraseri*, *Gastrolobium spinosum*, *Grevillea hookeriana* and *Leptospermum erubescens*.

Summary of population land vesting, purpose and tenure

Pop. No. & Location	DEC District	Shire	Vesting	Purpose	Manager
1. N of Cunderdin	Avon Mortlock	Cunderdin	Unvested Reserve	Road reserve	Shire of Cunderdin
2T. NE of Cunderdin (translocation)	Avon Mortlock	Cunderdin	Freehold	Private Property	Landholders

Populations in **bold text** are considered to be Important Populations

Biology and ecology

Daviesia cunderdin matures early, producing flowers and seed at three years of age.

Seed from *Daviesia cunderdin* requires fire to stimulate germination, however burning too frequently before soil seed banks can be replenished or at inappropriate times of the year may result in population decline. No seedlings have been recorded in the absence of fire.

There is a high mortality rate among seedlings in the summer following germination especially in drought years with up to 90% mortality under drought conditions despite watering every 1 to 2 weeks plus mulching and weeding. Seven months after germinating seedlings are observed to be 4 cm high.

Germination tests conducted by DEC's Threatened Flora Seed Centre (TFSC) on *Daviesia cunderdin* seed produced results ranging between 33 to 67% germination. In 1998 the Botanic Gardens and Parks Authority (BGPA) conducted propagation tests on 20 cuttings from *D. cunderdin* with results ranging from 20-60% survival. Cutting strike rate was typically low, with success rate much greater for cuttings struck from young plants grown *ex situ* from seed.

Daviesia seeds have an elaisome (a small outgrowth on the surface of the seed) that is common to many species in the family Papilionaceae. This attracts ants that disperse the seed.

Daviesia cunderdin flowers from April to June with opportunistic flowering earlier in the year following good rainfall. Immature fruit has been recorded in August and dehisced fruit in October. Likely pollinators observed on *D. cunderdin* flowers include bees and wasps.

Threats

Daviesia cunderdin was declared as Rare Flora under the Western Australian *Wildlife Conservation Act 1950* in 1997 and is currently ranked as Critically Endangered (CR) under World Conservation Union (IUCN 1994) Red List criteria B1+2c, e; C2b; D due to the species being confined to a single population containing fewer than 50 plants and a previous continuing decline in the number of plants and quality of habitat. The main threats are road maintenance, weed invasion, inappropriate fire regimes, exposure to wind, senescence, high germinant mortality, chemical drift, firebreak and fence maintenance, grazing and rabbit burrowing. The species is listed as Endangered (EN) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

- **Road maintenance.** The natural population of *Daviesia cunderdin* is located on a narrow road reserve, less than 5 m wide in places. This population is threatened by grading and indiscriminate spraying of weeds. Relevant authorities have been informed of this location so that appropriate protective actions can be implemented.
- **Weed invasion** threatens *Daviesia cunderdin* Population 1. Weeds complete for space and resources reducing population health and reproductive output.
- **Inappropriate fire regimes.** Fire is required by *Daviesia cunderdin* for recruitment through seed germination, however, as plants younger than 3 years old do not produce seed, frequent fires may be a threat. Only mature plants produce enough seed to ensure population persistence post fire.

- **Senescence.** Prior to recovery actions being implemented the natural population of *Daviesia cunderdin* was in serious decline due to senescence. Due to the relatively short life span of the species this is an ongoing threat and control burns may bee needed every 10 yrears or so to stimulate the germination of soil-stored seed.
- **High germinant mortality.** Following control burns in 1998 and 2000 high germinant mortality of up to 90% was observed even with regular watering. Whether this is a result of natural genetic selection for vigor or a response to unfavorable weather conditions is unknown.
- **Chemical drift and spraying.** Herbicide spraying occurred in the area of the roadside population over a three year period to 1997, however liaison with local land owners and the Shire of Cunderdin has abated this threat. Relevant authorities have been informed of the location of the species so that spraying does not occur.
- **Firebreak and fence maintenance.** Maintenance of the fire break and fence on private property bordering the natural population of *Daviesia cunderdin* is a threat. Relevant land owners have been informed of the species location and conservation status and their legal obligations to protect it.
- **Grazing.** Young seedlings (6 to 12 months) are vulnerable to grazing, after which they develop prickly, spiny branchlets characteristic of mature plants (Brown 1998). With rabbit activity noted around Population 1, rabbit grazing could pose a threat to young seedlings.
- **Rabbit burrowing** has been recorded around the base of mature plants in Population 1. Such activity damages roots and exposes subsurface soil reducing moisture availability to plants.

Summary of population information and threats

Pop. No. & Location	**Land Status**	**Year/ No. plants**	**Current Condition**	**Threats**
1. No of Cunderdin	Road reserve	1991 14 1999 5 (3) 2000	Healthy	Road maintenance, weeds

		4 (8) [3] 2003 5 (7) [3] 2005 11 2006 9 [3]		, inappropriate fire regimes, senescence, high germinate mortality, ch

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				a b b i t b u r r o w i n g .
2 T . N E o f C u n d e r d i n (t r a n s l o c a t i o n)	P r i v a t e P r o p e r t y	2 0 0 5 4 3 [7 6] 2 0 0 6 1 3 [5 9]	M o d e r a t e	G r a z i n g , w e e d s

Populations in **bold text** are considered to be Important Populations; Note: ( ) = number of seedlings, [ ] = number dead

Guide for decision-makers

Section 1 provides details of current and possible future threats. Developments and/or land clearing in the immediate vicinity of either of the populations of *Daviesia cunderdin* require assessment. No developments or clearing should be approved unless the proponents can demonstrate that their actions will not have a significant impact on the species, its habitat or potential habitat or on the local surface hydrology, such that drainage in the habitat of the species would be altered.

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

Given that *Daviesia cunderdin* is ranked as CR, it is considered that all known habitat for wild and translocated populations is critical to the survival of the species, and that all wild and translocated populations are important

populations. Habitat critical to the survival of *D. cunderdin* includes the area of occupancy of the natural and translocated populations, areas of similar habitat surrounding the natural and translocated populations (this is necessary to allow access for pollinators and provide room for population expansion) and additional occurrences of similar habitat that may contain the species or be suitable for future translocations.

Benefits to other species or ecological communities

Recovery actions implemented to improve the quality or security of habitat for *Daviesia cunderdin* will also improve the status of remnant associated vegetation notably undifferentiated kwongan communities dominated by *Allocasuarina campestris* thickets and *Eucalyptus loxophleba* and *Eucalyptus salmonophloia* woodlands. One conservation listed flora species located with *D. cunderdin* is listed in the table below.

Conservation-listed flora species occurring in habitat of *Daviesia cunderdin*

Species name	Conservation Status (Western Australia)	Conservation Status (EPBC Act)
Acacia volubilis	DRF, Critically Endangered	Endangered

DRF – Declared Rare Flora.

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. *Daviesia cunderdin* is not listed under any specific international treaty however, and therefore this IRP does not affect Australia's obligations under any other international agreements.

Indigenous consultation

According to the Department of Indigenous Affairs Aboriginal Heritage Sites Register, no sites of Aboriginal significance are known at or near populations of the species covered by this IRP. However, the involvement of the Indigenous community is currently being sought to determine whether there are any issues or interests identified in the Plan. If no role is identified for indigenous communities in the recovery of this species, opportunities may exist through cultural interpretation and awareness of the species.

The advice of the South West Aboriginal Land and Sea Council (SWALSC) and Department of Indigenous Affairs is being sought to assist in the identification of potential indigenous management responsibilities for land occupied by threatened species, or groups with a cultural connection to land that is important for the species' conservation.

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

Social and economic impact

The implementation of this recovery plan is unlikely to cause significant adverse social and economic impacts. However, as one population of *Daviesia cunderdin* occurs adjacent to private land and another on private land the protection of this species may potentially affect farming activities. Management of the roadside adjacent to the natural population will need to ensure the protection of the *Daviesia cunderdin* plants and habitat.

Affected interests

Stakeholders potentially affected by the implementation of this plan include owners of private property and the Shire of Cunderdin.

Evaluation of the plan's performance

The Department of Environment and Conservation, in conjunction with the Avon Mortlock District Threatened Flora Recovery Team (AMDTFRT) 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 IRP is to abate identified threats and maintain or enhance viable *in situ* populations to ensure the long-term preservation of the species in the wild.

Criteria for success: The number of populations have increased and/or the number of mature individuals have increased by fifty percent or more over the term of the plan.
Criteria for failure: The number of populations have decreased and/or the number of mature individuals have decreased by fifty percent or more over the term of the plan.

3. RECOVERY ACTIONS

Completed recovery actions

Land managers, including the Shire of Cunderdin and owners of private property have been made aware of the threatened nature of the species, its location and their legal obligations to protect it.

Declared Rare Flora (DRF) markers have been installed at Population 1.

In 2004 a translocation proposal for *Daviesia cunderdin* was completed. This plan identified several areas for the establishment of translocated populations. These sites include remnant vegetation on private property, the Shire of Dowerin 'Parklands Reserve' and Cunderdin Museum Gardens. The plan also covers translocation design, sources of plants and a timetable for actions.

In 2005, *Daviesia cunderdin* plants were translocated into remnant vegetation on private property. These plants have been fenced and 13 healthy plants were recorded when the population was surveyed in a 2006.

In 1998 and 2000, recovery burns were conducted by a research consultant and staff from DEC's Avon Mortlock District. Each burn covered the area of two dead plants. The 1998 burns resulted in 9 seedlings and the 2000 burns in 30 seedlings of which 5 survived. Plants were watered every 1 to 2 weeks, mulch added to the site and weeds removed by hand.

In 2000, smoke water was applied to an unburnt area (2 m x 2 m) below a dead specimen of *Daviesia cunderdin* at a rate of 100 ml/m^2 using a hand sprayer. This action was unsuccessful in stimulating germination.

Intensive survey for *Daviesia cunderdin* was conducted in 1995 and 1996. Surveys took the form of 'drive by' inspections of suitable road verge habitat. Suitable vegetation remnants were also searched on foot. Surveys covered areas within a 40 km radius of the existing population, Charles Gardner Reserve and other likely sites. No new populations of *D. cunderdin* were located.

In 1998, an A4 glossy poster picturing *Daviesia cunderdin* and describing its location, history, and threats was produced by DEC and distributed by DEC's Avon Mortlock District office to local land owners, relevant authorities and volunteer organizations, libraries and schools.

Weed control in the area of the natural population of *Daviesia cunderdin* is undertaken regularly by staff from DEC's Avon Mortlock District.

DEC's TFSC holds 214 seeds made from Population 1 between 1996 and 1999.

The BGPA has 0.33 g of seed collected from Population 1 in 1995 by Joanna Seabrook.

DEC's TFSC has conducted germination trials on seed collections. The BGPA has conducted seed germination trials and propagation trials using cuttings from *Daviesia cunderdin*.

Ongoing and future recovery actions

The AMDTFRT is overseeing the implementation of this IRP and will include information on progress in their annual report to DEC's corporate Executive and funding bodies.

Staff from DEC's Avon Mortlock District office regularly monitor both populations.

Where recovery actions are implemented on lands other than those managed by DEC, permission has been or will be sought from the appropriate land manager prior to actions being undertaken. The following recovery actions are roughly in order of descending priority, influenced by their timing over the term of the plan. However this should not constrain addressing any of the priorities if funding is available for 'lower' priorities and other opportunities arise.

1. Coordinate recovery actions

The AMDTFRT will continue to coordinate the implementation of recovery actions for *Daviesia cunderdin* and will include information on progress in their annual reports to DEC's Corporate Executive and funding bodies.

Action: Coordinate recovery actions
Responsibility: AMDTFRT
Cost: $1,400 per year

2. 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.

Action: Monitor populations
Responsibility: DEC (Avon Mortlock District) through the AMDTFRT
Cost: $500 per year

3. Liaise with relevant land managers

Staff from DEC's Avon Mortlock District will liaise with the owners of private property that borders Population 1 and the owners of private property on which the translocated Population 2 is located to ensure that they are not accidentaly damaged or destroyed. Spray drift from bordering farming properties continues to pose a threat along with fence and firebreak maintenance.

Action: Liaise with land managers
Responsibility: DEC (Avon Mortlock Districts), through the AMDTFRT
Cost: $600 per year

4. Undertake weed control

Weeds are a threat to the natural population of *Daviesia cunderdin*. Currently RoundUp™ has proven successful controlling weeds around *D. cunderdin* plants as long as direct spraying of *D. cunderdin* is avoided. This action should be continued. Weed control should be scheduled to include spraying of other threatened flora populations in the District and local area.

Action: Undertake weed control
Responsibility: DEC (Avon Mortlock District, DEC's Science Division) through the AMDTFRT
Cost: $1,700 per year

5. Develop and implement fire and disturbance trials

Daviesia cunderdin requires fire to stimulate the germination of its soil seed bank. DEC Avon Mortlock District will, in consultation with private landowners the Shire of Cunderdin and relevant authorities, develop and implement burn and disturbance trials to stimulate the germination of soil stored seed. Trials will be monitored regularly and larger scale operations undertaken if required. Attention will be given to each of the following to ensure maximum recruitment and survival of germinants but at the same time maintaining the integrity of the population.

- Burning discrete dead plants.
- Raking of the soil below and near dead plants.
- Regular watering of germinants.

Action: Develop and implement fire and disturbance trials
Responsibility: DEC (Avon Mortlock District) through the AMDTFRT, and relevant authorities
Cost: $2,500 in the first year; $3,000 in years 3 and 5; $800 in years 2 and 4

6. Develop and implement a fire management strategy

Daviesia cunderdin plants start producing seed when three years of age however the quantities at this age are not adequate to ensure population replacement post burn. Overly frequent fires may therefore result in population extinction. The development of a fire management strategy is recommended and will be addressed under this action.

Action: Develop a fire management strategy
Responsibility: DEC (Science Division, Avon Mortlock District) through the AMDTFRT and relevant authorities
Cost: $2,500 in the first year

7. Undertake further translocation

In 2004 a translocation plan was completed for *Daviesia cunderdin* identifying several suitable sites. *Daviesia cunderdin* has been translocated to private property, and under this action further plantings at this and other sites is recommended.

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.

Action: Undertake further translocation
Responsibility: DEC (Avon Mortlock district) and BGPA through the AMDTFRT
Cost: $6,700 in year 3

8. Purchase land bordering the natural population

The purchase of a strip of private property bordering *Daviesia cunderdin* Population 1 will be considered. This action will increase the area of habitat in which *D. cunderdin* occurs.

Action: Purchase land bordering the natural population
Responsibility: DEC (Avon Mortlock District) through the AMDTFRT
Cost: $1,700 in the first year.

9. Revegetate road verge habitat

Revegetating the road verge habitat where *Daviesia cunderdin* occurs is recommended. This action will create a buffer of vegetation around *Daviesia cunderdin* that will reduce the impact of spray drift from bordering farmland and reduce wind damage to plants. Revegetation will also create more suitable habitat for pollinators and encourage an ant guild composed of non disturbance species. This transition is likely to have a positive

effect on the survival of soil seed banks as ants are likely dispersers of *D. cunderdin* seed and field evidence indicates some disturbance species predate seed from *D. cunderdin.*

Action: Revegetate road verge habitat
Responsibility: DEC (Avon Mortlock District and TFSC) and BGPA through the AMDTFRT
Cost: $13,400 in year 3, $6,700 in year 4.

10. Collect seed

DEC's TFSC and the BGPA currently hold seed and live plants of *Daviesia cunderdin*. Further seed collections are needed and should aim to sample and preserve the maximum range of genetic diversity possible. The "Germplasm Conservation Guidelines for Australia" produced by the Australian Network for Plant Conservation (ANPC) should be used to guide this process.

Actions: Collect seed
Responsibility: DEC (Avon Mortlock District, TFSC), and BGPA through the AMDTFRT
Cost: $2,300 per year for the first three years

11. Obtain biological and ecological information

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

1. Optimal fire frequency and intensity to maximise population size and health.
2. Identify factors that trigger or influence effective germination and recruitment.
3. Pollination biology and methods of seed dispersal.
4. Rate of seed set and size of soil seed banks.

Action: Obtain biological and ecological information
Responsibility: DEC (Science Division, Avon Mortlock District) through the AMDTFRT
Cost: $8,000 in years 2 and 3

12. Promote awareness

The importance of biodiversity conservation and the protection of *Daviesia cunderdin* will continue to be promoted to the public. This will be achieved through an information campaign using local print and electronic media and by setting up poster displays. An A4 information sheet, which includes a description of the plant, its habitat type, threats, management actions and photo's will be circulated to local land owners, relevant authorities and volunteer organizations, libraries and schools. The preparation of a poster illustrating all CR flora species in the Avon Mortlock District is also recommended. Formal links with local naturalist groups and interested individuals should be encouraged.

Action: Promote awareness
Responsibility: DEC (Avon Mortlock District, SCB and Strategic Development and Corporate Affairs Division) through the AMDTFRT
Cost: $1,000 in years 1, 3 and 5

13. Conduct further surveys

Further surveys should be done during the species flowering period between April and June, with assistance from local naturalists and volunteers.

Action: Conduct further surveys
Responsibility: DEC (Avon Mortlock District) through the AMDTFRT
Cost: $1,100 in years 2 and 3.

14. Review the plan and need for further recovery actions

At the end of the five-year term this IRP will be reviewed and the need for further recovery actions assessed.

Action: Review the need for further recovery actions
Responsibility: DEC (SCB, Avon Mortlock District) through the AMDTFRT
Cost: $1,500 in the fifth year

Summary of recovery actions

Recovery Actions	Priority	Responsibility	Completion date
Coordinate recovery actions	High	AMDTFRT	Ongoing
Monitor populations	High	DEC (Avon Mortlock District) through the AMDTFRT	Ongoing
Liaise with relevant land managers	High	DEC (Avon Mortlock Districts), through the AMDTFRT	Ongoing
Undertake weed control	High	DEC (Avon Mortlock District, DEC's Science Division) through the AMDTFRT	Ongoing
Develop and implement fire and disturbance trials	High	DEC (Avon Mortlock District) through the AMDTFRT, and relevant authorities	Ongoing
Develop and implement a fire management strategy	High	DEC (Science Division, Avon Mortlock District) through the AMDTFRT and relevant authorities	Develop by 2007 with implementation ongoing
Undertake translocation	High	DEC (Avon Mortlock District) and BGPA through the AMDTFRT	2011
Purchase land bordering Population 1	High	DEC (Avon Mortlock District) through the AMDTFRT	2009
Revegetate road verge habitat	High	DEC (Avon Mortlock District and TFSC) and BGPA through the AMDTFRT	2012
Collect seed	Moderate	DEC (Avon Mortlock District, TFSC), and BGPA through the AMDTFRT	2011
Obtain biological and ecological information	Moderate	DEC (Science Division, Avon Mortlock District) through the AMDTFRT	2011
Promote awareness	Moderate	DEC (Avon Mortlock District, SCB and Strategic Development and Corporate Affairs) through the AMDTFRT	2013
Conduct further surveys	Moderate	DEC (Avon Mortlock District) through the AMDTFRT	2011
Review the plan and need for further recovery actions	Moderate	DEC (SCB, Avon Mortlock District) through the AMDTFRT	2013

4. TERM OF PLAN

Western Australia

This IRP will operate from April 2008 to March 2013 but will remain in force until withdrawn or replaced. If the species is still ranked CR after five years, the need for further recovery actions and an update of this IRP will be assessed.

Commonwealth

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

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

5. REFERENCES

Atkins, K. (2008) *Declared Rare and Priority Flora List for Western Australia.* Department of Environment and Conservation, Western Australia.

Australian Network for Plant Conservation. (1997). *Germplasm Conservation Guidelines for Australia, An introduction to the principles and practices for seed and germplasm banking of Australian Species.* Canberra, Australian Network for Plant Conservation Germplasm Working Group.

Brown, A., Thomson-Dans, C. and Marchant, N. (1998). *Western Australia's Threatened Flora*. Department of Conservation and Land Management. pp 80.

Department of Environment and Conservation (2007). *Western Australian Herbarium FloraBase 2 – Information on the Western Australian Flora*. Department of Environment and Conservation, Perth, Western Australia. Accessed 2007. http://www.calm.wa.gov.au/science/

Department of Environment and Conservation (2007). *Threatened Flora Database (DEFL)*. Species and Communities Branch, Department of Environment and Conservation, Perth, Western Australia. Accessed 2007.

Department of Conservation and Land Management (1995). Policy Statement No. 29 *Translocation of Threatened Flora and Fauna*. Department of Conservation and Land Management, Western Australia.

Department of Conservation and Land Management (1992). Policy Statement No. 44 *Wildlife Management Programs*. Department of Conservation and Land Management, Western Australia.

Department of Conservation and Land Management (1994). Policy Statement No. 50 *Setting Priorities for the Conservation of Western Australia's Threatened Flora and Fauna*. Department of Conservation and Land Management, Western Australia.

Department of Conservation and Land Management (1999). *Cunderdin Daviesia (Daviesia cunderdin) Interim Recovery Plan 1999-2002. Interim Recovery Plan No. 37.* Department of Conservation and Land Management, Western Australia.

Crisp, M.D. and Chandler, G.T. (1997). Contributions towards a revision of Daviesia (Fabaceae: Mirbelieae). V.* D. cardiophylla sens. lat. *Australian Systematic Botany*. **10**: 321-329.

IUCN (1994). *IUCN Red List Categories: Version 2.3.* Prepared by the IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK.

IUCN (2001). *IUCN Red List Categories: Version 3.1*. Prepared by the IUCN Species Survival Commission.

Weaving, S.J. (1995). Native vegetation handbook for the Shire of Cunderdin. Department of Agriculture, Perth, Western Australia. pp 4.

6. TAXONOMIC DESCRIPTION

Excerpt from: Crisp, M.D. and Chandler, G.T. (1997). Contributions towards a revision of Daviesia (Fabaceae: Mirbelieae). V.* D. cardiophylla sens. lat. *Australian Systematic Botany*. **10**: 321-329.

Erect, compact to open, divaricate *shrub*, to 1.2-1.6 m high and c. 1.5 m wide, minutely hispid on branchlets and pedicels. *Branchlets* at c. 45^0, prominently ribbed, with a pedestal at each node. *Phyllodes* scattered, at c. 45^0 to the stem, elliptical to ovate or narrowly so, more or less flat, with an acuminate (to 3-4 mm long) pungent apex, rounded and articulate with 3 node-like thickenings on nerves at base, (6-)10-20x4-9 mm, rigid and sometimes slightly wrinkled on drying, dull green. *Unit inflorescences* solitary or in pairs (rare) in the axils, 1-flowered; peduncle nil; *subtending bracts* oblong, keeled, 1-1.5 mm long. *Pedicels* 3-5 mm long, hispid. *Calyx* 5-7 mm long including the c. 1.5 mm receptacle, minutely hispid; upper 2 lobes united in a truncate recurved lip with outcurved tips, 2 mm long; lower 3 lobes triangular, 2 mm long; a small, dark-coloured bulge just below each sinus (except between the upper 2 lobes). *Corolla* red to orange-red; *standard* remaining partly folded and only tardily opening out, broadly obovate to elliptical with a broad shallow sinus at apex, 12-15 mm x 12-14 mm including 3-4 mm claw with two raised deltoid appendages (calli), c.0.6-0.7 mm high, red with a dark red centre; *wings* elliptical to narrowly so, rounded at apex, auriculate, 13-17x4-5 mm including 4-5 mm claw, darker red towards base; *keel* 8-8.5 mm claw, petals fully joined from base of lamina to tip, claws free. *Stamens* strongly dimorphic, inner whorl of 5 with longer, slender filaments and shorter, rounder, versatile anthers with confluent thecae; outer whorl of five with shorter, broader filaments and longer, 2-celled, basifixed anthers. Ovary slightly obovate. *Style* curving gradually through c.120^0. *Pod* and seed not seen.

In general aspect plants of *Daviesia cunderdin* are larger and coarser than in any of *Daviesia cardiophylla*, *Daviesia euryloba* or *Daviesia umbonata*. However, it is most readily distinguished by the flowers, which are dull red and much larger than the more conventional yellow and red flowers of the other three species. Moreover, *D. cunderdin* has a unique standard petal, 12-15 mm long, which remains partly folded and bears a pair of deltoid appendages at the base. The other species have a fully opening standard less than 10 mm long, with only slightly raised calli. In *D. cunderdin* the bases of the phyllodes are rounded, not cordate as in *D. cardiophylla* nor cuneate like *D. umbonata*. Those of *D. euryloba* are similar in outline to those in *D. cunderdin*, but more or less longitudinally folded up, or at least adaxially concave. There are bulges below the sinuses of

the calyx in both *D. cunderdin* and *D. umbonata*, but these are rare in *D. cardiophylla* and absent in *D. euryloba*.