INTERIM RECOVERY PLAN NO. 271

SPINY BENTLEYA

(*Bentleya spinescens*)

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This IRP will operate from April 2008 to March 2013 but will remain in force until withdrawn or replaced. This IRP will be reviewed at the end of five years and the need for further recovery actions assessed.

This IRP was approved by the Director of Nature Conservation on the 30 April 2008. The 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 at 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] and Bethea Loudon[2]

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ACKNOWLEDGMENTS

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

Andrew Crawford	Technical Officer, Threatened Flora Seed Centre, DEC
Bob Dixon	Manager of Biodiversity and Extensions, Botanic Gardens and Parks Authority
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 Ken Dixon and Steve Hopper. Image used with the permission of the Western Australian Herbarium, DEC (http://florabase.calm.wa.gov.au/help/copyright). Accessed July 2006.

CITATION

This IRP should be cited as:

Department of Environment and Conservation (2008). Spiny Bentleya (*Bentleya spinescens*) Interim Recovery Plan 2008-2013. Interim Recovery Plan No. 271. Department of Environment and Conservation, Western Australia.

SUMMARY

Scientific Name:	***Bentleya spinescens***	**Common Name:**	Spiny Bentleya
Family:	Pittosporaceae	**Flowering Period:**	August-October
DEC Region:	Wheatbelt	**DEC District:**	Great Southern
Shire:	Lake Grace, Kent, Jerramungup	**Recovery Team:**	Great Southern 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; Bennett, E.M. (1986). *Bentleya*, a new genus of Pittosporaceae from southern Western Australia. *Nuytsia* 5(3): 401-406; Brown, A., Thomson-Dans, C. and Marchant, N. (1998). *Western Australia's Threatened Flora*. Department of Conservation and Land Management, Western Australia. Pp 71; DEC (2003 onwards) *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/.

Current status: *Bentleya spinescens* is listed as Priority 4 (P4) on the Environment and Conservation's Priority Flora list (Atkins 2008) and has now been removed from the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) where it was previously listed as Endangered. The species is regarded as being not currently threatened, but is being monitored to ensure that its conservation status does not change. The main potential threats include road, rail and firebreak maintenance, damage to plants on and bordering Private Property and inappropriate fire regimes.

Bentleya spinescens is currently known from 12 extant populations and 162, 882 plants in DEC's Great Southern District.

Eighty nine percent of *Bentleya spinescens* plants are located on Unallocated Crown Land (UCL), 10.5% on road reserves, 0.6% in nature reserves and 0.09% on Private Property, Shire Reserve and rail reserves collectively.

Description: *Bentleya spinescens* is a shrub 5 to 20 cm tall and 2 to 20 cm across. Its stems are much branched and ending in spines, older stems have grey, fissured bark, younger branches are reddish-brown, with scattered white hairs. Leaves occur in bunches of up to seven, originating from the same place, with scattered white hairs on the upper surface, covered in downy hairs on the lower surface. Flowers occur on the stems at or just above ground level, occasionally a few along the stems, each flower is subtended by two whorls totaling ten to twelve bracts, which are pale brown, very densely hairy and with an abaxial surface featuring scattered hairs, the margins are densely ciliate. The sepals are greenish-white, the petals are coherent when young for two thirds of their length, becoming free at base with age, and are whitish-green to cream. The seeds are reddish-brown (Bennett 1986).

Habitat requirements: *Bentleya spinescens* occurs on sandy clay and sandy loam soils in open mallee and mixed Melaleuca scrub.

Habitat critical to the survival of the species, and important populations: Although *Bentleya spinescens* is now listed as a Priority 4 flora, it is considered that all known habitat for wild populations is critical to its survival, and that all wild populations are important populations. Habitat critical to the survival of *B. spinescens* includes the area of occupancy of extant populations, areas of similar habitat (i.e. sandy clay and sandy loam soils in open mallee and mixed *Melaleuca* scrub) surrounding important populations (this is necessary to allow access for pollinators) 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 the habitat of *Bentleya spinescens* will also improve the status of associated native vegetation dominated by mallee and mixed *Melaleuca* scrub. Two threatened and three priority flora species are located with *B. spinescens*.

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. *Bentleya spinescens* 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 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 IRP is unlikely to cause significant adverse social and economic impacts. However, as some of the populations of *Bentleya spinescens* occur on, or adjacent to, private land the protection of them may potentially affect farming activities. Some development in the Newdegate townsite may be affected with a population bordering the township.

Affected interests: Stakeholders potentially affected by the implementation of this plan include the Shires of Lake Grace, Kent and Jerramungup, Main Roads WA, WestNet Rail and owners of Private Property.

Evaluation of the plan's performance: DEC in conjunction with the Great Southern District Threatened Flora Recovery Team (GSDTFRT) 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 four years of implementation.

Completed recovery actions

1. Land managers including private land owners, Shires, MainRoads WA and WestNet Rail with populations on their property have been made aware of the threatened nature of this species, its location and their legal obligations to protect the species.
2. Declared Rare Flora (DRF) markers have been installed at Population 8 and Subpopulations 1a-d, 4a-d, 5a, 5b, 6a, 6c, 9a, 9b.
3. Fencing of Population 11 on private property was undertaken in 2002.

Ongoing and future recovery actions

1. Vesting Water Reserve no. 31111 as a Nature Reserve is currently being investigated.
2. The GSDTFRT are overseeing the implementation of this IRP and will include information on progress in their annual reports to DEC's Corporate Executive and funding bodies.
3. Staff from DEC's Great Southern District are monitoring all known 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: There has been no decrease in the number of populations and/or the number of mature individuals 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 ten percent or more over the term of the plan.

Recovery actions

1. Coordinate recovery actions
2. Monitor populations
3. Liaise with relevant land mangers
4. Conduct further surveys
5. Obtain biological and ecological information
6. Map habitat critical to the species' survival
7. Review the plan and need for further recovery actions

1. BACKGROUND

History

Bentleya spinescens was first collected west of Newdegate township by Eleanor Bennett in 1982. At the time she was accompanied by horticultural students from the Bentley Technical College, hence the name *Bentleya*. The genus and species was formally described by Eleanor Bennett in 1986.

In 2001 Bethea Loudon (Great Southern District Flora Conservation Officer) discovered an estimated 160, 000 mature individuals on Unallocated Crown Land (Subpopulations 12ab).

Bentleya spinescens is currently known from 12 populations and 162, 882 plants.

Description

Bentleya spinescens is a shrub 5 to 20 cm tall and 2 to 20 cm across. Its stems are much branched and end in spines, older stems have grey, fissured bark, younger branches are reddish-brown, with scattered white hairs. Leaves occur in bunches of up to seven, originating from the same place, with scattered white hairs on the upper surface, covered in downy hairs on the lower surface. Flowers occur on the stems at or just above ground level, occasionally a few along the stems, each flower is subtended by two whorls totaling ten to twelve bracts, which are pale brown, very densely hairy and with an abaxial surface featuring scattered hairs, the margins are densely ciliate. The sepals are greenish-white, the petals are coherent when young for two thirds of their length, becoming free at base with age, and are whitish-green to cream. The seeds are reddish-brown (Bennett 1986).

Distribution and habitat

Bentleya spinescens is found only in the southern Wheatbelt of Western Australia.

Habitat is sandy clay or occasionally sandy loam soils in open mallee and mixed *Melaleuca* scrub. Species associated with *Bentleya spinescens* include *Eucalyptus occidentalis*, *Eucalyptus flocktoniae*, *Santalum acuminatum*, *Melaleuca violacea*, *Melaleuca uncinata* complex, *Gastrolobium parviflorum*, *Olearia revoluta*, *Daviesia* affin. *aphylla*, *Grevillea pauciflora*, *Grevillea pritzelii*, *Lasiopetalum rosmarinifolium* and *Westringia rigida*.

Summary of population land vesting, purpose and manager

Pop. No. & Location	**DEC District**	**Shire**	**Vesting**	**Purpose**	**Manager**
1a Newdegate	Great Southern	Lake Grace	Minister for Transport	Road Reserve	Main Roads WA
1b Newdegate	Great Southern	Lake Grace	Minister for Works	Water Reserve	Water Corporation
1c Newdegate	Great Southern	Lake Grace	Shire of Lake Grace	Recreation Reserve (Showgrounds)	Shire of Lake Grace
1d Newdegate	Great Southern	Lake Grace	DLI	Unallocated Crown Land	Shire of Lake Grace
1e Newdegate	Great Southern	Lake Grace	DLI	Unallocated Crown Land	Shire of Lake Grace
2 E of Newdegate	Great Southern	Lake Grace	Unvested Reserve	Road Reserve	Shire of Lake Grace
3 NW of Newdegate	Great Southern	Lake Grace	Unvested Reserve	Use and Requirements of the Minister for Works	-
4a NW of Newdegate	Great Southern	Lake Grace	Unvested Reserve	Road Reserve	Shire of Lake Grace
4b NW of Newdegate	Great Southern	Lake Grace	Public Transport Authority	Rail Reserve	WestNet Rail
4c NW of Newdegate	Great Southern	Lake Grace	Unvested Reserve	Road Reserve	Shire of Lake Grace
4d NW of Newdegate	Great Southern	Lake Grace	Public Transport Authority	Rail Reserve	WestNet Rail
5a W of Newdegate	Great Southern	Lake Grace	Unvested Reserve	Road Reserve	Shire of Lake

Pop. No. & Location	DEC District	Shire	Vesting	Purpose	Manager
					Grace
5b W of Newdegate (Nature Reserve)	Great Southern	Lake Grace	Conservation Commission of Western Australia	Conservation of Flora and Fauna	DEC
6a W of Newdegate	Great Southern	Lake Grace	Minister for Transport	Road Reserve	MainRoads WA
6b W of Newdegate (Nature Reserve)	Great Southern	Lake Grace	Conservation Commission of Western Australia	Conservation of Flora and Fauna	DEC
6c W of Newdegate	Great Southern	Lake Grace	Minister for Transport	Road Reserve	MainRoads WA
7a NW of Newdegate	Great Southern	Lake Grace	Unvested Reserve	Road Reserve	Shire of Lake Grace
7b NW of Newdegate	Great Southern	Lake Grace	Freehold	Private Property	Landholders
7c NW of Newdegate	Great Southern	Lake Grace	Unvested Reserve	Road Reserve	Shire of lake Grace
7d NW of Newdegate	Great Southern	Lake Grace	Public Transport Authority	Rail Reserve	WestNet Rail
7e NW of Newdegate	Great Southern	Lake Grace	Unvested Reserve	Townsite	Shire of Lake Grace
7f NW of Newdegate	Great Southern	Lake Grace	Unvested Reserve	Road Reserve	Shire of Lake Grace
8 NW of Newdegate	Great Southern	Lake Grace	Unvested Reserve	Road Reserve	Shire of Lake Grace
9a W of Newdegate	Great Southern	Lake Grace	Minister for Transport	Road Reserve	MainRoads WA
9b W of Newdegate	Great Southern	Lake Grace	Minister for Transport	Road Reserve	MainRoads WA
10 NW of Newdegate (Nature Reserve)	Great Southern	Lake Grace	Conservation Commission of Western Australia	Conservation of Flora and Fauna	DEC
11 NW of Newdegate	Great Southern	Lake Grace	Freehold	Private Property	Landholders
12a S of Newdegate	Great Southern	Kent	Minister for Transport	Road Reserve	Shire of Kent
12b S of Newdegate	Great Southern	Kent	DLI	Unallocated Crown Land	DEC / DPI
12c S of Newdegate	Great Southern	Jerramungup	Unvested Reserve	Road Reserve	Shire of Jerramungup
13 S of Newdegate	Great Southern	Jerramungup	Unvested Reserve	Road Reserve	Shire of Jerramungup

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

Biology and ecology

Bennett (1986) observed that *Bentleya spinescens* propagates asexually with a suckering habit from underground rhizomes, which is unusual in the family Pittosporaceae but is known to occur in *Pittosporum phylliraeoides*. Due to the suckering habit of this species the number of actual genotypes in small populations and subpopulations is potentially limited as several plants may originate from a single parent.

Plants have been reported to survive fire and disturbances, such as grading of roads and chaining of vegetation. Plants resprout from the underground rhizomes with soft furry foliage.

Germination of seed from *Bentleya spinescens* is not fire dependent with germination known to occur following light to moderate road grading. Limited germination is also observed at undisturbed sites.

Fruits appear on plants between December and January.

There are only two species in the genus *Bentleya* - *B. spinescens* and *B. diminuta*. Both are found in the South West of Western Australia. *B. diminuta* was described in 1990 from specimens collected in Cape Arid National Park (Crisp and Taylor 1990) and is ranked as Priority 2 (P2) on DEC's Priority Flora list (Atkins 2008).

From analysis of taxonomic features Bennett (1986) concludes that the genus *Bentleya* may represent an entirely new family to science. *Bentleya spinescens* currently belongs to the family *Pittosporaceae* due to several taxonomic similarities. However one feature distinguishes *B. spinescens* from all other members of the family. *B. spinescens* has two whorls of ten to twelve bracts compared to members of the *Pittosporaceae* which typically have two bracts. *B. spinescens* also has many taxonomic characteristics in common with the family

Rutaceae, however it differs in that it lacks a major characteristic of the *Rutaceae*, the presence of oil glands. *B. spinescens* also differs from the family *Rutaceae* in several other taxonomic features.

Threats

Bentleya spinescens is listed as Priority 4 on Environment and Conservation's Priority Flora list (Atkins 2008) and has now been removed from the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) where it was previously listed as Endangered. The species is regarded as being not currently threatened, but is being monitored to ensure that its conservation status does not change. The main potential threats include road, rail and firebreak maintenance, damage to plants on and bordering Private Property and inappropriate fire regimes.

- **Road, rail and firebreak maintenance** threatens 2 populations and 22 subpopulations. Threats include grading, construction and maintenance of spoon drains, chemical spraying, and mowing of roadside vegetation. Apart from causing damage to actual plants, such activities also encourage weed invasion. The extinction of Population 2 was most likely due to road grading prior to 1992. Relevant authorities have been informed of the location of populations so that appropriate protective measures can be implemented.
- **Damage to plants on and bordering Private Property.** Landowners with properties containing populations or with populations bordering their property need to be informed of the location of these populations in order to prevent damage through grazing, maintenance of farm fencing and erosion from farming properties.
- **Inappropriate fire regimes** is potentially a threat, with too frequent fires leading to the death of mature plants. Seedlings are also vulnerable prior to establishing rhizomes from which they can regenerate after disturbance.

Summary of population information and threats

Pop. No. & Location	Land Status	Year/No. plants	Condition	Threats
1a Newdegate	MainRoads WA Reserve	1991 50 [2] 1995 309* 1999 244*	Healthy	Road maintenance, Newdegate townsite development
1b Newdegate	Water Reserve	1991 123 [2] 1995 309* 1999 not counted	Healthy	Road maintenance, Newdegate townsite development, water supply/amenities development
1c Newdegate	Shire Reserve (Showgrounds)	1991 50 1995 309* 1999 244*	Healthy	Road maintenance, Newdegate townsite development
1d Newdegate	Unallocated Crown Land	1991 22 1995 309* 1999 not counted	Healthy	Newdegate townsite development
1e Newdegate	Unallocated Crown Land	2001 157 2003 504 [10]	Healthy	Road maintenance, Newdegate townsite development
2 E of Newdegate	Shire Road Reserve		Extinct	
3 NW of Newdegate	Unvested Reserve - Water	1992 150	Healthy	
4a NW of Newdegate	Shire Road Reserve	2000 50 (7)*	Moderate	Road maintenance, maintenance of spoon drain
4b NW of Newdegate	WestNet Rail Reserve	2000 50 (7)*	Moderate	Rail maintenance
4c NW of Newdegate	Shire Road Reserve	2000 20 [4]*	Moderate	Road maintenance, maintenance of spoon drain
4d NW of Newdegate	WestNet Rail Reserve	2000 20 [4]*	Moderate	Rail maintenance
5a W of Newdegate	Shire Road Reserve	1999 186	Healthy	Road maintenance
5b W of Newdegate	Nature Reserve	1999 75	Healthy	Road maintenance
6a W of Newdegate	MainRoads WA Reserve	2000 59	Healthy	Road maintenance, maintenance of spoon drain
6b W of Newdegate	Nature Reserve	2000 124 (5)	Healthy	Firebreak maintenance
6c W of Newdegate	MainRoads WA Reserve	2000 not counted	Healthy	Road maintenance
7a NW of Newdegate	Shire Road Reserve	2000 25 [1]	Healthy	Road maintenance
7b NW of Newdegate	Private Property	2000 18 [2]	Healthy	Farm-fence maintenance

7c	NW of Newdegate	Shire Road Reserve	2000 not counted	Healthy	Road maintenance
7d	NW of Newdegate	WestNet Rail Reserve	2000 not counted	Healthy	Road and rail maintenance
7e	NW of Newdegate	Not Vested (townsite)	2000 not counted	Healthy	Road maintenance
7f	NW of Newdegate	Shire Road Reserve	2000 not counted	Moderate	Road maintenance
8	NW of Newdegate	Shire Road Reserve	2000 51 [2]	Sth-Healthy Nth-Poor	Road maintenance, maintenance of spoon drain
9a	W of Newdegate	MainRoads WA Reserve	2001 132 [1]	Healthy	Road maintenance
9b	W of Newdegate	MainRoads WA Reserve	2001 100	Healthy	Road maintenance
10	**NW of Newdegate**	Nature Reserve	2001 700	Healthy	
11	NW of Newdegate	Private Property	2002 50	Moderate	
12a	**S of Newdegate**	Shire Road Reserve	2001 160,000* est.	Healthy	Road maintenance
12b	**S of Newdegate**	Unallocated Crown Land	2001 160,000* est.	Healthy	
12c	S of Newdegate	Shire Road Reserve	2001 115 (25) [6]	Healthy	Road maintenance
13	S of Newdegate	Shire Road Reserve	2001 279 (1) [14]	Healthy	Road maintenance

Populations in **bold text** are considered to be Important Populations; Note: * = total for both subpopulations, ( ) = 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 any of the populations of *Bentleya spinescens* 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

Although *Bentleya spinescens* is listed P4, it is considered that all known habitat for wild populations is critical to its survival, and that all wild populations are important populations. Habitat critical to the survival of *B. spinescens* includes the area of occupancy of extant populations, areas of similar habitat (i.e. sandy clay and sandy loam soils in open mallee and mixed *Melaleuca* scrub) surrounding important populations (this is necessary to allow access for pollinators) 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 the habitat of *Bentleya spinescens* will also improve the status of associated native vegetation dominated by mallee and mixed *Melaleuca* scrub. Two threatened and three other priority flora species are located with *B. spinescens*.

Conservation-listed flora species occurring in habitat of *Bentleya spinescens*

Species name	**Conservation Status (Western Australia)**	**Conservation Status (EPBC Act, 1999)**
Acacia auratiflora	DRF, Vulnerable	Endangered
Acacia lanuginophylla	DRF, Vulnerable	Endangered
Eremophila veneta	Priority 4	Endangered
Melaleuca sculponeata	Priority 3	
Guichenotia asteriskos	Priority 2	

DRF – Declared Rare Flora; For a description of the Priority categories see Atkins (2008)

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. *Bentleya spinescens* 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 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 IRP is unlikely to cause significant adverse social and economic impacts. However, as some of the populations of *Bentleya spinescens* occur on, or adjacent to, private land the protection of them may potentially affect farming activities. Some development in the Newdegate townsite may be affected with a population bordering the township.

Affected interests

Stakeholders potentially affected by the implementation of this plan include the Shires of Lake Grace, Kent and Jerramungup, Main Roads WA, WestNet Rail and owners of Private Property.

Evaluation of the plan's performance

DEC in conjunction with the Great Southern District Threatened Flora Recovery Team (GSDTFRT) 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 four 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: There has been no decrease in the number of populations and/or the number of mature individuals 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 ten percent or more over the term of the plan.

3. RECOVERY ACTIONS

Completed recovery actions

Land managers including private land owners, Shires, MainRoads WA and WestNet Rail with populations on their property have been made aware of the threatened nature of this species, its location and their legal obligations to protect the species.

Declared Rare Flora (DRF) markers have been installed at Subpopulations 1a-d, 4a-d, 5a, 5b, 6a, 6c, 9a, 9b and Population 8.

Fencing of Population 11 on Private Property was undertaken in 2002 in joint venture with the Natural Heritage Trust (NHT) and DEC.

Ongoing and future recovery actions

Vesting a Water Reserve as a Nature Reserve is currently being investigated.

The GSDTFRT 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 Great Southern District office regularly monitor 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 managers prior to actions being undertaken. The following recovery actions are roughly in order of descending priority, however this should not constrain addressing any of the lower priorities if funding is available and other opportunities arise.

1. Coordinate recovery actions

The GSDTFRT will continue to coordinate the implementation of recovery actions for *Bentleya spinescens* and will include information on progress in their annual report to DEC's Corporate Executive and funding bodies.

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

2. Monitor populations

Monitoring of factors such as weed encroachment, habitat degradation, population stability (expansion or decline), pollination activity, seed production, recruitment, and longevity is required every 5-10 years and will be addressed under this action.

Action: Monitor population
Responsibility: DEC (Great Southern District) through the GSDTFRT
Cost: $1,900 in years 1 and 5.

3. Liaise with relevant land managers

Staff from DEC's Great Southern District will liaise with relevant land owners and managers on an opportunistic basis to ensure that populations are not accidentaly damaged or destroyed and that land managers are informed of population locations, the conservation status of the species and their legal reponsability to protect this species. Input and involvement will also be sought from any Aboriginal groups that have an active interest in areas that are habitat for *Bentleya spinescens*.

Action: Liaise with land managers
Responsibility: DEC (Great Southern District), through the GSDTFRT
Cost: $1,700 per year

4. Conduct further surveys

All known populations of *Bentleya spinescens* are in need of more thorough surveys to accurately confirm the size of populations, particularly subpopulations 4a-d, 5a and b, 6a and b (plants to the west of this population have not been surveyed/counted) and Subpopulation 12b, part of which was possibly chained and control burnt in September 2001. Numbers of plants in subpopulations 1b-d, 7c-f and Population 10 need to be accurately counted, especially Population 10 that is noted to contain several hundred plants. There are several locations near existing populations that are likely to contain populations of *B. spinescens* and are in need of survey, these locations include land owned by the Department of Agriculture as an experimental farm and Reserve No. 24932 both on Holland Track Road. It is also recommended that areas of suitable habitat close to extinct Population 2 be surveyed.

Surveys will be done during the species' flowering period, which is between August and October.

It is suggested that surveys be conducted with the help of volunteers from the local community, wildflower societies and naturalist clubs and supervised by DEC staff.

Action: Conduct further surveys
Responsibility: DEC (Great Southern District) through the GSDTFRT
Cost: $1,600 in years 2 and 4.

5. Obtain biological and ecological information

Research designed to increase understanding of the biology of the species will provide a scientific base for management of *Bentleya spinescens* in the wild. Research will include:

1. Genetic research into the phylogenetic affiliations of *B. spinescens* this will allow the taxonomic status of the species and genus to be assessed.
2. Genetic research into the level of genetic differentiation between *B. spinescens* and *B. diminuta*, this will allow the conservation significance of *B. spinescens* to be assessed.
3. Research into the inter- and intra-population genetic structure of *B. spinescens*. This will allow the proportions of populations composed of clones suckered from parental individuals to be established and will be useful to better identify genetically important populations and efficiently target resources.
4. Conditions required for germination.
5. Appropriate fire regimes to stimulate germination of seed and maximize population size and health.
6. Age at which plants establish root systems substantial enough to survive and regenerate after disturbance.
7. Investigation into rates of seed set and seed viability.
8. Pollination and dispersal mechanisms.
9. Density of *B. spinescens* in soil seed banks.

Action: Obtain biological and ecological information
Responsibility: DEC (Science Division, Great Southern District) through the GSDTFRT
Cost: $7,500 per year in years 2, $27,300 in year 3 and $18,800 in year 4

6. Map habitat critical to the species' survival

It is a requirement of the EPBC Act that spatial data relating to habitat critical for the survival of listed species be determined. Although this is described in Section 1, the areas described have not yet been mapped. Although the species is no longer listed, this will be redressed under this action.

Action: Map habitat critical to the species' survival
Responsibility: DEC (Great Southern District) through the GSDTFRT
Cost: $3,000 in the first year

7. Review the need for further recovery actions

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

Action: Review the need for further recovery actions
Responsibility: DEC (Species and Communities Branch (SCB), Great Southern District) through the GSDTFRT
Cost: $1,500 in the fourth year.

Summary of recovery actions

Recovery Actions	Priority	Responsibility	Completion date
Coordinate recovery actions	High	GSDTFRT	Ongoing
Monitor populations	High	DEC (Great Southern District) through the GSDTFRT	Ongoing
Liaise with relevant land managers	High	DEC (Great Southern District) through the GSDTFRT	Ongoing
Conduct further surveys	Moderate	DEC (Great Southern District) through the GSDTFRT	2011
Obtain biological and ecological information	Moderate	DEC (Science Division, Great Southern District) through the GSDTFRT	2011
Map habitat critical to the species' survival	Moderate	DEC (Great Southern District) through the GSDTFRT	2008
Review the plan and need for further recovery actions	Moderate	DEC (Species and Communities Branch (SCB), Great Southern District) through the GSDTFRT	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. Given the current status of the species as not threatened, the need for further recovery actions and an update of this IRP will be assessed.

Commonwealth

The species has been recently de-listed, and hence adoption of the plan is not required under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

5. REFERENCES

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6. TAXONOMIC DESCRIPTION

Excerpt from: Bennett, E.M. (1986). *Bentleya*, a new genus of Pittosporaceae from southern Western Australia. *Nuytsia* 5(3): 401-406

Shrubs 5-20cm tall, 2-20cm across. Stems much branched, lower and older part of stem with grey, fissured bark, younger branches reddish-brown, with scattered white hairs, becoming glabrous with age, ending in spines; spiny branches often arising from prominent protuberances. Leaves in fascicles of up to 7, linear to narrowly obovate, 2-6 x c.0.5mm, minutely mucronate, glabrous or with scattered white hairs on upper surface, pubescent on lower surface, midrib prominent on lower surface, bearing several white hairs; margins revolute; Leaf clusters subtended by deciduous, deltoid scales c.1-1.5mm long. Flowers mainly on stems at or just above ground level, occasionally a few along the stems; each flower subtended by two whorls of bracts; outer bracts 5-6, of two sizes, some 0.5-1mm, alternating with others 0.25-0.5 x 0.3mm, pale brown, very densely hairy with long midrib, abaxial surface with scattered hairs; margins densely ciliate; pedicel 3mm long densely hairy. Sepals 6-7 x 1.5-2mm, greenish-white, scattered white hairy on surface, hairs shorter and denser on margin. Petals 1.2-2cm long, coherent when young for 2/3 of their length, becoming free at base with age but remaining joined in middle for 2-3mm, lobes imbricate, whitish-green to cream, 3-nerved, outer surface with scattered white hairs, inner incurved, distinctly ciliate along margins of lobes and inner surface of tube; apex acute. Filaments 0.9-1.5mm long, white; Anthers 2-3mm long, pale mauve; pollen pale mauve. Ovary 1.5-2.5mm long, velutinous; style 1-1.9mm long, pale pink, hairy except for upper 2mm; stigma purple-red, papillate, prominently exserted in the mature flower. Capsule brown, velutinous with white hairs, 10-14 x 5-8mm Seeds 1.75-2.25 x 1.5-2mm, reddish-brown, rugose.