



Government of Western Australia
Department of Environment and Conservation



Australian Government

WA INTERIM RECOVERY PLAN NO. 318

FALSE PLUMED-BANKSIA

(Banksia pseudoplumosa)

INTERIM RECOVERY PLAN

2011-2016



September 2011
Department of Environment and Conservation
Kensington

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: 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.

These plans 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 by ensuring that conservation action commences as soon as possible.

This plan will operate from August 2011 to July 2016 but will remain in force until withdrawn or replaced. It is intended that, if the taxon is still ranked as Endangered (EN) in WA, this plan will be reviewed after five years and the need for further recovery actions assessed.

This plan was given regional approval on 9 September 2011 and was approved by the Director of Nature Conservation on 20 September 2011. The provision of funds identified in this plan is dependent on budgetary and other constraints affecting DEC, as well as the need to address other priorities.

This plan 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).

Information in this plan was accurate at September 2011.

PLAN PREPARATION

This plan was prepared by Nick Casson¹.

¹ Senior Ecologist, DEC Species and Communities Branch, Locked Bag 104, Bentley Delivery Centre, WA 6983.

ACKNOWLEDGMENTS

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

Sarah Barrett	Threatened Flora Officer, DEC South Coast Region
Andrew Brown	Threatened Flora Coordinator, DEC Species and Communities Branch
Amanda Shade	Assistant Curator (Nursery), Botanic Gardens and Parks Authority
Andrew Crawford	Principal Technical Officer, DEC Science Division

Thanks also to the staff of the W.A. Herbarium for providing access to Herbarium databases and specimen information.

Cover photographs by M. Hancock and M. Pieroni.

CITATION

This plan should be cited as:

Department of Environment and Conservation (2011) *Banksia pseudoplumosa* Interim Recovery Plan 2011-2016. Interim Recovery Plan No.318. Department of Environment and Conservation, Western Australia.

SUMMARY

Scientific Name:	<i>Banksia pseudoplumosa</i>	Common Name:	False Plumed-Banksia
Family:	Proteaceae	Flowering Period:	November to December
DEC Region:	South Coast	DEC District:	Albany
Shires:	Shires of Cranbrook, Gnowangerup and Plantagenet	NRM Region:	South Coast
Recovery Team:	Albany District Threatened Flora Recovery Team (ADTFRT)	IBRA Region:	Esperance Plains, Mallee

Illustrations and/or further information: Brown, A., Thomson-Dans, C. and Marchant, N. (Eds) (1998) *Western Australia's Threatened Flora*; George, A.S. 1996 New taxa and a new infrageneric classification in *Dryandra*.; Mast, A.R. & Thiele, K. (2007) The transfer of *Dryandra* R.Br. to *Banksia* L.f. (Proteaceae).; Western Australian Herbarium (1998–) *FloraBase – The Western Australian Flora*. Department of Environment and Conservation. <http://florabase.dec.wa.gov.au/>.

Current status: *Banksia pseudoplumosa* was declared to be Rare Flora under the Western Australian *Wildlife Conservation Act 1950* in 2003 and is currently ranked as Endangered (EN) in WA under International Union for Conservation of Nature (IUCN 2001) Red List criteria B2ab(ii) due to the small number of populations and a continuing decline in area of occupancy. The species is listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as Endangered. The main threats to the species are disease (*Phytophthora*), altered fire regimes, roadworks, drought, security of tenure, fragmentation and isolation, and the effects of agricultural encroachment.

Description: A shrub to 1.8 m, without lignotuber. Stems are silky hairy. Leaves are broadly linear, divided with 15-31 lobes per side; blade 8-17 cm long, 6-15 mm wide; margins inrolled. The cup-shaped inflorescence are sessile and axillary, with rows of curved leaves and bracts. Follicles are 1-3 per head. *Banksia pseudoplumosa* differs from *B. plumosa* in having shorter, thicker involucre bracts without filiform tips, more flowers per head, the pistils bowed equally around head, and larger, densely tomentose follicles that are firmly attached. It can be distinguished from *B. plumosa* in the field by its distinctive columnar habit and larger flowers.

Distribution and habitat: *Banksia pseudoplumosa* is known from eight Populations over a 65 km range in the Stirling Range National Park and south-east of Ongerup. All Populations are found in DEC's Albany District and together comprise approximately 6622 plants. *Banksia pseudoplumosa* occurs in mallee over heath on flat to slightly sloping topography in orange gravelly clay loam over laterite.

Habitat critical to the survival of the species, and important Populations: *Banksia pseudoplumosa* is ranked in WA as Endangered and, as such, it is considered that all known habitat for wild populations is habitat critical to the survival of the species, and that all wild populations are important populations. Habitat critical to the survival of *Banksia pseudoplumosa* includes the area of occupancy of populations, areas of similar habitat surrounding and linking populations (these providing potential habitat for population expansion and for pollinators), additional occurrences of similar habitat that may contain undiscovered Populations of the species or be suitable for future translocations, and the local catchment for the surface and/or groundwater that maintains the habitat of the species.

Benefits to other species or ecological communities: Recovery actions implemented to improve the quality or security of the habitat of *Banksia pseudoplumosa* will also improve the status of associated native vegetation and several other Threatened and Priority flora species. *Banksia pseudoplumosa* does not occur within or adjacent to any known Threatened or Priority Ecological Community (TEC/PEC).

International obligations: This plan is fully consistent with the aims and recommendations of the Convention on Biological Diversity, ratified by Australia in June 1993, and will assist in implementing Australia's responsibilities under that Convention. The plan does not affect Australia's obligations under any other international agreements.

Indigenous Consultation: A search of the Department of Indigenous Affairs Aboriginal Heritage Sites Register did not reveal any sites of Aboriginal significance within or adjacent to Populations of *Banksia pseudoplumosa*. However, input and involvement has been sought through the South West Aboriginal Land and Sea Council (SWALSC) and Department of Indigenous Affairs to determine if there are any issues or interests. Indigenous opportunity for future involvement in the implementation of the Recovery plan is included as an action in this plan.

Social and economic impact: The implementation of this plan may cause some economic impact through the loss of potentially arable farmland and the cost of implementing recovery actions (i.e. fencing maintenance or long-term disease or weed control) for Populations occurring on private property.

Affected interests: The protection of the taxon will affect private landholder operations, and may affect future mining tenements.

Evaluation of the Plan's Performance: The DEC in conjunction with the Albany District Threatened Flora Recovery Team (ADTFRT) will evaluate the performance of this plan. In addition to annual reporting on progress and evaluation against the criteria for success and failure, the plan will be reviewed following five years of implementation.

Existing Recovery Actions: The following recovery actions have been or are currently being implemented and have been considered in the preparation of this plan:

1. All stakeholders have been made aware of the existence of this species and its locations.
2. Rare flora markers have been installed at Populations 2 and 3, and Subpopulations 1a, 1b, 1c and 5b.
3. Most remnants on private property are fenced and protected from livestock.
4. Population 2 was hand-sprayed with phosphite in 2009.
5. Surveys undertaken from 2000 located several new populations.
6. Over 2961 seeds, collected from Populations 1, 2, 3, 5, & 6 between 2001 and 2009 are stored in the Threatened Flora Seed Centre (TFSC). Germination rates are high, generally above 90%.
7. The Botanic Gardens and Parks Authority (BGPA) hold two cultivated plants.
8. Staff from DEC's Albany District monitor populations as regularly as practicable.
9. Population 3 was excluded from prescribed burning between 2004 and 2006.
10. The ADTFRT oversees the implementation of this plan and will include information on progress in their annual report to DEC's Corporate Executive and funding bodies.

Plan Objective: The objective of this 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.

Recovery Criteria

Criteria for success: The number of Populations has increased and/or the number of mature individuals has increased by ten percent or more over the five year term of the plan.

Criteria for failure: The number of Populations has decreased and/or the number of mature individuals has decreased by ten percent or more over the five year term of the plan.

Recovery actions

1. Coordinate recovery actions
2. Undertake *Phytophthora* dieback control
3. Continue *Phytophthora* dieback hygiene practices
4. Monitor Populations
5. Collect seed
6. Develop and implement a fire management strategy
7. Undertake surveys
8. Survey for potential translocation sites and develop a translocation proposal
9. Liaise with land managers
10. Ensure long-term protection of habitat
11. Deter access
12. Promote awareness
13. Obtain biological and ecological information
14. Map habitat critical to the survival of *Banksia pseudoplumosa*
15. Review this plan

1. BACKGROUND

History

The first known collection of *Banksia pseudoplumosa* was made in Stirling Range National Park by A. Morrison in October 1900. The species was formally named by A. George (George 1996).

Further collections were made between Yetermerup and Warrangup in 1902, at Pallinup River in 1962, south of Toompup in 1963, east of Red Gum Pass in 1986; on North Woogenillup Road in 1986 and 1997; west of Chester Pass Road in 2000; on Salt River Rd in 2001 and west of West Hill in 2003.

There are currently eight known populations (incorporating four subpopulations) within an area bounded by Cranbrook, Ongerup and Porongurup National Park. Together these comprise about 6622 plants.

Description

A shrub to 1.8 m tall, without a lignotuber. Stems are silky hairy. Leaves are broadly linear, divided with 15-31 lobes per side, the blade is 8-17 cm long by 6-15 mm wide, the margins in-rolled. The cup-shaped inflorescence is sessile and axillary with rows of curved leaves and bracts. Follicles are 1-3 per head. *Banksia pseudoplumosa* differs from *B. plumosa* in having shorter, thicker involucral bracts without filiform tips, more flowers per head, the pistils bowed equally around head, and larger, densely tomentose follicles that are firmly attached. It can be distinguished from *B. plumosa* in the field by its distinctive columnar habit and larger flowers (George 1996).

Distribution and habitat

Banksia pseudoplumosa is known from eight populations over a 65 km range in the Stirling Range National Park and south-east of Ongerup. All populations are found in DEC's Albany District. The species occurs in mallee over heath on flat to slightly sloping topography in orange gravelly clay loam over laterite.

The extent of occurrence is approximately 600 km². Populations occupy areas ranging from less than 1 ha to 10 ha. The area of occupancy for all eight Populations was estimated to be 0.15 km² in 2006 and 0.2km² in 2011.

Table 1. Summary of population land vesting, purpose and manager

Pop. No.	DEC District	Shire	Vesting	Purpose	Manager
1A	Albany	Cranbrook	CC	National Park	DEC
1B	Albany	Cranbrook	CC	National Park	DEC
1C	Albany	Cranbrook	Shire	Road Verge	Shire
2	Albany	Plantagenet	Shire	Road Verge	Shire
3	Albany	Plantagenet	CC	National Park	DEC
4	Albany	Gnowangerup	Freehold	Private property	Landholder
5A	Albany	Gnowangerup	Freehold	Private property	Landholder
5B	Albany	Gnowangerup	Shire	Road Verge	Shire
6	Albany	Plantagenet	Freehold	Private property	Landholder
7A	Albany	Gnowangerup	Freehold	Private property	Landholder
7B	Albany	Gnowangerup	Freehold	Private property	Landholder
7C	Albany	Gnowangerup	Freehold	Private property	Landholder
8A	Albany	Gnowangerup	Freehold	Private property	Landholder
8B	Albany	Gnowangerup	Freehold	Private property	Landholder
8C	Albany	Gnowangerup	Freehold	Private property	Landholder

Note: Populations in **bold text** are considered to be important Populations; CC – Conservation Commission.

Biology and ecology

Flowering occurs between November and December. Little is known about its reproductive biology.

Banksia pseudoplumosa is an obligate re-seeder with a canopy-stored seed bank (Barrett et al 2008; 2009). Adults are usually killed by fire with populations re-establishing from seed. The species has a juvenile period, or time to first flowering after germination for 50% of the population, of 5-6 years. Consequently frequent fire, of

intervals less than or equal to the juvenile period, are a threat to the species. Conventional guidance is to burn at intervals greater than 2x the juvenile period (Gill and Nicholls 1989; Burrows, Ward and Robinson 1999).

Field observation indicates that some individuals have their first fruits about six years after fire.

Results of seed germination testing by the DEC Threatened Flora Seed Centre showed the seed has excellent germination rates of about 90%.

Cockatoos may assist seed dispersal as they have been observed to feed on the fruit at Population 8.

Banksia pseudoplumosa is highly susceptible to *Phytophthora* dieback caused by *Phytophthora cinnamomi* (Barrett et al 2008).

Threats

Banksia pseudoplumosa was declared to be Rare Flora under the Western Australian *Wildlife Conservation Act 1950* in 2003 and is currently ranked as Endangered (EN) in WA under International Union for Conservation of Nature (IUCN 2001) Red List criteria B2ab(ii) due to the small number of populations and a continuing decline in area of occupancy. The species is listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999) as Endangered. The main threats to the species are disease (*Phytophthora*), altered fire regimes, roadworks, drought, security of tenure, fragmentation and isolation, and the effects of agricultural encroachment.

Currently, *Phytophthora cinnamomi* affects Populations 2 and 3 (S. Barrett pers. comm.). In Population 2 there have been deaths of about 23% of *B. pseudoplumosa* plants. At population 3 there were deaths along the firebreak amounting to about 13% of plants and signs of disease movement toward the main population. All other Populations are at long-term risk due to the species being highly susceptible to *Phytophthora cinnamomi* (Barrett et al 2008).

Canker may have been observed at Populations 1 and 3, and Subpopulation 7b. Aerial canker has caused high mortality rates in *Banksia coccinea* on the south coast (Shearer and Fairman 1991).

Banksia pseudoplumosa is an obligate seeder and is susceptible to increased fire frequency. The species is killed by fire and recruits from seed. Fire before plants reach sexual maturity (approximately 6 to 12 years after germination) would deplete the seed bank of the population.

Absence of fire may also be an issue in populations on private property (S. Barrett pers. comm.). Fire exclusion may ultimately lead to senescence and a lack of recruitment.

Drought may be adversely affecting some populations and may be the cause of some deaths.

Security of tenure is a long-term issue for the species. Only three subpopulations occur in a National Park, while three are on shire road verges, and nine occur on private property.

Fragmentation and isolation may pose increased risk of local decline for the smaller populations if there are barriers to re-colonization (such as a road). The smallest include Population 4 and Subpopulations 1c and 5a.

The effects of agricultural encroachment are a long-term threat to populations on private property and at the margins of conservation areas. The primary effects were contraction of the vegetation around the species over the last 50–100 years. Secondary effects include altered land use and landscape processes. Other effects may relate to activities such as maintaining fence lines/firebreaks, chemical drift, land degradation by stock (should land use change), and weed invasion. Such factors may gradually impact the species' habitat.

The intent of this plan is to provide actions that will deal with immediate threats to *Banksia pseudoplumosa*. Although climate change may have a long-term effect on the species, actions taken directly to prevent the impact of climate change are beyond the scope of this plan.

Table 2. Summary of population information and threats

Pop. No. & Location	Land Status	Year	No. of plants	Current Condition	Threats
1a Stirling Range National Park	National Park	2000 2001 2006	150 (1000) [20] 850 (1000) [200] 2000 [200]	Moderate	Waterlogging, drought, canker, altered fire regime
1b Stirling Range National Park	National Park	2006	1000 [1]	Moderate	Dieback, altered fire regime
1c Salt River Rd	Shire verge	2006	1 [1]	Moderate	Dieback, altered fire regime
2 Woogenellup Rd	Shire verge	2000 2001 2002 2002 2008 2009 2009	100 100 100 [3] 100 200 Unknown 100 [30]	Poor	Dieback, roadworks
3 Stirling Range National Park	National Park	2000 2002 2002 2004 2006 2009	20 (1000) 200 (700) [8] Unknown [1] 700 (600) [1+] 1000 1000 (400) [133]	Moderate	Dieback, canker, altered fire regime
4 South Toompup Road	Private -	2002 2003	10 [2] 7	Healthy	Drought
5a South Toompup Road	Private -	2002	7	Moderate	Roadworks, drought
5b South Toompup Road	Shire verge	2002 2002 2003	65 [10] 60 [8] 100	Moderate	Roadworks, drought
6 Woogenellup Rd	Private	2002 2003	200 1000	Healthy.	Unknown
7a West of West Hill	Private	2003 2010	200 800 [30]	Healthy.	Dieback
7b West of West Hill	Private	2004 2010	500 [50] (See 7A)	Moderate	Senescence, canker
7c West of West Hill	Private	2005 2010	100 (See 7A)	Healthy.	Unknown
8a West of Ongerup-Boxwood Hills Rd	Private	2006	(see 8C)	Healthy	Unknown
8b West of Ongerup-Boxwood Hills Rd	Private	2006	(see 8C)	Healthy.	Unknown
8c West of Ongerup-Boxwood Hills Rd	Private	2006	200 [5]	Healthy.	Unknown
Most recent totals			6622 [451]		

() = seedlings; [] = dead.

Guide for decision-makers

Section 1 provides details of current and possible future threats. Proposed development and/or land clearing or any on-ground works in the immediate vicinity of *Banksia pseudoplumosa* may require assessment.

Actions that could result in any of the following may potentially result in a significant impact on the species:

- damage or destruction of occupied or potential habitat.
- alteration of the local surface hydrology or drainage.
- a reduction in population size.
- a major increase in disturbance in the vicinity of Populations.

This species is protected under the *Environment Protection and Biodiversity Conservation Act 1999* and the *Western Australian Wildlife Conservation Act 1950*.

Management Practices

DEC will continue to liaise with land managers to ensure that the above actions will not impact upon the species. Where direct action is required, specific management actions will be implemented to address threats.

In addition to the recovery actions outlined in this plan the species is included in the broader District Plan “Western Australian Wildlife Management Program 20 - Declared Rare and Poorly Known Flora in the Albany District” (Robinson and Coates 1995).

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

Banksia pseudoplumosa is ranked in WA as Endangered, and as such it is considered that all known habitat for wild populations is critical to the survival of the species, and that all wild populations are important populations. Habitat critical to the survival of *Banksia pseudoplumosa* includes the area of occupancy of populations, areas of similar habitat surrounding and linking populations (these providing potential habitat for population expansion and for pollinators), additional occurrences of similar habitat that may contain undiscovered populations of the species or be suitable for future translocations, and the local catchment for the surface and/or groundwater that maintains the habitat of the species.

Benefits to other species or ecological communities

Recovery actions implemented to improve the quality or security of the habitat of *Banksia pseudoplumosa* will also improve the status of associated native vegetation, and Threatened and Priority flora listed in the table below.

Table 3. Conservation-listed flora species occurring within 600m of *Banksia pseudoplumosa*

Species name	Conservation Status (WA)	Conservation Status (EPBC Act)
<i>Hibbertia priceana</i>	DRF - Endangered	Critically Endangered
<i>Orthrosanthus muelleri</i>	DRF - Vulnerable	Endangered
<i>Banksia rufa</i> subsp. <i>pumila</i>	DRF - Endangered	-
<i>Myoporum cordifolium</i>	DRF - Endangered	Vulnerable
<i>Thelymitra psammophila</i>	DRF - Vulnerable	Vulnerable
<i>Leucopogon</i> sp. Ongerup (A.S. George 16682)	Priority 1	-
<i>Banksia aculeata</i>	Priority 2	-
<i>Banksia calophylla</i>	Priority 3	-
<i>Spyridium oligocephalum</i>	Priority 3	-

For a description of the Priority categories see Smith (2010).

Banksia pseudoplumosa does not occur within or adjacent to any known Threatened or Priority Ecological Community (TEC/PEC).

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. This plan does not affect Australia’s obligations under any other international agreements.

Indigenous Consultation

A search of the Department of Indigenous Affairs Aboriginal Heritage Sites Register did not reveal any sites of Aboriginal significance within or adjacent to populations of *Banksia pseudoplumosa*. However, input and involvement has been sought through the South West Aboriginal Land and Sea Council (SWALSC) and Department of Indigenous Affairs to determine if there are any issues or interests. Indigenous opportunity for future involvement in the implementation of the Recovery plan is included as an action in this plan.

Social and economic impacts

Implementation of this plan may result in some economic impact through the loss of potentially arable farmland and the cost of implementing recovery actions (i.e. fence maintenance or long-term disease or weed control) for populations on private property.

Affected interests

The protection of the species will affect private landholder operations, and may affect future mining tenements.

Evaluation of the Plan's Performance

The DEC in conjunction with the Albany District Threatened Flora Recovery Team (ADTFRT) will evaluate the performance of this plan. 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

Objective

The objective of this 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 Populations has increased and/or the number of mature individuals has increased by ten percent or more over the five year term of the plan.

Criteria for failure: The number of Populations has decreased and/or the number of mature individuals has decreased by ten percent or more over the five year term of the plan.

3. RECOVERY ACTIONS

Existing recovery actions

All stakeholders have been made aware of the existence of this species and its locations. This includes the Shire councils, landholders, and DEC staff. Notifications to stakeholders detail the current status of the species as Declared Rare Flora (DRF) and the associated legal obligations regarding its protection.

Rare flora markers have been installed at Population 2 and 3, and Subpopulations 1a, 1b, 1c and 5b.

Population 4 and Subpopulations 5a, 7a, 7b, 7c, 8a, 8b and 8c on private property are fenced from livestock. Fencing is not required for populations in the Stirling Range National Park (Population 3 and Subpopulations 1a and 1b) and on shire verges (Population 2 and Subpopulations 1c and 5b).

In order to contain dieback Population 2 was hand-sprayed with phosphite in 2009 (S. Barrett pers. comm.). DEC operations within or close to areas of *Banksia pseudoplumosa* are carried out according to Plant Disease management Guidelines and Policy.

Surveys undertaken from 2000 onwards located Populations 2, 3 and 5, and Subpopulation 7a, 7b, 7c; 8a, 8b & 8c. Population 6 was found by a consultant in 2002 (S. Barrett pers. comm.).

Over 2961 seeds were collected from Populations 1, 2, 3, 5 & 6 by DEC staff between 2001 and 2009. Seeds are stored in DEC's Threatened Flora Seed Centre (TFSC) at -18°C . Germination rates are high, ranging from 73 to 100% with a mean of 90% (see table).

Date	Location	Population	Seeds in storage	Germination %
23/02/2001	Salt River Rd.	1	845	90
22/02/2001	North Woogenillup Rd.	2	588	100
13/02/2002	West of Chester Pass Rd., SRNP	3	580	73
19/01/2009	Southern internal firebreak SRNP	3	Not processed	-

19/12/2003	Toompup South Rd.	5	371	97
20/02/2003	North of Woogenilup Rd.	6	577	92
Total 2011			2961	90.2 (mean)

The Botanic Gardens and Parks Authority (BGPA) do not currently hold any seed of *Banksia pseudoplumosa*; however, they have two plants in their nursery container collection that were supplied by the TFSC in April 2004 (Amanda Shade pers. comm.).

Populations are monitored as regularly as practicable by Staff from DEC's Albany District. Monitoring may include the rate of spread of *Phytophthora cinnamomi*, effectiveness of phosphite application, post-fire seedling recruitment and fruiting success.

A draft Fire Management Strategy has been developed for the Stirling Range NP (Barrett et al. 2003). The strategy recommends that demographic processes and life history attributes (vital attributes) be used to identify fire sensitive species and communities in order to determine suitable fire frequencies (Barrett et al. 2009).

The ADTFRT oversees the implementation of this plan and will include information on progress in their annual report to DEC's Corporate Executive and funding bodies.

Future recovery actions

Where recovery actions occur on lands other than those managed by DEC, permission has been or will be sought prior to actions being undertaken. The following recovery actions are generally in order of descending priority, influenced by their timing over the life of the plan. However this should not constrain addressing any of the actions if funding is available and other opportunities arise.

1. Coordinate recovery actions

The ADTFRT will oversee the implementation of the recovery actions for *Banksia pseudoplumosa*. DEC will include information on progress in their annual report to DEC's Corporate Executive and funding bodies.

Action: Coordinate recovery actions
Responsibility: DEC (Albany District) through the ADTFRT
Cost: \$6,000 per year

2. Undertake *Phytophthora* dieback control

Continue the current regime of hand phosphite application and increase where appropriate. There is also a need to consider alternative application techniques.

Action: Continue spraying with phosphite and increase where appropriate
Responsibility: DEC (Albany District)
Cost: \$4,000 per year

3. Continue *Phytophthora* dieback hygiene practices

Access by DEC staff and volunteers to areas containing *Banksia pseudoplumosa* populations will be restricted to dry soil conditions in accordance with DEC guidelines. Shires will be encouraged to follow similar hygiene practices on Shire Reserves where *Banksia pseudoplumosa* occurs.

Action: Continue *Phytophthora* dieback hygiene practices
Responsibility: DEC (Albany District)
Cost: \$400 per year

4. Monitor Populations

Continue regular monitoring of all populations, including the incidence and rate of spread of *Phytophthora cinnamomi*, habitat degradation, population stability (expansion or decline in numbers or extent), pollinator activity, seed production, recruitment (with or without fire), effectiveness of phosphite application, and longevity.

Action: Monitor Populations
Responsibility: DEC (Albany District)
Cost: \$10,000 per year

5. Collect seed

Further seed collections are required both for long term storage as insurance against extinction and to ensure sufficient seed is available for possible re-stocking or direct seeding translocations to establish new populations.

Action: Collect seed
Responsibility: DEC (Albany District, TFSC), BGPA
Cost: \$5,000 per year

6. Develop and implement a fire management strategy

In the first instance, and where possible, fire will be prevented from occurring in the habitat of populations except where it is being used experimentally as a recovery tool. A fire management strategy will be developed for *Banksia pseudoplumosa* that is in line with what is known of the species' juvenile period and the appropriate fire frequency, intensity, season, and control measures (Barrett et al., 2009). Burning within the Stirling Range NP will also take into account the Draft Fire Management Strategy (Barrett et al. 2003). Fire management may have to be modified at populations affected by *Phytophthora* dieback as there may be an increase in *P. cinnamomi* activity post fire (Gilfillan and Barrett 2005).

Fire to be used for recovery for *Banksia pseudoplumosa*, which is an obligate seeder with a canopy stored seed bank, should occur during autumn. An autumn fire will minimise the interval (and therefore predation or deterioration of seed) between seed release and germination in winter (Gilfillan and Barrett 2005).

Action: Develop and implement a fire management strategy
Responsibility: DEC (Albany District)
Cost: \$10,000 in first year and \$2,000 in subsequent years

7. Undertake surveys

Further survey is a high priority as other populations may exist in remnant vegetation on private property. Surveys should be focused in areas containing similar soil and vegetation types during the species' flowering period (November to December). All surveyed areas will be recorded and the presence or absence of the species documented to increase survey efficiency and reduce duplicate surveys. The involvement of interested community groups may be sought for future surveys.

Action: Undertake surveys
Responsibility: DEC (Albany District)
Cost: \$5,000 in years 1, 3 and 5

8. Survey for suitable potential translocation sites and develop and implement a Translocation Proposal

Given the Endangered status of this species and the susceptibility of all populations to *Phytophthora cinnamomi* a translocation to a non-infested site may be necessary. Potential translocation sites need to be identified and surveyed for their suitability. A translocation proposal should then be developed and implemented. Information on the translocation of threatened animals and plants in the wild is provided in the CALM Policy Statement No. 29 Translocation of Threatened Flora and Fauna. Translocation should also meet the standards set in Guidelines

for the Translocation of Threatened Australian Plants (Vallee *et al* 2004). All translocation proposals require endorsement by the Director of Nature Conservation.

Action: Survey for potential translocation sites and develop a Translocation Proposal
Responsibility: DEC (Albany District)
Cost: \$5000 per year for the first two years

9. Liaise with land managers

Staff from DEC's Albany District will liaise with appropriate land managers to ensure that populations of *Banksia pseudoplumosa* are not accidentally damaged or destroyed, and that the impacts of identified threats are minimised, in particular the impact of *Phytophthora cinnamomi*. Input and involvement will also be sought from any Noongar groups that have an active interest in areas that are habitat for *Banksia pseudoplumosa*.

Action: Liaise with land managers
Responsibility: DEC (Albany District)
Cost: \$2,000 per year

10. Ensure long-term protection of habitat

Investigate formal conservation arrangements, management agreements and covenants to protect habitat of the species on private land.

Action: Ensure long-term protection of habitat
Responsibility: DEC (Albany District, Land Unit); Department of Planning (DoP); Department of Mines and Petroleum (DMP)
Cost: \$3,000 per year

11. Deter access

Barriers to deter public access to populations within the National Park and fencing to prevent stock access may be required.

Action: Deter access
Responsibility: DEC (Albany District)
Cost: \$5,000 in years 1 and 2

12. Promote awareness

The importance of biodiversity conservation and the protection of *Banksia pseudoplumosa* will be promoted to the public through poster displays and the local print and electronic media. An information sheet that includes a description of the plant, its habitat type, threats, management actions, and photos will be produced. Formal links with local naturalist groups and interested individuals will also be encouraged.

Action: Promote awareness
Responsibility: DEC (Albany District, SCB, Strategic Development and Corporate Affairs Division)
Cost: \$4,000 in year 1 and \$2,000 in years 2-5

13. Obtain biological and ecological information

Improved knowledge of the biology and ecology may provide a better basis for management of *Banksia pseudoplumosa* in the wild. Investigations may include:

1. Study of the canopy (and any residual soil) seed bank dynamics and the role of various factors including the roles of disturbance (especially fire and dieback), competition, and climate (drought) in recruitment and seedling survival.
2. Determination of reproductive strategies, phenology and seasonal growth.
3. Investigation of reproductive success and pollination biology.

4. Investigation of population genetic structure, levels of genetic diversity and minimum viable population size.

Action: Obtain biological and ecological information
Responsibility: DEC (Science Division, Albany District)
Cost: \$10,000 per year

14. Map habitat critical to the survival of *Banksia pseudoplumosa*

Spatial data relating to habitat critical to the survival of *Banksia pseudoplumosa* needs to be determined. Although this is alluded to in Section 1, it has not yet been fully mapped and will be addressed under this action. If additional populations are located, then habitat critical to their survival will also be determined and mapped.

Action: Map habitat critical to the survival of *Banksia pseudoplumosa*
Responsibility: DEC (SCB, Albany District)
Cost: \$6,000 in year 2

15. Review this plan

If *Banksia pseudoplumosa* is still ranked as Endangered at the end of the five-year term of this plan, the need for further recovery actions, or a review of this plan will be assessed and a revised plan prepared if necessary.

Action: Review this plan
Responsibility: DEC (SCB, Albany District)
Cost: \$3,000 in year 5

Table 4. Summary of Recovery Actions

Recovery Action	Priority	Responsibility	Completion Date
Coordinate recovery actions	High	DEC (Albany District) through the ADTFRT	Ongoing
Undertake <i>Phytophthora</i> dieback control	High	DEC (Albany District)	Ongoing
Continue <i>Phytophthora</i> dieback hygiene practices	High	DEC (Albany District)	Ongoing
Monitor Populations	High	DEC (Albany District)	Ongoing
Collect seed	High	DEC (Albany District, TFSC), BGPA	Year 5
Develop and implement a fire management strategy	High	DEC (Albany District)	Developed by 2012 with implementation ongoing
Undertake surveys	High	DEC (Albany District)	Ongoing
Survey for potential translocation sites and develop a Translocation Proposal	High	DEC (Albany District)	Year 5
Liaise with land managers	High	DEC (Albany District)	Ongoing
Ensure long-term protection of habitat	High	DEC (Albany District, Land Unit); Department of Planning (DoP); Department of Mines and Petroleum (DMP)	Ongoing
Deter access	High	DEC (Albany District)	Ongoing
Promote awareness	High	DEC (Albany District, SCB, Strategic Development and Corporate Affairs Division)	Ongoing
Obtain biological and ecological information	High	DEC (Science Division, Albany District)	Ongoing
Map habitat critical to the survival of <i>Banksia pseudoplumosa</i>	High	DEC (SCB, Albany District)	Ongoing
Review this plan	Medium	DEC (SCB, Albany District)	Year 5

4. TERM OF PLAN

Western Australia

This plan will operate from September 2011 to August 2016 but will remain in force until withdrawn or replaced. If the species is still ranked Endangered after five years, the need for further recovery actions and a revised Plan will be assessed.

Commonwealth

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

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

5. REFERENCES

- Barrett S, Broomhall G, Comer S, Freebury G and Grant M (2003) Draft Fire Management Strategy for the Stirling Range National Park. Department of Conservation and Land Management Unpublished Report
- Barrett, S., Shearer, B. L., Crane, C. E., & Cochrane, A. (2008). An extinction-risk assessment tool for flora threatened by *Phytophthora cinnamomi*. *Australian Journal of Botany*, 56; 477-486.
- Barrett, S Comer S, McQuoid N, Porter M, Tiller C. Utber D (2009) Identification and conservation of fire sensitive ecosystems and species of the South Coast Natural Resource Management Region. DEC South Coast Region, Western Australia.
- Brown, A., Thomson-Dans, C. and Marchant, N. (Eds). (1998) *Western Australia's Threatened Flora*. Department of Conservation and Land Management, Western Australia.
- Burrows, N.D., Ward, B. and Robinson, A.D. (1999) The role of indicators in developing appropriate fire regimes. Australian Bushfire Conference, Albury, Australia, 7-9 July 1999.
- Commonwealth Government of Australia (1999) Environment Protection and Biodiversity Conservation Act. 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 (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 (2004) Best practice guidelines for the management of *Phytophthora cinnamomi* - Guidelines to manage the threat to biodiversity posed by *P. cinnamomi* and the disease caused by it in native vegetation managed by the Department of Conservation and Land Management 2004. Public Consultation Draft.
- Department of Environment and Conservation (2011) Biodiversity Conservation – Inventory – Flora. Corporate Files for *Banksia pseudoplumosa*.
- Department of Environment and Heritage (2006) Species Information Sheet for *Banksia pseudoplumosa*.
- Gilfillan, S. and Barrett, S. (2005) Feather-leaved Banksia (*Banksia brownii*) Interim Recovery Plan 2005-2010. Department of Environment and Conservation, Interim Recovery Plan No. 210.
- Gill, A.M. and Nicholls, A.O. (1989) Monitoring fire-prone flora in reserves for nature conservation. In: "Fire management on Nature Conservation Lands" Proceedings of a National Workshop held in Busselton, Western Australia (Eds N.D. Burrows, L. McCaw and G. Friend). Occasional paper 1/89, Department of Conservation and Land Management, Perth Western Australia, 137-152.
- Mast, A.R. & Thiele, K. (2007) The transfer of *Dryandra* R.Br. to *Banksia* L.f. (Proteaceae). *Australian Systematic Botany* 20(1): 63-71.
- Robinson, C.J. and Coates, D.J. (1995) Declared Rare and Poorly Known Flora in the Albany District. Wildlife Management Program No. 20. Department of Conservation and Land Management, Western Australia.
- Shearer B L and Fairman RG (1991) Control of Phytophthora species in native communities with phosphorous acid. In " Proceedings of Conservation Biology in Australia and Oceania Conference" P. 72 . University of Queensland, Brisbane.
- Smith M.G. (2010) *Declared Rare and Priority Flora List for Western Australia*. Department of Environment and Conservation, Perth, Western Australia.
- Threatened Species Scientific Committee (TSSC) (2008). Commonwealth Listing Advice on *Banksia pseudoplumosa* [Online]. Department of the Environment, Water, Heritage and the Arts. Available from: <http://www.environment.gov.au/biodiversity/threatened/species/pubs/82760-listing-advice.pdf>

- Vallee, L., Hogbin T., Monks L., Makinson B., Matthes M. and Rossetto M. (2004) Guidelines for the Translocation of Threatened Australian Plants. Second Edition. *The Australian Network for Plant Conservation*. Canberra, Australia.
- Western Australian Herbarium (1998–) *FloraBase – The Western Australian Flora*. Department of Environment and Conservation. <http://florabase.dec.wa.gov.au/>.
- International Union for Conservation of Nature (2001) *IUCN Red List Categories: Version 3.1*. Prepared by the IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, UK.

6. TAXONOMIC DESCRIPTION

George, A.S. 1996 New taxa and a new infrageneric classification in *Dryandra*. *Nuytsia* 10(3): 313-408

Mast, A.R. & Thiele, K. (2007) The transfer of *Dryandra* R.Br. to *Banksia* L.f. (Proteaceae). *Australian Systematic Botany* 20(1): 63-71.

Banksia pseudoplumosa (A.S.George) A.R.Mast & K.R.Thiele
[*Dryandra pseudoplumosa* A.S.George is a nomenclatural synonym and the basionym.]

Shrub to 1.8 m, without lignotuber. Stems villous. *Leaves* broadly linear, pinnatipartite; lamina 8-17 cm long, 6-15 mm wide; margins revolute; lobes 15-31 per side, triangular, acute, pungent, the lower edge concave, upper edge convex; petiole 1-2 cm long. *Inflorescence* sessile, axillary, subtended by small ‘involucral’ leaves; involucral bracts broadly linear, tapering, acute, the longest to 20 mm long, villous, the outermost denticulate; flowers c. 90-1—per head. *Perianth* 16-18 mm long, villous-hirsute; limb c. 3mm long, sparsely pubescent and with terminal, long, twisted caduceus hairs. *Pistil* 23-25 mm long, strongly incurved, glabrous except for long hairs on ovary; pollen presenter narrowly ellipsoidal, ribbed, 1-1.1 mm long, brown. *Follicles* 1-3 per head, broadly oblong-ovate, gently curved, 17-18 mm long, densely tomentose.

This species differs from *B. plumosa* in having shorter, thicker involucral bracts without filiform tips, more flowers per head, the pistils bowed \pm equally around head, and larger, densely tomentose follicles that are firmly attached.