



Department of
Parks and Wildlife



Interim Recovery Plan No. **377**

Northern serrate Banksia *(Banksia serratuloides subsp. perissa)*

Interim Recovery Plan
2017–2022



Department of Parks and Wildlife, Western Australia

March 2017

List of Acronyms

The following acronyms are used in this plan:

BGPA	Botanic Gardens and Parks Authority
CFF	Conservation of Flora and Fauna
CITES	Convention on International Trade in Endangered Species
CPC	Conservation and Parks Commission
CR	Critically Endangered
DAA	Department of Aboriginal Affairs
DPaW	Department of Parks and Wildlife (Parks and Wildlife)
DRF	Declared Rare Flora
EN	Endangered
EPBC	Environment Protection and Biodiversity Conservation
GPS	Global Positioning System
IBRA	Interim Biogeographic Regionalisation for Australia
IRP	Interim Recovery Plan
IUCN	International Union for Conservation of Nature
LGA	Local Government Authority
MDTFRT	Moora District Threatened Flora Recovery Team
NRM	Natural Resource Management
PICA	Public Information and Corporate Affairs
SCB	Species and Communities Branch
SWALSC	South West Aboriginal Land and Sea Council
TFSC	Parks and Wildlife Threatened Flora Seed Centre
TPFL	Threatened and Priority Flora Database
UNEP-WCMC	United Nations Environment Program World Conservation Monitoring Centre
VU	Vulnerable
WA	Western Australia

Foreword

Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Parks and Wildlife Corporate Policy Statement No. 35 (DPaW 2015a) and Department of Parks and Wildlife Corporate Guideline No. 35 (DPaW 2015b). 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.

Parks and Wildlife are committed to ensuring that threatened flora 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This plan will operate from March 2017 to February 2022 but will remain in force until withdrawn or replaced. It is intended that, if *Banksia serratuloides* subsp. *perissa* is still listed as Threatened in Western Australia following five years of implementation, this plan will be reviewed and the need for further recovery actions assessed.

This plan was given regional approval on 13 March 2017 and was approved by the Director of Science and Conservation on 22 March 2017. The provision of funds identified in this plan is dependent on budgetary and other constraints affecting the Parks and Wildlife, as well as the need to address other priorities.

Information in this plan was accurate at March 2017.

Plan preparation. This plan was prepared by:

Robyn Luu	Project Officer, Department of Parks and Wildlife Species and Communities Branch, Locked Bag 104, Bentley Delivery Centre, Western Australia 6983.
Andrew Brown	Threatened Flora Coordinator, Parks and Wildlife Species and Communities Branch, Locked Bag 104, Bentley Delivery Centre, Western Australia 6983.

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

Andrew Crawford	Principal Technical Officer, Threatened Flora Seed Centre, Department of Parks and Wildlife Science and Conservation Division
Amanda Shade	Assistant Curator (Nursery), Botanic Gardens and Parks Authority
Niall Sheehy	Former Flora Conservation Officer, Department of Parks and Wildlife Moora District
Benson Todd	Former Nature Conservation Coordinator, Department of Parks and Wildlife Moora District

Thanks also to the staff of the Western Australian Herbarium for providing access to Herbarium databases and specimen information, and other Parks and Wildlife Species and Communities Branch staff for assistance in developing this plan.

Cover photographs by Stephen Hopper and Margaret Pieroni.

Citation. This plan should be cited as:

Department of Parks and Wildlife (2017) Northern Serrate Banksia, *Banksia serratuloides* subsp. *perissa* Interim Recovery Plan 2017–2022. Interim Recovery Plan No. 377. Department of Parks and Wildlife, Western Australia.

Summary

Scientific name:	<i>Banksia serratuloides</i> subsp. <i>perissa</i>	Shires:	Dandaragan, Coorow
Common name:	Northern Serrate Banksia	IBRA region:	Geraldton Sandplains
Family:	Proteaceae	IBRA subregion:	Lesueur Sandplain GES02
Flowering period:	August to September	NRM region:	Northern Agricultural
DPaW region:	Midwest	Recovery team:	Moora District Threatened Flora Recovery Team
DPaW district:	Moora		

Distribution and habitat: *Banksia serratuloides* subsp. *perissa* is found west of Quairading and near Younegin, growing in shallow soils on lateritic breakaways in open woodland, mallee shrubland or heath. Associated species include *Banksia armata*, *B. nobilis*, *Beaufortia incana*, *Eucalyptus argyphaea*, *E. astringens*, *E. salmonophloia*, *E. wandoo*, *Grevillea insignis* and *Hakea subsulcata* (Wege and Coates 2007).

Habitat critical to the survival of the subspecies, and important populations: It is considered that all known habitat for wild populations is critical to the survival of *Banksia serratuloides* subsp. *perissa*, and that extant wild populations are important populations. Habitat critical to the survival of the subspecies includes the area of occupancy of populations and areas of similar habitat surrounding and linking populations (these providing potential habitat for population expansion and for pollinators). It may also include additional occurrences of similar habitat that may contain undiscovered populations of the subspecies or be suitable for future translocations, and the local catchment for the surface and/or groundwater that maintains the habitat of the subspecies.

Conservation status: *Banksia serratuloides* subsp. *perissa* was listed as specially protected under the Western Australian *Wildlife Conservation Act 1950* on 27 July 1995. It is ranked as Critically Endangered (CR) in Western Australia under International Union for Conservation of Nature (IUCN) 2001 criteria B1ab(iii,v)+ 2ab(iii,v) due to its extent of occurrence estimated to be less than 100km²; its area of occupancy estimated to be less than 10km²; its geographic range being severely fragmented; and there being a continuing decline in its area, extent and the quality of its habitat and the number of individuals. The subspecies is listed as CR under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Threats: The main threats to the subspecies are road, track and firebreak maintenance, weeds, fire, poor recruitment, Phytophthora dieback and drought

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. Parks and Wildlife, with the assistance of the Moora District Threatened Flora Recovery Team, is overseeing the implementation of recovery actions for *Banksia serratuloides* subsp. *perissa*.
2. Land managers have been notified of the location and threatened status of the subspecies.
3. Staff from Parks and Wildlife have undertaken surveys for the subspecies with new populations found.
4. Declared Rare Flora (DRF) markers have been installed at Subpopulations 2c, 2d, 2h, 2j, 3a, 3b and 3c.
5. A total of 461 seeds and 1,113 follicles collected from Population 3 is stored at the Threatened Flora Seed Centre (TFSC).
6. The Botanic Gardens and Parks Authority (BGPA) has 1.2g of seed in storage.
7. Monitoring has been carried out opportunistically with plant numbers and current threats recorded. Global Positioning System (GPS) locations have been recorded in Geographic Information System databases at Moora District, and at Species and Communities Branch (SCB).

Plan objective: The objective of this plan is to abate identified threats and maintain or enhance extant populations to ensure the long-term conservation of the subspecies in the wild.

Recovery criteria

Recovery will be considered successful if one or more of the following take place over the term of the plan.

- There is no reduction in the extent of occurrence and the number of mature plants within known populations has remained within a 10% range or has increased by >10% from 2241 to 2465 or more or
- New populations have been found, increasing the number of known populations three to four or more with no net loss of mature plants or
- The area of occupancy has increased by >10% with no net loss of mature plants.

Recovery will be considered unsuccessful if one or more of the following take place over the term of the plan.

- Populations have been lost which result in a reduction in the extent of occurrence or
- The number of mature plants has decreased by >10% from 2241 to 2017 or less or
- The area of occupancy has decreased by >10%, with a net loss of mature plants.

Recovery actions

1. Coordinate recovery actions
2. Monitor populations
3. Install and reposition DRF markers
4. Undertake weed control
5. Maintain protective hygiene measures
6. Undertake regeneration trials
7. Collect and store seed
8. Liaise with land managers and Aboriginal communities

9. Develop and implement translocations
10. Undertake surveys
11. Develop and implement a fire management strategy
12. Obtain biological and ecological information
13. Map habitat critical to the survival of *Banksia serratulooides* subsp. *perissa*
14. Promote awareness
15. Review this plan and assess the need for further recovery actions

1. Background

History

Banksia serratuloides subsp. *perissa* was described as a *Dryandra* by Alex George in 1996 from specimens he collected in 1986. Following a phylogenetic analysis by Mast and Thiele in 2007 it was transferred to the genus *Banksia*.

In 1991, new populations of *Banksia serratuloides* subsp. *perissa* were located during surveys conducted by Departmental staff. Further surveys have since been undertaken with no new locations found. The subspecies is currently known from three populations comprising approximately 2,241 mature individuals. However, this number is likely to be inaccurate as some populations have not been surveyed recently.

Description

Banksia serratuloides subsp. *perissa* is a compact shrub to 1m tall and 1.2m across. The leaves, which are crowded on erect branches, are 5 to 8cm long, paler beneath and divided almost to the midrib. The flower heads are held in the leaf axils and are surrounded by long bracts (hairless on the back). The bracts have white woolly margins initially, but later become smooth. The flowers are yellow and are about 2.5cm long. The outer floral whorl is covered with silky hairs. The style is long and hairless and has a narrow, furrowed, darker coloured stigmatic end (Brown *et al.* 1998). It is distinguished from the typical subspecies by the greater number of leaf lobes, longer involucral bracts which tend to be more hairy, the slightly longer perianth and shorter pistil (George 1996).

The scientific name *perissa* is derived from the Latin *perissos* which means having more than the regular number, referring to this subspecies having more leaf lobes than the typical subspecies (George 1996).

Illustrations and/or further information

Brown, A., Thomson-Dans, C. and Marchant, N. (Eds) (1998) *Western Australia's Threatened Flora*. Department of Conservation and Land Management, Western Australia; George, A.S. (1996) New taxa and a new infrageneric classification in *Dryandra* R. Br. (Proteaceae: Grevilleoideae). *Nuytsia* 10(3): 313–408; Western Australian Herbarium (1998–) *FloraBase—the Western Australian Flora*. Department of Parks and Wildlife. <https://florabase.dpaw.wa.gov.au/>.

Distribution and habitat

Banksia serratuloides subsp. *perissa* is endemic to Western Australia where it is found over a small geographic range north of Badgingarra, growing in shallow brown loam on ridge tops and slopes or in red-brown clayey-sand in lower areas. The subspecies favours areas of low, dense heath but can also be found in mallee shrubland and low, open woodland (Brown *et al.* 1998). Associated species include *Banksia armata*, *B. nobilis*, *Beaufortia incana*, *Eucalyptus argyphaea*, *E. astringens*, *E. salmonophloia*, *E.*

wandoo, *Grevillea insignis* and *Hakea subsulcata* (Wege and Coates 2007). The extent of occurrence is 57km² and the area of occupancy is less than 1km² (Smith 2011).

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

TPFL population number & location	Parks and Wildlife District	Shire	Vesting	Purpose	Manager
1. N of Badgingarra	Moora	Coorow	CPC	CFF	Parks and Wildlife
2a. N of Badgingarra	Moora	Coorow	LGA	Road reserve	Shire of Coorow
2b. N of Badgingarra	Moora	Coorow	LGA	Road reserve	Shire of Coorow
2c. N of Badgingarra	Moora	Coorow	LGA	Road reserve	Shire of Coorow
2d. N of Badgingarra	Moora	Coorow	LGA	Road reserve	Shire of Coorow
2e. N of Badgingarra	Moora	Coorow	CPC	National park	Parks and Wildlife
2f. N of Badgingarra	Moora	Coorow	CPC	National park	Parks and Wildlife
2g. N of Badgingarra	Moora	Coorow	CPC	National park	Parks and Wildlife
2h. N of Badgingarra	Moora	Coorow	CPC	National park	Parks and Wildlife
2i. N of Badgingarra	Moora	Coorow	CPC	National park	Parks and Wildlife
2j. N of Badgingarra	Moora	Coorow	LGA	Road reserve	Shire of Coorow
3a. NNE of Badgingarra	Moora	Coorow/ Dandaragan	LGA	Road reserve	Shires of Coorow and Dandaragan
3b. NNE of Badgingarra	Moora	Coorow/ Dandaragan	LGA	Road reserve	Shires of Coorow and Dandaragan
3c. NNE of Badgingarra	Moora	Coorow/ Dandaragan	LGA	Road reserve	Shires of Coorow and Dandaragan
3d. NNE of Badgingarra	Moora	Dandaragan	Private property		Landowners
3e. NNE of Badgingarra	Moora	Dandaragan	Private property		Landowners

Biology and ecology

Banksia serratuloides subsp. *perissa* appears to be moderately susceptible to *Phytophthora cinnamomi*. Under laboratory conditions 13 out of 22 plants (59%) died as a result of infection.

In December 2009 a wildfire burnt Population 3 killing all extant plants with no subsequent germination of seed.

A study found that there was a slight increase (although not significant) in the germination percent of *Banksia serratuloides* subsp. *perissa* seed after storage for one year at -20°C and at moisture content of 5±1% (Cochrane *et al.* 2002).

Conservation status

Banksia serratuloides subsp. *perissa* was listed as specially protected under the Western Australian *Wildlife Conservation Act 1950* on 27 July 1995. It is ranked as Critically Endangered (CR) in Western Australia under International Union for Conservation of Nature (IUCN) 2001 criteria B1ab(iii,v)+ 2ab(iii,v) due to its extent of occurrence estimated to be less than 100km²; its area of occupancy estimated to be less than 10km²; its geographic range being severely fragmented; and there being a continuing decline in its area, extent and the quality of its habitat and the number of individuals. The subspecies is listed as CR under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Threats

- **Road, track and firebreak maintenance.** Threats include grading, chemical spraying, construction of drainage channels and the mowing of roadside vegetation. Several of these actions also encourage weed invasion.
- **Weed invasion.** Weeds compete with the subspecies and its associated vegetation for soil moisture, nutrients and light. They also exacerbate grazing pressure and increase the fire hazard.
- **Altered fire regimes.** All plants in Population 3 appeared to die following a wildfire in 2009 with no recruitment observed in 2010.
- **Poor recruitment.** Not enough is known about the biology of the subspecies to understand the influence of disturbance, fire and drought on seed germination and seedling survival. The subspecies appears to require a disturbance to recruit, but if disturbance is too frequent, occurs at the wrong time of the year or is followed by a drought, populations are likely to be severely impacted.
- **Dieback (*Phytophthora cinnamomi*).** *Banksia serratuloides* subsp. *perissa* and its associated habitat is susceptible to dieback and populations are at risk of infestation.
- **Drought.** Poor rainfall is a threat to the subspecies long-term viability.

The intent of this plan is to identify actions that will mitigate immediate threats to *Banksia serratuloides* subsp. *perissa*. Although climate change may have a long-term effect on the subspecies, actions taken directly to prevent its impact are beyond the scope of this plan.

Table 2. Summary of population information and threats

TPFL population number & location	Land status	Year/no. mature plants	Condition		Threats
			Plants	Habitat	
1. N of Badgingarra	Nature reserve	1992 200			Firebreak maintenance, fire, weeds, disease
2a. N of Badgingarra	Road reserve	1991 7 1993 30 (20) 2008 10	Moderate		Road maintenance, weeds, fire, disease
2b. N of Badgingarra	Road reserve	1991 33	Disturbed		Road maintenance, weeds, fire, disease
2c. N of Badgingarra	Road reserve	1991 33 2008 200 2012 147	Healthy	Good	Road maintenance, weeds, fire, disease
2d. N of Badgingarra	Road reserve	1991 33 2008 60 2012 40	Moderate	Good	Road maintenance, weeds, fire, disease
2e. N of Badgingarra	National park	1991 200+ 2012 106	Moderate	Good	Firebreak maintenance, fire, weeds, disease
2f. N of Badgingarra	National park	1991 25 2002 20+ 2012 250	Healthy/ disturbed	Good	Firebreak maintenance, fire, weeds, disease
2g. N of Badgingarra	National park	1991 25 2002 10+ 2012 598	Moderate	Good	Firebreak maintenance, fire, weeds, disease
2h. N of Badgingarra	National park	1991 700 2008 500 2012 253	Moderate	Good	Firebreak maintenance, fire, weeds, disease
2i. N of Badgingarra	National park	1991 520	Healthy		Firebreak maintenance, fire, weeds, disease

2j. N of Badgingarra	Road reserve	2002 2008	20+ 80	Moderate		Road maintenance, weeds, fire, disease
3a. NNE of Badgingarra	Road reserve	1991 1994 2003 2010	100+ *200+ *550+ 0		Poor	Road maintenance, weeds, fire (burnt 29/12/2009), disease
3b. NNE of Badgingarra	Road reserve	1991 1994 2003 2009 2013	10 *200+ *550+ 0 4		Poor	Road maintenance, weeds, fire (burnt 29/12/2009), disease
3c. NNE of Badgingarra	Road reserve	1991 1994 2003 2009 2013	10+ *200+ *550+ 0 0		Poor	Road maintenance, weeds, fire (burnt 29/12/2009), disease
3d. NNE of Badgingarra	Private property	1987 2009 2013	Not recorded 0 0			Population cleared?
3e. NNE of Badgingarra	Private property	1987 2009 2013	Not recorded 0 0			Population cleared?

Note: populations in bold are considered to be important populations; () = number of juveniles/seedlings; * = total for subpopulations combined.

Guide for decision-makers

Section 1 provides details of current and possible future threats. Actions for development and/or land clearing in the immediate vicinity of *Banksia serratuloides* subsp. *perissa* may require assessment. Actions that could result in any of the following may potentially significantly impact the subspecies:

- Damage or destruction of occupied or potential habitat
- Altered fire regimes
- Reduction of pollinator habitat
- Alteration of the local surface hydrology or drainage
- Reduction in population size and
- A major increase in disturbance in the vicinity of a population

Habitat critical to the survival of *Banksia serratuloides* subsp. *perissa* and important populations

It is considered that all known habitat for the wild populations is critical to the survival of the subspecies, and that wild populations are important populations. Habitat critical to the survival of the subspecies includes the area of occupancy of populations and areas of similar habitat surrounding and linking populations (these providing potential habitat for population expansion and for pollinators). It may also include additional occurrences of similar habitat that may contain undiscovered populations of the subspecies or be suitable for future translocations and the local catchment for the surface and/or groundwater that maintains the habitat of the subspecies.

Benefits to other species or ecological communities

Recovery actions implemented to improve the quality or security of the habitat of *Banksia serratuloides* subsp. *perissa* will also improve the status of associated native plant species including the Declared Rare Flora (DRF) and Priority flora listed in the table below.

Table 3. Conservation-listed flora species occurring within 500m of *Banksia serratuloides* subsp. *perissa*

Species name	Conservation status (WA)	Conservation status (EPBC Act 1999)
<i>Acacia wilsonii</i>	DRF (EN)	-
<i>Eucalyptus crispata</i>	DRF (EN)	VU
<i>Eucalyptus leprophloia</i>	DRF (EN)	EN
<i>Spirogardnera rubescens</i>	DRF (VU)	EN
<i>Stylidium diplotrichum</i>	Priority 2	-
<i>Acacia epacantha</i>	Priority 3	-
<i>Acacia flabellifolia</i>	Priority 3	-
<i>Banksia splendida</i> subsp. <i>macrocarpa</i>	Priority 3	-
<i>Drosera marchantii</i> subsp. <i>prophylla</i>	Priority 3	-
<i>Diuris recurva</i>	Priority 4	-
<i>Eucalyptus pendens</i>	Priority 4	-

For a description of conservation codes for Western Australian flora see https://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/conservation_code_definitions.pdf

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 subspecies is not listed under Appendix II in the United Nations Environment Program World Conservation Monitoring Centre (UNEP-WCMC) Convention on International Trade in Endangered Species (CITES), and this plan does not affect Australia's obligations under any other international agreements.

Aboriginal consultation

A search of the Department of Aboriginal Affairs (DAA) Aboriginal Heritage Sites Register revealed no sites of Aboriginal significance adjacent to populations of *Banksia serratuloides* subsp. *perissa*. However, input and involvement has been sought through the South West Aboriginal Land and Sea Council (SWALSC) and DAA to determine if there are any issues or interests with respect to management for this subspecies. Opportunity for future Aboriginal involvement in the implementation of the plan is included as an action in the plan. Aboriginal involvement in management of land covered by an agreement under the *Conservation and Land Management Act 1984* is also provided for under the joint management arrangements in that Act, and will apply if an agreement is established over any reserved lands on which this subspecies occurs.

Social and economic impacts

For populations occurring on private property and on land managed by the Shires of Coorow and Dandaragan, social and economic impacts may occur through the implementation of recovery actions (controlling weeds; fencing maintenance; restricting stock access) and restrictions imposed on the management of the land, including maintenance of road infrastructure.

Affected interests

The implementation of this plan has some implications for private landholders and the Shires of Coorow and Dandaragan, particularly where populations occur on lands that are not specifically managed for conservation.

Evaluation of the plan's performance

Parks and Wildlife, with assistance from the Moora District Threatened Flora Recovery Team (MDTFRT), will evaluate the performance of this plan following five years of implementation.

2. Recovery objective and criteria

Plan objective

The objective of this plan is to abate identified threats and maintain or enhance *in situ* populations to ensure the long-term conservation of the subspecies in the wild.

Recovery criteria

Recovery will be considered successful if one or more of the following take place over the term of the plan.

- There is no reduction in the extent of occurrence and the number of mature plants within known populations has remained within a 10% range or has increased by >10% from 2241 to 2465 or more or
- New populations have been found, increasing the number of known populations three to four or more with no net loss of mature plants or
- The area of occupancy has increased by >10% with no net loss of mature plants.

Recovery will be considered unsuccessful if one or more of the following take place over the term of the plan.

- Populations have been lost which result in a reduction in the extent of occurrence or
- The number of mature plants has decreased by >10% from 2241 to 2017 or less or
- The area of occupancy has decreased by >10%, with a net loss of mature plants.

3. Recovery actions

Existing recovery actions

Parks and Wildlife, with the assistance of the MDTFRT, is overseeing the implementation of recovery actions for *Banksia serratuloides* subsp. *perissa*.

Land managers have been notified of the location and threatened status of the subspecies.

Departmental staff have undertaken surveys for the subspecies with new populations found.

Declared Rare Flora (DRF) markers have been installed at Subpopulations 2c, 2d, 2h, 2j, 3a, 3b and 3c. These alert people working in the vicinity of populations of the need to avoid work that may damage the subspecies or its associated habitat. Dashboard stickers and posters describing the significance of DRF markers have been produced and distributed to relevant Shires and other organisations.

A total of 461 seeds and 1,113 follicles collected from Population 3 is currently stored at -20°C at the Threatened Flora Seed Centre (TFSC) (see table 4).

Table 4. TFSC collection details for *Banksia serratuloides* subsp. *perissa*

Accession number	Date collected	TPFL population number	Number of plants collected (B: bulk, I:individual)	Quantity in storage (seed/follicles)	Estimated germinable seed
00167-1	28/07/1994	3	I/15	1,038 follicles	
00167-2	28/07/1994	3	B/15	75 follicles	56
00167-3	28/07/1994	3	B/15	29 seed	29
03102-1	16/08/2009	3	B/100	432 seed	415

Monitoring has been carried out opportunistically with plant numbers and current threats recorded. Global Positioning System (GPS) locations of plants within the population have been recorded in Geographic Information System databases at Moora District, and at Species and Communities Branch (SCB).

Future recovery actions

The following recovery actions are listed in approximate order of decreasing priority, influenced by their timing over the term of the plan however, this should not constrain addressing any recovery action if funding is available and other opportunities arise. Where these recovery actions are implemented on lands other than those managed by Parks and Wildlife, permission has been or will be sought from the appropriate land managers prior to actions being undertaken.

1. Coordinate recovery actions

Parks and Wildlife with assistance from the MDTFRT will oversee the implementation of recovery actions for *Banksia serratuloides* subsp. *perissa* and will include information on progress in annual reports.

Action:	Coordinate recovery actions
Responsibility:	Parks and Wildlife (Moora District), with assistance from the MDTFRT
Cost:	\$8,000 per year

2. Monitor populations

Monitoring of *Banksia serratuloides* subsp. *perissa* and its habitat should be undertaken to identify trends or potential management requirements. Population monitoring should record the health and expansion or decline in populations, pollinator activity and seed production. Site monitoring should include observations of grazing and habitat degradation including weed invasion. Specific monitoring of hydrology and activities relating to research into the biology and ecology of *Banksia serratuloides* subsp. *perissa* are included in other recovery actions detailed below.

Surveys of Subpopulations 3d and 3e should be undertaken to ascertain if they are still present.

Action:	Monitor populations
Responsibility:	Parks and Wildlife (Moora District), with assistance from the MDTFRT
Cost:	\$8,000 per year

3. Install and reposition DRF markers

DRF markers are required on the road reserve at Subpopulation 2a, and need to be repositioned on the road reserves at Subpopulations 2c, 2d, 2h and 2j.

Action:	Install and reposition DRF markers
Responsibility:	Parks and Wildlife (Moora District) and Shire of Coorow
Cost:	\$4,000 in year 1

4. Undertake weed control

Weeds are a threat to populations and the following actions are recommended:

1. Determine which weeds are present and map them.
2. Control invasive weeds by hand removal and/or spot spraying.
3. Report on the method and success of otherwise of the treatment.
4. Revegetate with site-specific species (in autumn) to suppress weeds.

Action:	Undertake weed control
Responsibility:	Parks and Wildlife (Moora District) and Shires of Coorow and Dandaragan
Cost:	\$10,000 per year, as required

5. Maintain protective hygiene measures

To protect populations from *Phytophthora* dieback, hygiene measures (as outlined in Department of Parks and Wildlife 2014) will be followed during installation and maintenance of firebreaks and when walking into populations in wet soil conditions. Purpose-built signs advising of the dieback risk and high conservation values of the sites will be installed if required.

Action:	Maintain protective hygiene measures
Responsibility:	Parks and Wildlife (Moora District)
Cost:	\$4,000 per year

6. Undertake regeneration trials

Habitat disturbance (physical or fire) may promote recruitment in *Banksia serratuloides* subsp. *perissa* and it is recommended that disturbance trials be undertaken. Permanent quadrats will be established to monitor the response of the subspecies to any disturbance application (refer to Action 10.4).

Action:	Undertake regeneration trials
Responsibility:	Parks and Wildlife (Science and Conservation Division, Moora District)
Cost:	\$10,000 in years 1 and 3, \$4,000 in years 2, 4 and 5

7. Collect and store seed

To guard against the extinction of natural populations of *Banksia serratuloides* subsp. *perissa* it is recommended that seed be collected and stored at the Parks and Wildlife TFSC. Collections should aim to sample and preserve the maximum range of genetic diversity possible by collecting from the widest range of reproductive plants.

Action:	Collect and store seed
Responsibility:	Parks and Wildlife (Moora District, TFSC)
Cost:	\$10,000 per year

8. Liaise with land managers and Aboriginal communities

Parks and Wildlife Moora District will liaise with the land managers to ensure the populations of *Banksia serratuloides* subsp. *perissa* are not accidentally damaged or destroyed, and the habitat is maintained in a condition that is suitable for the conservation of the subspecies. Consultation with the Aboriginal community will take place to determine if there are any issues or interests in areas that are habitat for the subspecies and opportunities will be provided for Aboriginal people to be involved in implementing this plan.

Action:	Liaise with land managers and Aboriginal communities
Responsibility:	Parks and Wildlife (Moora District)
Cost:	\$4,000 per year

9. Develop and implement translocations

Translocations may be required for the long term conservation of *Banksia serratuloides* subsp. *perissa*, with the first priority being augmentation of populations.

Information on the translocation of threatened plants and animals in the wild is provided in Parks and Wildlife Corporate Policy Statement No. 35 (DPaW 2015a), Parks and Wildlife Corporate Guideline No. 36 (DPaW 2015c) and the Australian Network for Plant Conservation translocation guidelines (Vallee *et al.* 2004). The 2004 guidelines state that a translocation may be needed when a species is represented by few populations and the creation of additional self-sustaining, secure populations may decrease its susceptibility to catastrophic events and environmental stochasticity. For small populations which may be declining in size or subject to high levels of inbreeding, successful population enhancement may increase population stability and hence long-term viability (Vallee *et al.* 2004).

Depending on the characteristics of the species, Vallee *et al.* (2004) suggest a minimum viable population size estimated between 50 and 2,500 individuals will be required. Suitable translocation sites may include where the taxon occurs, where it was known to have occurred historically and other areas that have similar habitat (soil, associated vegetation type and structure, aspect etc.), within the known range of the taxon (Vallee *et al.* 2004).

All translocation proposals require endorsement by the department's Director of Science and Conservation. Monitoring of translocations is essential and will be included in the timetable developed for the Translocation Proposal.

Action:	Develop and implement translocations
Responsibility:	Parks and Wildlife (Science and Conservation Division, Moora District), BGPA
Cost:	\$42,000 in years 1 and 2; and \$26,500 in subsequent years as required

10. Undertake surveys

Areas of potential habitat should be surveyed with all surveyed areas recorded and the presence or absence of the subspecies documented to increase survey efficiency and reduce unnecessary duplicate surveys. Where possible, volunteers from the local community, Landcare groups, the Wildflower Society of WA and naturalists' clubs will be encouraged to become involved.

Action:	Undertake surveys
Responsibility:	Parks and Wildlife (Moora District), with assistance from the MDTFRT and volunteers
Cost:	\$10,000 per year

11. Develop and implement a fire management strategy

A fire management strategy will be developed, in consultation with land managers, that recommends fire frequency, intensity and seasonality, precautions to prevent bushfire and strategies for reacting to bushfire, and the need, method of construction and maintenance of firebreaks. The risk of fire occurring in the habitat of populations will be minimised, except where it is being used to assist recovery. All data relating to fire response of the subspecies will be entered into the Threatened Priority Flora (TPFL) fire response data base.

Action:	Develop and implement a fire management strategy
Responsibility:	Parks and Wildlife (Moora District) and land managers
Cost:	\$10,000 in year 1, and \$6,000 in years 2–5

12. Obtain biological and ecological information

Research on the biology and ecology of *Banksia serratuloides* subsp. *perissa* should include:

1. Identification of pollinators and their local abundance and effectiveness.
2. Seed viability.
3. Conditions necessary for natural germination.
4. Response to disturbance, competition, drought, salinity and grazing.
5. Longevity of plants, time taken to reach maturity, and minimum viable population size.

Action:	Obtain biological and ecological information
Responsibility:	Parks and Wildlife (Science and Conservation Division, Moora District)
Cost:	\$50,000 in years 1–3

13. Map habitat critical to the survival of *Banksia serratuloides* subsp. *perissa*

Although habitat critical to the survival of the subspecies is alluded to in Section 1, it has not yet been 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 <i>Banksia serratuloides</i> subsp. <i>perissa</i>
Responsibility:	Parks and Wildlife (SCB, Moora District)
Cost:	\$6,000 in year 2

14. Promote awareness

The importance of biodiversity conservation and the protection of *Banksia serratuloides* subsp. *perissa* will be promoted through direct contact with affected land owners/managers and more broadly through the print and electronic media and by setting up poster displays. Formal links with local naturalist groups and interested individuals will also be encouraged.

Action:	Promote awareness
Responsibility:	Parks and Wildlife (Moora District, SCB, Public Information and Corporate Affairs (PICA)), with assistance from the MDTFRT
Cost:	\$7,000 in years 1 and 2; \$5,000 in years 3–5

15. Review this plan and assess the need for further recovery actions

If *Banksia serratuloides* subsp. *perissa* is still listed as Threatened 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 and assess the need for further recovery actions
Responsibility:	Parks and Wildlife (SCB, Moora District)
Cost:	\$6,000 at the end of year 5

Table 5. Summary of recovery actions

Recovery action	Priority	Responsibility	Completion date
Coordinate recovery actions	High	Parks and Wildlife (Moora District), with assistance from the MDTFRT	Ongoing
Monitor populations	High	Parks and Wildlife (Moora District), with assistance from the MDTFRT	Ongoing
Install and reposition DRF markers	High	Parks and Wildlife (Moora District) and Shire of Coorow	2017
Undertake weed control	High	Parks and Wildlife (Moora District) and Shires of Coorow and Dandaragan	Ongoing
Maintain protective hygiene measures	High	Parks and Wildlife (Moora District)	
Undertake regeneration trials	High	Parks and Wildlife (Science and Conservation Division, Moora District)	2021
Collect and store seed	High	Parks and Wildlife (Moora District, TFSC)	2021
Liaise with land managers and Aboriginal communities	High	Parks and Wildlife (Moora District)	Ongoing
Develop and implement translocations	High	Parks and Wildlife (Science and Conservation Division, Moora District), BGPA	2021
Undertake surveys	Medium	Parks and Wildlife (Moora District), with assistance from the MDTFRT and volunteers	Ongoing
Develop and implement a fire management strategy	Medium	Parks and Wildlife (Moora District) and land managers	Developed by 2017, implementation ongoing
Obtain biological and ecological information	Medium	Parks and Wildlife (Science and Conservation Division, Moora District)	2019
Map habitat critical to the survival of <i>Banksia serratuloides</i> subsp. <i>perissa</i>	Medium	Parks and Wildlife (SCB, Moora District)	2018
Promote awareness	Medium	Parks and Wildlife (Moora District, SCB, PICA), with assistance from the MDTFRT	2021
Review this plan and assess the need for further recovery actions	Medium	Parks and Wildlife (SCB, Moora District)	2021

4. Term of plan

This plan will operate from March 2017 to February 2022 but will remain in force until withdrawn or replaced. If the subspecies is still listed as Threatened after five years, a review of this plan will be completed, the need for further recovery actions determined and a revised plan prepared if necessary.

5. References

- Brown, A., Thomson-Dans, C. and Marchant, N. (Eds) (1998) *Western Australia's Threatened Flora*. Department of Conservation and Land Management, Western Australia.
- Cochrane, A., Brown, K. and Kelly, A. (2002) Low temperature and low moisture storage of seeds of rare and threatened taxa in the endemic Western Australian genus *Dryandra* (R.Br.) (Proteaceae). *Conservation Science Western Australia* 4(1): 1–12.
- Department of Parks and Wildlife (2014) Policy Statement No. 3 Management of *Phytophthora* disease. Department of Parks and Wildlife, Western Australia.
- Department of Parks and Wildlife (2015a) Corporate Policy Statement No. 35 *Conserving Threatened Species and Ecological Communities*. Perth, Western Australia.
- Department of Parks and Wildlife (2015b) Corporate Guideline No. 35 *Listing and Recovery of Threatened Species and Ecological Communities*. Perth, Western Australia.
- Department of Parks and Wildlife (2015c) Corporate Guideline No. 36 *Recovery of Threatened Species through Translocation and Captive Breeding or Propagation*. Perth, Western Australia.
- George, A.S. (1996) New taxa and a new infrageneric classification in *Dryandra* R. Br. (Proteaceae: Grevilleoideae). *Nuytsia* 10(3): 313–408.
- Government of Australia (1999) Environment Protection and Biodiversity Conservation Act.
- 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.
- Mast, A.R and Thiele, K. (2007) The transfer of *Dryandra* R.Br. to *Banksia* L.f. (Proteaceae). *Australian Systematic Botany* 20(1): 63–71.
- 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 Parks and Wildlife. <http://florabase.dpaw.wa.gov.au/>.

6. Taxonomic description

The following description is from George (1996).

***Dryandra serratuloides* subsp. *perissa* A.S. George, subsp. nov.**

Leaves to 19cm long, 7–12mm wide, with 20–33 narrowly triangular lobes each side, the sinuses 1.5–6mm across. *Involucral bracts* ovate (outer) to lanceolate–oblong (inner), the margins and upper lamina silky–hirsute, the innermost 22–25mm long; floral bracts oblong, slightly hairy, 2.8–3mm long. *Perianth* 20–33mm long, silky–hirsute but tip of limb glabrous; limb 5–6mm long. *Pistil* 22–25mm long; pollen presenter 3–3.8mm long. *Follicles* obovate, thick, densely hirsute, 6mm long.

